Literature Cited

Auffenberg, W. 1963. The fossil snakes of Florida. Tulane Stud. Zool. 10:131–216.

Brattstrom, B. H. 1958. New records of Cenozoic amphibians and reptiles from California. Bull. South. California Acad. Sci. 57:5–12.

Green, M. 1972. Lagomorpha from the Rosebud Formation of South Dakota. J. Paleontol. 46:377–385.

Hecht, M. K. 1959. Amphibians and reptiles, p. 117–176. *In* Paul D. McGrew [ed.]. The geology and paleontology of the Elk Mountain and Tabernacle Butte area, Wyoming. Bull. Am. Mus. Nat. Hist. 117:121–176.

Hoffstetter, R., and J. Gasc. 1969. Vertebrae and ribs of modern reptiles, p. 201–310. *In* C. Gans and T. S. Parsons [eds.] Biology of the Reptilia, Vol. 3. Academic Press, New York.

Holman, J. A. 1970. Herpetofauna of the Wood Mountain Formation (Upper Miocene) of Saskatchewan. Can. J. Earth Sci. 7:1317–1325.

———. 1972. Herpetofauna of the Calf Creek local fauna (Lower Oligocene:Cypress Hills Formation) of Saskatchewan. Can. J. Earth Sci. 9:1612–1631.

———. 1973. Reptiles of the Egelhoff local fauna (Upper Miocene) of Nebraska. Contrib. Mus. Paleontol. Univ. Michigan 24:125–134.

———. 1975. Herpetofauna of the WaKeeney local fauna (Lower Pliocene:Clarendonian) of Trego County, Kansas. Univ. Michigan Pap. Paleontol. 12:49–66.

Received: 27 September 1974
Accepted: 15 November 1974

Museum, Michigan State University, East Lansing, Michigan 48824, *USA*

TWO NEW SPECIES OF FROGS OF THE GENUS *EUPARKERELLA* (AMPHIBIA: LEPTODACTYLIDAE) FROM ECUADOR AND PERÚ

John D. Lynch

Abstract: The eleutherodactyline frog genus *Euparkerella* is reported from the Amazon Basin of Ecuador (*E. lochites* sp. nov. from the Cordillera del Condor, Morona-Santiago Province) and northern Perú (*E. myrmecoides* sp. nov. from the vicinity of Iquitos, Depto. Loreto). The new Amazonian species require modification of the generic definition; although the new species are clearly more similar to one another than either is to *E. brasiliensis*, generic partitioning of *Euparkerella* cannot be supported.

In 1973 I examined several minute leptodactylid frogs collected in Ecuador and Perú which initially I thought were juveniles of undescribed species. Later I discovered adult females in each of the two samples. The frogs are distinctive in having two large metatarsal tubercles, no digital webbing, pointed discs on the toes, a reduced phalangeal formula for the fourth finger (a single subarticular tubercle is evident under the fourth finger), and in lacking prevomerine dentition. These traits in combination with the short, broad head, small size of adults, and partially fused epicoracoid cartilages are characteristic of the southeastern Brazilian endemic, *Euparkerella brasiliensis*.

One specimen of the Peruvian species was cleared and stained in order to compare the skeletal features with those of *E. brasiliensis*. The only differences noted are (1) the presence of a plectrum (cavum tympanicum and tympanic annulus also present) in the Peruvian species (absent in *E. brasiliensis*), (2) the terminal phalanges are more knob-like in the Peruvian species, and (3) minor proportional differences. These differences are not ade-

quate to preclude assignment of the Ecuadorian and Peruvian frogs to *Euparkerella* but do require a re-diagnosis of the genus. The definition provided by Lynch (1971) must be modified in that the new species have complete ears and do not have the peculiar terminal phalanges of *E. brasiliensis*. The phalangeal reduction of the outermost finger noted by Lynch (1971) also occurs in the two new species and is a unique trait among leptodactyloid frogs; externally, the reduction is evidenced by loss of a subarticular tubercle on the fourth finger (Fig. 1).

Euparkerella Griffiths, 1959

Type-species.—*Sminthillus brasiliensis* Parker 1926.

