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A NEW SALAMANDER OF THE GENUS *PSEUDOEURYCEA*
FROM TAMAULIPAS

BY CHARLES F. WALKER

AMONG the first reptiles and amphibians received by the University of Michigan Museum of Zoology from the mountains of southern Tamaulipas were three individuals of a strikingly patterned, black and white plethodontid salamander which seemed to represent an undescribed form. These were included in a small collection made by Paul S. Martin in the mountains north of Gómez Farías in the summer of 1948. Returning to this area in the following year, Mr. Martin, accompanied by C. Richard Robins and William B. Heed, collected a large number of salamanders including an excellent series of the new form. This material has subsequently been augmented by other collectors including myself. In allusion to its propensity for climbing, a trait which seems to be distinctive in a genus otherwise of terrestrial habits, this salamander may be called:

Pseudoeurycea scandens, new species

HOLOTYPE.—University of Michigan Museum of Zoology (UMMZ) 100639. An adult male, one of six collected March 17, 1949, by Paul S. Martin, C. Richard Robins, and William B. Heed from the walls of a cave at "Rancho del Cielo," on the forested slopes of the Sierra Madre Oriental in southern Tamaulipas, about five miles NW of Gómez Farías; elevation about 3500 feet.

PARATYPES.—UMMZ 98968–70, April 24–May 10, 1948, by P. S. Martin; 100638, 100640–59, 105301–2, March 11–July 1, 1949, by P. S. Martin, Richard Robins, William Heed, and Frank Harrison—50 specimens, all from "Rancho del Cielo" except 100647 and 100650 from "mountain west of Rancho del Cielo, elevation about 4000 feet."

RANGE.—Southwestern Tamaulipas, in humid montane forest.

In the region of the type locality the known altitudinal range extends from about 3500 to 6000 feet throughout the zone of cloud forest and into the more mesic part of the oak-pine above, the highest known station being at Agua Linda. In 1953 Paul S. Martin and Byron E. Harrell collected two quite typical specimens (UMMZ 111290-91) from a small cave at 6200 feet near El Chihue, in the mountains about 20 miles northwest of Ciudad Victoria, and 65 airline miles to the north of the type locality.

DIAGNOSIS.—A moderate-sized *Pseudoeurycea*; adult males 49–71 mm. in snout-vent length; a lateral or dorsolateral pattern of irregular grayish white blotches on a black ground color; belly black, usually immaculate; toes of appressed limbs usually touching or overlapping, never separated by more than one intercostal fold; toes webbed at base, the web involving the greater part of the proximal phalanges of the middle digits; toes beyond web flattened, their sides approximately parallel, tips truncate; vomerine tooth rows long, not fewer than 16, and usually 18 or more teeth in row (75 per cent); distinguished from *P. cephalica* and its races by the presence of large white blotches on sides and tail, usually uniform dark belly, larger size, and more numerous vomerine teeth; from *P. galeanae* in having longer legs, more truncate, parallel-sided toes, and more extensive light markings on body.

DESCRIPTION OF HOLOTYPE.—Adult male, with swollen snout, a prominent mental gland, and papillate vent. A dorsal furrow, 13 costal grooves including indistinct axillary and inguinal grooves; tail slightly compressed laterally, a weakly marked constriction at base; tail length slightly less than head and body length from snout to posterior angle of vent. Head length contained 3.9 times in head and body length; head width contained 6.1 times in head and body length. Snout truncate as seen from above, projecting strongly beyond lower jaw; head between orbits flat and moderately broad; interorbital width distinctly greater than width of eyelid and very slightly less than internarial distance; a weakly marked canthus rostralis, below this a slight concavity anterior to eye. A groove extending back from posterior angle of upper eyelid, intersecting a vertical groove at angle of jaws, ending at the vertical extension of the gular fold, the latter continuous dorsally with a weakly marked groove which extends to mid-line.

