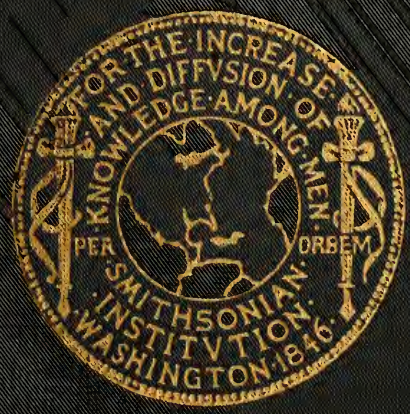
FOR THE INCREASE
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ORBEM
SMITHSONIAN
INSTITVTION
WASHINGTON 1846

BUFO ALVARIUS GIRARD

Illustrating parotoid, ulnar, and tibial glands, skin texture, and other identification points. Upper photograph by Dr. Walter P. Taylor, Bureau of Biological Survey.

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

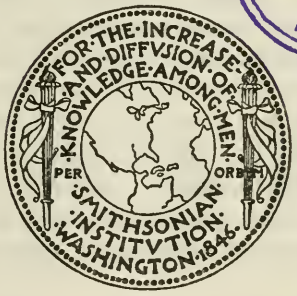
BULLETIN 160

MEXICAN TAILLESS AMPHIBIANS IN THE UNITED STATES NATIONAL MUSEUM

BY

REMINGTON KELLOGG

Assistant Curator, Division of Mammals
United States National Museum



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The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects. The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The series of *Bulletins*, the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogues of type specimens and special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

The present work forms No. 160 of the *Bulletin* series.

ALEXANDER WETMORE,
Assistant Secretary, Smithsonian Institution.

WASHINGTON, D. C., *March 31, 1932.*

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MEXICAN TAILLESS AMPHIBIANS IN THE UNITED STATES NATIONAL MUSEUM

By Remington Kellogg

Assistant Curator, Division of Mammals, United States National Museum

HISTORICAL INTRODUCTION

In 1926 the writer was instructed by Dr. E. W. Nelson, at that time chief of the Bureau of Biological Survey of the United States Department of Agriculture, to examine and prepare a report on the herpetological collections made by Doctor Nelson and Edward A. Goldman in Mexico. This work has been completed since the writer became a member of the staff of the United States National Museum. In the course of this study the scope of the report was enlarged to include all the Mexican material that was available in the National Museum and other American institutions. Inasmuch as it was originally intended to deal with the Mexican collection of Nelson and Goldman, a few facts in regard to the inauguration of their field work and the extent of their explorations may be of interest.

COLLECTING WORK OF NELSON AND GOLDMAN

Upon completion of field work by the Death Valley expedition and the consequent disbanding of the party at Visalia, Tulare County, Calif., the various members scattered to take up other assignments. Doctor Nelson traveled southward through the San Joaquin Valley to the Goldman ranch at Alila (now Earlimart), Calif., where he mentioned to E. A. Goldman's father his intention of obtaining an assistant. The father spoke of his son's interest in natural history and remarked that he was then in Fresno. As a result of this conversation, the senior Goldman went to Fresno and brought Edward back with him to the ranch for Nelson's appraisal. On October 10, 1891, Goldman left his father's ranch as Nelson's personal assistant, the understanding being that he was to be given $30 a month and his board. This was paid by Nelson out of his own salary of $150 a month. They traveled in a buckboard outfit, which was the object of no little curiosity because of two 42-pound bear traps that hung one from each side. For some reason Nelson had chosen the name "Scalops" for one member of their team, while the other went by the name of "Johnny."

Nelson and Goldman drove through the southern end of the San Joaquin Valley to a site 8 miles west of Tejon Pass and thence to the head of San Emigdio Canyon. Leaving this camping site they crossed the southern end of the valley, collecting at various localities on their northward trip to San Luis Obispo, Calif. From this place they worked northward to San Simeon and the mountains near by, and in a few days drove southward along the coast, collecting sea birds particularly, to Santa Paula, where, about January 4, 1892, they abandoned the buckboard and field outfit.

Orders had been received from Dr. C. Hart Merriam, chief of the Bureau of Biological Survey, for Nelson to start on what it was anticipated would be a three months' trip to western Mexico. Nelson and Goldman traveled by rail from Santa Paula to San Francisco and sailed on the Pacific mail steamer *Acapulco* for Manzanillo, Colima, where they landed on January 24, 1892. From the time of sailing until March 1, 1892, Goldman, who had previously been a personal assistant of Nelson, worked for the experience without pay, and then he received his first official appointment from the Biological Survey, which authorized his employment at $75 a month, out of which he was to pay his board and traveling expenses. Instead of lasting three months, the field trip was extended, until Goldman had passed four years in Mexico, after which he received permission to visit his home.

In September, 1893, Nelson left Chihuahua City for Washington, D. C., but returned to the City of Mexico in December, 1893, where he was met by Goldman, and they continued the field work together. Again on August 15, 1896, Nelson left Carneros, Coahuila, for Washington. The same year, Goldman received permission to visit his home in California, and he accordingly left Santa Rosa, Guanajuato, on November 18, 1896, for Alila, Calif., but resumed field work at Rio Verde, San Luis Potosi, on January 7, 1897. Nelson rejoined Goldman at Ameca, Jalisco, on February 6, 1897. Field work for that season was completed on September 17, 1897, at Bolaños, Jalisco, where Goldman left to revisit his home in California and Nelson to return to Washington. Goldman, on his return to Mexico, went to the Valparaiso Mountains in Zacatecas, where he began collecting on November 26, 1897. Doctor Nelson rejoined him at Altamira, Tamaulipas, on April 24, 1898.

About September 20, 1898, Nelson left Goldman at Parral in Chihuahua and returned to Washington, while the latter proceeded across the Sierra Madre. Again, on June 3, 1899, Nelson met Goldman at Casas Grandes, Chihuahua, and the two continued to collect until October 7, 1899, when they discontinued field work for the season at Sierra en Media, Chihuahua. Goldman again left for California and while there did some collecting. About December 30, 1900, he arrived in Arizona and began field work near Winslow, the main

object of the trip being to obtain a series of wild turkeys. About the middle of January, 1900, he went to Washington for the first time and remained there for about six weeks before returning to Mexico. He resumed field work at Frontera, Tabasco, on March 3, 1900, and after a trip into the interior he returned there to meet Nelson on April 20, 1900. This season's field work ended at Carrizal, Vera Cruz, about May 15, 1901, and then both Nelson and Goldman returned to Washington. Early in the winter of that year Goldman received instructions to return to Mexico, and accordingly he resumed field work on December 19, 1901, at Nuevo Laredo, Tamaulipas. This rail journey was somewhat unusual in that it marked a departure from the previous practice of the Biological Survey in regard to the payment of traveling expenses, for Goldman's expenses were paid to the Mexican boundary from Washington. Nelson met Goldman about February 6, 1902, at Matamoros, Tamaulipas, and after about four months in the field both of them left Eagle Pass, Tex., on June 8, 1902, for Washington.

After spending a brief period at headquarters, Goldman was sent on a field trip to California, where he began collecting on July 17, 1902, at Paraiso Springs in Monterey County. The last entry in the field catalogue was on September 10, 1902. During part of this trip Dr. C. Hart Merriam was with him. Returning to Washington, Goldman remained a few weeks before being ordered again to Zacatecas in Zacatecas, where he resumed field work on December 19, 1902. Nelson joined Goldman on December 23, 1902, at Ocotlan in Jalisco. On June 28, 1903, they terminated their collecting at La Barca, Jalisco, and returned to Washington. This was Nelson's last trip on the mainland of Mexico.

The following year Goldman visited Mexico City on his way to Jaltipan in Vera Cruz, where field work was begun on February 3, 1904. This season's field work ended in July, 1904, at Lerma in the State of Mexico, and Goldman returned to Washington. In the course of these 12 years, since the beginning of their partnership, Nelson and Goldman had visited every State and Territory in the mainland of Mexico, and in some instances had crossed and recrossed them several times.

OTHER SOURCES OF NATIONAL MUSEUM MATERIAL

The United States National Museum has received Mexican specimens of tailless amphibians from a number of other sources. Most of the early acquisitions came from individuals with whom Prof. Spencer F. Baird had corresponded. Numerous letters on file in the archives of the Smithsonian Institution reveal Baird's active interest in building up a representative collection of Mexican animals. He was instrumental also in effecting the appointment of qualified

naturalists on the various expeditions and surveys of the United States Government, and made an effort to get in contact either personally or by letter with everyone who showed any interest in natural history.

From Dr. Thomas H. Webb, secretary and surgeon of Commissioner John Russell Bartlett's party of the United States and Mexican Boundary Commission, the Smithsonian Institution received its first collection from Mexico. Upon the completion of the Gila River survey, Bartlett's party left Tucson, Ariz., on July 17, 1852, for El Paso, Tex. Their route traversed northern Sonora and continued through the villages of Tubac, Santa Cruz, Agua Prieta, Janos, and Corralitos, the party arriving at El Paso, Tex., on August 18, 1852. Owing to the lack of an adequate military escort, Bartlett accepted the offer of one from the Mexican Boundary Commissioner, and then proceeded to Ringgold Barracks, Tex., through the Mexican States of Chihuahua, Durango, Coahuila, and Nuevo Leon. The party left El Paso, Tex., on October 7, 1852, en route to the city of Chihuahua, and arrived there on October 22, 1852. The road taken passed through Guadalupe, Carrizal, Encinillas, and Sauzillos. The type specimen of *Bufo insidior* Girard, collected by Dr. Thomas H. Webb, came from Chihuahua, possibly from the city itself, but this is uncertain. Bartlett states that when Doctor Webb's wagon broke down south of the Laguna de los Patos, the members of the party amused themselves by collecting insects, reptiles, and other objects of natural history while it was being repaired. Bartlett's party remained 10 days in the city of Chihuahua, and it is to be presumed that Doctor Webb utilized his leisure to make collections, as there is ample evidence in the commissioner's narrative that the surgeon availed himself of every opportunity to collect minerals and natural-history specimens. Leaving Chihuahua on November 1, 1852, Bartlett's party passed through Saucillo, La Cruz, Las Garcas, Santa Rosalia, Jimenez, Cerro Gordo, San Pedro del Gallo, Quincamé, and La Pena, arriving at Parras on November 27, 1852. They reached Saltillo, the capital of Coahuila, on December 7, 1852, Santa Catarina on December 11, and Monterey, the capital of Nuevo Leon, on December 12. They left Monterey the next day by a route that passed through Marin, Carrizitos, and Cerralvo, and on December 19, 1852, they arrived at Mier. The following day the party passed through Camargo and thence across the Rio Grande to Ringgold Barracks in Texas.

John H. Clark, a collector employed by the United States and Mexican Boundary Survey under the direction of Commissioner Bartlett, accompanied Col. J. D. Graham, chief astronomer, from Fort Davis, Tex., to Copper Mines, N. Mex., where they arrived on August 2, 1851. On August 28, Bartlett and his personal party set out for Santa Cruz, Sonora, to replenish their supplies. On September 18,

Colonel Graham caught up with Bartlett at the Calabassa Hacienda on Santa Rita Mountain, Sonora. Both parties then proceeded on their way to Santa Cruz. Although Bartlett does not specifically state that Clark accompanied Colonel Graham on this trip, he must have done so, for the type specimen of *Hesperomys sonoriensis* Le Conte was collected at Santa Cruz in Sonora, about 6 miles south of the Mexican boundary line. In that event the cotypes of *Hyla affinis* Baird were collected somewhere along the route from Copper Mines in New Mexico to Santa Cruz in Sonora. Baird published the description of this tree frog in 1854, and since the Boundary Commission, of which Clark was the principal assistant and surveyor, did not resurvey the Sonora boundary line until 1855, these cotypes must have been collected in September or October, 1851. Additional details in regard to Clark's field work will be found in the remarks under *Bufo punctatus* (p. 62).

Arthur C. V. Schott was appointed a collector and assigned to the party of Lieut. A. W. Whipple by Commissioner Bartlett. Subsequently Schott was transferred to the party working under the direction of Maj. William H. Emory. During the period between September, 1851, and October, 1854, Schott evidently was assigned to work along the Rio Grande. One of the cotypes of *Bufo debilis* was collected during this period. In October, 1854, when the Boundary Commission was again reorganized, Schott was assigned as an assistant to Lieut. N. Michler, and this division proceeded through New Mexico to California. After establishing the initial point of the boundary line on the Colorado River, Michler's party journeyed to Tucson, Ariz., along the wagon road that followed the Gila River. Pending the arrival of Major Emory, the party remained in Tucson, and it was not until June 26, 1855, that the survey of the oblique line from Los Nogales to the Colorado River was commenced. Two of the cotypes of *Bufo alvarius* were collected by Schott during the survey of this line.

In July, 1853, the Smithsonian Institution received another collection of amphibians from Mexico. The records show that Professor Baird corresponded with Maj. William Rich at Mexico City as early as September, 1852, and in the following year a small miscellaneous collection from him was received. Among these specimens were two tree frogs that became the cotypes of *Hyla eximia* and a small series of frogs that formed the basis for *Rana montezumae*.

To Lieut. Darius Nash Couch the Museum is indebted for one of the largest Mexican collections received in the early days of the Smithsonian Institution. He conducted the exploring expedition that surveyed northern Mexico for a Pacific railroad and that set out on March 1, 1853, from Matamoros in Tamaulipas and passed through Nuevo Leon and Coahuila to at least as far as the Rio Nasas in Durango. The type specimens of *Bufo speciosus* Girard, *Scaphiopus*

couchii Baird, *Scaphiopus rectifrenis* Cope, and *Bufo debilis* Girard were collected on this trip. In addition to the specimens collected by himself, Lieutenant Couch purchased the entire collection of Dr. Luis Berlandier and presented it to the Smithsonian Institution. The Rio Nasas was reached in June, 1853, and on August 1, 1853, he was back again in San Diego, Nuevo Leon. The exact itinerary of this expedition is not known to the writer, for the report although written was never published. A more extended account of this expedition is published in the remarks under *Bufo debilis* (p. 52).

On April 7, 1854, a small collection made in Chihuahua was received from John Potts. Subsequent collections received from Potts in 1854 and 1855 contained a number of additional species, including the type specimens of *Eleutherodactylus longipes* (Baird) and *Scaphiopus multiplicatus* Cope.

An exchange with the Muséum d'Histoire Naturelle in Paris some time in 1855 resulted in the transfer of a few of the Mexican amphibians collected by Adolphe Boucard. In 1860, duplicates of Mexican amphibians and reptiles were received in exchange from the Academy of Natural Sciences of Philadelphia. Included among them were several amphibians collected by R. Montes d'Oca at Jalapa in Vera Cruz. One of these was a tree frog with a small tympanum, which later became a cotype of *Hyla miotympanum* Cope.

In 1859, Professor Baird began to correspond with Dr. Carlos Sartorius, who with his son Florentin collected a number of specimens in the vicinity of Mirador and Orizaba, including the types of *Hyla miotympanum* Cope, *H. muricolor* Cope, and *H. gracilipes* Cope. From Charles Laszlo, of Tabasco, the Smithsonian Institution in 1860 received a small collection of alcoholic specimens.

From the Smithsonian annual report for 1861,[1] one learns that a collection of reptiles from "Guadalaxara" had been received from J. J. Major. This shipment presumably included the type of *Gastrophryne usta* (Cope), a small narrow-mouthed toad described by Cope in 1866.

Following a brief expedition to the interior of Mexico, Louis John Xantus de Vesey, a Hungarian, and one or more of his companions settled on a homestead in Iowa, but as might have been anticipated, Xantus soon tired of this. Fortunately for all concerned he had in the meantime become acquainted with Dr. John F. Hammond, U. S. A., who, with the assistance of Professor Baird, obtained for Xantus the appointment as hospital steward in the United States Army. For a part of his enlistment, Xantus was stationed at Fort Riley, Kans., and later was transferred to Fort Tejon, Calif. Specimens collected at these localities were transmitted to Baird, who became more and more interested in his natural ability along these

[1] Ann. Rep. Board Reg. Smithsonian Inst. for 1861, p. 66, 1862.

lines. On the expiration of his enlistment in the Army, in April, 1859, Xantus was placed in charge of the tidal station of the United States Coast Survey at Cape San Lucas, Lower California, at the earnest solicitation of Professor Baird, and he remained there until 1861.

Through the influence of Professor Baird, Xantus was appointed in 1863 as United States consul at Colima, Mexico, and in return made large collections in that region, including the type specimens of *Phyllomedusa dacnicolor* Cope and *Bufo argillaceus* Cope. This appointment was revoked some time previous to August 11, 1863, because of certain indiscreet understandings that Xantus had with local "politicos," but he remained at Manzanillo for some months afterwards as receiver for wrecked vessels. Part V of his Mexico catalogue was mailed to Professor Baird on February 29, 1864. Xantus was intensely interested in all branches of natural history, as is shown by the quantity and variety of material he collected for the Smithsonian Institution.

In 1863, Francis Sumichrast, of Orizaba, Vera Cruz, began sending specimens to the Smithsonian Institution, and additional collections were received from this region until 1867. Sumichrast, who was born in Yvorne, Switzerland, on October 15, 1828, accompanied M. de Saussure of Geneva, the grandson of the celebrated geologist, on his voyage to Mexico in 1855–56. The Mexican revolution made traveling difficult, and Saussure after a year's stay returned to Geneva with their collections. Sumichrast elected to remain in Mexico and devote his attention to the natural history of that country. During his residence in the State of Vera Cruz, he collected the type specimens of *Hyla spilomma* Cope, *H. staufferi* Cope, *H. bistincta* Cope, *Syrrhophus cystignathoides* (Cope), and *Eleutherodactylus rhodopis* (Cope). In the Smithsonian annual report for 1868,[2] there appears the following statement: "Under the joint auspices of the Smithsonian Institution and the Kentucky University, at Lexington, Professor Sumichrast, a well-known naturalist, long resident in Mexico, has gone to the Isthmus of Tehuantepec to make observations and collections in natural history * * *." His first collecting seems to have been done at Juchitan, Tehuantepec, in July, 1868. While the full details of his movements are not known, it is certain that he was at Iztaltepec, Oaxaca, on April 30, 1870; at Rancho de Cacoprieto in Chiapas in April, 1872; and in December, 1872, evidently he had settled down at Santa Efigenia, Oaxaca, where he made his home during the remaining years of his life. In his explorations Sumichrast visited the States of Vera Cruz, Puebla, Mexico, Oaxaca, and Chiapas and sent collections of natural-history specimens to the Smithsonian Institution, the Academy of Natural Sciences of Philadelphia, and

[2] Ann. Rep. Board Reg. Smithsonian Inst. for 1868, p. 25, 1869.

the Museum of Comparative Zoology at Cambridge, as well as to museums in Switzerland, Germany, and France. A number of amphibians were sent to the Jardin des Plantes in Paris, where they were studied by Paul Brocchi while he was preparing his "Étude des Batraciens de l'Amérique Centrale," published in 1882 as a part of the contribution made by the "Mission Scientifique au Mexique et dans l'Amérique Centrale." Among the numerous specimens collected by Sumichrast during his residence on the Isthmus of Tehuantepec in the State of Oaxaca are the types of *Hylella sumichrasti* Brocchi, *H. platycephala* Cope, *Cystignathus perlaevis* Cope, *C. labialis* Cope, *Eleutherodactylus rugulosus* (Cope), *Syrrhophus leprus* Cope, and *Bufo canaliferus* Cope. Sumichrast died of cholera on September 26, 1882, at Tonala in Chiapas.

A few toads and frogs collected in1863 and 1864 by Dr. H. Berendt in Tabasco, chiefly at San Juan Bautista, were presented by him to the Smithsonian Institution.

At the solicitation of Governor Jose Salazar y Larregui, Arthur Schott, who had previously been employed as a naturalist on the United States and Mexican Boundary Commission under the direction of Maj. W. H. Emory, was appointed to the Comision Cientifica de Yucatan. By March 20, 1865, he had collected 300 specimens, according to a letter written from Merida, Yucatan. The type specimen of the peculiar *Triprion petasatus* (Cope) was collected by Schott near this locality. A letter received by Baird on June 6, 1865, states that Schott had made a trip that included Sisal, Campeche, and Celestun. On November 21, 1866, Schott returned to Washington, D. C., but later went back to Yucatan and collected there until 1868. Schott collected also in Sonora in 1871.

From Mazatlan in Sinaloa, specimens collected by Ferdinand Bischoff were received by the Smithsonian Institution in 1868. Dr. Gideon C. Lincecum, an entomologist, presented amphibians collected by himself in 1869 at Tuxpam, Vera Cruz. There is a specimen of *Rhinophrynus dorsalis* in the collection that was taken by Dr. T. H. Richardson at Cordoba in Vera Cruz on October 19, 1874.

From time to time, beginning in 1877 and continuing until 1887, Alfred Dugés sent to the National Museum specimens labeled as coming from Guanajuato, though Dr. E. W. Nelson is of the opinion that some of them at least were given him by students and that the specimens actually may not have come from that locality. This naturalist also supplied the Muséum d'Histoire Naturelle in Paris with similar collections. Professor Dugés collected the type specimens of *Scaphiopus dugesii* Brocchi, *Cystignathus microtis* Cope, *Eleutherodactylus alfredi* (Boulenger), *E. augusti* (Dugés), *Syrrhophus guttilatus* (Cope), *Bufo monksiae* Cope, and *Rana montezumae concolor* Cope.

From C. T. Hoege, a collector previously employed by F. D. Godman, the National Museum received amphibians collected in

the Valleys of Mexico and Toluca in 1884 and 1885. Alphonso Forrer, another one of Godman's collectors, sent specimens collected in 1885 at Ciudad in Durango and at the Presidio de Mazatlan in Sinaloa.

During March and April, 1891, William Lloyd, a field naturalist employed by the Bureau of Biological Survey, obtained a few amphibians near the Mexican boundary in the States of Nuevo Leon and Tamaulipas. Pierre Louis Jouy, an ornithological collector employed to obtain specimens for the National Museum exhibit at the Chicago World's Columbian Exposition, brought back a few specimens taken in February, 1892, at Lake Chapala in Jalisco.

Maj. E. A. Mearns was detailed by the War Department to act as the medical officer of the International Boundary Commission, and in the course of his work he traversed the entire boundary line and collected a number of amphibians at localities along it. He reported for duty at El Paso, Tex., on February 1, 1892, and completed the work of the biological section on July 20, 1894, at San Diego, Calif. A few amphibians taken in Sonora in 1893 were received from an army hospital steward, Ernest C. Merton.

Dr. Edward Palmer, a well-known professional botanical collector, in 1896 forwarded specimens collected in Durango. Dr. Charles Haskins Townsend collected at Frontera in Tabasco during April, 1897. General herpetological collections were made in Chihuahua during 1895 by H. H. and C. S. Brimley. The late J. N. Rose, a botanist employed by the National Museum, and his assistant J. H. Painter collected in Jalisco in 1903.

From 1908 to 1923, a few amphibians were received from entomologists, as follows: In 1908, Frederick Knab collected at Cordoba, Vera Cruz; in 1918, J. A. Kusche at Venodio, Sinaloa; in 1920, W. S. Blatchley at Orizaba, Vera Cruz; and, in 1923, Dr. William M. Mann at Tepic, Nayarit. A *Phyllomedusa helenae* taken at Berta, Vera Cruz, in 1910 was purchased from Charles R. Orcutt. Surg. J. C. Thompson collected a *Hyla baudinii* at San Blas, Nayarit, in 1913. A few specimens taken at Nogales, Sonora, in 1919, were received from American Consul Francis J. Dyer.

MATERIAL IN OTHER MUSEUMS

American.—The writer was enabled, while a member of the staff of the Bureau of Biological Survey, to visit several American institutions for the purpose of studying their collections of Mexican amphibians. A large number of important distributional records were obtained from these collections.

The Mexican herpetological collection of the American Museum of Natural History in New York ranks next to that of the United States National Museum in size and includes specimens received from

several sources. The bulk of this collection, however, was gathered by two men: Dr. Alexander G. Ruthven, who made a herpetological collection for this museum in Vera Cruz, and Paul D. R. Ruthling, who during 1919 and 1920 assembled a large and varied collection. Ruthling's itinerary covered Mexican States as follows: In 1919 collections were made in Colima in April; in the Federal District in May and July; in Vera Cruz in June; field work was carried on in Guanajuato during the first week in August; the remainder of August, September, and October were spent in Jalisco; in November and December field work was carried on in Nayarit and Sinaloa; during May, June, and the first part of July, 1920, amphibians were collected in Oaxaca, while Puebla was visited during the latter part of July. This material for the most part is well preserved, so that a critical determination of some doubtful points of external form of some of the amphibians, which hitherto had been known only from specimens collected many years ago, was possible.

The Museum of Comparative Zoology, at Harvard College, Cambridge, Mass., possesses a number of Mexican amphibians. From 1878 to 1880, Dr. Edward Palmer, a botanical collecter, seems to have been somewhat interested in the natural history of Tamaulipas, San Luis Potosi, and Coahuila, as specimens from these localities were sent to Cambridge. In 1911–12, members of a party engaged in Mayan archeological work in Yucatan, particularly L. J. Cole, Edward H. Thompson, and O. Ricketson, sent specimens to this museum. A few specimens were collected by J. L. Peters in the State of Quintana Roo. From the State of Hidalgo, this museum has specimens collected by Dr. William M. Mann. An ornithological collector, W. W. Brown, preserved a few amphibians in the course of his field work in Tamaulipas, San Luis Potosi, and Sonora. Dr. E. R. Dunn collected in the State of Vera Cruz and in the Federal District in 1921. On this trip Doctor Dunn collected the type specimens of *Eleutherodactylus dunnii* Barbour and *Syrrhopus mystaceus* Barbour near Jalapa in Vera Cruz. Several other individuals, including Dr. G. O. Rogers, P. Townsend, D. B. van Brunt, G. Glückert, and T. J. Potts, have presented Mexican amphibians to the Museum of Comparative Zoology.

Along with his collections of fishes, S. E. Meek included a small number of amphibians found in the States of Tamaulipas, Guanajuato, Federal District, and elsewhere in Mexico in his shipments to the Field Museum of Natural History, Chicago, Ill. Two mammal collectors, Edmund Heller and C. M. Barber, likewise collected a few amphibians in the State of Vera Cruz. A few specimens were presented by Dr. C. H. T. Townsend, and a collection made by Senor F. Ferrari-Perez, director of the museum at Tacubaya, Mexico,

in 1889 was purchased. From these sources were obtained practically all the Mexican amphibians belonging to this museum.

In 1910, about 15 species of Mexican amphibians were collected for the University Museums, University of Michigan, by Dr. A. G. Ruthven on a low plain at the foot of the San Andreas Tuxtla Range in southern Vera Cruz. From H. B. Baker this museum in 1926 received a small number of amphibians collected in Puebla and Vera Cruz.

During July, 1925, Joseph R. Slevin made general herpetological collections for the California Academy of Sciences, San Francisco, in Vera Cruz, Federal District, and Oaxaca.

European.—Herpetologists of Europe have described 54 species of Mexican tailless amphibians, and the majority of the types and cotypes of these forms are still extant in European museums. The writer therefore made an effort during April and May, 1930, to locate and examine as many of these original specimens as possible.

The nucleus of the Mexican herpetological collection in the Museum für Naturkunde in Berlin seems to have been obtained from three botanical collectors. Included in the herpetological collections made by Ferdinand Deppe, Christian Julius Wilhelm Schiede (who died in Mexico in 1836), and Graf von Sack were the types of the toads of the genus *Bufo* described by Dr. Arend Frederick August Wiegmann in Oken's Isis for 1833. These toads, *Bufo compactilis*, *B. cristatus*, *B. horribilis*, *B. marmoreus*, and *B. valliceps*, formed a part of what appears to be the first Mexican herpetological collection received by any European museum, and presumably led Wiegmann to publish in 1834 his "Herpetologia Mexicana." In 1870, Dr. Wilhelm C. H. Peters published a report on a collection made by Berkenbusch near Matamoros and at other localities in Puebla. In reporting upon this collection, Peters described the following new species: *Hyla microtis*, *Hylodes berkenbuschii*, *Liuperus nitidus*, and *Engystoma mexicanum*. A new leptodactylid collected at Haunusco [=? Huatusco in Vera Cruz] by Doctor Hille was named *Phyllobates verruculatus* by Peters.

Fifteen supposedly new species of Mexican amphibians were based upon specimens belonging to the Muséum National d'Histoire Naturelle, in Paris. In their "Erpétologie Générale" published in 1841, Duméril and Bibron recognized two new amphibians from Mexico, one a peculiar burrowing narrow-mouthed toad (*Rhinophrynus dorsalis*), which had been collected by Auguste Sallé, and the other a widely distributed tree frog (*Hyla baudinii*). In 1853, Duméril discovered the broad-headed cave frog (*Eleutherodactylus laticeps*) among specimens collected by Arthur Morelet in Yucatan. The French naturalist Pierre Marie Arthur Morelet made an extended field trip through southern Mexico and Central America during the years 1847 and 1848, and presented his collection to the Paris Museum.

Following the example of Napoleon I after the conquest of Egypt, Napoleon III promulgated a decree, dated February 27, 1864, that formally established the Mission Scientifique au Mexique et dans l'Amérique Centrale. Firmin Bocourt received an appointment as naturalist to this commission. Adolphe Boucard seems to have been attached to the commission in some capacity, as his name appears among those appointed as *voyageurs*. The exploratory work of this commission extended from 1865 to 1867. Boucard had visited Mexico at least once prior to this, for in 1855 he and Auguste Sallé were making collections in Vera Cruz. After the death of Auguste Duméril in 1871, during the siege of Paris, Firmin Bocourt was given the task of completing the report upon the herpetological collections. The aid of Paul Brocchi having been obtained, he was commissioned to prepare the report on the amphibians, and this was published in 1882 under the title of "Étude des Batraciens de l'Amérique Centrale." Preliminary descriptions of the new species were published in 1877 and 1879. Two of those described as new, *Leiuperus mexicanus* and *Cauphias crassus*, were collected by Adolphe Boucard. The types of *Hyla plicata* and *Leptodactylus fragilis* were found by Firmin Bocourt. In addition to the material assembled by the personnel of the mission, the Muséum National d'Histoire Naturelle received herpetological collections from Auguste Sallé, Consul Ghiesbreght, Baron Frederic de Müller, Francis Sumichrast, and Alfred Dugés. *Rhinophrynus rostratus* and *Exerodonta sumichrasti* were based upon specimens received from Sumichrast. Sallé collected the type of *Bufo mexicanus* and Dugés sent Brocchi the type of *Scaphiopus dugesii*. During the years 1896 and 1897, Léon Diguet made collections in Mexico for the Paris Museum, particularly in the State of Oaxaca, in the vicinity of Guadalajara, Jalisco, and in the Territory of Tepic (Nayarit). In reporting upon these collections in 1899, Mocquard recognized three new species, which were named *Rana trilobata*, *Hyla rudis*, and *Hyliola digueti*.

The British Museum of Natural History has a large representative collection of Mexican amphibians, including the type specimens of the species described by Günther and Boulenger. In tabulating the described species, the writer found that in this collection alone specimens from Mexico have formed the basis for 27 species of tailless amphibians.

Previous to 1858, the British Museum had acquired by purchase, gift, or exchange a small number of Mexican amphibians, among which were several amphibians taken by Auguste Sallé in Vera Cruz and Oaxaca. On April 16, 1855, Sallé and his companion Adolphe Boucard were located at Tospam near Cordoba, Vera Cruz, where they were visited by Francis Sumichrast. At Cordoba in Vera Cruz,

Sallé collected cotypes of *Hyla euphorbiacea* Günther, *H. lichenosa* Günther, and *Bufo sternosignatus* Günther, and the type of *Gastrophryne elegans* (Boulenger). One of the cotypes of *Eleutherodactylus sallaei* (Günther) was also received from Sallé, and while Mexico is the only locality given, it too was probably collected somewhere in the State of Vera Cruz. The following specimens, purchased from Émile Parzudaki, a dealer at Paris, lack definite localities: Cotypes of *Hyla euphorbiacea* Günther, *H. lichenosa* Günther, and *Bufo sternosignatus* Günther, and the type of *B. anomalus* Günther. The specimens acquired from Hugh Cuming, including cotypes of *Hyla euphorbiacea* and *H. lichenosa*, were collected in the State of Vera Cruz, probably by Auguste Sallé, as the former secured a number of birds from this collector.

In 1876, Frederick du Cane Godman and Osbert Salvin conceived the idea of promoting a monumental work entitled "Biologia Centrali-Americana," which was begun as a private undertaking, though later (beginning in 1881) the collections were presented to the British Museum. To Dr. Albert C. L. G. Günther were assigned the sections on reptiles and amphibians, and collectors were employed to secure specimens that would supplement available material. Among these collectors was Herbert H. Smith, who collected at Atoyac in Vera Cruz, Teapa in Tabasco, Omilteme and Amula in Guerrero, and Cuernavaca in Morelos. From Omilteme came the cotypes of *Rana omiltemana* Günther, *Syrrhaphus omiltemanus* Günther, and *Eleutherodactylus calcitrans* (Günther); from Amula the type of *Tomodactylus amulae* Günther; and from Cuernavaca the cotypes of *Hyla nana* Günther (*H. smithii* Boulenger). Dr. A. C. Buller collected on the plateau of central Mexico, and at the Hacienda el Florencio in Zacatecas he obtained the cotypes of *Borborocoetes mexicanus* Boulenger. Godman collected in Mexico during 1887 and 1888, and he is listed in the records of the British Museum as the collector of the types or cotypes of five of the species described by Günther. C. T. Hoege and an Indian assistant of Godman, Mateo Trujillo, collected at Jalapa and Misantla in Vera Cruz. At Jalapa, Hoege collected a cotype of *Hyla nigropunctata* Boulenger, while Trujillo secured the type of *Hylella picta* Günther and the cotypes of *Hyla taeniopus* Günther. Godman obtained the types of *Eleutherodactylus venustus* (Günther) and *E. plicatus* (Günther) at Jalapa, while the cotypes of *Hyla godmani* Günther came from Misantla and Jalapa.

Alphonso Forrer collected on the Tres Marias Islands and at several localities in western Mexico, particularly at Presidio near Mazatlan in Sinaloa, from where Forrer forwarded specimens that became the types of *Rana forreri* Boulenger and *Pternohyla fodiens* Boulenger and the cotypes of *Diaglena spatulata* (Günther) and *Hypopachus oxyr-*

rhinus Boulenger. Forrer collected also the type of *Rana pustulosa* Boulenger at Ventanas in Durango. In 1888 George F. Gaumer worked in Yucatan and visited Cozumel, Ruatan, and the Bonacca Islands.

The cotypes of *Eleutherodactylus alfredi* (Boulenger), which were presented by Alfred Dugés, came from Atoyac in Vera Cruz. Dr. Hans Gadow and his wife on one of their visits to Mexico collected the cotypes of *Eupemphix gadovii* Boulenger at San Mateo del Mar near Tehuantepec, and those of *Eleutherodactylus beatae* (Boulenger) at La Perla near Orizaba. The cotypes of *Rana tarahumarae* from the Sierra Tarahumari formed part of a collection acquired from Doctor Gadow.

So far as known only one of the Mexican types—*Bufo lateralis*—is located in the Naturhistorische Museum at Vienna, and that was described by Dr. Franz Werner from a toad collected in Tehuantepec in 1872 by T. K. Salmon. A number of Mexican amphibians collected by Dr. Hans Gadow are in the Vienna museum.

The type of the Mexican toad *Bufo occipitalis*, which was described by Prof. Lorenzo Camerano in 1879, should be in the museum at Turin, Italy, but it could not be found at the time of the writer's visit there in 1930. The type of *Hylodes augusti* remained in the possession of Dr. Alfred Dugés at Guanajuato, Mexico, and its present whereabouts are unknown.

The tailless amphibians of Mexico are not known to be less abundant than those found within the borders of the United States, and yet some of these species are very meagerly represented in American collections. For some of the species only a single individual was available, and in one or two instances the species is known to the writer solely from the diagnosis published by the original describer. Practically all the types of species described by Baird, Barbour, Bocourt, Boulenger, Brocchi, Cope, Günther, Mocquard, Peters, Werner, and Wiegmann have been studied by the writer. The majority of the specimens examined have been preserved in alcohol from 30 to 100 years, and the vicissitudes of time, including evaporation and action of the preservatives, as well as the bleaching effect of light, have hindered and in some instances prevented critical comparisons. Among the many published reports that deal with or refer to Mexican amphibians, there are a number of such a general nature that no reference is made to them in the text. Shorter articles and particularly those containing either descriptions of new species or supplemental data on those already described are cited in the synonymy.

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ABBREVIATIONS

The following abbreviations are used in the lists of specimens examined during the preparation of this report and in the text where catalogue numbers are given:

A.M.N.H.....American Museum of Natural History, New York, N. Y.
A.N.S.P.....Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.
B.M.....British Museum of Natural History, London, England.
C.A.S.....California Academy of Sciences, San Francisco, Calif.
C.G.E.M.....Comision Geografica Exploradora de Mexico, Mexico City, Mexico.
F.M.N.H.....Field Museum of Natural History, Chicago, Ill.
M.C.Z.....Museum of Comparative Zoology, Cambridge, Mass.
M.H.N.P.....Muséum National d'Histoire Naturelle, Paris, France.
M.N.B.....Museum für Naturkunde, Berlin, Germany.
N.M.W.....Naturhistorische Museum, Vienna, Austria.
U.M.U.M.....University Museums, University of Michigan, Ann Arbor, Mich.
U.S.N.M.....United States National Museum, Washington, D. C.

Class AMPHIBIA Linnaeus

1758. Amphibia Linnaeus, Systema naturae, ed. 10, vol. 1, p. 194.

The amphibians have a skull that is characterized by several morphological features. The chrondrocranium is platybasic; the quadrate is immovably united with the cranium by an otic process, which joins the otic capsule, and by an ascending process, which reaches to the pterygoid; the stapes occupies the fenestra vestibuli of the otic capsule; and there are two occipital condyles.

Of the three recent orders included in this class, the Salientia (frogs and toads) are far more numerous as regards genera and species than either the Caudata (salamanders) or the Apoda (caecilians). The Salientia alone are treated in this report.

Order SALIENTIA Laurenti

1768. Salientia Laurenti, Synopsin reptilium, p. 24.

The members of this order have the hind limbs developed for leaping, and they are much longer and stronger then the forelegs. The most striking skeletal feature found in the Salientia is the fusion of the caudal vertebrae into a single rod, the coccyx or urostyle. The skull is characterized in part by the absence of basioccipital, supraoccipital, and supratemporal bones, by the ankylosis of the frontal and parietal bones, and by the lack of any connection between the stapes and the quadrate. Vomerine and palatine bones are present but are not united with each other, and the latter bounds the choana posteriorly and joins the pterygoid externally. The astragalus and calcaneum are elongated and form a distinct section of the hind limb, the tarsus.

The classification of the Salientia adopted is based on slight modifications of internal structure, and some of the forms can only be distinguished from closely related species by close scrutiny. The minute details of internal structure, such as the relations of the several elements that compose the ventral portion of the shoulder girdle, the shape of the sacral diapophyses, the articular relations between the sacral vertebra and coccyx, the number of presacral vertebrae, the shape of the terminal phalanges, and the presence or absence of intercalary disks, can only be determined by dissection. Other characters employed are the presence or absence of maxillary, vomerine, and parasphenoid teeth, the attachment of the tongue, the presence or absence of parotoid glands, the presence or absence of lumbar glands, the shape of the pupil of the eye, the extent of the web between the digits of the fore and hind feet, the characters furnished by the texture of the skin, and the color patterns.

The present report is based on the critical study of nearly 2,200 specimens from the mainland of Mexico. Seven families of Salientia are represented in Mexico by a total of 19 genera and 65 species.

KEY TO FAMILIES OF MEXICAN SALIENTIA

1. Sacral vertebra procoelous 2
   Sacral vertebra biconvex, with double condyle for coccyx (fig. 1, *a*); eighth vertebra biconcave, preceded by seven procoelous vertebrae; without ribs; sacral diapophyses cylindrical or dilated; pectoral girdle firmisternal (fig. 21, p. 195) 6
2. Sacral vertebra ankylosed to coccyx (fig. 1, *b*); presacral vertebrae eight, uniformly procoelous (rarely opisthocoelous); without ribs at any stage in development; sacral diapophyses dilated; pectoral girdle arciferal; pupil of eye vertically elliptical; sole of foot smooth, but provided with a large inner tubercle with black cutting edge ..... **Pelobatidae** (p. 18)
   Sacral vertebrae free (fig. 1, *c*), with double condyle for coccyx; presacral vertebrae eight to five, procoelous; without ribs; pectoral girdle arciferal (fig. 3, p. 27) 3
3. Neither maxillary nor vomerine teeth present; parotoid glands generally visible 4
   Maxillary teeth present (except in *Engystomops*); no visible parotoid glands; vomerine teeth present or absent 5
4. Head small and unusually narrowed; no distinct neck; size of body disproportionate to size of head; mouth conspicuously small and narrow; snout truncated in front, forming a flat circular disk; eyes rather small; pupil vertical; parotoid glands flattened and not raised above skin on shoulders; no tympanum; fingers free; toes fully webbed, the tips not dilated; outer metatarsals united; inner toe tuberclelike; a very large shovellike inner metatarsal tubercle; epicoracoid cartilages narrow, scarcely overlapping; no omosternum; sternum vestigial; sacral diapophyses noticeably dilated; terminal phalanges simple ..... **Rhinophrynidae** (*Rhinophrynus*) (p. 24)
   Head not unusually narrowed; mouth large; parotoid glands distinct; terminal phalanges T-shaped or simple (very rarely claw-shaped); sacral diapophyses cylindrical or dilated; presacral vertebrae eight ..... **Bufonidae** (p. 27)
5. No intercalary cartilage or bone between ultimate and penultimate phalanges of each digit, supporting the claw-shaped or T-shaped terminal joint (fig. 17, p. 76); sacral diapophyses cylindrical or dilated ..... **Leptodactylidae** (p. 74)
   An intercalary cartilage or bone supporting terminal phalanges (fig. 2), which are generally claw-shaped; sacral diapophyses dilated ..... **Hylidae** (p. 129)
6. Head distinctly narrowed and mouth small; generally a fold of skin on top of head behind the eyes; a dermal ridge extends across the palate between the choanae, and another in front of the esophagus; tympanum indistinct or not visible; vomerine teeth absent; sacral diapophyses somewhat dilated; no omosternum ..... **Brevicipitidae** (p. 182)
   Head not unusually narrowed; mouth large; tympanum distinct; maxillary and vomerine teeth present; tongue bicornuate or deeply notched behind; sacral diapophyses cylindrical or slightly dilated ..... **Ranidae** (p. 189)

Family PELOBATIDAE Lataste

1865. Scaphiopodidae Cope, Nat. Hist. Rev., London, p. 107, Jan.
1879. Pelobatidae Lataste, Compte Rendu Assoc. Franç. Avanc. Sci., for 1878, pp. 761, 762.—Boulenger, 1882, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 432.

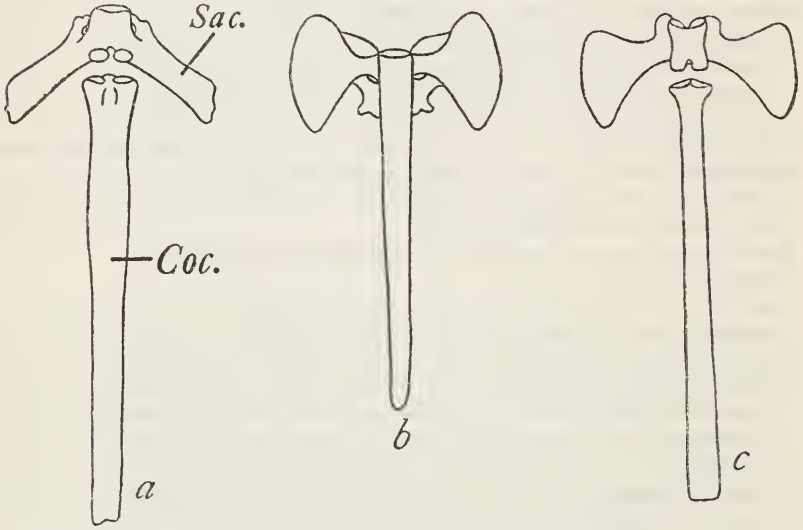

Figure 1.—Diagrams illustrating structural conditions found in the sacral vertebra and coccyx of Mexican tailless amphibians: *a*, *Rana pipiens* (U.S.N.M. No. 541); sacral vertebra (*Sac.*) free and biconvex with double condyle for the coccyx (*Coc.*); *b*, *Scaphiopus hammondii* (U.S.N.M. No. 60359); sacral vertebra procoelous, that is, with an anterior concave articular surface for corresponding presacral vertebra, and ankylosed posteriorly with coccyx; *c*, *Hyla baudinii* (U.S.N.M. No. 16563); sacral vertebra free, procoelous, and with double condyle for coccyx

The genera comprising the true spade-foot series of toads have a nearly continuous distribution over most of the Palaearctic region, and a second series—*Megalophrys* and *Aelurophryne*—have a restricted range in southern Asia and the neighboring islands. Doctor Noble[3] has recently studied *Sooglossus* and *Nesomantis*, which are indigenous to the Seychelles Islands in the Indian Ocean, and concludes that his dissections show that this family did penetrate into the Southern Hemisphere. This is generally considered to be one of the primitive families of living Salientia.

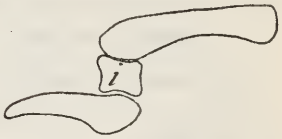

Figure 2.—Terminal phalanges of the toe in the foot of *Hyla*, *i* indicating the position of the intercalary phalanx

Genus SCAPHIOPUS Holbrook

1836. *Scaphiopus* Holbrook, North American herpetology, Philadelphia, ed. 1, vol. 1, p. 85. [Genotype, *Scaphiopus solitarius* Holbrook, *idem*, vol. 1, p. 85, pl. 12 (Carolina, Georgia, and Tennessee) = *Rana holbrookii* Harlan, 1835, Medical and physical researches, p. 105 (South Carolina).]

[3] Noble, G. K., An analysis of the remarkable cases of distribution among the Amphibia, with descriptions of new genera, Amer. Mus. Nov., no. 212, pp. 8-12, 1926.

1866. *Spea* COPE, Journ. Acad. Nat. Sci. Philadelphia, new ser., vol. 6, pt. 1, p. 81, July. [Genotype, *S*[*caphiopus*] *bombifrons* COPE, 1863, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 53, Mar. (type locality not designated, but the cotypes were obtained at Fort Union on the Missouri River, latitude 48° N.; on the Platte River, 200 miles west of Fort Kearney; and at Llano Estecado, Tex.).]

The genus *Scaphiopus* is the only representative of the family Pelobatidae in North America. The several species breed in temporary pools after rains, and the ropelike egg mass is attached to water weeds. Wright has found that the eggs of *Scaphiopus hammondii* are occasionally stalked. The egg has two capsules in addition to the vitelline membrane. In one species, *S. holbrookii*, the intracapsular development is very short, the larvae hatch in an immature condition, and the frontal gland initiates the hatching process, the tadpoles emerging before the gills are formed. The tadpoles of *Scaphiopus* have simple teeth.

KEY TO MEXICAN SPECIES OF SCAPHIOPUS

1. Glandular enlargements or parotoid glands variable in their presence, generally limited to a thickening of the skin in scapular region; skin of upperparts generally conspicuously warty, covered with closely spaced large tubercles, especially on sides and shoulders; a conspicuous pair of light-colored supra-anal spots; vomerine teeth in two clusters either between or at level of posterior margin of choanae; tympanum visible or concealed by hypertrophy of parotoid; canthus rostralis scarcely indicated; head flat or slightly concave between the eyes; cephalic ossification incomplete; underparts smooth, with a few rounded areolae; fingers in order of decreasing length, 3, 1, 4, 2; palm smooth except for conspicuous elongated inner metacarpal tubercle and less distinct small outer metacarpal tubercle; fingers essentially free, with a vestigial web on each side of second finger rarely present; first and second fingers of breeding males with horny nuptial excrescences; heels not meeting when legs are flexed; web complete or strongly scalloped, in which case the distal phalanx is largely free on all toes but fourth, on which the two distal phalanges either are or are not bordered with dermal fringe; sole smooth except for large external metatarsal tubercle with black cutting edge; toes in order of decreasing length, 4, 3, 5, 2, 1; color pattern of upperparts variable; darker coloration restricted chiefly to V-shaped interorbital band and anastomosing blotches or wavy cross bands in thoracic and sacral regions, which may or may not interrupt distinct or indistinct longitudinal light stripes; generally a pair of blotches of same color in scapular region; longitudinal light-colored stripes when present 2 to 4 in number, the inner pair of which are on a line with inner margins of orbits, and the outer with tympanum; vertical light-colored stripe on tip of nose; fore and hind limbs with transverse dark crossbars; head-and-body length of adults, 55 mm---- **hammondii multiplicatus** (p. 22)

No glandular enlargement on post-tympanic region; a supra-scapular dermal enlargement above and in front of tympanum; parotoid glands generally absent, or small and indistinct; skin of upperparts rough, with scattered low tubercles, more closely spaced on sides and shoulders than elsewhere; light-colored supra-anal spots smaller and generally indistinct; vomerine teeth in two clusters behind or at level of posterior margin of choanae; tympanum large, more than half the diameter of the eye, but anterior margin often indistinct; canthus rostralis rounded; head rounded anteriorly, depressed or flattened between the eyes; cephalic ossification complete; skin of underparts slightly roughened, smoother anteriorly; fingers in order of decreasing length, 3, 1, 2, 4; palm smooth except for two large metacarpal tubercles; fingers free; first and second fingers black and horny internally in breeding males; heels not meeting when legs are flexed; foot large, web strongly scalloped, the fourth digit having the two distal phalanges bordered by dermal fringes; sole smooth except for large external metatarsal tubercle with black cutting edge; color pattern of upperparts irregular, asymmetrical, but with intricate arrangement of spots, or network of brown bands; upperparts variable in color—green, olive, or brown—and streaked, spotted, or blotched more or less irregularly with some shade of yellow; a dark V-shaped interorbital band; pustules black or yellow; underparts light colored; fore and hind limbs barred or spotted with some darker color; head-and-body length of adults, 65 mm..... **couchii** (p. 20)

SCAPHIOPUS COUCHII Baird

COUCH'S SPADE-FOOT TOAD

1854. *Scaphiopus couchii* BAIRD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 62, Apr.—BAIRD, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 28, pl. 35, figs. 1–6.

1863. *S* [*caphiopus*] *rectifrenis* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 53, Mar. (Tamaulipas; Rio Nazas, Coahuila).

Type locality.—Rio Nazas, State of Coahuila, and Matamoros, State of Tamaulipas, Mexico.

Range.—In Mexico from Matamoros southwestward through the States of Tamaulipas, Coahuila, and San Luis Potosi to Acaponeta in Nayarit.

According to Strecker,[4] Couch's spade-foot toad inhabits the entire Rio Grande Valley from Brownsville to El Paso, Tex., and, although its range in Texas is still imperfectly known, it does not appear to range east of the 96th parallel. The northernmost record is 50 miles south of Fort Worth.

Remarks.—Baird gave Coahuila and Tamaulipas as the habitat of *S. couchii*, but neglected to cite the catalogue numbers of the cotypes. Cope, however, in revising this genus in 1863 removed one (U.S.N.M. No. 3714) of Baird's original cotypes of *S. couchii* and

[4] Strecker, J. K., Notes on the life history of *Scaphiopus couchii* Baird. Proc. Biol. Soc. Washington, vol. 21, pp. 199–206, Nov. 24, 1908.

transferred it to his new species *rectifrenis*. This specimen was collected on the Rio Nazas in Coahuila by Lieut. D. N. Couch and unfortunately can not now be located in the collection. In this same paper, Cope cited a specimen (U.S.N.M. No. 3713) obtained by Couch at Matamoros in Tamaulipas as the basis for the diagnosis of *S. couchii*. The other cotype of *S. rectifrenis* (U.S.N.M. No. 3715), which was collected in Tamaulipas by Couch, is marked in the record book of the division of reptiles as having been destroyed. The collections that Cope had in his possession for study so many years were returned to the National Museum after his death, but so far as known not one of these cotypes was ever found.

This night-prowling spade-foot toad has a somewhat bloated appearance in life and frequents lowlands as well as plateaus. It is most frequently observed during the time of the spring rains, when it comes forth to breed in temporary pools and at other times when heavy rains drive it from its burrow. It is well adapted for a subterranean and nocturnal life, and at certain seasons may be found half buried in moist earth under some old log. From 350 to 500 eggs are laid in strings, the number in each string varying from 45 to 125. The eggs are attached to grass, weeds, or roots in shallow water, generally less than 6 inches in depth, and they hatch in 8 to 10 days. The growth of the tadpole is very rapid, and within three weeks the metamorphosis to the land stage has taken place. Doctor Nelson observes in his field catalogue that hundreds of these spade-foot toads were mating at Acaponeta on June 26, 1897, in a pool of water near the river bank.

Specimens examined.—Thirty, as follows:

Scaphiopus couchii

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			TAMAULIPAS:		
U.S.N.M.	47912	1	Mier	Apr. 30, 1891	William Lloyd.
M. C. Z.	1659	3	Savincto (tropical mountains on road to Tampico).	Dec. 15, 1878	Edward Palmer.
			COAHUILA:		
U.S.N.M.	46947	1	Carneros	Aug. 11, 1896	Nelson and Goldman.
M. C. Z.	1639	6	Monclova		Edward Palmer.
			SAN LUIS POTOSI:		
Do.	1664	10	San Luis Potosi	1879	Do.
Do.	1669	3	San Luis Potosi (9 leagues south).	do.	Do.
U.S.N.M.	47859–64	6	NAYARIT: Acaponeta	June 26, 1897	Nelson and Goldman.

SCAPHIOPUS HAMMONDII MULTIPLICATUS (Cope)

Mexican Spade-foot Toad

1863. *S[caphiopus] multiplicatus* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 52, Mar.

1879. *Scaphiopus dugesii* Brocchi, Bull. Soc. Philom. Paris, ser. 7, vol. 3, no. 1, p. 23.—Brocchi, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 24, pl. 9, fig. 4 (Mexico).

Type locality.—"Valley of Mexico," State of Mexico, Mexico.

Range.—From Sonoyta in northwestern Sonora south through western Chihuahua and Durango to northern Jalisco; east to Miquihuana in western Tamaulipas, and south through San Luis Potosi to Guanajuato, Mexico, and Federal District. North of the Mexican boundary, the species *S. hammondii* and its geographic races are distributed from the northern Okanagan Lake district (Vernon) of British Columbia, south through western Washington, Oregon, Nevada, and California, to northern Lower California (Ensenada); east to the western margin of the great plains in northwestern North Dakota (Fort Union); and south along the great plains to western Kansas, the panhandle district of Texas, and to San Antonio and El Paso.

Remarks.—The type (U.S.N.M. No. 3694) was sent by John Potts to the Smithsonian Institution. The actual preservation of the type is fairly good, notwithstanding numerous incisions made by Cope. There is a transverse incision across the right suprascapular region, one across angle of jaw, a longitudinal and two crosswise cuts along the sacrum, and an oblique cut on the upper surface of the right tibia. There are lengthwise and transverse cuts on the throat, and the viscera have been exposed by a long crescentic incision. The skin has been freed from the upper surface of the head.

The two cotypes of *Scaphiopus dugesii* (M.H.N.P. No. 281a, parchment labels 86–287, 86–288) are both young individuals, with head-and-body lengths of 32 mm. and 33.5 mm., respectively. Black spots are present on the upperparts and the black inner metatarsal tubercle is quite distinct. Both of these cotypes are typical young individuals of this Mexican form. Alfred Dugés is listed in the catalogue as the collector of the cotypes of *S. dugesii*.

Specimens from northern Sonora have a relatively smoother skin on the dorsal surface of the body than those taken farther south. Some of those from northern Sonora differ in no appreciable manner from California and Nevada specimens unquestionably referred to *S. hammondii*. Along the southern border of the known range of *Scaphiopus* in Mexico, individuals with very warty skins and with an appreciable thickening of the skin in the parotoid region predominate. Between these two extremes are various intermediate individuals, and no satisfactory method for determining the status or relations of

such extreme types is apparent. Additional material may show that these spade-foot toads with skins grading from relatively smooth to warty are separable into at least two groups, and that a more satisfactory disposition of this puzzling question will result from the allocation of those taken along the northern border of Mexico to the subspecies *hammondii* and those with unusually warty skins from farther south to the subspecies *multiplicatus*.

The spade-foot toad may be very abundant wherever it is found, though it may escape observation because of its nocturnal habits. It is commonly assumed that it remains in its burrow most of the year and that it comes out only to deposit its eggs in June and July in pools formed by heavy rains. The spade-foot makes circular holes in the ground near the bases of shrubs and clumps of weeds, and yet in very sandy soil it is very difficult to find the place where it has burrowed, for in most instances it appears as if the hole has been pulled in after the toad. After the breeding season is over, these toads seem to take more pains in constructing their burrows, as they are well-rounded inside and resemble somewhat an earthen jar with a narrow top. The surface around the neck of the burrow is often quite sticky when the spade-foot is discovered inside. In Montana during June, 1916, I found that these toads made their appearance after midnight on dark nights, and when hunted with a flash light they burrowed from sight in a very short time. The time from the laying of the eggs to the transformation of the tadpoles and their leaving the water does not exceed 30 days. This rapid development is necessitated by the tendency of the breeding pools of rain water to dry up very quickly.

This spade-foot toad can be distinguished almost instantly by its trim and neat body appearance, by its moist and usually warty skin, if it has not been hopping about long enough to fill the pores with fine sand and dust, and, like its relatives, by the catlike vertical pupils of the eyes. In life the upperparts are usually olive-colored with splotches of black or purplish black, and with orange-red tubercles scattered over the skin.

Specimens examined.—Seventy-one, as follows:

Scaphiopus hammondii multiplicatus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SONORA:		
U.S.N.M.	62253	1	Nogales	July 27, 1919	F. J. Dyer.
Do.	21801	1	Sonoyta	Jan. 20, 1894	E. A. Mearns
Do.	26597	1	CHIHUAHUA: Meadow Valley	July 18, 1898	H. H. and C. S. Brimley.
M.C.Z.	10038–39	2	TAMAULIPAS: Miquihuana	1924	W. W. Brown.
Do.	8363–66	4	DURANGO: Durango (streams near city).	1921	P. Townsend.

Scaphiopus hammondii multiplicatus—Continued

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SAN LUIS POTOSI:		
M.C.Z.		1	Alvarez (kilo. 58, alt. 8,000 feet).	June 23, 1926–Sept. 30, 1926	W. W. Brown.
Do.	9678	1	Morales	1923	Do.
			GUANAJUATO:		
U.S.N.M.	9881	1	Guanajuato	1877	Alfred Dugés.
Do.	9884–85	2	do	1877	Do.
Do.	11360	4	do	Jan. 30, 1880	Do.
Do.	16203–04	2	do		Do.
Do.	16205–07	3	do		Do.
Do.	16208–17	10	do		Do.
Do.	9915	1	do	1877	Do.
Do.	32383	1	do		Do.
Do.	17437–38	2	Silao		Do.
			JALISCO:		
A.M.N.H.	12551	1	Arroyo Hondo, below Hostotipaquillo.	Oct. 31, 1919	Paul D. R. Ruthling.
U.S.N.M.	46971	1	Etzatlan	June 17, 1892	E. W. Nelson.
			FEDERAL DISTRICT:		
M.C.Z.	8452–57	6	Lake Xochimilco	July —, 1921	E. R. Dunn.
A.M.N.H.	10490	1	Llanos la Vaquita	Oct., —, 1919	E. Lopez.
Do.	12091–12100	10	Santa Cruz (1 mile north)	July 10, 1919	Paul D. R. Ruthling.
			? STATE:		
U.S.N.M.	71153	1	Between Chihuahua and Valley of Mexico.		John Potts.
Do.	71709–11	3	do		Do.
Do.	3694	[1] 1	Valley of Mexico		Do.
Do.	14599	8	No definite locality	Sept. 1, 1881	Alfred Dugés.
M.H.N.P.	281α	[2] 2	do		Do.

[1] Type of *Scaphiopus multiplicatus*. [2] Cotypes of *Scaphiopus dugesii*.

Family RHINOPHRYNIDAE Günther

1858. Rhinophrynidae GÜNTHER, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 127.

A single genus, *Rhinophrynus*, is the sole known representative of Rhinophrynidae. The precise relationships of this family are somewhat uncertain, and, although it is to be referred to the suborder Procoela, it occupies a somewhat anomalous position on account of the presence of a peculiarly modified pectoral girdle. Among the arciferal amphibians the clavicles and coracoids extend toward the middle line to join the corresponding epicoracoid cartilaginous plate. The two halves of the pectoral girdle thus overlap on the mid-line. In *Rhinophrynus*, however, both halves of the pectoral girdle are attached to a single curved epicoracoid cartilage. The under epicoracoid seems to have been lost. *Bombinator* and *Ceratophrys* have somewhat similarly shaped coracoids and clavicles, but both of these genera have overlapping curved epicoracoid cartilages.

The life history and developmental peculiarities of the eggs and tadpoles of this toad are unknown.

Genus RHINOPHRYNUS Duméril and Bibron

1841. *Rhinophrynus* DUMÉRIL and BIBRON, Erpétologie générale, vol. 8, p. 757. [Genotype, *Rhinophrynus dorsalis* DUMÉRIL and BIBRON, *idem*, vol. 8, p. 758, pl. 91, figs. 2, 2a (Vera Cruz, Mexico).]

The absurd-appearing *Rhinophrynus*, locally known in Mexico as "poche" or "po-chi," is dark brown in life, with a yellow or orange vertebral stripe in addition to smaller spots or blotches of the same color. The head is narrow and unusually small for so large an animal, the skin on the oval-shaped body is loose and flabby, and the limbs are rather short. When disturbed the body is distended and the limbs are drawn up beneath. The small nostrils are located on the top of the snout, nearer the eyes than the end of the muzzle. Being nocturnal, the small eyes of this toad have vertical pupils. No vestige of an external tympanum is discernible. Neither maxillary nor vomerine teeth are present. Although the tongue is attached posteriorly and can not be flung forward like that of the common toad, it is said to be remarkably adept in licking up insects. It has a foot remarkably well adapted for burrowing, with an inner horny metatarsal tubercle on the calcar fully 10 millimeters in length and a secondary shovellike tubercle about half as long on the end of the first toe.

Correlated with its burrowing habits are certain anatomical modifications. Inasmuch as the rather brief published diagnoses of this toad do not adequately describe its structural peculiarities, the following diagnosis is given:

Superior plate of sphenethmoid covered by the completely ossified fronto-parietals; sphenethmoid septal walls ossified to end of muzzle, and separating the nasals; nasals large, entirely in contact with fronto-parietals, separated by median process of the latter, and by the sphenethmoid septum; pterygoid straight, thin, with a short maxillary suture; no wing of pterygoid extending inward to parasphenoid; exoccipital nearly completely covered by parasphenoid; single fissure for anterior cranial nerves; neither maxillary nor vomerine teeth; no tympanum; tongue attached behind; coracoid short, expanded at extremities, and slightly curved; clavicle narrow, flattened, and strongly curved upward; clavicles and coracoids attached medially to a single curved or epicoracoid cartilage; no omosternum; scapula short and wide; suprascapula thin, constricted medially, and with distal dilation; suprascapula normally in close proximity to and in certain positions capable of sliding over pro-otic; humerus with flat head and high knifelike deltoid crest; radius and ulna fused; presacral vertebrae eight; sacral vertebra free, procoelous, and with double condyle for coccyx; sacral diapophyses short, dilated; femur with flat head, slender shaft, inner and outer crests on posterior surface, and greatly expanded distal end; tibia and fibula fused, shorter than femur; two very short, flattened metatarsals separated by median oval aperture; large flattened shovellike calcar; first toe with vertically expanded terminal phalanx; remaining terminal phalanges simple.

RHINOPHRYNUS DORSALIS Duméril and Bibron

BURROWING TOAD

1841. *Rhinophrynus dorsalis* DUMÉRIL and BIBRON, Erpétologie générale, vol. 8, p. 758, pl. 91, figs. 2, 2a.—GÜNTHER, 1858, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 127, pl. 12.

1897. *Rhynophrynus dorsalis* DUGÉS, La Naturaleza, Mexico, ser. 2, vol. 2, pp. 98–100, pl. 5, figs. 1–5. [Colored plate with correct spelling.]

1877. *Rhinophrynus rostratus* BROCCHI, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 4, p. 196.—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, pp. 98, 99, pl. 9, fig. 1 (Tehuantepec, Mexico).

Type locality.—Vera Cruz, State of Vera Cruz, Mexico.

Range.—From Tuxpam in northeastern Vera Cruz, south through Tabasco (reported by Dugés from Chiapas), Yucatan, and Quintana Roo to Guatemala; on the west coast in the region of the Isthmus of Tehuantepec.

Remarks.—The type of *Rhinophrynus dorsalis* (M.H.N.P. No. 693, parchment label No. 743) was collected by Auguste Sallé. It is a young individual and is fairly typical of the species. The head-and-body length is 44.5 mm.

Remarks.—One of these burrowing toads was found by Hugo Fuick on October 19, 1874, in the neighborhood of Cordoba in a lagoon at an altitude of 2,100 feet. Among the field notes of Dr. E. W. Nelson are the following observations on this interesting toad:

They occur in thickets and woods near Tuxtepec in the state of Oaxaca. One came into camp at night during a rainstorm and at the same time the muffled call notes of others, which were more like the hoarse calls of some bird than of a toad, were heard. These toads live in the ground and are called "Po-chi." When held in the closed hand they try to escape by moving backwards, and by a kind of a hitching motion of the hinder parts they exert a surprising amount of force. The hard callosities on the inside border of the feet are used to secure a hold and no doubt serve in this way when the animal is burrowing underground.

Specimens examined.—Fifty-eight, as follows:

Rhinophrynus dorsalis

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
U.S.N.M.	8262	1	Cordoba	Oct. 19, 1874	Hugo Fuick.
M. C. Z.	8458–8506	40	Hacienda Cerro del Gallo, near San Cristobal del Llave.	1921	E. R. Dunn.
U.S.N.M.	25213–14	2	Tuxpam	1870	Gideon C. Lincecum.
C. G. E. M.		1	Vera Cruz		
M. H. N. P.	693	[1]1	do		Auguste Sallé.
			OAXACA:		
U.S.N.M.	30271–73	3	Tehuantepec City		Francis Sumichrast.
Do.	70404	1	do		Do.
Do.	46920–21	2	Tuxtepec	Apr. 9, 1894	Nelson and Goldman.
			TABASCO:		
Do.	47312	1	Montecristo	May 8, 1900	Do.
Do.	47313	1	do	May 29, 1900	Do.
M. C. Z.	2421	1	No definite locality	1895	T. J. Potts.
U.S.N.M.	6622	2	do	1860	Ch. Laszlo.
M. C. Z.	2772	1	YUCATAN: Chichen Itza sacred cenote.	1911	E. H. Thompson.
Do.	2856	1	QUINTANA ROO: Xcopen	1912	J. L. Peters.

[1] Type.

Family BUFONIDAE Hogg

1841. Bufonidae Hogg, Ann. and Mag. Nat. Hist., ser. 2, vol. 7, no. 45, p. 361.

The family Bufonidae is here retained for the genus *Bufo*, which comprises numerous species in the Old and New Worlds. The majority of the species are readily recognized, and a few of them have an extensive range in their respective regions. Adults of the genus *Bufo* lack maxillary teeth. There is some evidence, however, that *Bufo* is a derivative of a toothed ancestor. The presence of a tooth ridge and a tooth furrow in the upper jaw of a *Bufo* tadpole is regarded by Oeder [5] as conclusive evidence that the ancestors of this genus had teeth. Doctor Noble [6] has examined the morphological details of the several families of living Salientia and has concluded that the bufonids are inseparable from the leptodactylids.

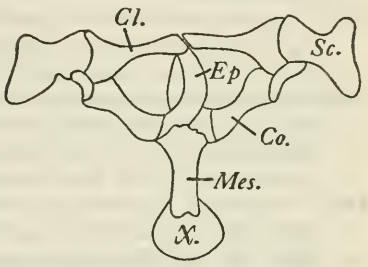

FIGURE 3.—Diagrammatic ventral view of shoulder girdle of *Bufo americanus;* arciferal in structure. The opposite halves of the shoulder girdle, or pectoral arch, are capable of movement with contraction and expansion of the thorax; the epicoracoid cartilages overlap

Cl., clavicle; *Co.*, coracoid; *Ep.*, epicoracoid; *Mes.*, sternum or mesosternum; *Sc.*, scapula; *X.*, xiphisternum

The accumulating evidence seems to indicate that a satisfactory scheme of classification can not be based solely on dentition characters. Cope attempted to outline a natural classification based largely on the pectoral girdle, Nicholls employed characters furnished by the vertebral column, while more recently Noble has stressed the importance of the thigh musculature. As might be expected there are exceptions to all these schemes of classification. The toothless toads of the genus *Bufo* have long been recognized as a natural group, and while the known morphological evidence may not warrant the retention of the family Bufonidae solely for this genus, some allowance must be made for the fact that relatively few species have been critically studied by those interested in classification schemes.

Genus BUFO Laurenti

1768. *Bufo* Laurenti, Synopsin reptilium, p. 25. [Genotype, *Bufo vulgaris* Laurenti, *idem*, p. 28=[*Rana*] *bufo* Linnaeus, 1758, Systema naturae, ed. 10, vol. 1, p. 210 (Europe).]

1824. *Oxyrhynchus* Spix, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 49. [Included species: *Bufo naricus*, p. 49, pl. 14, fig. 2; *B. nasutus*, p. 50, pl. 14, fig. 3; *B. semilineatus*, p. 51, pl. 21, fig. 1; *B. granulosus*, p. 51, pl. 21, fig. 2; *B. acutirostris*, p. 52, pl. 21, fig. 3; *B. proboscideus*, p. 52, pl. 21, fig. 4 (all from Brazil).]

[5] Oeder, R., Die Zahnleiste der Kröte. Zool. Anz., vol. 29, p. 538, 1905.
[6] Noble, G. K., The phylogeny of the Salientia. Bull. Amer. Mus. Nat. Hist., vol. 46, art. 1, p. 20, 1922.

1828. *Chaunus* Wagler, Isis von Oken, vol. 21, p. 744. [Genotype, *Chaunus marmoratus* Wagler, *idem*, p. 744 = *Bufo granulosus* Spix, *op. cit.*, p. 51, pl. 21, fig. 2 (habitat in Provincia Bahia, Brazil).]

1838. *Osilophus* Tschudi, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, pp. 52, 89. [Genotype, *Osilophus typhonius* Cuvier=[*Rana*] *typhonia* Linnaeus, 1758, Systema naturae, ed. 10, vol. 1, p. 211 (America).]

1843. *Phrynoidis* Fitzinger, Systema reptilium, fasc. 1, p. 32. [Genotype, *Bufo asper* Kuhl=*B*[*ufo*] *asper* Gravenhorst, 1829, Deliciae musei zoologici Vratislaviensis, fasc. 1, p. 58 (Java).]

1843. *Phrynomorphus* Fitzinger, Systema reptilium, fasc. 1, p. 32. [Genotype, *Bufo leschenaultii* Duméril and Bibron=*Bufo leschenaultii* Tschudi, 1838, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, p. 89 (India?)=[*Bufo*] *guttatus* Schneider, 1799, Historiae amphibiorum naturalis et literariae, fasc. 1, p. 218 (India Orientali).] (Preoccupied by *Phrynomorphus* Curtis, 1833, Hemiptera.)

1843. *Leptophryne* Fitzinger, Systema reptilium, fasc. 1, p. 32. [Genotype, *Bufo cruentatus*=*Bufo cruentatus* Tschudi, 1838, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, pp. 52, 88 (India Orientali).]

1843. *Docidophryne* Fitzinger, Systema reptilium, fasc. 1. p. 32. [Genotype, *Bufo agua* Daudin, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 64, pl. 37 (Brazil)=[*Rana*] *marina* Linnaeus, 1758, Systema naturae, ed. 10, vol. 1, p. 211 (America).]

1843. *Peltophryne* Fitzinger, Systema reptilium, fasc. 1, p. 32. [Genotype, *Bufo peltocephalus* Duméril and Bibron=*Bufo peltocephalus* Tschudi, 1838, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, pp. 52, 89 (Cuba).]

1843. *Otolophus* Fitzinger, Systema reptilium, fasc. 1, p. 32. [Genotype, *Bufo margaritifer* Daudin=*Rana margaritifera* Laurenti, 1768, Synopsin reptilium, p. 30=[*Rana*] *typhonia* Linnaeus, 1758, Systema naturae, ed. 10, vol. 1, p. 211 (America).]

1843. *Eurhina* Fitzinger, Systema reptilium, fasc. 1, p. 32. [Genotype, *Bufo proboscideus* Wagler=*Bufo proboscideus* Spix, 1824, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 52, pl. 21, fig. 4 (habitat ad flumens Solimoens, Brazil)= *Bufo typhonius* (Linnaeus).]

1843. *Chilophryne* Fitzinger, Systema reptilium, fasc. 1, p. 32. [Genotype, *Bufo d'orbignyi* Duméril and Bibron, 1841, Erpétologie générale, vol. 8, p. 697. (Montevideo, Uruguay).]

1843. *Phryne* Fitzinger, Systema reptilium, fasc. 1, p. 32. [Genotype, *Bufo vulgaris* Laurenti, 1768, Synopsin reptilium, p. 28=*Rana bufo* Linnaeus, 1758, Systema naturae, ed. 10, vol. 1, p. 210 (Europe)=*Bufo bufo* (Linnaeus).]

1845. *Anaxyrus* Tschudi, Untersuchungen über die Fauna Peruana, Herpetologie, p. 78. [Genotype, *Anaxyrus melancholicus* Tschudi, *idem*, p. 78, pl. 11, fig. 5=*Bufo compactilis* Wiegmann, 1833, Isis von Oken, vol. 26, pt. 7, p. 661 (Mexico).]

1849. *Schmismaderma* Smith, Illustrations of the zoology of South Africa, appendix, p. 28. [Genotype, *Schismaderma lateralis* Smith=*Bufo carens* Smith, 1848, *idem*, pl. 68, fig. 1.]

1860. *Adenomus* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 371, Sept. [Genotype, *Adenomus badioflavus* Cope (Ceylon)=*Bufo kelaartii* Günther, 1858, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 140, pl. 10, fig. A (Ceylon).]

1862. *Rhaebo* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 358, Sept. [Substitute name for *Phrynomorphus* Fitzinger, 1843.]

