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A New Plethodontid Salamander from Oaxaca, Mexico

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While collecting on the slopes of the Sierra de Juárez in the Mexican state of Oaxaca, I came across a population of salamanders that seems to represent an undescribed species. Mr. C. M. Bogert kindly called my attention to examples of this form in the American Museum of Natural History (A.M.N.H.) that he had obtained in the same region earlier. He also provided photographs of two living adults, a male and a female. I am grateful for such help as well as for loans of comparative material. Also, I thank Drs. Hobart M. Smith of the University of Illinois Museum of Natural History (U.I.M.N.H.) and Robert C. Stebbins of the Museum of Vertebrate Zoology (M.V.Z.) for loans of comparative material, and Mr. Arden Brame, and Drs. George Rabb and David Wake for discussing the problems entailed in preparing this description. I thank Dr. Richard G. Zweifel for help in the preparation of the illustrations. I am grateful to the American Society of Ichthyologists and Herpetologists and to the Society of the Sigma Xi for financial assistance.

Pseudoeurycea juarezi, new species

HOLOTYPE: A.M.N.H. No. 74403, a female, obtained on July 31, 1963, by Philip J. Regal and George V. Elliott in a ravine in the cloud forest on the northeastern slope of the Sierra de Juárez, near latitude 17° 48' N., longitude 96° 20' W., in the state of Oaxaca, Mexico, about 58

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kilometers south of Valle Nacional on the road between Ixtlán de Juárez and Tuxtepec.

PARATYPES: In the same series as the holotype are the topotypes (A.M.N.H. Nos. 74404-74409, and specimens retained in the collection of the author pending future deposition: P.J.R. Nos. 1089, 1090, 1093, 1095-1098, 1100-1102, 1104-1106). Specimens taken August 23, 1961, by C. M. Bogert at an elevation of 9100 feet in the Sierra de Juárez, 0.7 mile northeast of Cerro Pelón (A.M.N.H. Nos. 69449-69454), are also paratypes.

HABITAT: Specimens taken with the holotype were found under loose bark on standing and fallen trees in a ravine heavily wooded with a few conifers, but mostly with tall, broad-leaved trees. The area was sufficiently wet or moist to support moss on rocks, logs, and soil.

Bogert noted on the field tag that the specimens obtained near Cerro Pelón were near a stream in a ravine with fir, pine, dwarf bamboo, in cloud-shrouded habitat, where temperatures of the air, water, and soil were at 10.2° C. The specimens obtained near Cerro Pelón were on the ground, and the two adults were found together under a large flat rock at the very edge of a rivulet.

DIAGNOSIS: The broad feet with the webbing including the proximal phalanges, long legs (adpressed limbs touching or overlapping), the light dorsum with darker markings and dark sides, at least posteriorly, and the moderate size (no specimen at hand exceeds 50 mm. in snout-to-vent length) readily distinguish this species from its cogeners. The number of teeth on the maxilla and premaxilla (74-100 in specimens from 38 to 50 mm. in body length), the flattened condition of the toes, and the glandular dorsum of the tail, which tends to make the tail seem wider dorsally than ventrally, form a combination of characters unusual in *Pseudoeurycea*.

DESCRIPTION OF HOLOTYPE: The holotype female measures 43.5 mm. from the snout to the posterior end of the vent (vent 4 mm.), and possesses a tail that is 41.3 mm. in length. The adpressed limbs touch and slightly overlap; the tongue, as is that of others in the group, is stalked, the terminus free, and there is a sublingual fold. The webbing on the feet includes the proximal phalanges; the digits are slightly expanded and flattened; and the palms and under sides of the terminal phalanges are slightly thickened.

The venter is light cream yellow, but the presence of irregularly placed melanophores, apparent under magnification, darkens its appearance. The upper surfaces of the limbs tend to light brown, which merges with the distinct light to dark brown upper sides on the dorsum of the head

and neck. Behind the forelimbs a light dorsal stripe begins to become distinguishable from the darker sides and head, and continues posteriorly onto the tail, where it is light and more distinct though marked by black spots.