Floor of mouth below anterior part of tongue with a free-edged, crescent-shaped dermal fold. Vomerine teeth 20–21, in long rows, each extending from a point considerably lateral to the choana almost to mid-line, the distance between the two rows rather less than the diameter of a choana. Parasphenoid tooth patches separated from the

vomerine rows by a distance about twice the diameter of a choana, the two patches closely approximated at their anterior ends, diverging posteriorly. Premaxillary-maxillary teeth about 55 on a side; three premaxillary teeth, elongate, widely spaced, piercing lip. Teeth on jaws and palate narrowly tipped with brown.

Limbs well developed, toes overlapping a little less than the distance of an intercostal space when limbs are appressed. Fingers in order of decreasing length—3, 2, 4, 1; toes—3, 4, 2, 5, 1. Fingers and toes webbed at base, the web including most of the length of the proximal phalanges of the middle digits; finger 1 and toe 1 webbed almost to tips; fingers and toes truncate, much flattened, the web-free parts not tapering toward tips, but with approximately parallel sides; tips ventrally with well-developed, raised pads.

Color dull blackish slate above and below; belly and an irregular narrow area along middorsal line of trunk unmarked; a lateral pattern of blotches, dull grayish on head, brighter toward tail; on sides between limbs blotches more or less coalesced, forming an almost continuous light band at level of limb insertion, sharply defined from blackish belly, narrowly interrupted by dark lines in costal grooves; dorsolaterally and merging basally with lateral band are large, irregular light blotches, two on left side, three on right, each covering an area of one or two intercostal spaces basally, narrowing at upper ends, none reaching dorsal furrow. Light lateral band continues onto tail, becoming broken into small irregular flecks toward tip; upper sides of tail with dull white blotches, somewhat brighter and more sharply defined than those of sides, irregular in outline and in arrangement, some reaching or crossing middorsal line. Soles of feet, area of mental gland, and tail tip whitish, contrasting with rest of ventral surface; some light mottling along upper and lower jaws.

The measurements (in mm.) are: Snout to anterior angle of vent 63.5; posterior angle of vent 67.5; head length 17.5; head width 11; tail, from posterior angle of vent 64.5; eye to snout 4.7; width of eyelid 2.5; interorbital distance 3.4; internarial distance 3.8.

VARIATION.—An adult female, UMMZ 105301, differs from the holotype male in the usual characters associated with sex. The lining of the vent is folded; snout bluntly rounded as viewed from above, projecting slightly beyond lower jaw, not swollen as in male; nasolabial grooves terminating in small, rounded whitish projections at lip; head relatively wider than in male, its width contained 5.2 times in snout-vent length; tail shorter than in male, equal to about 88 per cent of snout-vent length. Premaxillary-maxillary teeth about 62 on each side, those of the pre-

maxillary closely set, regularly spaced and not enlarged; vomerine teeth in rows of 21 and 22. Toes of appressed limbs barely meet. Light pigment on lower sides forming a zone of coarse mottling, above which are three larger, separate, dorsolateral blotches and two smaller, light spots near mid-line of dorsum. Throat mottled with light.

Measurements (in mm.) of this female are: Snout to anterior angle of vent 61.5; to posterior angle of vent 64.5; head length 16.5; head width 12.4; tail 56.5; eye to snout 4.3; width of eyelid 3; interorbital distance 3.7; internarial distance 3.4.

The smallest of the paratypes, UMMZ 105302, with a snout-vent length of 29 mm., agrees with adults in color and essential details of pattern. Nostrils normal in size; vomerine teeth in irregular patches, not forming definite rows; toes of appressed limbs separated by one intercostal space; toes relatively shorter than in adults, their margins tapering to bluntly rounded tips.

There is considerable variation in the size and extent of the white markings. On the lower sides there is frequently an almost continuous zone of white as in the type (Pl. I). In others there may be only a few scattered white flecks in this position. On the trunk between the verticals of the limb insertions there are typically from two to four large white blotches in a dorsolateral position (90 per cent of individuals); these blotches are conspicuously asymmetrical in arrangement, as are also those on the tail. The minimum development of light pigment found in 51 specimens is seen in UMMZ 100641 (Pl. I). In life these markings are silvery white on a black ground color; those on the nape and anterior part of the trunk are often perceptibly less brilliant (grayer) than the more posterior ones. In preservative these light markings fade rapidly to a dull gray, those on the tail remaining brighter than those on the head and trunk.