1863. *Incilius* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 50, Mar. [Genotype, *Chilophryne conifera* COPE=*Bufo coniferus* COPE, 1862, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 158, Mar.] (See also COPE, 1865, Nat. Hist. Rev., p. 102.)

1865. *Epidalea* COPE, Nat. Hist. Rev., p. 102, Jan. [Genotype, *Epidalea calamita* COPE=*Bufo calamita* LAURENTI, 1768, Synopsin reptilium, pp. 27, 119 (Europe).]

1868. *Otaspis* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 20, p. 312, Nov. [Genotype, *Otaspis empusa* COPE=*Peltaphryne empusa* COPE, 1862, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 344, Sept. (Cuba).]

1870. *Nannophryne* GÜNTHER, Proc. Zool. Soc. London, p. 402, June 9. [Genotype, *Nannophryne variegata* GÜNTHER, *idem*, p. 402, pl. 30, fig. 2 (Puerto Bueno, Port Grappler, and Eden Harbour, in Territorio Magallanes, west coast of South America).]

1870. *Ansonia* STOLICZKA, Journ. Asiatic Soc. Bengal, vol. 39, pt. 2 (Nat. Hist.), p. 152, June 7. [Genotype, *Ansonia penangensis* STOLICZKA, *idem*, p. 152, pl. 9, fig. 4 (Penang Island, Straits Settlements).]

1876. *Cranopsis* COPE, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 8, pt. 2, p. 96. [Genotype, *Cranopsis fastidiosus* COPE, *idem*, p. 96, pl. 23, figs. 1, 1a (2,500 feet elevation on slope of Pico Blanco, district of Uren, Costa Rica).]

1876. *Crepidius* COPE, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 8, pt. 2, p. 97. [Genotype, *Crepidius epioticus* COPE, *idem*, p. 97, pl. 23, figs. 2, 2a (5,000 feet elevation on Pico Blanco, Costa Rica).]

1876. *Ollotis* COPE, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 8, pt. 2, p. 98. [Genotype, *Ollotis coerulescens* COPE, *idem*, p. 98, pl. 23, figs. 3, 3a (3,000 to 5,000 feet elevation on Pico Blanco, Costa Rica).]

1879. *Dromoplectrus* CAMERANO, Atti R. Accad. Sci. Torino, vol. 14, p. 882. [Genotype, *Dromoplectrus anomalus* CAMERANO=*Bufo anomalus* GÜNTHER, 1858, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 57 (Mexico)=*Bufo compactilis* WIEGMANN, 1833, Isis von Oken, vol. 26, pt. 7, p. 661 (Mexico).]

Thirteen species of *Bufo* are recognized in Mexico. One, *B. alvarius*, is semiaquatic and has a rather smooth leathery skin, but most of the species are mainly terrestrial except during the breeding season. Three others, *B. compactilis*, *B. cognatus*, and *B. woodhousii*, have a large shovellike inner metatarsal tubercle, which facilitates burrowing. The extent to which cranial crests are developed constitutes an important diagnostic character for many species. Cranial crests are quite prominent in some, especially in *B. valliceps*, which has high sharp-edged bony ridges. Conversely, there are others, particularly *B. punctatus*, that have a nearly flat interorbital region and normally are devoid of such crests. Abnormal development or peculiarities in the conformation of the cranial crests are occasionally observed in a large series of any species of *Bufo*. The Mexican toad *B. cristatus* may be an instance of this sort, for, with the exception of the peculiarly enlarged parietal crests, it conforms in most respects to the *valliceps* type of toad. The nondevelopment of certain cranial crests when associated with an exceptionally tubercular skin, such as has been hereinafter described in the case of certain individuals

of *B. compactilis* and *B. simus*, often materially changes the general appearance of the species. Nieden, in his key to the genus *Bufo*, often uses the occurrence of single or double subarticular tubercles on the toes as a diagnostic character. In many instances the number of subarticular tubercles present at each joint varies from one to two on the same digit, and yet the number of such tubercles will be constant in the majority of the specimens in any large series.

Although most kinds of toads are squat, fat, and warty, there are some smooth-skinned species, one of which (*Bufo alvarius*) inhabits the arid sections of Southwestern United States and northwestern Mexico. There is also a slender-bodied tropical toad (*B. haematiticus*) that reminds one of a frog. Of the many kinds of toads living to-day in different parts of the world, both the largest and the smallest belong to the American fauna. The largest, *B. marinus*, ranges from northern Mexico southward to Patagonia, and within the United States and northwestern Mexico is a form nearly as large, which is locally known as the Colorado River toad (*B. alvarius*). Large individuals of *B. marinus* may have a body length of 9 inches and a mouth large enough to swallow small birds, but insects constitute the major portion of their food. Probably the smallest living toad is the oak toad, *B. quercicus*, of the Southeastern United States; this species feeds largely on ants. The little green toad, *B. debilis*, is the smallest Mexican member of the genus.

Most toads have the skin covered with warts, which are more closely aggregated on the sides of the neck than elsewhere, and these, together with a pair of large glandular masses, the parotoid glands, situated behind the eyes, secrete a milky poisonous fluid whenever the animal is molested. This secretion is an acrid irritant, causing pain in cuts and producing a bitter astringent sensation in the mouth. Some investigators have advanced the idea that the female lacks this fluid during the breeding season, while the male at the same time has an overabundant supply of it.

According to Madame Phisalix, toads possess two distinct kinds of glands, which secrete venom of different properties, one type producing a mucous and the other a granular venom. While the mucous glands are distributed over the entire body, they are principally found on the abdomen. The mucous secretion produced is an alkaloid that acts as a narcotic, its effect being confined to the nerve centers. Glands situated on the back, together with the parotoid glands on the shoulders and connected with them, secrete a granular acid venom that acts as a convulsive.

It is not unusual to find hundreds of toads belonging to the same species congregated in a small pond, temporary pool, or shallow stream during the breeding season. Some species are far less numerous, and a dozen pairs may comprise the breeding population for

some small temporary pool. Under normal conditions, if mated in the water, the female begins laying at once, and according to species may lay from 600 to 16,000 eggs, the process usually being completed within one day unless there should be a sudden drop in the temperature. The eggs are generally laid in long spiral strings of jelly, which are attached to or which come in contact with some submerged object. One species, *B. punctatus*, does not deposit the eggs in strings, but singly or in a scattered mass. The inner tube of the egg string is absent in *B. compactilis* but present in *B. valliceps*. The length of the hatching period depends upon the temperature. Below 65° F. it requires 8 to 12 days, and above that temperature 3 to 8 days. Warm weather speeds up the rate of development and shortens the total time in the egg and tadpole stages. Toads are thus born in the water and in it spend their early life in a larval, fishlike state, breathing by means of gills. The transformation of the tadpole to a young toad takes place some time between 30 and 65 days after hatching, and under abnormal conditions 200 days have been required.

KEY TO MEXICAN SPECIES OF BUFO

1. Elongated gland extending full length of ulna; oval gland on upper surface of thigh and an interrupted gland on superior surface of tibia; parotoid gland long, oval, and nearly as large as side of head, descending on shoulder; tympanum large, two-thirds the diameter of orbit; supraciliary cranial crest forming regular curve with more elevated postorbital crest; a narrow preorbital crest; one or more prominent warts posterior to rictus oris; first finger longer than second; smooth leathery skin, with scattered warts; grayish or brownish green above; underparts light; size large, head-and-body length, 125 to 160 mm ..... **alvarius** (p. 35)

   No elongated glands on ulna and tibia 2

2. Parotoid gland subtriangular in outline and nearly as large as or larger than side of the head 3

   Parotoid gland smaller than side of the head 4

3. Parotoid glands divergent, very large, each extending backward to a point beyond shoulders, and covered with small tubercles; a small indistinctly margined tympanum almost contiguous to orbit; short-legged, small-bodied, with rough granular or tubercular skin on upperparts and top of head; supraciliary and postorbital crests indistinct; greenish or bluish slate above, with small blackish spots; eyelids with oblique cross-bar; tarsal fold with row of warts; metatarsal tubercles insignificant; head-and-body length, 40 to 75 mm ..... **debilis** (p. 50)

   Parotoid glands divergent, unusually large, and studded with large pores; a distinctly margined tympanum, about one-half width of eye; skin of upperparts warty, interorbital region generally smooth; prominent cranial crests, including canthal, preorbital, supraciliary, parietal, postorbital, orbito-tympanic, and supratympanic; interorbital space wider than upper eyelid; coloration of upperparts variable, ranging

through various shades of brown, including yellowish, reddish, or even blackish, and sometimes greenish olive; upperparts with or without large black insuliform spots, which when present are usually edged with pale yellow; a light vertebral line occasionally visible; arms and legs of immature individuals usually banded with dark brown; underparts dingy white or yellow; first finger longer than second; toes half or two-thirds webbed; double subarticular tubercles on distal phalanges of fourth toe; a distinct tarsal fold; head-and-body length, 115 to 185 mm---------- marinus (p. 53)

4. Inner metatarsal tubercle large and shovellike, with sharp, horny, and usually black edge---------- 5

Inner metatarsal tubercle neither large nor shovellike nor with sharp cutting edge---------- 7

5. Coloration of upperparts leopardlike, with conspicuous blotches, which vary from green to brown, margined with white or pale yellow; a bony elevation or boss between and considerably above level of nostrils, from which thick, blunt-edged cranial crests diverge backward; postorbital crest thick; interorbital region narrower than upper eyelid; reniform parotoid gland almost in contact anteriorly with postorbital crest; first finger longer than second; toes one-half webbed; double subarticular tubercles on distal phalanges of fourth toe; a thick tarsal fold or ridge; head-and-body length, 65 to 95 mm---------- cognatus (p. 41)

Coloration of upperparts not leopardlike---------- 6

6. A light vertebral streak extending from transverse interorbital band to vent; upperparts generally grayish or dull yellowish brown, conspicuously blotched with a darker color or with scattered spots; limbs obscurely barred; underparts light yellowish, with or without black markings on breast; largest warts red tipped and encircled at base with narrow black border; cranial crests distinct, but not high; canthus rostralis generally distinct; interorbital space either concave or convex, depending upon approximation of supraciliary crests, which may either parallel one another or diverge slightly posteriorly; parietal crests generally lacking, but supraciliary crests may be thickened at their posterior extremities; transverse postorbital crest forms right angle with supraciliary crest; a well-developed preorbital, a less distinct orbito-tympanal, but no supratympanic crest; parotoid glands in contact with postorbital crests, about twice as long as broad, their maximum diameter being longer than length of orbit; tympanum oval, higher than wide, and equal to half or more of length of orbit; toes one-third webbed; inner metatarsal tubercle large, with free cutting edge; subarticular tubercles on distal phalanges of fourth toe single or double; tarsal fold indistinct or absent; head-and-body length, 80 to 115 mm------- woodhousii (p. 72)

No light vertebral streak; coloration of upperparts generally light greenish gray or brown, irregularly spotted with darker color; interorbital light band occasionally present; top of head without or with poorly defined cranial crests; parotoid glands reniform in outline, in contact anteriorly with postorbital crest or upper eyelid; tympanum generally more than half the diameter of orbit, rarely indistinct and par-

tially concealed by tubercles; first finger longer than second; subarticular tubercles on distal phalanges of fourth toe generally single, occasionally double; a tarsal fold; head-and-body length, 60 to 87 mm---------- compactilis (p. 44)

7. Head broad, flat or shallowly concave, and thin through, without raised cranial crests, or with only vestiges of such; snout short, blunt; parotoid glands elevated, rounded or broader than long, and studded with minute tubercles; skin of upperparts with closely set small tubercles; coloration ranging from light reddish brown to gray or even malachite green; warts on upperparts tipped with red, orange, or yellow and encircled or partially encircled at base by narrow black border; obscure black markings occasionally present on limbs; underparts uniform white or spotted with darker color; diameter of oval tympanum more than half that of orbit; first finger longer than second; subarticular tubercles on distal phalanges of fourth toe single; a tarsal fold bearing row of small tubercles; head-and-body length, 55 to 80 mm. punctatus (p. 60)

Head narrow or broad, but with distinctly raised cranial crests---------- 8

8. Parietal crests unusually swollen, merging with thickened postorbital crests; supraciliary crests high, converging anteriorly; supratympanic crest short and connecting with large swollen subtriangular or ovoidal parotoid gland; interorbital region concave; snout pointed, prominent; tympanum small, less than one-half diameter of orbit and often rather indistinct; skin of upperparts and upper surfaces of fore and hind limbs with scattered small conical warts; underparts strongly granular; upperparts (in alcohol) sooty brown with a few indistinct markings of some lighter color; throat and chest dusky or blackish; belly with irregular blotches of yellow; under surfaces of fore and hind limbs irregularly marked with yellow and some dusky color; first and second fingers subequal; toes about two-thirds webbed, the penultimate and last phalanx of fourth toe free; metatarsal tubercles of moderate size; subarticular tubercles on distal phalanges of fourth toe single or double; bicolored parotoid glands, black laterally and grayish superiorly; head-and-body length, 48 to 75 mm---------- cristatus (p. 48)

Parietal crests when present not unusually swollen or expanded laterally [parietal crests of *Bufo valliceps* considerably swollen in rare instances]---------- 9

9. Parotoid glands elongate, in contact anteriorly either with postorbital crest or with upper eyelid; no supratympanic crest---------- 10

Parotoid glands not in contact either with upper eyelid or with postorbital crest, but separated by an interval of varying width; parietal crests generally present, occasionally vestigial; supratympanic crests present---------- 11

10. Parietal crests slender, short, and converging posteriorly; supraciliary crests convergent anteriorly; interorbital space wider than upper eyelid; postorbital crests very short, if present, and not extending more than halfway across toward tympanum; parotoid glands elongated, as large as or larger than upper eyelid; tympanum either distinctly outlined or largely concealed by tubercular skin and closely set

conical warts; general coloration of upperparts grayish, greenish, or brownish, marbled with a darker shade of brown; an interrupted irregular light vertebral stripe and an irregular lateral light band formed by anastomosing spots generally present; a transverse ashy white or yellowish band extending across upper eyelids and anterior interorbital region; underparts immaculate or spotted with some darker color; skin of upperparts with scattered small conical warts or decidedly tubercular; first finger longer than second; toes half webbed; a tarsal fold with linear series of small conical warts; subarticular tubercles on distal phalanges of fourth toe generally double; head-and-body length, 65 to 85 mm. **simus** (p. 63)

No parietal crests present; low curving supraciliary crests continuous with short postorbital crests; parotoid glands elongate, larger than upper eyelids, and contiguous anteriorly with postorbital crests; tympanum distinct, one-half the diameter of orbit; skin of upperparts rough, with numerous small warts; underparts coarsely granular; coloration of upperparts light brown, with light vertebral stripe from snout to vent, on each side of which are large blackish brown angular spots; posterior interorbital region with inverted dark chevron, which ends on upper eyelids; a dark band extending from orbit to thigh below light longitudinal band; underparts immaculate or grayish white; first finger longer than second; toes half webbed; no tarsal fold; subarticular tubercles on distal phalanges of fourth toe single; metatarsal tubercles small; head-and-body length, 40 to 52 mm. **canaliferus** (p. 40)

11. Cranial crests high, sharp edged, conspicuous; superior margin of upper jaw generally protruding 12

Cranial crests less conspicuous; parietal crests often indistinct or absent; combined supraciliary and postorbital crests form a continuous curve from anterior margin of orbit to supratympanic crest; interorbital region shallowly concave, not wider than upper eyelid; preorbital crest indistinct or vestigial; supratympanic crest short and thick; snout short, bluntly truncated, with angular canthus rostralis; tympanum distinct, transverse diameter about half width of orbit; parotoid glands subtriangular, smaller or no larger than upper eyelid; skin of upperparts thickly set with small warts; a lateral row of light-colored warts, but lateral fold is indistinct; coloration of upperparts brownish gray, marbled more or less distinctly with some darker color; whitish vertebral stripe of varying width, on each side of which are three large and a greater number of small irregular light-margined dark blotches; whitish markings above and dark-brown markings below lateral row of warts form more or less confluent longitudinal bands of varying width; a continuous or medially interrupted chevron band crosses upper eyelids and interorbital region; fore and hind limbs with dark crossbars above; underparts immaculate; first finger longer than second; a row of small closely spaced warts along tarsal fold; toes less than half webbed; subarticular tubercles on distal phalanges of fourth toe single; inner metatarsal tubercle small; head-and-body length, 55 to 75 mm. ..... **marmoreus** (p. 58)

12. Parotoid glands ovoidal in outline, descending on shoulders; no linear series of enlarged warts on side of body; first and second fingers subequal; subarticular tubercles on fourth toe double; toes one-third webbed; no tarsal fold; two small metatarsal tubercles; skin of upperparts rough, tubercular; underparts coarsely granular; coloration of upperparts brown or brownish black with blotches of darker color on each side of vertebral line; yellowish or whitish lateral stripe from parotoid gland to thigh, below which is a broad dark-colored lateral band; underparts usually yellowish, rarely spotted with a darker color; interorbital region and upper eyelids with anterior and posterior transverse medially interrupted dark bands; cranial crests high; canthal, preorbital, supraciliary, postorbital, and supratympanic crests distinct in adults; parietal crests vestigial or absent; tympanum small but distinct, its diameter slightly more than half that of eye; head-and-body length, 63 to 71 mm..... **coccifer** (p. 41)

Parotoid glands subtriangular in outline, bicolored, and as large as or larger than upper eyelid; a linear series of large conical warts on side of body; first finger longer than second; subarticular tubercles on fourth toe generally single; toes one-third webbed; no tarsal fold; two small metatarsal tubercles; skin of upperparts rough, tubercular, but somewhat smoother in southern specimens; warts often spinose; underparts coarsely granular; coloration of upperparts quite variable, at one extreme yellowish or light grayish with distinct markings, and at the other extreme with markings subdued or obliterated by a dark slaty or blackish suffusion; prevailing color generally some shade of brown, with linear series of conical warts extending along lateral line from parotoid glands to thighs, above which is a light-colored stripe and below which a dark-colored one; near level of middle of parotoid glands an inverted black chevron bisects light vertebral line; back irregularly marbled or blotched with some darker color; limbs cross banded; underparts unicolored or heavily marbled with black; a posterior interorbital transverse black band; cranial crests relatively high; canthal ridges distinct; supraciliary crests high, diverging posteriorly; parietal crests lower than the latter and converging posteriorly; the thick transverse postorbital crest forms an obtuse angle with short supratympanic crest; distinct orbitotympanal and preorbital crests; interorbital space deeply concave and much broader than upper eyelid; tympanum distinctly outlined, ovoidal in outline, and equal in width to slightly more than half length of orbit; head-and-body length, 60 to 100 mm..... **valliceps** (p. 68)

BUFO ALVARIUS Girard

Plate 1, frontispiece; Figure 4

1859. *Bufo alvarius* Girard, *in* Baird, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 26, pl. 41, figs. 1–6.—Cope, 1889, U. S. Nat. Mus. Bull. 34, p. 265, fig. 62.—Dickerson, 1906, The frog book, pp. 106–108, figs. 107–111, col. pl. 5, fig. 4.—Nieden, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 75, 129, fig. 182.—Storer, 1925, Univ. California Publ. Zool., vol. 27, pp. 163–167, pl. 12, fig. 32.

Type locality.—Valley of the Gila and Colorado Rivers.

Range.—Vicinity of streams with permanent flow of water from Guadalupe Canyon in northeastern Sonora north to Turkey Creek near Prescott in central Arizona, and in the lower Colorado River Valley from Fort Mohave to Fort Yuma; also occurs in Imperial County, Calif. Exact limits of range unknown. Reported from Guaymas (Mocquard) and Cajon Bonito Creek (Mearns), Sonora.

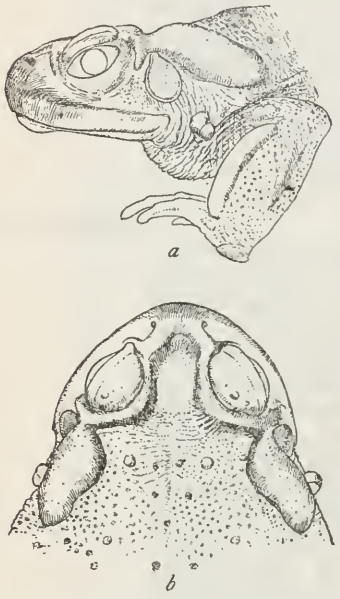

FIGURE 4.—Head of *Bufo alvarius* (U.S.N.M. No. 21063) from Guadalupe Canyon, Sonora, Mexico: *a*, Lateral view; *b*, dorsal view

Remarks.—This large toad frequents the hottest portion of the North American Continent, and, although it has never been found in the strictly desert areas, it seems to be extending its range with the advent of irrigation. It has been described as semiaquatic and, except in irrigated areas, is seldom observed during the dry season. The eggs are laid during the first heavy summer showers in temporary pools of water or in shallow streams.

Exceptionally large individuals may be rather uncommon, and the maximum size attained by this species can not be ascertained by the limited material available. One specimen (U.S.N.M. No. 66734) measures 160 mm. in head-and-body length. The distinctive characters of this species are a smooth leathery skin, large size, and greenish color. Unlike other Mexican toads, it has a large elongate gland on the forearm and several smaller ones on the hind limb.

Major Mearns,[7] in describing his experiences with this large toad, states:

> Of batrachians, a toad (*Bufo*) and a frog (*Rana virescens brachycephala* Cope) were found at Warsaw Mills; and at Buenos Ayres, at the beginning of the summer rains, Lieutenant Gaillard observed great numbers of a very large frog-like toad, named *Bufo alvarius* by Girard. Nothing was seen or heard of them until the advent of the early summer rains, which formed a large shallow lake near Buenos Ayres and about 10 kilometers (6 miles) north of the Boundary Line. These large toads then filled the air with their loud cries, which increased until a deafening roar was produced. Numbers of them were seen hopping about, but their rarity was not suspected by Lieutenant Gaillard, on which account none were collected. The range of *Bufo alvarius* Girard, extends from Monument

[7] Mearns, E. A., Mammals of the Mexican boundary of the United States. U. S. Nat. Mus. Bull. 56, pp. 113, 114, 1907.

No. 73, in Guadalupe Canyon, to the Colorado River (Monument No. 205). I first met with it in a dense growth of arrowwood (*Pluchea sericea*) on the edge of the Colorado River at Fort Mojave, Arizona, May 13, 1884. A specimen was carried to Peach Springs and given into the charge of the hotel proprietor, who allowed it to escape during my absence at the Grand Canyon of the Colorado. No specimen of this toad was again seen until July 6, 1892, when Lieutenants Gaillard and Irwin and the writer lay down to rest upon the damp grass beside the San Bernadino Springs, near Monument No. 77. At dusk these huge green batrachians began to hop about us, occasionally landing upon our faces. A few were caught and saved as specimens. No more were seen by me until October 3, 1893, when Hospital Steward E. C. Merton brought me another that he had just caught in a spring situated between Monument No. 73 and Cajon Bonito Creek, in Sonora, Mexico. Another was taken at Quitobaquita Springs, Monument No. 172, January 26, 1894.

The potency of the toxins secreted by this large toad during the physical stress of danger and pain has been recorded as follows by Musgrave:[8]

Just about sundown of that evening [September 1, 1928] I was looking over a planting in the front of our home when I discovered a large green toad in a standpipe used for irrigation purposes. I lifted the big fellow out and dropped him over the side. Our little wire haired fox terrier, standing near by made a dash at the toad, but I spoke to her and she stepped back. Immediately the toad swelled himself up, hissed at the dog and hopped a little way toward her. That was too much, the dog immediately grabbed him and in one shake the toad was dead. I was leaning over the standpipe and my face was perhaps 4 or 5 feet from the toad while she was shaking it.

About this time a large police dog that is a visitor at our home ran up and touched his nose to the toad; the little terrier snatched it away. I thought no more of it and started back to the house, the big police dog following. He had gone no more than a hundred feet when his front legs crumpled under him and he pitched forward. However, he gathered himself and then tipped backwards, his legs and body being paralyzed.

Immediately I realized that something was wrong and looking over to where the little terrier had been I saw her lying on the ground with her feet crumpled under her and her face in the dirt. I ran over and picked her up and found that she had fallen on top of the toad as she was carrying it. I felt her heart and found the action slow, and although she gasped and did her best, she could get no air into her lungs. Within two or three minutes from the time she first bit the toad she died. Immediately after death, bloody foam oozed from her mouth and nose.

About that time I became very sick myself, my head was swimming, and there was a lifting feeling in my lung cavity. It affected me rather peculiarly, as I wanted to walk and keep walking. I took a large dose of warm salt water and after disgorging what I had in my stomach I felt better. However, the effects did not wear off for about 30 minutes. The old police dog also revived in about three quarters of an hour.

I do not know whether I got the effects of the poison while leaning over the standpipe or while working with the little dog, as I pried her mouth open and tried to get salt water down her. I did not detect any odor whatsoever. I am sure that I did not get the poison from the toad before the dog attacked it,

[8] Musgrave, M. E., *Bufo alvarius*, a poisonous toad. Copeia, no. 173, pp. 96–98, Jan. 16, 1930.

although I did lift it with my hand, but this I have done on many occasions before without experiencing any trouble. I also handled with no ill effect a toad of the same species that was later sent to the Bureau of Biological Survey, Washington, D. C.

Recently I have had a communication from Miss May Noble, who lives in Phoenix and who within the past few days has had a similar experience. Her Pekinese dog seized one of these green toads but Miss Noble got it away from the dog before he had hurt it to any great extent. However, the dog soon became paralyzed and Miss Noble called two veterinarians, one of whom seemed to know nothing of the effects of that sort of poisoning, but the other said it was not uncommon in this valley. Miss Noble informs me that she used ammonia with good results and that the dog recovered within an hour after it had gotten the poison. This dog, however, did not puncture the skin of the toad, only picking it up.

Although it is not so stated in the original description, Girard seems to have based his description of *Bufo alvarius* on specimens received from two collectors. The locality is cited as the "Valley of Gila and Colorado," and the collector is stated to be "A. Schott." Arthur Schott was an assistant of Lieut. N. Michler, who was in charge of the party surveying the United States and Mexican boundary line from Fort Yuma, Calif., to Los Nogales, Sonora. Michler's party arrived at Fort Yuma from San Diego, Calif., on December 9, 1854, shortly after which Schott made surveys of the Gila and Colorado Rivers for short distances above their junction. After the initial point of the boundary line at the Colorado River was established on April 21, 1855, preparations were made for the survey of the oblique line. On May 5, 1855, the Mexican and American parties departed from Fort Yuma and began their journey along the wagon road up the Gila Valley to Tucson, Ariz. A camp was maintained near Tucson during most of June. It was not until June 26, 1855, that Michler's party met the United States Commissioner, Maj. W. H. Emory, and resumed the boundary survey near Los Nogales. The topography of the boundary line between Los Nogales and the Colorado River was completed on August 16, 1855. This itinerary shows that Schott actually traversed the area designated as the type locality. The next point to be determined is whether specimens of this toad were collected in this area by Schott and transmitted to the Museum.

On the lower margin of the original set of drawings of *Bufo alvarius* reproduced on the plate in the report on the reptiles of the United States and Mexican Boundary Survey, Baird has written "Sierra de la Union." There is only one entry in the catalogue of the division of reptiles that could possibly apply to this specimen. The original entry reads as follows: "Cat. No. 2571; *Bufo alvarius;* Sierra de la Union y Charcos de la Nariz; 2 specimens; received from Major Emory; collected by A. Schott." This range of mountains is located on the divide and not in the drainage of the Gila River, but it is quite

probable that Girard may have assumed that this range was so situated. It would seem that specimens collected along the route between Monument No. 14 on Sierra de la Union and the water holes of the Nariz Mountains were placed in one container and so labeled. The Sierra de la Union is shown on modern maps as Sierra de Moreno, and this range of mountains crosses the boundary line between Arizona and Sonora about 10 miles west and south of San Miguel in southern Pima County. The Sierra de la Nariz crosses the boundary line about 35 miles distant in a northwest direction. No other toad of this species collected by Schott is entered in the museum catalogue.

An examination of the catalogue of the division of reptiles reveals that another specimen (U.S.N.M. No. 2572) was available to Girard at the time the description was written. This was collected at old Fort Yuma, Calif., by Maj. George Henry Thomas, and is designated in the museum catalogue as the type of *Bufo alvarius*. Old Fort Yuma is located near the junction of the Gila and Colorado Rivers and thus lies in the "Valley of Gila and Colorado." The fact that Major Thomas had no official connection with any of the parties working on the survey of the boundary line does not suffice to explain the omission of this particular specimen, for a bat received in the same shipment with this toad is listed by Baird. The collection made by Thomas was received at the Museum in 1856.

It is quite certain from the notation made by Baird that the specimen figured on the plate accompanying the original description of *Bufo alvarius* came either from some spot between Sierra de la Union (Sierra de Moreno) and Charcos de la Nariz, or else from one or the other of these localities. These mountain ranges are located on the divide between the drainage of the Gila River in Arizona and that of the Rio Concepcion in Sonora. It is equally certain that the specimen which was collected by Major Thomas at Fort Yuma, Calif., had been received by the museum at least three years prior to the publication of Girard's description.

It is unfortunate that the type or cotypes of *Bufo alvarius* are not designated by the original describer. The usual procedure is to select as the lectotype or as the cotypes the specimen or specimens that were seen by the original describer before his description was published. In this instance one has to assume that all the material available in the Museum from the region covered by the boundary survey report was placed at Girard's disposal. If one takes Girard's "Valley of Gila and Colorado" at its face value, then the specimens taken by Schott and labeled as coming from "Sierra de la Union y Charcos de la Nariz" must be disregarded, inasmuch as they were not obtained at the type locality. On the other hand, if one insists that the type or cotypes were collected by Schott as stated by Girard, then the specimen collected by Major Thomas at Fort Yuma in the

valley of the Gila and Colorado must be ignored, because it was not taken by Schott. The selection of either of the above as the basis for Girard's description might lead to conflicting opinions, and since neither of these specimens has ever been formally designated as the type, the two specimens (U.S.N.M. No. 2571) collected by Schott and the one (U.S.N.M. No. 2572) collected by Major Thomas are hereby designated as the cotypes of *Bufo alvarius*. The specimens collected by Schott can not now be located. The one received from Thomas is quite well preserved and conforms in most details with the actual figures published by Girard.

Specimens examined.—One (U.S.N.M. No. 21063), collected by E. C. Merton, October 3, 1893, in Guadalupe Canyon, Sonora, in bed of dry wash about 3 miles southwest of Monument No. 73.

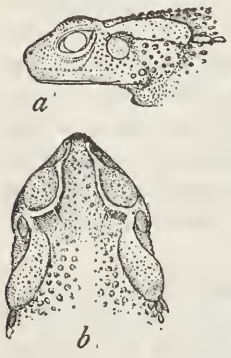

FIGURE 5.—Head of *Bufo canaliferus* (U.S.N.M. No. 30322) from Tehuantepec, Oaxaca, Mexico: *a*, Lateral view; *b*, dorsal view. Type specimen

BUFO CANALIFERUS Cope

Figure 5

1877. *Bufo canaliferus* COPE, Proc. Amer. Philos. Soc., vol. 17, no. 100, p. 85, July 20.—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 74, pl. 8, figs. 2, 2a–b.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 76, 131.

Type locality.—Tehuantepec, State of Oaxaca, Mexico.

Range.—This species has been collected at localities in the States of Vera Cruz, Oaxaca, and Chiapas, the most northerly record being Orizaba. It is reported from Tabasco (Dugés) and from Cerro de Valtierra (Günther) in Chiapas. The exact limits of its range are unknown. The most southerly record is Patulul in Guatemala.

Remarks.—This is a small light-colored toad, with a whitish vertebral stripe, on each side of which are dark-colored spots. It has a narrow head, low cranial crests, distinct tympanum, and elongate parotoid glands. The name chosen for this toad by Cope is in allusion to the once contemplated canal on the Isthmus of Tehuantepec. It seems to be a rare toad in American collections. There are no published observations on the habits and life history of this species.

The cotypes of this species (U.S.N.M. Nos. 30315–24) were collected by Francis Sumichrast. Notwithstanding their long immersion in a preserving fluid, most of them have a fairly well-preserved color pattern and are otherwise in very good condition.

Specimens examined.—Seventeen as follows:

Bufo canaliferus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			OAXACA:		
A.M.N.H.	13901	1	Chivela		Paul D. R. Ruthling.
U.S.N.M.	10022	1	Santa Efigenia, Tehuantepec		Francis Sumichrast.
Do.	10036	[1] 5	Tapana, Tehuantepec		Do.
Do.	30315-24	[2] 10	Tehuantepec		Do.

[1] Young. [2] Cotypes.

BUFO COCCIFER Cope

Figure 6

1866. *Bufo coccifer* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 130, May.—COPE, 1876, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 8, pt. 2, p. 100, pl. 23, fig. 5.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 76, 132.

Type locality.—Arriba, Costa Rica.

Range.—Specimens have been taken as far north as Tehuantepec, in the State of Oaxaca, and as far south as San Jose, Costa Rica.

Remarks.—It is rather surprising that so little is known in regard to the habits of this toad, for it has a rather extensive range on the Pacific slope of South America. It is brownish colored, with a yellowish vertebral line and irregular wavy chestnut-brown markings on the upperparts, and has a rather broad head, high cranial crests, small tympanum, and small circular parotoid glands.

The type of this species (U.S.N.M. No. 6490) was presented to the National Museum by Charles N. Riotte, who was the United States minister to Costa Rica for some years prior to 1868.

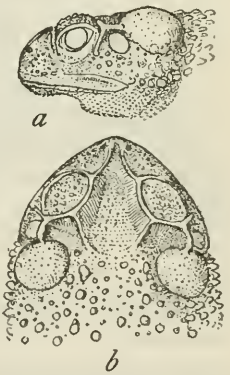

FIGURE 6.—Head of *Bufo coccifer* (U.S.N.M. No. 6490) from Arriba, Costa Rica: *a*, Lateral view; *b*, dorsal view. Type specimen

Specimens examined.—One (U.S.N.M. No. 51175), collected by Francis Sumichrast at Juchitan, Tehuantepec, Oaxaca.

BUFO COGNATUS Say

PLAINS TOAD

Figure 7

1823. *Bufo cognatus* SAY, *in* Long, Stephen H., Account of an expedition from Pittsburgh to the Rocky Mountains, vol. 2, p. 190.—COPE, 1889, U. S. Nat. Mus. Bull. 34, p. 275, fig. 67.—DICKERSON, 1906, The frog book, pp. 99–102, figs. 85–92, col. pl. 5, fig. 2.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 75, 127, fig. 180.—STORER, 1925, Univ. California Publ. Zool., vol. 27, pp. 187–192, pl. 11, fig. 31a.

1879. *Bufo dipternus* COPE, Amer. Nat., vol. 13, no. 7, p. 437, July (Montana).

Type locality.—Arkansas River, Prowers County, Colo.

Range.—In Mexico the range of this toad extends southward from the northern boundary to San Pedro in the State of Nayarit and to the mountains of Alvarez in the State of San Luis Potosi. Reported by Perez from Villa Lerdo, Durango. North of the Mexican boundary, the plains toad has been recorded from a wide extent of territory. It has been found in the Upper Missouri River drainage (Valley County) and in southeastern Montana (Yellowstone, Rosebud, and Custer Counties); in north-central (McHenry County) and eastern (Jamestown, Stutsman County) North Dakota; the Missouri Flood Plain area of central South Dakota (Fort Pierre); south through western South Dakota (Ardmore, Fall River County); eastern Wyoming (Laramie County); central Nebraska (Fort Kearney); northeastern (Sedgwick and Weld Counties) and south-central (Costilla County) Colorado; western Kansas (Trego, Gove, Wallace, and Morton Counties); northeastern New Mexico (Koehler Junction); central Oklahoma (Caddo and Cleveland Counties); southwestern Arkansas (Red River); the Staked Plains region from the northern boundary of Texas to Pecos River, the salt plains of El Paso County, and Jeff Davis County, Texas; central (Bernalillo County) and southwestern (Grant County) New Mexico; southeastern Arizona (Cochise, Maricopa, and Pima Counties) and along the Colorado River at Fort Mohave; Salton Sea Basin (Mecca and Brawley) and along the Colorado River from Fort Yuma to Needles, Calif.; and also in northern Utah (Utah and Emery Counties).

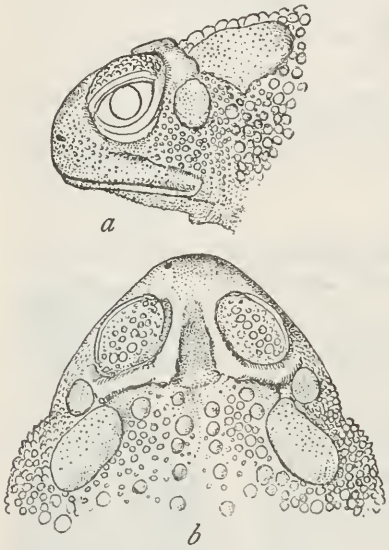

FIGURE 7.—Head of *Bufo cognatus* (U.S.N.M. No. 4626) from Nebraska: *a*, Lateral view; *b*, dorsal view

Remarks.—In life this toad can be recognized instantly by the conspicuous greenish blotches on the upperparts. These irregular spots, as will be noticed on closer inspection, vary from green to brown and are margined with white or pale yellow. The parotoid glands are short, broad, and widely separated; the bony crests on the top of the head converge anteriorly and are united on the muzzle, forming a raised boss. The so-called leopard, or plains, toad frequents

the plains and the foothills as a general rule, though it may be found occasionally in the vicinity of streams and in bottomlands that are subject to periodical overflow from some river. Although nocturnal like most toads, it leaves its place of hiding during heavy showers, and comes forth in search of food.

Say concludes his description of *Bufo cognatus* with the following statement: "A specimen is placed in the Philadelphia Museum." This specimen is undoubtedly the type of this species and presumably is the individual collected in July, 1820, in southeastern Colorado. The "Philadelphia Museum"[9] was established by Charles Wilson Peale in 1784. The collections made by the expedition of Major Long to the Rocky Mountains in 1819–1820 were deposited in this museum on March 23, 1821. Peale's museum was incorporated as a stock company in 1820 and continued in existence until 1846, when financial difficulties forced the sale of the collections at public auction. The natural-history collection, however, was kept intact and exhibited in Masonic Hall, Philadelphia, until 1850, when Moses Kimball bought one-half for the "Boston Museum," and the other half was sold to P. T. Barnum's "American Museum" in New York City. Barnum's "American Museum" was destroyed by fire on July 13, 1865. The bulk of the Boston Museum's share of the old natural-history collection of the Philadelphia Museum passed into the possession of the Boston Society of Natural History in 1893 and the residue in 1899. After this collection reached the society's rooms, some of the specimens were destroyed, but most of the birds were sold to C. J. Maynard in 1900. When the importance of this collection became generally appreciated, the Boston Society of Natural History redeemed it from Maynard. Again, in 1914, the remaining relics of this collection were transferred to the Museum of Comparative Zoology at Harvard College. The possibilities for the loss of the type of *Bufo cognatus* during the numerous transfers of the collections of the old "Philadelphia Museum," or while it was in the possession of either Barnum's "American Museum" or Kimball's "Boston Museum," are too numerous to leave any serious hope for its future recovery in some unexpected depository.

In 1876, Dr. F. V. Hayden, in charge of the United States Geological and Geographical Survey of the Territories, authorized an investigation of the Judith River Lignite Formation. Prof. E. D. Cope was placed in charge of the expedition that fitted out at Fort Benton, Mont., for this exploratory survey. Among the published results of this expedition is the description by Cope in 1879 of a toad, which he

[9] Faxon, W., Bull. Mus. Comp. Zool., vol. 59, no. 3, pp. 119–148, July, 1915.

had found "abundant on the plains north of the Missouri River east of Fort Benton," as a new species, *Bufo dipternus*. The following is quoted from the original description:

> There are two faint straight supraorbital ridges, and a postorbital but no supratympanic ridge. The supraorbitals are united by the enlargement of the posterior part of the prefrontal bones, which forms quite a tuberosity in adults.

In contradiction to this published description, Cope in 1889 stated that a large young specimen of this species served as the type and that "although an inch and a half long, this individual had not developed a trace of the cranial crests." Nothing is known in regard to the subsequent history of the material upon which Cope based this name.

Specimens examined.—Twenty, as follows:

Bufo cognatus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	19407	1	MEXICAN BOUNDARY		E. A. Mearns.
F.M.N.H.	1092	1	CHIHUAHUA: Colonia Juarez		S. E. Meek.
			COAHUILA:		
U.S.N.M.	2564	2	Alamo de Parras	June —, 1853	D. N. Couch.
M.C.Z.	1643	5	San Pedro	1880	Edward Palmer.
			DURANGO:		
U.S.N.M.	47246–51	6	Durango	July 6, 1898	Nelson and Goldman.
Do.	23997–99	3	No definite locality	Sept. —, 1896	Edward Palmer.
			SAN LUIS POTOSI:		
M.C.Z.	1660	1	Mountains of Alvarez	1879	Do.
Do.	1671	1	San Luis Potosi (9 leagues southeast).	1879	Do.

RUFO COMPACTILIS Wiegmann

Figure 8

1833. *Bufo compactilis* WIEGMANN, Isis von Oken, vol. 26, pt. 7, pp. 661, 662.—PETERS, W., 1863, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 80.—COPE, 1889, U. S. Nat. Mus. Bull. 34, p. 272, fig. 65.—DICKERSON, 1906, The frog book, pp. 102–104, figs. 93–98.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 74, 108.

1854. *Bufo speciosus* GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, pp. 85–87, May (valley of Rio Bravo [Rio Grande del Norte] and not uncommon in the province of New Leon).—BAIRD, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, pp. 26, 35, pl. 40, figs. 5–11.

1858. *Bufo anomalus* GÜNTHER, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 57 (Mexico).

1877. *Bufo levifrons* BROCCHI, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 4, pp. 187, 188 (Mexique).—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, pp. 70, 71, pl. 6, fig. 2.

1879. *Bufo mexicanus* BROCCHI, Bull. Soc. Philom. Paris, ser. 7, vol. 3, no. 1, pp. 23, 24 (Mexique).—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 85, pl. 8, figs. 3, 3a, 3b.

Type locality.—Mexico.

Range.—From Mexican boundary south to Atemajac in Tabasco, to Tupataro in Michoacan, Xochimilco in Federal District, and to Potrero in Vera Cruz. Reported from Ciudad, Durango (Forrer). In Southern United States, disregarding a doubtful record for southwestern Kansas, we may say that the range of this toad extends from the Red River Valley in southeastern Oklahoma (Frederick, Tillman County) south through the middle district of Texas (Upper Wichita River) west of the timber belt and east of the plains to McLennan, Burnet, Kendall, Austin, Colorado, Bexar, Goliad, Victoria, Refugio, Nueces, Starr, and Cameron Counties; northwest along the Rio Grande drainage through Kinney, Val Verde, and Reeves Counties to El Paso County, Tex.; northward in New Mexico along the Rio Grande to the Mimbres Mountains and to Albuquerque; in southeastern Arizona (Huachuca Mountains, Cochise County), as well as in Maricopa, Yavapai, and Mohave Counties; and in extreme southwestern Utah (Washington County).

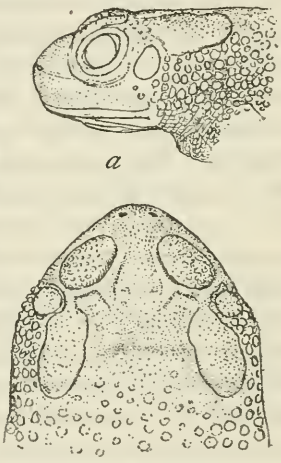

FIGURE 8.—Head of *Bufo compactilis* (U.S.N.M. No. 2611) from Pesquieria Grande, Nuevo Leon, Mexico: *a*, Lateral view; *b*, dorsal view. Cotype specimen

Remarks.—The type of Wiegmann's *Bufo compactilis* (M. N. B. No. 3528) was collected in Mexico by two botanical collectors, Ferdinand Deppe and C. J. W. Schiede. The ground color of the upperparts of the type is very light, although the mottling is dark; underparts white, with a few scattered dark spots on chest; vertical black bars on upper lip quite distinct; interorbital band light colored; supraciliary and postorbital crests distinct; a cluster of minute warts occupies the position of the parietal crest; parotoid glands elongated and in contact with postorbital crests, notwithstanding the presence of a rather prominent knoblike supratympanic crest; head relatively small; body wide and squat; skin of upperparts warty, with numerous small tubercles; length of body approximately 65 mm.

Three specimens are designated in the National Museum catalogue as the cotypes of Girard's *Bufo speciosus*. One of these (No. 2611) was collected by Lieut. D. N. Couch during April, 1853, at Pesquieria Grande, Nuevo Leon, Mexico, and was figured by Baird in his report on the reptiles of the United States and Mexican Boundary Survey. The viscera of this specimen have been removed through an abdominal opening, and the lower jaws have been cut away from the head at the

angles of the mouth. It is an adult and is fairly well preserved. The second cotype (U.S.N.M. No. 2608) was obtained in the vicinity of Ringgold Barracks [Rio Grande City, Starr County], Tex., by Arthur Schott, a surveyor attached to the United States and Mexican Boundary Commission under Maj. W. H. Emory. This is an adult female and may have been dissected by Cope. There is an incision on the abdominal wall, another across the right parotoid gland, and a third along the under surface of the humerus. At some time the preservative in which this cotype was kept may have been allowed to evaporate, for the skin is rather stiff. Capt. Stewart Van Vliet sent the third cotype (U.S.N.M. No. 2610) to the Museum from Brownsville, Tex. It is quite young, and the head-and-body length is 27.5 mm. The black-margined inner metatarsal tubercle is well developed. The body is shrunken and somewhat distorted.

The type of Günther's *Bufo anomalus* (B.M. No. 58. 9. 6. 12) is an adult male purchased from Émile Parzudaki, who was a dealer in natural-history specimens in Paris, and is labeled as coming from Mexico. The type does not have the cranial crests developed, the skin is rough and tubercular, and it is clearly an immature individual. The head-and-body length is 43.7 mm. The upperparts are light gray with black spots, and the warts are dark at the base. It has large inner and small outer metatarsal tubercles.

The type of *Bufo levifrons* could not be located in the Paris Museum at the time of my visit in April, 1930. Mexico is given as the type locality for this species. A specimen from Mexico collected by Dugés (M.H.N.P. No. 643b, parchment label No. 83–289) and labeled as the type does not agree with the figure published by Brocchi. This specimen has a head-and-body length of 53.5 mm. It is briefly described as follows: The tibio-tarsal joint, when the hind limb is carried forward along the body, reaches the posterior margin of the parotoid gland; skin of upperparts strongly tuberculate; cranial crests not developed; tympanum covered with minute tubercles; underparts light colored with scattered dark spots; a large black inner and a small light-colored outer metatarsal tubercle. The type of *Bufo mexicanus* was received from Auguste Sallé, according to Brocchi, but no entry of this specimen was found in the catalogue of the laboratory of herpetology of the Paris Museum.

This burrowing species has a rather compact body, and the skin is often covered with closely set pustulose warts. As a rule it is irregularly spotted with dark, though there are occasional individuals that exhibit little or no indication of darker spots. On many of the specimens there is a conspicuous white interorbital band that is almost on a line with the vertical white lip stripe below the eye. The underparts are often white with small dark spots. On some of the specimens the cranial crests are lacking. From the variation observed in a series of

42 individuals, it would seem that the development of the cranial crests is too unreliable a character to have much of a diagnostic value. Fourteen of the specimens examined have no vestiges of cranial crests on top of the head. When present, the postorbital crests are generally thick and blunt-edged. The supraciliary crests are often but faintly indicated, though they may be quite prominent on some individuals. When supraciliary crests are developed, the interorbital region seems more strongly concave than those without such crests.

In two instances the tympanum was covered with a tubercular skin, and on the others it was distinctly outlined and covered with a smooth skin. In the majority of the specimens examined, the parotoid gland was separated from the upper eyelid by the blunt-edged transverse postorbital crest. On two individuals (U.S.N.M. Nos. 47245 and 26596), however, the parotoid glands are almost in contact with the upper eyelids, and there are no vestiges of the postorbital crests. One individual from McLennan County, Tex. (U.S.N.M. No. 57625) has subcircular parotoid glands in contrast to the normal elongate type. These glands are rarely very narrow, but they often have a lateral enlargement that extends over upon the side of the shoulder.

Specimens taken in Durango and Chihuahua occasionally have the underparts spotted with dark brown or black. The skin of the upperparts is strongly tubercular and is covered with low pustulose warts. Brocchi's *Bufo levifrons* represents a variation of this sort. The figure of *Bufo mexicanus* published by Brocchi resembles two toads collected in Nuevo Leon (U.S.N.M. Nos. 46914–15) on which the warts are low and flat, and the skin feels smooth, as compared with the variety named *levifrons* by Brocchi. Variations such as these may be expected in this species. This species has a conspicuous palmar callosity and a large shovellike inner metatarsal tubercle.

Specimens examined.—Ninety-eight, as follows:

Bufo compactilis

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
M.C.Z.	2375	1	SONORA: No definite locality	Mar. 23, 1903	Ward's Nat. Sci. Establishment.
			CHIHUAHUA:		
F.M.N.H.	1779	1	Colonia Garcia	Aug. 17, 1902	S. E. Meek.
U.S.N.M.	47314–17	4	Colonia Garcia (near)	July —, 1899	Nelson and Goldman.
Do.	2654	5	Encinillas	Oct. 20, 1852	Thomas H. Webb.
Do.	47244	1	Guadalupe y Calvo	Sept. 8, 1898	Nelson and Goldman.
Do.	26596	1	Meadow Valley	July 6, 1896	H. H. and C. S. Brimley.
Do.	8327	2	No definite locality		John Potts.
			COAHUILA:		
Do.	47231	1	Jimulco	Dec. 16, 1893	Nelson and Goldman.
M.C.Z.	1637	4	Monclova	1880	Edward Palmer.
			NUEVO LEON:		
U.S.N.M.	46915	1	Doctor Cos	Apr. 20, 1891	William Lloyd.
Do.	2611	[1] 1	Pesquieria Grande	Apr. —, 1853	D. N. Couch.

[1] Cotype of *Bufo speciosus*.

Bufo compactilis—Continued

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.			TAMAULIPAS:		
Do	2627	1	Matamoros	Mar. —, 1853	D. N. Cough.
Do	46914	1	Mier	May 6, 1891	William Lloyd.
			DURANGO:		
Do	47245	1	El Salto	July 20, 1898	Nelson and Goldman.
Do	47447	1	Near Guanacevi	Aug. 19, 1898	Do.
			GUANAJUATO:		
A.M.N.H.	12228–36	9	Guanajuato	Aug. 6, 1919	Paul D. R. Ruthling.
Do	12237–60	24	Irapuato	----do----	Do.
Do	13778	[2] 1	VERA CRUZ: North of Rio Atoyac, near Potrero.	June 19, 1919	Do.
			FEDERAL DISTRICT:		
Do	13757–60	4	North of Guadalupe	July 19, 1919	Do.
Do	13444	1	Xochimilco (2 miles west)	May 10, 1919	Do.
			JALISCO:		
Do	12280	1	Atemajac	Sept. 23, 1919	Do.
U.S.N.M.	46962	1	----do----	May 28, 1892	Nelson and Goldman.
A.M.N.H.	12281	1	Buenavista	Aug. 10, 1919	Paul D. R. Ruthling.
Do	12279	1	Cerro del Col, or Cerrode el Fuerte, 6 miles west of Guadalajara.	Sept. 18, 1919	Do.
Do	12412–13	2	Jamay	{Aug. 17, 1919 Aug. 18, 1919}	Do.
U.S.N.M.	47151–54	4	Lagos	June 27, 1896	Nelson and Goldman.
A.M.N.H.	13767	1	On way to Magdalena	Sept. 29, 1919	Paul D. R. Ruthling.
Do	12272–77	6	South of Tlaguepaque	Sept. 10, 1919	Do.
Do	12278	1	Tonala	Oct. 6, 1919	Do.
			MICHOACAN:		
F.M.N.H.	963	1	La Palma	June —, 1901	S. E. Meek.
U.S.N.M.	10257	1	Tupataro	1879	Alfred Dugés.
			? STATE:		
B.M.	58. 9. 6. 12	[3] 1	No definite locality	----------	Émile Parzudaki.
M.N.B.	3528	[4] 1	----do----	----------	Ferdinand Deppe and C. J. W. Schiede.
A.M.N.H.	12261–71	11	----do----	----------	Paul D. R. Ruthling

[2] Young. [3] Type of *Bufo anomalus*. [4] Type of *Bufo compactilis*.

BUFO CRISTATUS Wiegmann

Figure 9

1833. *Bufo cristatus* WIEGMANN, Isis von Oken, vol. 26, pt. 7. pp. 660, 661.

1879. *Bufo occipitalis* CAMERANO, Atti R. Accad. Sci. Torino, vol. 14, pp. 889, 890.—GÜNTHER, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, pp. 243, 250, pl. 69, fig. C, Feb.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 74, 129.

Type locality.—Jalapa, Vera Cruz, Mexico.

Range.—At present can not be accurately defined.

Remarks.—The two cotypes of *Bufo cristatus* (M.N.B. Nos. 3523–3524) came from the vicinity of Jalapa in Vera Cruz, and they were collected by Ferdinand Deppe. The following notes were made on them:

No. 3523: Parietal crests 4 mm. high, enormously swollen, but without any vestiges of internal projections or buttresses, and in contact posteriorly with parotoid glands; parotoid glands somewhat ovoidal in outline; toes half webbed, with last three phalanges of fourth toe free from web; inner and outer metatarsal tubercles very small, the inner slightly larger than the outer; fore and hind feet with numerous supernumerary tubercles; skin of upperparts studded with numerous closely approximated small warts; color markings somewhat obliterated; a narrow black interorbital band; a narrow oblique outwardly

directed black stripe from each parietal crest; underparts brownish, with light spots; head-and-body length, 63.5 mm.

No. 3524: Parietal crests abnormally swollen, with internal projections or buttresses, and separated posteriorly from parotoid glands; interval between supraciliary crests 7.8 mm.; parotoid glands protuberant, somewhat elongate or ovoidal, and peculiarly marked with light spots; parotoid glands measure 14 mm. in length and 9 mm. in width; subarticular tubercles distinct; numerous supernumerary tubercles on soles of fore and hind feet; a narrow black interorbital band; a light mark in middle of back; underparts brown, with numerous light spots; head-and-body length, 75 mm.

FIGURE 9.—Head of *Bufo cristatus* (M.C.Z. No. 8362) from Jalapa, Vera Cruz, Mexico: *a*, Lateral view; *b*, dorsal view

A third specimen (N.M.W. No. 1869. I. 6) from Mexico was found in Vienna. This individual likewise has very thick enlarged parietal crests, a heavy supratympanic crest, a thick supraciliary crest, and ovoidal parotoid glands.

The original specimen on which the description of *Bufo occipitalis* Camerano was based is thought to be in the Zoological Museum at Turin, Italy, and is said to be labeled as having come from "Mexico." The type specimen could not be located at the time of my visit to this museum in April, 1930. In 1921, Dr. E. R. Dunn collected a fifth specimen of this species (M.C.Z. No. 8362) at Jalapa in Vera Cruz. The characters used in the key for Mexican species of *Bufo* are based on this specimen.

The large swollen parietal branches of the supraciliary crests will at once distinguish this species from any other Mexican toad. The supraciliary crests are high and converge anteriorly. The postorbital crests are rather thick. The large protuberant ovoidal or subtriangular parotoid glands are often bicolored, black laterally and grayish above. Small conical warts are scattered over the skin of the upperparts and the upper surfaces of the fore and hind limbs. The tympanum is small, less than one-half the diameter of the eye, and often is rather indistinctly outlined. This species seems to be most closely related to *Bufo valliceps*.

Specimens examined.—Four, as follows:

Bufo cristatus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
M.N.B.	3523-24	[1] 2	Jalapa		Ferdinand Deppe.
M.C.Z.	8362	1	do		E. R. Dunn.
			? STATE:		
N.M.W.	1869-I-6	1	No definite locality		

[1] Cotypes.

BUFO DEBILIS Girard

Figure 10

1854. *Bufo debilis* Girard, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 87, May.

1854. *Bufo insidior* Girard, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 88, May (Chihuahua, Mexico).—Baird, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, pp. 26, 35, pl. 41, figs. 13–18.

1889. *Bufo debilis* Cope, U. S. Nat. Mus. Bull. 34, p. 264, fig. 61.—Dickerson, 1906, The frog book, p. 112.—Strecker, 1922, Sci. Soc. San Antonio Bull. 4, p. 10, fig.—Nieden, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 73, 109.

Type locality.—"In the lower part of the valley of the Rio Bravo (Rio Grande del Norte), and in the province of Tamaulipas, Mexico."

Figure 10.—Head of *Bufo debilis* (U.S.N.M. No. 2624) from Delaware Creek, Culberson County, Tex.: *a*, Lateral view; *b*, dorsal view

Range.—From Mexican boundary southwest through the States of Tamaulipas and Chihuahua to Mazatlan in Sinaloa, and south along Pacific coast at least as far as Acaponeta in Nayarit. This small toad has a rather peculiar distribution in the United States. The northern limit seems to be extreme southwestern Kansas (Morton and Grant Counties). It has been taken in the Wichita Mountains (Comanche County), Oklahoma, and in eastern New Mexico (Cuervo, Guadalupe County). Cope reports that it occurs in the panhandle district of Texas. It occurs in the middle district of Texas from the Upper Wichita River south through McLennan, Burnet, Comal, Bexar, Bee, Refugio, Duval, and Nueces Counties to the Rio Grande, and along the Rio Grande from Brownsville (Cameron County) to the mouth of the Pecos River (Val Verde County). It has been recorded from Delaware Creek (Culberson County) in western Texas and also from Grant County in southwestern New Mexico.

Remarks.—Rough skin, small size, and greenish coloration usually will identify this toad in life, and doubtful specimens will be identified by transverse black bands across the upper eyelids. Although it is a burrowing species, the sole tubercles are insignificant; the body is small, less than 2 inches in length; the parotoid glands are large, and diverge posteriorly; and the legs are short.

These little green toads seem to prefer the open country and are generally found on mesquite-covered flats. They emerge after dark from their burrows under the roots of the mesquite and other shrubs. They breed during April and May in shallow depressions or ditches filled by heavy rains.

The cotypes of Girard's *Bufo debilis* are not designated in the catalogue of the division of reptiles. On searching, it was found that there are only two entries that could possibly have been collected prior to the publication of Girard's paper. One of these is a specimen (U.S.N.M. No. 2620) collected by Arthur Schott between the Salado River (which empties into the Rio Grande near the town of Guerrero in Tamaulipas) and Camargo in Tamaulipas. This locality is in the lower part of the valley of the Rio Bravo (Rio Grande). Under the initial organization of the United States and Mexican Boundary Survey under Commissioner J. R. Bartlett, Arthur C. V. Schott was appointed a collector and assigned to the party of Lieut. A. W. Whipple. The commissioner's party left El Paso, Tex., in November, 1850, and arrived at Copper Mines, N. Mex., in May, 1851. Col. J. D. Graham, the chief astronomer, did not arrive at Copper Mines until August 2, 1851, and this delayed the progress of the boundary survey considerably. The parties under the direction of Bartlett were then reorganized, and Schott must have received some other assignment, for his name is not included among those who left Copper Mines on August 28, 1851. On September 13, 1851, Maj. William H. Emory was directed to proceed to El Paso, Tex., to relieve Colonel Graham and take charge of the astronomical force. Observatories were established at Frontera (El Paso, Tex.), at San Elceario (Elizario, Tex.), and at Eagle Pass, Tex. It would seem that Schott was subsequently assigned to Major Emory, as a bird skin was collected by him at Eagle Pass, in June, 1852. Bartlett's expedition did not return to Ringgold Barracks, Tex., until December 20, 1852. When the work of the Boundary Commission was suspended in December, 1852, Major Emory left for New Orleans. That Schott either was left in Texas or was directed to report there in advance of the main party of the new commissioner seems to be confirmed by the birds collected by him at Sabanitas, Rio Grande, on September 20, 1853, at Rio Grande, Tex., on October 13, 1853, and at Brownsville, Tex., on October 25, 1853. The new commissioner, Gen. Robert B. Campbell, was appointed in March 1853, and work was recommenced in December, 1853. Arthur Schott was placed in charge of a surveying party under Major Emory and assigned the survey from Laredo to Ringgold Barracks, Tex. Although the date of completion of this portion of the survey is uncertain, the boundary survey was again reorganized in October, 1854, under Commissioner William Hemsley Emory. Schott was assigned as assistant to Lieut. N. Michler and this division proceeded through New Mexico to California, where camp was made on the initial point of the Rio Colorado in April 21, 1855. Inasmuch as the entry in the catalogue for this particular toad indicates that Schott was working under the direction of Major Emory, the assumption is that it may have been collected

some time between October, 1851, and October, 1854, and in all probability during the spring of 1854 while Schott was in charge of the party surveying the Rio Grande between Laredo and Ringgold Barracks, Tex. This specimen can not be located.

One lot of eight newly metamorphosed young of *Bufo debilis* (U.S.N.M. No. 2621) was collected by Lieut. Darius Nash Couch at Matamoros in the State of Tamaulipas. In 1853, Couch, acting under instructions received from the War Department, made a survey for a Pacific railroad in northern Mexico. Letters on file in the archives of the Smithsonian Institution show that Couch made preparations for his forthcoming Mexican trip at Fort Mifflin, near Philadelphia, Pa., and that, although he received orders to proceed to Brownsville, Tex., in October, 1852, he was notified by Professor Baird on December 26, 1852, that the letter from the Mexican minister addressed to Couch in care of Professor Henry had been received. It is thus apparent that Couch did not reach Brownsville before 1853, and this assumption is confirmed in part by the fact that the first specimens collected at that locality are dated February, 1853.

The exploring expedition conducted by Lieutenant Couch reached Matamoros, Tamaulipas, on March 1, 1853. While there Couch purchased the collection of Luis Berlandier and presented it to the Smithsonian Institution. Baird acknowledged its safe arrival in Washington on April 25, 1853. The party then proceeded westward through the States of Tamaulipas, Nuevo Leon, and Coahuila, at least as far as the Rio Nasas in Durango. The report of this exploring expedition was never published, and it is difficult to determine from the labels attached to specimens the route followed on the return trip to Brownsville. A specimen labeled as having been taken by Lieutenant Couch at Ringgold Barracks, Tex., is dated July 15, 1853, and this date would seem to indicate that the trip was one of short duration. There are, however, other specimens that are labeled as having been taken in August, 1853, in Nuevo Leon and Tamaulipas. It is apparent, however, that all the Mexican specimens received from Couch were collected during 1853, since he arrived in Washington some time prior to January 10, 1854. Couch remained in Washington for some months writing a report on the explorations made by his party in Mexico, and was then ordered to Boston, Mass., and in October, 1854, to Fort Leavenworth, Kans., where he remained until he resigned from the Army on April 30, 1855. These specimens are undoubtedly cotypes of Girard's species.

Two specimens (U.S.N.M. No. 2622) from Chihuahua, collected by Dr. Thomas H. Webb, are designated in the museum catalogue as the cotypes of Girard's *Bufo insidior*. The preservation of these specimens is fair, but both are very much bleached. Doctor Webb was the secretary and surgeon of Commissioner John R. Bartlett's

party of the United States and Mexican Boundary Commission. Returning from the Pacific coast, Bartlett's party followed the road through the State of Chihuahua, and, according to the commissioner's journal, was within the limits of that Mexican State from October 8 until November 14, 1852. The entry in the museum catalogue reads "Chihuahua, Mex.," which may or may not refer to the city of Chihuahua.

Specimens examined.—Twelve, as follows:

Bufo debilis

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	2622	[1] 2	CHIHUAHUA: No definite locality.	1852	Thomas H. Webb.
Do.	25153	1	SINALOA: Mazatlan	Apr. —, 1868	F. Bischoff.
Do.	2621	[2] 8	TAMAULIPAS: Matamoros	Mar. —, 1853	D. N. Couch.
Do.	47865	1	NAYARIT: Acaponeta	June 26, 1897	Nelson and Goldman.

[1] Cotypes of *Bufo insidior*. [2] Young; cotypes of *Bufo debilis*.

BUFO MARINUS (Linnaeus)

Figure 11

1758. [*Rana*] *marina* LINNAEUS, Systema naturae, ed. 10, vol. 1, p. 211 (no. 7).
1784. *Rana gigas* WALLBAUM, Schrift. Berlin. Ges. Nat. Freunde, vol. 5, p. 239.
1799. [*Bufo*] *marinus* SCHNEIDER, Historiae amphibiorum naturalis et literariae, fasc. I, pp. 219–222.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 76, 138.
1801. *Bufo agua* LATREILLE, Histoire naturelle des reptiles, vol. 2, p. 130, pl.—, fig. 1, An. X (Brazil and Cuba).—DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, pp. 64–66, pl. 37.—DAUDIN, 1803, Histoire naturelle, générale et particulière, des reptiles, vol. 8, p. 205, An. XI.
1833. *Bufo horribilis* WIEGMANN, Isis von Oken, vol. 26, pt. 7, pp. 654, 655 (vicinity of Vera Cruz, Mexico).—PETERS, 1863, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 81, Feb.

Type locality.—America.

Range.—From Rio Yaqui in southern Sonora (Camoa), southern Durango (Guasamota), Morelos, southeastern Mexico (Chalco), and the western boundary of Tamaulipas (Hidalgo), south through Mexico and Central America to southern Peru (Urubamba Valley) and Pacific coast of Argentina (Buenos Aires). These enormous toads either were indigenous to or have been introduced on many of the Windward Islands, including St. Kitts, Nevis, Antigua, Montserrat, Guadeloupe, Paget (East Bermuda), Martinique, Santa Lucia, Barbados, and Grenada. They occur also on Tobago and Trinidad, and have been introduced into Jamaica and Porto Rico. In most places where they have been introduced they have multiplied very rapidly. Reported from: Sinaloa, Presidio de Mazatlan (Forrer); Durango, Ventanas (Forrer); Jalisco, north of Rio de Santiago (Godman), Guadalajara

(Dugés); Michoacan (Dugés); Morelos, Cuautla (Dugés); Guerrero, Iguala, Tierra Colorado, and San Luis Allende (Gadow); Oaxaca, San Mateo del Mar, and Tehuantepec (Gadow); Vera Cruz, Tampico (Richardson), Coatzacoalcos (Street), Tetela (Gadow), Cuatotolapam and Lake Catemaco (Ruthven).

Remarks.—Linnaeus gave the name *Rana marina* to the toad described and figured by Seba,[10] and merely states that its habitat is in America. In the caption for the Dutch text, Seba refers to this species as a "rare Virginia frog." In the Latin text, however, it is listed as "*Rana, Marina, Americana, rara; Mas.*" The presence of scrotumlike protuberances below the vent, which possibly were the result of faulty preservation, led Seba to conclude that the specimen figured was a male. The type of *Bufo marinus* is therefore the specimen figured and described by Seba. Information furnished by Dr. Leonhard Stejneger indicates that the collection on which the "Thesaurus" was based was purchased in 1716 for 15,000 Dutch guilders by "Peter the Great" of Russia and taken to St. Petersburg. This collection subsequently became the property of the St. Petersburg Academy of Sciences, which, however, was not established by Catherine I until December 21, 1725. A large part of the first collection[11] assembled by Seba was destroyed by fire in St. Petersburg in 1747. Seba died in 1736, and his second collection was sold at public auction in 1752 at Amsterdam. A portion of this collection was also purchased by the St. Petersburg Academy of Sciences.

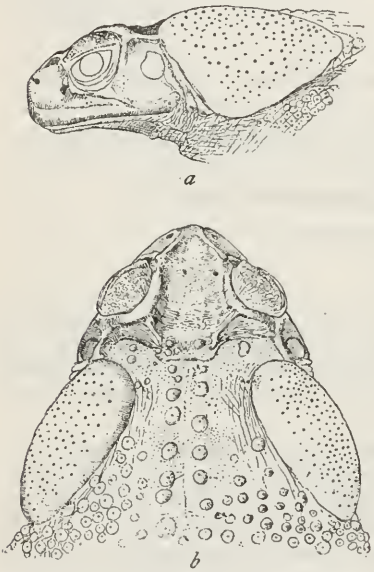

FIGURE 11.—Head of *Bufo marinus* (U. S. N. M. No. 54119) from Gatun, Panama: *a*, Lateral view; *b*, dorsal view

Wallbaum, who published an extended description of this toad, concludes that it is a land type because the construction of the foot does not seem to be adapted for swimming in the sea. Hence, he argues that if this observation is corroborated, the Latin specific name *Bufo marinus* (Linnaeus) must be corrected, because it is misleading. Wallbaum proposes *Rana gigas* as a substitute name for the inappropriate specific name *marinus*.

[10] Seba, A., Locupletissimi rerum naturalium thesauri accurata descriptio, et iconibus artificiossimis expressio, per universam physices historiam, Amsterdam, vol. 1, p. 120, pl. 76, fig. 1, 1734.

[11] Strauch, A., Das zoologische Museum der kaiserlichen Akademie der Wissenschaften zu St. Petersburg in Seinem fünfzig jährigen Bestehen, St. Petersburg, pp. IV+372, 1889; Thomas, O., Ann. and Mag. Nat. Hist., ser. 6, vol. 9, no. 53, p. 310, 1892.

In describing *Bufo agua*, Latreille seems to have confused the South American *Bufo marinus* with the Cuban *Bufo peltocephalus*. It is stated that this enormous toad has been found principally in Brazil and in Cuba. Reference is also made to the fact that the figure in Seba's "Thesaurus," which is the basis for *Bufo marinus* (Linnaeus), is hardly recognizable. Latreille does state, however, that his *Bufo agua* is the same toad as the *Bufo marinus* of authors, or "L'épaule-armée." One might infer from these remarks that the figure and description of *Bufo agua* was based upon some specimen in the "Cabinet d'Histoire Naturelle du Jardin du Roi" in Paris. It would appear from the synonymy listed under *Bufo agua* in Daudin's natural history of frogs and toads that this author had failed to recognize the essential characters of this species. In the eighth volume of his natural history of reptiles, which was published during the preceding year, Daudin curiously enough does differentiate between "Le Crapaud Épaule-Armée" and "Le Crapaud Agua." The synonymy given for "Le Crapaud Épaule-Armée" is correct and includes Seba's "Thesaurus," pl. 76, fig. 1. It should be noted that "Le Crapaud Agua" in this last-mentioned publication of Daudin is a quite different batrachian from *Bufo agua* Latreille.

Wiegmann's *Bufo horribilis* is based on specimens collected by Ferdinand Deppe and Graf von Sack in Mexico. The four cotypes (M.N.B. Nos. 3479–81) collected by Deppe are all toads of moderate size. The one collected at Misantla (No. 3479) has a head-and-body length of about 167 mm.; an annotation on the label states that this species is No. 57 in the sale catalogue of Deppe's brother. Of the two (No. 3481) labeled as coming from Vera Cruz, the largest has a body length of about 110 mm. The largest of the cotypes (No. 3480) is without definite locality and has a body length of about 125 mm. The fifth cotype (No. 3493) is a young individual collected in Mexico by Graf von Sack and F. Deppe that lacks cranial crests and has a head-and-body length of not more than 50 mm.

Full-grown toads with a rather rough skin and with triangular parotoid glands as large as or larger than the side of the head and studded with large pores may be referred without question to this species. In general, the coloration of *Bufo marinus* is quite variable, ranging through the various shades of brown, including yellowish, reddish, or even blackish, and occasionally greenish olive; upperparts with or without large black insuliform spots, which when present are usually edged with pale yellow; a light vertebral line occasionally visible; arms and legs of immature individuals usually banded with dark brown; underparts dingy white or yellow. The interorbital space is wider than the upper eyelid and the cranial crests are often quite prominent in old adults. Sexually mature males have numerous

low spiny tubercles on the back. The range of individual variation in *Bufo marinus* has been discussed by Ruthven[12] and Noble.[13]

Adults of *Bufo marinus* are the largest of the true toads. Miranda-Ribeiro [14] states that specimens with a head-and-body length of 220 mm. have been taken in Brazil and that this species ranges southward to the Patagonian district. These large toads are nocturnal in their habits and hide under fallen tree trunks, matted leaves, and stones, or burrow into loose soil.

Atmospheric conditions seemingly influence the time of breeding of this species. Egg laying may commence as early as February, if there has been plenty of rain, but may be delayed until July in regions of continued drought. The breeding season also varies according to locality. Tadpoles have been noticed in Barbados in the pools during August and February, while in Bermuda the eggs are usually laid during April. From the observations made by Ruthven,[15] it would appear that 45 days are required for development from egg to adult. The eggs that Mark [16] kept under observation hatched in a few hours less than 4 days.

The poisonous nature of the glandular secretions of some of the toads has been investigated by Madame Phisalix,[17] and she has discussed the kinds of toxins that are present. Few actual observations on the action of this secretion on other animals, however, have been published. It is therefore of interest to review a short paper by Dodds.[18] Near the end of July, 1922, at Los Mochis in northern Sinaloa, a small terrier dog was observed teasing a large toad, presumably *Bufo marinus*. At last the dog caught the toad by the back and "although the dog's mouth was not in contact with the toad for more than an instant, he immediately lost all interest in the animal." The dog refused water and "in about a minute's time showed signs of weakening and general paralysis. He sank to the ground with his legs spread out, writhing and whining with pain, and unable to recognize his master. During this time he was able to push himself along the ground, gradually becoming weaker and very rigid, with eyes greatly protruding and respiration and heart action exceedingly rapid. After twenty minutes he was somewhat quieter as if he was going to die." Castor oil was then administered to the terrier and an hour later the dog apparently was quite normal.

Specimens examined.—One hundred and four, as follows:

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[12] Ruthven, A. G., The amphibians and reptiles collected by the University of Michigan-Walker Expedition in southern Vera Cruz, Mexico. Zool. Jahrb. (Syst. Abt.), vol. 32, pl. 4, p. 309, 1912.

[13] Noble, G. K., Bull. Amer. Mus. Nat. Hist., vol. 38, art. 10, p. 333, 1918.

[14] Miranda-Ribeiro, A. N., Archiv. Mus. Nac. Rio Janeiro, vol. 27, pp. 134, 216, 217, 1926.

[15] Ruthven, A. G., The breeding season of *Bufo marinus* (L.) in Demerara. Copeia, no. 31, pp. 43, 44, May 24, 1916.

[16] Pope, P. H., The introduction of West Indian Anura into Bermuda. Bull. Mus. Comp. Zool., vol. 61, no. 6, pp. 123, 124, June, 1917.

