A New Species of Montane Rain Frog, Genus *Eleutherodactylus* (Leptodactylus), from Guerrero, Mexico

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Abstract. *Eleutherodactylus uno* n. sp. is described from the oak-pine zone of the Sierra Madre del Sur, in the Mexican state of Guerrero. The new species cannot be associated with any currently recognized supraspecific division within the genus and demonstrates the unsatisfactory nature of attempts to cluster the approximately 400 known species into groups.

Although the herpetofauna of Mexico has received intensive attention during the last five decades (e.g. Smith and Smith, 1973; 1980), novelties will probably continue to be discovered regularly for many years (e.g. Campbell, 1976; Campbell and Murphy, 1977). This is particularly true of the relatively inaccessible and unexplored mountains that form the Sierra Madre del Sur of the states of Guerrero and Oaxaca (Adler, 1965; Snyder, 1972; Adler and Dennis, 1972; Caldwell, 1974; Campbell, 1982; Myers and Campbell, 1981).

The present paper describes an unusual new frog of the genus *Eleutherodactylus* from the oak-pine zone of the Guerrero portion of the Sierra. Since the new form cannot be associated with any of the known supraspecific groups within the genus as established by Lynch (1976) or Savage (1976; 1980) it is called

*Eleutherodactylus uno*, sp. n. (Fig. 1-3)

**Holotype.** UTA (A) 7984, an adult female; Mexico: Guerrero: 12.9 km SW Puerto de Gallo, 2034 m; collected by Jonathan A. Campbell, 6 August 1979

**Diagnosis.** The new species is immediately separable from all other known Mesoamerican members of the genus by the following combination of features: having emarginate disks on several fingers and toes, a smooth venter, slight toe webbing and lacking a tarsal fold. In addition it is distinctive in its large size (62.5 mm in standard length) and in having a relatively broad head (head width 48.8% of standard length) while lacking cranial crests.

Superficially *E. uno* resembles the similarly large, robust, short-legged and broad-headed members of the allied genus *Hylactophryne* of the United States and Mexico, but the latter have no digital disks (distinct disks on fingers and toes in *uno*). The new form is also reminiscent of the large, robust, broad-headed Central and South American species allied to *E. biporcatus* (Lynch, 1975), but the latter have definite bony cranial crests and narrow unexpanded finger disks (no cranial crests and expanded, truncate and emarginate disks on fingers III-IV in *uno*).
Within the Mesoamerican region the new form might be confused with large members of the *Eleutherodactylus alfredi* group (Lynch, 1976), which have emarginate digital disks, a smooth venter and may lack a definite tarsal fold. Species within the latter group are without any trace of toe webbing; have narrow heads (head width 36-43% of standard length); have finger II decidedly longer than finger I; have greatly expanded truncate finger disks (3X width of digit on fingers III-IV), and appear more slender and longer limbed than *uno*, which has definite basal toe webbing, a relatively broad head (head width 48.8% standard length), fingers I-II equal and the finger disks only moderately expanded (2X width of digit on fingers III-IV).

The only other frog in the region resembling *E. uno* in large size (standard length to 80 mm in females), robust habitus and having a moderately broad head (head width 34-49% of standard length) is *E. laticeps* of the Atlantic versant of southern Mexico, Guatemala, Belize and Honduras. The two are trenchantly different in that *laticeps* (features for *uno* in parentheses) has a well-developed inner tarsal fold (absent); the first finger much longer than the second (about equal); the outer two finger disks much larger than those on fingers I-II, about 2 times width of digit (finger disks subequal, barely wider than digits); disk covers rounded (disk covers emarginate on fingers III-IV).

**General characteristics.** Head broad, subelliptical in doral outline; snout profile acuminate. Canthus rostralis sharp. Loreal region slightly concave, with upper lip flared in cross
A new species of *Eleutherodactylus*

Section. Choanae ovoid, small, slightly larger than vomerine tooth patches; vomerine tooth patches transverse, posterior but internal to choanae, very narrowly separated on mid-line. Upper anterior surface of head smooth, with a few large pustules; posterior head surface with numerous pustules, to produce a rugose appearance; upper eyelid rugose with a series of low superciliary pustules. Tympanum elliptical, vertical diameter 3/4 length of orbit; bordered above and posteriorly by a distinct glandular ridge. Dorsum, flanks and upper limb surfaces rugose. Fingers I and II about equal in relative lengths. Disk on finger I rounded, barely wider than finger. Disk on finger II slightly expanded and truncate. Disks on fingers III-IV expanded, truncate and emarginate above, almost twice as wide as fingers; disk pads broadened and truncate. Subarticular tubercles under fingers round in outline globular in profile, neither markedly flattened nor projecting; no supernumerary tubercles; thenar tubercle large, ovoid; palmar tubercle very large, cordate; several large rounded accessory palmar tubercles. No distinct heel tubercle or calcar. Toe disks smaller than finger disks, largest about equal to finger disk II; disks on toes II-IV palmate and emarginate; disks on toes I and V barely expanded. Very slight basal toe webbing between toes I-IV. Subarticular tubercles under toes ovoid, slightly projecting and globular in profile. No supernumerary tubercles; a few low plantar tubercles; inner metatarsal tubercle well-developed, ovoid; outer moderate and low; no tarsal fold or tubercles. No inguinal gland; venter smooth.