In 36 of 37 males the toes of the appressed limbs touch or overlap; in the remaining one they are separated by a distance of less than one costal interspace. Of 12 females the toes touch or overlap in 10, and are separated by the length of one costal interspace in the other two. In two small individuals, sex not determined, the toes touch in one and are separated by one costal interspace in the other.

Approximately half of the paratypes have from one to five pre-vomerine teeth anterior to, and out of line with, those forming the definitive row. Omitting these irregularly placed teeth, the number of teeth in a row varies from 16 to 26. The mean for 30 adult males is $20.6 \pm .29$, $\sigma = 2.3$; for 12 adult females, $20.2 \pm .69$,

$\sigma = 2.4$. The number of teeth on the maxillae and premaxilla, evidently influenced by size and perhaps also by sex, is highly variable, ranging from 73 to 124.

Among 75 additional specimens collected since this description was written, there are two which exhibit a variation not apparent in the type series. In these two the venter is rather conspicuously flecked with white, whereas in the remaining 73, as in the types, the entire venter from the gular fold to the vent is immaculate black.

SKELETAL ANATOMY.—In cleared, alizarin-stained preparations, the skeleton agrees in most details with published accounts of the genus *Pseudoeurycea* (Taylor, 1944; Baird, 1951). There are no septomaxillae; the nasal spines of the premaxilla arise separately and are distinct throughout their length, enclosing a narrow fontanelle. Prefrontals of moderate size are present, notched anteriorly around the foramen of the nasolacrimal duct, with an outer lobe which ends under the upper part of the maxilla, and a medial lobe which lies under the margin of the nasal. The prevomers are separate throughout their length, as are also the tooth patches on the parasphenoid. The columella has a vestigial stylus; the dorsal surface of the otic-occipital is not conspicuously ridged. Including the atlas there are 15 presacral vertebrae; the neural crests are feebly developed; the last of the series lacks ribs. The first postsacral vertebra has no haemal arch; the first two postsacrals have the transverse processes somewhat widened, their axes forming right angles with the centra, but are not otherwise specialized; transverse processes of the caudal vertebrae posterior to these are slender and directed somewhat forward. All of the carpals and tarsals are cartilaginous; the phalanges are constricted medially and flattened; the terminal phalanges, especially those of the longer, central digits have the greatest width of the expanded tips equal or very nearly equal to their respective lengths.

RELATIONSHIPS.—The foot structure of *scandens*, with broad, truncate toes, is unusual in *Pseudoeurycea* and resembles that of *Magnadigita*. The presence of a well-marked sublingual fold, however, readily distinguishes *scandens* from any species of the latter group. Several features, moreover, including size, length of prevomerine tooth rows, ground color, and type of pattern, relate *scandens* quite decisively to *Pseudoeurycea galeanae*, which has a foot structure more usual in *Pseudoeurycea* and especially similar to that of *cephalica* and its subspecies. The relationship of both *scandens* and *galeanae* to *cephalica* is indicated by other characters not found elsewhere in *Pseudoeurycea*, perhaps the most striking of these being the considerable amount of toe

webbing and the presence, in both sexes, of knoblike protuberances at the lower ends of the nasolabial grooves.