Diagnosis.—Diminutive leptodactylid frogs (adult ♀♀ 12–20 mm SVL) having lost the terminal phalanx of the outer finger (phalangeal formula for hand 2–2–3–2) and having discs on the toes; eight procoelous presacral vertebrae; atlantal cotyles widely separated; sacro-coccygeal articulation bicondylar; sacral diapophyses round; prevomer edentate; maxilla and premaxilla dentate; maxillary arch complete; fronto-parietals complete (no exposed fontanelle); nasals small, widely separated; anterior portions of epicoracoid cartilages fused; omosternum small, cartilaginous; sternum cartilaginous; pupil a horizontal ellipse; two metatarsal tubercles, subequal in size; digits not webbed; development direct.

Content.—Three species; *E. brasiliensis* (Parker) from the Orgão mountains in Estado Guanabara, Brazil; *E. lochites* sp. nov. from the Cordillera del Condor in eastern Ecuador; and *E. myrmecoides* sp. nov. from the Amazonian lowlands near Iquitos, Perú.

Euparkerella ***lochites*** sp. nov.

Holotype.—KU 147070, an adult ♀ from the Río Piuntza locality on the northern end of the Cordillera del Condor, Morona-Santiago Prov., Ecuador, 1550 m (approximately 3° 15′ S, 78° 20′ W), collected 3 January 1972 by John E. Simmons.

Diagnosis.—A species of *Euparkerella* most similar to *E. myrmecoides* but differing in having pointed digit tips (lacking distinct papillae at digit tips), in having a dull gray venter (not reticulated with dark brown), and in having the dorsum, side of head, and anterior flanks colored gray to brown (instead of a cream dorsum and brown face and anterior flank).

Euparkerella lochites differs from *E. brasiliensis* in having an inner tarsal tubercle, complete ear (tympanic annulus, cavum tympanicum, and plectrum present), truncate snout, and in not having a shortened fifth toe. The two species are also distinguishable on the basis of size (adult ♀♀ of *E. brasiliensis* are 18–20 mm SVL in contrast to 14.9 mm for the single *E. lochites*) and color patterns.

Description.—Head as wide as body, slightly wider than long; snout truncate in dorsal view, truncate in lateral profile, not overhanging lower jaw; snout short, E–N (eye to nostril distance) less than eye length; canthus rostralis rounded, straight; loreal region flat, abruptly sloping to lips (nearly vertical); nostrils weakly protuberant, directed laterally; interorbital space flat (no cranial crests), broader than upper eyelid width; temporal region swollen; tympanic region oriented vertically; tympanum higher than long, its length one-third eye length; no supratympanic fold; ear separated from eye by distance equal to tympanum length; no enlarged tubercles on head; choanae minute, oval, near anterolateral edges of palate, not concealed by palatal shelf of maxillary arch; prevomerine teeth and odontophores absent; tongue large, flat, its length (3.2 mm) much greater than its width (1.7 mm), posterior one-third not adherent to floor of mouth, posterior border not notched.

Skin of dorsum finely shagreened with a few moderate-sized warts on flanks; no folds on dorsum; skin of venter smooth; no discoidal folds; anal opening not modified; ventrolateral edges of thighs bearing low granules; forelimbs slender; obscure antebrachial tubercle present, otherwise no ulnar tubercles; tubercles on palm flattened (possibly due to preservation); palmar tubercle oval (Fig. 1), slightly larger than thenar tubercle; a few obscure supernumerary palmar tubercles present, none on fingers; fingers not fringed; subarticular tubercles broader than long, flat, simple; a single subarticular tubercle on finger IV (Fig. 1); tips of digits lacking pads or discs, somewhat