[17] Phisalix-Picot, M., Animaux venimeux et venins, vol. 2, pp. 1-174, 1922.

[18] Dodds, C. T., A note on *Bufo marinus*. Copeia, no. 114, pp. 5, 6, Jan. 20, 1923.

Bufo marinus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	47243	1	SONORA: Camoa	Nov. 8, 1898	E. A. Goldman.
Do.	47169	1	DURANGO: Guasamota	Aug. 14, 1897	Nelson and Goldman.
Do.	47450	1	TAMAULIPAS: Hidalgo	Mar. 18, 1891	William Lloyd.
Do.	30517	1	VERA CRUZ: Cordoba		(?) C. Sartorius.
F.M.N.H.	1361	4	El Juile	1903	S. E. Meek.
U.S.N.M.	71054–55	2	Mirador		C. Sartorius.
M.N.B.	3479	[1]1	Misantla		Ferdinand Deppe.
C.G.E.M.	13	1	Motzoronga		
Do.	8	1	do	Sept. 10, 1918	
U.S.N.M.	30354	1	Orizaba		(?) C. Sartorius.
Do.	6352	1	do		Francis Sumichrast.
F.M.N.H.	1367	4	Perez	1903	S. E. Meek.
A.M.N.H.	12305	1	Vera Cruz	June 3, 1919	Paul D. R. Ruthling.
M.N.B.	3481	[1]2	do		Ferdinand Deppe.
C.G.E.M.		1	do	July —, 1918	S. Senties.
A.M.N.H.	13751–52	2	NAYARIT: Puerta Azul, east of Santiago Ixcuintla.	Dec. 23, 1919	Paul D. R. Ruthling.
U.S.N.M.	18987–88	2	JALISCO: Barranca Ibarra	Apr. 21, 1892	P. L. Jouy.
Do.	47903	1	COLIMA: Armeria	Feb. —, 1892	E. W. Nelson.
Do.	63855–67	13	Colima	July —, 1863	John Xantus.
Do.	11113	1	do	1863	Do.
Do.	63665–71	7	do	1863	Do.
Do.	57591	1	do	July 27, 1902	Julius Hurter.
M.C.Z.	3950	1	do	1916	G. Glückert.
U.S.N.M.	57592	1	MORELOS: Puente de Ixtla	June —, 1901	Julius Hurter.
C.G.E.M.	10	1	Tetecala	Oct. 14, 1890	
F.M.N.H.	1379	1	Yantepec	1903	S. E. Meek.
Do.	1358	1	PUEBLA: Atlixco	1903	Do.
U.M.U.M.	14	1	Vaso de Tenango, 1,400–1,500 meters elevation.	July 17, 1926	H. B. Baker.
M.C.Z.	1253	1	GUERRERO: Acapulco	1872	Hassler Expedition.
Do.	1054	4	do	1872	Do.
C.A.S.	5040	1	OAXACA: Cosolapa	July 12, 1925	Joseph R. Slevin.
Do.	5188–89	2	do	July 20, 1925	Do.
U.S.N.M.	46968	1	Cuicatlan	Oct. 8, 1894	Nelson and Goldman.
Do.	47466–68	3	Guichicovi	June 24, 1895	Do.
A.M.N.H.	13920	1	Mixtequillo	May 14, 1920	Paul D. R. Ruthling.
C.A.S.	6345	1	do	Aug. 24, 1925	Joseph R. Slevin.
A.M.N.H.	6258	1	Tehuantepec	July —, 1920	Paul D. R. Ruthling.
Do.	6261–62	2	do	do	Do.
Do.	6266–67	2	do	do	Do.
Do.	6269–70	2	do	do	Do.
Do.	6274	1	do	do	Do.
Do.	6276	1	do	do	Do.
U.S.N.M.	47362	1	do	do	Do.
Do.	47465	1	do	May 28, 1895	Nelson and Goldman.
Do.	30434	1	do	May 1, 1895	Do.
A.M.N.H.	6252–57	6	West of Tehuantepec River		Francis Sumichrast.
U.S.N.M.	47080	1	Tuxtepec	May 1, 1920	Paul D. R. Ruthling.
A.M.N.H.	13906	1	Xadani and San Miguel del Puerto.	Apr. 6, 1894 {June 8, 1920 {June 10, 1920	Nelson and Goldman. Paul D. R. Ruthling.
U.S.N.M.	46854–56	3	CHIAPAS: La Trinidad, 800 feet altitude.	Nov. 10, 1895	Nelson and Goldman.
Do.	46847	1	Tapachula	Feb. 1, 1896	Nelson and Goldman.
Do.	46763	1	Tonala	Aug. 5, 1895	Do.
Do.	47310	1	TABASCO: Monte Cristo	May 8, 1900	E. W. Nelson.
Do.	46619	1	do	May 9, 1900	Nelson and Goldman.
Do.	47571	1	YUCATAN: Cozumel Island	Apr. 14, 1901	Do.
Do.	13907	1	do	{Jan. 23, 1885 {Jan. 29, 1885	Albatross, U. S. Fish Commission.
Do.	12288	1	No definite locality		Arthur Schott.
Do.	19280	1	do		Do.
F.M.N.H.	549	1	do		George F. Gaumer.
M.N.B.	3480	[1]1	(?) STATE No definite locality		Ferdinand Deppe.
Do.	3493	[1]1	do		Ferdinand Deppe and Graf von Sack.

[1] Cotypes of *Bufo horribilis*.

BUFO MARMOREUS Wiegmann

Figure 12

1833. *Bufo marmoreus* Wiegmann, Isis von Oken, vol. 26, pt. 7, p. 661.—Günther, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 246, pl. 70, fig. A, Feb.—Nieden, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 76, 130.

1868. *Bufo argillaceus* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 20, p. 138, Mar. (Colima, Mexico).

1894. *Bufo lateralis* Werner, Zool. Anz., Jahrg. 17, no. 446, p. 156, May 7 (Tehuantepec, Mexico).

Type locality.—Vera Cruz, Mexico.

Range.—From Mazatlan and Rosario in Sinaloa south through Colima, Jalisco, and Guerrero to the Isthmus of Tehuantepec in Oaxaca and to Tonala in Chiapas.

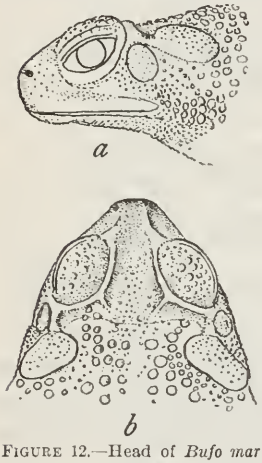

Figure 12.—Head of *Bufo marmoreus* (U.S.N.M. No. 47129) from mountains 12 miles north of Santo Domingo, Oaxaca, Mexico: *a*, Lateral view; *b*, dorsal view

Reported from: Guerrero, Cocoyul, Tierra Colorado, Cajones, Chilpancingo, Rio Balsas, and Iguala (Gadow); Oaxaca, Salina Cruz (Gadow).

Remarks.—The cotypes of *Bufo marmoreus* (M.N.B. Nos. 3529–31) were taken at Vera Cruz by Ferdinand Deppe, according to the label on the jar. These specimens have the light-colored vertebral stripe with irregular longitudinal light line. The supraciliary and postorbital crests are very low. The dark spots on the upperparts have a narrow white edge; the parotoids are light colored above and dark laterally; the underparts are white; the metatarsal tubercles are small; and the skin of the upperparts is studded with minute warts. The head-and-body lengths of the three cotypes are 58.2, 56.5, and 56.5 mm., respectively.

John Xantus de Vesey was appointed United States consul at Manzanillo, Mexico, in 1863. From March, 1863, to March, 1864, he remained in Colima, although his consular appointment was revoked prior to August 11, 1863. On February 29, 1864, his last shipment from Manzanillo was assembled, and he states in Part V of his field catalogue that this collection included 1,000 alcoholic specimens without labels. Evidently Xantus traveled a great deal while residing in Colima, as an entry in his journal dated June 25, 1863, states that he had traveled 700 miles that month. He made numerous trips to the city of Colima, and in all probability collected the cotypes of *Bufo argillaceus* (U.S.N.M. Nos. 27763–64) in the vicinity of that city. These cotypes are fairly well preserved, but are somewhat distorted. It is possible that the preservative may have been allowed

to evaporate at some time when they were in the possession of Professor Cope.

Professor Werner received the type specimen (N.M.W., Werner Coll. No. 115, 1929) of *Bufo lateralis* from T. K. Salmon, who made collections on the Isthmus of Tehuantepec in 1872. The following notes were made on the type: Head-and-body length, 59 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint does not reach to the level of the parotoid gland, and is at least 7 mm. from the posterior margin of the tympanum; the parotoid glands are placed diagonally on the shoulders, the greatest diameter of the right one being 6.4 mm. and that of the left one 6.8; cranial crests low; a short supratympanic crest; transverse diameter of tympanum, 3.3 mm.; transverse diameter of eye, 7.5 mm.; transverse diameter of head at level of angle of jaws, 21 mm.; subarticular tubercles on fourth toe double; soles of fore and hind feet with numerous supernumerary tubercles; inner metatarsal tubercle small, but larger than outer; a row of minute warts along tarsal fold; throat, abdomen, and under surfaces of thighs granular; warts on upperparts low and flattened; a white dorso-lateral longitudinal stripe above linear series of low warts; a lateral brown band extends from angle of parotoid to thigh; coloration of upperparts much faded; a light vertebral stripe, on each side of which is an anterior and a posterior dark blotch; under surfaces of fore and hind feet black.

The species *Bufo marmoreus* seems to be somewhat closely related to *B. canaliferus*, a species that has a somewhat similar coloration, but is distinguished at once by its elongated parotoid glands.

The habits and life history of *Bufo marmoreus* are unknown. Collectors in the past have paid little attention to the ecological preferences of Mexican toads. A large lot received from Xantus would seem to indicate that they congregate in pools in considerable numbers during the breeding season and that their breeding habits are not unlike those of other toads. Their main center of abundance seems to lie west of the Sierra Madre del Sur.

Toads belonging to this species have the following characteristics: Ground color of upperparts brownish gray, marbled more or less distinctly with some darker color; a whitish vertebral line of varying width, on each side of which are three large or a greater number of small irregular light margined dark blotches; the whitish markings above and the brown markings below the lateral row of small warts form more or less confluent longitudinal bands of varying width; a continuous or medially interrupted V-shaped band crosses the upper eyelids and interorbital region; fore and hind limbs above with dark crossbars; underparts immaculate; cranial crests low, the most conspicuous of which are the combined supraciliary and postorbital crests which form a continuous curve from the anterior margin of orbit to

supratympanic crest; orbito-tympanal crests short; canthal and parietal crests vestigial or absent; supratympanic crest short and thick; parotoid glands nearly subtriangular, smaller or at most no larger than upper eyelid; skin of upperparts rather thickly studded with small warts and tubercles; and a row of small closely spaced tubercles in place of a tarsal fold.

Specimens examined.—Two hundred, as follows:

Bufo marmoreus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SINALOA:		
M.C.Z.	8537	1	Mazatlan		Paul D. R. Ruthling.
U.S.N.M.	46942–46	5	Rosario	July 10, 1897	Nelson and Goldman.
Do.	47446–48	2	do	do.	Do.
M.N.B.	3529–31	[1] 3	VERA CRUZ: Vera Cruz		Ferdinand Deppe.
			COLIMA:		
U.S.N.M.	10310	57	Colima	1863	John Xantus.
Do.	11114–18	5	do	1863	Do.
Do.	79910–47	38	do	1863	Do.
Do.	27763–64	[2] 2	do	1863	Do.
Do.	31421–23	3	do	1863	Do.
Do.	57523	1	do	1903	Julius Hurter.
Do.	63609–15	7	do	1863	John Xantus.
Do.	63616–64	48	do	1863	Do.
F.M.N.H.	1626	2	do		C. H. T. Townsend.
Do.	1621	1	do		C. M. Barber.
A.M.N.H.	12459	1	JALISCO: Jamay	Aug. 22, 1919	Paul D. R. Ruthling.
M.C.Z.	1436	1	MEXICO: Acapulco	1880	D. B. von Brunt.
U.S.N.M.	47010	1	GUERRERO: Papayo	Apr. 20, 1903	Nelson and Goldman.
			OAXACA:		
A.M.N.H.	13898–900	3	Chivela	1920	Paul D. R. Ruthling.
U.S.N.M.	47123	1	Mountains near Santo Domingo.	June 11, 1895	Nelson and Goldman.
Do.	47129	1	Mountains 12 miles north of Santo Domingo.	June 19, 1895	Do.
Do.	10014	2	Tapana, Tehuantepec	Feb. —, 1876	Francis Sumichrast.
Do.	30431–33	3	Tehuantepec		(?) Francis Sumichrast.
Do.	30435–36	2	do		Do.
A.M.N.H.	6260	1	do	1920	Paul D. R. Ruthling.
Do.	6262–65	4	do	1920	Do.
Do.	6271–73	3	do	1920	Do.
Do.	6275	1	do	1920	Do.
N.M.W.	115–1929	[3] 1	Isthmus of Tehuantepec	1872	T. K. Salmon.

[1] Cotypes of *Bufo marmoreus*. [2] Cotypes of *Bufo argillaceus*. [3] Type of *Bufo lateralis*.

BUFO PUNCTATUS Baird and Girard

RED-SPOTTED TOAD

Figure 13

1852. *Bufo punctatus* BAIRD and GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 173, Oct.—BAIRD, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, pp. 25, 35, pl. 39, figs. 5–9.—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 68, pl. 7, figs. 2, 2a–d.—COPE, 1889, U. S. Nat. Mus. Bull. 34, p. 262, fig. 60.—DICKERSON, 1906, The frog book, pp. 110–112, figs. 116–120, col. pl. 5, fig. 1.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 74, 109.—STORER, 1925, Univ. California Publ. Zool., vol. 27, pp. 192–199.

Type locality.—Rio San Pedro (Devils River, Val Verde County, Tex.), a tributary of the Rio Grande del Norte.

Range.—From the Mexican boundary southward through Sonora, Chihuahua, Coahuila (Monclova and Castanuelas), and Tamaulipas (Sierra Nola) to San Luis Potosi and Guanajuato (Silao). In the Unites States the species is confined to the region west of the Mississippi River, where it occurs locally as far east as the Wichita Mountains (Mount Scott, Comanche County, Okla.). It has been taken in southwestern Colorado (Basin Creek, San Miguel County) in a small alkaline stream whose waters reach the Colorado River by way of the San Miguel and Dolores Rivers. Along the San Juan River in southeastern Utah this toad has been found at a number of localities (Bluff, Natural Bridges, and Caroline Bridge in San Juan County). In northern Arizona it has been found on the floor of the Grand Canyon between the Coconino and Kaibab Plateaus, and in southwestern Utah in the drainage of the Virgin River (Zion National Park, Washington County). It has been found in eastern California in the Panamint Mountains (Cottonwood Canyon, Inyo County) and in Death Valley (Furnace Creek). South of these localities it has been reported in California from the Turtle Mountains (San Bernardino County), Fort Yuma, the Imperial Valley, and in San Diego County (Vallecito); and thence southward in Lower California to Cape San Lucas. In west-central Arizona the red-spotted toad has been taken in the drainage of Salt River and its tributaries (White River Canyon, Navajo County; and McMillenville, Gila County). It has also been recorded in Arizona from Maricopa County (Cave Creek), Pima County (Catalina Mountains near Tucson), Santa Cruz County (Crittendon), and Cochise County (Ramsay Canyon, Huachuca Mountains). It is known to occur in extreme southwestern New Mexico (Dog Spring and Dog Mountains, Hidalgo County). With the exception of the panhandle region, this toad is distributed locally over the western half of Texas. The records by counties are as follows: Dallas (Dallas), Somervell (Glen Rose), Tom Green (Fort Concho), McLennan (Waco), Burnet (Sherrard Ranch), Hays (San Marcos, Wimberley, and Devils Canyon), Kendall (Boerne), Bexar (San Antonio and Helotes), and Duval (San Diego). The occurrences along the Rio Grande River by counties are as follows: Cameron (Brownsville), Starr (Ringgold Barracks), Val Verde

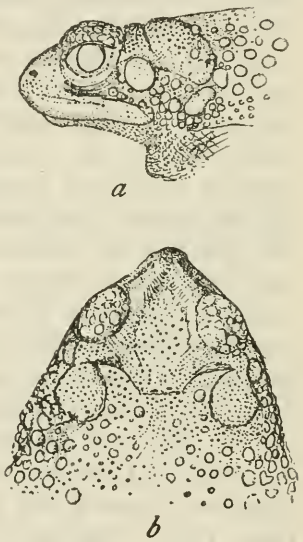

FIGURE 13.—Head of *Bufo punctatus* (U.S.N.M. No. 12661) from La Paz, Lower California: *a*, Lateral view; *b*, dorsal view

(Devils River and Comstock), Brewster (Boquillas and Terlingua), and El Paso (El Paso). In the drainage of the Pecos River in Texas this toad has been taken in Jeff Davis County (Fort Davis and Davis Mountains) and in Reeves County (Cherry Creek). Farther north there are records for Alamogordo in Otero County and Albuquerque in Bernalillo County, N. Mex.

Remarks.—The three cotypes of *Bufo punctatus* (U.S.N.M. No. 2618) were collected in Texas by John H. Clark, a member of Col. J. D. Graham's party of the United States and Mexican Boundary Survey, on the Rio San Pedro (Devils River), a tributary of the Rio Grande. According to the original entry in the catalogue of the division of reptiles, these cotypes were received from "J. D. G." (J. D. Graham). The name of the collector is not given in the catalogue, but Baird in his report on the reptiles of the United States and Mexican Boundary Survey credits their discovery to J. H. Clark. Inasmuch as they must have been collected not only prior to the publication of the original description, but also while Clark was working under the supervision of Colonel Graham, it will not be difficult to fix the approximate date of collection. The party under the direction of Graham followed well-known wagon roads used by the United States Army in southern Texas. Leaving Indianola they passed through San Antonio on their way to Fort Inge. From that post the old road turns westward toward the Rio Grande and crosses the Rio San Pedro (Devils River) near its mouth, and then follows the valley of the latter for some distance before going across to the Pecos River. The road followed the western bank of the Pecos River to the mouth of Delaware Creek and then taking a more westerly direction it passed Salt Lagoons Spring, and ended at Frontera (El Paso, Tex.). Graham's party arrived at Copper Mines, N. Mex., on August 2, 1851. Work on the boundary survey was commenced shortly after this date, and Clark accompanied Graham in September, 1851, as far west as Santa Cruz in Sonora, Mexico. On the return trip, Clark spent some time collecting in the vicinity of Copper Mines, N. Mex. Maj. W. H. Emory was not directed to proceed to El Paso, Tex., to relieve Colonel Graham until September 13, 1851. Clark received a new assignment from Major Emory, and on February 12, 1852, we find him at the Presidio del Norte, which was near the mouth of the Rio Conchos in Chihuahua, and in May, 1852, at Frontera. The cotypes thus were collected during the year 1851 and probably during July.

Spotted toads are readily distinguished from other species by the broadness and flatness of the top of the head, but vestigial cranial crests may or may not be present. The general coloration of the upperparts ranges from light reddish brown to olive or even malachite green. The small sharply pointed warts on the upperparts are bright

pink or vermilion at the base, and their bases are often encircled or partially encircled by narrow black borders. The underparts are whitish, irregularly speckled with black.

The spotted toad seems to prefer desert areas and in many localities is an inhabitant of rocky gulches and canyons with seepages and springs. During the hot midsummer it takes refuge under large flat stones and bowlders in creek bottoms, under stones partly imbedded in moist earth and sand, or in niches in rock bluffs. Although large numbers of them frequently congregate in pools of water during the breeding season, they are rarely found except after dark. The breeding season varies according to locality and meteorological conditions. In southern Texas, this toad breeds early in March but along the northern limits of its range the breeding season may be delayed until April and May.

Specimens examined.—Forty-five, as follows:

Bufo punctatus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
M.C.Z.	1658	[1] 1	TAMAULIPAS: Sierra Nola	1879	Edward Palmer.
			COAHUILA:		
U.S.N.M.	2617	1	Castanuelas	1853	D. N. Couch.
M.C.Z.	1638	26	Monclova	1880	Edward Palmer.
U.S.N.M.	2649	8	CHIHUAHUA: Chihuahua Rio		John Potts.
			SAN LUIS POTOSI:		
M.C.Z.	1668	[1] 3	San Luis Potosi (9 leagues south).	1879	Edward Palmer.
Do.	1662	[1] 4	San Luis Potosi (22 miles north).	Sept. 17, 1879	Do.
U.S.N.M.	26158–59	2	GUANAJUATO		Alfred Dugés.

[1] Young.

BUFO SIMUS Schmidt

Figure 14

1858. *Bufo simus* SCHMIDT, Denkschr. Akad. Wiss. math.-naturw. Classe, Wien, vol. 14, pt. 2, pp. 254, 255, pl. 3, fig. 22.—GÜNTHER, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, pp. 254, 255, May.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 74, 131.

1858. *Bufo intermedius* GÜNTHER, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 140, pl. 9, fig. A.—GÜNTHER, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 255, May.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 75, 133.

1879. *Bufo occidentalis* (MS. DE FILIPPI) CAMERANO, Atti R. Accad. Sci. Torino, vol. 14, p. 887 (Mexico).

1879. *Bufo monksiae* COPE, Proc. Amer. Philos. Soc., vol. 18, no. 104, p. 263, June 20 (Guanajuato, Mexico).—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 73, 110.

Type locality.—Chiriqui River in the vicinity of Bocas del Toro, Panama.

Range.—From Mazatlan in Sinaloa, Sierra Madre in Zacatecas, and Orizaba in Vera Cruz, south through Nayarit, Jalisco, Guanajuato, Hidalgo, Morelos, Puebla, and Guerrero to the Isthmus of Tehuantepec in Oaxaca; exact limits of range not known; occurs in the province of Bocas del Toro in northeastern Panama and in the Andes of Ecuador. Reported from: Vera Cruz, Tetela (Gadow); Sinaloa, Presidio (Günther); Durango, Milpas (Forrer); Guanajuato, Guanajuato, Huazteca Potosina, and Silao (Dugés); Puebla, Izucar de Matamoros (Perez); Guerrero, Omilteme and Chilpancingo (Gadow), Amula (H. H. Smith); Oaxaca, Totolapan (Gadow).

Remarks.—The original description of *Bufo simus* is based solely on young toads taken by J. von Warszewiez in shallow places in the Chiriqui River near Bocas del Toro, Panama. It is assumed that the author refers to rivers or streams descending from the Volcano Chiriqui through the present province of Bocas del Toro and flowing into the lagoon, which is connected with the Caribbean Sea by the so-called Bocas del Toro. It is stated that the cotypes are in the Zoological Museum of Krakow. According to the original description, the body length of the largest individuals (cotypes) is 26 mm. There are no bony crests on the crown and on the hinder part of the head. The tympanum is concealed. The parotoid glands are medium sized and irregularly rounded. There is a slight web on the hind foot, but the toes have dermal fringes. The skin on the back is studded with large and small warts, but the skin of the underparts, with the exception of the thighs, is nearly smooth. The coloration of the upperparts is a lighter or darker gray, and that of the underparts yellow-gray with irregular blackish spots.

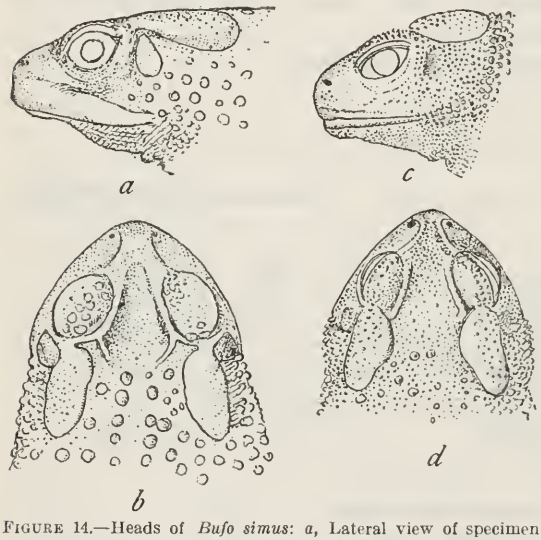

FIGURE 14.—Heads of *Bufo simus*: *a*, Lateral view of specimen (U.S.N.M. No. 2607) from Valley of Mexico, Mexico; *b*, dorsal view of same; *c*, lateral view of specimen (U.S.N.M. No. 47171) from Dolores, Nayarit, Mexico; *d*, dorsal view of same

It has been generally believed that *Bufo simus* was closely related to *Bufo intermedius*, and that it differed from the latter only in having the tympanum hidden under a tubercular skin. Ten young toads belonging to the American Museum of Natural History and collected at or near Orizaba in Vera Cruz were compared with the origina[1]

description of *Bufo simus*. These individuals have body lengths ranging from 22 mm. to 29 mm. A small indistinctly outlined tympanum, which was covered with minute tubercles, was recognized on five of these young toads. On the remaining five, the tympanum was entirely concealed by numerous closely spaced tubercles. On all, the skin of the underparts is seen on close inspection to be distinctly granular. Nevertheless the smaller individuals have a much smoother and a much more delicate skin on the underparts than have older individuals. A rather casual examination of such individuals might possibly have led Schmidt to infer that the skin on the underparts was nearly smooth. Günther,[19] however, states that the British Museum of Natural History received through Doctor Werner one of the cotypes of Schmidt's *Bufo simus*. This specimen (B. M. No. 98. 9.14. 6) has a tarsal fold, and the tympanum is concealed by the tubercular skin. The head and body length is 15 mm. Although it is a very young toad, the coloration of the upperparts, especially the light areas, the sides, and the upper lip, corresponds rather closely with the type of color pattern most commonly observed in Mexican specimens. The skin on the abdomen is distinctly granulated.

The cotypes of *Bufo intermedius* (B. M. Nos. 58. 9. 20. 3–6) were collected in 1857 by Louis Fraser, a bird collector employed by Dr. P. L. Sclater, and are labeled as coming from Guayaquil and the Andes of Ecuador. Although the Andes locality is not stated, it is known that Fraser was collecting at Gualaquiza and at Zamora in the eastern wooded region along the Rio S. Iago and on the eastern slope of the watershed at Cuenca, which is situated at an altitude of 8,200 feet on the Rio Matadero. Two of the cotypes have the type of coloration that is commonly present in Mexican specimens, one has prominent black spots on the light ground color of the upperparts, and the other has the color pattern somewhat obliterated by a darker suffusion. In addition, the parotoid glands come in contact with the postorbital cranial crests, the parietal crests are short, the subarticular tubercles on distal phalanges of the fourth toe are double, and a linear series of small tubercles extends along the tarsal fold. The measurements of these four cotypes are, respectively: Head-and-body length, 90.4, 88, 76.4, and 76.7 mm.; transverse diameter of tympanum, 3.8, 3.1, 3.7, and 3.2 mm.; transverse diameter of orbit, 8.5, 8.8, 8.1, and 6.9 mm.; distance between anterior rim of eye and nostril, 6.3, 5.8, 5.0, and 4.3 mm. The specimen figured and described by Günther bears a very close resemblance to the toad that occurs in Mexico, and there are no known characters that will separate the former from the latter. Camerano merely published De Filippi's manuscript name, *Bufo occidentalis*, in the synonymy of *Bufo intermedius*, and it is strictly a *nomen nudum*.

[19] Günther, A. C. L. G., Biologia Centrali-Americana, Reptilia and Batrachia, pp. 254, 255, May, 1901.

The type of *Bufo monksiae* (U.S.N.M. No. 9896) is a young toad that measures 23.5 mm. from the tip of the snout to the vent. It was collected at Guanajuato by Alfred Dugés in 1877. The upperparts are brownish, with a few small ashen spots and a vertebral stripe of the same color. A transverse light-colored band extends across the eyelids and the interorbital region. It is clearly a young individual of *Bufo simus*. It is possible that the coloration of this individual may have been changed somewhat by the preservative or by the container.

The general coloration of the upperparts of *Bufo simus* is light gray or olive, marbled with a darker shade of brown. A light-colored interorbital band is generally present. The spotted pattern is especially noticeable on a specimen (A. M. N. H. No. 13896) from Santa Catalina in Puebla. Some of the specimens collected in Jalisco have nearly white underparts. A specimen (A. M. N. H. No. 13905) taken at Cafetal Capalita in Oaxaca has an unusually warty skin. Young individuals of this species have a distinct light-colored vertebral stripe, and many have the belly and chin spotted with white. Twenty immature individuals, ranging from 32 mm. to 61 mm. in length, and collected in Vera Cruz, Jalisco, and Oaxaca, have the tympanum practically hidden by closely approximated conical warts. On all these the tympanum is covered with a tubercular skin, and on a number of them the sole discernible vestige of the tympanum is located in a dermal fold bordered by numerous conical tubercles. The parotoid glands are generally elongated, somewhat bean-shaped, and in contact with the upper eyelid. These glands are generally studded with minute pores and in rare instances are somewhat pustulose. The tarsal fold is more or less distinct and generally is furnished with a linear series of small closely spaced tubercles. Posteriorly diverging supraciliary crests, short oblique parietal crests, and vestigial postorbital crests are generally present, except on young or immature individuals. In a series of 50 individuals, all but two have double subarticular tubercles on the distal phalanges of the fourth toe.

Considerable variation in the color markings on the upperparts was observed in the series studied. The skin of the upperparts is generally covered with small warts, which are either conical or blunt. One individual (U.S.N.M. No. 47171), taken at Dolores in Nayarit on August 6, 1897, by Nelson and Goldman, differs in a number of respects from the average toad of this species. The skin of the upperparts, top of the head, and surfaces of the fore and hind limbs is exceptionally tubercular and is covered with closely set small conical warts. The elongated parotoid glands are likewise covered with spinose warts. The posteriorly diverging supraciliary crests are distinct, but there are no vestiges of the parietals and the postorbitals. The tympanum is indistinct and is covered with tubercular skin and

numerous small conical warts. There are single subarticular tubercles on the distal phalanges of the fourth toe. It would seem that the hind feet are deformed, for the fourth toe of the right foot is longer than the corresponding toe on the left foot, and both are considerably shorter than the normal. The tarsal fold has a linear series of small conical warts.

Specimens examined.—Eighty-four, as follows:

Bufo simus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SINALOA:		
A.M.N.H.	13253	1	Ruined monastery north of Mazatlan.	Nov. 25, 1919	Paul D. R. Ruthling.
U.S.N.M.	47449	1	Plomosas	July 19, 1897	Nelson and Goldman.
			ZACATECAS:		
Do.	46826	1	Sierra Madre	Aug. 17, 1897	Do.
Do.	47170	1	do	Aug. 18, 1897	Do.
			NAYARIT:		
Do.	47171	1	Dolores	Aug. 6, 1897	Do.
A.M.N.H.	13252	1	Marquesado	Nov. 14, 1919	Paul D. R. Ruthling.
			GUANAJUATO:		
U.S.N.M.	11358	2	Guanajuato	Jan. 30, 1880	Alfred Dugés.
Do.	21160–61	2	do		Do.
Do.	9896	[1] 1	do	1877	Do.
			HIDALGO:		
M.C.Z.	3951	1	Guenero	Sept. 24, 1913	W. M. Mann.
Do.	3953–55	3	do	do	Do.
Do.	9032–33	2	Velasco	1913	Do.
			VERA CRUZ:		
A.M.N.H.	13761–62	2	Orizaba	Apr. 25, 1919	Paul D. R. Ruthling.
Do.	13779–95	17	do	June 25, 1919	Do.
U.S.N.M.	30224–25	2	do		Francis Sumichrast.
Do.	19268	1	do	Aug. 2, 1891	Willis S. Blatchley.
A.M.N.H.	13764–65	[2] 2	Near Orizaba	Summer (?) 1918.	Paul D. R. Ruthling.
Do.	13776	1	North of Rio Atoyac, near Potrero.	June 18, 1918	Do.
			FEDERAL DISTRICT:		
Do.	13247	1	3 miles east of Ixtacalco	Oct. 27, 1918	Do.
			PUEBLA:		
Do.	6293	1	Puebla	July 22, 1920	Do.
Do.	13896–97	2	Santa Catalina	July 31, 1920	Do.
			MORELOS:		
F.M.N.H.	1359	1	Cuautla		S. E. Meek.
N.M.W.	1910–15	[2] 4	Cuernavaca		H. Gadow.
			JALISCO:		
U.S.N.M.	46961	1	Atemajac	May 28, 1892	Nelson and Goldman.
Do.	46825	1	Colotlan	Aug. 28, 1897	Do.
A.M.N.H.	13251	1	El Aquilar Mine	Nov. 6, 1919	Paul D. R. Ruthling.
Do.	13250	1	Hostotipaquillo	Nov. 1, 1919	Do.
Do.	13754	1	North of Hostotipaquillo	Sept. 26, 1919	Do.
U.S.N.M.	64663	1	Jacala	Mar. 6, 1897	Nelson and Goldman.
Do.	46827	1	La Laguna	Sept. 20, 1897	Do.
A.M.N.H.	13766	1	On way to Magdalena	Sept. 29, 1919	Paul D. R. Ruthling.
Do.	13248–49	2	Platanillo, 8 miles north of Magdalena.	Oct. 28, 1919	Do.
Do.	13753	1	Rio Blanco, north of Zapopan	Sept. 12, 1919	Do.
Do.	13755	1	West of Tonala	Sept. 17, 1919	Do.
			GUERRERO:		
U.S.N.M.	47916	1	Tlalixtaquillo	Dec. 10, 1894	Nelson and Goldman.
			OAXACA:		
A.M.N.H.	13905	1	Cafetal Capalita	July 15, 1920	Paul D. R. Ruthling.
Do.	13890–95	6	Ejutla	July 9, 1920	Do.
U.S.N.M.	47200	1	Juquila, 5,000 feet altitude	Mar. 2, 1895	Nelson and Goldman.
A.M.N.H.	13902–04	3	Mountain descent into valley of Miahuatlan.	July 7, 1920	Paul D. R. Ruthling.
C.G.E.M.	2	[2] 4	Oaxaca	Aug. 10, 1919	J. Jarduno.
F.M.N.H.	3027	[2] 1	do		C. H. T. Townsend.
U.S.N.M.	47009	1	Mountains near Oaxaca, 9,000 feet altitude.	June 20, 1894	Nelson and Goldman.
A.M.N.H.	6259	1	Tehuantepec	1920	Paul D. R. Ruthling.
			?STATE:		
U.S.N.M.	25258	1	No definite locality		
Do.	2607	1	Valley of Mexico		John Potts.

[1] Type of *Bufo monksiae*.

[2] Young.

BUFO VALLICEPS Wiegmann

NEBULOUS TOAD

Figure 15

1833. *Bufo valliceps* WIEGMANN, Isis von Oken, vol. 26, pt. 7, pp. 657–659.—PETERS, 1863, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 81.—COPE, 1889, U. S. Nat. Mus. Bull. 34, p. 292, fig. 73.—DICKERSON, 1906, The frog book, pp. 108–110, figs 112–115, col. pl. 5, fig. 3.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 76, 128.

1833. *Bufo trachypus* MS. WIEGMANN, Isis von Oken, vol. 26, pt. 7, pp. 657, 658, footnote. (Nomen nudum.)

1852. *Bufo granulosus* BAIRD and GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 173, Oct. [*Nec Bufo granulosus* SPIX, 1824.)

1854. *Bufo nebulifer* GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 87, May.—BAIRD, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, pp. 25, 35, pl. 40, figs. 1–4.

1858. *Bufo sternosignatus* [part] GÜNTHER, Catalogue of the Batrachia Salientia in the collection of the British Museum, pp. 68, 69, pl. 5, fig. C′ (Cordova and Mexico).

1896. *Bufo valliceps microtis* WERNER, Verhandl. k. k. zool.-bot. Gesell. Wien, vol. 46, no. 8, p. 350. (Honduras.)

Type locality.—Mexico.

Range.—From the Rio Grande, below the mouth of Pecos River, southwest through Tamaulipas, Nuevo Leon, Coahuila, and Durango to southern Sinaloa (Mazatlan) and Nayarit (Acaponeta), and thence southward along both coasts as well as in the interior of Mexico to southern Costa Rica (Buenos Aires). Reported from Sinaloa, Presidio de Mazatlan (Forrer); Vera Cruz, Tampico (Richardson), Jalapa (Hoege), Atoyac (H. H. Smith), Cuatotolapam (Ruthven), and Presidio, Tetela, and Agua Fria (Gadow).

The range of this toad in the United States extends from the eastern boundary of Louisiana (Como, Franklin Parish) west to Bosque, Llano, Kendall, and Val Verde Counties in Texas, and along the Gulf coast from the mouth of Pearl River, La., to the mouth of the Rio Grande, Tex.

Remarks.—The so-called nebulous toad occurs in the vicinity of coastal marshes in southern Louisiana. In eastern Texas it has been found along the edges of pine forests. Along the western border of its range in central Texas on the grand prairie region, this toad seems to prefer small streams with rocky banks, and hides in fissures and niches in the rocks. In Guatemala, it occurs in considerable numbers along the margins of forests, in the clearings around villages, and in lesser numbers in the savannas. No published information is available in regard to its breeding habits.

It has very high cranial crests and a dark interorbital cross band. The coloration of the upperparts is quite variable; the lighter-colored individuals are generally yellowish or light gray, and the darker ones have the color pattern subdued or obliterated by a dark slate or black

suffusion. The vertebral line is usually light colored, and the back is generally blotched with some dark color. The linear series of conical warts extending along lateral line from parotoid gland to thigh separates the dorsal light-colored stripe from the lateral dark-colored one. The parotoid glands are often bicolored.

The normal coloration of this toad may be described as follows: Below lateral linear series of yellowish warts extending from parotoid gland to thighs is a blackish stripe and above it is a light-colored, often yellowish, stripe. A black transverse bar extends across head between orbits and near origin of parietal crests; a black obliquely placed spot is placed in front of antero-internal angle of parotoid gland; a dark inverted V bisects light-colored vertebral stripe near level of middle of parotoid glands; behind this marking and on each side of vertebral stripe are small irregular dark-colored blotches; an irregular elongate black blotch in sacral region on each side of vertebral stripe; warts conspicuous and numerous; cranial crests very distinct.

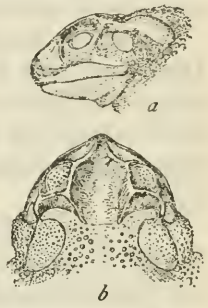

FIGURE 15.—Head of *Bufo valliceps* (U.S.N.M. No. 42351) from Victoria, Tex.: *a*, Lateral view; *b*, dorsal view

One of the variants has the upperparts suffused with reddish brown. In another phase the upperparts are very light colored, and are generally yellowish or light gray. In this phase the dark blotches or markings are often indistinct.

In the dark phase the upperparts are slate colored or even blackish. All the markings are either somewhat subdued or less evident because of the general darkening of the entire ground color. The lateral dorsal light-colored stripes are less noticeable because of an invasion of a slaty suffusion. Some of the lateral linear series of warts may be slate colored.

In some immature individuals, the black markings have a velvety appearance. This condition is occasionally met with in subadult specimens. The underparts are often unspotted, but in most instances dark spots or blotches are present.

It would appear from the footnote in Wiegmann's article that the brother of Ferdinand Deppe had been selling specimens of this toad under the name *Bufo trachypus*. It is a *nomen nudum* and has no standing in zoological nomenclature. The cotypes of *Bufo valliceps* (M. N. B. Nos. 3525–27, 3532) were collected in Mexico by Ferdinand Deppe, who was a member of a party of Germans engaged in making botanical collections in Mexico. The following notes were made on these cotypes:

No. 3525, two cotypes collected by Deppe in Mexico. Head-and-body length, 94 mm. and 100 mm., respectively; the former has white underparts and the latter has white underparts with brown marbling.

These specimens correspond to normal individuals of this species, and have heavy, high, and relatively thick cranial crests. The lateral row of warts is well developed.

No. 3526, one cotype collected by Deppe in Mexico. Head-and-body length, 84 mm.; underparts white with brown marbling; a dark-colored individual with light blotches on upperparts; cranial crests sharp-edged; parotoid glands subtriangular in outline; a lateral row of minute warts; inner metatarsal tubercle small, but larger than the outer.

No. 3527, one cotype collected by Deppe in Mexico. Underparts white, with dusky spots; upperparts light colored, with dark interorbital band, dark spots and dark stripes; cranial crests sharp; inner metatarsal tubercle small, but larger than the outer.

No. 3532, one cotype collected by Deppe at Vera Cruz, Mexico. Head-and-body length, 55 mm. Underparts white, with dark marbling; upperparts dark, marbled with light colors; cranial crests blunt-edged and rather thick; parotoid glands subtriangular in outline; a light-colored vertebral stripe and a light-colored interorbital band.

The type of *Bufo granulosus* (U.S.N.M. No. 2595) was collected in 1851 by John H. Clark, a member of Col. J. D. Graham's party of the United States and Mexican Boundary Survey, somewhere along the old wagon road that extended from Indianola to San Antonio, Tex. Inasmuch as this name is preoccupied, Girard proposed *Bufo nebulifer* as a substitute name. The specimen (U.S.N.M. No. 2602) figured by Baird in his report on the reptiles of the United States and Mexican boundary came from New Braunfels, Comal County, Tex.

Günther's *Bufo sternosignatus* was based on three adult toads from Venezuela and two half-grown individuals from Mexico. One of these latter (B. M. No. 56. 3. 17. 25) was taken by Auguste Sallé at Cordoba in Vera Cruz, and the other, labeled as coming from Mexico, was purchased from Parzudaki (B. M. No. 58. 9. 6. 13). The last-mentioned specimen has a head-and-body length of 30 mm. Boulenger [20] has shown that the two half-grown Mexican toads are identical with *Bufo valliceps* and has restricted the name *Bufo sternosignatus* to the Venezuela form.

More recently Werner has proposed to recognize the Honduran form as a distinct subspecies. The type of *Bufo valliceps microtis* (M. N. B. No. 13200) is an adult female with a small tympanum and was collected by Schlüter. The following notes were made on this specimen: Head-and-body length, 73 mm.; transverse diameter of tympanum, 3.7 mm.; transverse diameter of eye, 9 mm.; cranial crests high, sharp-edged; thin, sharp-edged, and nearly vertical preorbital and postorbital crests; parotoid glands protuberant; general coloration of upper-

[20] Boulenger, G. A., Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 323, 1882.

parts light; upper lip white; a wide white interorbital band, bordered anteriorly and posteriorly by a black stripe; white vertebral stripe interrupted and irregular in width; a lateral white stripe; underparts yellowish, with dusky marbling; a lateral row of small warts; skin of upperparts tubercular; bony surface of top of head fairly smooth. In the southern part of the range of *Bufo valliceps* specimens will be found that have a much yellower ground color than typical individuals and these usually have rather conspicuous dark-brown spots irregularly arranged on the upperparts. They often occur along with other specimens that exhibit the normal coloration of this species. Females generally have a smaller tympanum than males. In a large series of specimens considerable variation in the size of the tympanum will be noted.

Specimens examined.—One hundred and thirty-three, as follows:

Bufo valliceps

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
M.C.Z.	1636	7	COAHUILA: Monclova	1880	Edward Palmer.
			NUEVO LEON:		
U.S.N.M.	47168	1	Cerro de la Silla	Mar. 27, 1902	Nelson and Goldman.
Do.	2599	2	Santa Catarina	Apr. —, 1853	D. N. Couch.
			TAMAULIPAS:		
Do.	47081-83	3	Alta Mira	Apr. 23, 1898	Nelson and Goldman.
Do.	46918	[1] 1	Hidalgo	Mar. 19, 1891	William Lloyd.
Do.	47053-55	[1] 3	Jaumave	June 4, 1898	Nelson and Goldman.
Do.	42501-04	[1] 4	La Barra, 8 kilo. east of Tampico.		Edward Palmer.
Do.	2591	2	Matamoros	Mar. —, 1853	D. N. Couch.
			VERA CRUZ:		
F.M.N.H.	1481	3	Achotal	1904	Edmund Heller and C. M. Barber.
M.C.Z.	8447-51	5	Cerro del Gallo	1921	E. R. Dunn.
A.M.N.H.	13756	1	Cocos	June 22, 1919	Paul D. R. Ruthling.
B.M.	56. 3. 17. 25	[2] 1	Cordoba		Auguste Sallé.
U.S.N.M.	12170	4	Mirador		C. Sartorius.
Do.	25094-96	3	do		Do.
Do.	71056	1	do		Do.
C.G.E.M.		1	Motzoronga		
U.S.N.M.	47230	1	Orizaba	Jan. 19, 1894	Nelson and Goldman.
Do.	30360-69	10	do		Francis Sumichrast.
A.M.N.H.	13792	1	do	June 25, 1919	Paul D. R. Ruthling.
Do.	13763	1	do	do	Do.
U.S.N.M.	16548-51	[1] 4	Vicinity of Orizaba		Francis Sumichrast.
M.C.Z.	10298	1	Panuco	1923	W. W. Brown.
F.M.N.H.	1687	1	Perez	1903	S. E. Meek.
A.M.N.H.	13768-72	5	Potrero	June 19, 1919	Paul D. R. Ruthling.
Do.	13774-77	4	North of Rio Atoyac near Potrero.	June 18, 1919	Do.
C.A.S.	5083	1	Tezonapa	July 14, 1925	Joseph R. Slevin.
Do.	5299	1	Vera Cruz	July 24, 1925	Do.
Do.	5468	1	do	July 23, 1925	Do.
Do.	5563	1	do	July 25, 1925	Do.
M.N.B.	3532	[3] 1	do		Ferdinand Deppe.
A.M.N.H.	12306-08	3	do	June 3, 1919	Paul D. R. Ruthling.
Do.	12292	1	do	June 2, 1919	Do.
Do.	12340	1	Vera Cruz (2 miles south)	Mar. 1, 1919	Do.
U.S.N.M.	46948-49	2	NAYARIT: Acaponeta	June 30, 1897 July 2, 1897	Nelson and Goldman.
C.G.E.M.		1	PUEBLA: Puebla		
M.C.Z.	2630	1	MORELOS: Cuernavaca		T. Barbour.

[1] Young.
[2] Cotypes of *Bufo sternosignatus*.
[3] Cotypes of *Bufo valliceps*.

Bufo valliceps—Continued

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			OAXACA:		
U.S.N.M.	46967	1	Choapam	July 28, 1894	Nelson and Goldman.
C.A.S.	5038	1	Cosolapa	July 12, 1925	Joseph R. Slevin.
Do.	5039	1	do	July 13, 1925	Do.
Do.	5091–97	7	do	July 14, 1925	Do.
Do.	5099–5104	6	do	do	Do.
Do.	5170	1	do	July 16, 1925	Do.
Do.	5187	1	do	July 19, 1925	Do.
Do.	5190–91	2	do	July 20, 1925	Do.
U.S.N.M.	47117–18	2	Guichicovi	June 24, 1895–June 26, 1895	Nelson and Goldman.
Do.	47123	1	Santo Domingo	June 11, 1895	Do.
Do.	47125–26	2	do	do	Do.
Do.	47127–28	2	Mountains near Santo Domingo.	June 19, 1895	Do.
Do.	10013	1	Tapana	Feb. —, 1876	Francis Sumichrast.
Do.	30180–81	2	Tehuantepec		Do.
			CHIAPAS:		
Do.	46766–69	4	Ocozocoautla	Aug. 20, 1895	Nelson and Goldman.
Do.	46761	1	Oculapa	Aug. 27, 1895	Do.
Do.	46849	1	Tumbala	Nov. 16, 1895	Do.
Do.	46851	1	Valley of Comitan	Dec. 9, 1895	Do.
			TABASCO:		
Do.	47311	1	Teapa	Apr. 15, 1900	Do.
Do.	37747	1	Frontera	Mar. 12, 1897	C. H. T. Townsend.
			YUCATAN:		
Do.	12285	3	No definite locality		Arthur Schott.
Do.	12292–93	2	do		Do.
			? STATE:		
M.N.B.	3525–27	[3] 4	No definite locality		Ferdinand Deppe.
B.M.	58. 9. 6. 13	[2] 1	do		Émile Parzudaki.

[2] Cotypes of *Bufo sternosignatus*. [3] Cotypes of *Bufo valliceps*.

BUFO WOODHOUSII Girard

Figure 16

1852. *Bufo dorsalis* HALLOWELL, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 181, Oct. (New Mexico). [*Nec Bufo dorsalis* SPIX, 1824.]—HALLOWELL, 1853, Sitgreaves's report of an expedition down the Zuni and Colorado Rivers, U. S. Senate Doc. 59, 32d Cong., 2d Sess., p. 142, pl. 19.

1854. *Bufo woodhousii* GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 86, May.—STORER, 1925, Univ. California Publ. Zool., vol. 27, pp. 199–203, pl. 11, fig. 31b.

1866. *Bufo frontosus* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 301, Oct.—COPE, 1889, U. S. Nat. Mus. Bull. 34, p. 283.

1875. *Bufo lentiginosus frontosus* YARROW, Report upon geographical and geological explorations and surveys west of the One Hundredth Meridian (Wheeler survey), vol. 5, chap. 4, p. 520.—COUES, 1875, *idem*, chap. 5, pp. 627, 628.

1889. *Bufo lentiginosus woodhousei* COPE, U. S. Nat. Mus. Bull. 34, p. 281, fig. 69.—DICKERSON, 1906, The frog book, pp. 91–93, figs. 68–74, col. pl. 4, fig. 2.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, p. 126.

Type locality.—"New Mexico" [= San Francisco Mountain, Coconino County, Ariz.].

Range.—From the Missouri River in Montana (north of Wilder) and in North Dakota (Goodall), west to near the junction of the Umatilla and Columbia Rivers (Umatilla); south through western Idaho (Boise), northwestern Nevada (Humboldt County), southwestern Utah (Washington County), to the Lower Colorado River

(Yuma), the Salton Sea Basin (Agua Dulce), southern Arizona (Nogales), and northern Sonora; and east through the Rocky Mountain region to the Badlands of South Dakota, the Loup fork of the Platte River in Nebraska, northeastern Kansas (Doniphan County), the Arkansas River in eastern Oklahoma (Okmulgee, Pushmataha, and McCurtain Counties), southern Texas (Hays and Bexar Counties) and along the Rio Grande west of the mouth of the Pecos River (Brewster and El Paso Counties); and thence to southern Chihuahua (Santa Rosalia).

Remarks.—The misstatements in regard to the type of *Bufo dorsalis* and the assumed type of *Bufo woodhousii* published by Cope in his "Batrachia of North America" have been corrected by Doctor Stejneger.[21] The actual type of *Bufo dorsalis* (U. S.N.M. No. 2531) is still extant and was collected in October, 1851, on San Francisco Mountain, Coconino County, Ariz., by Dr. S. W. Woodhouse, who accompanied Capt. L. Sitgreaves on the expedition down the Zuni and Colorado Rivers. Girard found that the name *Bufo dorsalis* was preoccupied by an earlier application of *dorsalis* by Spix to a toad found in the province of Rio de Janeiro, Brazil, and therefore he proposed *Bufo woodhousii* as a substitute name. Both of these specific names are based on the same type specimen.

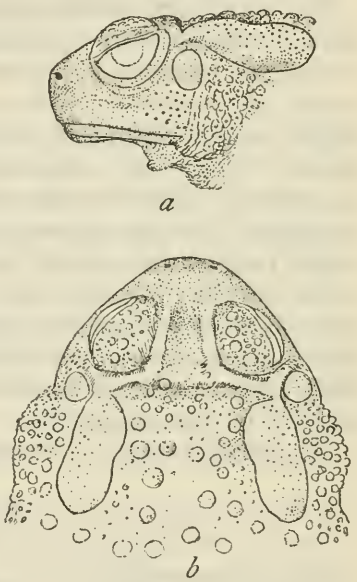

FIGURE 16.—Head of *Bufo woodhousii* (U.S. N.M. No. 2531) from San Francisco Mountain, Ariz.: *a*, Lateral view; *b*, dorsal view. Type specimen

No specific type locality for *Bufo frontosus* is given in the original description, except for a rather general one—"Territory of Arizona"— which appears in the introductory remarks. The original description is reprinted by Dr. Elliott Coues in his "Synopsis of the Reptiles and Batrachians of Arizona," and the following is added: "One specimen from Los Pinos, Rio Grande, N. Mex. [=Valencia County, N. Mex.]; type of the species." This specimen was collected in 1864 by Coues, whose collection and field notes were placed in the hands of Professor Cope. There is no record that indicates that the type of *Bufo frontosus* was ever sent to the National Museum by Coues, and it is possible that it may have been sent direct to Cope. At any event

[21] Stejneger, L., Annotated list of reptiles and batrachians collected by Dr. C. Hart Merriam and Vernon Bailey on the San Francisco Mountain Plateau and desert of the Little Colorado, Arizona, with descriptions of new species. North Amer. Fauna No. 3, pt. 5, pp. 116, 117, Sept. 11, 1890.

the type has never been recognized among the unlabeled specimens returned to the National Museum by the executors of Cope's estate.

The habitat of *Bufo woodhousii* is by no means restricted to mountainous regions, but includes surroundings as diverse as the sagebrush flats of eastern Montana, the prairie fields among the chalk cliffs of western Kansas, the Hudsonian Zone mountain sides of eastern Colorado, the irrigation ditches that traverse the mesquite plains of New Mexico, and the bottomlands along the Colorado River near Yuma, Ariz. During May and June, according to locality, adults of this species may be found breeding in shallow, sluggish creeks, in irrigation ditches, or in fresh-water pools in the canyons.

The upperparts of this toad are generally grayish or dull yellowish brown, conspicuously blotched with a darker color or without such markings; vertebral stripe whitish; limbs obscurely barred; underparts light yellowish, with or without black markings on breast; largest warts red-tipped and encircled at base with narrow black border. The cranial crests are distinct, but not high; canthus rostralis generally distinct; interorbital space either concave or convex, depending upon the approximation of supraciliary crests, which may either parallel one another or diverge slightly posteriorly; parietal crests generally lacking, but supraciliary crests may be thickened at their posterior extremities; parotoid glands often in contact with postorbital crests, about twice as long as broad, their maximum diameter being almost twice the length of the orbit; inner metatarsal tubercle large, with free cutting edge.

Specimens examined.—Two as follows:

Bufo woodhousii

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	2651	1	SONORA: No definite locality	1851	Thomas H. Webb.
Do	47108	1	CHIHUAHUA: Santa Rosalia	Sept. 19, 1893	E.W. Nelson.

Family LEPTODACTYLIDAE Berg

1896. Leptodactylidae BERG, Anal. Mus. Nac. Buenos Aires, vol. 5, p. 161, Nov. 28.

Noble [23] has attempted to throw doubt on the validity of the family Leptodactylidae by advancing the argument that "they can not be distinguished by any family character from *Bufo*" and that "the bufonid and leptodactylid genera exhibit no constant features by which to distinguish them." The validity of the family Leptodactylidae seems to resolve itself into the difficult matter of deter-

[23] Noble, G. K., Bull. Amer. Mus. Nat. Hist., vol. 46, art. 1, pp. 20, 21, 1922.

mining what is a family character. The phylogenetic importance of the various characters that have been selected from time to time to express relationships of supposedly allied groups of genera is in most cases rather doubtful, for the grouping is based solely on recent genera. In view of the admitted deficiency in the paleontological record of an undoubtedly old group like the Anura, a classification based upon structures that have been either remodeled or modified may fail to eliminate all cases of convergent and parallel development. By definition the limits of families can be extended or restricted as the taxonomist so desires. Difficulties familiar to all are encountered when one attempts to set up arbitrary limits or structural features that will invariably characterize all genera of the family. If we grant that families and genera are derived from older types, then we may expect to encounter overlapping structural features in related groups.

It may be conceded that any classification based on dentition does not adequately express true relationships. There seems to be an evolutionary tendency in some groups toward the elimination of teeth and equivalent stages in this process do not necessarily indicate relationship. *Engystomops* and *Bufo* lack maxillary and vomerine teeth. There are, however, important differences in the mode of life history. *Engystomops* and *Bufo* are very much alike externally, but the former lacks the characteristic protruding parotoid glands of the latter, and furthermore their life histories are quite unlike. The toads of the genus *Bufo* lay their eggs in long or short strings in the water, while the leptodactylids lay theirs in masses or clusters either on land or floating on the water's surface.

According to Noble,[33] *Syrrhophus* "is a polyphyletic group of species of *Eleutherodactylus* which have independently lost the vomerine teeth." Granted that this is the case, a stage in this general process is represented by *Eleutherodactylus mexicanus*, in which all steps from toothless to a normal vomerine series may be encountered in a series of individuals. Both *Eleutherodactylus* and *Syrrhophus* have T-shaped terminal phalanges and the same type of sternal construction, including a cartilaginous style. In *Leptodactylus* the mesosternum has ossified. *Tomodactylus* seems to be related to *Eleutherodactylus* and *Syrrhophus*, since it has T-shaped terminal phalanges and a cartilaginous mesosternum, but lacks vomerine teeth. *Engystomops* is more distantly related to the Mexican leptodactylids, for it lacks both vomerine and maxillary teeth and possesses terminal phalanges with nodular extremity, as well as a straplike bony mesosternum with each branch of distal bifurcation furnished with a cartilaginous plate.

The egg-laying habits of these leptodactylids indicate that they have taken advantage of the limitations of their mode of life. Of

[33] Noble, G. K., Bull. Amer. Mus. Nat. Hist., vol. 46, art. 1, p. 18, 1922.

those in which development is indirect, *Engystomops* makes floating, foamy nests for the eggs, while *Leptodactylus* forms froth nests in contact with water. Although no observations have been published on the life histories of the Mexican species of *Eleutherodactylus*, it is quite likely that some of the species have the direct development in which the young hatch fully formed from the egg capsules. The life histories of *Tomodactylus* and of the Mexican species of *Syrrhophus* have not been observed.

KEY TO GENERA OF MEXICAN LEPTODACTYLIDAE

1. Vomerine and maxillary teeth present 3
   Vomerine teeth absent 2
2. Maxillary teeth low, projecting very little if at all beyond outer ridge of this bone, and often barely penetrating the gum 5
   Maxillary teeth absent; a diamond-shaped area inclosed by glandular dermal ridges, with black outer border and brown, orange, or vermilion-colored center in interscapular region; omosternum cartilaginous, with terminal dilation; mesosternum ossified, forming a straplike bony style, which is bifurcated distally but not proximally, and each of the branches is furnished with a separate cartilaginous plate (xiphisternum); sacral diapophyses moderately dilated; skin of upperparts decidedly tubercular and glandular; tympanum minute or hidden by tubercles; a conical tubercle on middle of inner edge of tarsus; fingers free; toes nearly free; ends of fingers and toes slightly swollen, no distinct terminal disks; outer metatarsals united; terminal phalanges with peculiar nodular extremity and rarely with pseudo-T-shaped distal end ..... **Engystomops** (p. 77)

FIGURE 17.—The T-shaped terminal phalanx of *Eleutherodactylus*

3. Mesosternum ossified, forming a bony style; fingers and toes free, without distinct distal dilations or disks; male of *Leptodactylus melanonotus* with two spine-bearing tubercles on inner side of first finger; outer metatarsals united; tympanum distinct; pupil horizontal ..... **Leptodactylus** (p. 81)
   Mesosternum not forming a bony style, but cartilaginous, with bisagittate (double arrow-shaped) extremity or xiphisternum 4
4. An external tympanum, more or less distinctly outlined; fingers free; toes either free or slightly webbed; terminal phalanges T-shaped (fig. 17); digital dilations or disks present, although generally small, and rarely as large as tympanum; outer metatarsals united; pupil horizontal ..... **Eleutherodactylus** (p. 90)
   No external indication of a tympanum; fingers with or without vestige of web at base; toes nearly fully webbed; terminal phalanges T-shaped; apical disks of fingers and toes well developed; body stout; hind limbs rather short; male of *Cauphias guatemalensis* with well-developed clawlike vestige of pollex buried in fleshy apophysis on side of first finger. **Cauphias** (p. 118)
5. Large lumbar gland present, barely visible above the skin, its position marked by an irregular dark brown or black area, with two or three white spots, or with white vermiculations; outer metatarsals united; fingers and toes free, with small distally truncated dilations or disks; terminal phalanges

T-shaped; tympanum distinct; cartilaginous omosternum and mesosternum; mesosternum sometimes forms a straplike bony style, possibly an age character ..... Tomodactylus (p. 120)

No lumbar gland present; mesosternum not forming a bony style but cartilaginous, straplike, and often spatulate; toes free; apical disks, if developed, generally small; terminal phalanges T-shaped; subarticular tubercles generally extending backward on plantar surface; outer metatarsals united; tympanum distinct; pupil horizontal ..... Syrrhophus (p. 123)

Genus ENGYSTOMOPS Espada

1872. *Engystomops* Jimenez de la Espada, Anales Soc. Espan. Hist. Nat., vol. 1, p. 86. [Genotype, *Engystomops petersi* Jimenez de la Espada, *idem*, p. 86 (Provincia de Oriente, Ecuador).]—Jimenez de la Espada, 1875, Vertebrados del Viaje al Pacifico, etc., Batracios, pl. 2, figs. 3–3d.

1873. *Microphryne* Peters, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 616, Oct. [Genotype, *Paludicola pustulosa* Cope, 1864, Proc. Acad. Nat. Sci. Philadelphia, vol. 16, p. 180, Aug. (Truando River, New Granada, Colombia).]

1875. *Peralaimos* Jimenez de la Espada, Vertebrados del Viaje al Pacifico, etc., Batracios, p. 163. [Genotype, *Peralaimos stentor* Jimenez de la Espada, *idem*, p. 163, pl. 2, figs. 4, 4b (Isla de Tobaga) = *Bufo stentor* Jimenez de la Espada, 1875, Anales Soc. Espan. Hist. Nat., vol. 1, p. 85.]

In 1882, Boulenger [24] recognized *Engystomops* as a valid genus that included the following species: *petersii*, *pustulosus*, and *stentor*. Boulenger stated in his catalogue that *Eupemphix nattereri* seemed to agree with *Paludicola fuscomaculata*. Six years later he [25] revised his views on this group and published the following explanatory statement:

> The genus *Eupemphix*, Stdr. (= *Engystomops*, in part), must, on account of the absence of teeth, be referred to the family Bufonidae, although it is in every other respect identical with *Paludicola*, to which it stands in the same relation as *Pseudophryne* to *Crinia;* this shows that frog-families founded upon the presence or absence of teeth are artificial associations.

A key to four species of *Eupemphix* follows after this statement, two of which, *nattereri* (the genotype) and *nana*, were formerly included in *Eupemphix*, but *pustulosa* and *stentor* were allocated to *Engystomops*. No reference is made to the allocation of *Engystomops petersii*. Professor Méhely in 1904 did not concur with the allocation of *Eupemphix* to the family Bufonidae, and held that the structural features did not warrant this classification. Hence *Eupemphix* and *Paludicola* were referred to the Cystignathidae [= Leptodactylidae].

A small group of species, including *petersii*, *stentor*, and *pustulosus*, seems to form a natural assemblage somewhat closely related to *Pleurodema* and *Eupemphix*. Southern Mexico on the north and

[24] Boulenger, G. A., Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., pp. 275-277, 1882.

[25] Boulenger, G. A., Descriptions of new Brazilian batrachians. Ann. and Mag. Nat. Hist., ser. 6, vol. 1, no. 3, p. 188, Mar., 1888.

Ecuador on the south are the known limits of the range of this group. These small species have much more slender bodies than those of either *Pleurodema* or *Eupemphix*, and the skin on the upperparts is decidedly glandular. A diamond-shaped mark on the back bounded by glandular ridges seems to be a constant character.

The sternal apparatus of *Engystomops* is quite similar to that of the *Paludicola signifera* figured by Méhely.[26] The omosternum, however, is cartilaginous and not semiossified as in *P. signifera*, and the bony style is bifurcated distally but not proximally also, as in the latter. Each of the branches of the bony style are furnished with a separate cartilaginous plate. The terminal phalanges are rarely simple, but generally have a peculiar nodular distal end, and occasionally a pseudo-T-shaped distal end.

ENGYSTOMOPS PUSTULOSUS (Cope)

Figure 18

1864. *Paludicola pustulosa* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 16, p. 180, Aug.

1876. *Microphryne pustulosa* Cope, Journ. Acad. Nat. Sci. Philadelphia, n. s., vol. 8, pt. 2, p. 155.

1882. *Engystomops pustulosus* Boulenger, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 275.—Günther, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 242, Feb.

1882. *Bufo* (*Microphryne*) *pustulosus* Brocchi, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 86, pl. 8, figs. 1, 1a–d.

1923. *Eupemphix pustulosa* Nieden, Das Tierreich, Lief. 46, Amphibia, Anura I, p. 165.

Type locality.—New Granada, on the River Truando, Colombia.

Range.—Interior valleys on the southern side of the Isthmus of Tehuantepec in southern Oaxaca, southward to Panama and Venezuela.

Remarks.—Cope designated a specimen in the National Museum (No. 4339) as the type and stated that it was collected by W. S. Wood of Lieutenant Michler's surveying expedition. The original entry in the museum catalogue for this number gives Darien [Panama] as the locality and [Arthur] Schott as the collector. The type can not now be found.

Surprisingly little is known in regard to the natural habitat of this widely distributed species. According to an annotation in the field catalogue of Nelson and Goldman, this small leptodactylid was found to be rather common during wet weather in the vicinity of Santo Domingo in Oaxaca at an elevation of 900 feet. It was observed that they were especially active on rainy nights and that they often came into the house where Nelson and Goldman were staying.

[26] Méhely, L. v., Ann. Hist. Nat. Mus. Nat. Hungarici, Budapest, vol. 2, pl. 13, fig. 6, 1904.

The following account of the life history of this species has been published by Doctor Noble:[27]

The species of *Eupemphix* which both Mr. Breder and Doctor Chapin have studied, is the wide-spread *pustulosus*. It has the peculiar shoulder girdle characteristic of the genus and of *Paludicola*. Breder made his observations in Darien, Panama, during February, March, and April, 1924. Most of his breeding pairs he found during the second and third week of March. *E. pustulosus* lays its eggs in a foamy mass which floats so lightly on the water that it does not break the surface film. No less than thirty-six nests were studied critically by Breder. The nests were usually at the water's edge, generally floating but adhering to any adjacent object. The few "nests" that were not in contact with the water had probably been left stranded as the water in the pool receded during a drought. Sometimes the "nests" were partly and, rarely, completely hidden by leaves. The eggs developed normally whether or not the mass was in contact with the water. Doctor Chapin found *E. pustulosus* breeding at Tapia, Canal Zone, August 7, 1923, in circular basins of cement placed around the bases of trees to protect them from leaf-cutting ants and kept filled by rain water. The egg masses were laid on the edges of this basin exactly as in the case when larger bodies of water were utilized. Other egg masses were found in small stagnant pools near by or even in hoof marks which had become filled with water.

FIGURE 18.—Head of *Engystomops pustulosus* (U. S. N. M. No. 47124) from Santo Domingo, Oaxaca, Mexico: *a*, Lateral view; *b*, dorsal view

The eggs of *E. pustulosus* are practically identical with those of *P. fuscomaculata*, being only 1.4 mm. in diameter, unpigmented and laid in large numbers. Development, however, is slower than in the latter species and many details which Budgett tells us are "blurred and, as it were, hurried over" in *P. fuscomaculata* are accentuated in *E. pustulosus*. In both species the yolk is small, but obviously dense, for the embryo soon curves around it instead of incorporating it at once into the body as in our common frogs and toads. The adhesive organs, which Bles found to arise separately in *Paludicola*, differentiate in *Eupemphix* from a crescent as in less specialized frogs (*Scaphiopus*, etc.). The external gills, which remain small in the first genus, soon develop extraordinary proportions in the latter. The nasal pits differentiate in the latter at the apex of the head and are not visible from the ventral surface as in the case of the former. In short, practically every larval feature other than general body form differs in *Paludicola* and *Eupemphix* during the early stages.

Here again as in the pelobatids and ranids mentioned above the early larval stages may show great differences when the other life history features are very similar. In the case of *Eupemphix* and *Paludicola* the differences, however, are not due merely to the different stage at which the frontal organ cells begin to secrete their liquifying fluids, a change in the growth rate of the whole or a part of the *Eupemphix* embryo must have occurred to produce the large gills and other distinctive features of the early larva. Nevertheless, the place of egg deposition, the form of the egg mass and egg-capsules, the structure of the mature larvae and the general breeding habits are much alike and conform to our conclusions that the genera are closely related.

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[27] Noble, G. K., The value of life history data in the study of the evolution of the Amphibia. Ann. New York Acad. Sci., vol 30, pp. 87, 88, Oct. 31, 1927.

According to Ruthven [28]—

The colors of this species have not been accurately described, probably because the red fades rapidly in alcohol. The ground color above is gray, relieved by irregular black blotches. Most of the warts on the head and nape and a few on the body are dull orange (142) [29] or red orange (78c or 78d), as are also the light coccygeal line, the broad light area on the fore limbs, and more or less of the light cross bands on the hind limbs, particularly on the feet. The light spot in the interscapular region and the one on either side of the back are present in all specimens, and, with the line of enlarged warts behind the angle of the mouth, are usually very pale yellow, but occasionally red. The line in the coccygeal region is usually well defined only to the pair of large blotches in the lumbar region. It is occasionally continued narrowly to the broad black margin of the interscapular spot, and occasionally beyond this to the snout, in which case it is interrupted by the supraocular band. In the single very young example these three light vertebral marks form a narrow line from snout to anus, that is narrowly interrupted in the same places as in the adults. With the exception of a median line, the chin, throat, and breast are gray, generally profusely spotted with black or brown and generally somewhat speckled with pale yellow. The median line, which is present even in very young specimens, is whitish, or pale yellow, which is the dominant color of the abdomen, the dark color of the chin, throat, and breast being broken up into large spots on the posterior part of the ventral surface.

This little toad was found in about the same places as *B. valliceps*, but seemed to prefer the wetter places and was more secretive. It was most numerous under logs and decaying vegetation in a low partially cleared area along La Laja Creek, but it was also found under logs on the shore of the prairie ponds, and in the banana grove at San Juan. During the rains it was found at night in the pools, and an immature specimen that had but recently emerged from the tadpole stage was found on the shores of a temporary pool on La Laja Creek, August 14. The note is a low chirp that is repeated regularly at intervals of one second.

The species that occurs in Mexico may be recognized by the following combination of characters: A diamond-shaped area inclosed by glandular dermal ridges, with black outer border and brown, orange, or vermilion center in interscapular region; a short light-colored sacral stripe; coloration of remainder of upperparts grayish olive or blackish brown with scattered darker markings; fore and hind limbs and feet broadly banded with pinkish gray or brownish; under surfaces of limbs yellowish; underparts yellowish or white, marbled or spotted with black; throat and breast heavily mottled with grayish or brownish, frequently bisected by longitudinal pin stripe and occasionally by transverse stripe of same color; neither vomerine nor maxillary teeth; tympanum minute and distinct, or for the most part hidden by tubercles; fingers slender and free; first finger not extending beyond second; no subarticular tubercle on penultimate finger joint; small supernumerary tubercles continued backward on palmar surface; two palmar callosities; no prominent terminal disks; toes not unusually long, free, and with lateral dermal ridges extending to distal phalanx;

[28] Ruthven, A. G., The amphibians and reptiles collected by the University of Michigan-Walker Expedition in southern Vera Cruz, Mexico. Zool. Jahrb. (Syst. Abt.), vol. 32, pt. 4, pp. 308, 309, 1912.

[29] The numbers refer to the "Code des Couleurs," by Klincksiek and Vallete.

third toe slightly longer than fifth; prominent subarticular tubercles; supernumerary tubercles continued backward on plantar surface; *a conical tubercle on the middle of inner edge of tarsus marks the end of the tarsal fold;* two small metatarsal tubercles, the inner larger than the outer; the hind limb being carried forward along the body, the tibiotarsal joint barely reaches beyond insertion of fore limb; head small; snout prominent, acuminate; width of interorbital space greater than that of upper eyelid; canthus rostralis rounded; loreal region subvertical; large vocal sac; skin of upperparts, including top of head and upper surfaces of fore and hind limbs, pustulose or tubercular and exceedingly glandular; throat smooth; belly areolate; under surfaces of thighs granular; head-and-body length, 27 to 30 mm.

Specimens examined.—Thirty-four, as follows:

Engystomops pustulosus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			OAXACA:		
C.A.S.	5108–5123	16	Cosolapa	July 14, 1925	Joseph R. Slevin.
U.S.N.M.	47124	1	Santo Domingo (900 feet altitude).	June 10, 1895	Nelson and Goldman.
Do.	10023–28	6	Tehuantepec		Francis Sumichrast.
Do.	30247–57	11			Do.

Genus LEPTODACTYLUS Fitzinger

1826. *Leptodactylus* FITZINGER, Neue Classification der Reptilien, p. 38. [Genotype, *Leptodactylus typhonia* FITZINGER = *Rana typhonia* (part) DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 36, pl. 17, figs. 3, 4 (Surinam).] (Type fixed by FITZINGER, 1843, Systema reptilium, fasc. 1, p. 31; *nec Rana typhonia* LINNAEUS, 1758.)

1830. *Cystignathus* WAGLER, Natürliches System der Amphibien, p. 202. [Genotype, *Cystignathus pachypus* WAGLER = *Rana pachypus* SPIX, 1824, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 26, pl. 2, figs. 1, 2 (Brazil).] (Type fixed by FITZINGER, 1843, Systema reptilium, fasc. 1, p. 31.)

1843. *Gnathophysa* FITZINGER, Systema reptilium, fasc. 1, p. 31. [Genotype, *Cystignathus labyrinthicus* DUMÉRIL and BIBRON, 1841, Erpétologie générale, vol. 8, p. 407 = *Rana labyrinthica* SPIX, 1824, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 31, pl. 7, figs. 1, 2 (Brazil) = *Rana pentadactyla* LAURENTI, 1768, Synopsin reptilium, p. 32, "in Indiis" (erroneous).]

1870. *Entomoglossus* PETERS, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 647, Aug. [Genotype, *Entomoglossus pustulatus* PETERS, *idem*, p. 647, pl. 2, fig. 1 (Ceará, Maranhão, northern Brazil).]

Various devices have been tried out by amphibians to insure the development of their eggs. *Leptodactylus* seems to have adopted froth nests for this purpose. These are generally made in water or near water in damp hollows. One South American species lays its eggs on the surface of pools, while another deposits them in holes near

the water's edge. No observations on the breeding habits of *Leptodactylus* in Mexico have been published, but it is quite probable that the breeding habits of *L. albilabris* in southern Mexico agree with those of their West Indian relatives. Doctor Stejneger has reported the finding of a remarkable foamy "nest" of *L. albilabris*, "with numerous small black larvae just hatched," on April 7 in a small stream near Utuado, Porto Rico.