The dorsum of the tail is glandular and is wider than the ventral side. The jaw is somewhat countersunk, giving the leading edge an acute angle in profile. There is a small gland above and somewhat posterior to the insertion of the femur. The nasolabial protuberances are slight. The small glands that cover the dorsal surfaces produce a dense pitting on preserved specimens.

The following measurements of the holotype are given in millimeters: snout to gular fold, 10.5; head width, 7.3; snout to anterior insertion of forelimbs, 13.6; forearm and manus, 8.4; length of upper arm, 4.6; length of trunk between insertions of limbs, 21.6; length of hind limb from body to tip of longest digit, 12.0; width of foot, 5.2; length of femur (body to joint), 3.9; length of eye, 3.1; distance between nares, 2.1; the teeth in maxillary-premaxillary series total 82; vomerine teeth, 13-13.

VARIATION: The number of maxillary-premaxillary teeth varies with body size, but the increase in number is not directly proportional to the snout-to-vent length in three of the larger males (fig. 1). The maximum number of vomerine teeth found was 15-15, and the minimum 3-5.

In two females the adpressed limbs do not quite touch, though on some the overlap of the toes of the adpressed limbs may extend the width of two costal folds. The limbs and feet are proportionately larger in males than in females.

The greatest individual variation noted is in the tendency toward development of a light dorsal stripe. The stripe is invariably present, at least on the tail, and all specimens have black spots or markings. In some light specimens the dorsal stripe is faintly discernible, and the sides and dorsum are only slightly darker than the light cream-yellow venter. In some specimens the black dorsal punctations run together and produce somewhat irregular patterns on the lighter dorsal stripe. The dark wash on the venter of some specimens may be moderately intense, but it is usually evident as an irregular mottling, which does not extend onto the gular region.

The mental gland is easily seen on most large males, though it may be indistinct owing to the lack of dark pigmentation in the gular area. The nasolabial protuberances and snout area are more strongly developed in males than in females.

RELATIONSHIPS: *Pseudoeurycea juarezi* retains the prefrontal and lacks a septomaxilla, precluding the likelihood of a close relationship with typi-