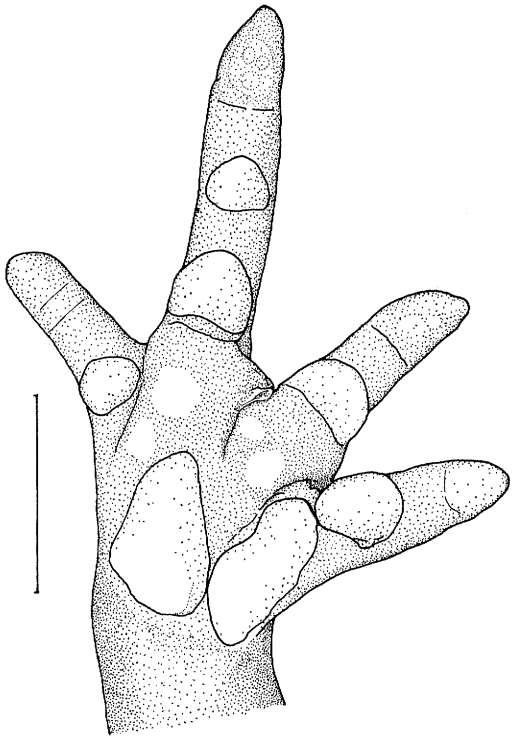

FIG. 1.—Ventral view of hand of *Euparkerella lochites*, KU 147070. Line = 1 mm.

swollen and pointed; first finger shorter than second, longer than fourth; third finger longest.

Heel lacking tubercles; no tubercles on outer edge of tarsus; one large, transversely oriented, inner tarsal tubercle; two metatarsal tubercles, both prominent, inner slightly larger than outer; both roughly twice as long as wide; supernumerary plantar tubercles present, obscure; subarticular tubercles low, flat, longer than wide; no fringes on toes; toes not webbed; toe tips pointed (not bearing papilla at tip), weakly dilated into pads; pads bearing elongate discs; no toe obviously shortened; toe length (shortest to longest)—I–II–V–III–IV.

Color in Preservative.—Dorsum gray with rusty-brown stripe down center of back; two black suprainguinal spots; labial bars obscure; an obscure brown spot anterior to eye; no supratympanic or canthal stripes; dark brown stripe on anterior edge of upper arm and a similar stripe on inner edge of forearm; hindlimbs barred, bars brown; faint black line above vent and lateral to vent (defining anal triangle); area about vent white; posterior surface of thighs dull gray; venter dull gray without pattern; undersides of distal one-half of tarsus dark brown.

Measurements of Holotype (in millimeters).—SVL 14.9; tibia 7.0; head width 5.2; head length 4.9; upper eyelid width 1.15; interorbital distance 1.55; tympanum length 0.5; eye length 1.55; E–N 0.8.

Etymology.—Greek, *lochites*, a recluse—in reference to its occurrence in the comparatively remote Cordillera del Condor.

Natural History.—The holotype is an adult ♀ with extensively convoluted oviducts and large yellow ovarian eggs. She was collected during day in leaf litter in cloud forest.

Remarks.—*Euparkerella lochites* is obviously closely allied to *E. myrmecoides*. In comparing the character-states of *E. brasiliensis*, *E. lochites*, and *E. myrmecoides*, it is apparent that *E. brasiliensis* is well differentiated from the two new species. In spite of the structural similarities between the Ecuadorian and the Peruvian species, I am according each species-level recognition. The color pattern differences are striking but not so great as to preclude the possibility of pattern polymorphism. The major distinctions between the two include relative sizes of the toe pads (larger in *E. myrmecoides*), degree of pointedness of the toe pads (ending in a distinct papilla in *E. myrmecoides* and merely pointed in *E. lochites*), and the presence of obscure plantar supernumerary tubercles in *E. lochites* (none in *E. myrmecoides*).

Euparkerella ***myrmecoides*** sp. nov.

Holotype.—TCWC 41532, an adult ♀ from Mishana (2½ hours by speedboat up the Río Nanay from the Navy dock 5 km NNE Iquitos), Depto. Loreto, Perú, collected in May 1972 by Pekka Soini.

Paratypes.—TCWC 41602, Mishana, collected 1 December 1972 by James R. Dixon; TCWC 41701–02 (41702 is a cleared and stained skeleton), Centro Union (30 min up Río Amazonas towards Pucalpa from Iquitos by speedboat to mouth of Río Aucayo, then 1 hour by paddling up Río Aucayo), Depto. Loreto, Perú, collected 29 November 1972 by J. R. Dixon.