KEY TO MEXICAN SPECIES OF LEPTODACTYLUS

1. A white stripe on upper lip, most conspicuous in front of eye, commencing on snout and extending backward to insertion of fore limb, and touching inferior margin of eye and tympanum; a dark stripe running backward along canthus rostralis from tip of snout to eye and from eye to above tympanum and then downward to above insertion of fore limb; upperparts clay-colored, reddish brown, or a pale orange-brown with four longitudinal rows of more or less irregularly placed dark brown or black spots; a W-shaped mark extending laterally upon upper eyelids in posterior interorbital region; underparts white; distal phalanges of fingers without distinct dilations or disks; first finger longer than second; fingers not webbed at base; two palmar callosities; subarticular tubercles continued backward on palmar surface; toes in order of decreasing length, 4, 3, 5, 2, and 1, with vestigial web at base; subarticular tubercles continued backward on plantar surface; two metatarsal tubercles, the inner connected with a slight but distinct tarsal fold; the hind limb being carried forward along the body, the tibio-tarsal joint reaches at most to anterior margin of eye; vomerine teeth in two transverse slightly curved series behind and generally within the level of inner margins of the choanae; tongue large, ovoidal, and slightly notched behind; canthus rostralis rounded; loreal region oblique; snout pointed and projecting beyond upper lip; interorbital space equals width of upper eyelid; tympanum generally about two-thirds and always more than one-half the diameter of the eye, overhung by a dermal fold; skin of upperparts smooth; numerous small pointed tubercles on outer surface of tibia; a narrow interrupted dorso-lateral dermal fold and another similar one, though less pronounced, on side from shoulder to groin; abdominal disk distinct; ventral surfaces of thighs granulated; head-and-body length, 33 to 36 mm..... albilabris (p. 83)

No white stripe on upper lip anterior to eye; adults with short white line below eye and often with short posteriorly directed oblique continuation of the same; coloration of upperparts dark brown or brownish orange, with as many as four longitudinal rows of elongate black spots; a black, light-margined, "butterfly-shaped" mark extending laterally upon upper eyelids in posterior interorbital region; hind limbs distinctly cross banded with a darker color; fore limbs with dark spots; a dark stripe extending from nostril backward along canthus rostralis to eye and from eye to above tympanum and then downward; sides, throat, belly, and under surface of hind

limbs reticulated, marbled, or spotted with brown; distal phalanges of fingers very slightly if at all dilated; first finger as long as or longer than second; fingers not webbed at base; palmar callosities fairly distinct; subarticular tubercles continued backward upon palmar surface; male with two spine-bearing tubercles on inner side of first digit; toes in order of decreasing length, 4, 3, 5, 2, and 1, with vestigial web at base; subarticular tubercles not continued backward upon plantar surface; two metatarsal tubercles, the inner connected with distinct tarsal fold; legs stout; the hind limb being carried forward along the body, the tibio-tarsal joint reaches at least to the tympanum and often to eye; vomerine teeth in two transverse series behind the choanae; tongue small, ovoidal, and slightly notched behind; canthus rostralis indistinct; loreal region oblique; tympanum one-half to two-thirds the diameter of the eye, overhung by a dermal fold; skin of upperparts, sides of body, and upper surfaces of hind limbs with longitudinal series of small tubercles; ventral surfaces of thighs granulated; head-and-body length, 35 to 46 mm.... **melanonotus** (p. 88)

LEPTODACTYLUS ALBILABRIS (Günther)

1859. *Cystignathus albilabris* Günther, Ann. and Mag. Nat. Hist., ser. 3, vol. 4, no 21. p. 217.

1877. *Cystignathus labialis* Cope, Proc. Amer. Philos. Soc., vol. 17, no. 100, p. 90, July 20 (type locality uncertain, probably Mexico).

1877. *Cystignathus fragilis* Brocchi, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 4, p. 182 (Tehuantepec, Mexico).

1879. *C[ystignathus] gracilis* Cope, Proc. Amer. Philos. Soc., vol. 18, no. 104, pp. 269, 270. June 20. [*Nec Cystignathus gracilis* Duméril and Bibron, 1841, Erpétologie générale, vol. 8, pp. 406, 407 (Montevideo).]

1882. *Leptodactylus fragilis* Brocchi, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 19, pl. 5, figs. 2–2b.

1900. *Leptodactylus albilabris* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, p. 213, Apr.

Type locality.—St. Thomas, West Indies.

Range.—From Cordoba in Vera Cruz south to Tekanto in Yucatan and southward through Central America to Nicaragua; apparently restricted to the State of Oaxaca on the Pacific coast of Mexico.

Remarks.—The occurrence of this frog on West Indian islands, as well as on the mainland of tropical America, still remains one of the unexplained problems of distributional zoology. Some herpetologists have advocated the recognition of the mainland form as a species distinct from the one that occurs on a number of the islands. None of the diagnostic criteria thus far suggested will even in the majority of cases serve as a means for the identification of specimens without reference to the locality. A reexamination of the types of the species included above in the synonymy and a critical comparison of specimens from the mainland with those from the islands failed to indicate any reliable criteria for such a distinction.

The following notes were made on the cotypes of *Cystignathus albilabris*:

B.M. Nos. 60. 4. 18. 61–64, St. Thomas, Rüses Coll.: One adult and three young (head-and-body length of largest being 17.2 mm.). Adult individual: Head-and-body length, 41.2 mm.; transverse diameter of tympanum, 2.5 mm.; transverse diameter of eye, 4.7 mm.; anterior edge of eye to nostril, 3.3 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of tympanum; a vertical white line on lower eyelid; white stripe on upper lip indistinct, although it is present on the three young; a distinct tarsal fold; large inner and small outer metatarsal tubercles; long longitudinal dermal folds on sides, with intercalated linear series of smaller dermal ridges, in addition to others irregularly placed; white reticulations appear through brown on the sides; underside of tibia spotted; vomerine teeth in transverse rows far behind level of choanae.

B.M. Nos. 60. 4. 18. 65–67, St. Thomas, Rüses Coll.: One adult and three young (the head-and-body length of largest being 17.2 mm.). Adult individual: Head-and-body length, 42 mm.; transverse diameter of tympanum, 2.8 mm.; transverse diameter of eye, 4.8 mm.; anterior edge of eye to nostril, 3.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to posterior margin of orbit; white stripe on upper lip indistinct, although it is present on the three young; other characters the same as in the preceding cotype, except that the sides are more nearly smooth, there being a few scattered dermal nodular elevations in place of dermal ridges; throat, sides of chest, and concealed surfaces of tibia thickly spotted with small brown specks; vomerine teeth in slightly arched transverse rows far behind level of choanae.

B.M. No. 60. 4. 18. 68, St. Thomas, Rüses Coll.: One adult and two young (the head-and-body length of largest being 17 mm.). Adult individual: Head-and-body length, 36.8 mm.; transverse diameter of tympanum, 2.2 mm.; transverse diameter of eye, 4.5 mm.; anterior edge of eye to nostril, 3.4 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of eye; white stripe on upper lip indistinct, although it is present on the two young; a sharp tarsal fold; toes with vestigial web at base; throat and sides of chest with closely approximated small brown spots; skin on sides fairly smooth, with no distinct longitudinal dermal folds or ridges, though there are a few scattered nodular elevations; minute supernumerary tubercles on plantar surface of foot; vomerine teeth in transverse rows far behind level of choanae.

Cope states that his supposedly new species, *Cystignathus labialis* (U.S.N.M. Nos. 31300–05), was based on young specimens in which

the posterior limbs are not so long as in adults. In 1879 Cope [30] referred to "numerous specimens from Tehuantepec, which fix the characters and the locality." One of the six cotypes (U.S.N.M. No. 31302) agrees with the measurements given by Cope in the original description of *C. labialis*, but inasmuch as all of them are quite young individuals the designation of an electotype will not simplify taxonomic procedure. The color markings of these young individuals are either indistinct or obliterated by action of the preservative. The rows of tiny asperities or tubercles on back and on upper surfaces of the hind limbs are quite distinct.

The specimens identified as *C. gracilis* Duméril and Bibron, by Cope (U.S.N.M. Nos. 10018–19), were collected in Tehuantepec, Mexico, by Francis Sumichrast, who wrote that the specimens forwarded to the National Museum, as well as those sent to the Paris Museum, were found under old logs and stones near the water.

The type of *Cystignathus fragilis* (M.H.N.P. No. 195a, parchment label No. 6316) is labeled as having been collected by Bocourt in Tehuantepec, Mexico. The following notes were made on this specimen: Head and body length, 35.2 mm.; transverse diameter of tympanum, 2.6 mm.; tympanum two-thirds the diameter of the eye; the hind limb being carried forward along the body, the tibiotarsal joint reaches to center of eye; a tarsal fold present; vomerine teeth in two transverse rows behind the level of the choanae.

Ives [31] reports the finding of four specimens of *Leptodactylus labialis* near a water trough on a hacienda near Tekanto, Yucatan, and Noble [32] has recorded the accession of a large series from several localities in Nicaragua.

Schmidt [33] dissents from the prevailing opinion that the Mexican *L. labialis* is identical with the Porto Rican *L. albilabris*, which also occurs on several of the Virgin Islands, and says:

> I am unable to agree with Stejneger and Noble, who have compared the Central American *L. labialis* with this species, that they are identical. In a series of many hundreds of specimens from Nicaragua in the American Museum of Natural History, there is no approach to the adult size of the Porto Rican specimens; other differences have been pointed out by Noble (1918, Bull. Amer. Mus. Nat. Hist., Vol. XXXVIII, p. 323); and a comparison of the voices and breeding habits of the two species remains to be made. They are so closely related, however, that the problem of distribution is scarcely altered by this view.

Noble, in 1918, after handling a large series of these frogs from Nicaragua, called attention to three characters that he thought

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[30] Cope, E. D., Eleventh contribution to the herpetology of tropical America. Proc. Amer. Philos. Soc., vol. 18, no. 104, p. 270, June 20, 1879.

[31] Ives, J. E., Reptiles and batrachians from northern Yucatan and Mexico. Proc. Acad. Nat. Sci. Philadelphia, 1891, p. 461.

[32] Noble, G. K., Bull. Amer. Mus. Nat. Hist., vol. 38, art. 10, p. 323, 1918.

[33] Schmidt, K. P., Scientific survey of Porto Rico and the Virgin Islands. New York Acad. Sci., vol. 10, pt. 1, Amphibians and land reptiles, pp. 38, 39, 1928.

would separate average individuals on the mainland from those on the islands. These distinctions, however, are qualified by the remark that there are individuals that are so similar that no distinguishing characters are apparent. The series of specimens from St. Thomas Island, West Indies, and from the mainland of Mexico available for comparison is not very large, but nevertheless the distinctions made by Noble fail to separate these lots into two categories. The specimens from St. Thomas Island used in these comparisons do not have the skin on the tibia any more noticeably studded with numerous sharp-pointed tubercles than those from the mainland, and the throat is stippled with brown around the edges. Furthermore, many of the mainland specimens have light-margined brown spots on the upper-parts, and the color pattern is quite if not almost identical with the island specimens. It is true, however, that specimens from St. Thomas Island are somewhat larger than any of those collected in Mexico, but otherwise they are inseparable from the latter.

In commenting upon the relations and origin of the Porto Rican herpetological fauna, Doctor Stejneger [34] says:

> The status of the frog, *Leptodactylus albilabris*, is quite different from that of the other species of the fauna. In the Antilles it is restricted to the Virgin Islands, St. Croix, Vieques, and Porto Rico. There is apparently no indigenous species of the genus in the Caribbean chain, the other two which occur in various islands being evidently introduced by man and belonging to widely different South American species. No *Leptodactylus* or related form is found in Haiti, Cuba, or Jamaica. But the most curious feature is that a frog which neither Dr. Boulenger nor I can distinguish from *L. albilabris*, is a native of southern Mexico, State of Vera Cruz, and the Isthmus of Tehuantepec. I know of absolutely no parallel to this extraordinary range, which is inexplicable on ordinary distributional grounds, for certainly it would transgress the boundaries of the probable to suppose either that this species had once covered the whole country between Tehuantepec and the Virgin Islands and become extinct in the intermediate territory, or that there had at any time been a direct connection between the localities mentioned to the exclusion of the large Antilles. Nor can it for a moment be supposed that the species exists in the latter without having attracted attention. No doubt there are many species yet to be discovered in these islands, but *L. albilabris* is not likely to be one of them, for it is one of the commonest, most obtrusive, and most easily caught batrachians wherever it occurs. In suggesting accidental introduction by man I am fully aware that this explanation does not at first appear plausible, as there does not seem to be or to have been any direct route of communication between southern Mexico or Yucatan and Porto Rico or the Virgin Islands, but I offer it as the only possibility I can think of. The wrecking of a vessel with a cargo of logwood or mahogany a hundred years or more ago might account for this remarkable distribution.

Doctor Barbour [35] is inclined to question this assumption and contends that the occurrence of this species in the West Indies is not traceable to any agency of man. He says:

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[34] Stejneger, L., The herpetology of Porto Rico. Ann. Rep. U. S. Nat. Mus. for 1902, pp. 561, 562, 1904.

[35] Barbour, T., A contribution to the zoogeography of the West Indies, with special reference to amphibians and reptiles. Mem. Mus. Comp. Zool., vol. 44, no. 2, p. 253, Mar., 1914.

Now, considering that *L. albilabris* occurs upon more than one island, it is necessary to postulate a series of unlikely events to explain its accidental occurrence. It is more probable that the Porto Rican and mainland individuals have by some fortuitous parallelism become indistinguishable if they originally belonged to different stocks or if both were derived from the same stock then they have preserved their identity in parts of their range and varied with isolation in other parts. The occurrence in the East Indies of *Rana macrodon* in the greater Sunda Islands and New Guinea, and of *Rana modesta*, a derivative of *R. macrodon* in Celebes is a case of similar distribution. The Lesser Antillean species are almost certainly not introduced, since Labat informs us that frogs (*L. pentadactylus*) were a common article of food in Martinique and other islands as early as 1724. That they probably belonged to this species is shown by his stating that they lived in the woods and not in the water and by his description of their colors. The occurrence of a peculiar Leptodactylus upon Haiti, and there is evidence that a species occurs upon Cuba also, is not as astonishing as appears at first.

Schmidt[36] contributes the following notes on the life history of this species.

At Coamo Springs, on the terrace behind the bathhouses of the hotel, the water of some of the springs forms a permanent rivulet at the base of the cliff. *Leptodactylus albilabris* was abundant on the terrace, beneath loose stones, and under a large stone at the edge of the creek, the writer found, on August 27, 1919, a shallow, rounded excavation, 6 or 7 cm. in diameter and about 3 cm. deep, filled with a mass of white foam, in which were the small tadpoles of this species (12 mm. in length, body 3–4 mm.). There were between 75 and 100 tadpoles in the mass, by no means confined to the central hollow, which was present, as in the foam mass described by Stejneger. The bottom of the excavation was about 3 cm. above the water level. Two similar excavations were discovered in the immediate vicinity, in the same relative position with reference to the water, but empty. On August 29, near Bayamon, a small mass of foam, between 3 and 4 cm. in diameter, containing similar tadpoles, was noted under a stone on a hilltop, with no water whatever in the neighborhood. On October 1, near the forester's cabin on El Yunque, at about 1,200 feet, a nest of this species was observed beside a pool of standing water (also at a slightly higher level than that of the water) under a rotten log. This nest contained between 150 and 200 eggs, uniformly distributed through the foam, and with no central hollow. It was somewhat larger than those previously observed, measuring 8 cm. in diameter. The eggs are light yellow and measure 2.5 mm. to 3 mm. in diameter. The smallest tadpoles taken swimming at large measured 6 mm. in body length, which probably represents their size at the time they escape from the foam. It is evident that the tadpoles usually will be washed from the nest into the adjacent water by a flood or heavy rain. The location of the small nest away from water was probably a mistake on the part of the frog, and the nest described by Stejneger under water probably had been covered by a rise in the creek after the deposition of the eggs. The largest larvae, nearly ready to transform, measure 13 mm. from snout to vent. The V-shaped dorsal markings are already evident in the tadpoles at this stage. The median dorsal white line is probably an adult character.

[36] Schmidt, K. P., Scientific survey of Porto Rico and the Virgin Islands. New York Acad. Sci., vol. 10, pt. 1, Amphibians and land reptiles, pp. 41, 42, 1928.

Specimens examined.—Twenty-four, as follows:

Leptodactylus albilabris

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
U.S.N.M.	32410–12	3	Potrero, near Cordoba		Francis Sumichrast.
M.C.Z.	4651–52	2	Vera Cruz	1917	A. G. Ruthven.
			OAXACA:		
U.S.N.M.	30241–42	2	Barrio		Francis Sumichrast.
C.A.S.	5105	1	Cosolapa	July 14, 1925	Joseph R. Slevin.
U.S.N.M.	10029	6	Santa Efigenia in Tehuantepec.		Francis Sumichrast.
Do.	10018–19	2	do		Do.
Do.	27765	1	Tehuantepec		Do.
M.H.N.P.	195a	[1] 1	do		Firmin Bocourt.
			? STATE:		
U.S.N.M.	31300–05	[2] 6	No definite locality	Previous to 1877	Francis Sumichrast.

[1] Type of *Cystignathus fragilis.* [2] Cotypes of *Cystignathus labialis.*

LEPTODACTYLUS MELANONOTUS (Hallowell)

1860. *Cystignathus melanonotus* HALLOWELL, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 485, Oct.

1879. *Cystignathus microtis* COPE, Proc. Amer. Philos. Soc., vol. 18, no. 104, p. 265, June 20 (Guanajuato, Mexico).

1879. *Cystignathus perlaevis* COPE, Proc. Amer. Philos. Soc., vol. 18, no. 104, p. 269, June 20 (Japana, western Tehuantepec, Mexico).

1900. *Leptodactylus caliginosus* GÜNTHER, Biologia Centrali-Americana, Reptilia and Batrachia, p. 214, Apr. [*Nec Leptodactylus caliginosus* GIRARD, 1853.]—RUTHVEN, 1912, Zool. Jahrb. (Syst. Abt.), vol. 32, pt. 4, p. 306.

Type locality.—Nicaragua.

Range.—From Mazatlan in Sinaloa eastward to Orizaba in Vera Cruz and southward through Colima, Guanajuato, Jalisco, and Oaxaca to Guatemala, Nicaragua, and Costa Rica.

Remarks.—The type of *Leptodactylus melanonotus* (U.S.N.M. No. 6264) was collected by C. Wright, a member of the North Pacific Exploring Expedition under Capt. John Rogers. This specimen has not been located in the collection of the division of reptiles and batrachians. Notwithstanding Cope's statement to the contrary, the type of *Cystignathus microtis* (U.S.N.M. No. 9906) has dermal fringes on the toes, and this modification is especially well marked on the basal portion of the fourth toe. The type as well as the other specimens referred by Cope to this species are unquestionably the young of *L. melanonotus.* These have a rather small tympanum and the mottling of the underparts is less evident than in adults. Adults of this species have a short white line below and adjacent to the eye. *Leptodactylus melanonotus* is not a synonym of *Leptodactylus caliginosus,* as stated by Günther, for the type of the latter (U.S.N.M. No. 7389) has a somewhat different coloration, wider rows of vomerine teeth, and longer head.

The type of Cope's *Cystignathus perlaevis* (U.S.N.M. No. 10041), which was found in a well near Japana, in western Tehuantepec, is simply an emaciated and somewhat faded specimen of an adult *Leptodactylus melanonotus*.

Ruthven [37] writes that *Leptodactylus caliginosus* is not uncommon at Cuatotolapam and Lake Catemaco, in southern Vera Cruz. He says:

In those in which the color was examined in life the ground color above was brownish orange (138),[38] the margin of the occipital spot a pale dull yellow (153d), and the ventral parts black and white or gray and white. The colors of the dorsal surface are frequently darker, however, and the pale margin of the occipital spot is not always well defined. The dark head markings are quite regular in arrangement, consisting of a band along the canthus rostralis, one from the lower part of the anterior margin of the orbit to the mouth and two from the posterior margin of the orbit on the neck, the lower involving the tympanum. These dark bands with the occipital spot are usually margined with pale yellow, and the pale lines that margin the dark bands on the canthus rostralis are often connected with the anterior margin of the occipital spot to form a triangle. These light bands are frequently more or less obsolete, occasionally entirely so.

This little amphibian, while not uncommon in the region studied, is so secretive as to be little in evidence. We only found it under logs and other decaying vegetable débris in the vicinity of water. It is quite generally distributed on low ground, however, occurring both in the woods and on the prairie. It breeds in the lowland forest pools and in swampy places on the shores of Lake Catemaco, in July and August, and immature individuals were taken in both places.

Specimens examined.—Sixty-three, as follows:

Leptodactylus melanonotus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SINALOA:		
U.S.N.M.	25154–59	6	Mazatlan		Ferdinand Bischoff.
Do.	14080	5	Presidio, 50 miles from Mazatlan.	Apr. 3, 1884	Alphonso Forrer.
			GUANAJUATO:		
Do.	9908–09	2	Guanajuato	1877	Alfred Dugés.
Do.	9906	[a] 1	do	do.	Do.
F.M.N.H.	1483	1	VERA CRUZ: Achotol	(Dec. —, 1904) (Jan. —, 1905)	E. Heller and C. M. Barber.
M.C.Z.	8369–73	5	Alvarado	1921	E. R. Dunn.
U.S.N.M.	16552–56	5	Vicinity of Orizaba		Francis Sumichrast.
			COLIMA:		
Do.	57765	1	Colima	July 8, 1902	J. Hurter.
F.M.N.H.	1631	1	do		C. H. T. Townsend.
U.S.N.M.	17439–40	2	JALISCO: Guadalajara		Alfred Dugés.
			OAXACA:		
Do.	30523–24	2	Barrio in Tehuantepec		Francis Sumichrast.
Do.	10041	[b] 1	Japana in Tehuantepec		Do.
F.M.N.H.	1366	1	Rio Obispo	Apr. 24, 1903	S. E. Meek.
U.S.N.M.	30300–01	2	Tehuantepec		Francis Sumichrast.
Do.	30437–52	16	do		Do.
Do.	70402–03	2	do		Do.
Do.	30116–25	10	Tehuantepec (west side)		Do.

[a] Type *Cystignathus microtis*. [b] Type *Cystignathus perlaevis*.

[37] Ruthven, A. G., Zool. Jahrb. (Syst. Abt.), vol. 32, pt. 4, pp. 306, 307, 1912.

[38] The numbers refer to the "Code des Couleurs," by Klincksiek and Vallete.

Genus ELEUTHERODACTYLUS Duméril and Bibron

1841. *Eleutherodactylus* Duméril and Bibron, Erpétologie générale, vol. 8, p. 620. [Genotype, *Eleutherodactylus martinicensis*=*Hylodes martinicensis* Tschudi, 1838, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, p. 77 (no locality designated).]

1843. *Batrachyla* Bell, Voyage of H. M. S. *Beagle*, Zoology, pt. 5, Reptiles, p. 43, Oct. [Genotype, *Batrachyla leptopus* Bell, *idem*, p. 43, pl. 18, fig. 5 (Valdivia, Chile).]

1843. *Euhyas* Fitzinger, Systema reptilium, fasc. 1, p. 31. [Genotype, *Hylodes ricordii* Duméril and Bibron, 1841, Erpétologie générale, vol. 8, p. 623 (Cuba).]

1843. *Lithodytes* Fitzinger, Systema reptilium, fasc. 1, p. 31. [Genotype, *Hylodes lineatus* Duméril and Bibron=(*Rana*) *lineata* Schneider, 1799, Historiae amphibiorum, naturalis et literariae, fasc. 1, p. 138 (no locality given)=*R.*(*ana*) *lineata* Gravenhorst, 1829, Deliciae musei zoologici Vratislaviensis, fasc. 1, p. 44, pl. 8, fig. 2.]

1862. *Craugastor* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol 14, p. 153, Mar. [Included species: *Hylodes hallowellii*, *idem*, p. 153 (near Carthagena, New Granada), and *Hylodes fitzingeri* Schmidt, 1858, Denkschr. k. Akad. Wiss. math.-naturw. Classe, Wien, vol. 14, pt. 2, p. 248, pl. 1, fig. 10 (Cordilleren von Neu Granada, elevation 4,000 feet).]

1863. *Strabomantis* Peters, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 405, Oct. [Genotype, *St*(*rabomantis*) *biporcatus* Peters, *idem*, p. 405 (Veragua).]

1866. *Epirhexis* Cope, Journ. Acad. Nat. Sci. Philadelphia, n. s., vol. 6, pt. 1, p. 96, July. [Genotype, *Batrachyla longipes* Baird, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 35, pl. 37, figs. 1–3 (no description) (Mexico).]

1868. *Leiyla* Keferstein, Archiv. f. Naturg., Berlin, vol. 1, pt. 3, p. 296. [Genotype, *Leiyla güntheri* Keferstein (Costa Rica).]

1869. *Liyla* Cope, Proc. Amer. Philos. Soc., vol. 11, no. 82, p. 160, July 16. [Errore typogr. for *Leiyla* Keferstein, 1868.]

1870. *Limnophys* Jimenez de la Espada, Jorn. Sci. Math. Phys. e Nat., Lisboa, vol. 3, no. 9, p. 59, June. [Included species: *Limnophys cornutus* and *L. napaeus* Espada, *idem*, p. 60 (Ecuador).]

1870. *Pristimantis* Jimenez de la Espada, Jorn. Sci. Math. Phys. e Nat., Lisboa, vol. 3, no. 9, p. 61, June. [Genotype, *Pristimantis galdi* Espada, *idem*, p. 61 (Ecuador).]

1893. *Liohyla* Cope, Proc. Amer. Philos. Soc., vol. 31, no. 142, p. 335, Nov. 17. [Genotype, *Liohyla ranoides* Cope=*Lithodytes ranoides* Cope, 1885, Proc. Amer. Philos. Soc., vol. 23, no. 122, p. 275, Nov. 20 (Nicaragua).]

A critical review of the status of Fitzinger's *Hylodes* has been published by Dr. L. Stejneger,[39] and is summarized as follows:

1826. *Hylodes* Fitzinger, Neue Classification der Reptilien, pp. 38, 64. [Genotype, *Hyla ranoides* Spix, 1824, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 32, pl. 6, fig. 3 (Brazil)] =*Elosia* Tschudi, 1838, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, p. 77 [Genotype, *Hyla nasus* Lichtenstein, 1823, Verzeichniss d. Doubletten Zool. Mus. k. Univ. Berlin, etc., p. 106 (Brazil).] [*Hyla ranoides* Spix is not equivalent to *Hyla nasus* Lichtenstein; for illustrations of the pectoral girdles of these two species see Miranda-Ribeiro, 1926, Archiv. Mus. Nac. Rio de Janeiro, vol. 27, p. 54, fig. 31, and p. 32, fig. 17.]

[39] Stejneger, L., The herpetology of Porto Rico. Ann. Rep. U. S. Nat. Mus. for 1902, pp 582, 583, 1904.

1830. *Enydrobius* WAGLER, Natürliches System der Amphibien, p. 202. [Substitute name for *Hylodes* FITZINGER, 1826.]

In this review ten species of the genus *Eleutherodactylus* are recognized within the borders of Mexico. Three of these, *mexicanus*, *rhodopis*, and *rugulosus*, have been taken much more frequently than any of the others. Larger series of *dunnii* and *venustus*, obviously related to *rhodopis*, are necessary for an accurate determination of their status. The robber frog, *E. augusti*, is quite closely related to *E. laticeps*. The species *laticeps* and *longipes* seem to be the rarest of all Mexican eleutherodactylids, since at present they are known from one and two individuals, respectively. The specimen taken north of Vera Cruz by Dugés and referred to *E. melanostictus* by Günther in his Biologia Centrali-Americana, 1900, p. 236, is the only reported occurrence of this species in Mexico, and as this determination has been questioned it has not been listed herein.

In contrast to many other well-known kinds of frogs, some of the species referable to *Eleutherodactylus* hatch fully formed from the egg capsules. Their larvae have a peculiar hatching mechanism, the so-called egg-tooth, which consists of a horny structure derived from modified epidermis. There are, however, many species of *Eleutherodactylus* whose life histories are entirely unknown. Although direct development is definitely known to take place in a few species, this may not necessarily be the invariable process. The Texan cliff frog, or robber frog, *E. latrans*, is reported by Strecker to pass through a tadpole stage in the water.

According to Noble [40]—

> The diagnostic characters of the life history of *Eleutherodactylus* are the terrestrial mode of egg-laying, the large eggs with two or more resistent capsules devoid of peduncles or "foam," the absence of tadpole mouth parts, the presence of a premaxillary egg tooth, and a broad highly vasculated tail.

The life histories of the two species studied by Noble [41] are supposedly typical for most of the members of this genus; the following quotation summarizes the essential steps in their development:

> The eggs of the various species of *Eleutherodactylus* may be laid between leaves of epiphytes, palms, bananas, etc., or on the ground under rocks, logs, vegetation, or merely in a hole in the bank. The breeding site may be near water or far away from it. As a rule, each species has a definite habitat preference for its eggs, but this is not constant. I have found in Santo Domingo that two species, *E. abbotti*, and *E. flavescens*, may lay their eggs among leaves above the ground or on the ground at the base of reeds. Development is in these species direct. All species of *Eleutherodactylus* fully investigated have been found to have an egg tooth lying directly over the symphysis of the premaxillae. This may vary in size and shape in the different species. I have found that *E. abbotti* on hatching

[40] Noble, G. K., The value of life history data in the study of the evolution of the Amphibia. Ann. New York Acad. Sci., vol. 30, p. 90, Oct. 31, 1927.

[41] Noble, G. K., The hatching process in *Alytes*, *Eleutherodactylus*, and other amphibians. Amer. Mus. Nov., no. 229, pp. 4, 5, Oct. 14, 1926.

rips first the inner capsule and then the outer with its egg tooth. *E. inoptatus*, on the other hand, has a very small egg tooth and one bunch of eggs on which I experimented could not be induced to hatch without the application of water. Then the eggs elongated, the outer capsule broke first and the inner only some time later. It would therefore seem that forms such as *E. abbotti* may hatch any time the encapsuled larva has the strength to rip the capsules, while in nature, *E. inoptatus* must wait for the rains. The first species sometimes lays its eggs among reeds in such a position as to be well protected from the rains. The latter always (three observations) lays its eggs in shallow holes in the bank. Such situations become soaking wet with every rain. The eggs of *E. inoptatus* would therefore become wet long before they are ready to hatch. Thus there is probably a time factor which prevents the recently laid eggs from splitting open at the first soaking. In other Salientia the egg capsules after a long soaking are much less resistant than recently laid ones.

The habitats of most of the Mexican species of *Eleutherodactylus* are very imperfectly known. In March, 1895, Nelson and Goldman collected a specimen of *E. rugulosus* in a small stream in the woods at 3,000 feet altitude near Pluma in Oaxaca. On August 30, 1894, they took specimens of *mexicanus* at an altitude of 10,000 feet in dense growths of grass about springs and little streams in the vicinity of Cerro San Felipe, and during September, 1894, found this species at altitudes varying from 4,000 to 9,500 feet in oak woods on the mountains west of Oaxaca. Gadow found *rhodopis* living on the ground in masses of rotten leaves, in tillandsia clusters, and on green shrubs, as high as 10,000 feet on Citlaltepetl in Vera Cruz.

KEY TO MEXICAN SPECIES OF ELEUTHERODACTYLUS

1. A white or silvery white streak edged with black or with dark iron gray extends along upper lip from snout, below eye and tympanum, to fore limb; a light or dusky band across interorbital region; upperparts dark brown or dark mahogany brown; limbs with dark, light-edged crossbars; lower parts white, more or less speckled with brown; male with two vocal sacs, indicated externally by a fold on each side of throat; first and second fingers equal; fingers and toes slender, with very small terminal disks and fairly strong subarticular tubercles; a very distinct vestige of web between the toes; two metatarsal tubercles, the inner oval, the outer round and smaller; plantar surface with small scattered tubercles; a distinct crested tarsal tubercle or ridge about midway but no tarsal fold; the hind limb being carried forward along the body, the tibio-tarsal joint reaches the tip of snout or a little beyond; vomerine teeth in two oblique series behind the level of the choanae; tongue oval, or oblong; snout pointed, projecting beyond mouth; canthus rostralis distinct; loreal region slightly concave; nostril near end of snout; interorbital space a little broader than upper eyelid; tympanum round, very large and distinct, as large as or larger than the eye; skin of upperparts with many small tubercles and plicate rugosities; a faint vertebral linear dermal ridge; a pair of converging dorsal dermal ridges present or absent; several other irregular lateral glan-

dular folds present; upper surfaces of thighs with scattered tubercles like back; underparts smooth; inferior surfaces of thighs granular; discoidal abdominal fold present; head-and-body length, 25 mm.---------- **beatae** (p. 104)

No white streak edged with black along upper lip---------- 2

2. Loreal region oblique, shelving outward to edge of upper jaw; either an intratympanic or postcephalic dermal fold; a large abdominal disk---------- 3

Loreal region not shelving outward to edge of upper jaw; neither an intratympanic nor a postcephalic dermal fold---------- 4

3. A distinct sharp-edged tarsal fold; tarsal-metatarsal joint to tip of fourth toe, 36 mm.; a large protuberant inner and a very small outer metatarsal tubercle; subarticular tubercles at ends of metapodials fairly large; a few small supernumerary tubercles on metatarsals; toes webbed at base; the hind limb being carried forward along the body, the tibio-tarsal joint reaches between eye and nostril; first finger exceeds second by length of its apical disk; large subarticular tubercles and palmer callosities; fingers and toes with blunt apical disks; fingers without web at base; head thick, remarkably wide, its transverse diameter being one-fifth greater than its length; muzzle obtuse and rounded; canthus rostralis rounded; tympanum large, higher than wide, overhung by prominent dermal fold extending from eye to angle of lower jaw, where one of its two branches goes to shoulder and the other to insertion of fore limb; vomerine teeth in two short oblique clusters, considerably behind but within level of inner margins of choanae; tongue broad and somewhat oval in outline; skin on throat, abdomen, and under surfaces of thighs smooth; posterior surfaces of thighs granulated; a transverse post-tympanic dorsal dermal fold; skin of upperparts somewhat shagreen; general tint of upperparts dark greenish brown; loreal region and tympanum black; hind limbs with black transverse bars; soles of feet black; under surface of forearm black; underparts yellowish white; outer margins of throat and under surfaces of thighs and tibiae marbled with brown specks; sides finely marbled with brown; head-and-body length, 74 mm.---------- **laticeps** (p. 106)

No tarsal fold; tarsal-metatarsal joint to tip of fourth toe, 28 mm.; inner and outer metatarsal tubercles large, the inner elongated and swollen, the outer broad and flattened, and in addition the outer metatarsal tubercle is nearly as large as the inner; large subarticular tubercles at ends of metapodials; feet with numerous supernumerary tubercles on plantar surface; toes free from web at base and without marginal dermal fringes; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center or to anterior margin of eye; heels touch but do not overlap when legs are placed transverse to axis of body; first finger exceeds the second by length of its apical disk; fingers long and slender, with terminal T-shaped phalanges; apical disks blunt, swollen inferiorly; two large palmar callosities, the external one divided by a longitudinal groove; head much wider than long, with large eyes widely separated; canthus rostralis fairly distinct; muzzle truncate; width of upper eyelid one-half to three-fifths that of

interorbital space; transverse diameter of tympanum occasionally less than one-half, always less than two-thirds, that of the eye, and overhung by a dermal fold that extends from eye backward over tympanum to angle of mouth; vomerine teeth in adults in two essentially transverse clusters between or nearly on a line with posterior margins of choanae [teeth behind but within level of choanae in young]; tongue narrow, elongate; skin on abdomen smooth; circular abdominal disk present; under surfaces of thighs granulated; a transverse intratympanic dorsal dermal fold; skin of upperparts and top of head either shagreen or with small scattered tubercles; color of upperparts brown or gray, with dark brown spots; sides with light-margined black spots; hinder surface of thighs with closely approximated or with large coalesced black markings; upper surface of tarsus and foot with black blotches; lower fore limb with transverse black bars; abdominal disk yellowish, with faint vermiculations; throat black [in young or immature individuals, the color surrounding elongated spots on top of head and middle of back is bright salmon pink or pale yellow; a broad transverse pink or pale yellow band with several dark spots crosses back behind level of origin of fore limbs; an aggregation of smaller dark brown spots in sacral region; small irregular dark spots on top and sides of head; brown spots below tympanum, eye, and loreal region]; head-and-body length, 64.5 to 75 mm ..... **augusti** (p. 100)

4. Terminal disks distinctly enlarged or dilated, those of fingers 2 and 3 about twice the width of corresponding digit 5

Terminal disks less noticeably dilated, generally rounded or ball-like, rarely flattened, and those of fingers scarcely larger than those of toes 6

5. Terminal disks of fingers 2, 3, and 4 fully twice the width of corresponding digit, subtriangular in outline, flattened, and truncated distally, their diameter nearly equaling that of the tympanum; first finger shorter than second; large subarticular tubercles at ends of metapodials; toes free or with vestiges of web at base; third toe as long as or only reaching to disk of fifth; terminal disks of toes flattened and dilated, but noticeably smaller than those of fingers; subarticular tubercles moderately large, very prominent, and not continued backward on plantar surface; two small metatarsal tubercles, the inner larger than outer; tarsal fold indistinct; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to or beyond the tip of the snout; vomerine teeth in two short transverse groups behind and well within the level of inner margins of choanae, the distance between their outer edges being equivalent to slightly more than one-half the interval between the choanae; tongue subcordiform; snout depressed, rather short, and acuminate; canthus rostralis fairly distinct; loreal region rather oblique, very slightly concave; upper eyelid wider than interorbital space; tympanum very distinct, one-half to two-thirds diameter of eye, depending upon the sex; a dermal fold above tympanum; skin of upperparts either smooth or sparsely studded with small tubercles and glandular dermal folds; an indistinct fine vertebral dermal ridge from muzzle to vent; sides areolate; underparts

generally smooth, but hinder half of belly may be faintly areolate; under surface of thighs granular; color of upperparts and sides grayish or brownish, mottled and speckled with blackish or grayish; occasionally with a narrow interorbital black band and a narrow preorbital transverse black bar on light-colored snout; a narrow dark chevronlike mark with apex pointed inward on each shoulder; one or more pairs of narrow longitudinal mid-dorsal markings; a narrow black stripe from posterior edge of eye to above tympanum and downward behind latter nearly to rictus oris; upper lip and loreal region with continuous or discontinuous oblique dark bars; fore and hind limbs crossbarred; under surfaces either uniformly white or throat marbled with brownish; head-and-body length, 50 mm..... **alfredi** (p. 99)

Terminal disks of fingers 2, 3, and 4 almost twice the width of corresponding digit, rounded, but their diameter is less than diameter of tympanum; first finger with tip scarcely if at all dilated; subarticular tubercles at ends of metapodials; toes with vestigial web at base; third toe as long as fifth; terminal disks of toes smaller than those of fingers and truncated distally; no supernumerary tubercles on plantar surface; inner and outer metatarsal tubercles rather small and flat; tarsal fold present; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to or beyond the tip of the snout; vomerine teeth in two small round groups well behind and within level of inner margins of choanae; tongue large, subcircular; canthus rostralis distinct; loreal region oblique and slightly concave; diameter of tympanum less than half that of eye; skin of upperparts smooth; underparts, sides, and lower surfaces of thighs coarsely granular or areolate; upperparts brownish with triangular interorbital black spot extending laterally on eyelids, a transverse black band across shoulders, and six or more large irregular black spots on back; fore and hind limbs with broad dark cross bands, or else with ornamental markings obliterated or merging into the dark brown or almost black ground color; underparts lighter brown or yellow, with fine black specks on throat and belly; head-and-body length, 38 mm..... **longipes** (p. 107)

6. Toes united at base by vestigial web, with obvious marginal dermal fringes extending to terminal disks; web at base of toes extends to or a little beyond basal subarticular tubercle; marginal dermal fringes extend to terminal disks; toes in order of decreasing length, 4, 3, 5, 2, and 1; fifth toe reaching to terminal disk of third; two metatarsal tubercles, the inner large and elongated, the outer small and indistinct; a distinct tarsal fold; no supernumerary tubercles on plantar surface; disks of toes distinct, those of 2, 3, and 4 most noticeably dilated; first finger either shorter than or slightly longer than second; terminal disks of fingers distinct, but not noticeably enlarged; subarticular tubercles not continued backward on palmar surface; two palmar callosities, the inner large and elongate, the outer flattened and usually divided by longitudinal groove; the hind limb being carried forward along the body, the tibio-tarsal joint reaches at least to between eye and nostril and at most beyond end of snout; vomerine teeth in two nearly transverse groups, behind and

almost within level of inner margins of choanae, and separated medially by very narrow interval; tympanum very distinct, its horizontal diameter generally about two-thirds diameter of eye, rarely in very large individuals more than one-third but less than one-half diameter of eye; tympanum overhung by a dermal fold; snout acuminate; canthus rostralis distinct; loreal region oblique and concave; upper eyelid wider than interorbital space; nostrils lateral and near end of snout, their distance from eye equal to or less than diameter of latter; skin of upperparts generally rugose and tuberculate, rarely smooth, but always with short interrupted glandular dermal folds along lateral borders; folds are most conspicuous in intratympanic region and on back; a distinct abdominal disk; hinder border of belly areolate; under surfaces of thighs strongly granular; a more or less distinct continuous or interrupted lateral dermal fold; a continuous or discontinuous oblique dermal ridge at level of quadrate cartilage; ground color of upperparts brown, with scattered spots of yellowish, and mottled or blotched with dark brown or black; white or yellowish ground color of sides vermiculated or variegated with blackish brown; darker brown ground color of posterior surfaces of thighs vermiculated with white or yellow; limbs with more or less distinct cross bands, the banding extending upon fingers and toes; oblique dark brown bands, separated by narrower light spaces, extend upward across lower and upper lips to eye and loreal region; the two below eye widest at lip margin, another one nearer the nostril than the eye, and a somewhat larger dark spot bisected by two narrow vertical light lines on end of snout; anterior rim of orbit margined with black; a light brown or yellow loreal spot; an interorbital dark band behind light-colored snout; a black streak extends backward from eye over tympanum and downward to insertion of fore limb; dark streak along canthus rostralis present or absent; underparts white; throat marbled with brown; head-and-body length, 43 to 65 mm ..... **rugulosus** (p. 116)

Toes free, not united at base by vestigial web, and without obvious marginal dermal fringes 7

7. A broad longitudinal mid-dorsal purplish band extending from snout to vent between a pair of undulating medially converging linear dermal ridges, each of which extends from supraciliary to end of sacral diapophysis; remainder of upperparts light mauve; linear dermal ridges, stripe along canthus rostralis extending backward above and behind the tympanum, an oval spot on each side of pelvis, and some small irregular spots on sides of body, black; upper lip and posterior surfaces of thighs powdered with gray; fore and hind limbs crossbanded; underparts white, immaculate; first finger longer than or subequal with second; subarticular tubercles continued backward on inferior surfaces of metacarpals; two palmar callosities; disks of fingers small; toes not united by web at base; subarticular or supernumerary tubercles continued backward on plantar surface; two metatarsal tubercles, the inner one the largest; tarsal fold indistinct; the hind limb being carried forward along the body, the tibio-tarsal

joint reaches beyond the end of the snout; vomerine teeth in two small rounded groups behind the choanae, well separated from each other, and not extending outward beyond level of inner margins of choanae; tongue subround, scarcely or not notched behind; canthus rostralis distinct; loreal region subvertical; head with flat crown and subacuminate snout; tympanum round, one-half, three-fourths, or even equivalent to diameter of eye; skin of upperparts smooth, with exception of a pair of undulating, anteriorly bifurcating linear dermal folds; upper surface of head smooth, with a few indistinct tubercles on upper eyelid; legs and underparts smooth; no dermal fold across chest; head-and-body length, 35 mm.--venustus (p. 117)

No broad longitudinal dark-colored band bounded laterally by converging dermal folds; a black stripe runs from nostril along canthus rostralis through eye to above tympanum, decurving behind the latter; plantar surface often black or dark colored.....8

8. Skin of upperparts finely granular, with scattered tubercles; a faintly defined granular vertebral dermal ridge; skin of underparts smooth or with hinder half of belly areolate; thighs heavily granulate; canthus rostralis fairly distinct; loreal region subvertical; upper eyelid narrower than interorbital space; tympanum large, round, considerably more than half diameter of eye, its distance from eye being just over one-half of its own diameter; vomerine teeth in two short heavy oblique series some distance behind the choanae, the interval between them being less than distance from outer end of each one and corresponding choana; first finger slightly longer than or subequal with second; fingers with small ball-like terminal disks; subarticular tubercles on palmar surface, as well as on digits; toes with more flattened and less ball-like terminal disks; two metatarsal tubercles, the outer one small, round, and conical, the inner one oblong and large; a rather indistinct tarsal fold; the hind limb being carried forward along the body, the tibio-tarsal joint reaches beyond the tip of the snout; upperparts lichen gray, rather smoky, with minute black spots scattered over head and back; grayish fore and hind limbs with indistinct darker cross bands; a black streak curves around tympanum from eye to above insertion of fore limb; three subvertical dark brown bars, separated by narrower light spaces, extend across lower and upper lips to eye and loreal region; a pair of dark spots on end of snout in front of nostrils; head-and-body length, 35 mm.....dunnii (p. 105)

Skin of upperparts either areolate or smooth, occasionally with scattered or sparsely placed tubercles;.....9

9. A tarsal fold or a crested tubercle 2 or 3 mm. above inner metatarsal tubercle generally present; skin of belly either areolate or smooth; throat smooth; under surface of thighs granular; skin of upperparts areolate or apparently smooth, but with tiny asperities; several exceedingly fine dermal ridges generally present, the longest of which extends along vertebral column from snout to vent; one from eye above tympanum to shoulder and thence along side; another oblique one extending from eye toward center of back and thence backward and outward to point where sacral diapophysis juts out, which together with corresponding one on opposite side incloses an hourglass-shaped

area; and one between the former and the latter on hinder half of back; canthus rostralis fairly distinct; loreal region oblique, flattened; snout acuminate; interorbital space much wider than upper eyelid; tongue subovate; vomerine teeth in two slightly oblique series well behind the choanae, well separated from each other, and each series not extending outward beyond level of inner margin of corresponding choana; horizontal diameter of tympanum two-thirds, three-fourths, or almost equal to diameter of eye, and overhung by a dermal fold; first finger generally a little longer than second, rarely shorter; two palmar callosities, the outer with longitudinal groove; subarticular tubercles continued backward on palmar surface; terminal disks of fingers and toes very small; third and fifth toes equal in length; supernumerary tubercles may or may not be continued backward on plantar surface; two small metatarsal tubercles, the inner larger than the outer; the hind limb being carried forward along the body, the tibio-tarsal joint reaches beyond anterior margin of eye and rarely beyond end of snout; upper parts dark brown, reddish brown, or green (actually grayish olive or brownish in alcohol); a narrow indistinct dark interorbital band behind light colored snout; a black streak, margined above with a lighter color, commences at nostril and extends backward along canthus rostralis to eye, and from eye backward above tympanum to side or curving downward behind tympanum; vent black; a pair of short black glandular ridges in center of back, present or absent; forearm with at least one dark cross band; posterior limbs obscurely cross-banded; underparts white; head-and-body length, 28 to 36 mm.....**rhodopis** (p. 112)

Tarsal fold normally absent; skin of hinder half of belly generally areolate, occasionally smooth; under surface of thighs granular; skin of upperparts either smooth or else roughened by dermal ridges; exceedingly fine or inconspicuous dermal folds inclosing an hourglass-shaped area on back may or may not be present; a short dermal ridge along vertebral edge of scapula generally present; discoidal fold normally present; canthus rostralis fairly distinct and curved; loreal region oblique; snout rather broad and acuminate; width of upper eyelid equal to or less than interorbital space; vomerine teeth absent, hidden in the gum, or represented by two short oblique groups well behind and within level of inner margins of choanae; horizontal diameter of tympanum one-half to two-thirds diameter of eye; first finger generally shorter and rarely longer than second; two palmar callosities, the outer generally unequally divided by a longitudinal groove; subarticular tubercles continued backward on palmar surface; terminal disks of fingers and toes slightly developed, scarcely dilated; toes almost free, but with vestiges of web at base; supernumerary tubercles may or may not be continued backward on plantar surface; two metatarsal tubercles, the inner one usually large, prominent, and compressed, the outer one small and rounded; the hind limb being carried forward along the body, the tibio-tarsal joint generally reaches beyond end of snout and rarely only to anterior margin of eye; color of upperparts variable, grayish rose, brownish gray, or grayish, marbled or mottled with some darker tint, and separated from light-colored snout by a dark inter-

orbital band; darker spots on back sometimes confluent and form a pair of longitudinal bands; a sharply defined vertebral white stripe extending from muzzle to vent may or may not be present; limbs with narrow crossbars, which on hind limb occasionally encroach upon concealed hinder surface; throat brownish or speckled with brown; remainder of underparts whitish or yellowish; a blackish streak along canthus rostralis sometimes extends over whole side of head and may be continued backward on side of body; lower and upper lips with dark spots or bars that generally have light edges; head-and-body length, 36 to 40 mm..... **mexicanus** (p. 108)

ELEUTHERODACTYLUS ALFREDI (Boulenger)

1898. *Hylodes alfredi* BOULENGER, Proc. Zool. Soc. London, p. 480, pl. 39, fig. 1, June 7.

1882. *Hylodes conspicillatus* BROCCHI, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 59 (Andes, Orizaba). [*Nec Hylodes conspicillatus* GÜNTHER, 1858.]

Type locality.—Atoyac, State of Vera Cruz, Mexico.

Range.—So far as known, found only at Orizaba and at Atoyac in Vera Cruz.

Remarks.—The leptodactylid from the Andes of Orizaba, which Brocchi identified as *Hylodes conspicillatus* Günther, is certainly not that species. Brocchi states that the adhesive disks are very distinct, and since the external characters and general coloration are described rather briefly, the relationships of this frog are established mainly by the process of elimination. Distinctive characters of constant value are hard to find in this genus, but the species *alfredi* fortunately has especially large subtriangular and rather squarely truncated adhesive disks on the two outer fingers.

This frog was named in honor of the donor, Prof. Alfred Dugés, of Guanajuato, Mexico, and there are two cotypes in the collection of the British Museum of Natural History. The following notes were made on these specimens:

B.M. No. 98. 2. 19. 1: Head-and-body length, 37.2 mm.; transverse diameter of tympanum, 2.8 mm.; transverse diameter of eye, 4.2 mm.; anterior edge of eye to nostril, 4.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches considerably beyond the tip of snout; apical disks of fingers very large; vomerine teeth in two small oblique posteriorly converging rows behind and within level of the choanae; skin of abdomen smooth; large subarticular tubercles; soles of feet with supernumerary tubercles; large elongate inner and small conical outer metatarsal tubercles; tarsal fold indistinct, if present; apical disks of toes considerably smaller than those of fingers.

B.M. No. 98. 4. 7. 1: Head-and-body length, 30.8 mm.; transverse diameter of tympanum, 2 mm.; transverse diameter of eye, 3.6 mm.; anterior edge of eye to nostril, 4.1 mm.; the hind limb being carried

forward along the body, the tibio-tarsal joint reaches the tip of the snout; apical disks of fingers large and subtriangular; vomerine teeth as in the preceding; large subarticular tubercles; soles of feet without small supernumerary tubercles; apparently no tarsal fold.

Specimens examined.—Four, as follows:

Eleutherodactylus alfredi

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
B.M.	98.2.19.1	[1] 1	Atoyac		Alfred Dugés.
Do.	98.4.7.1	[1] 1	do		Do.
U.S.N.M.	71157–58	2	Orizaba		Francis Sumichrast.

[1] Cotypes.

ELEUTHERODACTYLUS AUGUSTI (Dugés)

1879. *Hylodes augusti* DUGÉS, *in* Brocchi, Bull. Soc. Philom. Paris, ser. 7, vol. 3, no. 1, p. 21.—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 52, pl. 16, figs. 1, 1a–c.—MOCQUARD, 1899, Bull. Soc. Philom. Paris, ser. 9, vol. 1, no. 4, pp. 159–163, pl. 1, fig. 2.

Type locality.—Guanajuato, State of Guanajuato, Mexico.

Range.—From Guanajuato and Nayarit, southward to Jalisco, Mexico.

Remarks.—Professor Cope [42] states that—

> The *Hylodes augusti* (Dugès, MS.), Brocchi Mision Scientifique de Mexique, 1881, from Guanajuato, Mexico, is related to the present animal [i. e., *Eleutherodactylus latrans*]. I do not know what the specific difference is, unless it be in the form of the vomerine patches, which I can not clearly make out from Brocchi's description.

The type of *Hylodes augusti* remained in the possession of Alfred Dugés, who had, as Mocquard says, the unhappy idea of sacrificing it for the sake of a prepared skeleton. Mocquard mentions a young individual from Guanajuato that he had received from Dugés. This specimen (M.H.N.P. No. 508α, parchment label No. 99–291) has a head-and-body length of 20 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches the middle of the eye; a broad transverse pink or pale yellow band with several dark spots crosses the back behind the level of the fore limbs; and the hind limbs have dark transverse bars. Differences in coloration alone distinguish it from adults of this species.

Six specimens (M.H.N.P. No. 508β, parchment labels Nos. 98–260, 98–261, 98–262; No. 508γ, parchment labels Nos. 98–263; 98–264; 98–265), collected by Léon Diguet at the commencement of the rainy season on the western slope of Cerro San Juan, territory of Tepic

[42] Cope, E. D., The Batrachia of North America. U. S. Nat. Mus. Bull. 34, p. 317, 1889.

[=Nayarit], form the basis for the following notes: Tarsal fold absent; tarsal-metatarsal joint to tip of fourth toe, 28 mm.; inner and outer metatarsal tubercles large, the inner elongated and swollen, the outer broad and flattened; large subarticular tubercles at ends of metapodials; feet with numerous supernumerary tubercles on plantar surface; the hind limb being carried forward along the body, the tibiotarsal joint reaches to center or to anterior margin of eye; heels touch but do not overlap when legs are placed transverse to axis of body; first finger exceeds the second by length of its apical disk; canthus rostralis fairly distinct; transverse diameter of tympanum occasionally less than one-half, always less than two-thirds, diameter of eye, and overhung by a dermal fold that extends from eye backward over and behind tympanum to angle of mouth (transverse diameter of tympanum, 3.7 mm.; transverse diameter of eye, 8.2 mm.); distance from eye to nostril equal to or less than diameter of eye; tongue narrow, elongate; skin on abdomen smooth; circular abdominal disk present; under surfaces of thighs granulated; a transverse intratympanic dorsal dermal fold; skin of upperparts and top of head either shagreened or with small scattered tubercles; sides with light margined large black blotches; hinder surface of thighs with closely approximated or with large coalesced black markings; upper surface of tarsus and foot with black blotches; lower fore limb with transverse black bars; abdominal disk yellowish, with faint vermiculations; throat black; head and body length, snout to vent, 75, 65.5, 65.5, 64.5, 67.5, and 66.2 mm., respectively.

Mocquard concluded that *E. augusti* was identical with Cope's *E. latrans* from central Texas. Direct comparison of Mexican specimens with the cotypes of *E. latrans* does not entirely confirm this assumption. Though there are no constant structural features that will distinguish specimens from these two areas, it was observed that in *E. latrans* the fourth toe is relatively longer, the color pattern consists of fairly closely aggregated large black blotches, the sides and hinder half of the abdomen are faintly areolate, and the skin on the upperparts of old adults is stiff, coarse, and areolate. These two forms are unquestionably rather closely related. An immature individual from Jalisco and an adult individual (with a body length of 75 mm.) collected by Ruthling, which unfortunately is without any definite locality, were used in these direct comparisons. The skin on the upperparts of the immature individual from Jalisco is much more tubercular and warty than that on the Texas specimens. Juvenile characters, such as vestigial postcephalic intratympanic dermal fold and vomerine teeth in minute clusters, are not unusual, but the presence of an abdominal disk seems rather remarkable for so young an individual. Mocquard[43] has published some interesting

[43] Mocquard, F., Reptiles et batraciens recueillis au Mexique par M. Léon Diguet en 1896 et 1897. Bull. Soc. Philom. Paris, ser. 9, vol. 1, no. 4, pp. 160, 161, 1899.

notes on *E. augusti*, which are taken from the field notes of Léon Diguet and from which the following is quoted (translation):

H. augusti appears to be essentially nocturnal, which explains its rarity in collections. Cope had already made known some facts regarding their habits, after the data furnished to him by Mr. G. W. Marnock, who discovered it in Texas. In confirming these details for me, Mr. Diguet has been good enough to add to them the following information: "This batrachian is encountered in the territory of Tepic in damp ravines at the commencement of the rainy season; that is, the end of June and July. Its voice is resounding and can be heard at a distance after sunset. At this time, it is found attached upon certain smooth-barked trees, such as the Burseras, the color of which is the same as that of the animal."

This last observation of Mr. Diguet has its importance, in that it establishes for us the significance of the ventral disk: It is, undoubtedly, an *adhesive disk*. The fingers, in fact, lack terminal disks and are only feebly swollen at their extremities; the animal therefore can not maintain itself along vertical surfaces except by means of this ventral disk. Furthermore as this disk can not be other than an organ of attachment, the progression of this batrachian upon the trunks of trees or in the vertical cracks of rocks, where it has been found by Mr. G. W. Marnock in Texas, must be effected by leaps: This is actually the case and Mr. Diguet has seen it constantly leaping from one branch to another when it tried to hold on.

Mr. Diguet has never encountered *H. augusti* during the day, but [only] at night with the aid of a light. He was able to capture eight specimens, seven males and one female, in the vicinity of small puddles of water on the western slope of the Cerro San Juan, territory of Tepic. He had at first grasped a male, next a female, whose sex he identified by the presence of ovaries loaded with eggs, which the transparency of the abdominal wall let be seen; he held this female upon the ground and saw arriving successively 6 other males which followed her and which he seized.

Inasmuch as Mocquard makes reference to the field observations of Marnock published by Cope and since *E. augusti* and *E. latrans* seem to be quite closely related, quotations from accounts dealing with the habits and life histories of *E. latrans* are here given.

In his preliminary notice of the discovery of the Texas cliff frog, Cope writes [44] that—

It lives in fissures in the limestone cliffs that stretch across that section of the State. According to Mr. Marnock the eggs hatch out in the winter, and the tadpoles live in the rainwater which is caught in the shallow holes in the rocks, far from the creeks. During the winter the adults are very noisy, the rocks resounding in the evening with their dog-like bark.

Miss Dickerson [45] has published a very interesting account of this species, from which the following is taken:

This smooth frog-like batrachian attains a surprisingly large size for one so delicately built. The arms and legs are peculiarly slender, and look out of proportion when seen on a frog three and a half inches long.

In fact, *Lithodytes latrans* is a very curious-looking creature. It rests on hands and feet only, the tarsus and other parts of the legs as well as the body being kept

[44] Cope, E. D., Amer. Nat., vol. 12, no. 3, p. 186, Mar., 1878.
[45] Dickerson, M. C., The frog book, p. 164, 1906.

elevated some distance above the ground. If its tracks could be seen, they would show impressions of the soles and long toes, of the palms and long fingers only. It moves about slowly and seriously in this stilted fashion, a grotesque little creature indeed. Its grotesqueness is enhanced by the transversely elongated spots of the back, set in their light pink background like two staring eyes.

This species lives in fissures of the limestone cliffs along the borders of the first plateau region of Texas. The method of proceeding with body elevated, instead of dragged on the ground, is perhaps correlated with its habit of living among the limestone rocks.

Some additional observations on the breeding habits of the Texan robber frog have been published by Strecker: [46]

Lithodytes latrans has in all probability an extensive range, but, on account of its peculiarly secretive and nocturnal habits, has been overlooked by the most eminent herpetologists who have visited Texas. Its distribution is entirely dependent on the presence of the exposures of white limestone which enclose many of the streams of the central and southern sections of the State.

It is a land animal, hiding in caves and fissures during the daytime, and, excepting during the brief breeding period, venturing abroad only at night. Breeding in water-filled pockets and hollows in the rocks and in the rocky beds of small streams, it does not appear to be perfectly at home in the water at any time and specimens observed by me made no attempt to conceal themselves by diving but swam clumsily across small pools and sought to escape by leaping up the bank on the opposite side. A breeding pair remain in copula close in to the bank. The masses of water-soaked leaves which line the edges of the pools and hollows serve them for the purpose of floating their fertilized eggs. * * *

This species breeds unusually early in the year. Marnock informed Cope that the eggs were hatched in winter. Here in central Texas the breeding season is later than it is in Bexar County and the eggs are deposited early in February. If the eggs were deposited before the 9th of that month in the present year, they were subjected to some of the hardest freezes we have had in years. On the 9th and 10th the ground was covered with two inches of water. A few days later the weather was warm and clear and melted snow filled the hollows in many of the gulches that are usually dry at this season.

On March 5 a number of tadpoles were found in small pools in the gully 3 miles north of town. They were in two stages, the larger ones having the hind limbs well developed. In form these larvae were short and round bodied, with slender, but rather short, tails. In a specimen 36 mm. in total length, the distance from muzzle to anus was 14 mm. In a smaller example, the tail was only 4 mm. longer than head and body. * * *

These little pollywogs are very active and on being disturbed conceal themselves among leaves in the bottoms and on the sides of the pools. The larger ones are unusually wary and it is a difficult matter to capture them even with a dip net. * * * By the 19th of March the larger tadpoles had become fully developed frogs and left the water with their short tails still in evidence. They were slightly over a third as large as full-grown adults. The complete metamorphosis must not take over six weeks, if we are to judge by the length of time required for other frogs to transform after the first appearance of the hind limbs.

The indirect development described by Strecker and the presence of narrow toes have led Noble [47] to infer that this species does not

[46] Strecker, J. K., jr., Notes on the robber frog (*Lithodytes latrans* Cope). Trans. Acad. Sci. St. Louis, vol. 19, no. 5, pp. 73–79, June 14, 1910.

[47] Noble, G. K., An outline of the relation of ontogeny to phylogeny within the Amphibia, I. Amer. Mus. Nov., no. 165, pp. 14, 15, Apr. 16, 1925.

belong in the genus *Eleutherodactylus*. Contrary to Noble's assumption, at least one of the cotypes of *Lithodytes latrans* (U.S.N.M. No. 10058) has typical, well-developed, T-shaped terminal phalanges, and there is no reason to suspect that this modification does not occur in the remaining cotypes. A dissected specimen of this species was found to have the usual *Eleutherodactylus* type of sternum, without a bony style and with a cartilaginous mesosternum with bisagittate extremity.

Specimens examined.—Nine, as follows:

Eleutherodactylus augusti

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
M.H.N.P.	508 $\beta\gamma$	6	NAYARIT: Cerro San Juan	June–July	Léon Diguet.
Do.	508 α	1	GUANAJUATO: Guanajuato		Alfred Dugés.
U.S.N.M.	46828	1	JALISCO: La Laguna at 6,900 feet altitude.	Sept. 20, 1897	Nelson and Goldman.
A.M.N.H.	12567	1	? STATE: No definite locality		Paul D. R. Ruthling.

ELEUTHERODACTYLUS BEATAE (Boulenger)

1903. *Hylodes beatae* BOULENGER, Ann. and Mag. Nat. Hist., ser. 7, vol. 12, no. 71, pp. 552, 553, Nov.

1922. *Syrrhopus mystaceus* BARBOUR, Proc. Biol. Soc. Washington, vol. 35, p. 112, Oct. 17 (Cerro de los Estrapajos, Vera Cruz).

Type locality.—Among moist dense shrubs at La Perla, near Orizaba, at an altitude of 6,000 feet, State of Vera Cruz, Mexico.

Range.—Vicinity of Jalapa and Orizaba in Vera Cruz, Mexico.

Remarks.—The type of *Syrrhopus mystaceus* (M.C.Z. No. 8241) has the same peculiar white black-edged streak on the upper lip as the two cotypes of *Eleutherodactylus beatae* (B.M. Nos. 1903.9.30.236–237). Unlike the latter, *mystaceus* has converging linear dermal ridges on the back, but both have a discoidal abdominal fold. Vomerine teeth are present in the type of *S. mystaceus*, but they are minute and can be seen only with a lens. Furthermore, there is a trace of a web between the toes.

The cotypes of *Eleutherodactylus beatae* do not have converging dorsal dermal ridges inclosing an hourglass-shaped area, and in addition the diagnosis published by Boulenger may be supplemented as follows:

B.M. No. 1903. 9. 30. 236: Head-and-body length, 26.2 mm.; transverse diameter of tympanum, 2.7 mm.; transverse diameter of eye, 2.7 mm.; anterior edge of eye to nostril, 3.2 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches barely beyond tip of snout; a distinct crested tarsal tubercle or ridge about midway, but no tarsal fold; inner metatarsal tubercle of medium size, outer small and conical; subarticular tubercles large; a few

supernumerary tubercles on plantar surface of foot; first finger longer than second; a broad white streak extends backward from tip of snout above brown upper lip and below eye and tympanum to fore limb; lower lip variegated with light and dark; fore limb with dark cross bands; upper surface of thigh and tibia with indistinct dark cross bands; an exceedingly fine vertebral dermal ridge; skin of upperparts with tiny asperities and small glandular elevations; a short curved dermal ridge along vertebral margin of scapula; canthus rostralis rounded; vomerine teeth in two oblique posteriorly converging rows behind and within level of choanae.

B.M. No. 1903. 9. 30. 237: Head-and-body length, 23.2 mm.; transverse diameter of tympanum, 2.7 mm.; transverse diameter of eye, 2.8 mm.; anterior edge of eye to nostril, 2.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches beyond end of snout; a distinct crested tarsal tubercle about midway; supernumerary tubercles on plantar surface of foot; coloration the same as in the preceding, except that lower lip is brown and not variegated with a light color; canthus rostralis rounded; vomerine teeth similar to the other cotype.

Specimens examined.—Three, as follows:

Eleutherodactylus beatae

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
M.C.Z.	8241	[1] 1	Cerro de los Estrapajos, west of Jalapa.	Aug. —, 1921	E. R. Dunn.
B.M.	1903. 9. 30. 236, 237	[2] 2	La Perla, near Orizaba, 6,000 feet altitude.		Dr. and Mrs. Hans Gadow.

[1] Type of *Syrrhopus mystaceus.* [2] Cotypes of *Eleutherodactylus beatae.*

ELEUTHERODACTYLUS DUNNII Barbour

1922. *Eleutherodactylus dunnii* BARBOUR, Proc. Biol. Soc. Washington, vol. 35, p. 111, Oct. 17.

Type locality.—Cerro de los Estrapajos, somewhat west and a little higher than the city of Jalapa, State of Vera Cruz, Mexico.

Range.—Evidently restricted to a limited district in western Vera Cruz.

Remarks.—Dr. E. R. Dunn collected two specimens at the type locality and a third from the near-by village of Xico. This species seems to be characterized by having the skin of the upperparts finely granular and studded with scattered tubercles. The texture of the skin seems to be the diagnostic character. It is unquestionably closely related to *E. rhodopis* and for the present is recognized as a distinct species. The acquisition of an adequate series of specimens of both

of these species may possibly show that *E. dunnii* is merely a variant of the widely distributed *E. rhodopis*.

Doctor Dunn writes to me from London as follows:

There are specimens in the British Museum which fit the description of *E. dunnii* more closely than any other. Ten specimens from Xometla (1903. 9. 30. 238–247, Brit. Mus.) and four from Ste. Barbara in Vera Cruz (1903. 9. 30. 248–251, Brit. Mus.) are referred to this species. These are differently preserved, but I think that they are the same. Tympanum black; considerable black around eye and on lip in spots. Glandular ridges do not show up. Apparently a W-shaped scapular fold. In these specimens the converging dorsal dermal ridges are lacking.

Specimens examined.—Two, as follows:

Eleutherodactylus dunnii

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
M.C.Z.	8242	[1] 1	Vera Cruz: Cerro de los Estrapajos, west of Jalapa.	Aug. —, 1921	E. R. Dunn.
U.M.U.M.	6	1	Puebla: Huachinango, 1,550 meters altitude.	July, 10, 1926	H. B. Baker.

[1] Type.

ELEUTHERODACTYLUS LATICEPS (Duméril)

Broad-headed Cave Frog

1853. *Hylodes laticeps* Duméril, Ann. Sci. Nat., Paris, ser. 3, Zoology, vol. 19, p. 178.—Duméril and Bibron, 1854, Erpétologie générale, vol. 9, p. 408; Atlas, pl. 99, figs. 1–4.

Type locality.—Yucatan, Mexico.

Range.—Limits of range as yet undetermined; known to occur in Yucatan, Mexico.

Remarks.—The unique type (M.H.N.P. No. 509, parchment label No. 1547) of this species was presented to the Paris Museum by Arthur Morelet. Its natural habitat and the exact type locality are unknown. A rather careful search of the literature revealed no mention of the finding of additional specimens. This species differs from *Eleutherodactylus augusti* in having a tarsal fold, a post-tympanic dorsal dermal fold, sides marbled with brown specks, inner metatarsal tubercle noticeably larger than the outer, and a relatively longer fourth toe. The following notes were made on the type specimen:

A distinct sharp-edged tarsal fold; tarsal-metatarsal joint to the tip of fourth toe, 36 mm.; a large protuberant inner and a very small outer metatarsal tubercle; subarticular tubercles at ends of metapodials fairly large; a few small supernumerary tubercles on metatarsals; toes webbed at base; the hind limb being carried forward along the body, the tibio-tarsal joint reaches between eye and nostril; first finger exceeds second by length of its apical disk; large subarticular tubercles

and palmar callosities; head broad, 33.3 mm. wide at angle of jaws; loreal region somewhat shelving; canthus rostralis rounded; vomerine teeth in two short oblique clusters, considerably behind but within level of inner margins of choanae; tongue broad and somewhat oval in outline; skin on throat, abdomen, and under surfaces of thighs smooth; a distinct abdominal disk; posterior surfaces of thighs granulated; a transverse post-tympanic dorsal dermal fold; skin of upperparts somewhat shagreened; hind limbs with black transverse bars; soles of feet black; under surface of forearm black; outer margins of throat and under surfaces of thighs and tibiae marbled with brown specks; sides with small anastomosing brown specks; head-and-body length, 74 mm.; transverse diameter of tympanum, 4.7 mm.; transverse diameter of eye, 8.8 mm.; anterior edge of eye to nostril, 9.7 mm.

Specimens examined.—One, the type.

ELEUTHERODACTYLUS LONGIPES (Baird)

1859. *Batrachyla longipes* Baird, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 35, pl. 37, figs. 1–3 (no description).—Barbour, 1923, Proc. New England Zool. Club, vol. 8, pp. 81–83 (80 miles S. W. Victoria, Tamaulipas, Mexico).

1866. *Epirhexis longipes* Cope, Journ. Acad. Nat. Sci. Philadelphia, n. s., vol. 6, pt. 1, July, p. 96.—Cope, 1875, U. S. Nat. Mus. Bull. 1, p. 31 (Lower Rio Grande).—Cope, 1887, U. S. Nat. Mus. Bull. 32, p. 16.

Type locality.—Mexico.

Range.—Exact limits of range unknown; probably occurs on the Mexican Plateau from southern Tamaulipas to Puebla.

Remarks.—Under the caption for the explanation of the plate with the original illustration of this frog, Baird simply stated that it was collected in Mexico. The original drawing of the type, which was used by Professor Baird in his report on the reptiles of the United States and Mexican Boundary Survey, was made by J. H. Richard and is dated 1856. At the right lower margin, "City of Mexico" is written in pencil and on the left lower margin "Batrachyla." In 1875, Cope gave "Lower Rio Grande" as the locality, but in 1887 he stated that the type was taken 40 leagues north of the City of Mexico and that it bore the number 3207 in the collection of the National Museum. An unlocated specimen from Camp Yuma, Calif., collected by Dr. R. O. Abbott, bears this number in the catalogue with the original entries. A missing "Hyla" collected by John Potts "40 leagues S. of City of Mex.," and catalogued under the number 3237, may be the original entry for the type of *Batrachyla longipes*. The type is now lost.

Specimens examined.—One (M.C.Z. No. 9308), collected at Miquihuana, 80 miles southwest of Victoria, Tamaulipas, in 1922 by W. W. Brown.

ELEUTHERODACTYLUS MEXICANUS (Brocchi)

1877. *Leuiperus* [sic] *mexicanus* Brocchi, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 4, p. 184.—Brocchi, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 21, pl. 5, figs. 3, 3a–c.

1879. *Hylodes lineatus* Brocchi, Bull. Soc. Philom. Paris, ser. 7, vol. 3, no. 1, p. 22, (Attitlan, probably Guatemala). [Preoccupied by *Hylodes lineatus* Günther, 1858=*Rana lineata* Schneider, 1799.]

1898. *Borborocoetes mexicanus* Boulenger, Proc. Zool. Soc. London, p. 481, pl. 39, fig. 2, June 7 (Hacienda el Florencio, State of Zacatecas, Mexico).

1900. *Syrrhaphus omiltemanus* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, p. 216, Apr. (Omilteme, State of Guerrero, Mexico).

1900. *Hylodes calcitrans* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, p. 230, pl. 67, fig. B, Aug. (Omilteme, State of Guerrero, and Jalisco, Mexico).

1927. *Pleurodema mexicana* Parker, Ann. and Mag. Nat. Hist., ser. 9, vol. 20, no. 118, p. 475, Oct.

Type locality.—Mexico.

Range.—Western side of the Mexican Plateau from Zacatecas southward through Jalisco and Oaxaca to the Isthmus of Tehuantepec.

Remarks.—An examination of the type of *Leuiperus mexicanus* (M.H.N.P. No. 226a, parchment label No. 6318) convinced Dr. E. R. Dunn that Parker had erred in referring it to the genus *Pleurodema* and that this species was the same as Günther's *Hylodes calcitrans* from western Mexico. In commenting upon this species Parker stated that:

> No specimens of this species have been examined, but it has been referred to this genus rather than to *Physalaemus* on account of the absence of any tarsal tubercle; its real position is still uncertain. Known only from the type specimens from Mexico.

Adolphe Boucard is listed as the collector of the type of *Leuiperus mexicanus* in the catalogue of the Muséum National d'Histoire Naturelle, Paris. The following notes were made on this specimen: Head-and-body length, 39 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to or slightly beyond tip of snout; no tarsal fold; plantar surface of foot without supernumerary tubercles; small inner and outer metatarsal tubercles; faint black crossbars on hind limbs; vomerine teeth in two minute clusters between the choanae; first finger longer than the second. It is clearly a member of the genus *Eleutherodactylus*.