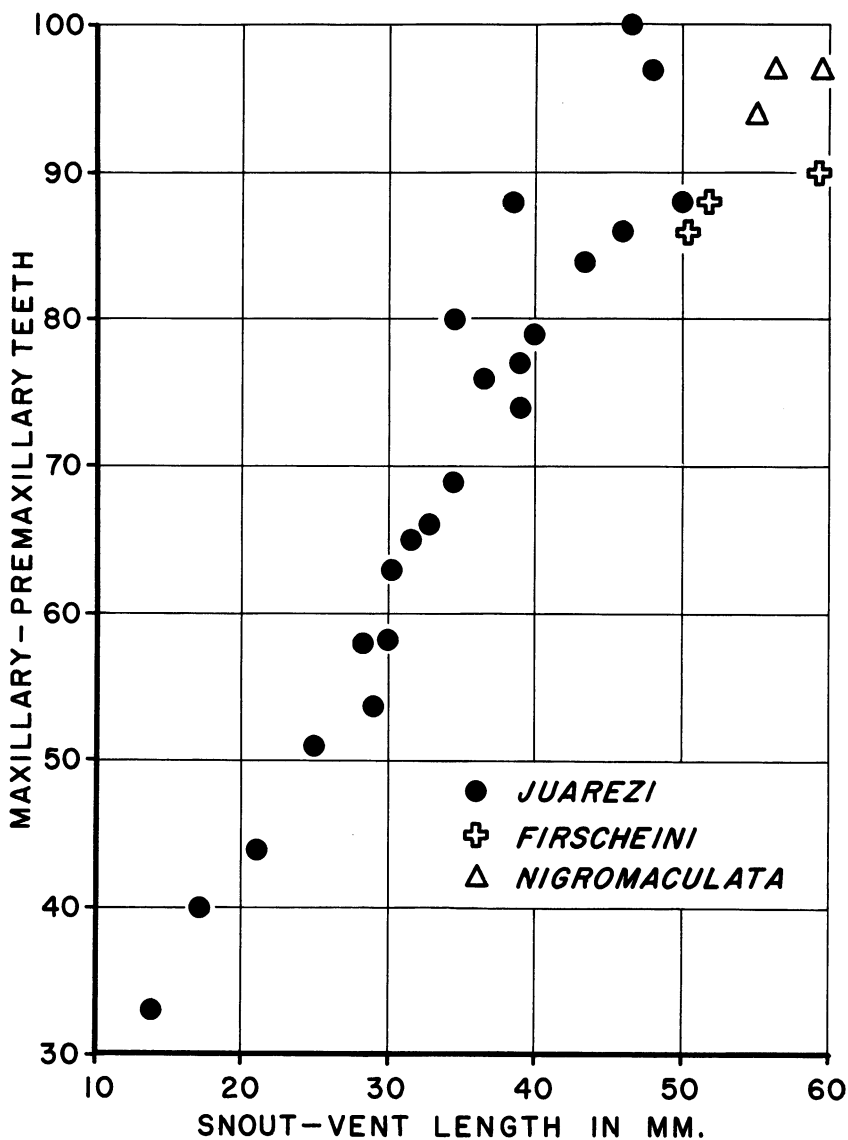


FIG. 1. Number of maxillary-premaxillary teeth in relation to body size in three species of *Pseudoeurycea*. See text for comment on data for *firscheini* and *nigromaculata*.

cal *Chiropterotriton*. Specimens of *Chiropterotriton* taken north of the range of *juarezi* usually retain the septomaxilla, whereas those obtained in areas to the south lack both the prefrontal and septomaxilla (Rabb, 1960). Despite a general resemblance to *Chiropterotriton*, the relationships of *juarezi* are to be sought within the genus *Pseudoeurycea* as we now understand it. Distal tarsal 4 articulates with the fibulare, and therefore distal tarsal 5 does not articulate with centrale 2-3 in *juarezi*, distinguishing it from most species of *Chiropterotriton*.

Although the species of *Pseudoeurycea* inhabiting the areas south of the Isthmus of Tehuantepec (Central America in this text) are generally larger than *P. juarezi*, they have fewer teeth. In some respects *juarezi* resembles members of this group. *Pseudoeurycea goebeli* and *P. exspectata* have long legs that touch or overlap when adpressed. Characters are not easily ascertained in the paratypic series of *Pseudoeurycea brunnata*, but perhaps this species resembles *juarezi* in having the toes flattened and slightly expanded, in having a glandular area on the dorsum of the tail, and in being of similar size. If specimens better suited for examination than the paratypes conform to this description, *P. brunnata*, despite its having fewer teeth and shorter legs, may prove to be related to *juarezi*. Such features of the tail and feet are not usual in *Pseudoeurycea*. These similarities between *juarezi* and Central American species may represent parallelisms.

Other species of *Pseudoeurycea* from Oaxaca, *smithi*, *unguidentis*, and *cochranae* (and perhaps *sulcata*; Brame tells me he no longer believes the last to be synonymous with *cochranae*), all have lower tooth counts than *juarezi* and differ in various other details that suggest lack of any close relationship.