Diagnosis.—A species of *Euparkerella*

most similar to *E. lochites* but distinguished in having broader toe pads ending in distinct papillae (Fig. 2), in lacking supernumerary plantar tubercles, in having brown and cream reticulation on venter, and in having a cream dorsal ground color and brown face and anterior flanks.

Euparkerella myrmecoides differs from *E. brasiliensis* in the same way *E. lochites* does, viz., ear present, inner tarsal tubercle present, fifth toe not shortened, and snout truncate. *Euparkerella myrmecoides* resembles *E. brasiliensis* in color pattern in having a pale dorsum and darker flanks but differs in having the reticulate pattern on the venter. *Euparkerella myrmecoides* is smaller than *E. brasiliensis* (adult ♀♀ are 12.0–13.6 mm and 18.0–20.0 mm SVL, respectively).

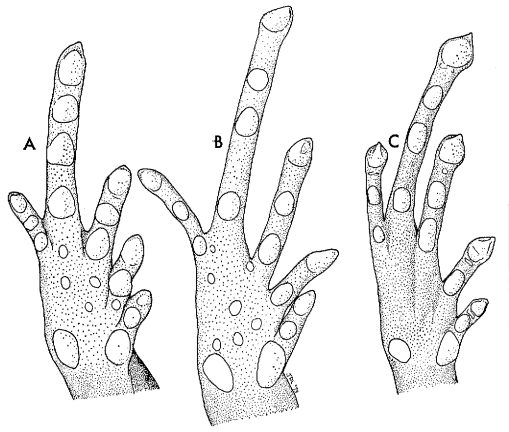

FIG. 2.—Ventral views of feet of (A) *Euparkerella brasiliensis* (KU 112370), (B) *E. lochites* (KU 147070), and (C) *E. myrmecoides* (TCWC 41532). Line = 2 mm.

Description.—Head nearly as wide as body, wider than long; snout truncate in dorsal view, rounded in lateral profile, not overhanging lower jaw; snout short, E–N much less than eye lengh; canthus rostralis rounded, weakly concave; loreal region weakly concave, sloping abruptly to lip (but not vertical as in *E. lochites*); nostrils weakly protuberant, directed laterally; interorbital space flat (no cranial crests), much broader than upper eyelid width; temporal region not swollen; tympanic region vertical; tympanum round, separated from eye by three-fourths ear diameter; no supratympanic fold; head lacking enlarged tubercles; choanae small, round in outline, near anterolateral edges of palate, not concealed by palatal shelf of maxillary arch; no prevomerine teeth or odontophores; tongue slightly longer than wide, posterior one-third not adherent to floor of mouth, posterior edge not notched.

Skin of dorsum finely shagreened with scattered tubercles on flanks; no dorsolateral folds; skin of venter smooth, no discoidal folds; anal opening not modified; ventrolateral edges of thighs areolate; forelimbs slender; no ulnar tubercles except for obscure antebranchial tubercle; palmar tubercle nearly round, larger than oval thenar tubercle; a few obscure supernumerary palmar tubercles; subarticular tubercles longer than wide, low, flat, simple; a single subarticular tubercle on finger IV; no fringes on fingers; finger lengths, shortest to longest, IV–I–II–III; tips of digits not dilated into pads, no discs on fingers, tips of fingers bearing papillae.

No heel tubercles; outer edge of tarsus lacking tubercles; inner tarsal tubercle transversely oriented, nearly as large as outer metatarsal tubercle; two metatarsal tubercles, inner nearly twice as large as outer, both longer than wide, outer somewhat conical; no supernumerary plantar tubercles; subarticular tubercles longer than wide, low, flat, simple; toes lacking fringes and webbing; digits bearing dilated pads and discs; tips of digits bearing papillae (Fig. 2); toe lengths, shortest to longest, I–II–V–III–IV.