Brocchi's *Hylodes lineatus* seems to have been a rose-gray individual with very narrow vertebral stripe, and in so far as color is concerned it is not unlike other specimens taken in the State of Oaxaca. Although a rather thorough search was made in the catalogues of the laboratory of herpetology of the Paris Museum, no entry of a *Hylodes* from Attitlan was found.

In response to an inquiry in regard to the type of *Borborocoetes mexicanus*, H. W. Parker, of the British Museum of Natural History, replied as follows:

> As you suspect, this is probably an *Eleutherodactylus*. The terminal phalanges are T-shaped, but the digits are scarcely dilated; fingers and toes subequal distally. No tarsal fold seems to be present.

After having examined the cotypes (B.M. Nos. 1892. 2. 8. 66–67), Doctor Dunn corroborated the assumption that *Borborocoetes mexicanus* and *Eleutherodactylus calcitrans* did not represent distinct species and affirmed that they were the same. The cotypes of *B. mexicanus* were collected by Dr. A. C. Buller on the Hacienda el Florencio, and according to his route map they were taken on August 15, 1891, at a locality nearly directly north of San Cristobal on the eastern slope of Sierra de Florencio in Zacatecas. The following notes were made on these cotypes:

B.M. No. 1892. 2. 8. 66: Head-and-body length, 37.4 mm.; transverse diameter of tympanum, 2 mm.; transverse diameter of eye, 4.2 mm.; anterior edge of eye to nostril, 3.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches between the eye and tip of snout; vomerine teeth in two small clusters, each about the diameter of a choana, widely separated medially, within and considerably behind level of choanae; no tarsal fold; inner metatarsal tubercle very large, outer one quite small; large subarticular tubercles; supernumerary tubercles on plantar surface of foot; side of head black; a black band from eye to about middle of side; lower lip marbled with black; upperparts light gray; upper surface of thigh and tibia with dark cross bands; forearm with two dark cross bands.

B.M. No. 1892. 2. 8. 67: Head-and-body length, 28.8 mm.; a dark interorbital band; upper surface of snout light colored; lower and upper lips with light vertical bars; vomerine teeth in same position as in the other cotype; other characters likewise essentially the same as in the other cotype.

Doctor Dunn, writing from London, says that *Syrrhaphus omiltemanus* (cotypes, B.M. Nos. 1901. 12. 19. 7–8) belongs unquestionably in the genus *Eleutherodactylus*. Dunn and Parker after examining the cotypes reported that they have vomerine teeth but that they are very much reduced, and that a backwardly projecting vomer is present. The following notes were made on these specimens: Head-and-body length of largest individual, 21.5 mm.; transverse diameter of tympanum, 2.1 mm.; transverse diameter of eye, 2.4 mm.; anterior margin of eye to nostril, 2 mm.; vomerine teeth rather minute; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between the eye and end of snout; apical disks of fingers and toes

not grooved or divided; a pair of converging linear dorsal dermal ridges inclosing an hourglass-shaped area, and a pair of dark spots, one on each side, external to ridge; abdomen and under surface of thighs areolate; both specimens are young individuals. *Syrrhaphus omiltemanus* is a strict synonym of *E. calcitrans* = *E. mexicanus*.

One of the cotypes of *Hylodes calcitrans* from Jalisco (B. M. Nos. 1901. 12. 19. 35–36) could not be found, and the other one does not have converging linear dermal ridges on the upperparts such as are present on some of the specimens in the United States National Museum. The following notes were made on this cotype: Head-and-body length, 34.5 mm.; transverse diameter of tympanum, 3.6 mm.; transverse diameter of eye, 4.3 mm.; anterior edge of eye to nostril, 3.5 mm.; lateral dermal fold extends backward over tympanum and along side of body; dermal asperities present on sides of body and on back in sacral region; large subarticular tubercles; small supernumerary tubercles on plantar surface of foot; unusually large inner metatarsal tubercle and minute conical outer one; no tarsal fold; vomerine teeth in two small clusters, each about the diameter of a choana, widely separated medially, within and considerably behind level of choanae; skin on abdomen areolate, but smoother than on Omilteme cotypes; light vertical bars on upper lip; a black canthal stripe, but side of head is not so dark as in *Borborocoetes mexicanus*; upperparts gray.

Nineteen cotypes (B.M. Nos. 1901. 12. 19. 25–43) from Omilteme in Guerrero were received from F. D. Godman. All these have areolate skin on the abdomen, but this seems to have resulted in part at least from partial desiccation at some time. Only two have small supernumerary tubercles on the plantar surface of foot. On all the upper surface of the snout is light colored, the thighs and tibiae have transverse dark bands, and vomerine teeth are present. Eleven specimens have distinct medially converging dorsal dermal ridges that inclose an hourglass-shaped area. Nine have the anterior end of each of these dermal ridges ending in a black dermal elevation, lateral and posterior to which is a second short black dermal elevation that is not connected with either of above ridges. Thus on each side of the vertebral line in the suprascapular region there is a pair of short black dermal ridges. One cotype measured by Günther has: Head-and-body length, 36.6 mm.; transverse diameter of tympanum, 2.5 mm.; transverse diameter of eye, 3.9 mm.; anterior edge of eye to nostril, 3.3 mm.; no dark band on side of head, though it is present behind tympanum to a point about halfway length of side; skin of upperparts fairly smooth; converging linear dorsal dermal ridges absent; large inner and small outer metatarsal tubercle; no tarsal fold; undersurface of thighs coarsely granular; skin of abdomen areolate; large subarticular tubercles; no supernumerary tubercles on plantar surface of foot; vomerine teeth in short, oblique, posteriorly

converging rows behind and within level of choanae. In case of two other cotypes, having head-and-body lengths of 38 and 41.7 mm., respectively, the tibio-tarsal joint reaches to between eye and tip of snout when the hind limb is carried forward along the body.

It is apparent from the synonymy of *E. mexicanus* that some of the more pronounced variants of this species have been incorrectly allocated generically. Some of the confusion that has prevailed in the past may possibly be explained by the occurrence of occasional individuals that lack vomerine teeth. Of the 13 specimens of this frog in the National Museum, all from the State of Oaxaca, there are two with a white vertebral stripe at least 1 mm. wide, one with a white pin stripe, and the remainder show no trace of a vertebral line. Most of them have a short dermal ridge above the edge of the scapula. Eight have more or less distinct converging dorsal dermal folds, while five show no trace of such folds. On some the skin of the upperparts is roughened by dermal ridges, and on others it is quite smooth. The skin on the posterior half of the abdomen is generally areolate, but occasionally is smooth. No trace of vomerine teeth can be observed in 3 of these specimens, and in the remaining 10 these teeth vary not only in the width of the series, but also in the extent to which they project beyond the gum.

In general *E. mexicanus* has a much more variegated appearance than *E. rhodopis*. Darker colors predominate, and the black and brown mottling of the upperparts is especially noticeable. The dark bars on the hind limbs are quite distinct. The tarsal fold is normally absent, though this distinction will not hold invariably.

Certain specimens from the west coast of Mexico are rather puzzling, for they approach *rhodopis* in some details and *mexicanus* in others. They are tentatively assigned to this species until a larger series is available to determine their precise relationships. A short-legged individual (U.S.N.M. No. 47433) collected by Nelson and Goldman at Plomosas in Sinaloa is referred to *E. mexicanus* partly on geographical grounds and partly because of the absence of a tarsal fold, although in general appearance it bears some resemblance to *E. rhodopis*. When the hind limb is carried forward along the body, the tibio-tarsal joint barely reaches the anterior margin of the eye. This dull-colored individual has a dark interorbital streak behind the light-colored snout, and a pair of short black glandular ridges on the mid-dorsum. Distinctive markings on the side of the head consisting of subvertical dark brown bars, separated by narrower light spaces, that extend across lower and upper lips to eye and loreal region are also present.

Three specimens (U.S.N.M. Nos. 47905–07) were found about springs and little streams in dense growths of grass and other plants at 10,000 feet altitude at Cerro San Felipe. One (U.S.N.M. No.

47911) was found in a damp gulch in the shade of bushes and trees at 7,800 feet altitude at La Parada.

Dr. Hans Gadow [48] in reporting his experiences at Omilteme in Guerrero says:

An insignificant and diminutive toad (*Borborocoetes mexicanus*) lived in the irrigated patches of Indian corn, and emitted a sharp, double, piping note. One of these specimens was inside an orange-headed grass snake (*Tropidonotus chrysocephalus*) caught by Rafael, the "arriero," who was much astonished when he received the promised pay for two instead of one creature caught.

Specimens examined.—Forty-eight, as follows:

Eleutherodactylus mexicanus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	47433	1	SINALOA: Plomosas	July 19, 1897	Nelson and Goldman.
B.M.	92. 2. 8. 66–67	[1] 2	ZACATECAS: Hacienda el Florencio.		A. C. Buller.
Do.	1901. 12. 19. 35–36	[2] 2	JALISCO: No definite locality.		F. D. Godman.
			GUERRERO:		
U.S.N.M.	47013–14	2	Omilteme	May 20, 1903	Nelson and Goldman.
B.M.	1901. 12. 19. 7–8	[3] 2	do		F. D. Godman.
Do.	1901. 12. 19. 25–43	[3] 19	do		Do.
			OAXACA:		
U.S.N.M.	47905–07	3	Cerro San Felipe, 10,000 feet altitude.	Aug. 30, 1894	Nelson and Goldman.
C.A.S.	5042	1	Cosolapa	Mar. —, 1925	Paul D. R. Ruthling.
U.S.N.M.	47911	1	La Parada, 7,800 feet altitude.	Aug. 19, 1894	Nelson and Goldman.
Do.	46964–65	2	Mountains west of Oaxaca, oak woods at 9,400 feet altitude.	Sept. 18, 1894	Do.
Do.	47143–50	7	Mountains west of Oaxaca, oak woods at 6,000–9,500 feet altitude.	Sept. 19, 1894	Do.
Do.	10020	1	Tehuantepec		Francis Sumichrast.
Do.	30325–26, –28	3	do		Do.
Do.	47913	[4] 1	Totontepec	July 26, 1894	Nelson and Goldman.
M.H.N.P.	226a	[5] 1	? STATE: No definite locality.		Adolphe Boucard.

[1] Cotypes of *Borborocoetes mexicanus*.
[2] Cotypes of *Hylodes calcitrans*.
[3] Cotypes of *Syrrhophus omiltemanus*.
[4] Young.
[5] Type of *Leuiperus mexicanus*.

ELEUTHERODACTYLUS RHODOPIS (Cope)

1866. *Lithodytes rhodopis* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 323, Nov.—COPE, 1869, Proc. Amer. Philos. Soc., vol. 11, no. 82, p. 160, footnote, July 16.—COPE, 1893, Proc. Amer. Philos. Soc., vol. 31, no. 142, p. 337, Nov. 17.

1868. *Hylodes sallaei* GÜNTHER, Proc. Zool. Soc. London, p. 487, pl. 38, fig. 3, June 25 (Mexico).—BOULENGER, 1882, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 204.

1900. *Hylodes plicatus* GÜNTHER, Biologia Centrali-Americana, Reptilia and Batrachia, p. 228, pl. 66, fig. B, June (Jalapa, Vera Cruz, Mexico).

1900. *Hylodes rhodopis* GÜNTHER, Biologia Centrali-Americana, Reptilia and Batrachia, p. 232, pl. 67, figs. C, C′, Aug.

[48] Gadow, H., Through southern Mexico: Being an account of the travels of a naturalist, London, p. 380, 1908.

Type locality.—Orizaba and Cordoba, State of Vera Cruz, Mexico.

Range.—From Orizaba in Vera Cruz southward through Chiapas to Costa Rica; apparently restricted to the eastern side of the Mexican Plateau.

Remarks.—The type of *Lithodytes rhodopis* was not designated by Cope. A specimen (U.S.N.M. No. 16558) from the vicinity of Orizaba agrees with the measurements published by Cope and may be designated as the electotype. Some of the other specimens (U.S.N.M. Nos. 16557, 16559–61) mentioned by Cope in his original description have been located, and they should be considered as paratypes. In 1869, Cope remarked that his *L. rhodopis* was the same as Günther's *Hylodes sallaei*. According to Dr. E. R. Dunn, who has recently examined the type (B.M. No. 57. 7. 31. 27), *H. sallaei* is unquestionably identical with *E. rhodopis*. This assumption is corroborated by the following notes made on the type specimen:

Head-and-body length, 27.7 mm.; transverse diameter of tympanum 2 mm.; transverse diameter of eye, 3.3 mm.; anterior edge of eye to nostril, 3.3 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to the end of the snout; inner metatarsal tubercle of medium size, outer one minute; a short tarsal fold ending in a crestlike tarsal tubercle; rows of minute supernumerary tubercles on plantar surface of foot; first finger slightly longer than second; vomerine teeth in two short oblique rows, widely separated medially, well behind, and within level of the choanae; under surface of thighs granular, abdomen areolate; an exceedingly fine vertebral dermal ridge from occiput to vent; an oblique dermal ridge extending from postero-external angle of eye to short glandular ridge in a black spot at about middle of back, forms inverted chevron with opposite dermal ridge; a lateral linear dermal ridge from shoulder backward to and along sacrum; and lateral to this another linear dermal ridge extends from posterior edge of eye, above tympanum, and backward along side to a point slightly beyond middle of body; skin of upperparts with rather scattered minute glandular asperities; glandular asperities on sides are rather closely approximated and somewhat linear in arrangement; black streak from tip of snout to nostril and along canthus rostralis to eye, and from eye backward above tympanum and downward behind to below level of angle of jaw.

The type of *Hylodes sallaei* was received from Auguste Sallé and presumably came from the State of Vera Cruz. Günther laid considerable emphasis on the fact that the skin on the posterior half of the abdomen was granular, though he admits that in consequence of imperfect preservation this granulation may be obliterated. On some specimens the skin of the underparts seems to be smooth, though an areolated condition may be seen on closer inspection with a lens, and on others the skin is distinctly granulated. This criterion

was used by Cope as a basis for generic discrimination of *Lithodytes* and *Hylodes*.

The type of *Hylodes plicatus* (B.M. No. 1901. 12. 19. 38) is here identified as an immature individual of *Eleutherodactylus rhodopis*. When direct comparisons were made between the types of *H. plicatus* and *H. sallaei*, it was observed that the existing differences are too slight to have any taxonomic significance. For purposes of comparison, the following notes on the type of *H. plicatus* are here recorded: Head-and-body length, 19.8 mm.; transverse diameter of tympanum, 1.8 mm.; transverse diameter of eye, 2.8 mm.; anterior edge of eye to nostril, 2.2 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to end of snout; a long narrow tarsal fold; inner metatarsal tubercle large and elongate, outer quite small and conical; minute supernumerary tubercles on plantar surface of foot; apical disks not very large; canthus rostralis fairly sharp; vomerine teeth in two small widely separated clusters far behind, and well within level of, the choanae; a vertebral linear dermal ridge from snout to vent; a pair of medially converging dorsal dermal ridges that inclose an hourglass-shaped area; skin of abdomen apparently areolate; a black streak with light upper margin from nostril to eye and from posterior edge of eye backward above tympanum, and downward behind to above its lower edge; faint transverse dark bars on upper surfaces of thigh and tibia.

Some variation in the development of the tarsal fold may be expected. Four of the specimens referred to this species have a distinct tarsal fold, three have a low crested tubercle 2 or 3 mm. above the base of the inner metatarsal tubercle, but the connecting tarsal ridge is barely discernible, and on one the tarsal fold seems to be absent. Exceedingly fine medially converging dorsal dermal folds are generally present. Similarly the short black glandular ridges in the mid-dorsal region are present in some and absent in others. With the exception of the vomerine teeth, which are normally behind the level of the choanae, no constant character that will invariably distinguish this species is apparent in the series studied.

In life this little frog may be dark brown, reddish yellow, or green, depending to some extent upon the surroundings. The ventral surface of the tarsus and of the foot is either dark brown or black. On the forearm there is either a dark-brown spot or a transverse dark-brown bar. A dark-brown or black stripe with a light-colored or white edge extends along the canthus rostralis from snout to eye; beginning again at posterior margin of eye it extends backward above the tympanum and along the lateral line for 6 or 8 mm., or else curves downward behind the tympanum.

Dr. Hans Gadow [49] contributes the following notes on this species:

Of tailless amphibians only one kind exists, but this is rather plentiful, *Hylodes rhodopis*, a small *Cystignathid*, which leads the life of a tree frog. It seems to be a southerner, which, although not extending onto the plateau itself, ascends the high mountains on its eastern, southern and western borders. On Citlaltepetl, for instance, it occurs well up to 10,000 feet, whilst it also inhabits the "hot lands" in the State of Vera Cruz. Most of the specimens were dark brown, with reddish tints, and lived on or near the ground amongst the dark masses of rotten leaves; others had made their home in the tillandsia clusters, or on the green shrubs at the edge of the forest; these frogs were quite green, but when caught soon changed to reddish yellow, and ultimately assumed the natural coloration, which is also that of specimens preserved in spirit. None of these frogs in the forest itself, upon the ground, showed a trace of green. The genus *Hylodes* comprises the *H. martinicensis*, the "coqui" of the West Indies, which has become famous as the first frog known to lay a few large eggs only, from which within a few days the young are hatched, as almost perfect little frogs, they having hurried through the gilled and tailed tadpole stage in a diagrammatically precipitate fashion. Most kinds of *Hylodes* seem to go through such a "condensed" process of babyhood; the eggs are laid in a foaming lather or spume wrapped between leaves. Suitable places upon the mountain, shady places with decaying leaves, were swarming with these little baby frogs, but our search for nests was without result, since the proper breeding season was already passed, and the adults kept quite mute. In any case, the presence of these peculiar frogs was significant, they, with the newts, being the sole representatives of amphibia. There were no other frogs or toads whatever, nor were any known to occur. Both toads and frogs require standing water in which to deposit their eggs, and there is no standing water anywhere near the Xometla level. The streams were quick running and very cold; some were fed by melting snow, or became rapid torrents when it rained, and for these reasons they contained no fish either.

Specimens examined.—Eleven, as follows:

Eleutherodactylus rhodopis

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
B.M.	1901. 12. 19. 38	[1] 1	VERA CRUZ: Jalapa		F. D. Godman.
U.S.N.M.	7091	3	Orizaba, alpine region	1864 (?)	Francis Sumichrast.
Do.	16558	[2] 1	Vicinity of Orizaba		Do.
Do.	16557	[3] 4	do		Do.
	59–61				
Do.	47199	1	CHIAPAS: Chicharras, 3,400 ft. altitude.	Feb. 17, 1896	Nelson and Goldman.
B.M.	57. 7. 31. 27	[4] 1	?STATE: No definite locality.	1855	Auguste Sallé.

[1] Type of *Hylodes plicatus*.
[2] Type of *Lithodytes rhodopis*.
[3] Paratypes of *Lithodytes rhodopis*.
[4] Type of *Hylodes sallaei*.

[49] Gadow, H., Through southern Mexico: Being an account of the travels of a naturalist, London, pp. 55, 56, 1908.

ELEUTHERODACTYLUS RUGULOSUS (Cope)

1869. *Liyla rugulosa* Cope, Proc. Amer. Philos. Soc., vol. 11, no. 82, p.160, July 16.
1869. *Hylodes berkenbuschii* Peters, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 879, Dec. (probably vicinity of Matamoros, Puebla).—Boulenger, 1882, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 202.—Nieden, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, p. 424.

Type locality.—Pacific region of the Isthmus of Tehuantepec, Mexico.

Range.—Central Vera Cruz southward through the Isthmus of Tehuantepec to San Salvador.

Remarks.—The type of *Hylodes berkenbuschii* (M.N.B. No. 6666) has been examined, independently, by Dr. E. R. Dunn and myself, and both of us agree that it is identical with Cope's *Liyla rugulosa*. The following notes were made on this specimen:

Head-and-body length, 42.5 mm.; transverse diameter of tympanum, 3.9 mm.; transverse diameter of eye, 5.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to end of snout; web at base of toes extends to or a little beyond proximal subarticular tubercle; tarsal fold sharp and quite distinct; inner metatarsal tubercle quite large, outer tubercle minute; no supernumerary tubercles on plantar surface of foot; apical disks of toes smaller than those of fingers; canthus rostralis sharp; loreal region oblique; tympanum overhung by dermal fold; skin of upperparts rather rough, with a pair of oblique dermal plicae on each shoulder and a linear series of short interrupted glandular ridges along sides of back; skin of abdomen areolate; under surface of thighs areolate, with a few warts below vent; upperparts brown; a dark interorbital transverse band, in front of which the top of the head is suffused with white, extends laterally upon posterior edges of upper eyelids; narrow vertical light yellow stripes on upper lip alternating with subtriangular dark spots; dark stripe above and downward behind tympanum; sides of body mottled with a darker color; hind limbs with indistinct dark cross bands; a narrow white throat line; underparts brownish yellow, with darker mottling; posterior surfaces of thighs with small white spots.

The two cotypes of *Liyla rugulosa* (U.S.N.M. Nos. 29771–72) mentioned by Cope are now poorly preserved and rather soft. Portions of both specimens are bleached nearly white, and the color markings are obliterated. The skin of the upperparts is somewhat wrinkled, but the dermal glandular ridges are still visible. One of the cotypes (U.S.N.M. No. 29772) has the skin freed from the head, the sternum dissected out, and the extremity of the right sacral diapophysis exposed. This specimen has a head-and-body length of 33 mm., while the other cotype measures 36 mm. in length. A large

individual with a head-and-body length of 65 mm., which was collected at Achotal in Vera Cruz, is referred to Cope's species.

Specimens examined.—Twenty-eight, as follows:

Eleutherodactylus rugulosus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
F.M.N.H.	1482	1	Achotal	Dec. —, 1904 Jan. —, 1905	E. Heller and C. M. Barber.
U.S.N.M.	71159	1	Orizaba		Francis Sumichrast.
Do.	16567	1	Vicinity of Orizaba		Do.
M.N.B.	6666	[1] 1	PUEBLA (?): No definite locality.		Herr Berkenbusch.
			OAXACA:		
U.S.N.M.	47910	1	Pluma, 3,000 feet altitude	Mar. 19, 1895	Nelson and Goldman.
Do.	10038	19	Tehuantepec		Francis Sumichrast.
Do.	29971–72	[2] 2	----do		Do.
Do.	30327	1	------do		Do.
Do.	46850	1	CHIAPAS: Tumbala, 4,000 feet altitude.	Nov. 16, 1895	Nelson and Goldman.

[1] Type of *Hylodes berkenbuschii.* [2] Cotypes of *Liyla rugulosa.*

ELEUTHERODACTYLUS VENUSTUS (Günther)

1900. *Hylodes venustus* GÜNTHER, Biologia Centrali-Americana, Reptilia and Batrachia, p. 234, pl. 68, fig. C, Aug.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 409, 425.

Type locality.—Jalapa, State of Vera Cruz, Mexico.

Range.—Limits of range as yet undetermined.

Remarks.—This variety was recognized as a distinct species by Günther chiefly on the account of the presence of a broad purplish band from snout to vent bounded laterally on the back by converging dermal ridges. These converging dermal ridges are much more widely separated than on any of the specimens of *E. rhodopis* that are available for comparison. A similar color variant has been observed in undoubted specimens of *rhodopis.* The chevronlike glandular ridge over the vertebral edge of the scapula is merely the most conspicuous portion of the converging dermal ridge that extends backward from upper eyelid to the level of the end of the sacral diapophysis. The skin of the upperparts is granular, that on the throat is smooth, and that on the abdomen is granular.

The type of *E. venustus* (B.M. No. 1901. 12. 19. 37) has been compared with specimens of *E. rhodopis*, and it unquestionably belongs in the same group as the latter. The species *venustus*, however, is tentatively retained until a series sufficient to determine its status is available for examination. The following notes were made on the type specimen: Head-and-body length, 36.9 mm.; transverse diameter of tympanum, 2.5 mm.; transverse diameter of eye, 3.9 mm.; anterior edge of eye to nostril, 3.8 mm.; the hind limb being carried

forward along the body, the tibio-tarsal joint reaches beyond tip of snout; tarsal fold with fairly prominent crestlike tubercle about halfway length of tarsus; inner metatarsal tubercle fairly large, a somewhat smaller conical outer one; large subarticular tubercles; a few supernumerary tubercles on plantar surface of foot; vomerine teeth in two small clusters, each slightly wider than choana, behind, and within level of, the choanae; medially converging dorsal dermal ridges inclose a semi-hourglass-shaped area; a fine vertebral dermal ridge; short dermal ridges and glandular elevations in sacral region; skin of abdomen smooth; a black canthal stripe with light upper margin from nostril to eye, along outer edge of eyelid to above tympanum and downward behind to level of its lower margin; a small black spot on shoulder behind this stripe; a purple median longitudinal stripe from tip of snout to vent extends over top of head and behind the eyes is bounded laterally by black streaks, which are coextensive with the converging dorsal dermal ridges; external to the sacrum is a linear series of indistinctly outlined and irregular dark blotches; outer surface of thigh, tibia, and tarsus with indistinct dark or dusky transverse bars; forearm with black spots; fine dark specks scattered over skin of underparts and concealed surfaces of limbs.

Specimens examined.—Two, as follows:

Eleutherodactylus venustus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
B.M.	1901.12.19.37	[1] 1	VERA CRUZ: Jalapa		F. D. Godman and O. Salvin.
U.S.N.M.	47529	1	Minatitlan	Apr. 22, 1896	Nelson and Goldman.

[1] Type.

Genus CAUPHIAS Brocchi

1877. *Cauphias* BROCCHI, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 3, p. 129. [Genotype, *Plectrohyla guatemalensis* BROCCHI, 1877, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 2, p. 93 (Pacicilla, Guatemala).]

Toes nearly fully webbed; terminal phalanges T-shaped; fingers without or with vestige of web at base; a distinct tarsal fold; no external indication of a tympanum; vomerine teeth present; body stout; hind limbs rather short.

CAUPHIAS CRASSUM Brocchi

1877. *Cauphias crassus* BROCCHI, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 3, p. 130.

1882. *Cauphias crassum* BROCCHI, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 64, pl. 12, fig. 4.

1882. *Hyla crassa* BOULENGER, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 396.—GÜNTHER, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 281, Sept.

Type locality.—Mexico.

Range.—Unknown.

Remarks.—There is no certainty that this amphibian was actually collected in Mexico. As originally described this species was placed in the genus *Cauphias*, which has for its genotype *Cauphias guatemalensis*. Brocchi evidently considered that *Cauphias guatemalensis* and *C. crassum* were related to *Hylodes* [=*Eleutherodactylus*], since they are placed after *Hylodes* in the family Hylodidae. A specimen of *Cauphias guatemalensis* [50] recently taken at Panajachel, near Sololá, Lake Atitlan, at an altitude of 4,500 feet in the mountains of Guatemala, conclusively shows that this species is related to *Eleutherodactylus*. The webbing of the hind feet, however, of both *Cauphias guatemalensis* and *C. crassum* is quite unlike any known *Eleutherodactylus*.

The two cotypes of *Cauphias guatemalensis* (M.H.N.P. No. 509β, parchment label No. 6332) were collected at Pacicilla, Guatemala, by Adolphe Boucard in 1873. They are, respectively, one adult and one immature individual. The head-and-body length of the largest individual is 54.5 mm. The diagnostic characters of this species may be described briefly as follows: The hind limb being carried forward along the body, the tibio-tarsal joint reaches to posterior margin or to center of eye; a well-developed tarsal fold extends full length of tarsus; a large inner, but no outer metatarsal tubercle; toes fully webbed, slightly scalloped; first finger bifurcated at base; fingers 2, 3, and 4 slightly webbed at base; well-developed and rounded apical disks; no external indication of tympanum; a thick dermal fold from posterior margin of eye curves backward and downward to origin of fore limb; vomerine teeth in two transverse rows behind but within level of inner margins of choanae; canthus rostralis distinct; loreal region subvertical; skin of upperparts, top of head, upper surfaces of fore and hind limbs with scattered tubercles; skin of throat, abdomen, and under surface of thighs coarsely granular; coloration of upperparts (in alcohol) uniformly bluish slate.

The first finger of *Cauphias guatemalensis* has a well-developed clawlike vestige of the pollex buried in a fleshy apophysis, which seemingly arises from the side of the thumb, giving a peculiar bifid appearance to that digit. This same structure is present on the immature individual, but is not developed on the first finger of *Cauphias crassum*. There are striking similarities in the general build of these two species that are apparent when they are compared side by side. Boulenger referred this short-toed and nearly fully webbed *crassum* to the genus *Hyla*, but this is incorrect since the type has T-shaped

[50] Barbour, T., *Cauphias* rediscovered. Copeia, no. 165, pp. 96–98, Dec. 23, 1927.

terminal phalanges. *Cauphias crassum* with its hidden tympanum is tentatively recognized as a distinct species, though there are some indications that subsequent collecting may show that it is merely a female of *Cauphias guatemalensis*.

The type of *Cauphias crassum* (M.H.N.P. No. 509*a*, parchment label No. 6331) was likewise collected by Adolphe Boucard in 1873, according to the catalogue somewhere in Mexico, though it is quite likely that this locality may be incorrect. The following notes were made on the type of this species: Head-and-body length, 54.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of eye; tarsal fold distinct and strong; a small inner but no outer metatarsal tubercle; toes fully webbed, with exception of fourth toe on which the penultimate joint has a dermal fringe; terminal phalanges T-shaped; first finger without basal bifurcation; fingers without web at base; no external indication of tympanum; a dermal fold above and behind normal position of tympanum; distance from eye to nostril less than transverse diameter of eye; vomerine teeth in two rounded clusters between choanae; loreal region oblique; skin on abdomen coarsely granular; throat with scattered granulations; under surface of thighs areolated; coloration of upperparts gray, without darker markings; slight grayish marbling on upper lip; sides light with gray vermiculation; throat with gray marbling; abdomen and under surfaces of thighs yellowish.

Specimens examined.—One, the type.

Genus TOMODACTYLUS Günther

1900. *Tomodactylus* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, p. 219, Apr. [Genotype, *Tomodactylus amulae* Günther, *idem*, p. 219, pl. 64, fig. C (Amula, Guerrero, Mexico).]

For many years this unique little frog was confused with *Physalaemus* and *Pleurodema*, chiefly on account of the occurrence of a black lumbar spot on some of the species referred to these genera. There are species of *Pleurodema* that have a lumbar gland, but they have simple terminal phalanges and a sternum with a bony style. *Tomodactylus*, however, has T-shaped terminal phalanges and a cartilaginous sternum and omosternum, but lacks vomerine teeth. It is here recognized as a valid genus related to *Eleutherodactylus* and *Pleurodema*.

TOMODACTYLUS NITIDUS (Peters)

1869. *Liuperus* [sic] *nitidus* Peters, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 878, Dec.

1900. *Tomodactylus amulae* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, p. 219, pl. 64, fig. C, Apr. (Amula, State of Guerrero).

1927. *Paludicola* [*Liuperus*] *nitidus* Parker, Ann. and Mag. Nat. Hist., ser. 9, vol. 20, no. 118, p. 451, Oct.

Type locality.—State of Puebla, Mexico, possibly from the vicinity of Matamoros.

Range.—Exact limits of range unknown; records of capture indicate that it occurs from southern Nayarit (El Ocotillo) and Guanajuato, southward through Puebla and Michoacan to central Guerrero (Chilpancingo).

Remarks.—The earliest available specific name for this small frog seems to be *Liuperus* [sic] *nitidus* Peters. This name was based on a specimen (M.N.B. No. 6669) that was included in a small collection made by Herr Berkenbusch in Mexico. Inasmuch as the diagnostic features of this species have been ignored for so many years, a short description of the type of *nitidus* is herewith given: Head-and-body length, 20 mm.; transverse diameter of tympanum, 1 mm.; transverse diameter of eye, 1.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to anterior margin of tympanum; tarsal fold very indistinct, if present; large subarticular tubercles; minute supernumerary tubercles on sole of foot; fore limbs slender; toes slender; fourth toe considerably longer than third or fifth; skin of abdomen smooth; under surface of thighs areolate; no visible vomerine teeth; coloration, seemingly dark brown with light marbling; lumbar gland white with wavy or zigzag dark bands; transverse dark bands on hind limbs rather indistinct.

Brocchi likewise referred *nitidus* to *Leiuperus*, while Boulenger, Günther, and Nieden interpreted the original description as indicating that this species should be allocated in the genus *Paludicola*. Günther seemingly ignored the resemblances to his *Tomodactylus amulae* that are clearly disclosed in the published description of *nitidus*. The obvious similarity of the specimens dealt with in these two descriptions is at once apparent when they are compared side by side. Parker seems to have been the first to suggest that the correct relationships of *nitidus* are with *Tomodactylus* and cites as follows his reasons for this allocation:

> A specimen in the British Museum which agrees with the type in all external characters is scarcely distinguishable from the type-specimen of *Tomodactylus amulae*. Like the latter it also has T-shaped terminal phalanges, cartilaginous sternum and omosternum, and a lumbar gland, and so must be referred to the genus *Tomodactylus*, at least until the position of this genus has been satisfactorily determined.

Inasmuch as it seemed improbable that *nitidus* and *amulae* were distinct species, the cotypes of the latter (B.M. Nos. 1901. 12. 19. 9–12) have been reexamined. They comprise one adult and three young. The following notes were made on the adult specimen: Head-and-body length, 23.8 mm.; transverse diameter of tympanum, 0.8 mm.; transverse diameter of eye, 2.9 mm.; anterior edge of eye to nostril, 2.4 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of tympanum; no tarsal fold;

inner metatarsal tubercle slightly larger than outer one; large subarticular tubercles; small supernumerary tubercles on plantar surface of foot; ball-like apical disks on fingers; first finger shorter than second; no vomerine teeth; tongue subpyriform in outline, indistinctly notched behind; abdomen and under surface of thighs coarsely areolate.

Some individual variation in the general color pattern was observed in the small series of specimens examined. The darker markings are much more conspicuous on some than on others, and the ground color varies from olive-gray to reddish brown. Some of the specimens have a light-colored lumbar gland with wavy or zigzag dark streaks. The others have the lumbar gland largely black with branching light streaks or with light centers. A surprising degree of variation exists in the relative measurements of the body, tympanum, and eye. Four specimens, one of which is from Guerrero (U.S.N.M. No. 47012), two from Nayarit (A.M.N.H. Nos. 12552–53), and one from Puebla (A.M.N.H. No. 13867) measure, respectively, as follows: Head-and-body length, 26.8, 22.4, 25.2, and 26 mm.; transverse diameter of tympanum, 1.3, 0.9, 1.2, and 1 mm.; transverse diameter of eye, 3.1, 2.9, 3, and 3.7 mm.; anterior edge of eye to nostril, 2.8, 2.3, 2.5, and 2.6 mm.

Examination of specimens in the British Museum of Natural History by Dr. E. R. Dunn disclosed three additional records for this frog. These localities are: Guanajuato (No. 1898. 7. 19. 10); Tancitaro in Guerrero (Nos. 1914. 1. 28. 176–180); and Chilpancingo in Guerrero (No. 1906. 6. 1. 1899).

The single known species may be recognized by the following combination of characters: Coloration of upperparts brownish, grayish, or olive gray, spotted or splotched with some darker color or with black; a dark triangular interorbital spot sometimes present; snout in front of transverse interorbital light line rarely light colored; lip border spotted with brown or green; lumbar gland coextensive with an oval partly brown or partly black spot, with two or three white dots, or with light background and zigzag dark streaks; fore and hind limbs with brown or black cross bands; a conspicuous light-colored spot on anterior surface of upper end of thigh; remainder of thigh broadly marbled with brown and white; coloration of underparts uniform white, or spotted with black, or brownish with obscure light stippling; canthus rostralis rounded; snout subacuminate and rounded; loreal region subvertical; tympanum vertically oval or circular, about one-third diameter of eye; diameter of eye a little more than or equivlent to its distance from nostril; body slender; tongue entire or indistinctly notched behind; maxillary teeth present; no vomerine teeth; sacral diapophysis not widened; skin of upperparts fairly smooth, but with scattered rugosities and small tubercles; skin of abdomen smooth or faintly granulated; fore limb slender; first finger slightly shorter

than or subequal with second; fingers and toes quite free, with small but distinct terminal disks; subarticular tubercles very prominent; supernumerary tubercles continued backward on palmar and plantar surfaces; two distinct metatarsal tubercles; the hind limb being carried forward along the body, the tibio-tarsal joint reaches the tympanum or at most to the posterior margin of the eye; head-and-body length, 20 to 26.5 mm.; adults probably 25 to 26.8 mm.

Specimens examined.—Nine, as follows:

Tomodactylus nitidus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			NAYARIT:		
A.M.N.H.	12553	1	El Ocotillo	Nov. 14, 1919	Paul D. R. Ruthling.
Do.	12552	1	Before reaching Las Chivas	Nov. 17, 1919	Do.
			GUERRERO:		
B.M.	1901. 12. 19. 9–12	[1] 4	Amula		F. D. Godman.
U.S.N.M.	47012	1	El Limon [=Limoncito]	Apr. 2, 1903	Nelson and Goldman.
			PUEBLA:		
A.M.N.H.	13867	1	Santa Catarhina	July 31, 1920	Paul D. R. Ruthling.
M.N.B.	6669	[2] 1	No definite locality		Herr Berkenbusch.

[1] Cotypes of *Tomodactylus amulae*. [2] Type of *Liuperus nitidus*.

Genus SYRRHOPHUS Cope

1878. *Syrrhophus* COPE, Amer. Nat., vol. 12, no. 4, p. 253, Apr. [Genotype, *Syrrhophus marnockii* COPE, *idem*, p. 253 (near San Antonio, Texas).]

1879. *Malachylodes* COPE, Proc. Amer. Philos. Soc., vol. 18, no. 104, p. 264, June 20. [Genotype, *Malachylodes guttilatus* COPE, *idem*, p. 264 (Guanajuato, Mexico).]

1885. *Hypodictyon* COPE, Proc. Amer. Philos. Soc., vol. 22, pt. 4, no. 120, p. 383, Apr. 17. [Genotype, *Phyllobates ridens* COPE, 1866, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 131, May (St. Juan River, Nicaragua).]

1888. *Syrrhopus* BOULENGER, Proc. Zool. Soc. London, pt. 2, p. 206, Aug. [Emendation of *Syrrhophus* COPE.]

1900. *Syrrhaphus* GÜNTHER, Biologia Centrali-Americana, Reptilia and Batrachia, p. 215, Apr. [Emendation of *Syrrhophus* COPE.]

Although these small Mexican frogs resemble the young of *Eleutherodactylus*, they lack vomerine teeth and have a rounded canthal region with no discernible ridge. The Mexican species do not have a tarsal fold. It would seem that the species of *Syrrhophus* either are so closely interrelated that the resemblances far outnumber the differences, or else the names available exceed the recognizable species. The specific differences that have been noted seem rather trivial in some instances. One can not be certain from the material at hand whether an areolated condition of the skin has any diagnostic significance for differentiating the species. With the existing inadequacy of the material it would be difficult to justify the suppression of specific names for which only a single specimen is available or for which the original description is the sole available source of information.

A taxonomist should act as an impartial judge in matters relating to the validity of species, for it is his business to ascertain how many actually exist and, having done so, to designate the characters by which they may be recognized. Unfortunately, the lack of a uniform yardstick for measurement of distinctness makes the recognition of species a matter of interpretation, since different sets of characters must unavoidably be used in the discrimination of species in unrelated and occasionally in related genera.

Specimens collected half a century or more ago are generally so poorly preserved that any precise determination of their structural peculiarities is out of the question. Freshly preserved specimens would be much better to work with than some of the types of Mexican species of *Syrrhophus* described by Cope. A satisfactory elucidation of the Mexican species of *Syrrhophus* will necessarily await the accumulation of an adequate series of well-preserved or of living individuals, preferably topotypes. For the present the toothless eleutherodactylids to which names have been applied are listed merely as nominal species without regard to their possible relationships, since in most instances they are known solely from the material available to the original describer.

According to H. W. Parker [51] the large eggs of *Syrrhophus* suggest a shortened life history.

KEY TO MEXICAN SPECIES OF SYRRHOPHUS

1. Tympanum very small, one-third or at most less than one-half the diameter of the eye 2
   Tympanum larger, one-half to two-thirds the diameter of the eye 3

2. Smooth skin on hinder half of abdomen; tympanic membrane one-third the diameter of the eye; canthal region rounded, with no discernible ridge; loreal region subvertical; muzzle broadly acuminate and obtuse; head flat above, the maximum width of upper eyelid two-thirds the width of interorbital region; nares lateral and terminal, and their distance from eye less than one-half the diameter of the latter; tongue subpyriform; skin of upperparts, sides, throat, chest, and belly smooth; underside of thighs coarsely granulated; fingers free, without any vestige of membrane at base; first finger shorter than second; large subarticular or supernumerary tubercles at ends of metapodials of fingers; apical disks of fingers and toes slightly wider than corresponding digit, but not especially enlarged, truncated at extremity, and flattened; a large palmar tubercle; toes with slight vestige of web at base; free portion of fourth toe more than twice the length of free portion of fifth; small subarticular or supernumerary tubercles extended backward on inferior surfaces of metatarsals; inner metatarsal tubercle larger than outer; the hind limb being carried forward along the body, the tibio-tarsal joint reaches about the middle of the eye; the hind limbs being

[51] Parker, H. W., Ann. and Mag. Nat. Hist., ser. 9, vol. 20, no. 118, p. 452, Oct., 1927.

placed at right angles to the long axis of the body, the heels touch but do not overlap; upperparts dark mulberry brown, dotted with moderately large gray spots (yellow in life); lores and upper lip black; underparts pale pinkish brown, without markings; head-and-body length, 24 mm.----------leprus (p. 128)

Areolate skin on hinder half of abdomen; tympanic membrane more than one-third but less than one-half the diameter of the eye; canthal region rounded, with no discernible ridge, loreal region subvertical; head flat above; maximum width of upper eyelid one-half to two-thirds the width of interorbital region; external nares small, rather widely separated, and their distance from the eye slightly less than diameter of the latter; tongue subpyriform; skin of upperparts and sides apparently smooth, but actually areolated as seen under the lens; areolation on lower half of sides visible without aid of lens; skin of underparts smooth, except posterior half of abdomen, which is areolated; inferior surfaces of thighs coarsely granular; fingers free, without vestige of membrane at base; first finger shorter than second; large subarticular or supernumerary tubercles continued backward on metacarpals; a large palmar callosity; apical disks slightly wider than finger, truncated at extremity, and apparently flattened; toes with slight vestige of web at base; free portion of fourth toe twice as long as free portion of fifth; subarticular or supernumerary tubercles especially large at ends of metapodial bones; plantar surface of foot covered with numerous minute tubercles; inner metatarsal tubercle larger than outer; no tarsal fold; apical disks of toes smaller than those of fingers; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to posterior edge or to middle of eye; the hind limbs being placed at right angles to the long axis of the body, the heels overlap slightly; upperparts (in alcohol) ranging from dark vinaceous-drab to brownish drab, marked with numerous blue-black spots without sharply defined borders, but tending to merge with ground color of upperparts; a blue-black mark curving from above downward behind tympanum; fore and hind limbs with dark cross bands; external digit of hand and foot with faint cross bands; upper and posterior surfaces of femur with white or light-colored spots on a darker ground color; edge of upper lip with a few light splotches; darker streak along canthal region from external narial opening to eye; ground color much lighter on sides, with distinct light spots; inferior surfaces light colored, unspotted; head-and-body length, 22 mm.----------guttilatus (p. 127)

3. Skin of upperparts distinctly roughened, with wartlike tubercles; sides areolated; tympanum very distinct, in diameter equal to one-half to two-thirds of that of eye; canthal region rounded, no discernible ridge; loreal region vertical; snout a little longer than diameter of eye; skin on throat and breast smooth; hinderpart of belly areolated; underside of thighs closely granulated; first finger shorter than second, fourth a little longer than second; distinct subarticular tubercles; apical disks moderately large, but those of two outer fingers appreciably larger than the tolerably small disks of the toes;

toes free, progressively increasing in length from first to fourth, the fifth being a little shorter than third; large subarticular tubercles extended backward upon inferior surfaces of metatarsals; plantar surface covered with small supernumerary tubercles; inner and outer metatarsal tubercles slightly if at all larger than the subarticular tubercles; upperside of body and limbs yellow-brown, spotted and stippled with black; a dark streak along canthal region and above tympanum; large triangular black mark with apex pointing backward occasionally present in interorbital region; loreal and temporal region blackish brown; underside brownish yellow, sprinkled with dark; a black mark over large tympanum; head-and-body length, 20 mm ..... **verruculatus** (p. 129)

Skin of upperparts generally apparently smooth, but often areolate, and rarely shagreen 4

4. Tympanum subround, about one-half, occasionally less, diameter of eye; canthal region rounded, with no discernible ridge; loreal region subvertical; muzzle rather elongate, with narrowed and rounded extremity; nares lateral and their distance from eye less than diameter of the latter; tongue pyriform, much narrowed in front; skin of upperparts and sides apparently smooth, but actually areolated under the lens; skin of throat and chest smooth; hinder half of belly smooth or areolate; inferior surfaces of thighs coarsely granulated; fingers free, without any vestige of membrane at base; first finger shorter than second; large subarticular tubercles at ends of metapodials of fingers; apical disks somewhat wider than corresponding finger and appreciably larger than small disks on the toes; a large palmar callosity; toes with slight vestige of web at base; free portion of fourth toe more than twice the length of free portion of fifth; small subarticular tubercles continued backward on inferior surfaces of metatarsals; inner metatarsal tubercle slightly larger than outer; the hind limb being carried forward along the body, the tibio-tarsal joint reaches either to the middle or to the anterior margin of the eye; the heels being placed at right angles to the long axis of the body, the heels overlap; upperparts reddish or dark mulberry brown, thickly spotted or speckled with large darker brown or blackish blotches, the largest of which reaches to between the eyes; limbs obscurely cross-banded; a black or dark mark extends from above to behind tympanum; upper lip with a few pale spots; loreal region dark colored or with dark streak along canthal region from external narial opening to eye; sides paler, with distinct spots; underparts uniformly leather brown or yellowish; head-and-body length, 22.5 mm. ..... **cystignathoides** (p. 127)

Tympanum more than two-thirds the diameter of the eye; canthus rostralis obtuse or blunt; loreal region vertical; head flat above, moderately wide, with muzzle slightly prominent; external nares almost at extremity of muzzle; skin everywhere smooth except on the sides, which are tubercular areolate; no abdominal or gular fold; apical disks of fingers a little larger than those of toes; one large palmar tubercle; toes of moderate length, with small disks, and with prominent subarticular tubercles, which are especially large at ends of meta-

podial bones; two small metatarsal tubercles; the hind limb being carried forward along the body, the tibio-tarsal joint reaches the anterior edge of the eye; color above, dark bluish gray, marked with numerous black spots with ill-defined borders; limbs similar, with black cross bands, which are continued on external digit of each foot; closely spaced white spots on dark ground color of upper surface of femur; a few small white spots on the dark posterior face of femur; edge of lips with a few light spots; underparts, white, unspotted; head-and-body length, 23.5 mm.....**verrucipes** (p. 128)

SYRRHOPHUS CYSTIGNATHOIDES (Cope)

1877. *Phyllobates cystignathoides* Cope, Proc. Amer. Philos. Soc., vol. 17, no. 100, p. 89, July 20.

Type locality.—Potrero, near Cordoba, State of Vera Cruz, Mexico.

Range.—Not known to occur elsewhere than at the type locality.

Remarks.—Cope stated that "numerous specimens of this species were found by Francis Sumichrast at Potrero, near Cordoba, Vera Cruz, under the decayed trunks of trees." No other observations on its habits have been published. There are now eight specimens in the jar containing the cotypes of this species, although it is possible that a larger series was loaned Cope. At that time Cope was actively engaged in extending our knowledge of the herpetology of North and South America, and incoming material apparently was often shipped by the Smithsonian Institution directly to Cope without being unpacked. Cope managed to publish reports on these collections about as fast as they were received. The cotypes of *cystignathoides* have the fronto-parietals meeting medially, eliminating the fontanelle. No type is designated, and only one specimen (U.S.N.M. No. 32402) has the skin dissected away from the cranium to expose the fronto-parietal region. The following measurements were taken from a cotype (U.S.N.M. No. 32404): Head-and-body length, 22.5 mm.; transverse diameter of tympanum, 1.2 mm.; transverse diameter of eye, 3 mm.; anterior edge of eye to nostril, 2.3 mm. It is quite possible that these cotypes may be the young of *Leptodactylus melanonotus*, as all of them have a dark occipital spot that extends laterally upon the upper eyelids in the posterior interorbital region.

Specimens examined.—The eight cotypes (U.S.N.M. Nos. 32402–09) collected by Francis Sumichrast at Potrero, near Cordoba, Vera Cruz.

SYRRHOPHUS GUTTILATUS (Cope)

1879. *Malachylodes guttilatus* Cope, Proc. Amer. Philos. Soc., vol. 18, no. 104, p. 264, June 20.

Type locality.—Guanajuato, State of Guanajuato, Mexico.

Range.—So far known to occur only in the sierras of southern San Luis Potosi and in the vicinity of Guanajuato.

Remarks.—Cope considered that the presence of a fronto-parietal fontanelle was of sufficient importance to warrant a generic separation of this form from related species of *Syrrhophus*. The type of this species (U.S.N.M. No. 9888) should be compared with the young of *Leptodactylus melanonotus*. It was collected by Alfred Dugés at Guanajuato and is now somewhat shrunken and faded. It measures as follows: Head-and-body length, 21.7 mm.; transverse diameter of tympanum, 1.2 mm.; transverse diameter of eye, 3 mm.; anterior edge of eye to nostril, 2.2 mm. The terminal phalanges of the toes on left hind foot are missing.

Specimens examined.—Three, as follows:

Syrrhophus guttilatus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			GUANAJUATO:		
U.S.N.M.	9888	[1] 1	Guanajuato		Alfred Dugés.
Do.	9907	1	do		Do.
M.C.Z.	1670	1	SAN LUIS POTOSI: Sierra di San Miguelito, 9 leagues south of San Luis Potosi.	Oct. 10, 1879	Edward Palmer.

[1] Type.

SYRRHOPHUS LEPRUS Cope

1879. *Syrrhophus leprus* COPE, Proc. Amer. Philos. Soc., vol. 18, no. 104, p. 268, June 20.

Type locality.—Santa Efigenia in Tehuantepec, State of Oaxaca, Mexico.

Range.—Not known to occur elsewhere than at the type locality.

Remarks.—Our knowledge of this little toothless frog is limited to the type specimen (U.S.N.M. No. 10040) collected by Francis Sumichrast. So far as known no other collector has since rediscovered this species. The coloration as described by Cope does not seem to agree with what might be expected to occur in the young of the leptodactylids whose geographic ranges include Oaxaca. The measurements are as follows: Head-and-body length, 24.3 mm.; transverse diameter of tympanum, 1.4 mm.; transverse diameter of eye, 3.5 mm.; anterior edge of eye to nostril, 2.5 mm.

Specimens examined.—One, the type.

SYRRHOPHUS VERRUCIPES Cope

1885. *Syrrhophus verrucipes* COPE, Proc. Amer. Philos. Soc., vol. 22, pt. 4, no. 120, p. 383, Apr. 17.

Type locality.—At the bottom of a rocky gorge of a stream near its junction with the San Miguel River, at least 1,800 feet below the town of Zacualtipan in northeastern Hidalgo, Mexico.

Range.—Not known to occur elsewhere than at the type locality.

Remarks.—The present location of the type of this species is unknown. It is possible that it may be found in the Academy of Natural Sciences of Philadelphia along with other types from Cope's collection, since it formed part of a small collection made by Cope and Dr. Santiago Bernad. No specimens referable to this species were found in any American institution.

Specimens examined.—None.

SYRRHOPHUS VERRUCULATUS (Peters)

1870. *Phyllobates verruculatus* PETERS, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 650, Aug.

Type locality.—Huanusco [=? Huatusco, State of Vera Cruz, Mexico].

Range.—From the Rio Necaxa in northeastern Puebla southward to central Vera Cruz (? Huatusco).

Remarks.—It seems quite probable that some mistake in the original label or in the printing of the description led Peters to publish Huanusco as the type locality. No place name with this spelling was located on any of the Mexican maps, and it would appear that Huatusco in Vera Cruz was the intended locality.

The genus *Hypodictyon* was proposed by Cope in 1885 for species with an areolated abdomen. Peters's *verruculatus* was one of the three species mentioned as possessing this character. A reexamination of the cotypes of *cystignathoides* shows that they likewise have an areolated abdomen and this condition also exists in *guttilatus*. Faulty preservation may account for some of the differences noted. On the basis of available material it would seem that this areolated condition of the skin is of little significance.

The type of *Phyllobates verruculatus* (M.N.B. No. 6957), according to Doctor Dunn, has a large tympanum with a black mark over it, no distinct terminal disks, heavy subarticular tubercles, no vomerine teeth, and a parotoid gland. The lumbar gland is not present. A specimen in the British Museum (No. 1906. 6. 1. 100) from Buena Vista, Guerrero, is referred to this species by Dunn.

Specimens examined.—One (U.M.U.M. No. 2), collected at Necaxa, Puebla, July 5, 1926, by H. B. Baker.

Family HYLIDAE Günther

1858. Hylidae GÜNTHER, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 96.

Tropical forests must have tree frogs, according to Dr. Hans Gadow, and in each region these are fashioned from the nearest available material. In Mexico, most of the frogs that live in the trees belong to the family Hylidae, but elsewhere in Central and South America, as well as in Mexico, there are a number of less closely related frogs

that have been adapted to an arboreal life. The ends of the fingers and toes are provided with adhesive disks, by means of which these tree frogs are able to obtain a firm foothold on relatively smooth surfaces, though they are employed mainly for climbing and for clinging to foliage and limbs when jumping. Diverse ecological niches are filled with different kinds of animals, and it is therefore not surprising that Mexico with its varied climate and topography should be endowed with a remarkable assemblage of hylids. Not less than 7 genera and 20 species are recognized in this review.

Most peculiar of all these hylids is the marsupial frog *Gastrotheca*, in which the whole brood is sheltered in a common pouch on the back of the female. Another interesting genus, *Phyllomedusa*, is represented herein by three species. Some tree frogs of the genus *Phyllomedusa* are known to lay their eggs in nests of froth attached to leaves, but unfortunately the life histories of those that occur in Mexico are unknown, and it is barely possible that all of them may not have acquired this curious habit. The eggs of one species of the diminutive toothless *Hylella* are laid in the sheathing leaf bases of a dust-feeding plant that grows on tropical trees.

A curious adaptation to the habit of digging occurs in the genus *Pternohyla*, which differs from other hylids in having a shovellike internal metatarsal tubercle. Tree frogs without a visible covering of skin on their heads also occur in Mexico. Besides *Gastrotheca* and *Pternohyla*, there are two other little-known genera, *Diaglena* and *Triprion*, with bony casques. The presence of palatine or parasphenoid teeth in *Diaglena* and their absence in *Triprion* are quite inexplicable.

The gradation in the size of the adhesive disks possessed by the Mexican hylas suggests that arboreal adaptation has not progressed with equal rapidity and that some species of the genus *Hyla* are better adapted for climbing than others. The hind limbs of most of these hylas are elongated for leaping, though the ability to jump seems to vary with the different species. One of the larger species, *H. venulosa*, has been known to leap and alight without injury from a height of 140 feet. The extent of the webbing between the toes varies in the different species. In *H. miotympanum* the toes are four-fifths webbed. Some individuals of *H. eximia* have the toes not more than half webbed.

Within certain limits tree frogs can change their general coloration so that their bodies will blend more perfectly with the surroundings. These changes in color are more marked in some species than in others. One of the most widely distributed Mexican species, *H. baudinii*, seems to have an exceptional color range. Most of the Mexican hylas have their own distinctive color patterns or markings and, while the general coloration is not necessarily dull, brilliant hues are never contiguous.

KEY TO GENERA OF MEXICAN HYLIDAE

1. Derm of head of adults completely involved in cranial ossification, forming a bony casque 2
   Derm of head of adults not involved in cranial ossification and not forming a bony casque; head covered with soft loose skin; no parasphenoid teeth 5
2. Posterior edge of bony casque studded with high, conical, erect, bony spines; top of head bony; canthus rostralis sharply defined, granular; snout rounded; loreal region concave; upper labial borders smooth, not projecting conspicuously beyond lower jaws; supratympanic ridge strongly elevated, tubercular; supraciliary crest tubercular; interorbital space concave; vomerine teeth in two nearly transverse rows on level with posterior margins of choanae; no parasphenoid teeth; tongue subcircular, not or slightly notched behind; pupil horizontal, circular when contracted; tympanum circular, two-thirds diameter of eye; fingers free; toes one-third webbed; adhesive disks of fingers and toes smaller than tympanum; tarsal fold distinct; large internal metatarsal tubercle; no outer metatarsal tubercle; female with dorsal pouch---**Gastrotheca** (p. 133)
   Posterior edge of bony casque more or less upturned, but without high conical spines; upper labial borders projecting conspicuously beyond lower jaws; snout extended beyond symphysis of lower jaws; females without dorsal pouch 3
3. Inner metatarsal tubercle greatly enlarged and compressed; outer metatarsal tubercle quite small; eye separated from outer margin of flaring labial border of upper jaw by an interval equivalent to more than one-third of its diameter; posterior edge of rugose bony casque not upturned; canthus rostralis raised, curved, separating external nares; snout rounded; loreal region very wide, concave; upper labial borders projecting and slightly upturned; interorbital space broader than upper eyelid, deeply concave; vomerine teeth in two groups between choanae; no parasphenoid teeth; tongue circular, notched behind; pupil transversely oval; tympanum oval, one-half to two-thirds diameter of eye; fingers slender, free or with vestigial web at base; no projecting rudiment of pollex; toes slender, one-third webbed; adhesive disks of fingers and toes quite small, considerably smaller than tympanum; subarticular tubercles small, prominent; tarsal fold absent or faint; skin of back closely granulated; underparts and inferior surface of thighs coarsely granulated; upperparts brownish, with large elongate insuliform or anastomosing dark-brown black-edged spots; thighs sulphur yellow, marbled with dark brown; upper surfaces of fore and hind limbs with large dark brown transverse spots; underparts white----------**Pternohyla** (p. 135)
   Inner metatarsal tubercle not greatly enlarged; eye almost in contact with outer margin of flaring labial border of upper jaw; tympanum distinct; transverse vomerine and longitudinal parasphenoid teeth present, the former in two small clusters and the latter in a single narrow row 4
4. Palatine teeth present, forming slightly curved row on each side posterior to choanae; vomerine teeth in two narrowly separated clusters between choanae; parasphenoid teeth small, closely

set, and forming single longitudinal series; top of head bony; canthus rostralis or preorbital ridge very little elevated, terminating posteriorly in an obtuse tuberosity above anterior margin of eye, meeting the opposite one at level of or in front of the external nares, and continuing forward to muzzle as narrow elevated ridge; crenelations on superior labial borders extending inward at least halfway to canthus rostralis; upper labial margin moderately thick, abruptly elevated in front of eye, producing there a sharp angle from which it curves or slopes toward muzzle and tympanum; supratympanic ridge not very sharp; posterior margin of bony casque thick, rugose; interorbital space rather concave; tongue not or slightly notched behind; pupil transversely oval when expanded, subquadrangular when contracted, but never vertical; tympanum oval or circular, two-thirds diameter of eye; fingers free; toes one-half webbed; adhesive disks of fingers and toes much smaller than tympanum; short tarsal fold; upperparts light olive, with dark spots----------**Diaglena** (p. 137)

Palatine teeth absent; vomerine teeth in two narrowly separated clusters between choanae; parasphenoid teeth small, closely set, and forming single longitudinal series; top of head bony; canthus rostralis developed as high preorbital ridge, which is continuous or nearly so with the opposite one considerably behind external nares, terminating posteriorly in strong projection above anterior margin of eye, and not continued forward in front of external nares as elevated ridge in case of adults; upper labial margin thin, curved, but not abruptly elevated in front of eye; prominent bony supratympanic ridge; posterior margin of bony casque thin, upturned, and nearly straight; interorbital space deeply concave; tongue subcircular, slightly notched behind; pupil vertical; tympanum oval, one-half diameter of eye; fingers united by vestigial web at base; toes one-half webbed; adhesive disks of fingers and toes smaller than tympanum; indistinct tarsal fold; coloration of upperparts brownish, with darker spots; head with lighter spots----------**Triprion** (p. 138)

5. Pupil vertical; vomerine teeth generally present in two oblique clusters between choanae; palatine and parasphenoid teeth absent; tympanum distinct, more than one-half diameter of eye; canthus rostralis rounded; upper labial margin not projecting; tongue entire or slightly notched behind; interorbital space broader than upper eyelid, imperceptibly convex; webbing between fingers and toes variable in extent; adhesive disks of fingers and toes varying from less than half to more than the diameter of the tympanum; subarticular tubercles of fingers and toes distinct; first finger shorter than second; first and second fingers opposable; a projecting rudiment of the pollex; a faint tarsal fold present; outer metatarsals united; diapophyses of sacral vertebrae strongly dilated; mesosternum cartilaginous, posteriorly notched and rounded. ----------**Phyllomedusa** (p. 139)

Pupil horizontal; tympanum distinct or indistinct---------- **6**

6. Vomerine teeth present; tongue not or slightly notched behind; fingers and toes with adhesive disks, the former free or webbed, the latter always webbed----------**Hyla** (p. 147)

Vomerine teeth absent; tongue circular or suboval, slightly notched behind; fingers and toes with adhesive disks, the former webbed at the base and the latter extensively webbed.
---------- Hylella (p. 179)

Genus GASTROTHECA Fitzinger

1843. *Gastrotheca* Fitzinger, Systema reptilium, fasc. 1, p. 30. [Genotype, *Hyla marsupiata* Duméril and Bibron, 1841, Erpétologie générale, vol. 8, p. 598, pl. 98 (Cuzco, Peru).]

1854. *Notodelphys* Lichtenstein and Weinland, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 373, July. [Genotype, *Notodelphys ovifera* Lichtenstein and Weinland, *idem*, p. 373 (Puerto Cabello, Venezuela).] [Preoccupied by a genus of Entomostraca, *Notodelphys* Allman, 1847, Ann. and Mag. Nat. Hist., ser. 1, vol. 20, no. 130, p. 2, July.]

1858. *Nototrema* Günther, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 115. [Genotype, *Hyla marsupiata* Duméril and Bibron, 1841, Erpétologie générale, vol. 8, p. 598, pl. 98 (Cuzco, Peru).]

1858. *Opisthodelphys* Günther, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 117. [New name for *Notodelphys* Lichtenstein and Weinland, preoccupied.]

One of the most extraordinary adaptations for protecting the developing eggs is found in the marsupial frog *Gastrotheca*. The female has a dorsal pouch into which the eggs are probably introduced by the male. The whole development of the embryo, including the gilled stage, is passed within the gelatinous capsule of the egg in some of the species. In some of the South American species, particularly *G. marsupiata*, about 100 large eggs are deposited in the dorsal pouch and only a part of the metamorphosis is undergone within the egg. In this species the young escape from the common brood pouch in the tadpole stage. In other species, especially *G. ovifera*, a few unusually large eggs are introduced into the dorsal brood pouch, and there the young remain until the metamorphosis is completed. The life history of the Mexican species, *G. coronata*, is unknown.

GASTROTHECA CORONATA Stejneger

1858. *Opisthodelphys ovifera* Günther, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 117 (Cordoba, Mexico). [*Nec Notodelphys ovifera* Lichtenstein and Weinland, 1854, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 373, July; and Weinland, 1854, *in* Joh. Müller's Archiv. f. Anat. u. Physiol., Berlin, pp. 449–477, pls. 17–19 (Puerto Cabello, Venezuela).]

1882. *Nototrema oviferum* Boulenger, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 418.—Günther, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 288, pl. 74, fig. A, Sept.

1911. *Gastrotheca coronata* Stejneger, Proc. U. S. Nat. Mus., vol. 41, no. 1857, p. 287, Aug. 14.

Type locality.—Palomo, Valle de Orosi, Cartago, Costa Rica.

Range.—Exact limits of range unknown; occurs at Cordoba, Vera Cruz, Mexico, as well as in vicinity of type locality in Costa Rica. No specimens have been recorded from intermediate localities.

Remarks.—In commenting upon *Gastrotheca coronata,* Dr. L. Stejneger concluded that it is—

> probably the same as the young specimen from Carillo, Costa Rica, described and figured by Guenther in the Biologia Centrali-Americana as *Nototrema oviferum,* and possibly also with the Mexican specimen from Cordova in British Museum, described by Boulenger under the same name. I feel confident, however, that none of these belong to the true *Gastrotheca ovifera* of Weinland, from Venezuela.

Two marsupial frogs were listed by Günther as having been collected in Mexico. The one from the Sallé collection is a half-grown male collected at Cordoba in Vera Cruz. The adult male labeled as coming from Mexico was purchased from Émile Parzudaki, a Paris dealer in natural-history specimens. According to Gerrit S. Miller, jr., the localities given to specimens purchased from Parzudaki have the reputation in the British Museum of being quite unreliable.

The following notes were made on the specimen purchased from Sallé:

B.M. No. 1930. 4. 10. 1; Cordoba, Vera Cruz, Mexico, Sallé's collection: Head-and-body length, 64.6 mm.; transverse diameter of tympanum, 5.1 mm.; transverse diameter of eye, 8.2 mm.; anterior edge of eye to nostril, 5.8 mm.; posterior margin of bony casque to tip of snout, 20.6 mm.; width of head at level of posterior angles of jaws, 21.3 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches slightly beyond anterior margin of orbit; a thin tarsal fold reaches more than halfway from base of first toe to tibio-tarsal joint; toes about one-third webbed, the membrane reaching to base of last phalanx on first, second, third, and fifth toes, and leaving free the last two phalanges on fourth toe; a prominent inner metatarsal tubercle, but no outer one; subarticular and supernumerary tubercles on plantar surface of foot; first finger barely reaches apical disk of second; apical disks of fingers large; fingers not webbed at base; vomerine teeth in essentially transverse rows, between and slightly behind level of choanae; tongue subcircular, scarcely free behind; canthus rostralis raised and surmounted by a ridge of minute tubercles; interorbital width 7.9 mm., considerably greater than width of upper eyelid; posterior edge of bony casque with high, conical, erect bony spines; a similar series above tympanum, and a smaller series of spines takes the place of the combined supraciliary and postorbital curved cranial crest; upperparts apparently without darker color markings; sides with four light-edged dark pear or gourd shaped spots, oblique in position, and with the constricted end dorsal; the anterior spot is nearly longitudinal and extends forward over scapula; upper surface of thigh with three light-edged dark cross bands; under or concealed surface of tibia with three pairs of large light-edged dark spots in

place of transverse bars; four light-edged transverse dark bands on upper surfaces of tarsus and metatarsus.

Specimens examined.—Two, as follows:

Gastrotheca coronata

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	48279	[1] 1	COSTA RICA: Palomo, Valle de Orosi, Cartago, 1,200 meters altitude.	Apr. 19, 1911	C. Picado.
B.M.	1930.4.10.1	1	VERA CRUZ: Cordoba		Auguste Sallé.

[1] Type.

Genus PTERNOHYLA Boulenger

1882. *Pternohyla* BOULENGER, Ann. and Mag. Nat. Hist., ser. 5, vol. 10, no. 58, p. 326, Oct. [Genotype, *Pternohyla fodiens* BOULENGER, *idem*, pp. 326, 327, figs. (Presidio, State of Sinaloa, Mexico).]

This is a monotypical genus. The one known species is apparently as well adapted to a fossorial as to an arboreal life. A distinctive color pattern, a bony casque, a spadelike internal metatarsal tubercle, and absence of parasphenoid teeth characterize this frog.

PTERNOHYLA FODIENS Boulenger

1882. *Pternohyla fodiens* BOULENGER, Ann. and Mag. Nat. Hist., ser. 5, vol. 10, no. 58, pp. 326, 327, figs., Oct.—GÜNTHER, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 292, pl. 74, fig. B, Dec.

1899. *Hyla rudis* MOCQUARD, Bull. Soc. Philom. Paris, ser. 9, vol. 1, no. 4, pp. 163, 164, pl. 1, fig. 3 (Guadalajara, Jalisco, Mexico).

Type locality.—Presidio, 50 miles from Mazatlan, State of Sinaloa, Mexico.

Range.—Pacific drainage of Mexico, from Rosario in Sinaloa southward through Nayarit and Jalisco to Colima.

Remarks.—The type of *Pternohyla fodiens* (B.M. No. 1882. 11.27.8) was purchased from Alphonso Forrer and agrees with the description published by Boulenger. The following supplementary notes were made on this specimen: Head-and-body length, 60.7 mm.; transverse diameter of tympanum, 3.5 mm.; transverse diameter of eye, 5.8 mm.; anterior edge of eye to nostril, 5.2 mm.; posterior margin of bony casque to tip of snout, 18.6 mm.; width of head at level of angle of jaws, 20.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to anterior margin of tympanum; no tarsal fold; very large internal metatarsal tubercle, but no outer one; tip of first finger does not reach apical disk of second; vomerine teeth between and slightly in advance of level of middle of choanae; upperparts with dark elongate spots arranged or grouped so as to simulate longitudinal stripes; throat with aggregations of small brown spots; belly areolate and whitish.

After I read Mocquard's description of *Hyla rudis*, it became apparent that it was certainly not a *Hyla* and furthermore that it seemed to agree rather closely with specimens of this species. A reexamination of the type revealed that it was unquestionably a young individual of *Pternohyla fodiens*. The type of *H. rudis* (M.H.N.P. No. 373*a*, parchment label No. 97–217) was collected at Guadalajara in Jalisco by Léon Diguet. The following notes were made on this specimen: Head-and-body length, 34.5 mm.; tympanum one-half diameter of eye; top of head flat and rugose; the hind limb being carried forward along the body, the tibio-tarsal joint does not reach to edge of minute tympanum; a very faint indication of a tarsal fold; toes scarcely webbed; fingers free; very small adhesive disks; large inner metatarsal tubercle; abdomen and under surface of thighs coarsely areolate or granular. The color pattern described by Mocquard, the presence of a large internal metatarsal tubercle, as well as other peculiarities noted above are all characters that distinguish *P. fodiens* from other Mexican hylids.

A series of 67 of these burrowing tree frogs (A.M.N.H. Nos. 12415–12458; 12460–12482), all collected in Mexico by Paul D. R. Ruthling, are especially interesting, for they range in size from young with a body length of 17.5 mm. (No. 12482) to adults with a head-and-body length of 45 mm. (No. 12457). The young generally have a single pair of black spots on the posterior sacral region in front of the vent, and all except the very youngest have the characteristic splotched upperparts. The shape of the head is about the same in young and in adults, but in the former the ornamentation is less obvious because of the less advanced stage of dermal ossification, and in quite young individuals the loreal region is oblique and not shelving.

Nelson and Goldman removed one of these frogs from the stomach of a snake (*Leptophis diplotropis*) killed at Acaponeta in Nayarit. No field notes on the habits of this frog are available, but Boulenger (*op. cit.*) has published some observations on a living specimen obtained at Presidio by A. Forrer. He says:

> It is a timid creature, getting very frightened when handled, whilst all other Hylidae I have seen alive are very indifferent under similar circumstances. It is slow in its movements, and not a good climber. Its habits are more burrowing than arboreal. It is not able to climb up a glass, but burrows itself deeply in the moss by means of its metatarsal shovels, the movements executed in this proceeding being exactly those of *Pelobates*. I believe this to be the first instance of an adaptation to both burrowing and arboreal life.

Specimens examined.—Seventy-eight, as follows:

Pternohyla fodiens

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SINALOA:		
B.M.	82.11.27.8	[1] 1	Presidio de Mazatlan		Alphonso Forrer.
U.S.N.M.	46956–60	5	Rosario, 250 feet altitude	July 10, 1897	Nelson and Goldman.
Do.	47441	1	do	do	Do.
U.S.N.M.	47442	1	NAYARIT: Acaponeta	July 1, 1897	Do.
			JALISCO:		
A.M.N.H.	12476–77	2	Cerro del Col or Cerro del Cuatro.	Sept. 18, 1919	Paul D. R. Ruthling.
Do.	12460–74	15	El Fuerte near Ocotlan	Aug. 17, 1917	Do.
M.H.N.P.	373a	[2] 1	Guadalajara		Léon Diguet.
A.M.N.H.	12475	1	Hacienda de Santa Maria Magdalena.	Sept. 29, 1919	Paul D. R. Ruthling.
Do.	12455–58	4	Jamay	Aug. 22, 1919	Do.
M.C.Z.	6682–83	2	COLIMA: Colima	1919	Do.
			? STATE:		
A.M.N.H.	12478–82	5	No definite locality		Do.
Do.	12415–54	40	do		Do.

[1] Type of *Pternohyla fodiens*. [2] Type of *Hyla rudis*.

Genus DIAGLENA Cope

1887. *Diaglena* COPE, U. S. Nat. Mus. Bull. 32, p. 12. [Genotype, *Diaglena spatulata* (GÜNTHER) = *Triprion spatulatus* GÜNTHER, 1882, Ann. and Mag. Nat. Hist., ser. 5, vol. 10, no. 58, p. 279, Oct. (Presidio, Sinaloa, Mexico).]

This monotypical genus is characterized in part by the presence of palatine teeth and also by peculiarities in the conformation of the bony casque.

DIAGLENA SPATULATA (Günther)

1882. *Triprion spatulatus* GÜNTHER, Ann. and Mag. Nat. Hist., ser. 5, vol. 10, no. 58, p. 279, Oct.—BOULENGER, 1891, Ann. and Mag. Nat. Hist., ser. 6, vol. 8, no. 48, p. 456, Dec.—GÜNTHER, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 293, pl. 74, fig. C, Dec.

1887. *Diaglena spatulata* COPE, U. S. Nat. Mus. Bull. 32, p. 12.

Type locality.—Presidio, 50 miles from Mazatlan, State of Sinaloa, Mexico.

Range.—Exact limits of range problematical; thus far known to occur only in southern Sinaloa.

Remarks.—The three cotypes of this species were collected by Dr. Alphonso Forrer. The following notes were made on these specimens: Vomerine teeth behind but within level of inner margins of choanae; they vary in position from transverse to a broad open inverted V; no tarsal fold; large internal metatarsal tubercles; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of tympanum; fingers not webbed at base; tip of first finger reaches to apical disk of second; coloration as described by Boulenger.

B.M. No. 82. 11. 13. 1, one cotype: Head-and-body length, 86 mm.; transverse diameter of tympanum, 3.9 mm.; transverse diameter of eye, 7.2 mm.; posterior margin of bony casque to tip of snout, 30.2 mm.; width of head at level of posterior angles of jaws, 24.4 mm.; tip of snout spinose.