Two species of *Pseudoeurycea* characterized by high tooth counts and broad feet live in Veracruz to the north. These forms, *nigromaculata* and *firscheini*, may be related to *juarezi*, as suggested by the details of their morphology as well as by their occurrence in cloud-forest habitat along the eastern versant of the transverse volcanic highlands (Goldman and Moore, 1945, regarded Cerro Zempoaltepec as the southeastern limit of the Transverse Volcanic Biotic Province). A brief discussion of points of general similarity is, then, in order. A paratype of *firscheini* (U.I.M.N.H. No. 21807) was available for direct comparison with *juarezi*. Direct comparison was made with *nigromaculata* from near Las Vigas, Veracruz (U.I.M.N.H. Nos. 21808, 21809, 21811-21814). The data in figure 1 are from Taylor (1941) for *nigromaculata* and from Shannon and Werler (1955) for the smallest individual of *firscheini* (the holotype). In both cases the lengths plotted can only be approximations. I have added 4

mm. to the lengths reported by the above authors, since Taylor's measurements terminate at the anterior end of the vent, and Shannon and Werler do not indicate the technique they followed. The validity of the name *firscheini* was not investigated in the course of the present study.

Pseudoeurycea juarezi of 38–50 mm. in snout-to-vent length have 74–100 maxillary-premaxillary teeth. *Pseudoeurycea nigromaculata* with body lengths of 51.2–56.5 mm. are reported to have 94–108 teeth (Taylor, 1941), while *P. firscheini* of from 47 (51 mm.?, see above) mm. to 60 mm. have 84–90 teeth. Thus, of the three, *juarezi* may have the most maxillary-premaxillary teeth in proportion to its size, followed closely by *nigromaculata* and *firscheini*.

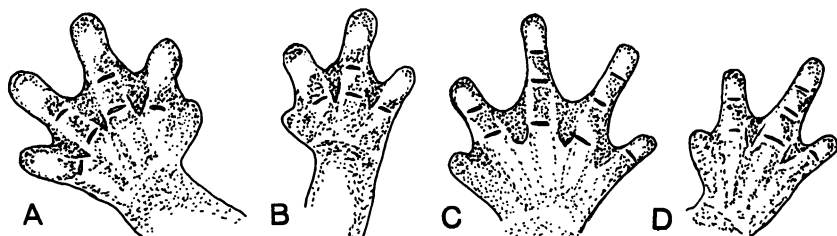


FIG. 2. Hands and feet of *Pseudoeurycea juarezi* (holotype, A.M.N.H. No. 74403) and *P. firscheini* (U.I.M.N.H. No. 21807, paratype) in dorsal aspect. The hands and feet of the specimens were projected, and tracings were made from the images. A. *P. juarezi*, left foot. B. *P. juarezi*, right hand. C. *P. firscheini*, right foot. D. *P. firscheini*, right hand.

Specimens of *juarezi* with from 84–100 maxillary teeth have no fewer than 12–13 vomerine teeth in the anterior series, and no more than 15–15 were found in any individual of *juarezi*. *Pseudoeurycea nigromaculata* and *firscheini* with from 84 to 100 maxillary-premaxillary teeth are reported to have from 16 to 21 vomerine teeth per side.

The three species have relatively long limbs which, however, fail to touch or overlap when adpressed in adult *nigromaculata* and *firscheini* (see also Shannon and Werler, 1955) but touch, or fall only slightly short of touching (two females), in *juarezi*, and overlap as much as two costal folds in some males. The feet of all are broad, but the feet of *juarezi* may be comparable in size to those of *firscheini* 5 mm. or more longer. The extent of webbing of the feet of *juarezi* is only slightly greater than in *firscheini*. The digits of *juarezi* are flattened and slightly expanded at the tips, more closely resembling those seen in several species of *Chiroptero-triton*. This fact is evident in well-preserved specimens. The basic pattern in *juarezi* consists of a cream-yellow venter (with a black mottling from