Color in Preservative.—Dorsum gray to cream with indefinite brown markings (chevrons, interorbital bar); pale interocular band anterior to brown interorbital bar; black suprainguinal spots and anal triangle; face brown, darker than dorsum with darker brown labial bars; no canthal or supratympanic stripes; area posterior to eye brown, continuing onto anterior flank; posterior flank suffused with brown; limbs weakly barred; posterior surface of thighs brown with cream flecks; anterior surface of thighs and groin brown with small colorless spots; throat brown with small white spots; venter cream with brown marbling; undersides of tarsus and foot brown.

Measurements of Holotype (in millimeters).—SVL 13.6; shank 6.4; head width 4.75; head length 4.25; upper eyelid with 0.8; interorbital distance 1.65; tympanum length 0.45; eye length 1.55; E–N 0.9.

Etymology.—Greek, *myrmex* and *-oides*, meaning ant-like, in reference to the small size of the frog.

Natural History.—The type-series includes two adult females (12.0–13.6 mm SVL) collected in May and November and two immature specimens. TCWC 41701 is

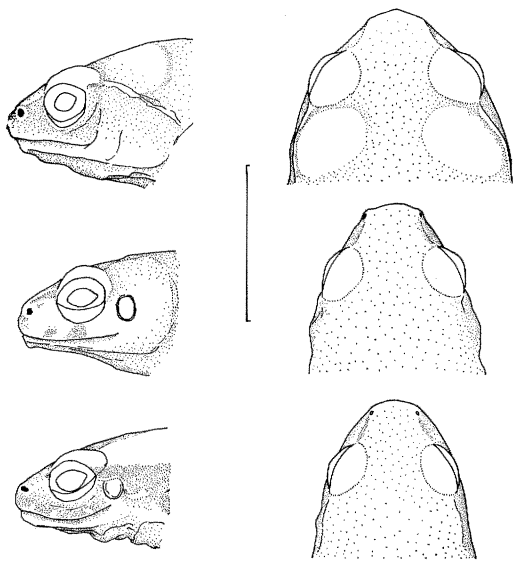

FIG. 3.—Heads of *Euparkerella* species. Top: *E. brasiliensis* (KU 112370). Middle: *E. lochites* (KU 147070). Bottom: *E. myrmecoides* (TCWC 41532). Line = 5 mm.

a juvenile female, 9.6 mm SVL, and TCWC 41602 appears to be a juvenile male, 8.1 mm SVL—if 41602 is a male, vocal slits and sac are lacking. All specimens were collected by day in leaf litter in primary rainforest (J. R. Dixon, *in litt.*).

Remarks.—Euparkerella myrmecoides (♀♀ 12.0–13.6 mm SVL) is considerably smaller than *E. brasiliensis* (♀♀ 18.0–20.0 mm SVL). Griffiths (1959) reported loss of the left oviduct in the yet smaller *Sminthillus limbatus*. The viscera of TCWC 41702 (12 mm SVL) are preserved and serve as the basis for the following comments. The frog contains six mature ovarian eggs. Five eggs have diameters of 2.0 mm; the sixth is smaller (1.65 mm). Using 2.0 mm as the value for the ovulated egg diameter, the E/C (diameter of ovulated egg/minimum coelomic width) value is 0.4, a value identical to that reported for *E. brasiliensis* by Griffiths (1959). This low E/C value means that two eggs could move down the oviducts simultaneously without exceeding the minimum coelomic width (≈ 5 mm in 41702). *E. myrmecoides* has two functional oviducts but the left is smaller than the right suggesting that simultaneous passage of mature eggs through the two oviducts may not occur.

DISCUSSION

Euparkerella brasiliensis is structurally distinct from *E. lochites* and *E. myrmecoides* in lacking the middle ear, in lacking an inner tarsal tubercle, having a proportionately shorter fifth toe (Fig. 2), having a relatively broader head with a sloping snout (Fig. 3), and in being one and one-half times as large as the other species. The differences suggest that *E. lochites* and *E. myrmecoides* are more closely related to one another than either is to *E. brasiliensis* but do not support generic separation of the former species from the latter. In these three species the similarities in digit morphology, condition of the palate, and arrangement of skull bones, coupled with the exhibition of a peculiar derived trait (loss of one phalanx in the fourth finger) compels recognition of a single genus.