B.M. Nos. 82. 12. 5. 11–12, two cotypes: (*a*), Head-and-body length, 84 mm.; transverse diameter of tympanum, 4.4 mm.; transverse diameter of eye, 7.5 mm.; posterior margin of bony casque to tip of snout, 30.2 mm.; width of head at level of posterior angles of jaws, 25.2 mm.; tip of snout spinose; skin on abdomen fairly smooth; body soft; (*b*), head-and-body length, 87.9 mm.; transverse diameter of tympanum, 4.2 mm.; transverse diameter of eye, 7.2 mm.; posterior margin of bony casque to tip of snout, 30.9 mm.; width of head at level of posterior angles of jaws, 23.6 mm.; tip of snout fairly smooth; skin on abdomen strongly areolate; body somewhat dried.

An entomological collector, J. Aug. Kusche, presented an adult specimen of this species to the National Museum and noted on the accompanying label that it was found in a white-ant nest in a tree at Venodio. In 1882, Doctor Forrer returned to London with three living specimens, which were described by Günther as follows:

> The coloration is a uniform light olive, without any spots, changing in intensity of shade only; the upper side of the head is sometimes of a yellowish bronze color * * * the pupil is transversely oval when expanded, and subquadrangular when more contracted, but never vertical. It can be shut entirely.

Specimens examined.—Four, as follows:

Diaglena spatulata

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
B.M	82. 11. 13. 1	[1] 1	SINALOA: Presidio, 50 miles from Mazatlan.		Alphonso Forrer.
Do	82. 12. 5. 11–12	[1] 2	do		Do.
U.S.N.M.	73266	1	Venodio, 4,000 feet altitude.	Apr. 26, 1918	J. Aug. Kusche.

[1] Cotypes.

Genus TRIPRION Cope

1865. *Pharyngodon* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 193, Oct. [Genotype, *Pharyngodon petasatus* COPE, *idem*, p. 193 (vicinity of Merida, Yucatan, Mexico).] (Preoccupied by *Pharyngodon* DIESING, 1860, Sitzungsber. k. Akad. Wiss. math.-naturw. Classe, Wien, vol. 42, no. 28, p. 642, Dec. 6.)

1866. *Triprion* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 127, May. [Genotype, *Triprion petasatus*=*Pharyngodon petasatus* COPE.]

A tree frog that lives in the lowlands of Yucatan and that has a bony casque but lacks palatine teeth is the sole known representative of this genus.

TRIPRION PETASATUS (Cope)

1865. *Pharyngodon petasatus* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 193, Oct.

1866. *Triprion petasatus* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 127, May.—COPE, 1866, Journ. Acad. Nat. Sci. Philadelphia, n. s., vol. 6, pt. 1, p. 112, pl. 25, figs. 7–8, July.

Type locality.—Vicinity of Merida, State of Yucatan, Mexico.

Range.—Not known to occur elsewhere than on the peninsula of Yucatan.

Remarks.—The type of this species (U.S.N.M. No. 12287) was taken from a hole in the rocky wall of the Cenote Pamanche near Merida on the road to Progressa. It is fairly well preserved notwithstanding numerous dissections made by Cope. The sternum has been dissected, the viscera are exposed by a longitudinal slit in the abdominal wall, and the shoulder girdle, sacrum, and sacral diapophyses have been freed from their muscle attachments through a longitudinal incision in the skin on the back. The measurements of this specimen are as follows: Head-and-body length, 72.5 mm.; transverse diameter of tympanum, 4 mm.; transverse diameter of eye, 6.8 mm.; anterior edge of eye to nostril, 10.3 mm; width of head at level of posterior angles of jaws, 22.7 mm.; posterior margin of bony casque to tip of snout (extremity missing), 25 mm.

The following field notes of Leon J. Cole [52] made at Chichen Itza in Yucatan are of special interest:

> Note an unmusical, rather drawn-out *quarr–quarr–quarr.* Not guttural, but with a rasping quality. Life colors as follows: Top of head fuscous, with silvery greenish gray dots; back silvery gray, with dark fuscous blotches and smaller spots; sides with yellowish green suffusion; arms and legs brown, with yellowish blotches on upper arms and legs; silvery gray on lower arms and legs. Under sides whitish. The gray has a decided greenish tinge, which became more marked in a short time while the creature was held in the hand. This frog was not heard during the drier part of the season (February and most of March), but was heard quite frequently during the last part of March, when there was more rain.

Specimens examined.—Four, as follows:

Triprion petasatus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			YUCATAN:		
M.C.Z.	3559	1	Chichen Itza	Mar. 28, 1904	Leon J. Cole.
Do.	11633	1	do	1927	O. Ricketson.
U.S.N.M.	12287	[1] 1	Near Merida		Arthur Schott.
M.C.Z.	6835	1	No definite locality	1920	Exchange with British Museum.

[1] Type.

Genus PHYLLOMEDUSA Wagler

1830. *Phyllomedusa* WAGLER, Natürliches System der Amphibien, p. 201, Aug. [Genotype, *Hyla bicolor* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, pp. 16–17, pls. 5, 6=*Rana bicolor* BODDAERT, 1772, Epistola de rana bicolore, p. 19, pl. (unnumbered), figs. 1–5 (Surinam).]

[52] Barbour, Thomas, and Cole, Leon J., Vertebrata from Yucatan, Reptilia, Amphibia, and Pisces. Bull. Mus. Comp. Zool., vol. 50, no. 5, p. 154, Nov., 1906.

1864. *Agalychnis* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 16, p. 181, Aug. [Genotype, *Hyla callidryas* Cope, 1862, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 359, footnote, Sept. (Panama).]—Cope, 1865, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 194, Oct.

There are three species of *Phyllomedusa* in Mexico, and the ranges of two of these extend southward into Central America. Related species occur in Central and South America. Some of the species have rather bizarre and striking color schemes. The largest one, *P. bicolor*, which is found in Guiana and Brazil, has a body length of 110 mm., and the smallest, *P. perlata*, a native of northeastern Peru, measures only 23 mm. Large individuals of a Mexican species, *P. dacnicolor*, may attain a body length of 90 mm. These frogs are supposedly nocturnal in habit, for all of them have eyes with vertical pupils, and presumably spend most of their lives in arboreal surroundings. Most of them have an eye with a red iris, and the body color is some shade of green. In one of the Mexican species, *P. dacnicolor*, the iris is black, vermiculated with gold. The viscous under surfaces of the large adhesive disks enable these frogs to attach themselves to the surfaces of leaves, limbs, and trunks of trees and shrubs. It is generally thought that those that have the hind toes united by a web or membrane are best fitted for swimming in water, and if this be true *P. moreletii* with its extensively webbed fingers and toes is exceptionally well adapted for this purpose. One of the Mexican species, *P. dacnicolor*, seems to be as much at home on the ground in the grass as it is when hidden in the foliage of trees and shrubs. Some species of *Phyllomedusa* merely deposit their eggs on the upper surface of leaves overhanging the water, while others seemingly succeed in curling leaves around the egg mass. After several days in the egg mass the tadpoles lose their external gills and drop into the water, where the metamorphosis is completed.

The supposedly least specialized species of these neotropical tree frogs were allocated to the genus *Agalychnis* by Cope. In characterizing the genus *Agalychnis* he cited the elongation of the inner toes, which are more or less opposable, the deeply emarginate xiphisternum, and the fact that the inferior palpebra is latticed or reticulated with strong white veins. In formulating the diagnoses for the genera *Phyllomedusa* and *Agalychnis*, Boulenger in 1882 made no reference to some of the characters cited by Cope, and introduced other structural characters overlooked by him. Although a number of structural features are listed in each, the diagnosis of *Agalychnis* differs from that of *Phyllomedusa* solely in having the "first [fingers and toes] opposite to the others." It has been confirmed by direct observation of living *Phyllomedusa* that the first finger and the first toe usually oppose the other digits when some small branch is grasped. This faculty of opposing the inner finger and the inner toe is by no means confined to the limited group formerly segregated under the name of *Agalych-*

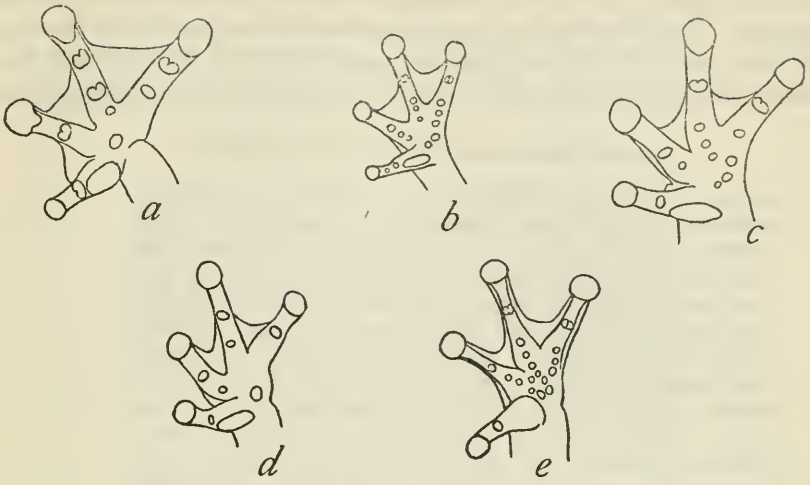

FIGURE 19.—Fore feet of Central American hylids, illustrating the extent of the web between the fingers: *a*, *Phyllomedusa moreletii* (U.S.N.M. No. 25370), two-thirds webbed; *b*, *Hyla gabbi* (U.S.N.M. No. 30658), two-thirds webbed; *c*, *H. venulosa* (U.S.N.M. No. 13976), one-half webbed; *d*, *H. miotympanum* (U.S.N.M. No. 71092), one-half webbed; *e*, *H. baudinii* (U.S.N.M. No. 25369), one-third webbed.

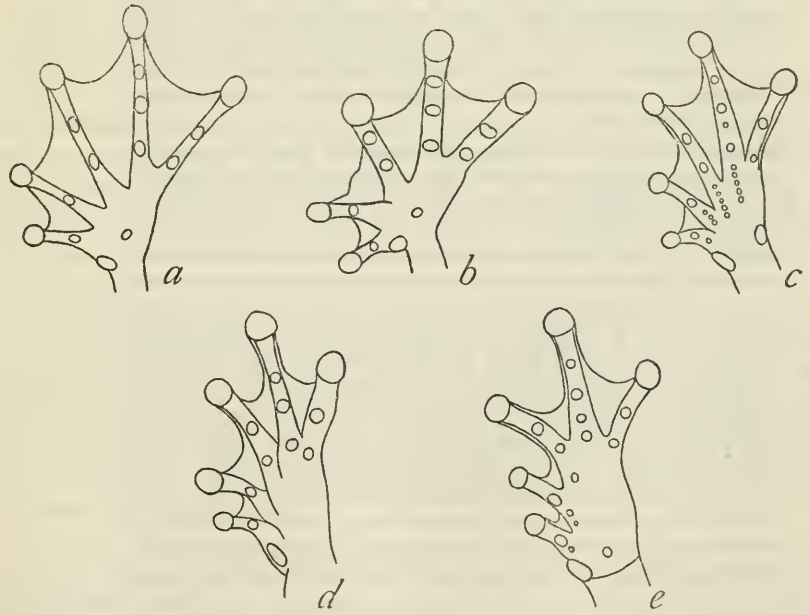

FIGURE 20.—Hind feet of Mexican hylids, illustrating the extent of the web between the toes: *a*, *Phyllomedusa moreletii* (U.S.N.M. No. 46916), fully webbed; *b*, *P. moreletii* (U.S.N.M. 25370), three-fourths webbed; *c*, *Hyla baudinii* (U.S.N.M. No. 25369), three-fourths webbed; *d*, *H. venulosa* (U.S.N.M. No. 13975), two-thirds webbed; *e*, *H. arenicolor* (U.S.N.M. No. 71183), one-half webbed.

nis, but exists to a varying degree in most of the species of *Phyllomedusa*. In *P. dacnicolor*, a species allocated to *Agalychnis* by Cope in 1866, the ability to oppose the inner digits of the fore and hind feet is less marked than in some of the typical species of *Phyllomedusa*.

KEY TO MEXICAN SPECIES OF PHYLLOMEDUSA

1. A single linear series of large quadrangular black spots on sides, which are set off from upperparts by a continuous or interrupted yellow border, and separated from one another by narrow oblique yellow stripes, but not extended ventrally upon the belly; upperparts, upper surfaces of forearm, tibia, tarsus, fifth finger, fifth toe, and narrow band on upper surface of femur greenish (green or sky blue in life); humerus together with concealed surfaces of limbs dark purplish; forearm, hand, tarsus, and foot margined with white; toes and under surfaces yellow, a deeper hue on belly; the hind limb being carried forward along the body, the tibio-tarsal joint reaches beyond the eyes and usually to the tip of the snout; tympanum indistinct, subvertical in direction, ovoidal, and two-thirds diameter of eye; tongue pyriform, and openly emarginate behind; vomerine teeth in short series, directed inward and backward from antero-internal angles of large choanae; inferior palpebra with oblique subparallel white veins; fingers one-third webbed; toes two-thirds webbed; digits of hands and feet furnished with large adhesive disks; skin of upperparts smooth; belly and underside of thighs strongly granulated; dermal folds on outer margin of underside of forearm, and on inner and outer margins of upperside of tibio-fibular region; head-and-body length, 30 to 68 mm ..... **helenae** (p. 145)

   No single linear row of large quadrangular black spots; sides either unicolored or marbled with yellow and reddish brown 2

2. Fingers slightly webbed at base; toes one-third webbed; adhesive disks of medium size; the hind limb being carried forward along the body, the tibio-tarsal joint does not reach beyond the eye; tympanum distinct, two-thirds the diameter of the eye; tongue large, pyriform, openly emarginate behind; vomerine teeth in two short or long, transverse or oblique rows between anterior margins of choanae; inferior palpebra reticulated with white veins; skin of upperparts smooth; belly and underside of thighs strongly granulated; superior surfaces grass green or violet-blue (narrowly on femur), occasionally with a few scattered yellow spots; gular region and posterior faces of femora immaculate; forearm, hand, and foot margined with white; sides marbled with yellow and reddish brown; a few small pustules on anterior part of sides, which are yellow, like the inferior surfaces; head-and-body length, 60 to 83 mm. ..... **dacnicolor** (p. 143)

   Fingers united for one-half or two-thirds of their length by web (fig. 19, *a*), the membrane often extending to disks of the second and fourth digits; and last phalanx of third is bordered by dermal fringe; toes two-thirds to fully webbed (fig. 20, *a* and *b*), the membrane often reaching to disks of all digits; tarsal fold

faint; adhesive disks of fingers slightly larger than those of toes and often larger than tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint reaches between eye and tip of the snout; vomerine teeth in two oblique series between anterior margins of choanae, almost in contact medially; fronto-parietal bones not in contact anteriorly, leaving a small fontanelle; tympanum more than one-half and often three-fourths diameter of eye; tongue broad, notched behind; head broad; canthus rostralis obtuse; loreal region concave, oblique; skin of back smooth, with a few scattered small warts; top of head shagreened between tympani; underparts, with exception of gular region, coarsely granulated; upperparts (of specimens in alcohol or formalin) green, blue-green, or violet, rarely with round yellow spots; sides often with lateral yellow bands; concealed surfaces of limbs, hands, and feet yellowish, with exception of outer finger and toe, which are same color as back; a white line along outer edge of forearm, lower hind limb, and tarsus; under surfaces white; male with single subgular sac; head-and-body length, 58 to 77 mm. ----------moreletii (p. 146)

PHYLLOMEDUSA DACNICOLOR Cope

1864. *Phyllomedusa dacnicolor* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 16, p. 181, Aug.

Type locality.—Near Colima, State of Colima, Mexico.

Range.—West of the Mexican Plateau, from southern Sinaloa to the southern boundary of Guerrero.

Remarks.—The type of this species, which can not now be located, was evidently collected by John Xantus de Vesey, for Cope states that it was removed "from the large Xantusian Coll." Several living individuals of this species collected near the Presidio in Sinaloa were brought to London by Alphonso Forrer. In describing these frogs Boulenger [53] remarks that large individuals may have a head-and-body length of 83 mm. and in addition makes the following comments:

> The faculty of opposing the inner finger and toe is conspicuous, though less so than in the typical species of *Phyllomedusa*. The colour of the upper parts is normally bright green, but rapidly changes to olive or brown; white dots are scattered on the flanks; the lower parts are pure white; the two inner fingers, the three inner toes, the lower surface of the hands and feet, and the sides of the limbs are yellowish pink. The iris is black, vermiculated with gold; a golden line borders the vertical pupil. The nictitating lid is veined with gold, and the lower eyelid completely opaque, green.

Entries made in the field catalogues of Nelson and Goldman show that two of these frogs (U.S.N.M. Nos. 46954–55), taken on June 30, 1897, in green grass on a plain near Acaponeta in Nayarit, were bright green on the back, and another individual (No. 46950) caught in a public garden in the middle of the city of Rosario, Sinaloa, on July 6,

[53] Boulenger, G. A., Description of a new genus and species of frogs of the family Hylidae. Ann. and Mag. Nat. Hist., ser. 5, vol. 10, no. 58, p. 328, October, 1882.

1897, was bright grass green on the back and yellowish white below. While collecting on February 13, 1895, in Guerrero, they found one (No. 47904) in dense green grass on the river bottom near Ometepec. These observations would seem to indicate that this species spends considerable time on the ground at periods not necessarily coincident with the breeding season.

Very little is known in regard to the breeding habits of *P. dacnicolor*. The following observations on Phyllomedusas at Balsas in Guerrero made by Dr. Hans Gadow [54] summarize what little is actually known:

> Lovely big tree-frogs, of a saturated green, dwelt during the heat of the day in the thick thatch of the huts, whilst at night especially during the rain, they hopped about on the ground, to pair. As a rule these *Phyllomedusas* do not deposit their spawn directly in the water; they wrap their eggs in a foamy lather, and suspend the whole mass between leaves or grass, over water, in such a position that the next heavy rain washes the rapidly developing eggs or tadpoles into it. Those which we could observe behaved in a rather puzzling manner. The pairs sat in a tangle of herbs at the edge of a little ditch in the middle of the village, whence the rain could wash the eggs only into a filthy lagoon some fifty yards off. In the morning the ditch was always quite dry, and there were no traces of frogs or eggs left. This may have been an error of judgment of the tree-frogs. The majority were barking, snarling, and entreating each other's attention on more suitable ground, but we failed ignominiously in our observations during the dark of night, and in the tropical downpour. The most remarkable feature, so far apparently unique, is the colour of the numerous and very small eggs, these all being of a light green!

Specimens examined.—Twenty-four, as follows:

Phyllomedusa dacnicolor

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SINALOA:		
U.S.N.M.	6837	3	Mazatlan	1868	F. Bischoff.
M.C.Z.	8631-32	2	do	1921	C. C. Torron.
A.M.N.H.	13126	1	North of Mazatlan	Feb. 2, 1920	Paul D. R. Ruthling.
U.S.N.M.	14081	4	Presidio, 50 miles from Mazatlan.	Apr. 3, 1885	Alphonso Forrer.
Do.	46950	1	Rosario	July 6, 1895	Nelson and Goldman.
A.M.N.H.	12565	1	San Francisquito	Dec. 2, 1919 Dec. 4, 1919	Paul D. R. Ruthling.
			NAYARIT:		
U.S.N.M.	46954-55	2	Acaponeta	June 30, 1897	Nelson and Goldman.
Do.	46953	1	Santiago	June 21, 1897	Do.
A.M.N.H.	12563	1	Rosamocada	Nov. 20, 1919	Paul D. R. Ruthling.
Do.	12565-66	2	do	Nov. 19, 1919	Do.
			COLIMA:		
M.C.Z.	2420	1	Colima	July 14, 1902	Thomas Barbour.
A.M.N.H.	13266-67	2	2 miles from Colima	Apr. 17, 1919	Paul D. R. Ruthling.
Do.	13265	1	East of Lo de Villa	Apr. 19, 1919	Do.
			GUERRERO:		
M.C.Z.	1060	1	Acapulco		Hassler expedition.
U.S.N.M.	47904	1	Ometepec, 200 ft. altitude	Feb. 13, 1895	Nelson and Goldman.

[54] Gadow, H., Through southern Mexico: Being an account of the travels of a naturalist, London, pp. 329, 330, 1908.

PHYLLOMEDUSA HELENAE (Cope)

BANANA FROG

1884. *Agalychnis helenae* COPE, Proc. Amer. Philos. Soc., vol. 22, pt. 2, no. 118, p. 182, Dec. 19.

Type locality.—Nicaragua.

Range.—From Costa Rica and Nicaragua northward through Tabasco to Puebla.

Remarks.—The type of this species (U.S.N.M. No. 13737) was collected on December 4, 1883, by Lieut. J. F. Moser. Although this frog is widely known in Central America as the banana frog, there are very few published observations on its habits. Clarence R. Halter kept a record in his field notebook of the color changes observed on a captive frog taken from the upper side of a leaf on a banana tree standing near the edge of the jungle at Colorado Bar, northeastern Costa Rica. The following notes published by Noble [55] were extracted from this notebook:

> During captivity, the dorsal coloration was subject to considerable variation. Generally the ground tone was a dark slaty green or a bright leaf-green. A number of pale green spots would often appear. These did not seem to be dependent upon the intensity of the light. They appeared irregularly scattered over the back. Sometimes they would form an H-shaped mark just anterior to the pectoral girdle. The changes in the color of the ground tone did not seem to be correlated with changes in the lighting. The concealed portions of the legs, which appear purplish in alcohol, were a deep blue in life. The feet and hands were brilliant orange. The edge of the upper eyelid was a deep yellow, in striking contrast to the orange-red iris. The ventral surface of the throat and body was yellowish white, of the anterior appendages a slaty color, of the posterior appendages a yellowish white washed entirely, except for a narrow strip, with the deep blue of the concealed portions.
>
> The specimen was rather awkward in its movements. Before jumping, it would crouch on all fours with appendages at right angles to the axis of the body. It would then laboriously raise the body about an inch from the ground. It would remain in that position for a few seconds, studying the nearby objects, and then would suddenly leap toward one.

Halter suggests that the breeding season in eastern Nicaragua may occur about the end of August, inasmuch as a female with ovaries distended with eggs was taken during that month at Cukra.

Specimens examined.—Two, as follows:

Phyllomedusa helenae

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	42271	1	VERA CRUZ: Berta near Coatzocoalcos.	Feb., 1910	C. R. Orcutt.
C.G.E.M.	104	1	PUEBLA: Feruitlan		

[55] Noble, G. K., The amphibians collected by the American Museum Expedition to Nicaragua in 1916 Bull. Amer. Mus. Nat. Hist., vol. 38, art. 10, pp. 343, 344, pl. 16, fig. 2, 1918.

PHYLLOMEDUSA MORELETII (Duméril)

MORELET'S FROG

Figures 19, *a*; 20, *a*, *b*

1853. *Hyla moreletii* DUMÉRIL, Ann. Sci. Nat., Paris, ser. 3, Zoology, vol. 19, p. 169.

1861. *Hyla holochlora* SALVIN, Proc. Zool. Soc. London, 1860, pt. 3, p. 460, pl. 32, fig. 2. Mar. (Coban, Guatemala.)

1882. *Hyla moreleti* BROCCHI, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 31, pl. 1, fig. 1; pl. 13, fig. 1.

1901. *Agalychnis moreletii* GÜNTHER, Biologia Centrali-Americana, Reptilia and Batrachia, p. 289, Sept.

Type locality.—Coban, Vera Paz, Guatemala.

Range.—From Volcan de Tuxtla in southern Vera Cruz and San Miguel in northern Oaxaca southward through Central America to Panama.

Remarks.—The two cotypes of *Hyla moreletii* (M.H.N.P. No. 428, parchment label No. 767) were collected at Coban in Vera Paz, Guatemala, by Arthur Morelet. The bodies of these cotypes are quite soft, and the coloration has faded to a creamy white. The head-and-body lengths are, respectively, 68.5 and 59 mm. It was further noted that the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between eye and tip of snout; toes fully webbed with exception of last phalanx of fourth toe, which has a dermal fringe; tarsal fold indistinct; fingers two-thirds webbed, the last phalanx of third finger bordered by a dermal fringe; an external callosity at base of first finger; skin on abdomen and under surface of thigh granular; vomerine teeth in transverse rows between and at level of anterior margins of choanae.

Osbert Salvin states that he obtained three examples of his *Hyla holochlora* at Coban in Vera Paz, Guatemala, and that all of them were caught by the Indians. One of these (B.M. No. 1864. 1. 26. 142) is listed in the catalogue as the type of this species. The following notes were made on this specimen: Head-and-body length, 76.5 mm.; transverse diameter of tympanum, 4.6 mm.; transverse diameter of eye, 6.6 mm.; anterior edge of eye to nostril, 7.2 mm.; width of head at level of posterior angles of jaws, 25.5 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to about halfway between eye and tip of snout; long tarsal ridge from base of first toe to tibio-tarsal joint; toes fully webbed with exception of last phalanx of fourth toe, which has a dermal fringe; inner metatarsal tubercle large and flat, no outer one; subarticular and supernumerary tubercles on plantar surface of foot; tip of first finger reaches to apical disk of second; fingers two-thirds webbed, the last phalanx of third finger bordered by dermal fringe; vomerine teeth between and at level of anterior margins of choanae; abdomen and under surface of

thighs coarsely granular; coloration of upperparts (in alcohol) blue; underparts yellowish brown.

From Bocourt's field notes [56] on a living frog and Salvin's description of *Hyla holochlora* and from the observed pigmentation of the skin on specimens preserved in alcohol, it would appear that the upperparts as well as the outer or upper surfaces of the forearm, fourth finger, tibia, tarsus, and fifth toe are grass green. The remainder of the fore and hind limbs, thighs, fore feet, and hind feet are orange-yellow. The sides are likewise orange-yellow, and the throat, chest, and belly are suffused with a paler tint of the same color.

This species can be recognized at once by the extensive webbing of the fore and hind feet. The terminal phalanges of the fingers and toes are clawlike, very sharp, and recurved. One individual in a series from Atitlan lacked vomerine teeth, according to Brocchi.

Specimens examined.—Sixteen, as follows:

Phyllomedusa moreletii

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	46916	1	VERA CRUZ: Volcano of Tuxtla, 4,500 feet altitude.	May 12, 1894	Nelson and Goldman.
A.M.N.H.	13814-23	10	OAXACA: Mirador, Hacienda near San Miguel.	June 12, 1920	Paul D. R. Ruthling.
U.S.N.M.	25370	1	?STATE: No definite locality		Alfred Dugés.
A.M.N.H.	13813	1	do		Paul D. R. Ruthling.
M.H.N.P.	428	[1] 2	GUATEMALA: Coban, Vera Paz		Arthur Morelet.
B.M.	64.1.26.142	[2] 1	do	1860	Osbert Salvin.

[1] Cotypes *Hyla moreletii.* [2] Type of *Hyla holochlora.*

Genus HYLA Laurenti

1768. *Hyla* LAURENTI, Synopsin reptilium p. 32. [Genotype, *Hyla viridis* LAURENTI, *idem*, p. 33 (Europe); fixed by STEJNEGER, 1907, U. S. Nat. Mus. Bull. 58, p. 75.]

1799. *Calamita* SCHNEIDER, Historiae amphibiorum naturalis et literariae, Ienae, fasc. 1, p. 151. [Genotype, [*Calamita*] *arboreus*=[*Rana*] *arborea* LINNAEUS, 1758, Systema naturae, ed. 10, vol. 1, p. 213 (Europe); fixed by STEJNEGER, 1907, U. S. Nat. Mus. Bull. 58, p. 75.]

1814. *Hylaria* RAFINESQUE, Specchio Sci., Palermo, vol. 2, fasc. 7 (substitute for *Hyla*).

1825. *Boana* GRAY, Ann. Philos., n. s., vol. 10, 214. [Genotype, [*Rana*] *boans* LINNAEUS, 1758, Systema naturae, ed. 10, vol. 1, p. 213 (America)=*Hyla boans* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 21, pl. 11 (Surinam).]

1827. *Rhacophorus* "KUHL," *in* Schlegel, Isis von Oken, vol. 20, p. 294 (not of TSCHUDI, 1838, nor of KUHL and VAN HASSELT, 1822). [Genotype, *Hyla palmata* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et

[56] Brocchi, P., Note sur quelques batraciens hylaeformes recueillis au Mexique et au Guatemala. Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 3, p. 122, 1877.

des crapauds, p. 26, pl. 14 ("Caroline et en Virginie"); fixed by STEJNEGER, 1907, U. S. Nat. Mus. Bull. 58, p. 76.]

1830. *Auletris* WAGLER, Natürliches System der Amphibien, p. 201. [Genotype, [*Rana*] *boans* LINNAEUS, 1758, Systema naturae, ed. 10, vol. 1, p. 213 (America) = *Hyla boans* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 21, pl. 11 (Surinam); fixed by STEJNEGER, 1907, U. S. Nat. Mus. Bull. 58, p. 76.]

1830. *Hyas* WAGLER, Natürliches System der Amphibien, p. 201. [Genotype, [*Rana*] *arborea* LINNAEUS, 1758, Systema naturae, ed. 10, vol. 1, p. 213 (Europe); preoccupied by *Hyas* LEACH, 1815, Crustacea.]

1830. *Hypsiboas* WAGLER, Natürliches System der Amphibien, p. 200. [Genotype, *Hyla palmata* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 26, pl. 14 ("Caroline et en Virginie").]

1830. *Scinax* WAGLER, Natürliches System der Amphibien, p. 201. [Genotype, *H*[*yla*] *aurata* WIED, 1825, Beiträge zur Naturgeschichte von Brasilien, p. 531 (Bahia, Brazil); fixed by STEJNEGER, 1907, U. S. Nat. Mus. Bull. 58, p. 76.]

1830. *Dendrohyas* WAGLER, Natürliches System der Amphibien, p. 342. [Substitute name for *Hyas*, preoccupied, *fide* STEJNEGER, 1907, U. S. Nat. Mus. Bull. 58, p. 76.]

1838. *Lophopus* TSCHUDI, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, pp. 32, 73. [Genotype, *Lophopus marmoratus* TSCHUDI, *idem*, pp. 32, 73 = *Bufo marmoratus* LAURENTI, 1768, Synopsin reptilium, p. 29 (Surinam); preoccupied by *Lophopus* DUMÉRIL, 1837, Polyzoan.]

1838. *Sphaenorhynchus* TSCHUDI, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, pp. 28, 71. [Genotype, *Sphaenorhynchus lacteus* TSCHUDI, *idem*, pp. 28, 71 = *Hyla lactea* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 21, pl. 10, fig. 2 (America).]

1838. *Trachycephalus* TSCHUDI, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, pp. 33, 74. [Genotype, *Trachycephalus nigromaculatus* TSCHUDI, *idem*, pp. 33, 74 (America meridionalis).]

1843. *Acrodytes* FITZINGER, Systema reptilium, fasc. 1, p. 30. [Genotype, *Hyla venulosa* DAUDIN = *Rana venulosa* LAURENTI, 1768, Synopsin reptilium, p. 31 ("Indiis").]

1843. *Dendropsophus* FITZINGER, Systema reptilium, fasc. 1, p. 31 [Genotype, *Hyla frontalis* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 17, pl. 7, figs. 1, 2 (Surinam).]

1843. *Dryomelictes* FITZINGER, Systema reptilium, fasc. 1, p. 31. [Genotype, *Hyla lactea* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 21, pl. 10, fig. 2 (America).]

1843. *Dryophytes* FITZINGER, Systema reptilium, fasc. 1, p. 31. [Genotype, *Hyla versicolor* LECONTE, 1825, Ann. Lyc. Nat. Hist. New York, vol. 1, pt. 2, p. 281 ("Northern States," U. S. A.).]

1843. *Hypsipsophus* FITZINGER, Systema reptilium, fasc. 1, p. 30. [Genotype, *Hyla xerophyllum* = *Hyla xerophylla* DUMÉRIL and BIBRON, 1841, Erpétologie générale, vol. 8, p. 549 (Cayenne).]

1843. *Lobipes* FITZINGER, Systema reptilium, fasc. 1, p. 30. [Genotype, *Hyla palmata* DAUDIN, 1803, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 26, pl. 14 ('Caroline et en Virginie'); preoccupied by *Lobipes*, CUVIER, 1817, Aves.]

1843. *Osteopilus* FITZINGER, Systema reptilium, fasc. 1, p. 30. [Genotype, *Trachycephalus marmoratus* BIBRON, 1842, *in* Ramon de la Sagra, Histoire physique, politique et naturelle de l'île de Cuba, Atlas, pl. 29 (Cuba); *nec Hyla marmorata* (LAURENTI), 1768 = *Hyla septentrionalis* BOULENGER, 1882, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 368 (Cuba).]

1843. *Phrynohyas* FITZINGER, Systema reptilium, fasc. 1, p. 30. [Genotype, *Hyla zonata* SPIX, 1824, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 41, pl. 12, fig. 1 (Brazil).]

1843. *Phyllobius* FITZINGER, Systema reptilium, p. 30. [Genotype, *Hyla albomarginata* SPIX, 1824, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 33, pl. 8, fig. 1 (Brazil); preoccupied by *Phyllobius*, SCHÖNHERR, 1824, Coleoptera.]

1856. *Centrotelma* BURMEISTER, Erläuterungen zur Fauna Brasiliens, enthaltend Abbildungen und ausführliche Beschreibungen neuer oder ungenügend bekannter Thier-Arten, p. 97. [Genotype, *Hyla* (*Centrotelma*) *infulata*= *Hyla infulata* WIED, 1825, Beiträge zur Naturgeschichte von Brasiliens, vol. 1, p. 533 (Brazil).]

1856. *Hylomedusa* BURMEISTER, Erläuterungen zur Fauna Brasiliens, enthaltend Abbildungen und ausführliche Beschreibungen neuer oder ungenügend bekannter Thier-Arten, p. 102. [Genotype, *Hyla* (*Hylomedusa*) *crepitans* BURMEISTER, *idem*, p. 103=*H*[*yla*] *crepitans* WIED, .1824, Abbildungen zur Naturgeschichte Brasiliens, pl. (47), fig. 1 (Tamburil im Sertong von Bahia, Brazil).]

1862. *Osteocephalus* STEINDACHNER, Archiv. Zool. Anat. e la Fisiol. Genova, vol. 2, fasc. 1, p. 77. [Genotype, *Osteocephalus taurinus* STEINDACHNER, *idem*, p. 77, pl. 6, figs. 1–3 (Barra do Rio Negro in Brasilien). Not of FITZINGER, 1843, a *nomen nudum*.]

1862. *Scytopis* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 354, Sept. [Genotype, *Scytopis hebes* COPE, *idem*, p. 354 (Paraguay).]

1865. *Smilisca* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 194, Oct. [Genotype, *Smilisca daulinia* COPE, *idem*, footnote, p. 65=*Hyla baudinii* DUMÉRIL and BIBRON 1841, Erpétologie générale, vol. 8, pp. 564, 565 (Mexico).]

1867. *Cinclidium* COPE, Journ. Acad. Nat. Sci. Philadelphia, n. s., vol. 6, pt. 2, p. 200, July. [Genotype, *Cinclidium granulatum* COPE, *idem*, pp. 200, 202 (Surinam).]

1870. *Cincloscopus* COPE, Proc. Amer. Philos. Soc., vol. 11, no. 84, p. 554, footnote, Sept. 16. [Substitute name for *Cinclidium* COPE.]

1870. *Cophomantis* PETERS, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 650, Aug. [Genotype, *C*[*ophomantis*] *punctillata* PETERS, *idem*, p. 651, pl. 2, fig. 4 (Sta.Catharina, Brazil).]

1872. *Hylomantis* PETERS, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 772. [Genotype, *Hylomantis aspera* PETERS, *idem*, p. 772, pl.–, fig. 2 (Bahia, Brazil).]

1885. *Epedaphus* COPE, Proc. Amer. Philos. Soc., vol. 22, pt. 4, no. 120, p. 383, Apr. 17. [Genotype, *Hyla gratiosa* LECONTE, 1856, Proc. Acad. Nat. Sci. Philadelphia, vol. 8, p. 146, pl. 4 (printed VI) Aug. ("lower country of Georgia").]

1899. *Hyliola* MOCQUARD, Nouv. Archiv. Mus. Hist. Nat. Paris, ser. 4, vol. 1, p. 337. [Genotype, *Hyliola regilla* MOCQUARD=*Hyla regilla* BAIRD and GIRARD, 1852, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 174, Oct. ("Sacramento River, in Oregon, and Puget Sound"); fixed by STEJNEGER, 1907, U. S. Nat. Mus. Bull. 58, p. 76.]

Eleven species of the genus *Hyla* are here recognized as occurring within the limits of continental Mexico. There is reason to believe that five of these—*arenicolor, baudinii, eximia, miotympanum*, and *venulosa*—are fairly common tree frogs, for they are most frequently found in collections made in Mexico. One, *H. phlebodes*, may yet be

found to be fairly abundant in the lowland swamps of Yucatan and Quintana Roo. *H. gracilipes* is a very close relative of *H. eximia*, but seems to be sufficiently distinct to be recognized as a full species, rather than as a variety of the latter. The habitat of the tree frog described by Brocchi as *H. plicata* is unknown, and, although the position of the vomerine teeth is quite different from other Mexican hylas, it is otherwise structurally quite similar to *H. eximia*. No additional specimens of *H. bistincta* have been reported since it was first described by Cope. The type of the peculiar little *H. staufferi* remained unique for more than 60 years, though quite recently Dr. E. R. Dunn discovered a second individual in the British Museum that was collected at Motzorongo in Vera Cruz, and there are three additional specimens in the United States National Museum from Potrero, Vera Cruz. Some uncertainty still exists as to the validity of *H. taeniopus*, a species based on two immature individuals.

The genus *Hyla*, in spite of its nearly world-wide distribution and numerous species, seems to have retained a fairly uniform type of life history. There is no evidence that any species of the genus skips the tadpole stage, and with the exception of certain Jamaican species all of them evidently lay their eggs in the water, where the tadpoles follow the usual aquatic development. The eggs are deposited in ponds, in flooded marshes, in stagnant pools of rain-water in forests, along the edges of streams where there is little or no current, or in little basins or pools on the edges of mountain brooks. In Jamaica, Dunn found three species of *Hyla* that laid their eggs in water caught between the leaves of bromeliads. Some of the large tree frogs of South America build mud basins, in which the eggs are deposited and in which the tadpoles pass through the larval stage.

According to Noble[57]—

> In *Hyla*, as in many large genera of Salientia, the tadpoles do not conform to a single type. Those species which lay their eggs in ponds have either broad-finned tadpoles of the "sunfish type" or bottom-wriggling larvae of the "polliwog type." The "sunfish type" has larger lungs, remains more frequently between surface and bottom and is usually a graceful swimmer. The "polliwog type" has a narrow fin restricted to the tail or only to the tail and posterior part of the body. This type is prevailingly a bottom-wriggler but may dart very rapidly in the undulatory manner characteristic of our common *Rana* polliwogs.

KEY TO MEXICAN SPECIES OF HYLA

1. Second to fourth fingers practically free, at most united at base by a vestigial web or entirely free from such 2
   Second to fourth fingers united at base by distinct web, which may extend for one-fourth to two-thirds of their length 8
2. Vomerine teeth behind or at most at level of posterior edge of choanae 3
   Vomerine teeth between or near level of anterior edge of choanae 4

[57] Noble, G. K., The value of life history data in the study of the evolution of the Amphibia. Ann. New York Acad. Sci., vol. 30, p. 95, Oct., 31, 1927.

3. Vomerine teeth behind or barely at level of posterior edge of choanae, each group consisting of about eight teeth; body with lateral color band; fronto-parietal bones ossified and in contact anteriorly, separated posteriorly, leaving a fontanelle; tympanum about two-fifths diameter of eye; adhesive disks nearly as large as tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint reaches the posterior portion of the orbit; tongue wide, not or scarcely notched behind; canthus rostralis indistinct; loreal region concave, oblique; skin of upperparts thickened, studded on back with large obtuse warts; upperparts light purplish brown, separated from sides in some specimens by a broad blackish band, which extends from above tympanum to loin; pupil cruciform, interspaces golden, black spot on outer margin----------**venulosa**, young [=**spilomma** Cope] (p. 176)

Vomerine teeth at level of posterior edge of choanae, each group consisting of four teeth; body without lateral longitudinal color band; tympanum one-third diameter of eye, overhung by thick dermal fold; frontal bones cartilaginous, thickened or stiffened in front, possibly ossified; fingers united at base by vestigial web; thumb of male with two corneous callosities on inner surface during breeding period; toes webbed for two-thirds of their length, the membrane being deeply incised and continued beyond the bases of the penultimate phalanges of the third to fifth toes as a narrow fringe; foot shorter than combined length of tibia and femur; tarsal fold indistinct; adhesive disks of approximately the same size as tympanum: the hind limb being carried forward along the body, the tibio-tarsal joint reaches the anterior margin of eye; tongue broad, oval, not notched behind; canthus rostralis rounded; skin of upperparts smooth; underparts granulated; a dermal fold across chest; coloration of upper surfaces, including femur and humerus, dark bluish plumbeous (in alcohol), without darker markings; sides with a network of dark streaks on a yellow background; posterior face of thigh brown, with few yellow specks along superior border; inferior surfaces yellow; eye unspotted; head-and-body length, 43.5 mm----------**bistincta** (p. 163)

4. Vomerine teeth situated in transverse rows near level of anterior margins of choanae; tympanum distinct, more than one-half diameter of eye and overhung by a dermal fold; adhesive disks small, less than one-half diameter of tympanum; fingers free from web at base; first finger shorter than second; toes webbed for one-half their length and membrane is continued as a narrow fringe on distal phalanges; an ovoidal inner metatarsal tubercle and an indistinct outer one; no supernumerary tubercles on plantar surface of foot; a tarsal fold; the hind limb being carried forward along the body, the tibio-tarsal joint reaches between eye and tip of snout; tongue ovoidal, notched behind, and free on its posterior one-third; canthus rostralis angular; skin of upperparts smooth; a very distinct dermal fold across chest; throat, abdomen, and under surface of thighs granulated; coloration of upperparts apparently green with indistinct spots of a darker color; a narrow light-yellow stripe along canthus

rostralis from nostril to eye, and from posterior edge of upper eyelid backward above tympanum, and then obliquely downward to middle of side; this stripe seems to be upper margin of broad dark band that extends obliquely downward behind tympanum; head-and-body length, 38.7 mm.....plicata (p. 173)

Vomerine teeth situated between the choanae..... 5

5. A tarsal fold present in adults, indistinct in young or immature individuals..... 6

No tarsal fold; second to fourth fingers free from web at base; adhesive disks nearly as large as tympanum; toes two-thirds webbed, the membrane reaching more than halfway to disk on penultimate phalanx of third and fifth toes; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center or at most to anterior margin of eye; tympanum less than or slightly more than one-half the diameter of the eye and overhung by an indistinct dermal fold; distance from eye to nostril somewhat greater than transverse diameter of eye; vomerine teeth in two elongate clusters, presenting an obtuse angle posteriorly, each group consisting of about four teeth, and situated between the choanae; tongue circular, scarcely notched behind; canthus rostralis indistinct; loreal region flat, oblique; snout prominent, rounded; skin of upperparts fairly smooth; sides rugulose; abdomen and under surface of thighs granulated; a dermal fold across chest; upperparts dark olive (in alcohol), with a short longitudinal or curved black streak over each scapula, and one from eye to eye; indistinct dark stripe along coccyx; a lateral dark streak from posterior edge of upper eyelid to about halfway length of body; sides minutely marbled with dorsal and ventral tints; upper lip olive, sending a pale line to near axilla; limbs may or may not have dark crossbars; underparts yellowish, grading from a deeper hue to brownish on the extremities; male with single large vocal sac; head-and-body length, 25 to 30 mm.....staufferi (p. 173)

6. Skin of upperparts rough, tubercular, or with small warts, the tubercles extending forward beyond the interorbital space; vomerine teeth in two clusters, each group consisting of five to six teeth, and between the choanae; fronto-parietal bones ossified and in contact anteriorly, leaving no fontanelle; tympanum distinct, generally one-half to three-fourths, rarely one-third, diameter of eye; adhesive disks of fingers a little larger than those of toes and often nearly as large as tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint usually reaches to anterior margin of eye, occasionally between eye and tip of snout, and rarely beyond tip of snout; toes one-half webbed (fig. 20, *e*), with narrow dermal fringe on terminal phalanges; a tarsal fold; tongue broad, notched behind; canthus rostralis indistinct; loreal region oblique; abdomen coarsely, throat generally finely granulated; a distinct dermal fold across chest; upperparts sand color, light or dark gray, or olive, with grayish or blackish blotches; a curved band, interrupted or continuous, between the eyes; a white spot generally present below eye; upper lip and upper surface of limbs crossbarred; posterior surface of thigh orange colored; throat brownish, with

black specks; rest of underparts pale yellow or white; males with external gular sac; head-and-body length, 30 to 43 mm. ---------- arenicolor (p. 156)

Skin of upperparts smooth, rarely sprinkled with minute tubercles; side of head and fore part of body with a longitudinal dark-colored streak ---------- 7

7. Dark markings on the greenish upperparts run more to longitudinal dark streaks than to distinct dorsal spots; hinder surface of thigh occasionally exhibits a distinct color pattern consisting of a darker area more or less marbled or spotted with yellow, and often with light upper edge; coloration of upperparts greenish or brownish (bluish in alcohol), with few or numerous blackish, and often light-edged, elongate spots; a black or brown band, narrow anteriorly and broad posteriorly, with white dorsal edge, commences at nostril and extends backward below canthus rostralis to eye, and from posterior edge of upper eyelid through tympanum and along side to about level of middle of sacrum, where it is interrupted or disappears entirely; horn-colored margins of upper and lower lips merging posteriorly into broad band of same color which terminates on fore limb; normal specimens have a white or light-colored infraorbital stripe from end of snout to axilla; a pair of elongate dark spots or streaks in sacral region; paired longitudinal dark streaks or sublinear arrangement of dark spots on back; dark spot on each upper eyelid; dark spots often present on each side of vent; upper surfaces of hind limbs with dark spots or complete crossbars; a light-edged dark streak along outer surface of tibia may or may not be present; underparts and concealed surfaces of limbs light colored; fingers practically free from web at base; toes one-half to two-thirds webbed, the membrane not reaching to adhesive disks of third and fifth; a tarsal fold; adhesive disks generally smaller and rarely as large as the tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint generally does not reach beyond anterior margin of eye; vomerine teeth in two elongate clusters between the choanae, occasionally in two slightly arched or oblique rows, and each group consisting of three to seven teeth; tympanum usually one-half transverse diameter of eye, overhung by a weak dermal fold; tongue pyriform or circular, notched behind; canthus rostralis fairly distinct; loreal region concave, oblique; gular region, abdomen, and under surface of thighs coarsely granulated; a dermal fold across chest; males with single external gular sac; head-and-body length, 25 to 41 mm ---------- eximia (p. 164)

Dark markings on greenish upperparts tend to be restricted to distinct spots on hinder half of body; hinder surface of thigh unmarbled and without color pattern, the dark flesh color showing through a bluish suffusion; upperparts dark green, grass green, olive green, or brownish in life (dirty blue in alcohol) with paired oblong white-edged dark spots on hinder back; sides of snout green; canthal stripe blackish, edged above with white, bronze, or light brown; from eye to tympanum and behind tympanum a dark lateral stripe of regular or irregular width extends backward to about half-

way length of body where it either disappears or is broken up on hinder half of flank into a series of spots; upper lip with dark gray stripe, edged above, or above and below with white; outer edge of tibia with lengthwise light-edged dark streaks or with dark spots; cross bands on limbs indistinct, or incomplete (small spots), or well developed; a dark spot on inner side of forearm; underparts whitish; fingers united at base by dermal fringe or vestigial web; first finger shorter than second; adhesive disks of fingers somewhat larger than those of toes and about one-half as large as tympanum; toes two-thirds webbed; tarsal fold weakly or strongly developed; inner metatarsal tubercle large; outer one small and conical, or flat, or absent; distinct subarticular tubercles; the hind limb being carried forward along the body, the tibio-tarsal joint reaches slightly beyond or to tip of snout; vomerine teeth in two short, somewhat oblique or transverse rows between the choanae; transverse diameter of tympanum generally slightly more than one-half diameter of eye, rarely less than one-half; a dermal fold extends above and downward behind tympanum to axilla; tongue large, broad, and feebly notched behind; canthus rostralis distinct; loreal region sloping more or less obliquely; throat, abdomen, and under surface of thighs granulated; a dermal fold across chest; head-and-body length, 30–50 mm.....gracilipes (p. 168)

8. Vomerine teeth on a level with or slightly behind posterior edge of choanae; tarsal fold absent or indistinct..... 9

Vomerine teeth in elongate clusters between the choanae; a distinct tarsal fold in adults, indistinct and possibly absent in young..... 10

9. Coloration of upperparts olive or brownish, generally with large, subsymmetrical, dark blotches, more or less confluent into a pair of longitudinal bands, and sharply defined against a lighter lateral band that extends from upper eyelid to loin; a large dark blotch extending from interorbital region backward upon shoulders generally present; a broad black band extends obliquely downward behind tympanum to beyond level of fore limb; warts often black; limbs may or may not be broadly crossbarred; underparts generally uniform whitish; transverse diameter of tympanum one-half (rarely one-third) diameter of eye, and overhung by a dermal fold; vomerine teeth on a level with hinder edge of choanae, forming either transverse or slightly arched series, or a very open chevron, the apex of which is directed posteriorly; fronto-parietal bones in contact medially, leaving no fontanelle; fingers one-fourth webbed (fig. 19, *c*); no projecting rudiment of pollex; adhesive disks of fingers slightly larger than those of toes, and equal in area to that of tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to but not beyond eye; toes two-thirds webbed (fig. 20, *d*), the membrane reaching to adhesive disks of third and fifth toes, but deeply incised, and leaving free the penultimate phalanx of fourth; tarsal fold absent or indistinct; tongue broad, notched behind; canthus rostralis rounded; loreal region oblique; skin of upperparts and sides covered with large round flat warts; brownish black minute

pustules on exposed surfaces of fore and hind limbs; skin of gular region, abdomen, and under surface of thighs coarsely granulated; male with two large external vocal vesicles behind angle of mouth; head-and-body length, 40 to 64 mm.---venulosa (p. 176)

Coloration of upperparts vinaceous-drab, with coarse network of dark purplish reticulations; tibia with a number of cross lines of same color; lower surfaces uniform white; transverse diameter of tympanum one-third the diameter of the eye, and overhung by a dermal fold; vomerine teeth in two small clusters on a level with posterior edge of the choanae, each group consisting of about four teeth, and the interval between the clusters about equivalent to their diameter; fingers one-fourth webbed; no projecting rudiment of pollex; adhesive disks as large as tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between eye and tip of snout; toes three-fourths webbed, the membrane reaching to the adhesive disks of the third and fifth toes, leaving free the penultimate phalanx of the fourth; tarsal fold absent or indistinct; tongue nearly circular, scarcely notched behind; canthus rostralis rounded; loreal region oblique, concave; skin of upperparts finely shagreened, with scattered indistinct warts; gular region smooth; rest of underparts coarsely granulated; a dermal fold across chest; head-and-body length, 28.5 mm.----------phlebodes (p. 172)

10. Tympanum not more than one-half diameter of eye---------- 11

Tympanum two-thirds to three-fourths diameter of eye, overhung by dermal fold; fronto-parietal bone often not in contact medially, leaving large fontanelle; fingers from one-fourth to one-third webbed (fig. 19, *e*); adhesive disks of fingers not noticeably larger than those of the toes, but smaller than tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to the eye, or between the eye and tip of the snout; toes three-fourths webbed (fig. 20, *c*), the membrane reaching the disks of the third and fifth, leaving free the last phalanx of the fourth; a distinct tarsal fold; tongue circular, usually notched behind; canthus rostralis angular; loreal region concave; skin of upperparts smooth or finely shagreened; underparts, including gular region and underside of thighs, granulated; upperparts sometimes uniform green, olive, or grayish, but generally brownish or greenish, with subsymmetrical markings of dark brown or dark green on back and crown of head; a dark band commences at tip of snout and extends backward below canthus rostralis through eye and tympanum, ending in a black spot behind fore limb; a vertical dark band below eye separating two large white spots on labial border of upper jaw; sides marbled with dark brown and black; fore and hind limbs with more or less distinct dark crossbars; lower surfaces whitish, immaculate; male with two large external vocal sacs behind angle of mouth; head-and-body length, 55 to 73 mm.----baudinii (p. 160)

11. Adhesive disks of fingers not noticeably larger than those of toes, but as large as or larger than tympanum; vomerine teeth in two elongate clusters between the choanae, presenting an obtuse angle medially and posteriorly, but their hinder ends do not quite reach the level of posterior margins

of choanae; fronto-parietal bones separated by large fontanelle covered by cartilaginous roof; tympanum usually one-third or less, and at most one-half the diameter of the eye, and overhung by a dermal fold; fingers one-fourth to one-half webbed (fig. 19, *d*); the hind limb being carried forward along the body, the tibio-tarsal joint reaches beyond the eye and at the most to the end of the snout; toes four-fifths webbed, the membrane reaching the disks of the third and fifth toes, but leaving free the last phalanx of the fourth; subarticular and supernumerary tubercles extended backward upon metatarsals; a tarsal fold; tongue notched behind; canthus rostralis distinct, short; loreal region oblique, concave; skin of upperparts smooth; under surfaces of thighs, underparts, and gular region coarsely granulated; dermal fold across chest present or absent; upper surfaces purplish ash (? green in life) or pale olive brown, with or without a few lighter specks, indistinct darker reticulations, or black spots; limbs paler, not crossbarred; a light external stripe from elbow and heel to digits; superior labial border and lateral stripe occasionally bright yellow, there being no abrupt demarcation between the latter and the abdomen in some cases; anal spot with light superior border; under surfaces yellow; head-and-body length, 35 to 40 mm.-------miotympanum (p. 170)

Adhesive disks of fingers larger than those of toes, and nearly as large as tympanum; vomerine teeth in oblique rows between and extending back to level of hinder edge of choanae; tympanum less than or slightly more than one-half the diameter of the eye; fingers one-fourth webbed; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of the eye; toes two-thirds webbed, the membrane reaching the disks of the third and fifth toes, but leaving free the last phalanx of the fourth; a tarsal fold; tongue oval, not notched behind; canthus rostralis rounded; loreal region oblique; skin of upperparts smooth; underparts granulated; no dermal fold across chest; upper surfaces light purplish, with or without darker marbling; no post-tympanic black mark; sides with a network of blackish brown spots or blotches on creamy white background; hind limbs with indistinct dark cross bands; underparts white, with scattered black specks on throat and anterior part of abdomen, concealed parts unpigmented, white; head-and-body length, 30 mm.----------taeniopus (p. 175)

HYLA ARENICOLOR Cope

CAÑON TREE TOAD

FIGURE, 20, *e*

1854. *Hyla affinis* BAIRD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 61, Apr. (preoccupied by *Hyla affinis* SPIX, 1824).—BAIRD, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 29, pl. 38, figs. 4–7.

1866. (*Hyla*) *arenicolor* Cope, Journ. Acad. Nat. Sci. Philadelphia, n. s., vol. 6, pt. 1, p. 84, July.—Dickerson, 1906, The frog book, pp. 122, 123, pl. 48, figs. 143–146.—Storer, 1925, Univ. California Publ. Zool., vol. 27, pp. 203–215, pl. 2, fig. 4; pl. 13, figs. 37–39; text figs. Z, LL.

1887. *Hyla copii* Boulenger, Ann. and Mag. Nat. Hist., ser. 5, vol. 20, no. 115, p. 53, July (El Paso, Tex.).—Boulenger, 1888, Ann. and Mag. Nat. Hist., ser. 6, vol. 1, no. 3, p. 189, Mar.—Günther, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 266, pl. 70, fig. C, June.

1888. *Hyla coper* [Cope], Amer. Nat., vol. 22, no. 253, p. 80, Jan. [*errore typogr.*].

1899. *Hyliola digueti* Mocquard, Bull. Soc. Philom. Paris, ser. 9, vol. 1, no. 4, p. 165, pl. 1, fig. 4 (territory of Tepic, Mexico).

1905. *Hyla copei* Gadow, Proc. Zool. Soc. London, vol. 2, p. 194.

Type locality.—Northern Sonora, Mexico.

Range.—From northern boundary of Sonora and Chihuahua southward to Michoacan (Tupataro) and to Guerrero (Chilpancingo), to the Federal District (Tacubaya), and to Vera Cruz (Presidio near Motzorongo, about 20 miles south of Cordoba). Of the three Mexican hylas that occur within the limits of Southwestern United States, this rough-skinned species is the most widely distributed, occurring from southern Utah to northern Lower California.

Remarks.—The cotypes of *Hyla affinis* may have been collected by J. H. Clark within the present boundaries of Arizona, although they are listed by Baird as coming from northern Sonora. A brief itinerary of Clark, while attached to Colonel Graham's party of the United States and Mexican Boundary Survey, will be found in the remarks under *Bufo punctatus* (p. 62). The original U.S.N.M. number assigned to the cotypes of *H. affinis* is 3261, and somewhat later this lot was reentered under 11410. There were originally four specimens, but the type bottle now has one additional young specimen.

In 1866 Cope published the results of his dissections on the abdominal integuments of Amphibia and described their union with the superficial fascia of the muscles by an areolar or fibrous network. These closely approximated areolae, which "secrete an adhesive fluid as aid in maintaining the peculiar positions assumed," are formed by a thickening of the abdominal skin, and they indicate the extent of abdominal attachment. Cope lists the hylids that he studied according to the extent of the dermal attachment, and in his second group *arenicolor* is proposed as a substitute name for *H. affinis*, which is preoccupied by a prior use of the same specific name by Spix.

Boulenger was misled by errors in the published description of *Hyla affinis* and concluded that a specimen of this tree frog from El Paso, Tex., represented a different species, which he named *Hyla copii*. Boulenger later insisted that "*H. arenicolor* Cope is a mere name, proposed to replace that of *affinis*, Baird, preoccupied," and that his

specimen differed from the original description of *Hyla affinis* in three important points. According to Baird, in *H. affinis* the tympanum is two-thirds the size of the eye, the web of hand extends only to the third joint of the second finger, and there is no vermiculation on anterior and posterior faces of hind legs. On the other hand, *H. copii*, is described by Boulenger as having a "tympanum hardly one-third the size of the eye, fingers without web, and hinder side of thighs mottled or vermiculated with brown."

The measurements of the four cotypes of *H. affinis* (U.S.N.M. No. 11410) are, respectively, as follows: Head-and-body length, 41.7, 40, 37.2, and 31.8 mm.; transverse diameter of tympanum, 3, 2.8, 2.6, and 2.1 mm.; transverse diameter of eye, 5, 4.9, 4.5, and 4 mm.; anterior edge of eye to nostril, 4.1, 3.8, 3.9, and 3.2 mm. On all four of these cotypes, the transverse diameter of the tympanum is slightly more than one-half that of the eye. Not one of them possesses any vestige of a web between the fingers at the base. The presence or absence of a brownish vermiculation on the posterior surface of the thigh of specimens preserved in spirits is of slight diagnostic value in this species, though as a general rule this area is flesh or orange colored in life and normally is without any brown spotting or marbling. In Mexican specimens, at least, the relative size of the tympanum to that of the eye seems to be quite variable. The transverse diameter of the tympanum is generally about one-half that of the eye, occasionally as much as three-fourths, and rarely only one-third.

The five cotypes of *Hyliola digueti* (M.N.H.P. Nos. 492m, 492n, parchment labels Nos. 98–257, 98–258, 01–343, 01–344, 01–345) were collected by Léon Diguet in the territory of Tepic [= Nayarit], Mexico. They comprise four adults and one young individual, and all are referable to *Hyla arenicolor*. The head-and-body lengths of the four adults are, respectively, 41.4, 33, 33.7, and 29.5 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between the eye and tip of snout in three individuals, and slightly beyond tip of snout in one; tarsal fold sharp-edged; large inner and small outer metatarsal tubercles; no web between fingers at base; transverse diameter of tympanum slightly more than half that of eye; vomerine teeth in two small groups between the choanae; skin of upper parts coarsely granular.

Relatively little individual morphological variation, except as noted in the preceding remarks, was observed in the series examined, although considerable color variation was seen.

Specimens examined.—Ninety-four, as follows:

Hyla arenicolor

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SONORA:		
U.S.N.M.	62076	1	Nogales	June, 1919	Francis J. Dyer.
M.C.Z.	7372	1	San Jose de Guaymas		W. W. Brown.
U.S.N.M.	11410	[1] 4	Northern Sonora	1851	J. H. Clark.
M.C.Z.	2386	1	No definite locality	1903	
			CHIHUAHUA:		
U.S.N.M.	47048	1	Near Balleza	Sept. 23, 1898	Nelson and Goldman.
M.C.Z.	7649–51	3	Barranca del Cobre, Sierra Tarahumare.	1921	Hans Gadow.
U.S.N.M.	47050	1	Near Batopilas	Oct. 11, 1898	E. A. Goldman.
Do.	8322	1	Between Mexico and Chihuahua.		John Potts.
M.C.Z.	9677	1	Morales	1923	W. W. Brown.
F.M.N.H.	1375	1	Sanz		S. E. Meek.
U.S.N.M.	47434	1	DURANGO: El Salto	July 20, 1898	Nelson and Goldman.
			SINALOA:		
Do.	47435	1	Plomosas	July 17, 1897	Do.
C.G.E.M.	6	2	No definite locality	Mar., 1920	J. M. Gallegos.
U.S.N.M.	46824	1	ZACATECAS: Plateado	Sept. 2, 1897	Nelson and Goldman.
			NAYARIT:		
M.H.N.P.	492m,492n	[2] 5	No definite locality		Léon Diguet.
			SAN LUIS POTOSI:		
U.S.N.M.	47917	1	Ahualulco	Aug. 28, 1892	E. W. Nelson.
M.C.Z.	12165	1	Alvarez (Kilo 58) near San Luis Potosi, altitude 8,000 feet.	June 23, 1926 / Sept. 30, 1926	W. W. Brown.
Do.	1663	1	Mountains of Mezquitic, 22 miles north of San Luis Potosi.	1879	Edward Palmer.
Do.	1665	12	Near San Luis Potosi	1879	Do.
Do.	10784	1	San Luis Potosi	1925	W. W. Brown.
			JALISCO:		
A.M.N.H.	12559–61	3	Aquilar Mine, Hostotipaquillo.	Nov. 7, 1919	Paul D. R. Ruthling.
Do.	12490–91	2	Atemajac	Sept. 23, 1919	Do.
Do.	12489	1	Cerro del Col	Sept. 18, 1919	Do.
Do.	12114–15	2	Cerro Pelón, Rio Blanco, north of Zapópan.	Sept. 12, 1919	Do.
U.S.N.M.	18989	1	Chapala	Feb. 24, 1892	P. L. Jouy.
A.M.N.H.	12558	1	West and above Hostotipaquillo.	Nov. 2, 1919	Paul D. R. Ruthling.
U.S.N.M.	33547–48	2	Rio Blanco near Guadalajara	Sept. 30, 1903	J. N. Rose and J. H. Painter.
A.M.N.H.	12492–96	14	On trail from Tequesquite to Hostotipaquilla (Sierra de Nayarit).	Sept. 25, 1919	Paul D. R. Ruthling.
Do.	12486–88	3	South of Tlaquepaque	Sept. 14, 1919	Do.
Do.	12483–84	2	Tonala	Oct. 6, 1919	Do.
Do.	12485	1	Between Tonala and Tlaquepaque.	Sept. 17, 1919	Do.
C.G.E.M.	7	2	No definite locality	July 15, 1919	C. Curota Terron.
			GUANAJUATO:		
U.S.N.M.	9897	1	No definite locality	1877	Alfred Dugés.
Do.	9916	1	----do----	1877	Do.
Do.	11359	2	----do----		Do.
Do.	26156–57	2	----do----		Do.
M.C.Z.	9028	1	HIDALGO: Miguel	1913	W. M. Mann.
			MEXICO:		
U.S.N.M.	32295	1	Valleys of Mexico and Toluca.	1884–85	C. T. Hoege
M.C.Z.	8367–68	2	San Juan Teotihuacan	1922	E. R. Dunn.
			FEDERAL DISTRICT:		
C.A.S.	5019	1	Mexico City	July 8, 1925	Joseph R. Slevin.
A.M.N.H.	13254	1	Santa Fe (1½ miles west)	May 18, 1919	Paul D. R. Ruthling.
U.S.N.M.	71183–85	3	Near Tacubaya, Santa Fe	1921	A. L. Herrara.
N.M.W.	1877–11–19	1	MORELOS: Cuernavaca		
			MICHOACAN:		
M.C.Z.	7632	1	Camp near Apatringan	1921	Hans Gadow.
U.S.N.M.	10256	1	Tupataro	1879	Alfred Dugés.
Do.	14598	1	? STATE: No definite locality		Do.

[1] Cotypes of *Hyla affinis*.

[2] Cotypes of *Hyliola digueti*.

HYLA BAUDINII Duméril and Bibron

Figures 1, *c*; 19, *e*; 20, *c*

1841. *Hyla baudinii* Duméril and Bibron, Erpétologie générale, vol. 8, pp. 564, 565.

1854. *Hyla vanvlietii* Baird, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 61, Apr. (Brownsville, Tex.).—Baird, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 29, pl. 38, figs. 1–3.

1862. *H[yla] muricolor* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 359, Sept. (Mirador, Vera Cruz).

1882. *Hyla baudini* Brocchi, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, pp. 29–31, pl. 14, figs. 4, 4a–b.—Günther, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 270, pl. 71, figs. a–d, Sept.

1906. *Smilisca baudinii* Dickerson, The frog book, p. 151, pl. 57, figs. 178–180.

Type locality.—Mexico.

Range.—From Bexar County, Tex., south through Vera Cruz to Yucatan and Central America; and on the west coast from Sinaloa (Mazatlan) southward through Jalisco, Guerrero, Oaxaca, and Chiapas to Guatemala.

Remarks.—The type of *Hyla baudinii* (M.H.N.P. No. 401, parchment label No. 4798), according to the catalogue, came from Mexico. It exhibits the typical features of this species, as is shown by the following notes: Head-and-body length, 54.8 mm.; transverse diameter of tympanum, 3.6 mm.; transverse diameter of eye, 6 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to anterior margin of eye; a long sharp-edged tarsal fold; a large inner but no outer metatarsal tubercle; toes webbed as usual; large apical disks; fingers webbed at base; tip of first finger reaches to apical disk of second; two external vocal vesicles; vomerine teeth in two transverse rows between and at about level of middle of choanae; throat, abdomen, and under surface of thighs coarsely areolate or granular; black crossbars on hind limbs; an interorbital black band with lateral streaks that connect posteriorly with irregular black markings on upperparts.

Although the type of *Hyla vanvlietii* (presumably U.S.N.M. No. 3239) is now lost, the description and figures published by Baird indicate that he had in hand a specimen of this species. According to the entry in the catalogue, this specimen was collected at the mouth of the Rio Grande, Tex., by J. H. Clark, while he was employed by the United States and Mexican Boundary Survey under the supervision of Maj. W. H. Emory. The type locality is given as Brownsville, Tex., in the original description.

The type of *Hyla muricolor* (U.S.N.M. No. 25097) is a large individual, which can be matched in size, color, and structure with specimens of *baudinii* taken elsewhere in Mexico. It was collected by Dr. Carlos Sartorius in the hills west of Mirador, Vera Cruz. The following notes were made on this type: Head-and-body length, 72.5

mm.; transverse diameter of tympanum, 5.5 mm.; transverse diameter of eye, 8.3 mm.; anterior edge of eye to nostril, 6.2 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of eye; a sharp-edged tarsal fold from inner metatarsal tubercle to tibio-tarsal joint; large inner and vestigial outer metatarsal tubercle; vomerine teeth in two transverse series near level of middle of choanae; upperparts with dark confluent spots and interorbital black band; fore and hind limbs with dark cross bands; skin on crown of head split longitudinally to expose fronto-parietal region; body wall on left side damaged, exposing egg mass.

Ruthven [58] says of this species:

There was much variation in color in the specimens of *H. baudini* which we examined in life. Occasional individuals were a dull orange [59] (about 153d) above, but in by far the greater majority of the ground color of the back was dark olive green (230), dark olive (180), dark brown (130 or 155) or dark orange (105). The head was a shade lighter than the ground color in most specimens, and the pale spot varied from a pale dull greenish tint (203d) to a very pale yellow (221) or bright green (336). The belly was nearly always a light orange tint (116, 121, 136), and the light spots on the sides, light orange yellow (191). The dark markings vary greatly in distinctness. In the paler individuals they are usually indistinct or even entirely wanting, except for faint traces. In those which have a darker ground color they are usually distinct, particularly the black stripe from the tympanic region to the shoulder. They also vary in arrangement, for they may either be connected into a more or less irregular dorsal stripe or stripes, beginning with the cross band between the eyes, or they may be in the form of irregularly extended spots.

We found *H. baudini* common at Cuatotolapam. Most of the specimens were taken during night rains on the banana trees at San Juan. At these times they were very noisy. During the day we found them secreted under boards, in the bases of such large leaved plants as the "elephant ears," bananas, etc. They were observed breeding in a pond near La Laja Creek on July 17.

Dr. E. W. Nelson states in his field catalogue that in wet weather on June 10, 1895, three of these tree frogs were found on the ground at an altitude between 900 and 1,200 feet in the mountains of Santo Domingo, Oaxaca. On July 19, 1897, he found two of them hiding under brick tiles on the roof of a veranda, where they uttered hoarse croakings during the evening and at nightfall.

As an illustration of the elusiveness of tree frogs, Dr. Hans Gadow [60] contrasted an occurrence of countless numbers of *Hyla baudinii* spawning in a wet meadow near Presidio south of Cordoba in Vera Cruz with his fruitless search for this species on his subsequent travels in Mexico. This experience is described as follows:

Whilst rambling along the edge of the forest we became conscious of a noise, at first resembling the mutter of a distant sawmill; but on our reaching the other

[58] Ruthven, A. G., The amphibians and reptiles collected by the University of Michigan-Walker Expedition in southern Vera Cruz, Mexico. Zool. Jahrb. (Syst. Abt.), vol. 32, pt. 4, pp. 310, 311, 1912.

[59] The numbers refer to the "Code des Couleurs," by Klincksiek and Vallete.

[60] Gadow, H., Through southern Mexico: Being an account of the travels of a naturalist, London, pp. 75, 76, 1908.

side of a cluster of trees this sound grew into a roar, like that of steam escaping from many engines, mingled with the sharp and piercing scream of saws. It came from a meadow containing a shallow pool of rainwater. In the wet grass, on its stalks, and on the ground, hopped about hundreds of large green tree-frogs; nearer the pool they were to be seen in thousands, and in the water itself there were tens of thousands. Hopping, jumping, crawling, sliding, getting hold of each other, or sitting still. Most of them were *in amplexus*, and these couples were quiet, but the solitary males sat on their haunches and barked solemnly, with their resounding vocal bags protruding. Every now and then one was making for a mate, and often there were three or four hanging on to each other and rolling over. The din was so great that it was with difficulty that we caught the remarks that we shouted, although we were standing only a few feet apart. Each sweep of a butterfly net caught at least half-a-dozen frogs.

Now the grassy pool, where the frogs were closest, was about 30 yards square (900 square yards), rather more than the area of a tennis lawn, and each square yard held from 50 to 100 frogs—many square yards certainly held several hundreds each. At the very lowest computation this gives 45,000 frogs; and there was, besides, an outer ring of some five hundred square yards where frogs were fairly numerous, say from 5 to 10 to the square yard, mostly spent females, but these few thousands we may leave out of the reckoning, to understate rather than overestimate the number. Supposing there were only 20,000 females, each spawning from 5,000 to 10,000 eggs—say only 5,000—the total would amount to just 100,000,000 eggs. The spawn literally covered both ground and water thickly. But the greatest surprise awaited us on the following morning, when we went to photograph the scene. There was not a single frog left; the water had all evaporated, and the whole place was glazed over with dried-up spawn! The prospective chance of millions of little frogs was gone, their expectant parents having been deceived in calculating their day of incarnation. That was on the 4th of July, several weeks after the beginning of the rather fitful rainy season.

Specimens examined.—Eighty-four, as follows:

Hyla baudinii

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SINALOA:		
A.M.N.H.	12562	1	North of Mazatlan	Nov. 23, 1919	Paul D. R. Ruthling.
U.S.N.M.	47439–40	2	Plumosas	July 19, 1897	Nelson and Goldman.
Do.	51408	1	NAYARIT: San Blas	Dec. 20, 1913 Dec. 25, 1913	J. C. Thompson.
			VERA CRUZ:		
Do.	30410–13	4	Cordoba		Francis Sumichrast.
C.G.E.M.	101	1	Jicaltepec		
N.M.W.	1910–26b	1	La Raya, close to Rio Tonto		Mateo Trujillo.
U.S.N.M.	25097	[1]2	Mirador, hills west of Vera Cruz.		Carlos Sartorius.
Do.	16563–66	4	Vicinity of Orizaba		Francis Sumichrast.
Do.	32365	1	Pasode Telaya, Jicaltepec	Apr. 1, 1921	T. Townsend.
M.C.Z.	8361	1	Potrero	Aug. —, 1921	E. R. Dunn.
U.S.N.M.	32391–95	5	Potrero, near Cordoba		Francis Sumichrast.
C.A.S.	5736	1	Tezonapa	Aug. 3, 1925	Joseph R. Slevin.
Do.	5775	1	do	Aug. 4, 1925	Do.
U.S.N.M.	24964	1	JALISCO: Guadalajara		J. J. Major.
			COLIMA:		
F.M.N.H.	1632	1	Colima		C. H. T. Townsend.
U.S.N.M.	58093	1	do	July 15, 1902	Julius Hurter.
M.C.Z.	8374	1	FEDERAL DISTRICT: Santa Fe, near Mexico City.	1921	E. R. Dunn.
			GUERRERO:		
U.S.N.M.	47909	1	Acapulco	Jan. 8, 1895	Nelson and Goldman.
N.M.W.	1910–26a	1	San Luis Allende		Hans Gadow.
Do.	1910–26	1	Tierra Colorado		Do.

[1] Type of *Hyla muricolor*.