![5mm](image.png)

Fig. 2. Lateral view of head of holotype of *Eleutherodactylus uno*, UTA (A) 7984.

Coloration. Dorsal ground color gray with much of mid-dorsal area and light areas of the limb surfaces brownish. A definite dark hour-glass shaped interocular dark spot, demarcated by a light interocular line anteriorly and anastomosing with the mid-dorsal dark area posteriorly. Upper lips barred with light and dark, one broad bar extending to orbit, black; several black spots along lower rim of orbit; a definite black tympanic stripe curving...
posteriorly and downward from above tympanum to just behind angle of jaw. A narrow white mid-dorsal stripe. A pair of black paravertebral and anterior and posterior supra­scapular black spots. Flank mottled white and gray. Upper limb surfaces barred with light brown and dark gray. Posterior thigh surfaces mottled with brown and white, no distinctive pattern of spots or stripes. Throat finely punctuated with gray, venter white; undersides of limbs with areas of brown pigment; sole of foot uniform brown.

**Measurements.** Standard length 62.5 mm (other measurements as % of standard length); head length 41.6; head width 48.8; length of eye 10.4; snout length 21.6; loreal length 10.4; vertical tympanum 8; hind limb length 17.4; tibia 56.8.

Fig. 3. Foot and hand of holotype of *Eleutherodactylus uno*, UTA (A) 7984.
Jaw musculature. The depressor mandibulae has three slips, one each from the dorsal fascia, the squamosal and the annulus tympanicus. The adductor mandibulae externus superficialis is present. The jaw musculature formula after Starrett (1968) is DFSQAT + e.

Etymology. The name uno refers to the uniqueness of the species within the genus *Eleutherodactylus*.

Relationships

As indicated in the introduction to this paper and emphasized by its name, *Eleutherodactylus uno* does not appear to be closely allied to any other known species in the genus. When one considers that approximately 400 valid species comprise the group and encompass an extraordinary array of morphological types, including huge, stream-adapted toad-like species, moderate-sized completely terrestrial forms, large toad-like forest floor burrowers and arboreal treefrog-like species with enormous finger and toe disks, the distinctness of *uno*, is even more remarkable. While this diversity of species makes *Eleutherodactylus* the largest genus of vertebrates, it creates extraordinary problems for the herpetologist attempting to cluster related forms. This problem is magnified by the fact that while many distantly related species are distinctive, the features of external morphology within the genus are recombined over and over again in a mosaic pattern. In consequence recognition of natural subdivisions is difficult because many apparently distantly related and/or geographically widely separated forms will share suites of characters that blur any attempt to define lineages within *Eleutherodactylus*.

Recently, two different approaches (Savage, 1976, 1980, and Lynch, 1976) have been applied to establishing subdivisions within *Eleutherodactylus*, based primarily on external morphological features that reflect the mosaic described above. In my system clusters comprised of species that are extremely similar in morphology and seemingly closely allied were recognized as "species groups". Lynch followed a different method by forming "species groups" that include much greater diversity and roughly correspond to subgeneric units, without formal nomenclatural status. By way of comparison my "species group" is equivalent to the same unit employed by students of the specioselizard genus *Anolis* (Williams, 1976a, 1976b). Lynch's "species group" is equivalent to a series in *Anolis*. In *Anolis* a series includes one to several species groups.

Savage and DeWeese (1979, 1981) have discussed briefly the weaknesses of both approaches particularly in the light of evidence, mostly unpublished, from jaw musculature (Starrett, 1968), serum proteins (Harris, 1973) and karyology (DeWeese, 1976). More recently Miyamoto (1981) utilizing electrophoretic data on tissue proteins has reached similar conclusions. These data sets tend to confirm the reality of the closely-knit, morphologically similar species groups (sensu Savage). In addition they suggest that at least six major evolutionary lineages are subsumed within *Eleutherodactylus*. In most instances these lineages do not correspond to any one of the 17 groups recognized by Lynch (1976). It thus seems premature (as pointed out by Savage and DeWeese, 1979) to establish higher level (suprageneric) taxonomic groupings in the genus solely upon traditional features of morphology (i.e. external and skeletal). Nevertheless, the sheer weight of species numbers requires that at least some pragmatic way be devised to cluster *Eleutherodactylus* species into phenetic groups until phylogenetic evaluation of multiple character sets can produce an evolutionary-based system.
With these points in mind, it seems convenient to use the “species groups” of Lynch (1976) as useful major subdivisions of the genus without any formal nomenclatural status and without any implication that they constitute monophyletic clusters. These major subdivisions may be called series because of their approximate equivalence to similar units referred to as series in other herpetological taxa, especially in Anolis (sensu lato). The term species group would then be restricted to smaller subsets of species within each series as has been traditional in vertebrate biology, is consistent with the usage of Anolis (and used in the large and complex tree-frog genus Hyla, Duellman, 1970, et seq.) and follows the practice of all other workers on the genus, except Lynch. The need for these two levels of discrimination is admitted by Lynch and Duellman (1980) who propose to divide one large unit (the unistrigatus series) into 16 subunits equivalent to the species groups of this paper. They coin a new term, assembly, for these subunits.