The discovery of *Euparkerella* in the upper Amazon Basin might be viewed with some zoogeographic skepticism but the distribution of *Euparkerella* as now known closely parallels that of another eleutherodactyline genus, *Ischnocnema* (Lynch, 1974). I suspect that the parallel is spurious in that *Euparkerella* are small and additional species (presently labeled as juvenile leptodactylids) are likely to be found in museum collections.

Acknowledgments.—Specimens were loaned by James R. Dixon, Texas A & M University (TCWC), and William E. Duellman, The University of Kansas Museum of Natural History (KU). Dr. Dixon and John E. Simmons provided ecological notes on the frogs they collected.

LITERATURE CITED

GRIFFITHS, I. 1959. The phylogeny of *Sminthillus limbatus* and the status of the Brachycephalidae (Amphibia, Salientia). Proc. Zool. Soc. London 132:457–87.

LYNCH, J. D. 1971. Evolutionary relationships,

osteology, and zoogeography of leptodactyloid frogs. Univ. Kansas Mus. Nat. Hist. Misc. Publ. (53):1–238.

———. 1974. A new species of leptodactylid frog (*Ischnocnema*) from the Cordillera del Condor in Ecuador. J. Herpetol. 8:85–87.

Received: 21 October 1974
Accepted: 21 November 1974

School of Life Sciences, The University of Nebraska-Lincoln, Lincoln, Nebraska 68508, USA

POPULATION ESTIMATES, AGE STRUCTURE, AND DENNING HABITS OF WHIPSNAKES, *MASTICOPHIS T. TAENIATUS*, IN A NORTHERN UTAH *ATRIPLEX-SARCOBATUS* COMMUNITY

WILLIAM S. PARKER

ABSTRACT: A population estimate of whipsnakes, *Masticophis t. taeniatus*, utilizing communal hibernacula at Lone Rock, Tooele County, Utah, was made by taking samples in autumn 1973 and in spring 1974. The number of whipsnakes using this site was estimated by various methods to be 425–543. Confidence limits for the Lincoln Index were 276–618. Estimates of postdispersal density ranged from 0.15–0.22 whipsnake/ha and 17.7–26 g/ha. Whipsnakes used at least three separate dens at this location, differing from other sites where only one den per den complex is used. Age structure appeared equally balanced among various age groups older than 1 year old, and the latter was underrepresented. Sex ratios were significantly biased toward ♂♂. The future of this population is briefly discussed.

POPULATION studies of snakes are uncommon, perhaps because of the secretive habits and low population densities of snakes. Aggregation for communal hibernation during the winter creates situations where data on large numbers of individual snakes can be obtained in a relatively short period of time. Lone Rock in Skull Valley, Tooele County, Utah, has been a known hibernaculum for large numbers of desert striped whipsnakes (*Masticophis t. taeniatus*), as well as Great Basin rattlesnakes (*Crotalus viridis lutosus*), Great Basin gopher snakes (*Pituophis melanoleucus deserticola*), and night snakes (*Hypsiglena torquata deserticola*), but no one has attempted to determine the numbers of snakes utilizing it as a den. I conducted a brief study to obtain a population estimate by taking one sample in autumn 1973 and a second in spring 1974. Supplementary information on sex ratios, age structure, and denning patterns was also obtained. These data are compared with those from a more detailed study of whipsnakes conducted in adjacent Tooele Valley from 1969 to 1973 (Parker, 1974).

MATERIALS AND METHODS

Snakes were captured by hand during two visits to Lone Rock in April 1972, 10 visits in autumn 1973 (3 September–13 October), and 9 visits in spring 1974 (9 April–7 May). Most were processed in Salt Lake City. Each snake was measured for snout–vent length (SVL) and tail length to the nearest 0.5 cm, and weighed to the nearest 0.1 g. For field identification of individuals, each snake was painted on the head and neck using a color code. Snakes were permanently marked by clipping ventrals. Locations of each snake were recorded relative to conspicuous landmarks to approximately the nearest meter.