Hyla baudinii—Continued

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			OAXACA:		
C.A.S	5036-37	2	Cosolapa	July 12, 1925	Joseph R. Slevin.
Do	5084-85	2	do	July 13, 1925	Do.
Do	5106	1	do	July 14, 1925	Do.
Do	5192	1	do	July 21, 1925	Do.
U.S.N.M	70400	1	Juchitan		Francis Sumichrast.
A.M.N.H	13832-39	8	Mirador, Hacienda near San Miguel.	June 12, 1920	Paul D. R. Ruthling.
Do	13842-45	4	do	do	Do.
Do	13924	1	Mixtequillo	May 14, 1920	Do.
U.S.N.M	47120-22	3	Santo Domingo, altitude 900 feet.	June 10, 1895	Nelson and Goldman.
Do	30171-74	4	Tehuantepec		Francis Sumichrast.
Do	30188	1	do		Do.
Do	10016	1	Western Tehuantepec		Do.
Do	46760	1	CHIAPAS: Tonala	Aug 4, 1895	Nelson and Goldman.
			YUCATAN:		
Do	72744	1	Chichen-Itza	June —, 1927	E. L. Crandall.
M.C.Z	2478	1	do	1904	L. J. Cole.
Do	2240	1	Merida	1889	Edward H. Thompson
Do	1435	1	MEXICO: Acapulco	1880	D. B. van Brunt.
			? STATE:		
A.M.N.H	13846-55	10	No definite locality		Paul D. R. Ruthling.
M.H.N.P	401	[2] 1	do		
U.S.N.M	31366	1	do		Adolphe Boucard.
Do	39857	1	do		
Do	32358	1	do		
Do	30540-42	3	do		
Do	25369	1	do		Alfred Dugés.

[2] Type of *Hyla baudinii*.

HYLA BISTINCTA Cope

1877. *Hyla bistincta* COPE, Proc. Amer. Philos. Soc., vol. 17, no. 100, p. 87, July 20.—GÜNTHER, 1901, Biologia Centrali-Americana, Reptilia and Batrachia, p. 265, June.—NIEDEN, 1923, Das Tierreich, Lief. 46, Amphibia, Anura I, pp. 192, 247.

Type locality.—"Most probably" Vera Cruz, Mexico.

Range.—Unknown.

Remarks.—The type of this species (U.S.N.M. No. 32361) seems to be a male in breeding condition, inasmuch as the thumb has two corneous callosities on its inner surface; the distal callosity is no larger than the apical disk, but the proximal one is enormously enlarged and forms a conspicuous prominence on the metacarpal. These callosities are covered with closely spaced horny points. According to Cope, this specimen was collected by Francis Sumichrast along with the types of *H. spilomma* and of *H. miotympanum*. Sumichrast spent some time at a hacienda near Cordoba in Vera Cruz, and it is possible that the type of *bistincta* was collected in this region. The measurements of the type are as follows: Head-and-body length, 43.5 mm.; transverse diameter of tympanum, 1.7 mm.; transverse diameter of eye, 5.1 mm.; anterior edge of eye to nostril, 3.7 mm.; width of head at level of posterior angles of jaws, 14.4 mm.

The diagnoses of *Hyla bistincta* and *H. taeniopus* show how closely these two tree frogs resemble each other. On both of them the sides have a network of dark streaks or of blotches superimposed over the yellow ground color. The fact that the upperparts (in alcohol) are

dark bluish plumbeous and purplish, respectively, indicates that the general color of the upperparts in both species in life is some shade of green. There are, however, some differences in the general body build of these tree frogs that are very difficult to describe.

The structual features that appear to distinguish them are as follows: In *Hyla taeniopus*, the vomerine teeth are in small clusters between the choanae; transverse diameter of tympanum about one-half that of the eye; a tarsal fold extends from inner metatarsal tubercle to tibio-tarsal joint; tip of first finger reaches to apical disk of second; fingers one-fourth webbed; upper surface of hind limb with dark crossbars. The type of *H. bistincta* differs from the cotypes of *H. taeniopus* in having the vomerine teeth in two slightly oblique rows at level of posterior margins of choanae; transverse diameter of tympanum one-third that of the eye; tarsal fold indistinct; first finger considerably shorter than second; fingers with vestigial web at base; upper surface of hind limb without any trace of dark crossbars.

Specimens examined.—One, the type.

HYLA EXIMIA Baird

1854. *Hyla eximia* Baird, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 61, Apr.—Baird, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 29, pl. 38, figs. 8–10.—Brocchi, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, pp. 32, 33, pl. 1, fig. 2; pl. 13, figs. 4, 4a.

1858. *Hyla euphorbiacea* Günther, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 109, pl. 10, fig. C (Cordoba and Cordilleras, Mexico).

1901. *Hyla nana* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, pp. 263, 264, pl. 73, fig. A, June (Cuernavaca, State of Morelos, Mexico). [*Nec Hyla nana* Boulenger, 1889, Ann. Mus. Civ. di Storia Nat. Genova, ser. 2, vol. 7, p. 249, pl. 2, fig. 2 (Colonia Resistencia, South Chaco, Argentine Republic).]

1902. *H[yla] smithii* Boulenger, Zool. Rec., vol. 38, Rept. and Batr., p. 33.

Type locality.—City of Mexico, Federal District, Mexico.

Range.—From Durango southward through Guanajuato, Hidalgo, and Puebla to Vera Cruz (Cordoba), and on the west coast southward through Nayarit to Michoacan and Oaxaca.

Remarks.—The two cotypes of *Hyla eximia* (U.S.N.M. No. 3248) were collected by Maj. William Rich, in the vicinity of the City of Mexico, Federal District. Both of these cotypes are young individuals and measure 19.2 and 19.5 mm. in length, respectively. The original coloration of these specimens has disappeared, and the bodies are soft and nearly transparent. The bodily proportions and structural features agree with young individuals of the tree frog currently recognized as *Hyla eximia*. The original drawing of the adult tree frog figured by Baird in 1859 does not have any notation as to the catalogue number or locality. This specimen has not been recognized

among the specimens of this species now deposited in the United States National Museum.

Günther's *Hyla euphorbiacea* was based on five specimens, which are clearly identical with *H. eximia*. The following notes were made on these cotypes:

B.M. No. 1930. 4. 10. 2: Collected by Auguste Sallé at Cordoba in Vera Cruz and figured by Günther in 1858; head-and-body length, 30.2 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to posterior margin of eye; normal color pattern. B.M. No. 57. 10. 28. 51: From the Cordilleras of Mexico and purchased from É. Parzudaki; head-and-body length, 33.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of eye; normal color pattern. B.M. No. 58. 11. 22. 5: From the Cordilleras of Mexico and purchased from É. Parzudaki; label states that it was found "dried up" in 1906. B.M. Nos. 1858. 6. 15. 4–8: From Hugh Cuming's Mexican collection; head-and-body length, respectively, 39.8 and 40.3 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to posterior margin of eye in one, and almost to center of eye in the other; a black canthal stripe edged above with white; and a post-ocular lateral dark stripe edged above with white, which tends to disappear on posterior half of side of body.

The cotypes (B.M. Nos. 1901. 12. 19. 76–82) of *Hyla nana* Günther (preoccupied = *Hyla smithii* Boulenger) are likewise referred to this species. Dr. E. R. Dunn carefully checked a series of specimens of *H. eximia* with the cotypes of *H. nana* and concluded that this species was not valid. Conversely, H. W. Parker, who had previously examined the cotypes, wrote that *H. smithii* seemed to differ from both *H. eximia* and *H. gracilipes*. The seven cotypes of *H. nana* [= *smithii*] were collected by H. H. Smith at Cuernavaca in Morelos. My own observations on one of these cotypes are as follows: Head-and-body length, 25.8 mm.; transverse diameter of tympanum, 1.2 mm.; transverse diameter of eye, 2.5 mm.; anterior edge of eye to nostril, 2.6 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to anterior margin of eye; no tarsal fold; an elongate inner, but no outer metatarsal tubercle; vomerine teeth quite small and in two clusters between the choanae; side of head from tip of snout to eye and from margin of upper lip to canthus rostralis dark brownish black, but edged above with a narrow light line; a black streak between eye and tympanum; behind tympanum this dark lateral band tapers posteriorly to a narrow ribbon and disappears on flanks; upperparts yellowish or olive-green; abdomen and under surface of thighs yellowish; skin on abdomen and under surface of thighs granular. The development of the vomerine teeth and the size of these cotypes indicate that none of them are fully adult. The largest individual lacks a tarsal fold and has a dark loreal region.

This combination has not been exactly matched in the series of *H. eximia* available for study. The tarsal fold on immature individuals of *eximia* is occasionally indistinct and when viewed under a microscope can be detected only by utilizing the light to the best advantage. A distinct tarsal fold was observed in a representative series of *eximia* from Vera Cruz, Guanajuato, Nayarit, and Michoacan, and in at least 13 of these 35 specimens this tarsal fold was distinctly sharp-edged. The tarsal fold extends in a somewhat curved line from the inner metatarsal tubercle nearly to the tibio-tarsal joint.

Individual variation in a tree frog as widely distributed as *H. eximia* occasions no surprise. In this species the dark markings on the upperparts generally run more to longitudinal dark streaks than to distinct dorsal spots. A specimen taken at Ciudad in Durango (U.S.N.M. No. 14083), however, has an unusual color pattern, consisting of closely spaced dark spots and streaks that extend from tip of snout to vent. Another specimen taken at Oaxaca in Oaxaca (U.S.N.M. No. 47908) has a large inner and a minute outer metatarsal tubercle. In at least one specimen, labeled as coming from Guanajuato (U.S.N.M. No. 9898), the tibio-tarsal joint reaches only to the tympanum.

It is often possible to point out pecularities that seem to be diagnostic characters in a limited series, but such distinctions frequently disappear when a large number is available. While the extreme variants of *H. eximia* may seem quite distinct, and this variability may account in part for several of the synonyms, there are so many intermediate types of color pattern that differences of this sort can hardly be considered of diagnostic importance. The average individual of *eximia* has a black spot on each upper eyelid; paired longitudinal dark streaks on back; dark spots in sacral region; a lateral dark streak, edged above with white, from nostril to eye, and from posterior edge of upper eyelid through tympanum and along sides to about level of middle of sacrum; and a white or light-colored stripe along upper lip below eye from end of snout to axilla. On some of the specimens, the color pattern of the upperparts consists of scattered dark spots, without any tendency toward uninterrupted streaks. Many specimens have a pair of longitudinal sacral streaks. A few specimens were noted that have uniformly colored upperparts without any trace of dorsal dark spots. A peculiarly marked specimen from Nayarit (U.S.N.M. No. 65890) had longitudinal dark streaks and also numerous fine black specks on upper surface of fore and hind limbs, and a lesser number on sides and back. A few individuals have complete transverse dark bars on upper surfaces of hind limbs, while others have dark spots, but no complete crossbars. At least 10 specimens having a light-edged dark streak along outer surface of tibia were noted. The hinder surface of the thigh occasionally exhibits a distinct color pattern consisting of a darker area more or

less marbled with light and often with a light upper edge. Other individual peculiarities less marked than those listed above might be cited, but they indicate the variation that may be expected.

Specimens examined.—One hundred and ninety-three, as follows:

Hyla eximia

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			DURANGO:		
U.S.N.M.	14083	2	Ciudad, altitude 8,100 feet	Apr. 3, 1885	Alphonso Forrer.
F.M.N.H.	1512	1	Coyotes		E. Heller and C. M. Barber.
			SAN LUIS POTOSI:		
M.C.Z.	1661	1	Mountains of Alvarez	1879	Edward Palmer.
Do.	10037	1	Ebano	May 10, 1922	W. W. Brown.
			NAYARIT:		
U.S.N.M.	46830–34	5	Santa Teresa, altitude 6,800 feet.	Aug. 8, 1897	Nelson and Goldman.
Do.	65889–90	2	Tepic	June 22, 1923	W. M. Mann.
			JALISCO:		
A.M.N.H.	12068–81	14	Aqua Delgada reservoir, 4 miles north of Guadalajara.	Aug. 10, 1919	Paul D. R. Ruthling.
Do.	12082	1	Jamay	Aug. 21, 1919	Do.
Do.	12067	1	Laguna de Magdalena	Sept. 29, 1919	Do.
Do.	12062	1	Ocotlan	Aug. 16, 1919	Do.
Do.	12063–66	4	South of Tlaquepaque	Sept. 10, 1919	Do.
Do.	12049–58	10	do	Sept. 14, 1919	Do.
Do.	12059–61	3	Tonala	Oct. 6, 1919	Do.
Do.	12083–90	8	Grassy fields between Tonala and Tlaquepaque.	Sept. 17, 1919	Do.
			GUANAJUATO:		
F.M.N.H.	961	4	Acambaro	May 27, 1901	S. E. Meek.
Do.	962	1	Celaya	May 28, 1901	Do.
U.S.N.M.	9875	1	Guanajuato	1877	Alfred Dugés.
Do.	9898	1	do	1877	Do.
Do.	11357	1	do	Jan. 30, 1880	Do.
Do.	12682	1	do	1881	Do.
Do.	10237	7	Silao	1879	Do.
			HIDALGO:		
M.C.Z.	3906–11	5	Guerrero	1913	W. M. Mann.
Do.	9029–31	4	Hacienda de Velasco, northeast of Real del Monte.	1913	Do.
			VERA CRUZ:		
B.M.	1930.4.10.2	[1] 1	Cordoba		Auguste Sallé.
M.C.Z.	7087	1	Orizaba	1920	W. S. Blatchley.
U.S.N.M.	31289–99	11	Vicinity of Orizaba		Francis Sumichrast.
Do.	32396–98	3	Potrero near Cordoba		Do.
F.M.N.H.	1522	1	Suchil	{Dec. —, 1904–Jan. —, 1905}	E. Heller and C. M. Barber.
			FEDERAL DISTRICT:		
A.M.N.H.	13256	1	Chapultepec Park	May 3, 1919	Paul D. R. Ruthling.
Do.	12042–48	7	North of Guadalupe	July 8, 1919	Do.
Do.	13257–64	8	do	May 5, 1919	Do.
U.S.N.M.	3248	[2] 2	City of Mexico		William Rich.
A.M.N.H.	13255	1	San Juanico	May 7, 1919	Paul D. R. Ruthling.
Do.	12005–41	37	One mile west of Tlalpam (rain pools).	July 13, 1919	Do.
			MEXICO:		
F.M.N.H.	962a	1	Chalco	{Apr. 30, 1901–May 1, 1901}	S. E. Meek.
Do.	1364	1	Lerma		Do.
U.S.N.M.	32296–97	2	Valley of Mexico and Toluca.	1884–85	C. T. Hoege.
M.C.Z.	2264 A–B	2	San Juan Teotihuacan, Valley of Mexico.	1890	G. O. Rogers.
Do.	2265	1	do	1890	Do.
B.M.	1901.12 19.76–82	[3] 7	MORELOS: Cuernavaca		H. H. Smith.
			PUEBLA:		
A.M.N.H.	13862	1	Los Reyes, near Santa Catalina.	July 28, 1920	Paul D. R. Ruthling.
C.G.E.M.	3	1	Puebla	Sept. —, 1919	H. Ruano.
A.M.N.H.	13863	1	Santa Catalina	July 31, 1920	Paul D. R. Ruthling.
U.S.N.M.	11364	1	MICHOACAN: Tupataro	1881	Alfred Dugés.
M.N.W.	1910–61	1	GUERRERO: Tacubaya		Hans Gadow.
			OAXACA:		
C.A.S.	5107	1	Cosolapa	July 14, 1925	Joseph R. Slevin.
Do.	5124	1	do	do	Do.
A.M.N.H.	13927	1	Mixtequillo	May 19, 1920	Paul D. R. Ruthling.
U.S.N.M.	47908	1	Oaxaca	June 20, 1894	Nelson and Goldman.

[1] Cotypes of *Hyla euphorbiacea.* [2] Cotypes of *Hyla eximia.* [3] Cotypes of *Hyla nana.*

Hyla eximia—Continued

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			?STATE:		
B.M.	58.11.22.5	[1] 1	The Cordilleras		É. Parzudaki.
Do.	57.10.28.51	[1] 1	do		Do.
U.S.N.M.	10308	5	Between Mexico and Chihuahua.		John Potts.
B.M.	58.6.15.4–8	[1] 2	No definite locality		Hugh Cuming.
U.S.N.M.	14601	6	do		Alfred Dugés.
Do.	31314	1	do		
A.M.N.H.	13925–26	2	do		Paul D. R. Ruthling.

[1] Cotypes of *Hyla euphorbiacea*.

HYLA GRACILIPES Cope

1865. *Hyla gracilipes* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 194, Oct.
1929. *Hyla lafrentzi* MERTENS and WOLTERSTORFF, Zool. Anz., vol. 84, pts. 9, 10, p. 235 (Desierto de los Leones, Federal District, Mexico).

Type locality.—Mirador, State of Vera Cruz, Mexico.

Range.—From southern Arizona southward through Chihuahua (Meadow Valley) to Vera Cruz (Mirador) and Federal District (Santa Rosa and Cuajimalpa).

Remarks.—This tree frog is a southern representative of the *Hyla regilla* group and is rather closely related to *H. eximia*. As a general rule the dark markings on the upperparts tend to be restricted to distinct spots on the hinder half of the body, and the hind limb being carried forward along the body, the tibio-tarsal joint reaches to or beyond tip of snout. In the northern part of its range there is a tendency for this frog to have longer legs, brighter colors, and less webbing than those from southern Mexico. Cope seemingly based his new species *gracilipes* on four specimens (U.S.N.M. Nos. 15318–21) and one of these (No. 15321) corresponds sufficiently with the original description to be designated as the electotype. The body measurements for these four specimens are, respectively, as follows: Head-and-body length, 28.6, 29.3, 27.5, and 35.3 mm.; transverse diameter of tympanum, 1.6, 1.6, 1.2, and 1.9 mm.; transverse diameter of eye, 3.1, 2.8, 2.8, and 3.7 mm.; anterior edge of eye to nostril, 2.3, 2.4, 2.4, and 2.7 mm.; width of head at level of posterior angles of jaws, 9.4, 8.5, 8.6, and 10.4 mm.

Mertens and Wolterstorff have recently renamed this frog *Hyla lafrentzi* and, although comparisons are made with *H. bocourti* and *H. eximia*, the species is considered to be more closely related to the *H. arborea* group. The type of this species (Magdeburger Museums für Natur und Heimatkunde und des Senckenberg-Museums in Frankfurt a. M., No. 49/27) was collected in a mountain forest at 3,000 meters altitude in a region known as "Desierto de los Leones" not far from the City of Mexico in Federal District. The following diagnosis is abridged from the description of the type of *H. lafrentzi* and six paratypes from the same locality: Vomerine teeth in two short,

somewhat oblique or transverse rows between the choanae, and separated medially by a short interval; tongue large, broad, and feebly notched behind; snout broad, rounded; canthus rostralis distinct; loreal region sloping more or less obliquely; distance between anterior edge of eye and narial opening greater than, equal to, or somewhat less than, transverse diameter of eye; interorbital space somewhat wider than upper eyelid; pupil oval, broader than high; iris dark yellow, spotted with bronze, and without cross line; greatest diameter of tympanum equal to two-thirds to three-fourths the transverse diameter of eye; fingers united at base by dermal fringe or vestigial web; first finger shorter than second; adhesive disks of fingers somewhat larger than those of toes and about one-half as large as tympanum; toes two-thirds webbed; tarsal fold weakly or strongly developed; inner metatarsal tubercle distinct, egg-shaped, and about as long as first joint of first toe; outer metatarsal tubercle small and conical, or flat, or absent; subarticular tubercles distinct; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to or slightly beyond tip of snout; the heels touch or overlap when the hind limbs are brought together at right angles to long axis of body; a discoidal dermal fold across chest; a dermal fold extends above and downward behind tympanum to axilla; upperparts dark green, grass green, olive-green, or brownish in life (dirty blue in alcohol) with paired oblong white-edged dark spots on hinder back; sides of snout green; upper lip with dark gray stripe, edged above, or above and below with white; loreal stripe blackish, edged above with white, bronze, or light brown; from eye to tympanum and behind tympanum a dark lateral streak of regular or irregular width extends backward to about halfway length of body, where it either disappears or is broken up on hinder half of flank into a series of spots; green of flanks not so sharply contrasted with whitish underparts; inguinal region either whitish or with bluish tinge; anterior surface of thigh whitish or bluish; hinder surface of thigh always without darker markings, with the flesh color showing through the bluish tinge: outer edge of tibia and tarsus with lengthwise light-edged dark streaks; cross bands on limbs indistinct, or incomplete (small spots), or well developed; a dark spot on inner side of upper arm; underparts whitish, without darker markings; throat of female white, of males either uniformly light gray or else rather dark greenish gray, and occasionally spotted; region of vent rather dark or intense gray; head-and-body length of males, 35 to 38 mm., of females, 37.8 to 50 mm.; greatest diameter of tympanum of males, 2.2 to 2.5 mm., of females, 2.1 to 2.7 mm.; transverse diameter of eye of males, 3.2 to 3.7 mm., of females, 3.4 to 3.8 mm.; width of head of males, 12.6 to 13 mm., of females, 13 to 15.5 mm.

Specimens examined.—Thirteen, as follows:

Hyla gracilipes

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			CHIHUAHUA:		
U.S.N.M.	47436-38	3	Near Colonia Garcia, Sierra Madre Mountains, altitude 8,000 feet.	July —, 1899	Nelson and Goldman.
Do	26595	1	Meadow Valley	July 18, 1895	H. H. and C. S. Brimley.
Do	26605-09	5	do	do	Do.
Do	15318-21	[1] 4	VERA CRUZ: Mirador	1863	Carlos Sartorius.

[1] Cotypes of *Hyla gracilipes*.

HYLA MIOTYMPANUM Cope

Figure 19, *d*

1863. *Hyla miotympanum* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 47, Mar.

1869. *Hyla microtis* PETERS, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 280, Dec. (State of Puebla, probably near Matamoros, Mexico).

1901. *Hyla godmani* GÜNTHER, Biologia Centrali-Americana, Reptilia and Batrachia, pp. 275, 276, pl. 72, fig. e, Sept. (Misantla and Jalapa, Vera Cruz).

Type locality.—Near Jalapa and Mirador, State of Vera Cruz, Mexico.

Range.—From Orizaba in Vera Cruz and Necaxa in Puebla southwest to Tehuantepec and Chiapas.

Remarks.—Unfortunately one of the cotypes of *Hyla miotympanum* (U.S.N.M. No. 6311), from near Jalapa in Vera Cruz and collected by R. Montes de Oca, is missing, and the other, a specimen from Mirador collected by Dr. Carlos Sartorius, apparently was never entered in the museum catalogue.

Cope in 1877 pointed out that Peters's *Hyla microtis* was identical with his *H. miotympanum*. The two cotypes of *H. microtis* (M.N.B. No. 6657) were collected by Berkenbusch. These specimens are typical individuals of *H. miotympanum*. A brief description of these cotypes follows: Head-and-body length, respectively, 35.4 and 39 mm.; tympanum minute, the transverse diameter of one being 1.4 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between eye and tip of snout; skin of underparts areolate; vent dark brown, with narrow white superior edge.

The general similarity of *Hyla godmani* Günther to *Hyla miotympanum* Cope became apparent when specimens of the latter were compared with the description and figures of Günther. This alloca-

tion has since been confirmed by Dr. E. R. Dunn, who has reexamined the cotypes of *H. godmani* in the British Museum of Natural History. Dunn reports that he was unable to distinguish Günther's species, and my own subsequent comparisons resulted in the same conclusion.

One of the cotypes of *H. godmani* (B.M. No. 1901. 12. 19. 96) was collected at Misantla in Vera Cruz in June, 1888, and was presented by F. D. Godman. It is described in my notes as follows: Head-and-body length, 36.5 mm.; transverse diameter of tympanum, 1.7 mm.; transverse diameter of eye, 4 mm.; anterior edge of eye to nostril, 3.3 mm.; width of head at level of posterior angles of jaws, 13 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to end of snout; toes four-fifths webbed, the last phalanx of fourth toe free; a long tarsal fold from inner metatarsal tubercle to tibio-tarsal joint; tip of first finger barely reaches to apical disk of second; fingers one-third webbed; abdomen and under surface of thighs coarsely areolate; vomerine teeth in slightly oblique, posteriorly converging rows, between the choanae.

The remaining eight cotypes of *H. godmani* (B.M. Nos. 1901. 12. 19. 88–95) came from Jalapa in Vera Cruz, and were likewise presented by F. D. Godman. This series ranges in head-and-body length from 25 mm. to 38.3 mm. In alcohol they are quite variable in color, the following varieties being noted: Uniform gray; gray with black specks; purplish gray with white specks; purplish gray with lighter blotches; reddish purple with darker confluent marks; brownish with black specks; and purplish brown. In case of the largest individual, the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between eye and tip of snout; and on the next to largest individual it reaches only to anterior margin of eye. There is a sharp-edged tarsal fold on both of these individuals that extends from inner metatarsal tubercle to tibio-tarsal joint. The vomerine teeth are in transverse rows between the choanae.

The coloration of this tree frog seems to be quite variable. The upperparts may be unicolored, with white supralabial and lateral line, and with whitish underparts, as in U.S.N.M. Nos. 57740 and 16568–76; or the upperparts may be finely speckled, as in U.S.N.M. No. 71090. Dr. E. W. Nelson found two of these tree frogs that were paired in a small stream in the woods near Mirador on February 11, 1894. They were pale olive-brown above and whitish below.

On July 9, 1926, a party from the University of Michigan took one of these tree frogs in a second growth of forest jungle near brook cascades in the vicinity of Necaxa, Puebla.

Specimens examined.—Eighty-two, as follows:

Hyla miotympanum

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
U.S.N.M.	38266–68	3	Cordoba	Apr. 28, 1908	Frederick Knab.
B.M.	1901. 12. 19. 88–95	[1] 8	Jalapa		F. D. Godman.
U.S.N.M.	46966	1	Jico	June 29, 1893	E. W. Nelson.
Do.	47228–29	2	Mirador	Feb. 11, 1894	Nelson and Goldman.
B.M.	1901. 12. 19. 96	[1] 1	Misantla	June —, 1888	F. D. Godman.
M.C.Z.	7038–42	5	Orizaba	1920	W. S. Blatchley.
U.S.N.M.	16568–76	9	do		Francis Sumichrast.
Do.	16577–82	6	do		Do.
Do.	16583–94	12	do		Do.
Do.	71090–109	20	do		Do.
Do.	71150–52	3	Orizaba, alpine region		Do.
Do.	71109	1	do		
Do.	32379–401	3	Potrero		Francis Sumichrast.
Do.	3243	1	(?) MORELOS: 40 leagues south of City of Mexico.		John Potts.
			PUEBLA:		
U.M.U.M.	5	1	Necaxa	July 9, 1926	H. B. Baker.
M.N.B.	6657	[2] 2	No definite locality		Herr Berkenbusch.
U.S.N.M.	30302–04	3	OAXACA: Tehuantepec		Francis Sumichrast.
U.S.N.M.	57740	1	CHIAPAS	June 5, 1905	J. Hurter.

[1] Cotypes of *Hyla godmani.*
[2] Cotypes of *Hyla microtis.*

HYLA PHLEBODES Stejneger

1906. *Hyla phlebodes* STEJNEGER, Proc. U. S. Nat. Mus., vol. 30, no. 1471, pp. 817, 818, June 4.—BARBOUR and COLE, 1906, Bull. Mus. Comp. Zool., vol. 50, no. 5, p. 154, Nov.

Type locality.—San Carlos, Costa Rica.

Range.—From Costa Rica northward through Guatemala to southern Yucatan, Mexico.

Remarks.—As with most of the tree frogs occurring in Mexico, very little is known in regard to the habits of this little delicate-skinned species. Joseph R. Slevin, of the California Academy of Sciences, observed numbers of these tree frogs clinging to reeds in a Guatemala slough and captured a large series with the aid of an insect net. The upperparts (in alcohol) of the type (U.S.N.M. No. 29970) are dark vinaceous-drab with a network of dark purplish reticulations. The measurements of this specimen are as follows: Head-and-body length, 28.5 mm.; transverse diameter of tympanum, 1.4 mm.; transverse diameter of eye, 3.5 mm.; anterior edge of eye to nostril, 2.3 mm. Two specimens (M. C. Z. No. 2463) from Chichen Itza in Yucatan are referred to this species, and they differ from the type in having more conspicuous darker markings. The color pattern is unsymmetrical and consists of a network of irregularly edged dorsal dark streaks in addition to scattered minute dark specks; interorbital dark band irregular. A curved dark streak with anterior and posterior projection crosses back near fore end of sacrum, and behind this are one or more dark blotches.

Specimens examined.—Two (M.C.Z. No. 2463), collected at Chichen Itza, Yucatan, in 1904, by L. J. Cole.

HYLA PLICATA Brocchi

1877. *Hyla plicata* Brocchi, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 3, p. 126.—Brocchi, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, pp. 35, 36, pl. 12, fig. 1.

Type locality.—Mexico.

Range.—Unknown.

Remarks.—This little tree frog is described as having the vomerine teeth situated at the level of the anterior edges of the choanae. This peculiarity alone distinguishes this species from all other known Mexican hylas. The type (M.H.N.P. No. 380a, parchment label No. 6317), according to the label was collected somewhere in Mexico by Firmin Bocourt, and is described in my notes as follows: Head-and-body length, 38.7 mm.; transverse diameter of tympanum, 2.4 mm.; transverse diameter of eye, 4.3 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between the eye and tip of snout; a tarsal fold; toes webbed to base of penultimate phalanx; inner metatarsal tubercle distinct, outer one missing or else very minute; no supernumerary tubercles on plantar surface of foot; fingers free, no web at base; first finger shorter than second; vomerine teeth in two transverse rows near level of anterior margins of choanae; coloration of upperparts apparently greenish; underparts yellowish; a narrow light yellow stripe along canthus rostralis from nostril to eye, and from posterior edge of upper eyelid backward above tympanum, and then obliquely downward to middle of side; this stripe seems to be the upper margin of a broad dark band that extends obliquely downward behind the tympanum; throat, abdomen, and under surface of thighs coarsely granulated.

Specimens examined.—One, the type.

HYLA STAUFFERI Cope

1865. *Hyla staufferi* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 195, Oct.

Type locality.—Orizaba, State of Vera Cruz, Mexico.

Range.—Known to occur only at three localities in western Vera Cruz—Orizaba, Potrero, and Motzorongo.

Remarks.—This puzzling little tree frog seems to differ from *Hyla eximia* in several respects. It has no tarsal fold, the loreal region is more oblique, and the interval between eye and nostril is noticeably greater than the transverse diameter of the eye. The original color pattern of the type (U.S.N.M. No. 15317) has disappeared. According to Cope, the upperparts were originally dark olive, with interorbital dark bar, a longitudinal black bar over each scapula, and an indistinct dark stripe along the coccyx. An approach to this arrange-

ment of the darker markings is found in some lightly marked individuals of *Hyla eximia*. On the other hand, the head of *H. staufferi* seems to have a different outline than that of *eximia*. The type of *staufferi* is approximately the same size as one of the cotypes of *H. nana* [=*smithii*], and all these specimens lack a tarsal fold. The cotypes of *H. smithii*, however, have a dark lateral band with white upper margin and thus agree with *eximia*.

Three specimens, one young and two supposed adults (U.S.N.M. Nos. 32396–98), collected by Francis Sumichrast at Potrero near Cordoba in Vera Cruz, are referred to this species. The following observations are based on the two adults: Head-and-body length, 27.3 and 30.3 mm.; transverse diameter of tympanum, 1.2 and 1.2 mm.; transverse diameter of eye, 2.6 and 3.1 mm.; anterior edge of eye to nostril, 2.9 and 3.5 mm.; width of head at level of posterior angles of jaws, 9.2 and 9.6 mm.; no tarsal fold; tip of first finger does not or barely reaches to base of second; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center or to anterior margin of eye; a dermal fold across chest; an interorbital dark bar; a curved dark streak over vertebral margin of scapula; a lateral dark streak from posterior edge of upper eyelid, backward above tympanum and along sides to about halfway length of body; dark spots or splotches in sacral region; upper surface of fore and hind limbs with dark crossbars.

The measurements of the type of *Hyla staufferi* are as follows: Head-and-body length, 25.5 mm.; transverse diameter of tympanum, 1.3 mm.; transverse diameter of eye, 2.4 mm.; anterior edge of eye to nostril, 3 mm.; width of head at level of posterior angles of jaws, 8.5 mm. The exact status of *staufferi* can not be settled by comparison with the available series of *eximia*, and in absence of conclusive evidence that it is merely a variant of the latter, this small tree frog is tentatively recognized as a distinct species.

A specimen (B. M. No. 1903. 9. 30. 286) from Motzorongo in Vera Cruz is considered by Dunn to be another example of *H. staufferi*.

Specimens examined.—Four, as follows:

Hyla staufferi

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
U.S.N.M.	15317	[1] 1	Orizaba		Francis Sumichrast.
Do	32396–98	3	Potrero near Cordoba		Do.

[1] Type.

HYLA TAENIOPUS Günther

1901. *Hyla taeniopus* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, pp. 269, 270, pl. 72, fig. f, Sept.

Type locality.—Jalapa, State of Vera Cruz, Mexico.

Range.—Not known to occur elsewhere than at the type locality.

Remarks.—The status and relationships of this species are quite puzzling. The two cotypes (B. M. Nos. 1901. 12. 19. 86–87) were collected by a Mexican Indian, Mateo Trujillo, who was employed as a collector by F. D. Godman. The development of the vomerine teeth indicates that they may possibly be immature individuals. The general shape of the body, the extent of the web between fingers and toes, as well as the coloration of the upperparts and sides, are superficially like a young *Phyllomedusa*. The shape of the pupil of the eye, however, is uncertain. After studying these cotypes, H. W. Parker is inclined to regard *taeniopus* as being specifically distinct from *baudinii*. One of the cotypes differs from a juvenile *Hyla baudinii* in having a tympanum that is slightly less than one-half the transverse diameter of the eye, and a more depressed and more prominent snout.

The following comments on the cotypes of this species were furnished by Dr. E. R. Dunn:

> I found it difficult to make up my mind about *Hyla taeniopus*. I believe that they are not *H. baudinii*, but it is difficult to decide. The cotypes are both young and differ from each other, but are obviously the same species. They lack the post-tympanic black mark and show more black on the sides. The lateral marbling is very striking, more so on one than on the other. The size of the tympanum is not the same on both cotypes, and one has a longer snout than the other.

These cotypes are described in my notes as follows: Larger individual: Head-and-body length, 30 mm.; transverse diameter of tympanum, 1.7 mm.; transverse diameter of eye, 3.3 mm.; anterior edge of eye to nostril, 3.1 mm.; width of head at level of posterior angles of jaws, 10.7 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of eye; fingers one-fourth webbed at base; tip of first finger reaches to apical disk of second; toes two-thirds webbed; large inner and small outer metatarsal tubercle; a tarsal fold from inner metatarsal tubercle to tibio-tarsal joint; vomerine teeth in small clusters between the choanae; tongue broad, circular; abdomen and under surface of thighs coarsely granular; upperparts (in alcohol) rather uniform purplish; sides creamy white with anastomosing blackish-brown spots or blotches, the white areas being slightly larger than the dark-brown areas; three indistinct dark crossbars on upper surface of thigh and tibia, and two on tarsus; throat and chest with brown specks. The coloration of the smaller cotype is the same as the preceding, except that the dark spots on sides do not anastomose, and there are similar dark crossbars on hind limbs. The head-and-body length of this cotype is 24.8 mm. The vomerine teeth of both have barely penetrated the gums.

Specimens examined.—Two cotypes (B.M. Nos. 1901. 12. 19. 86–87), collected at Jalapa, Vera Cruz, by Mateo Trujillo.

HYLA VENULOSA (Laurenti)

Figures 19, *c*; 20, *d*

1768. *Rana venulosa* Laurenti, Synopsin reptilium, p. 31.

1858. *Hyla lichenosa* Günther, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 102, pl. 8, fig. c (Vera Cruz and Cordoba, Vera Cruz, Mexico).—Brocchi, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 33, pl. 14, fig. 2.

1877. *Hyla spilomma* Cope, Proc. Amer. Philos. Soc., vol. 17, no. 100, p. 86, July 20 (Cosamaloapam, State of Vera Cruz, Mexico).

1882. *Hyla nigropunctata* Boulenger, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 366 (Jalapa, State of Vera Cruz, Mexico).

Type locality.—Indiis [incorrect = ? South America].

Range.—From Cordoba in Vera Cruz westward to the Presidio in Sinaloa, and southward through Oaxaca and Tabasco to Central and South America.

Remarks.—Laurenti based his *Rana venulosa* on the tree frog figured by Seba [61] and states that its habitat is in "Indiis," which is obviously incorrect if subsequent authors are right in allocating this name to the large tree frog that frequents South and Central America.

According to Boulenger (op. cit., p. 366) the cotypes of Günther's *Hyla lichenosa* were *b–e*, half-grown and young specimens from Vera Cruz; *f*, half-grown specimen from Cordoba (Sallé collection); and *g*, half-grown specimen from Mexico. These cotypes are described in my notes as follows:

Four cotypes (B.M. Nos. 54. 11. 13. 14–17) from the collection made by Hugh Cuming and labeled as coming from Vera Cruz. Two half-grown and two young individuals comprise this series. Head-and-body length, respectively, 36.9, 35.6, 25, and 23.3 mm.; lateral white stripes from posterior edge of upper eyelid to thigh quite prominent; black pustules on back; pustules on top of head the same color as rest of upperparts; brownish-black pustulose specks on exposed surfaces of fore and hind limbs; vomerine teeth in transverse rows at level of posterior margins of choanae; fingers with vestige of web at base; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to center of eye; no tarsal fold; skin on abdomen and under surface of thighs coarsely granular.

One cotype (B.M. No. 56. 3. 17. 24) from Cordoba, Vera Cruz, collected by Auguste Sallé. Head-and-body length, 44.7 mm.; fingers

[61] Seba, A., Locupletissimi rerum naturalium thesauri accurata descriptio, et iconibus artificiossimis expressio, per universam physices historiam, Amsterdam, vol. 1, p. 120, pl. 76, fig. 1, 1734.

with vestigial web at base; vomerine teeth in transverse rows between choanae; other characters similar to preceding diagnosis.

Two cotypes (B.M. No. 57. 10. 28. 49) from Mexico, a half-grown and a young individual, purchased from É. Parzudaki. Head-and-body length, 47.5 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between eye and tip of snout; vomerine teeth in transverse rows at level of posterior margins of choanae; coloration faded (in alcohol); skin similar to other cotypes.

Boulenger based his *Hyla nigropunctata* in part on these cotypes of *H. lichenosa*, which he states differ from *H. venulosa* in having the tympanum one-third the diameter of the eye, and in part on three additional specimens. One of the cotypes of this species (B.M. Nos. 81. 10. 31. 20) was collected at Jalapa in Vera Cruz by C. T. Hoege, a collector employed by F. D. Godman. The following notes were made on this specimen: Head-and-body length, 62.8 mm.; transverse diameter of tympanum, 3.6 mm.; transverse diameter of eye, 5 mm.; anterior edge of eye to nostril, 5.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to anterior margin of eye; throat, chest, and abdomen, and under surface of thighs coarsely areolate; vomerine teeth in transverse rows at level of posterior margins of choanae.

The two remaining cotypes (B.M. No. 59. 9. 20. 2), a half-grown and a young individual, have a general coloration (in alcohol) that is very similar to Günther's Vera Cruz specimens. The larger individual has a head-and-body length of 42 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to anterior margin of eye; and vomerine teeth are in transverse rows at level of posterior margins of the choanae.

Günther [62] has already remarked that "this species shows a somewhat perplexing amount of variation in the shape of the vomerine series, size of the tympanum, development of cuticular glands, and coloration." Topotype specimens agree with the original description of *lichenosa* and are sufficiently like *Hyla venulosa* to be considered the same species. Günther placed Boulenger's *H. nigropunctata* in the synonymy of *H. venulosa*.

The type of Cope's *Hyla spilomma*, which was collected by Francis Sumichrast and is now lost, seems to have been a young individual with fingers united at base by a vestigial web. Another young specimen collected at Santa Teresa in Nayarit (U.S.N.M. No. 46829) has a small tympanum, and the vomerine teeth are abnormal in that they are located between the choanae.

A living specimen collected at Presidio in Sinaloa by Alphonso Forrer is described by Boulenger [63] as follows:

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[62] Günther, A. C. L. G., Biologia Centrali-Americana, Reptilia and Batrachia, p. 273, Sept., 1901.

[63] Boulenger, G. A., Description of a new genus and species of frogs of the family Hylidae. Ann. and Mag. Nat. Hist., ser. 5, vol. 10, no. 58, pp. 327, 328, Oct., 1882.

Upper surfaces light brown, with large chestnut-brown spots; these occupy entirely the hinder part of the back and the hind limbs; upon the latter the lighter ground-color appears in the form of transverse lines; on the flanks the spots are bordered with pure white; lower surfaces of a rather dirty white, the throat with brown vermiculations. The eye is very beautiful, the iris being golden with black reticulations, and a vertical and a horizontal black bar, forming a cross. The vocal bladders are black; they can not be retracted, as in the *Ranae* with external vocal sacs; and when empty they hang on each shoulder like a cutaneous lobe. As is well known, the bones of this frog are of a beautiful "vert de gris"; this color is seen on the vomerine groups and on the borders of the lower jaw when the mouth is open.

The attitudes and movements of *H. venulosa* are much the same as those of its European congener; but it is entirely noctural, remaining concealed the whole of the day. It is by no means shy, but, when handled, exudes a great quantity of poisonous fluid, more so than any Batrachian I have had before. Besides, this fluid, of a milky appearance, coagulates instantaneously, sticking to the fingers in a very disagreeable manner; it has a strong odor, resembling that of peaches, and affects very disagreeably the mucous membrane of the nostrils, causing a strong itching.

Specimens forwarded to museums are rarely accompanied by field observations, and it is therefore of interest that Frederick Knab noted that a specimen taken at Cordoba was found in tillandsia.

A description of the gliding position assumed by the frog when it is falling is given by Cott [64]:

A preliminary experiment was made by launching one of the frogs from off the veranda of the house, whence it had a fall of about 25 feet on to the hard floor of the courtyard below. The little creature spread its arms and legs out widely as it fell, and landed the "right way up"; it appeared to be quite unhurt.

The animal was next flung high upwards, from the ground, and I was surprised and delighted to find that it invariably managed, by means of a violent wriggle, to establish itself in a definite balanced position, so that it always fell belly downwards, with its limbs stretched in a constant and characteristic attitude. Many times it was thrown in such a manner that it spun over and over on leaving the hand, but it never once failed to get into what I shall call its "gliding position" before reaching the culminating point of the trajectory, and this position, once assumed, was invariably maintained without a visible movement until the impact of landing.

At this early stage in the experiments, it was noticed that the frog appeared to fall much more slowly than might have been expected, and it was surprising to find that the impact of hitting a hard stone floor after a fall of some 35 or 40 feet did not in any way hurt the creature. * * *

On the 22d of October I set out in the direction of Souza, a suburb of Para, accompanied by a small Barbadian boy, named Geraldo, and taking with me some specimens of *H. venulosa*. At Souza there is a high water tower, and up this Geraldo climbed with instructions to release the frog from the top, on a given signal, while I remained below to pick up the pieces. The tower is not less than 140 feet high, and it is situated in an open space where the ground is hard and covered at this time of the year by a scanty growth of grass.

I stood near the foot of the tower, expecting the frog to fall nearly, if not quite, vertically. But on a wave from my handkerchief, I saw the little creature leap

[64] Cott, H. B., Observations on the life habits of some batrachians and reptiles from the Lower Amazon. Proc. Zool. Soc. London, 1926, pt. 4, pp. 1164, 1165, Dec., 1926.

into the air, immediately spread out its limbs, and sail slowly down in fine style, passing far over my head and landing at a spot 90 feet behind me. It was quite uninjured. (There was a slight breeze blowing at the time in the same direction toward which the frog glided, but not enough, I fancy, to account for more than a few yards of lateral movement.)

The experiment was repeated, and it was found that the frog took 7½ seconds to reach the ground. On this occasion I was at the top of the tower, and was able to observe that after it had dropped the first 12 feet up [sic] or so, there was, apparently, no further acceleration in the speed of descent; for at this point a state of equilibrium is reached in which the upward pressure of the air on the ventral surface of the frog is equal to the animal's weight.

Specimens examined.—Nineteen, as follows:

Hyla venulosa

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
M.C.Z.	8375	1	Cerro del Gallo	1921	E. R. Dunn.
U.S.N.M.	38264	1	Cordoba	Mar. 21, 1908	Frederick Knab.
Do.	38303	1	do	Mar. 25, 1908	Do.
B.M.	56.3.17.24	[1] 1	do		Auguste Sallé.
Do.	81.10.31.20	[2] 1	Jalapa		C. T. Hoege.
A.M.N.H.	6300	1	One mile south of New Cemetery.	June 16, 1919	Paul D. R. Ruthling.
M.C.Z.	9761	1	Panuco	Apr. 10, 1923	W. W. Brown.
B.M.	54. 11. 13. 14-17	[1] 4	No definite locality		Hugh Cuming.
U.S.N.M.	46829	1	NAYARIT: Santa Teresa	Aug. 9, 1897	Nelson and Goldman.
Do.	46917	1	OAXACA: Tuxtepec	Apr. 11, 1894	Do.
			?STATE:		
A.M.N.H.	13449	1	No definite locality		Paul D. R. Ruthling.
Do.	13841	1	do		Do.
B.M.	57.10.28.49	[1] 2	do		É. Parzudaki.
Do.	59. 9. 20. 2	[2] 2	do		

[1] Cotypes of *Hyla lichenosa.* [2] Cotypes of *Hyla nigropunctata.*

Genus HYLELLA Reinhardt and Lütken

1862. *Hylella* REINHARDT and LÜTKEN, Vidensk. Meddel. Nat. Forening, 1861, Kjøbenhavn, pt. 1, p. 199. [Included species: *Hylella tenera* REINHARDT and LÜTKEN, *idem*, p. 200; and *Hylella punctatissima* REINHARDT and LÜTKEN, *idem*, p. 200, pl. 4, fig. 5 (from vicinity of Lagoa Santa, Brazil).]

1879. *Exerodonta* BROCCHI, Bull. Soc. Philom. Paris, ser. 7, vol. 3, p. 20. [Genotype, *Exerodonta sumichrasti* BROCCHI, *idem*, p. 20 (Santa Efigenia, Mexico).]

Two species of *Hylella* are known to occur in Mexico, and they differ from all other Mexican Hylidae in the absence of vomerine teeth. These diminutive tree frogs must escape the notice of collectors, since they are rarely found in collections made in that country. Very few specimens of either of these species have thus far found their way into American museums. The eastern form, *Hylella picta*, is the most distinctively marked of the two Mexican species. The presence or absence of vomerine teeth in the young of some species of *Hyla* is sometimes difficult to determine without dissection, and they occasionally may be confused with adult *Hylella*.

KEY TO MEXICAN SPECIES OF HYLELLA

1. No tarsal fold; a narrow white stripe bordered below by darker streak commences at tip of snout and extends backward on canthus rostralis, across eyelid, and above tympanum, becoming fainter as it approaches the groin; upper surfaces light purplish, unicolored, or with scattered, round, dark purple light-edged spots of the size of the tympanum; under surfaces whitish; limbs mottled, with concealed portions pigmentless; skin of upperparts smooth; underparts, with exception of gular region, granulated; tympanum slightly more than one-third diameter of eye; no vomerine teeth; tongue nearly circular, scarcely notched behind; canthus rostralis angular; loreal region subvertical; fingers with vestigial basal web; toes three-fourths webbed, the membrane extending to disks of the third and fifth toes and leaving free the last phalanx of the fourth; adhesive disks smaller than or as large as the tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint reaches between the eye and the end of the snout; head-and-body length, 24 mm.....**picta** (p. 180)

A tarsal fold present; no lateral white stripe; upper surfaces ash colored; under surfaces yellowish or light orange; no markings on sides or on concealed surfaces of limbs, or on superior surfaces of limbs; skin of upperparts smooth; underparts, including gular region, granulated; tympanum one-third to one-half diameter of eye; no vomerine teeth; tongue circular, scarcely notched behind; canthus rostralis distinct, obtuse; loreal region subvertical; fingers one-third webbed; toes three-fourths webbed, the membrane reaching the disks of the third and fifth toes and leaving free the last phalanx of the fourth; adhesive disks as large as the tympanum; the hind limb being carried forward along the body, the tibio-tarsal joint reaches the eye; head-and-body length, 28–32 mm.**sumichrasti** (p. 181)

HYLELLA PICTA Günther

1901. *Hylella picta* GÜNTHER, Biologia Centralia-Americana, Reptilia and Batrachia, pp. 286, 287, pl. 73, fig. c, Sept.

Type locality.—Jalapa, State of Vera Cruz, Mexico.

Range.—From Jalapa in Vera Cruz southward to Frontera in Tabasco; not known to occur on the Pacific drainage area.

Remarks.—The type of this species (B.M. No. 1901. 12. 19. 100) was collected by Mateo Trujillo at Jalapa in Vera Cruz. It is described in my notes as follows: Head-and-body length, 24.1 mm.; transverse diameter of tympanum, 1 mm.; transverse diameter of eye, 2.3 mm.; anterior edge of eye to nostril, 2.2 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to the anterior margin of the eye; no tarsal fold; large inner but no outer metatarsal tubercle; fingers with vestige of web at base; no vomerine teeth; canthus rostralis rounded; loreal region subvertical; upperparts (in alcohol) light purplish red, with somewhat widely scattered black dots.

A notation on the label accompanying the small series in the United States National Museum indicates that Doctor Townsend found this tree frog on vegetation in the woods near Frontera in Tabasco.

Specimens examined.—Nine, as follows:

Hylella picta

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
B.M.	1901. 12. 19. 100.	[1] 1	Vera Cruz: Jalapa		Mateo Trujillo.
U.S.N.M.	37739–46	8	Tabasco: Frontera	Apr. 23, 1897	C. H. T. Townsend.

[1] Type.

HYLELLA SUMICHRASTI (Brocchi)

1879. *Exerodonta sumichrasti* Brocchi, Bull. Soc. Philom. Paris, ser. 7, vol. 3, no. 1, p. 20.—Brocchi, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 48, pl. 15, figs. 2, 2a–d.

1879. *Hylella platycephala* Cope, Proc. Amer. Philos. Soc., vol. 18, no. 104, p. 267, June 20 (Tehuantepec, Mexico).

Type locality.—Santa Efigenia, southeastern Tehuantepec, State of Oaxaca, Mexico.

Range.—Unknown; occurs on the Pacific drainage of the Isthmus of Tehuantepec and in the vicinity of Cualata, Colima.

Remarks.—In writing to Baird in regard to one of his shipments of specimens from Tehuantepec, Sumichrast stated that his lot No. 10, the cotypes of *Hylella platycephala*, were collected in oak woods at an elevation of 2,000 to 3,000 feet. About the same time another small series of these toothless tree frogs were forwarded to the Paris Museum, and they formed the basis for *Exerodonta sumichrasti*. The name proposed by Brocchi seems to have priority over that proposed by Cope.

The type of *Exerodonta sumichrasti* Brocchi seems to be lost, and no entry that corresponds with the locality data published by Brocchi was found in the catalogues of the Paris Museum. Furthermore, the following footnote in pencil and in the handwriting of Mocquard appears on page 48 of the copy of Brocchi's memoir belonging to the laboratory of herpetology: "Ne se trouvé pas dans la collection du Museum."

The five cotypes (U.S.N.M. No. 10037) of *Hylella platycephala* Cope differ very slightly from one another. The following notes were made on the largest individual: Head-and-body length, 31.7 mm.; transverse diameter of tympanum, 1.3 mm.; transverse diameter of eye, 3.7 mm.; anterior edge of eye to nostril, 3 mm.; head flat and thin through; a distinct tarsal fold from inner metatarsal tubercle to heel; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to posterior margin of eye; fingers one-third webbed at

base; skin on throat, abdomen, and under surface of thighs coarsely granulated.

It has been reported that the eggs of this tree frog are deposited in the axils of the leaves of Spanish beard (*Tillandsia*), where they undergo their whole metamorphosis.

Specimens examined.—Six, as follows:

Hylella sumichrasti

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	57518	1	Colima: Cualata		J. Hurter.
Do	10037	[1] 5	Oaxaca: Near Santa Efigenia altitude 2,000–3,000 feet.		Francis Sumichrast.

[1] Cotypes.

Family BREVICIPITIDAE Cope

1867. Brevicipitidae Cope, Journ. Acad. Nat. Sci. Philadelphia, n. s., vol. 6, pt. 2, p. 191, Sept.

Brevicipitid toads exhibit a great range of skeletal modification and comprise one of the most interesting families of recent Salientia. Genera referred to this family occur in Africa, Madagascar, southern Asia, the Malay Archipelago, East Indies and New Guinea, as well as in North, Central, and South America. Doctor Noble derives the brevicipitid toads from the true frogs, Ranidae. Two genera, *Hypopachus* and *Gastrophryne*, are represented by one or more species in Mexico. They are generally known as narrow-mouthed toads, and stomach examinations indicate that they depend upon ants for a considerable portion of their food. They are largely nocturnal in habit and are rarely observed, except during the breeding season, when large numbers may be found congregated in some small pool of water.

KEY TO MEXICAN BREVICIPITIDAE

1. Toes united at base by vestigial web; fingers free, not dilated at tips; subarticular tubercles large, distinct; terminal phalanges simple; precoracoids present, but very small; no omosternum; sternum cartilaginous; underparts dusky or dirty white, either more or less marbled with brownish or with lighter ground color showing through as spots; upperparts brown or vinaceous, immaculate, or with darker markings; sides anteriorly blackish brown, with rather sharply defined upper and lower limits; hinder surface of thighs marbled with dark brown or with coarse vinaceous vermiculations; a dark oblique band across thigh and another across leg; a very narrow light median line commencing at chin and extending backward to chest; snout short, subacuminate, and moderately prominent; nostrils nearly terminal; mandible with two symphyseal notches, and a median knob; tongue flat, elongate; slits of

vocal vesicle large; some vinaceous spots behind angle of mouth; the fore limb being carried forward along the head, the wrist reaches beyond the tip of the snout; fingers moderately elongated—in order of increasing lengths: 1, 2, 4, and 3; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to front of scapula or between shoulder and eye; hind limb stout; toes with blunt tips and distinct subarticular tubercles; two very prominent, oval, compressed metatarsal tubercles, the inner sublongitudinal and protuberant, the outer subtransverse; skin perfectly smooth or irregularly roughened by tiny asperities; a dermal fold extends across head behind the eyes; body length, snout to vent, 28 to 40 mm. ----------**Hypopachus variolosus** (p. 184)

Toes free, without vestigial web at base; fingers free, blunt or slightly dilated at tips; terminal phalanges simple; precoracoids absent; coracoids united by a simple cartilage; no omosternum; sternum cartilaginous; underparts yellowish or brownish, stippled or marbled with brown----------**Gastrophryne** (p. 186)--2

2. A prominent outer metatarsal tubercle and a somewhat larger oval inner metatarsal tubercle; snout acuminate, moderately projecting, and not twice as long as the diameter of the eye; the hind limb being carried forward along the body, the tibio-tarsal joint reaches the shoulder or slightly beyond; toes quite free, with blunt tips and distinct subarticular tubercles; skin smooth or with small tubercles on back; a more or less distinct dermal fold across the head behind the eyes; upperparts olive or brownish; generally a broad light band along each side of the body, and a narrow vertebral line; limbs lighter in color; thigh and leg each with a broad dark cross band; a white line from angle of mouth to insertion of fore limb; male with subgular sac; throat deep black; body length, snout to vent, 26 to 28 mm----------**Gastrophryne usta** (p. 187)

No outer metatarsal tubercle; inner metatarsal tubercle very small, indistinct; snout pointed, projecting, and twice as long as the diameter of the eye; the hind limb being carried forward along the body, the tibio-tarsal joint reaches in front of the shoulder; toes quite free, with blunt tips and distinct subarticular tubercles; skin perfectly smooth; a dermal fold across the head behind the eyes; upperparts rose colored or light brown; back with an irregular broad dark band; sides of head and body dark brown; hip with a large dark-brown round spot; thigh, leg, and tarsus each with a dark-edged cross band; belly marbled with brown; throat brown, marbled with white; body length, snout to vent, 32 mm---------- ----------**Gastrophryne elegans** (p. 187)

Genus HYPOPACHUS Keferstein

1867. *Hypopachus* Keferstein, Nachr. königl. Ges. Wiss. Univ. Göttingen, no. 18, p. 351, July 24. [Genotype, *Hypopachus seebachii* Keferstein, *idem*, p. 352 (Costa Rica)=*Engystoma variolosum* Cope, 1866, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 131, May (Arriba, Costa Rica).]

Three species of *Hypopachus*—*cuneus*, *inguinalis*, and *variolosus*—are now recognized. The Texan species, *H. cuneus*, has been taken

at Brownsville, Tex., and future collecting may show that it occurs also south of the Rio Grande in the State of Tamaulipas. This species is not listed in the key since there are no Mexican records. *H. variolosus* seems to be restricted in Mexico to the Pacific coast, where it has been found as far north as southern Sinaloa. A quite differently marked and much brighter-colored species, *H. inguinalis*, is known to occur as far north as the Lake Peten district of northern Guatemala. This species may possibly occur also in the adjoining states of Mexico. The habits and life histories of these narrow-mouthed toads are not on record. All three have loose leathery skins, and they may hide, as does *Gastrophryne*, under old logs and other débris.

HYPOPACHUS VARIOLOSUS (Cope)

1866. *Engystoma variolosum* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 131, May.

1867. *Hypopachus seebachii* Keferstein, Nachr. königl. Ges. Wiss. Univ. Göttingen, no. 18, p. 352, July 24 (Costa Rica).

1883. *Hypopachus oxyrrhinus* Boulenger, Ann. and Mag. Nat. Hist. ser. 5, vol. 11, no. 65, p. 344, May (Presidio near Mazatlan, Sinaloa).

Type locality.—Arriba, Costa Rica.

Range.—From near Mazatlan in Sinaloa southward through Jalisco to Costa Rica.

Remarks.—The type specimen of Cope's *Engystoma variolosum* (U.S.N.M. No. 6486) was collected at Arriba in 1863 by Charles N. Riotte, who was at that time the United States minister to Costa Rica. It is fairly well preserved, although the original color pattern has been somewhat obscured by the preservative and the light, and the left hind leg is missing below the knee. The measurements of the type are as follows: Head-and-body length, 35.5 mm.; transverse diameter of eye, 3.2 mm.; anterior edge of eye to nostril, 2.4 mm.; width of head at level of posterior angles of jaws, 9.8 mm.

Hypopachus seebachii, which was collected by Professor von Seebach during his travels in Costa Rica in 1865, was recognized as a new genus and species by Peters. Two years later, Cope [65] pointed out that *H. seebachii* was a synonym of his *H. variolosus*. Boulenger thought that specimens collected by Alphonso Forrer at Presidio near Mazatlan in Sinaloa represented a new species, which he named *Hypopachus oxyrrhinus*. The following notes relate to these two cotypes: Smaller individual (B.M. No. 1882. 12. 5. 8): Head-and-body length, 27.5 mm.; transverse diameter of eye, 3.3 mm.; anterior edge of eye to nostril, 1.9 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to barely beyond

[65] Cope, E. D., Seventh contribution to the herpetology of Tropical America. Proc. Amer. Philos. Soc., vol. 11, no. 82, p. 167, July 16, 1869.

the axilla; side of head below canthus rostralis and shoulder dark; dark cross bands on hind limbs, and when femur, tibia, and tarsus are folded back at right angles to long axis of body, the ends of these dark crossbars meet and simulate a continuous band. The other cotype (B.M. No. 1883. 4. 5. 3) does not differ in any essential detail from the preceding specimen and has a body length, snout to vent, of 29.8 mm.

The key prepared by Cope [66] in 1889 to distinguish *oxyrrhinus* from *variolosus* apparently was incorrectly drawn up from memory, for the heel of *oxyrrhinus* does not reach to end of the muzzle, and the sides of *variolosus* are blackish brown anteriorly, as stated in the original description. In describing *oxyrrhinus*, Boulenger observes that the heel or tibio-tarsal joint reaches to between the shoulder and the eye. The distinctions made by Cope do not exist. Günther [67] correctly placed *H. seebachii* and *H. oxyrrhinus* in the synonymy of *H. variolosus*.

A juvenile specimen (M.N.B. No. 7585) collected by Adolphe Boucard in Mexico is described in my notes as follows: Head-and-body length, 20 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to the eye; very large subarticular tubercles on fingers and toes; inner metatarsal tubercle quite large, the outer one smaller, but larger than the subarticular tubercles; skin of underparts minutely areolate; a quite narrow dark interorbital stripe; remainder of upperparts (in alcohol) grayish; a black stripe along canthus rostralis from tip of snout to eye, and from eye to above tympanum and to behind the latter on the sides; upper anterior surface of thighs pink; dark cross bands on hind limbs indistinct; underparts dark, with numerous closely spaced minute light spots.

Specimens examined.—Seven, as follows:

Hypopachus variolosus

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			SINALOA:		
B.M.	82. 12. 5. 8	[1] 1	Presidio de Mazatlan		Alphonso Forrer.
Do.	83. 4. 5. 3	[1] 1	do		Do.
			JALISCO:		
U.S.N.M.	9871–73	3	Guadalajara		A. Dugés.
A.M.N.H.	12112	1	Swamp southwest of Ocatlan.	Aug. 16, 1919	Paul D. R. Ruthling.
U.S.N.M.	6486	[2] 1	COSTA RICA: Arriba	1863	Charles N. Riotte.

[1] Cotypes of *Hypopachus oxyrrhinus*.
[2] Type of *Engystoma variolosum*.

[66] Cope, E. D., U. S. Nat. Mus. Bull. 34, p. 338, 1889.
[67] Günther, A. C. L. G., Biologia Centrali-Americana, Reptilia and Batrachia, p. 211, Feb., 1900.

Genus GASTROPHRYNE [68] Fitzinger

1828. *Microps* WAGLER, Isis von Oken, vol. 21, p. 744. [Genotype, *Microps unicolor* Wagler, *idem*, p. 744=[*Rana*] *ovalis* SCHNEIDER, 1799, Historiae amphibiorum, naturalis et literariae, fasc. 1, p. 131; *Microps* WAGLER preoccupied by *Microps* MEGERLE, 1823, Coleoptera.]

1838. *Stenocephalus* TSCHUDI, Mém. Soc. Sci. Nat. de Neuchâtel, vol. 2, pp. 49, 86. [Genotype, *Microps unicolor* WAGLER, 1828, Isis von Oken, vol. 21, p. 744=[*Rana*] *ovalis* SCHNEIDER, 1799, Historiae amphibiorum naturalis et literariae, fasc. 1, p. 131; *Stenocephalus* TSCHUDI preoccupied by *Stenocephalus* LATREILLE, 1825, Hemiptera.]

1841. *Engystoma* DUMÉRIL and BIBRON, Erpétologie générale, vol. 8, pp. 738, 740. [Genotype, [*Rana*] *ovalis* SCHNEIDER, 1799, Historiae amphibiorum, naturalis et literariae, fasc. 1, p. 131.] [*Nec Engystoma* FITZINGER, 1826=*Breviceps* MERREM, 1820.]

1843. *Gastrophryne* FITZINGER, Systema reptilium, fasc. 1, p. 33. [Genotype, *Engystoma rugosum* DUMÉRIL and BIBRON, 1841, Erpétologie générale, vol. 8, p. 744 (des parties méridionales de l'Amérique du Nord)=*Engystoma carolinense* HOLBROOK, 1836, North American herpetology, ed. 1, vol. 1, p. 83, pl. 11 (Charleston, S. C.).]

Thirteen species of the genus *Gastrophryne* were enumerated by Doctor Stejneger in 1910, the northernmost being the little *G. carolinensis* of Southeastern United States and the southernmost Boulenger's *G. leucosticta* from Santa Catharina, Brazil. The 12 American species form a natural assemblage with a rather widespread range, and hence the occurrence of Boulenger's *G. borneensis* in Borneo has long proved a puzzling obstacle to zoogeographers. This record has often been cited as one of the remarkable instances of discontinuous distribution in the Amphibia. A restudy of the type of *G. borneensis* in the British Museum of Natural History has been made by Doctor Noble,[69] who finds that the internal anatomy of the Bornean species differs from that of the American forms in a number of important details. He has shown that although *G. borneensis* resembles the species of *Gastrophryne* externally, the structural features indicate that it is not closely related to the American species, and he therefore proposes a new generic name, *Gastrophrynoides*, for the species that occurs in Borneo.

There are in American institutions relatively few specimens of narrow-mouthed toads from Mexican localities, and lack of adequate material, especially from critical areas, has made it rather difficult to draw any definite conclusions as to the number of species of this genus that may be expected to occur within the boundaries of the Mexican Republic. It is possible that Strecker's *G. areolata* and Girard's *G. texensis* may occur in northern Mexico, particularly south of and along

[68] For use of the name *Gastrophryne* in place of *Engystoma*, see Stejneger, L., Proc. Biol. Soc. Washington, vol. 23, pp. 165–167, Dec. 29. 1910.

[69] Noble, G. K., An analysis of the remarkable cases of distribution among the Amphibia, with descriptions of new genera. Amer. Mus. Nov., no. 212, pp. 20–23, 1926.

the Rio Grande. No intensive herpetological collecting has been carried on in recent years in the States of Tamaulipas and Chihuahua.

Very little has been published in regard to the habits and life histories of these little narrow-mouthed toads. The Texan species are known to hibernate in small groups under rotten logs and under piles of rubbish. During the breeding season, it frequents pools of stagnant water and may be observed floating on the surface, if one approaches quietly. Doctor Wright has published observations on the eggs [70] and the tadpoles [71] of two species found within the limits of the United States.

GASTROPHRYNE ELEGANS (Boulenger)

1882. *Engystoma elegans* BOULENGER, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 162.—GÜNTHER, 1900, Biologia Centrali-Americana, Reptilia and Batrachia, p. 210, pl. 62, fig. D, Feb.

1910. *Gastrophryne elegans* STEJNEGER, Proc. Biol. Soc. Washington, vol. 23, p. 166, Dec. 29.

Type locality.—Cordoba, State of Vera Cruz, Mexico.

Range.—Not known to occur elsewhere than at the type locality.

Remarks.—An adult female narrow-mouthed toad collected by Auguste Sallé at Cordoba in Vera Cruz and previously identified by Günther [72] as *Engystoma carolinense* was found by Boulenger to lack the outer metatarsal tubercle. This single character is the basis for the recognition of this species. The type, so far as known, remains unique. Not until a series of specimens from the type locality and vicinity is available for study, will it be possible to determine whether the outer metatarsal tubercle is normally absent in narrow-mouthed toads of that region.

Specimens examined.—None.

GASTROPHRYNE USTA (Cope)

1866. *Engystoma ustum* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 131, May.—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 94, pl. 10, fig. 1.

1869. *Engystoma mexicanum* PETERS, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 881, Dec. (State of Puebla, probably Matamoros).

1903. *Eupemphix gadovii* BOULENGER, Ann. and Mag. Nat. Hist., ser. 7, vol. 12, p. 552, Nov. (San Mateo del Mar, Tehuantepec).

1910. *Gastrophryne usta* STEJNEGER, Proc. Biol. Soc. Washington, vol. 23, p. 166, Dec. 29.

Type locality.—Guadalaxara [=Guadalajara], State of Jalisco, Mexico.

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[70] Wright, A. H., and Wright, A. A., A key to the eggs of the Salientia east of the Mississippi River. Amer. Nat., vol. 58, no. 657, p. 378, 1924.

[71] Wright, A. H., Synopsis and description of North American tadpoles. Proc. U. S. Nat. Mus., vol. 74, no. 2756, pp. 2, 3, 13–16; pl. 6, fig. 3; pl. 6, fig. 1, June 4, 1929.

[72] Günther, A. C. L. G., Catalogue of the Batrachia Salientia in the collection of the British Museum, pp. 51, 52, 1858.

Range.—From southern Sinaloa southward through San Luis Potosi and Jalisco to Tehuantepec in Oaxaca and southern Vera Cruz (Minatitlan).

Remarks.—The type of Cope's *Engystoma ustum* (U.S.N.M. No. 24965) is partially macerated, the fleshy portions are largely disintegrated, and the skeleton is more or less disarticulated. J. J. Major, the collector of the type, in 1861 sent a collection of reptiles to the Museum, and this type was presumably included in the shipment, since no other accessions are credited to him.

The three cotypes of *Eupemphix gadovii* (B. M. Nos. 1903. 9. 30. 259–261) were obtained by Dr. and Mrs. Hans Gadow at San Mateo del Mar in Oaxaca. H. W. Parker, of the British Museum of Natural History, has recently examined the cotypes and reports that they are narrow-mouthed toads belonging to the genus *Gastrophryne* and that although very young they seem to be referable to the species *usta*. According to my own observations, all these cotypes are very young individuals, the head-and-body length of the largest being 12.4 mm.; one has a light vertebral stripe; an inner metatarsal tubercle present; a light silvery streak extends along canthus rostralis from nostril to eye and is continued backward from eye along side to near level of anterior end of sacrum as a very irregular wavy band.

In the introduction to the report on the herpetological specimens collected by Berkenbusch in Puebla, Peters states that they were taken in the vicinity of Matamoros and at other localities. No specific type locality is given, except that of Puebla in the title of the paper, for his supposedly new species, *Engystoma mexicanum*. Cope [73] seems to have been the first to recognize that Peters's species was identical with *usta*, but nevertheless the last-mentioned species was mistakenly allocated to the genus *Systoma*.

Specimens examined.—Twenty, as follows:

Gastrophryne usta

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	73267	1	SINALOA: Venodio		J. Aug. Kusche.
Do	46919	1	SAN LUIS POTOSI: Valles	May 4, 1898	Nelson and Goldman.
			JALISCO:		
Do	46963	1	Atemajac	May 28, 1892	E. W. Nelson.
Do	24965	[1] 1	Guadalajara		J. J. Major.
A.M.N.H.	12113	1	Oblatos, northeast of Guadalajara, Jamay.	Aug. 12, 1919	Paul D. R. Ruthling.
U.S.N.M.	47530	1	VERA CRUZ: Minatitlan	Apr. 22, 1896	Nelson and Goldman.
			OAXACA:		
Do	10021	1	Santa Efigenia, Tehuantepec.		Francis Sumichrast.
A.M.N.H.	A-6730	1	do		Do.
M.C.Z.	1862	9	do		Do.
B.M.	1903. 9. 30. 259–261	[2] 3	San Mateo del Mar		Dr. and Mrs. Hans Gadow.

[1] Type of *Engystoma ustum.* [2] Cotypes of *Eupemphix gadovii.*

[73] Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia, vol. 23, p. 216, Oct. 24, 1871.

Family RANIDAE Bonaparte

1831. Ranidae Bonaparte, Giorn. Arcad. Sci. Lett. ed Arti, Roma, vol. 49, pp. 65, 75.

The members of the Ranidae have a wide distribution in temperate and tropical regions, but are not found in Australia, Tasmania, New Zealand, eastern Polynesia, or Hawaii. Frogs are generally thought of as being largely aquatic, but there are some with large digital disks that are arboreal in habit. Others, like the North American wood frog (*Rana sylvatica*), prefer a land life and are generally found on the ground in the woods. As with the true tree frogs, there are a few species that burrow in the ground. All the Mexican species of the genus *Rana* are more or less aquatic. One Mexican species, *R. montezumae*, is commonly sold for food in the markets of Mexico City.

The Ranidae have maxillary but no mandibular teeth, a firmisternal type of shoulder girdle, cylindrical or slightly expanded sacral diapophyses, and a biconvex sacral vertebra with double condyle for the coccyx. The tongue of the ranids differs from the type found in other families of tailless amphibians in that it is provided with two lateral posterior horns. In rare instances ranas have been found with a nearly trilobed tongue. Frogs of the genus *Oxyglossus* have a single median horn on the posterior free end of the tongue.

Genus RANA Linnaeus

1758. *Rana* Linnaeus, Systema naturae, ed. 10, vol. 1, p. 210. [Genotype, [*Rana*] *temporaria* Linnaeus, p. 212 (Europe); based upon Linnaeus, 1746, Fauna Svecica, p. 94.]

1814. *Ranaria* Rafinesque, Specchio Sci., Palermo, vol. 2, fasc. 7. [Substitute name for *Rana* Linnaeus.]

1843. *Pelophylax* Fitzinger, Systema reptilium, fasc. 1, p. 31. [Genotype, *Rana esculenta* Linnaeus, 1758, Systema naturae, ed. 10, vol. 1, p. 212.]

1859. *Ranula* Peters, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 402, May. [Genotype, *Ranula gollmerii* Peters, *idem*, p. 402 (Caracas, Venezuela).]

1867. *Pohlia* Steindachner, Reise der Oesterreichischen Fregatte *Novara*, Zoologischer theil, vol. 1, Amphibien, p. 15. [Genotype, *Pohlia palmipes* Steindachner, *idem*, p. 15, pl. 1, figs. 5–8=*Rana palmipes* Spix, 1824, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 5, pl. 5, fig. 1 (Amazon River, Brazil).]

1868. *Trypheropsis* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 20, p. 117. [Genotype, *Trypheropsis chrysoprasinus* Cope=*Ranula chrysoprasina* Cope, 1866, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 129 (Arriba, Costa Rica).]

1891. *Crotaphitis* Schulze, Jahresber. Naturw. Ver. Magdeburg, 1890, p. 176. [Genotype, *Rana temporaria* Linnaeus.]

1891. *Baliopygus* Schulze, Jahresber. Naturw. Ver. Magdeburg, 1890, p. 177. [Genotype, [*Rana*] *esculenta* Linnaeus, 1758, Systema naturae, ed. 10, vol. 1, p. 212; based upon "*Ranae viridis aquaticae*" Roesel von Rosenhof, 1758, Historia naturalis ranarum nostralium, p. 53, pl. 13 (Europe).]

With the exception of the generic names that are based on Linnaean species from Europe, the synonyms of the genus *Rana* here enumerated are restricted to those based on New World species.

There are at least six distinct species of the genus *Rana* on continental Mexico. The largest of these is the well-known North American bullfrog (*R. catesbeiana*), which is here for the first time recorded in Mexico. The wide-ranging leopard frog (*R. pipiens*) seems to be the most abundant rana in Mexico. One South American species, *R. palmipes*, reaches its northern limit in Vera Cruz. A Mexican relative, *R. tarahumarae*, of the Pacific coast yellow-legged frog (*R. boylii*) has been found in the high sierras of western Chihuahua. *R. montezumae* undoubtedly possesses the most peculiar color pattern of all Mexican ranas, and notwithstanding its characteristic appearance nothing has been published in regard to its life history, and all that is known of its habitat is that it frequents the lakes in the Valley of Mexico. The rarest of all Mexican frogs in collections is one which Boulenger named *Rana pustulosa*.