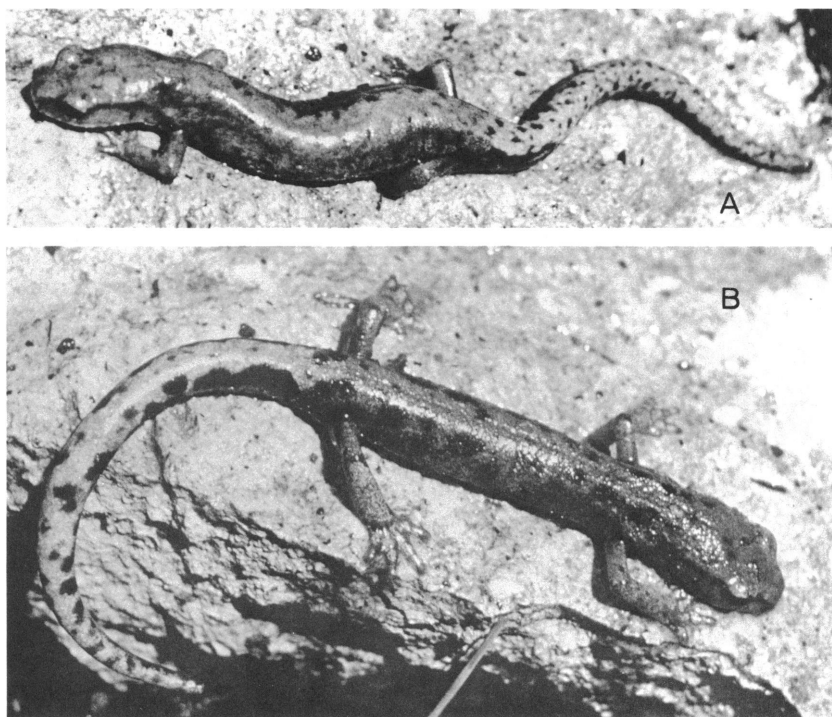


FIG. 3. Paratypes of *Pseudoeurycea juarezi* photographed in life by Charles M. Bogert. A. Female (A.M.N.H. No. 69449), 50 mm. in body length. B. Male (A.M.N.H. No. 69450), 46 mm. in body length.

the posterior gular area caudad in some specimens) with light brown to blue-black sides and a yellow to red or orange dorsal stripe. This stripe is most distinct caudad where black spots or markings usually persist. *Pseudoeurycea nigromaculata* approaches features of this pattern only in its tendency toward having a light venter and in having black dorsal spots. Shannon and Werler (1955) distinguish *firscheini* from *nigromaculata* by means of the former's uniformly darker ground color and reduction of black spotting. These characters also serve to distinguish it from *juarezi*.

In general, then, *Pseudoeurycea juarezi* has a more striking and colorful pattern than either *P. firscheini* or *P. nigromaculata* and shows greater development of the feet and legs. It is somewhat smaller, and has fewer vomerine teeth in proportion to the number of maxillary-premaxillary teeth. It is similar to *firscheini* and *nigromaculata* in general body form, as well as in having broad feet and generally more teeth.

It is possible that the two related forms in Veracruz represent separate northward penetrations across the Rio Papaloapan of an ancestor common to the three modern forms. If assumptions concerning relationship with *P. brunnata* or other Central American *Pseudoeurycea* should prove to be tenable, it would seem reasonable to assume that representatives of this group occupied Oaxaca at a relatively early stage in the differentiation of the three forms.

The available information suggests that terrestrial-arboreal *Chiropterotriton* have differentiated extensively north of Orizaba in Mexico (Rabb, 1958). The genus *Bolitoglossa* shows extensive differentiation in Central America, not only in the lowlands, but also in the cloud forest and at higher elevations (Schmidt, 1936). *Chiropterotriton* in northern Central America is represented by a few species that live in bromeliads. Thus, *juarezi* and related species are known from an area where *Chiropterotriton* is not common (none reported in the literature), and it has developed parallel modifications, suggesting that the lack of species of more characteristically arboreal genera may have permitted this radiation in *Pseudoeurycea*. Another arboreal form, *P. unguidentis*, has been reported from this same area.

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