Species groups (junior synonym = assembly) in the present sense are comprised of a monophyletic stock of closely related forms. They do not correspond to an Artenkreis (or superspecies sensu Mayr, 1963) as suggested by Lynch (1976), since the members are rarely exclusively allopatric and often several species of a group are sympatric at a given locality (Williams, 1976a).

Lynch's arrangement (1976) establishing 17 series within the genus doubtless will be subject to major revision as more data are accumulated, primarily because:

1) the groupings are based upon a series of trivial “key” characters of external morphology, principally the relative lengths of fingers I-II and the texture of the ventral skin, which are of dubious phylogenetic significance (i.e. are probably homoplasious)

2) the relative finger lengths and several subsidiary features (disk flap indentation, tympanum, and toe webbing) used by Lynch to define the series are variable within some series having a large number of species (e.g. the fitzingeri series; Savage, 1975, Savage and DeWeese, 1979)

3) the characteristics of jaw musculature, karyology and tissue proteins suggest that some of Lynch's series are polyphyletic and that others regarded as distinct by him may form a single lineage.

The system of species groups used by me (Savage, 1975, 1976, 1980, 1983) for Central America suffers from severe limitations as well. Review of the mounting evidence from jaw musculature, karyology and tissue proteins suggests that the problem of recognizing monophyletic clusters of closely related species in the genus is more complicated than I imagined 10 years ago; that the placement of a number of superficially similar species into the same species group by me (e.g. rhodopis and podiciferus in the gollmeri group) is untenable in a number of instances; and that the group that I would recognize currently will be subject to substantial change in the light of additional data during the next few years.

Fortunately, in the present case, the new species is so distinctive that it cannot be associated with any previously recognized series or species group of Eleutherodactylus. In terms of external morphology the relatively broad head and emarginate disks eliminate all of Lynch's (1976) series except the biporcatus (central America and northwestern South America), fitzingeri (most of tropical mainland America) and sulcatus (northern South America) stocks from consideration. The biporcatus and sulcatus series include frogs having distinct cranial crests, the disks reduced or absent and not emarginate. Eleutherodactylus uno lacks crests and has well-developed finger and toe disks some of which are emarginate.

Within the fitzingeri series only E. anomalus of northwestern South America, has a relatively broad head (HW/SL 41.8-48.3%). The remaining approximately 45 species are
A new species of *Eleutherodactylus* gracile frogs with narrow heads (HW/SL 32-43%), except for a lower Central American form (*E. taurus*) and one from the central Andes of Peru (*E. lymani*) that are somewhat intermediate (HW/HL 35-45%). Insofar as I can determine all members of this series have a distinct inner tarsal fold (absent in *uno*) and the relatively broad-headed *E. anomalus* has unexpanded non-emarginate finger disks and extensive toe webbing. In addition all members of the *fitzingeri* series except *E. berkenbuschii* of eastern Mexico, have finger I longer than finger II (I and II equal in *uno*, both conditions occur in *berkenbuschii*).

If the head width feature is ignored *E. uno* might be placed with the *rhodopis* series in the Lynch system, as frogs of that series have fingers I-II equal and the venter smooth. All known members of the *rhodopis* series lack tarsal folds and webs, have narrow finger (III-IV) and toe (III-V) disks on only the outer digits. In addition most forms included in the series are small to medium in size, with the largest species attaining a length of 45 mm. *Uno* has some webbing, well-developed disks and is a large form (over 60 mm). These features in combination with the relatively broad head make relationship with *rhodopis* and its allies distant at best.

Elsewhere I have emphasized the great utility of jaw muscle features as a basis for establishing relationships in the genus (Savage, 1980). At that time I reported the first instance of three major slips in the depressor mandibulae (DFSQAT) combined with the presence of the adductor externus superficialis (e) for the genus and the family Leptodactylidae. The presence of the same condition in *E. uno* might suggest a relationship to *E. cuaquero* of Costa Rica, the species described as having DFSQAT + e in that paper. *E. cuaquero* is a member of the *fitzingeri* series and within the series belongs to the *fitzingeri* species group. Unfortunately subsequent study has shown that the jaw muscle condition is present in a considerable number of disparate species of *Eleutherodactylus* from several of Lynch's series.

As may be seen from this discussion, *E. uno* cannot be readily associated with any currently recognized series or species group within the genus. While superficially it resembles the more robust members of the *fitzingeri* series, these forms (*anomalus*, *taurus* and narrow-headed members of the *rugolosus* group as defined by Savage, 1975) none of them has well-developed emarginate disks and unlike *uno* have a tarsal fold. Until further data, especially on karyotype and tissue proteins, become available for the new species, it seems best to regard its relationship as unknown and to assign it to no series or species group.

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References


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