All known species of the genus *Rana*, except one, deposit their eggs in the water, where they develop into tadpoles. The single exception of this general habit is a frog (*R. opisthodon*) that occurs on the Solomon Islands, and this species lays its eggs on land in moist crevices of rocks close to water. These eggs develop directly into frogs without any aquatic tadpole stage. The regular larval stage and subsequent metamorphosis are hurried through within the egg. The buccal apparatus of the larvae of these ranas is quite characteristic for each species, and many of them can be recognized in life by their color pattern. The mouth disk is devoid of horny teeth in some species. In others there are more than the normal number of rows. The tadpole of *R. catesbeiana* may have as many as three rows of horny teeth in the upper and in the lower jaws.

KEY TO MEXICAN SPECIES OF RANA

1. No trace of dorso-lateral glandular dermal folds 2
   Dorso-lateral glandular dermal folds present 3
2. Tympanum distinct, with or without small asperities, its transverse diameter two-fifths to one-half that of eye; upperparts, including top of head, brown or olive, marked with irregular blotches, or small black spots, or numerous dots; limbs with irregular dark crossbars; abdomen white; throat and chest either white or mottled with brown; limbs mottled with grayish brown; skin of upperparts either smooth or with small pustules; a feeble curved glandular fold from eye to shoulder, but no dorso-lateral glandular fold; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to or nearly to end of snout; tarsal fold distinct or indistinct; distance from snout to vent 1¾ to 2 times length of tibia; tips of toes swollen into small disks; a broad web between the toes; outer metatarsals separated nearly to base; inner metatarsal tubercle

elliptic, feebly prominent, one-third or more the length of inner toe; no outer metatarsal tubercle; subarticular tubercles large and prominent; tips of fingers feebly swollen; first finger longer than second; males with thick blackish pad on inner side of first finger; no external vocal vesicles; vomerine teeth in two small groups within and behind level of choanae; head broader than long and much depressed; snout rounded, as long as transverse diameter of eye, and barely projecting beyond mouth; canthus rostralis indistinct; loreal region very oblique, slightly concave; nostril equidistant from end of snout and from eye; interorbital width equal to or a little less than that of upper eyelid; head-and-body length of adults, 45 to 78 mm. ---------- tarahumarae (p. 214)

Tympanum very distinct, its transverse diameter nearly equal to that of eye in females and greater than the latter in males; upperparts brown or olive-brown, rarely green, uniform or spotted, or marbled with dark brown; limbs with or without dark cross bands; hinder side of thighs often marbled with black and yellow; chin yellow; rest of underparts white, sometimes marbled with brown, or spotted with white and yellow; skin of upperparts fairly smooth and leathery, with scattered warts; a strong glandular fold from eye to shoulder, but no dorso-lateral fold; sides often with pustulose warts; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to eye or tympanum; no tarsal fold; distance from snout to vent 2 to 2½ times length of tibia; tips of toes slightly swollen; toes fully webbed, with exception of distal joint of fourth; outer metatarsals separated to base; inner metatarsal tubercle elliptic, feebly prominent, one-third or more the length of inner toe; no outer metatarsal tubercle; subarticular tubercles small; tips of fingers pointed or obtuse; first finger as long as or a little longer than second; males with retracting pad on inner side of first finger; internal vocal vesicles present; vomerine teeth in small clusters or short oblique rows between or rarely behind level of choanae; head broader than long and much depressed; snout rounded, as long as or a little longer than transverse diameter of eye, and clearly projecting beyond mouth; canthus rostralis indistinct; loreal region very oblique, slightly concave; nostril equidistant from end of snout and from eye, or a little nearer the former; interorbital width varies from one-half to nearly once that of upper eyelid; head-and-body length of adults, 100 to 200 mm. catesbeiana (p. 195)

3. Ground color of upperparts as well as the dark spots stippled or dotted with closely approximated minute white spots or specks; underside of thighs occasionally reddish, but likewise covered with small white dots; upperparts purplish brown or olive-brown, uniform or speckled, vermiculated, or mottled with lighter and darker, with or without large rounded or elongated ocellated dark brown spots, which may be grass green in life and are often light edged or encircled with ring of white dots; tympanum occasionally stippled with white specks; limbs with or without dark cross bands; underparts grayish white, ash, dirty yellow, or brownish, conspicuously spotted, blotched, or vermiculated with spots and sinuations of white; anterior, posterior, and inferior surfaces of thighs marked with numerous

white dots and blotches; skin of back between dorso-lateral glandular dermal folds smooth or granular, and with small warts; a narrow or moderately broad, feebly prominent, dorso-lateral glandular dermal fold from above tympanum to sacral region or a little beyond, sometimes interrupted, and occasionally absent; sides with flattened warts; underparts generally smooth; abdomen and thighs sometimes granular; a broad glandular fold from below tympanum to above arm; upper surface of tibia with or without longitudinal glandular ridges; fingers long and slender, pointed, and sometimes bordered by narrow dermal fold; first finger usually as long as second, occasionally slightly longer or slightly shorter; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to tympanum or eye or beyond; distance from snout to vent 2 to 2⅓ times length of tibia; toes rather long, pointed, webbed to tips or with last joint of fourth free; outer metatarsals separated nearly to base; subarticular tubercles small, feebly prominent; tarsal fold feeble, but often a distinct ridge; inner metatarsal tubercle elliptic or subtriangular and prominent, one-fourth to one-third the length of inner toe; no outer metatarsal tubercle; width of head at level of posterior angles of jaws greater than distance between end of snout and posterior margin of tympanum; snout rounded, scarcely projecting beyond mouth, as long as or a little longer than transverse diameter of eye; canthus rostralis indistinct; loreal region very oblique, scarcely concave; nostril equidistant from eye and from end of snout or a little nearer the former; interorbital width less than that of upper eyelid; tympanum moderately or very distinct, two-thirds to once the diameter of the eye; vomerine teeth in small transverse or oblique groups between or barely behind posterior borders of choanae; male with a large blackish external vocal vesicle on each side, forming loose folds from behind angle of mouth to shoulder; head-and-body length of adults, 100 to 145 mm.....montezumae (p. 197)

Ground color of upperparts and underparts never stippled or spotted with white dots.....4

4. Skin of back between dorso-lateral glandular dermal folds smooth or granular, with more or less conspicuous elongated warts or interrupted glandular ridges; a prominent, narrow or moderately broad glandular dorso-lateral dermal fold, extending backward from upper eyelid at most to level of acetabulum, but generally interrupted or else ending at about level of middle of sacrum; a glandular fold from below eye to vocal vesicle or to above arm; longitudinal glandular ridges bearing small conical tubercles sometimes present on upper surface of tibia; hinder surface of thigh rugose or granular; sides of body with low papillae; lower parts smooth, abdomen exceptionally feebly granular; upperparts brown, gray, olive, or bright green, with numerous rounded or elongated dark brown or black spots strongly contrasted with lighter ground color and with or without light margins; upperparts rarely without dark spots; a dark central streak, a dark blotch on upper eyelid, and a rounded dark spot on top of snout sometimes present; tympanum often reddish or bronzed, occasionally with light spot in center; dorso-lateral glandular dermal folds

golden, bronzed, or grayish; sides of body paler than back and variously spotted or marbled with black; upper surfaces of limbs with large dark spots, or with continuous or interrupted dark cross bands; hinder surface of thighs yellow or grayish white, vermiculated, marbled, or spotted with black, or else black with reddish-yellow spots; underparts white or yellow; throat and chest often spotted, marbled, or mottled with gray or brown; longitudinal dark streak or dark marbling may or may not be present on anterior surface of thigh; fingers obtusely pointed, sometimes bordered by feeble lateral fringe; first finger equal to or longer than second; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to eye or to end of snout, or a little beyond, and usually to between eye and end of snout; distance from snout to vent 1⅔ to 2 times length of tibia; toes obtusely pointed, two-thirds to nearly entirely webbed, usually two phalanges of fourth free, occasionally one or three; outer metatarsals separated nearly to base; subarticular tubercles rather small, moderately prominent; tarsal fold distinct, feeble, or absent; inner metatarsal tubercle narrow, more or less prominent, or compressed, one-third to one-half the length of inner toe; outer metatarsal tubercle absent, or small and indistinct; width of head at level of posterior angles of jaws generally less than distance between end of snout and posterior margin of tympanum; snout rounded or obtusely or acutely pointed, projecting more or less beyond the mouth, and as long as or longer than the transverse diameter of eye; canthus rostralis distinct or obtuse; loreal region oblique, feebly concave; nostril equidistant from eye and from end of snout, or a little nearer the former; interorbital width one-third to once that of upper eyelid; tympanum very distinct, smooth surfaced, and one-half to three-fourths diameter of eye; vomerine teeth in short transverse or posteriorly converging oblique groups usually between the choanae (fig. 24), occasionally on a level with their posterior borders, or extending a little beyond their level, and rarely on a level with their anterior borders; male with vocal vesicles internal, or more or less developed externally, but not retractile, forming a flabby pouch behind angle of mouth and above arm; head-and-body length of adults, 65 to 110 mm..... **pipiens** (p. 203)

Skin of back between dorso-lateral glandular dermal folds without elongated warts or glandular ridges..... 5

5. Tips of fingers swollen; vomerine teeth in oblique posteriorly converging rows, the apex of which projects behind level of posterior borders of choanae; head broader than long, rather strongly depressed; snout rounded, scarcely projecting beyond the mouth, as long as transverse diameter of eye; canthus rostralis distinct; loreal region moderately oblique and deeply concave; nostril a little nearer to end of snout than to eye; tympanum very distinct, its transverse diameter less than half that of eye; first finger longer than second; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between eye and end of snout; distance from snout to vent 1¾ times length of tibia; toes with tips swollen into small disks, webbed to tips; outer metatarsals separated nearly to base; subarticular tubercles rather large and promi-

nent; no tarsal fold or ridge; inner metatarsal tubercle oval, two-fifths length of inner toe; no outer metatarsal tubercle; skin of back between dorso-lateral glandular dermal folds covered with small pustules; minute sharp pointed asperities as well as longitudinal rows of minute tubercles on upper surface of thigh, tibia, and tarsus; a strong glandular fold from postero-external angle of upper eyelid to shoulder, and its upper branch is continued backward as a moderately prominent narrow dorso-lateral fold to about level of middle of sacrum; underparts smooth; upperparts (in alcohol) olive, with indistinct dark spots; sides marbled with dark and light; hinder side of thighs blackish, marbled with gray; throat and chest with grayish suffusion; abdomen whitish; head-and-body length of type, 111 mm.....**pustulosa** (p. 213)

Tips of fingers obtuse or rather pointed; vomerine teeth in small oblique groups or short transverse series between the choanae, or on a level with the posterior borders of the latter, equidistant from each other and from choanae, or nearer to each other; width of head at level of posterior angles of jaws less than distance between end of snout and posterior margin of tympanum; snout rounded or obtusely pointed, projecting beyond the mouth, as long as or longer than transverse diameter of eye; canthus rostralis distinct; loreal region moderately oblique, concave; nostril equidistant from eye and from end of snout, or a little nearer the latter; interorbital width greater than, equal to, or less than that of upper eyelid; tympanum very distinct, one-half to five-sixths diameter of eye; fingers obtuse or rather pointed, with more or less distinct lateral dermal ridge; first finger longer than second; male during breeding season with large velvety brown horny pad on inner side of first finger; internal vocal vesicles present; terminal phalanges feebly expanded distally; the hind limb being carried forward along the body the tibio-tarsal joint reaches to eye, to end of snout, or to between these two points; distance from snout to vent 1¾ to 2 times length of tibia; tips of toes swollen into very small disks; toes webbed to tips or with two distal joints of fourth free; outer metatarsals separated nearly to base; subarticular tubercles rather small, fairly prominent; no tarsal fold, sometimes an indistinct ridge; inner metatarsal tubercle elliptic, fairly prominent, one-fourth to one-half the length of inner toe; no outer metatarsal tubercle; skin of back between dorso-lateral glandular dermal folds either smooth, or with minute hispid tubercles, or granular with small pearllike tubercles; a strong glandular fold from upper eyelid to shoulder, and its upper branch is continued backward as a narrow or moderately broad dorso-lateral fold to about level of acetabulum or not quite so far; a more or less distinct glandular fold, often interrupted posteriorly, from below eye to above arm; longitudinal or sinuous glandular ridges bearing numerous small hispid tubercles on upper surface of thigh, tibia, and tarsus; underparts smooth; upperparts green, olive, gray, or brown, sometimes green in front and brown behind, uniform or with small blackish spots and specks; dark canthal, supratympanic, and oblique post-tympanic streaks; loreal and temporal regions often dark brown, with light streak below eye and tympanum to

rictus oris; tympanum occasionally reddish brown; a short oblique dark bar extends downward upon front of forelimb; hind limbs with or without more or less regular dark cross bands; hinder surface of thighs often vermiculated with black and yellow, or marbled with dark brown and yellow; under surface of thighs mottled or marbled with dark brown; throat and chest sometimes entirely brown or heavily marked with blotches and fine specks of same color; abdomen generally uniform white, often yellow and mottled or spotted with some darker color; sides yellowish, vermiculated or mottled with dark brown or black; head-and-body length of adults, 95 to 125 mm----------**palmipes** (p. 200)

RANA CATESBEIANA Shaw

COMMON BULLFROG

Figures 21, 22, and 23

1802. *Rana catesbeiana* SHAW, General zoology, vol. 3, pt. 1, p. 106, pl. 33.—STORER, 1925, Univ. California Publ. Zool., vol. 27, p. 276, pl. 18, figs. 53–56.—WRIGHT, 1929, Proc. U. S. Nat. Mus., vol. 74, no. 2756, pp. 8, 37, pl. 8, figs. 7–9.

1889. *Rana catesbiana* COPE, U. S. Nat. Mus. Bull. 34, p. 424, fig. 108.—DICKERSON, 1906, The frog book, p. 227, pls. 87, 89–96.

Type locality.—South Carolina.

Range.—Probably restricted in Mexico to the coastal lowlands of Tamaulipas and northern Vera Cruz, and to the tributaries of the Rio Grande in the northern Mexican States.

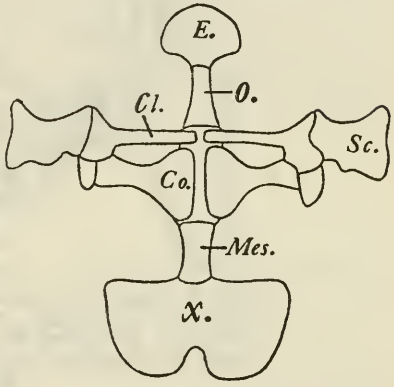

FIGURE 21.—Diagrammatic ventral view of shoulder girdle of *Rana catesbeiana*; firmisternal in structure. The inner extremities of the clavicle and coracoid are attached to the epicoracoid cartilage, and the opposite halves of the girdle are incapable of movement

Cl., clavicle; *Co.*, coracoid; *E.*, episternum; *Mes.*, sternum or mesosternum; *O.*, omosternum; *Sc.*, scapula; *X.*, xiphisternum

Remarks.—According to Stejneger and Barbour, [74] "Shaw evidently knew of the Bull Frog, principally from Catesby, but he speaks of it only as being North American and apparently saw no actual specimens himself." It seems desirable to select a more definite type locality than North America for this species. The assumption that Shaw based his description upon the account of this species by Catesby appears well founded. According to his brief itinerary, Mark Catesby arrived in Virginia, where he had relatives, on April 23, 1712, and remained there for seven years. He had not as yet given any thought to the publication of a work on natural history and had evidently made no drawings, although during this sojourn he did collect a few plants for a friend in England. On his next visit to North America, Catesby landed on May 23, 1722, at Charleston,

[74] Stejneger, L., and Barbour, T., A check list of North American amphibians and reptiles, p. 35, 1923. Cambridge, Mass.

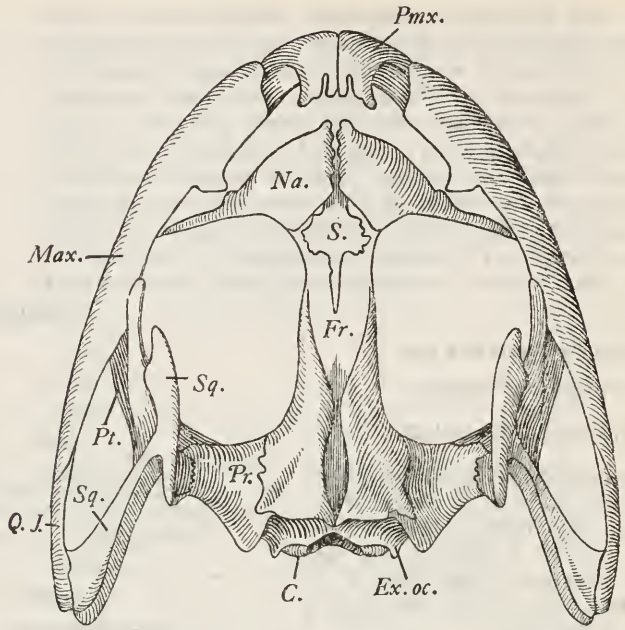

FIGURE 22.—Diagrammatic dorsal view of skull of *Rana catesbeiana*: *C.*, condyle; *Ex. oc.*, exoccipital; *Fr.*, frontoparietal; *Max.*, maxillary; *Na.*, nasal; *Pmx.*, premaxillary; *Pr.*, prootic; *Pt.*, pterygoid; *Q. J.*, quadratojugal; *S.*, sphenethmoid; *Sq.*, squamosal

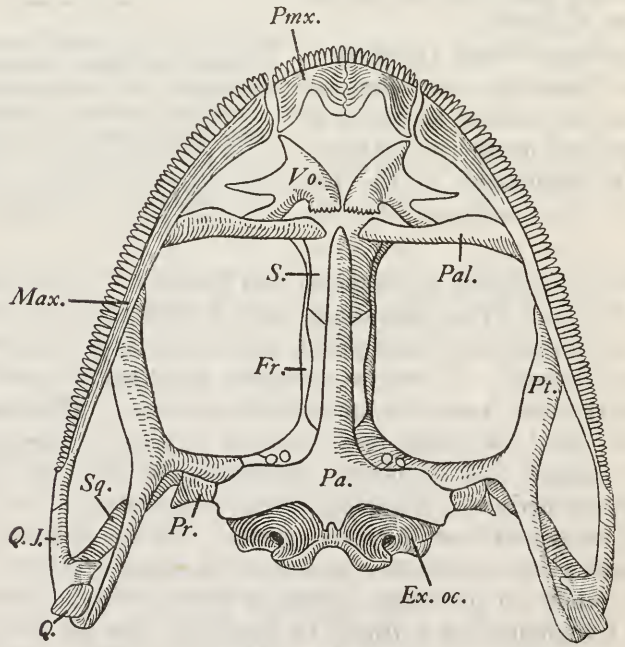

FIGURE 23.—Diagrammatic ventral view of skull of *Rana catesbeiana*: *Ex. oc.*, exoccipital; *Fr.*, frontoparietal; *Max.*, maxillary; *Pa.*, parasphenoid; *Pal.*, palatine; *Pmx.*, premaxillary; *Pr.*, prootic; *Pt.*, pterygoid; *Q.*, quadrate cartilage; *Q. J.*, quadratojugal; *S.*, sphenethmoid; *Sq.*, squamosal; *Vo.*, vomer

S. C. For about one year he searched for animals and plants along the seacoast, and then journeyed up the Savannah River to Fort Moore, where he continued to paint and describe the fauna and flora. After nearly three years in Carolina, Georgia, and Florida, he departed for the Bahama Islands, and later in 1726 returned to England. Although Catesby in his "Natural History of Carolina, Florida, and the Bahama Islands," 1731, frequently includes observations that date back to the time of his visit to relatives in Virginia, the descriptions and drawings were based upon animals actually observed on the second visit. The bullfrog that served as a basis for the drawing was no doubt captured somewhere in South Carolina, and the inclusion of observations on the habits of this frog in Virginia merely indicates that Catesby's knowledge of the habits of this species was not limited to his field work in South Carolina. Therefore South Carolina is here designated as the type locality for *Rana catesbeiana*.

Specimens examined.—Six, as follows:

Rana catesbeiana

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	3340	5	Nuevo Leon: San Diego, near Cadereyta.	April, 1853	D. N. Couch.
Do.	47114	1	Tamaulipas: Altamira	May 19, 1898	Nelson and Goldman.

RANA MONTEZUMAE Baird

1854. *Rana montezumae* Baird, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 61.—Baird, 1859, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 27, pl. 36, figs. 1–6.—Brocchi, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 14, pl. 4, fig. 2.—Cope, 1889, U. S. Nat. Mus. Bull. 34, p. 428, fig. 109.—Günther, 1900, Biologia Centrali-Americana, Reptilia and Batrachia, p. 197, Feb.—Boulenger, 1920, Proc. Amer. Acad. Arts and Sci., vol. 55, no. 9, pp. 415, 431, Aug.

1865. *Rana adtrita* Troschel, *in* Müller's Reisen in den Vereinigten Staaten, Canada, und Mexico, vol. 3, p. 616 (Mexico).

1887. [*Rana montezumae*] *concolor* Cope, U. S. Nat. Mus. Bull. 32, p. 20 (Guanajuato, Mexico).

Type locality.—City of Mexico, Federal District, Mexico.

Range.—From Federal District (Mexico City and Lake Xochimilco), Mexico (Lake Chalco), and Vera Cruz (Orizaba) south through southern Puebla (Chiguahuapan) to Tabasco; and from Guanajuato (Guanajuato) south through Jalisco (Zapotlan) and Michoacan (Tupataro) to Oaxaca (Tehuantepec).

Remarks.—At least 16 frogs of this species were collected by Maj. William Rich in the vicinity of the City of Mexico. One of these (U.S.N.M. No. 3344) has been designated as the electotype in the museum catalogue. According to the entry in the catalogue under

No. 3344, this number was originally assigned to "12+" frogs. A notation made some years later states that 15 of these specimens had been reentered under Nos. 39383–97. Fourteen paratypes (Nos. 39383–96), in addition to the electotype, are now in the possession of the museum. One paratype (M.C.Z. No. 2600) was evidently sent to the Museum of Comparative Zoology as an exchange. Of these 14 paratypes, nine have a head-and-body length that is not greater than 65 mm. The largest (U.S.N.M. No. 39383) has a head-and-body length of 95 mm.

Inasmuch as some diagnostic importance has been assigned to the relative lengths of the toes, the average ratios for this series of 14 specimens have been computed as follows: Lengths of first, second, and third toes, measured from inner metatarsal tubercle to tip of corresponding toe, are equivalent, respectively, to 28.33, 51.18, and 74.22 per cent of the fourth toe. In the largest paratype (No. 39383) the distance between the inner metatarsal tubercle and the tip of the fourth toe is 46.5 mm., and the corresponding measurement for the smallest (No. 39389) is 30.2 mm. The following measurements were taken from the electotype and the largest paratype: Head-and-body length, 77 and 95 mm.; transverse diameter of tympanum, 6 and 7.4 mm.; transverse diameter of eye, 7.5 and 8 mm.; and anterior edge of eye to nostril, 5.1 and 5.9 mm.

The three paratypes of *Rana adtrita* Troschel were collected by Baron J. W. von Müller somewhere in Mexico. As described by Troschel, these have the same peculiar and characteristic color pattern that so readily distinguishes *R. montezumae* from other Mexican frogs. The underside of the thigh is described as being reddish, but marked with numerous white spots. Cope has mentioned the presence of pink spots on the under surface of the thighs of a specimen he examined.

Cope failed to designate a type specimen for his supposedly distinct subspecies *concolor* and merely stated that it was collected by Dr. Alfred Dugés at Guanajuato. The original description is limited to the following words: "Similar to the typical form, but of a uniform fawn-brown color without the spots of the typical form." The subspecies *concolor* was either overlooked or ignored by Cope two years later, since it does not appear in the published synonymy of *Rana montezumae*, although at the end of the accompanying description it is stated that an unspotted brown variety had been found near Guanajuato by Dugés. Some of the specimens from Guanajuato are considerably larger than those from Mexico City. The head-and-body length of the largest specimen (U.S.N.M. No. 12684) is 125 mm.; transverse diameter of tympanum, 9.6 mm.; transverse diameter of eye, 11.5 mm.; and anterior edge of eye to nostril, 7 mm. Most of these specimens are so faded that the distinctive color pattern has been obliterated, and a few of them are bleached almost white. Dis-

tinct broad dark crossbars can be seen on several when the skin is wet. The skin on the back between the dorso-lateral glandular folds, unlike those from the City of Mexico, is distinctly warty. In view of the unsatisfactory condition of these specimens it is obviously difficult to determine their exact relationships, and they are tentatively referred to this species. Besides these larger individuals, there is in the collection one lot of four immature frogs (U.S.N.M. No. 10247) that are unquestionably *R. montezumae.* All are somewhat faded, and on two and possibly on a third this bleaching process has revealed distinct traces of darker spots on the back between the dorso-lateral glandular folds. The darker spots are not visible on the fourth individual and this (No. 81101) has been selected as the electotype for *Rana montezumae concolor* Cope.

Specimens examined.—One hundred and six, as follows:

Rana montezumae

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			GUANAJUATO:		
U.S.N.M.	9891	1	Guanajuato	1877	Alfred Dugés.
Do.	10247	3	do	1879	Do.
Do.	12684	1	do	1881	Do.
Do.	26155	1	do	1884	Do.
Do.	81101	[1] 1	do	1879	Do.
Do.	47206	1	Santa Rosa, 9,500 feet altitude.	Nov. 18, 1896	Nelson and Goldman.
			VERA CRUZ:		
Do.	25099	1	Mirador		Carlos Sartorius.
Do.	16562	1	Vicinity of Orizaba		Francis Sumichrast.
			FEDERAL DISTRICT:		
A.M.N.H.	13366–70	5	North of Guadalupe	May 8, 1919	Paul D. R. Ruthling.
Do.	13371–78	8	do	May 3, 1919	Do.
Do.	12216–27	12	do	July 8, 1919	Do.
U.S.N.M.	3344	[2] 1	City of Mexico		William Rich.
Do.	39383–96	[3] 14	do		Do.
M.C.Z.	2600	[3] 1	do		Do.
Do.	1655	3	do	1879	Edward Palmer.
Do.	2658	7	Lake Xochimilco	1910	Thomas Barbour.
			MEXICO:		
U.S.N.M.	58000	1	Chalco	June —, 1901	Julius Hurter.
Do.	32294	1	Valley of Mexico and Toluca	1884–85	C. T. Hoege.
Do.	21454–58	6	PUEBLA: Chiguahuapan, Alatristi.		Ferrari-Perez.
			MICHOACAN:		
Do.	10239	3	Tupataro	1879	Alfred Dugés.
Do.	10243	3	do	1879	Do.
Do.	10251	1	do	1879	Do.
Do.	10253–55	3	do	1879	Do.
Do.	10258	1	do	1879	Do.
			? STATE:		
Do.	8314	16	Between Mexico [City] and Chihuahua.		John Potts.
Do.	11356	2	No definite locality	Jan. 30, 1880	Alfred Dugés.
Do.	11372	1	do	1881	Do.
Do.	73713–17	5	do	1881	Do.
Do.	31360	1	do		Adolphe Boucard.
Do.	57999	1	do		Julius Hurter.

[1] Electotype of *Rana montezumae concolor.*
[2] Type of *Rana montezumae.*
[3] Paratypes of *Rana montezumae.*

RANA PALMIPES Spix

1824. *Rana palmipes* Spix, Animalia nova, sive species novae testudinum et ranarum quas in itinere per Brasiliam, etc., p. 5, pl. 5, fig. 1.—Boulenger, 1882, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 48.—Günther, 1900, Biologia Centrali-Americana, Reptilia and Batrachia, p. 202, Feb.—Noble, 1918, Bull. Amer. Mus. Nat. Hist., vol. 38, art. 10, p. 316, pl. 14.—Boulenger, 1920, Proc. Amer. Acad. Arts and Sci., vol. 55, no. 9, p. 473, Aug.—Miranda-Ribeiro, 1926, Archiv. Mus. Nac. Rio de Janeiro, vol. 27, p. 165, fig. 92.—Lutz, 1927, Mem. Inst. Oswaldo-Cruz, vol. 20, fasc. 1, pp. 46, 62, pl. 9.

1859. *Rana affinis* Peters, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 403, May (Caracas, Venezuela).—Cope, 1866, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, p. 130.—Boulenger, 1919, Ann. and Mag. Nat. Hist., ser. 9, vol. 3, no. 16, p. 416.

1859. *Ranula gollmerii* Peters, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 402, May (Caracas, Venezuela).

1863. *Rana clamata* var. *guiancnsis* Peters, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 412.

1867. *Pohlia palmipes* Steindachner, Reise der Oesterreichischen Fregatte *Novara*, Zoologischer theil, vol. 1, Amphibien, p. 15, pl. 1, figs. 5–8.

1874. *Ranula brevipalmata* Cope, 1874, Proc. Acad. Nat. Sci. Philadelphia, p. 131 (Nauta, Peru). [*Nec Rana brevipalmata* Peters, 1871, Monatsber. k. preuss. Akad. Wiss. Berlin, p. 646.]

1874. *Ranula nigrilatus* Cope, Proc. Acad. Nat. Sci. Philadelphia, p. 131 (Nauta, Peru).

1877. *Rana vaillanti* Brocchi, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 4, p. 175 (Mullins River, near Belize, British Honduras).—Brocchi, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 11, pl. 2, figs. 1–1c.

1882. *Rana copii* Boulenger, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 49. [Substitute name for *Rana brevipalmata* Cope, preoccupied.]

1900. *Rana bonaccana* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, p. 201, pl. 60, fig. B, Feb. (Bonacca Island, off coast of British Honduras).

1900. *Rana melanosoma* Günther, Biologia Centrali-Americana, Reptilia and Batrachia, p. 203, pl. 63, fig. B, Feb. (Duenas, Guatemala, and Hacienda Rosa de Jericho; altitude, 3,250 feet, Nicaragua).

1913. *Rana brevipalmata rhoadsi* Fowler, Proc. Acad. Nat. Sci. Philadelphia, p. 166, pl. 9 (Bucay, Province of Guayas, Ecuador).

Type locality.—Amazon River, Brazil.

Range.—From Vera Cruz (Jalapa) and Morelos (Cuernavaca) southward through Oaxaca and Chiapas to the Mexican border, and thence south through Central America and South America to northern Peru (Nauta, Maranon River), western Brazil (Matto Grosso or Villa Bella), and to Pernambuco on the Atlantic coast of Brazil.

Remarks.—Boulenger's monograph on the American frogs of the genus *Rana* has been followed in compiling the synonymy of *Rana palmipes* because sufficient material from critical areas in Central and South America is not now available in American institutions to permit a review of the forms that are obviously closely related or identical

with *R. palmipes*. Central American and Mexican specimens now referred to this species vary considerably in the extent of the web between the toes, the texture of the skin between the dorso-lateral glandular folds, the relative transverse diameter of the tympanum as compared with that of the eye, the shape of the snout, and the general coloration. Until the limits of variation with respect to characters such as those just mentioned can be determined by an examination of adequate series from one or more localities in South and Central America, respectively, it is impossible to arrive at any definite conclusion.

This frog is especially interesting because it is the only representative of the genus *Rana* in South America. Since its discovery by Spix in stagnant water along the Amazon River in Brazil, its range has been extended to western Brazil, to the Pacific coastal region of Ecuador, and north as far as central Mexico. In spite of its rather extensive range, comparatively little is known in regard to its habits and structural variation. With one exception, all the specific names hereinafter enumerated are based on young or immature individuals.

Ranula gollmerii, according to Boulenger, "was described from a recently transformed young, from Caracas, measuring 50 mm. from snout to vent." A somewhat larger frog from Caracas, which measured 63 mm. from snout to vent, became the type of Peters's *Rana affinis*. The describer was inclined to regard the last-mentioned species as a local variety of the European *Rana temporaria*. Peters some years later allocated these two species to *Rana palmipes*.

The types of *Ranula brevipalmata* and *Ranula nigrilatus* were collected by Prof. James Orton at Nauta on the Maranon River in northeastern Peru. Both of these specific names were based on young frogs, and they have head-and-body lengths of 49 and 48 mm., respectively. The toes of *brevipalmata* are not fully webbed, since the membrane reaches to the bases of the distal joints on all the toes except the fourth, on which it extends to the penultimate joint. The tympanum is described as being as large as the eye. The toes of *nigrilatus* are fully webbed, and the tympanum is two-thirds as large as the eye.

The type of *Rana vaillanti* was collected by Firmin Bocourt on the banks of Mullins River, near Belize in British Honduras. It is a large adult, with a head-and-body length of 125 mm. The toes are fully webbed, the vomerine teeth are in oblique groups at the level of the posterior borders of the choanae, and the coloration of the underparts and limbs is similar to other Central American specimens of *Rana palmipes*.

Günther seems to have overlooked the small terminal disks of the toes when he described *Rana bonaccana*. Bonacca Island lies off the coast of British Honduras and not off Yucatan as stated by Günther. It is the eastern one of a group known as the Bay Islands. No char-

acters are given in the description of this species that can not be matched in specimens from Central America. Günther based his *Rana melanosoma* on smooth-skinned specimens from Duenas in Guatemala and from Hacienda Rosa de Jericho in Nicaragua. The specimens are immature and the largest individual has a head-and-body length of 65 mm. The toes are webbed to the distal end of the penultimate joint, or nearly so.

The type of *Rana brevipalmata rhoadsi* (A.N.S.P. No. 18051) came from Bucay, Province of Guayas, in western Ecuador. Fowler recognized the resemblance in coloration between his supposedly new form and Cope's *R. brevipalmata*, but held that a new name was warranted because the diameter of the tympanum was only two-thirds that of the eye and the snout was shorter. The type is a young frog with a head-and-body length of 43 mm.

The habitat of this species in Vera Cruz is described by Ruthven as follows:[75]

This species was observed in some numbers along La Laja Creek and at Lake Catemaco, but specimens were very difficult to secure. It was found only where the shores were densely covered with vegetation, usually where there were bushes hanging low over the water. In such places the individuals stayed well out from shore, upon sticks or low branches, and upon the slightest alarm leaped into the water, where they were very difficult to see even when partially above the surface.

The following observations on the general coloration of this frog in life are based on specimens collected by C. R. Halter in Nicaragua:[76]

The variation in color of our specimens is limited to the fading out of the ground tone and to the developing of spots on the posterior part of the back. In life the color above was grass-green from the tip of the snout to the tympanum and olive from the tympanum to the ends of the appendages. In certain lights a bronze-like shimmer was present on the head. The posterior sides of the legs were mottled with dark brown and white. The lower parts of the legs were less distinctly mottled with brown. The throat was pearly white; the belly and ventral surfaces of the appendages were washed with lemon yellow. The posterior appendages were heavily mottled with brown below.

Specimens examined.—Fourteen as follows:

Rana palmipes

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			VERA CRUZ:		
M.C.Z.	8433	1	Alvarado	1921	E. R. Dunn.
U.S.N.M.	4791	1	Jalapa		R. Montes d'Oca.
Do.	47115–16	2	Tlacotalpam	May 18, 1894	Nelson and Goldman.
Do.	20165	1	MORELOS: Cuernavaca	Aug. —, 1892	P. L. Jouy.
			OAXACA:		
Do.	47119	1	Mountains near Santo Domingo, altitude 1,600 feet.	June 16, 1895	Nelson and Goldman.
Do.	30329–31	3	City of Tehuantepec		Francis Sumichrast.
Do.	30485–88	4	do		Do.
Do.	46762	1	CHIAPAS: Mountains near Tonala.	Aug. 15, 1895	Nelson and Goldman.

[75] Ruthven, A. G., Zool. Jahrb. (Syst. Abt.), vol. 32, pt. 4, p. 306, 1912.

[76] Noble, G. K., The amphibians collected by the American Museum expedition to Nicaragua in 1916. Bull. Amer. Mus. Nat. Hist., vol. 38, art. 10, p. 317, 1918.

RANA PIPIENS Schreber

COMMON LEOPARD FROG

Figures 1, *a*, and 24

1782. *Rana pipiens* SCHREBER, Der Naturforscher, Halle, vol. 18, p. 185, pl. 4.—DICKERSON, 1906, The frog book, p. 171, pls. 43–50, col. pls. 11, 12.—WRIGHT, 1914, Carnegie Inst. Washington Publ. No. 197, p. 52, pl. 15, Sept. 8.—STORER, 1925, Univ. California Publ. Zool., vol. 27, p. 266, pl. 17, fig. 52.

1803. *Rana halecina* DAUDIN, Histoire naturelle des rainettes, des grenouilles et des crapauds, p. 41.—HOLBROOK, 1836, North American herpetology, vol. 1, p. 89, pl. 13.—HOLBROOK (1842), 1844, North American herpetology, vol. 4, p. 91, pl. 22.—BOULENGER, 1882, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 41.—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 10.—COPE, 1886, Proc. Amer. Philos. Soc., vol. 23, no. 124, p. 517, Oct. 1.—GÜNTHER, 1900, Biologia Centrali-Americana, Reptilia and Batrachia, p. 198, Feb. 1.—BOULENGER, 1920, Proc. Amer. Acad. Arts and Sci., vol. 55, no. 9, p. 433, Aug.

1826. *Rana utricularius* HARLAN, Amer. Journ. Sci. and Arts, vol. 10, p. 60 (Pennsylvania and New Jersey).

1856. *Rana oxyrhynchus* HALLOWELL, Proc. Acad. Nat. Sci. Philadelphia, vol. 8, p. 142, Aug. (Florida; *nec* A. Smith).

1858. *Rana lecontii* GÜNTHER, Catalogue of the Batrachia Salientia in the collection of the British Museum, p. 15 (*nec* BAIRD and GIRARD, 1853).—BOULENGER, 1882, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2d edit., p. 42.

1859. *Rana berlandieri* BAIRD, Report on the United States and Mexican Boundary Survey, vol. 2, Reptiles, p. 27, pl. 36, figs. 7–10 (Brownsville, Tex.).

1877. *Rana macroglossa* BROCCHI, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 4, p. 177 (Plateau of Guatemala).—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 12, pl. 3, figs. 1–1c.

1877. *Rana maculata* BROCCHI, Bull. Soc. Philom. Paris, ser. 7, vol. 1, no. 4, p. 178 (Totonicapan, Guatemala).—BROCCHI, 1882, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 13, pl. 3, figs. 2–2c.

1882. *Rana nigricans* BROCCHI, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 15, pl. 4, fig. 3 (*nec* HALLOWELL, 1854).

1882. *Rana lecontei* BROCCHI, Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques, pt. 3, sect. 2, p. 14, pl. 4, figs. 1–1c. (*nec* BAIRD AND GIRARD, 1853).

1883. *Rana forreri* BOULENGER, Ann. and Mag. Nat. Hist., ser. 5, vol. 11, no. 65, p. 343, May (Presidio, Sinaloa).—GÜNTHER, 1900, Biologia Centrali-Americana, Reptilia and Batrachia, p. 199, pl. 60, fig. A, Feb.

1886. *R.* [*ana*] *h.* [*alecina*] *austricola* COPE, Proc. Amer. Philos. Soc., vol. 23, no. 124, p. 517, Oct. 1.—COPE, 1887, U. S. Nat. Mus. Bull. 32, p. 19.

1886. *Rana h.* [*alecina*] *sphenocephala* COPE, Proc. Amer. Philos. Soc., vol. 23, no. 124, p. 517, Oct. (Substitute name for *Rana oxyrhynchus* HALLOWELL.)

1889. *R.* [*ana*] *v.* [*irescens*] *austricola* COPE, U. S. Nat. Mus. Bull. 34, pp. 398, 399.

1889. *Rana virescens sphenocephala* COPE, U. S. Nat. Mus. Bull. 34, p. 399, fig. 99.

1889. *Rana virescens virescens* COPE, U. S. Nat. Mus. Bull. 34, p. 401, fig. 100.

1889. *Rana virescens brachycephala* COPE, U. S. Nat. Mus. Bull. 34, p. 403, fig. 101. (Yellowstone River, Mont.).

1899. *Rana trilobata* MOCQUARD, Bull. Soc. Philom. Paris, ser. 9, vol. 1, no. 4, p. 158, pl. 1, fig. 1 (Jalisco, Mexico).

1900. *Rana omiltemana* GÜNTHER, Biologia Centrali-Americana, Reptilia and Batrachia, p. 200, pl. 61, fig. A, Feb. (Omilteme, Guerrero, Mexico).

1922. *Rana burnsi* WEED, Proc. Biol. Soc. Washington, vol. 35, p. 108, Oct. 17 (New London, Kandiyohi County, Minn.).

1922. *Rana kandiyohi* WEED, Proc. Biol. Soc. Washington, vol. 35, p. 109, Oct. 17 (New London, Kandiyohi County, Minn.).

Type locality.—Raccoon, Gloucester County, N. J.

Range.—From Nova Scotia, southern New Brunswick (St. Croix River), Ontario (Ottawa River), Keewatin (Norway House), northern Alberta (Fort Smith on Slave River), the Kootenay district of southeastern British Columbia, Snake River of western Idaho and down the Columbia River as far as Fort Dalles, Oreg., northeastern California (Alturas, Modoc County), Pyramid Lake in Nevada, and the Lake Tahoe region (Placer and Eldorado Counties) of eastern California, south to the lower Colorado River Valley in Arizona and California, Florida, the Gulf coast, Mexico, Guatemala, and Nicaragua.

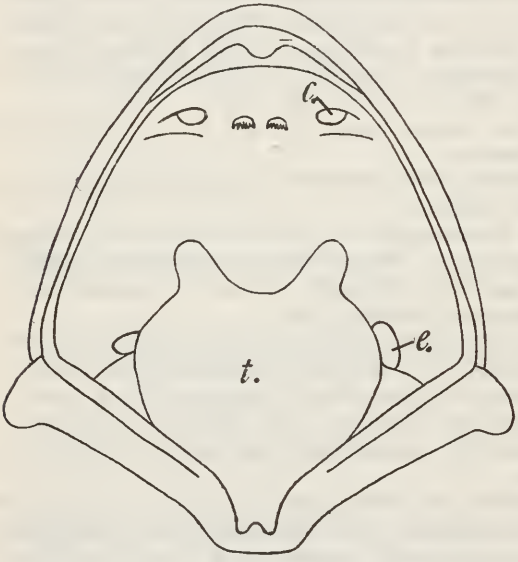

FIGURE 24.—Opened mouth of *Rana pipiens*, showing position of vomerine teeth; *c.*, Choana; *e.*, orifice of eustachian tube; *t.*, tongue, with bilobed posterior extremity and with attachment at anterior end

Remarks.—Boulenger[77] has preferred to use *Rana halecina* for the American leopard frogs, citing Linnaeus[78] as the authority for this name, but is careful to state that the name appears in the synonymy of *Rana ocellata*. In explaining the derivation of the name *halecina*, Boulenger remarks that the "Sillhoppetosser" of Kalm[79] has been latinized by Linnaeus. Kalm states that the Swedes in America call these frogs "sillhoppetosser," or herring hoppers, in allusion to the fact that they make their appearance early in the spring at the beginning of the herring season. *Rana halecina* is clearly employed by Linnaeus as a vernacular descriptive term in

[77] Boulenger, G. A., A monograph of the American frogs of the genus *Rana*. Proc. Amer. Acad. Arts and Sci., vol. 55, no. 9, p. 433, Aug., 1920; Burt, C. E., Proc. Biol. Soc. Washington, vol. 44, p. 13, Feb. 21, 1931.

[78] Linnaeus, C., Systema naturae, ed. 12, vol. 1, p. 356, 1766.

[79] Kalm, P., En Resa til Norra America, vol. 3, p. 45, 1761; Forster, Kalm's travels into North America, London, vol. 1, pp. 379, 380, 1772.

Latin form, in allusion to the comment on the habits of this frog by the original author. There are numerous similar usages of Latin descriptive terms in this edition of Linnaeus. They have no status under any code of nomenclature.

The specific name *Rana pipiens* seems to have been published first by Schreber, and he likewise based the description of this species on the "Sillhoppetosser" (*op. cit.*, vol. 3, p. 46), which Kalm observed on March 11 at Raccoon, Gloucester County, N. J.

Harlan failed to state whether the original description of *Rana utricularius* was based on preserved specimens, and inasmuch as he was at that time somewhat interested in the life histories of frogs, it is quite likely that this diagnosis was based on captive individuals. It is stated, however, in a footnote that "a specimen preserved in spirits in the cabinet of the Philadelphia Acad. of Nat. Sc. is erroneously labelled *R. halecina*." The presence of an external greenish vocal vesicle extending from the lower jaw to above the shoulder joint is a modification that permits a greater distension of this apparatus, and for such males Harlan proposed the name *Rana utricularius*, and those that show no such modification of the outer skin were allocated to *R. halecina*.

In 1856, Edward Hallowell gave the name *Rana oxyrhynchus* to a male frog collected by Mr. Ashmead "in a sulphur spring, near the St. John's River, about three hundred miles from Key West," Fla. Inasmuch as this name was preoccupied, Cope in 1886 proposed *Rana h.*[*alecina*] *sphenocephala* as a substitute name. The type of this subspecies is presumably in the collection of the Academy of Natural Sciences of Philadelphia. The diagnostic characters of the subspecies *sphenocephala* were defined by Cope in 1889 as follows:

> Head entering length of head and body two and a half or less than three times; males with external vesicles; muzzle more acuminate; no cross bars on tibia; spots smaller.

Hallowell, however, describes the type of *R. oxyrhynchus* as being entirely destitute of vocal vesicles, head narrow and acute, and hind limbs with white-margined transverse black bars.

Baird gives "southern Texas generally" as the habitat of *Rana berlandieri*. The 11 cotypes of this species (U.S.N.M. No. 3293) were collected by Capt. Stewart Van Vliet, at Brownsville, Tex. Two of them (M.C.Z. No. 155) were sent to the Museum of Comparative Zoology at Cambridge, Mass., and there now remain in the collection of the United States National Museum 1 adult, 2 young, and 6 tadpoles. The adult specimen in this lot was figured by Baird on Plate 36, Figures 7–10, of the report on the reptiles of the United States and Mexican Boundary Survey.

According to the characters employed by Cope in 1889 for distinguishing the subspecies of *virescens* [=*pipiens*], *Rana berlandieri* is distinguished as follows: Head narrow; muzzle acuminate; interorbital space two-thirds the width of upper eyelid; short glandules and linear series of glandulose tuberosities on back between dorsolateral glandular dermal folds; dark spots on upperparts irregular in outline and narrowly edged with light yellow; hind limbs with light-edged dark crossbars; longitudinal dark streak on anterior face of thigh; large external vocal vesicles; the hind limb being carried forward along the body, the tibio-tarsal joint reaches the end of the snout; body length, snout to vent, 79 mm.

The three cotypes (M.H.N.P. No. 169a, parchment label No. 632) of *Rana macroglossa* Brocchi are labeled as coming from the plateau of Guatemala and were received from the "Sociedad Ecónomica de Guatemala." Among other characters assumed to be of diagnostic value, Brocchi called attention to the rather wide tongue with prominent posterior horns, the vomerine teeth in two small rounded groups between the choanae, the smooth skin, and a first finger longer than the second. These cotypes are described in my notes as follows: Head-and-body length, respectively, 64, 66.5, and 46.5 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between the eye and end of snout; terminal phalanges claw-like; transverse diameter of tympanum one-half to three-fourths that of eye; muzzle rounded; interorbital space as wide as upper eyelid; skin of upperparts fairly smooth, without prominent elongate glandules on back between dorso-lateral glandular dermal folds; dark spots on upperparts indistinctly outlined and somewhat effaced; throat spotted with brown or gray; sides marbled, spotted with black on brownish or grayish background; interrupted transverse dark bands on upper surfaces of hind limbs. Two of these cotypes are clearly referable to *Rana pipiens*. The third, to which the parchment label is attached, has the under surface of the thighs brown and stippled with light specks. This specimen is questionably referred to this species.

Paul Brocchi gave the name *Rana maculata* to three frogs (M.H.N.P. parchment label No. 6412) collected by Firmin Bocourt, a member of the staff of the "Mission Scientifique au Mexique et dans l'Amérique Centrale" at "Totonicapam (Mexique)" [=Totonicapan, Guatemala]. In the description of this species, Brocchi mentioned the small oval tongue with posterior horns of moderate size, nearly subequal first and second fingers, unusually swollen first finger, slightly developed subarticular tubercles, and vomerine teeth in two oblique rows, with apex of open chevron thus formed on a level with choanae. These cotypes are characterized as follows: Head-and-body length, respectively, 61, 58.5, and 54.5 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches beyond end of

snout; transverse diameter of tympanum about two-thirds that of eye; muzzle acuminate; interorbital space as wide as upper eyelid; well marked dorso-lateral glandular dermal folds; black spots on upperparts small and closely approximated; throat marbled with dark gray; sides and posterior surfaces of thighs marbled with dark brown or black on a grayish white background; continuous narrow transverse dark bands on upper surfaces of hind limbs.

The type of *Rana nigricans* Brocchi seems to be lost, and no entry with corresponding data was found in the catalogues of the Muséum National d'Histoire Naturelle in Paris.

A female frog collected by Alphonso Forrer at Presidio [de Mazatlan] in Sinaloa, which was subsequently acquired by the British Museum of Natural History, became the type of *Rana forreri* Boulenger (B.M. No. 1882. 12. 5. 7). This specimen is described in my notes as follows: Head-and-body length, 71.6 mm.; transverse diameter of tympanum, 6.5 mm.; transverse diameter of eye, 8.1 mm.; anterior edge of eye to nostril, 5.5 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches nearly to end of snout; a distinct tarsal fold; a large elongate internal metatarsal tubercle; muzzle broad and rounded; interorbital space narrow, not quite half the width of upper eyelid; numerous large light-edged black spots; large prominent elongate glandules on back between dorso-lateral glandular dermal folds; limbs with black crossbars; under surface of thighs areolated. This is the specimen figured by Günther on Plate 60, Figure A, Biologia Centrali-Americana.

Cope, in 1886, established the subspecific name *austricola* by remarking that the "Mexican specimens referred to in these citations [i. e., the synonymy for "*Rana halecina* Daudin (Kalm)"] constitute a subspecies, which I call *R. h. austricola*." When we examine these 11 citations to the literature we find that mention of Mexican specimens is made in only three. Günther and Boulenger both refer six Mexican specimens in the British Museum collection to *Rana lecontii*, while Brocchi figures a frog from Vera Cruz, which is referred to *R. lecontei* on the captions for the plate and in the text. Inasmuch as it is generally the practice to select as the lectotype either a specimen or a published illustration actually seen by the original describer before the description is published, I definitely choose the specimen figured by Brocchi[80] on Plate 4, Figure 1, of his "Étude des Batraciens de l'Amérique Centrale" as the type of this subspecies. The illustration published by Brocchi, if correctly drawn, shows that the specimen, upon which it is based, differs from the diagnosis for the subspecies *austricola* in having the muzzle obtuse at the end and the

[80] Brocchi, P., Mission scientifique au Mexique et dans l'Amérique Centrale, recherches zoologiques Paris, pt. 3, sect. 2, p. 14, pl. 4, fig. 1, 1882.

crossbars on the tibia interrupted. The diagnosis published by Cope in 1889 reads as follows:

> Head entering length of head and body two and a half to nearly three times; no external vocal vesicles; muzzle more or less acuminate; spots less distinct; tibia generally crossbarred; no longitudinal band on front of femur.

In 1886, Cope [81] states that the "*Rana halecina*, Kalm, subspecies *berlandieri*" in his [82] "Check-List of North American Batrachia and Reptilia" is not the *Rana berlandieri* of Baird. Again in 1889, Cope [83] remarks that the "last named subspecies [i. e., *Rana virescens brachycephala* Cope] is the one I called *R. v. berlanderi* [sic], but it turns out that the typical specimens of that species belong to the subspecies *virescens*." Taken at its face value, this statement is rather contradictory, for Cope listed the cotype of *R. berlandieri* Baird (U.S.N.M. No. 3293) among the specimens referred to his subspecies *R. virescens brachycephala*. What Cope seemingly intended to say was that "the typical specimens" of the *Rana halecina berlandieri* of his check list actually belong to the subspecies *virescens*.

The subspecific name *brachycephala* appears for the first time in 1886 in Cope's "Synonymic List of North American species of *Bufo* and *Rana*," where its habitat is given as the "Central and Sonoran regions." No description accompanies the name, and the synonymy includes two citations, one of which is the "*R. h. berlandieri* Cope" of his "Check List" published in 1875 and the other, "*Rana halecina* Boulenger, Cat. Batr. Brit. Mus., ed. ii, p. 41, *nec* Kalmii." Until the publication of Cope's "Batrachia of North America," the subspecific name *brachycephala* was strictly a *nomen nudum*, inasmuch as the characters that distinguished this subspecies from supposedly typical *halecina* [=*virescens* Cope, 1889] were not indicated. Cope's diagnosis of the subspecies *brachycephala* published in 1889 is seemingly based upon one specimen, and this inference is drawn from his introductory remark that "I select as typical a specimen from the Yellowstone River (No. 3363)." There are, however, 15 specimens catalogued under that number, although Cope mentions only 5 in his list of specimens examined, and all of them were collected by Dr. F. V. Hayden in 1857 along the Yellowstone River in Montana. This lot consists of 2 adults, 1 young, and 12 tadpoles. Inasmuch as it is now impossible to recognize the actual individual upon which Cope based his description, all these specimens have been designated as the cotypes of the subspecies *brachycephala*. The following notes apply to the largest cotype: Head-and-body length, 86; transverse

[81] Cope, E. D., Synonymic list of North American species of *Bufo* and *Rana*, with descriptions of some new species of Batrachia, from specimens in the National Museum. Proc. Amer. Philos. Soc., vol. 23, no. 124, p. 517, Oct. 1, 1886.

[82] Cope, E. D., Check-list of North American Batrachia and Reptilia. U. S. Nat. Mus. Bull. 1, p. 32, 1875.

[83] Cope, E. D., U. S. Nat. Mus. Bull. 34, p. 398, 1889.

diameter of tympanum, 6; transverse diameter of eye, 8; anterior edge of eye to nostril, 5.4 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to anterior margin of eye. Cope in 1889 published the following short diagnosis of the subspecies *brachycephala*:

> Head shorter and more obtuse, entering the length [of head and body] three and a half times; males without or with rudimental external vocal vesicles; dorsal spots larger, widely yellow bordered; tibial crossbands complete; no longitudinal band on the front of the thigh.

Mocquard's *Rana trilobata* (M.H.N.P. No. 169α, parchment label No. 97–189) is based on a single young individual collected by Léon Diguet at Guadalajara in Jalisco. The specific name alludes to the trilobed form of the posterior end of the tongue. Boulenger [84] has examined the type in the Paris Museum and states that "there is a short furrow between the horns of the tongue, such as I have observed in some *R. esculenta*." This specimen may be briefly characterized as follows: Head-and-body length, 33.5 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to about the center of the eye; a dorso-lateral glandular dermal fold present; posterior end of tongue has three projections as described by Mocquard; muzzle rounded; no linear glandular folds on back between dorso-lateral glandular dermal folds; dark spots and markings on upperparts indistinct; posterior limbs indistinctly crossbarred; tympanum slightly more than half the diameter of the eye.

Five adult males (B.M. Nos. 1895. 7. 15. 31–35), which were collected at Omilteme in Guerrero by H. H. Smith, a collector employed by Godman and Salvin, become the cotypes of Günther's *Rana omiltemana*. The largest one of these cotypes has a head-and-body length of 60.5 mm. Günther's published description of this species may be summarized as follows: Snout narrow, acuminate; interorbital space narrow, a little more than half the width of the upper eyelid; rather small rounded or subquadrangular dark spots with narrow light edges on back; small glandules on back between narrow dorso-lateral glandular dermal folds; hind limbs with light edged dark crossbars; external vocal vesicles small; hind limb, without tarsus, as long as two-thirds length of body.

Weed has published descriptions of two well-marked color variants of the leopard frog. These specimens were selected from a tank containing several thousand frogs. Color characters alone were employed to distinguish *Rana burnsi* (F.M.N.H. No. 3065) and *Rana kandiyohi* (F.M.N.H. No. 3066) from *Rana pipiens*. The upperparts of *Rana burnsi* are described as being more or less immaculate, with some shade of green or brown, while *Rana kandiyohi* has black spots that apparently fuse with a mottled ground color.

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[84] Boulenger, G. A., Proc. Amer. Acad. Arts and Sci., vol. 55, no. 9, p. 435, footnote, Aug., 1920.

The various forms that have been enumerated are here interpreted as individual variations. This conclusion has been reached after a critical examination and tabulation of many specimens. No constant geographic peculiarities were encountered among the specimens studied. Unique variations in color pattern were found in almost every local series studied, and as none of these variations are exactly alike, it seems necessary to disregard such peculiarities and group all the leopard frogs of North and Central America under one name.

The ground color of the upperparts varies greatly and is rarely uniform green or brown. There are two prominent dorso-lateral glandular dermal folds, which are either bronze or yellow, sometimes a very light tint of yellow, and which extend almost parallel to each other from the upper eyelid to the sacral region. These folds often become silvery white after long immersion in alcohol, and between them are brown, olive-green, or nearly black spots, which are generally irregular in shape and arrangement. In many instances the arrangement of the darker markings on one side is totally different from that on the opposite side.

A tabulation of the Mexican series of leopard frogs demonstrated the existence of an endless variety of patterns. One of the variants has numerous, closely aggregated, dark spots. On another the dark dorsal spots are unusually elongated, and several spots apparently are fused. Other specimens have small widely separated dark spots. Fourteen frogs have the dorsal dark spots indistinctly outlined, and in a few instances the spots were nearly effaced. A few individuals were noted that have no apparent dark markings between the dorso-lateral glandular dermal folds. Large dark dorsal spots with distinct yellow borders were observed on 45 specimens. At least 50 frogs were counted that have the dorsal dark spots distinctly outlined, but on these the light margins are either very narrow or lacking. Wide or narrow transverse dark bars on the hind limbs, which may be continuous or interrupted, occur more frequently than dark oval spots. The dark transverse bars were continuous on 70 individuals and interrupted on 35. A dark marbling on the anterior surface of the thigh is quite noticeable on some specimens and in eight instances a dark band was formed. Many of the frogs, however, lack this darker marbling. Most of the specimens have the throat and chest uniformly light colored, though there were a number of frogs among those examined that have the throat and chest variegated or marbled with some darker color.

The Mexican specimens generally have an acuminate snout and a rather narrow head. Other specimens taken at the same localities as those with narrow heads, however, have a much wider head and an obtuse snout. One series of 13 specimens from Durango have the skin of the upperparts unusually rough and pustulose. This condi-

tion exists also on immature individuals and has been observed on specimens with a body length as short as 35 mm. More than 20 specimens were found that have distinct longitudinal rows of pustules on the upper surface of the tibia. On the majority of the adult frogs the skin of the upperparts is granular, with more or less prominent longitudinal glandular folds on back between the dorso-lateral folds of the skin. Young frogs and occasional adults have the skin of the upperparts nearly smooth. A dark spot is generally present on each upper eyelid, and in 40 instances a dark spot was noted on the upper surface of the snout.

The absence of a well-defined streak that extends from end of snout to end of glandular fold behind angle of the mouth on each side of the head above the dark or mottled upper lip is stated by Boulenger in his monograph on the American frogs of the genus *Rana* to be geographically distinctive for specimens from Arizona, Texas, Mexico, and Central America. This light streak is absent or only distinct from below the eye posteriorly in many of the Mexican specimens. Nevertheless, there are leopard frogs in the United States National Museum from Tamaulipas, Vera Cruz, Guanajuato, Jalisco, Guerrero, and Tabasco that have this light streak as well defined as any individual from Eastern United States or Canada. The general coloration of live frogs of this species taken at Cuatotolapam in Vera Cruz is described as follows by Ruthven:[85]

> Ground color of upper parts dark brownish olive, occasionally speckled with bright green; stripe on canthus rostralis and dorsal spots black or blackish, the latter margined with greenish; stripe along upper lip light greenish yellow, frequently much broken up; dorso-lateral glandular fold light greenish yellow to orange brown; belly white.

The length of the hind limb has very little diagnostic value. In a series of 50 individuals, 10 were found in which the tibio-tarsal joint reached to the middle or anterior margin of the eye, when the hind limb was carried forward along the side of the body, 15 in which it reached to between the eye and the end of the snout, 17 to the end of snout, and 8 beyond the end of the snout.

Noble [86] has published the following comments on a small series of frogs that are referred to *Rana austricola* and that were collected by C. R. Halter in Nicaragua:

> The variation in color is not limited to an intensifying or fading of the tones. There is also a slight variation in pattern. The spots on the back may be more or less confluent. In the smallest and the largest specimens in the collection the spots have been extended to form an unbroken but irregular streak on each side of the back. Each pair of spots may be confluent in a transverse direction, but it is more common for the spots in each longitudinal row to run together. There

[85] Ruthven, A. G., Zool. Jahrb. (Syst. Abt.), vol. 32, pt. 4, pp. 305, 306, 1912.

[86] Noble, G. K., The amphibians collected by the American Museum Expedition to Nicaragua in 1916. Bull. Amer. Mus. Nat. Hist., vol. 38, art. 10, p. 316, 1918.

does not seem to be any progressive development of pattern during the growth of an individual, for specimens of the same size may have very different color patterns.

Specimens examined.—Two-hundred and sixty-seven, as follows:

Rana pipiens

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
U.S.N.M.	3293	[1] 9	UNITED STATES: Brownsville, Tex.		Stewart Van Vliet.
			SONORA:		
Do.	21103	1	San Pedro River	July 25, 1893	E. A. Mearns.
Do.	19363-64	2	Santa Cruz River near Lochiel, Pima County, Ariz.	July —, 1893	Do.
			CHIHUAHUA:		
Do.	47047	1	Near Balleza	Sept. 23, 1898	Nelson and Goldman.
Do.	47049	1	Near Batopilas	Oct. 9, 1898	E. A. Goldman.
Do.	21090-97	8	Cajon Bonita Creek	Sept. 8, 1893	E. A. Mearns.
Do.	21099-100	2	do	Sept. 28, 1893	Do.
Do.	47239-40	2	Guadalupe y Calvo, Sierra Madre.	Sept. 8, 1898	Nelson and Goldman.
Do.	47113	1	Lake Santa Maria	Sept. —, 1899	Do.
Do.	19396-406	11	Mexican Boundary	1892	E. A. Mearns.
M.C.Z.	2656	1	Ojos del Diablo		
Do.	1641	5	COAHUILA: Monclova	1880	Edward Palmer.
U.S.N.M.	4871	3	NUEVO LEON: Monterey	{Apr. —, 1853 / May —, 1853}	D. N. Couch.
			TAMAULIPAS:		
Do.	3295	3	Charco Escondido	1853	Do.
Do.	47451-52	2	Hidalgo	{Mar. 17, 1891- / Mar. 18, 1891}	William Lloyd.
Do.	47052	1	Jaumave	June 6, 1898	Nelson and Goldman.
Do.	3282	33	Matamoros	Mar. —, 1853	D. N. Couch.
Do.	47915	1	Mier	Apr. 28, 1891	William Lloyd.
Do.	47077-79	3	do	May 2-5, 1891	Do.
			SAN LUIS POTOSI:		
M.C.Z.	9670-71	3	Alvarez	July 25, 1923	W. W. Brown.
Do.	1666	2	San Luis Potosi	Oct. 28	Edward Palmer.
Do.	1673	1	San Luis Potosi (9 leagues south).	do	Do.
Do.	9669	1	Soledad	Aug. 25, 1923	W. W. Brown.
			ZACATECAS:		
U.S.N.M.	47900-01	2	Monte Escobedo, altitude 6,200 feet.	Aug. 27, 1897	Nelson and Goldman.
Do.	46970	1	Valparaiso, altitude 6,400 feet.	Dec. 9, 1897	E. A. Goldman.
			DURANGO:		
Do.	24003-15	13	Durango	Sept. —, 1896	Edward Palmer.
Do.	47443-44	2	El Salto, altitude 8,400 feet	July 12, 1898	Nelson and Goldman.
Do.	47241-42	2	Papasquiaro	Aug. 8, 1898	Do.
			SINALOA:		
Do.	47445	1	Near Mazatlan	Apr. 1, 1899	E. A. Goldman.
A.M.N.H.	13127-28	2	North of Mazatlan	Feb. 1, 1920	Paul D. R. Ruthling.
B.M.	82. 12. 5. 7	[2] 1	Presidio de Mazatlan		Alphonso Forrer.
A.M.N.H.	13125	1	Ricon de Urias	Feb. 1, 1920	Paul D. R. Ruthling.
U.S.N.M.	47051	1	Sierra de Choix, 50 miles northeast of Choix.	Oct. 18, 1898	E. A. Goldman.
Do.	47902	1	NAYARIT: Santa Teresa, 6,800 feet altitude.	Aug. 10, 1897	Nelson and Goldman.
			JALISCO:		
Do.	47072-74	3	Barranca Ibarra	May 14, 1892	E. W. Nelson.
M.H.N.P.	169α	[3] 1	Guadalajara		Léon Diguet.
U.S.N.M.	19500	1	Near Guadalajara	Apr. 15, 1892	P. L. Jouy.
Do.	19497-99	3	Hacienda El Molina, near Negrete.	June 12, 1892	Do.
Do.	47155-56	2	Lagos	June 27, 1896	Nelson and Goldman.
Do.	46952	1	La Laguna, Sierra de Juanacatlan.	Mar. 23, 1897	Do.
			GUANAJUATO:		
Do.	9900	1	Guanajuato	1877	Alfred Dugés.
Do.	10248	3	do	1879	Do.
Do.	47205	1	Santa Rosa, Sierra de Guanajuato, altitude 9,500 feet.	Nov. 18, 1896	Nelson and Goldman.

[1] Cotypes of *Rana berlandieri*.
[2] Type of *Rana forreri*.
[3] Type of *Rana trilobata*.

Rana pipiens—Continued

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			HIDALGO:		
M.C.Z	9065-81	18	Hacienda de Velasco, east of Real de Monte.	1913	W. M. Mann.
Do	9013-17	5	Miguel	1913	Do.
Do	9060-64	5	do	1913	Do.
			VERA CRUZ:		
U.S.N.M	4791	5	Jalapa		R. Montes d'Oca.
Do	10296	3	do		Do.
M.C.Z	361	1	do		Exchange.
Do	8439-46	8	do	1921	E. R. Dunn.
U.S.N.M	25100	2	Mirador		Carlos Sartorius.
Do	47224-26	3	do	Feb. 6, 1891	Nelson and Goldman.
Do	8380	1	Orizaba		Francis Sumichrast.
Do	47227	1	do	Mar. 9, 1891	Nelson and Goldman.
Do	16595-615	21	Vicinity of Orizaba		Francis Sumichrast.
M.C.Z	10783	1	Presidio near Motzoronga	1923	W. W. Brown.
U.S.N.M	30511	1	Vera Cruz		Francis Sumichrast.
C.A.S	5296-98	3	do	July 23, 1925	J. R. Slevin.
U.S.N.M	47923	1	PUEBLA: Atlixco	June 18, 1903	Nelson and Goldman.
Do	20160-64	5	MORELOS: Cuernavaca	Aug. —, 1892	P. L. Jouy.
Do	47011	1	MICHOACAN: Los Reyes	Feb. 16, 1903	Nelson and Goldman.
			GUERRERO:		
Do	47914	1	Acapulco	Jan. 24, 1895	Do.
M.C.Z	3903-05	3	Hidalgo	Sept. 24, 1913	W. M. Mann.
B.M	95.7.15.31-35	[4] 5	Omilteme		H. H. Smith.
			OAXACA:		
U.S.N.M	46969	1	Cuicatlan, altitude 2,000 feet	Oct. 8, 1894	Nelson and Goldman.
Do	47060-62	3	Mitla, 5,600 feet altitude	June 30, 1894	Do.
Do	46972	1	City of Oaxaca, 5,200 feet altitude.	Sept. 26, 1894	Do.
Do	47058-59	2	City of Oaxaca	June 12, 1894-June 15, 1894	Do.
Do	47075-76	2	Valley of Oaxaca	June 12, 1894-June 15, 1894	Do.
Do	10035	1	City of Tehuantepec		Francis Sumichrast.
Do	47363-66	4	do	May 26, 1895	Nelson and Goldman.
			CHIAPAS:		
Do	46848	1	Chicharras	Feb. 14, 1896	Do.
Do	47109	1	Comitan, altitude 5,200 feet	Apr. 30, 1904	Do.
Do	6506	3	TABASCO: Coast of Tabasco in wells.	Mar. —, 1864	H. Berendt.
			YUCATAN:		
M.C.Z	9710-11	2	Progresso	1923	Leon J. Cole.
U.S.N.M	47572	1	Puerto Morelos	Apr. 2, 1901	Nelson and Goldman.
M.C.Z	4060	1	Sacred Cenote, Chichen-Itza.	Mar. 15, 1904	
Do	9712-14	3	do	Mar. 4, 1924	Yucatan Expedition.
U.S.N.M	12286	1	No definite locality	1865-66	Arthur Schott.
			GUATEMALA:		
M.H.N.P	169a	[5] 3	Plateau		Sociedad Ecónomica d Guatemala.
Do	6412	[6] 3	Totonicapan		Firmin Bocourt.

[4] Cotypes of *Rana omiltemana*. [5] Cotypes of *Rana macroglossa*. [6] Cotypes of *Rana maculata*.

RANA PUSTULOSA Boulenger

1883. *Rana pustulosa* BOULENGER, Ann. and Mag. Nat. Hist., ser. 5, vol. 11, p. 343.—GÜNTHER, 1900, Biologia Centrali-Americana, Reptilia and Batrachia, p. 202, pl. 61, fig. B, Feb.—BOULENGER, 1920, Proc. Amer. Acad. Arts and Sci., vol. 55, no. 9, p. 471, Aug.

Type locality.—Ventanas, State of Durango, Mexico.

Range.—Southwestern Durango (Ventanas) and presumably along Rio Mazatlan in southern Sinaloa to the coast.

Remarks.—The type of this species (B.M. No. 1883. 4. 16. 42) was collected by Alphonso Forrer at Ventanas in Durango. This frog seems to be allied to *Rana palmipes*, but differs from the latter

in having the tips of the fingers distinctly swollen. The following notes were made on the type: Head-and-body length, 110.8 mm.; transverse diameter of tympanum, 5.8 mm.; transverse diameter of eye, 12.2 mm.; anterior edge of eye to nostril, 7.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to between eye and end of snout; a prominent glandular fold from postero-external angle of upper eyelid to shoulder, and its upper branch is continued backward as narrow dorso-lateral dermal fold to about level of middle of sacrum; no tarsal fold; skin of upperparts covered with small pustules; minute sharp pointed asperities as well as longitudinal rows of minute tubercles on upper surface of tibia; vomerine teeth in oblique posteriorly converging rows, the apex of which projects behind level of posterior borders of choanae; upperparts (in alcohol) olive, with indistinct dark spots; sides marbled with dark and light; hinder side of thighs blackish, marbled with gray; throat and chest with grayish suffusion; abdomen whitish.

Specimens examined.—One, the type.

RANA TARAHUMARAE Boulenger

1917. *Rana tarahumarae* Boulenger, Ann. and Mag. Nat. Hist., ser. 8, vol. 20, no. 120, pp. 416, 417.—Boulenger, 1919, *idem*, ser. 9, vol. 3, no. 16, p. 411.—Boulenger, 1920, Proc. Amer. Acad. Arts and Sci., vol. 55, no. 9, p. 468, Aug.

Type locality.—Ioquiro and Barranca del Cobre, Sierra Tarahumare, State of Chihuahua, Mexico.

Range.—Not known to occur elsewhere than in the Sierra Tarahumare in western Chihuahua.

Remarks.—Günther based his description of this species upon six cotypes, four of which came from Ioquiro [=? Yoquiva] and two from Barranca del Cobre. The coloration of the upperparts alone will distinguish this species from any other Mexican *Rana*. The characters possessed by this frog indicate that it is an isolated race of the *boylii* group. Boulenger correctly summarized the relationships of this frog in the following words: "This species is very closely allied to *R. boylii*, differing in the larger eye, the more oblique loreal region, the more distinct tympanum, the shorter tibia, and the absence of vocal sacs." Although the distributional limits of this frog are unknown, it is clear that its range is isolated from that of *boylii* by several well-defined barriers, of which the arid region of southwestern Arizona and the Mohave Desert of California are the most effective.

These six cotypes of *Rana tarahumarae* are described in my notes as follows:

Four cotypes: B.M. Nos. 1911. 12. 12. 36–39; Ioquiro [=? Yoquiva], Sierra Tarahumare; Neilly, collector. Largest individual: Head-and-body length, 78 mm.; transverse diameter of tympanum,

3.5 mm.; transverse diameter of eye, 8.4 mm.; anterior edge of eye to nostril, 6.2 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to end of snout; vomerine teeth within and behind level of posterior margins of the choanae; a large elongate internal metatarsal tubercle; no dorso-lateral glandular dermal fold; a feeble, curved glandular fold from eye to shoulder; upperparts, including top of head, grayish (in alcohol) with numerous small black spots or dots; skin on back pustulose on one cotype; throat and limbs heavily mottled with brownish; abdomen white.

Two cotypes: B.M. Nos. 1914. 1. 28. 148–149; Barranca del Cobre, Sierra Tarahumare, altitude 3,000 feet; Dr. Hans Gadow, collector. Largest individual: Head-and-body length, 61.3 mm.; transverse diameter of tympanum, 3.7 mm.; transverse diameter of eye, 7.7 mm.; anterior edge of eye to nostril, 4.8 mm.; the hind limb being carried forward along the body, the tibio-tarsal joint reaches to barely beyond the nostril; a distinct tarsal fold; elongate internal metatarsal tubercle, but no outer one; vomerine teeth in two small clusters mostly behind, but within level of choanae; no dorso-lateral glandular dermal fold; upperparts olive brown, marked with black spots with light centers; black spots on upperparts tend toward a linear arrangement; black crossbars on upper surfaces of thigh, tibia, and tarsus, and outer surface of foot; dark crossbars on forearm.

Boulenger erred when he stated that this species lacked a tarsal fold. This fold is quite distinct on one of the larger cotypes, but is less sharply defined on some of the smaller ones.

Specimens examined.—Six, as follows:

Rana tarahumarae

Museum	Catalogue No.	Number of specimens	Locality collected	Date collected	By whom collected or from whom received
			CHIHUAHUA:		
B.M.	1914. 1. 28. 148–149	[1] 2	Barranca del Cobre, Sierra Tarahumare, 3,000 feet altitude.		Hans Gadow.
Do	1911. 12. 12. 36–39	[1] 4	Ioquiro, Sierra Tarahumare		Mr. Neilly.

[1] Cotypes.

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(Principal references are given in boldface figures)