Although the meager distributional data now available in the literature might suggest that all of these forms are allopatric and conspecific, collections made at Rancho del Cielo in 1950 by William B. Heed and myself show that the actual situation is more complex. Here, in the same forest with *scandens* we took 17 specimens (UMMZ 102994–103000) of another *Pseudoeurycea*, conspicuously smaller and differently colored, which has tentatively been identified as *P. cephalica rubrimembris*, previously known only from Hidalgo. The Tamaulipas specimens are highly variable in color and pattern, but characteristically have a paler ground color than *scandens*, brownish or purplish brown rather than black; there are reddish areas on the limbs and tails of most individuals and also on the bodies of a few; from one to three white blotches are present on the tail, and occasionally one or two similar blotches on the body; the venter is white flecked; in size, proportions, and in all structural details these specimens closely resemble *rubrimembris*. No such ventral flecking is apparent in two paratopotypes of *rubrimembris* (USNM 110659–60), and none is mentioned in the original description (Taylor and Smith, 1945), which is quite sketchy as regards details of pigmentation and was evidently based on preserved material. Since white flecking of this type (guanophore?) frequently disappears in preservative, the significance of this difference between the Tamaulipas and Hidalgo material remains questionable. Although it is possible that the Tamaulipas population will prove to be subspecifically distinct, its agreement with *rubrimembris* is so close as to admit of no reasonable doubt that the two are conspecific. On the basis of their sympatric occurrence at Rancho del Cielo it is clear that *rubrimembris* and *scandens* represent distinct species.

Present evidence as to the relationship of *scandens* to *galeanae* is scanty and inconclusive. They have much in common, as pointed out above, and conceivably may prove to intergrade. *P. galeanae* has been recorded only from the type locality, which lies about 60 airline miles north-northwest of El Chihue, the nearer of the two known *scandens* localities. Material recently acquired by the Museum of Zoology, however, shows that the range of *galeanae* extends also far to the south, beyond that of *scandens*. A series of four salamanders (UMMZ 106456–59) collected by James E. Mosimann and George B. Rabb from beneath rocks in an area of scrubby oaks and pines at Minas Viejas, near the town of Durango, Hidalgo, agrees closely with paratypes of *galeanae* in size, structure, proportions, color, and most features of pattern.

However, distinct white flecking is present on the venters of the Hidalgo series, a feature not mentioned in the original description (Taylor, 1941) and not now apparent in the *galeanae* paratypes, although possibly present in living or freshly preserved material.

The differences between *scandens* and *galeanae* seem quite constant and are, moreover, of a sort suggestive of different habits. *P. galeanae*, with its relatively short legs and small head, has the appearance of a burrowing salamander; *scandens*, on the other hand, is known to be a proficient climber. Such a divergence in habits is not common among salamander subspecies. The four locality records now available for the two forms, although too few to provide convincing evidence, fail to fit any very credible subspecific pattern. On these admittedly slender grounds it seems preferable to regard these two salamanders as distinct species.

HABITS.—Although individuals of *P. scandens* were occasionally found under rocks and logs in the humid forests near Rancho del Cielo, the majority were taken in caves, where the salamanders were commonly found in crevices and crannies well above the cave floor, sometimes far above reach of the collector. As additional evidence of scansorial habits it is noteworthy that two adult females were found in cavities of standing trees, and five other specimens including adult females and immature young of both sexes were taken from arboreal bromeliads. The predilection for caves is apparently not a matter of season, since it has been observed throughout several periods of field work including not only the drier season from February through early June, but also the rainy period in August and September. Among the specimens taken from caves, however, it is perhaps significant that males far outnumber females and, furthermore, that few juveniles are represented. It seems quite possible that the eggs are deposited elsewhere.

Among the adult males those taken between the latter part of March and early June seem to be in breeding condition; the mental glands are more conspicuous, and the snout region and cloaca more swollen than in individuals of comparable size collected in August and September. A female taken on May 10 contained large ovarian eggs, the maximum size being about 3.5 mm. The smallest of the paratypes, with a snout-vent length of 29 mm., was collected March 28, from beneath leaf litter in the floor of a sinkhole.

In addition to *scandens* and *rubrimembris* a third member of the genus, *P. belli*, also occurs in the forests near Rancho del Cielo, far northeast of any previously recorded station for this wide-ranging

species. In contrast to *scandens*, both *rubrimembris* and *belli* seem to be entirely terrestrial in habit. Of these three salamanders, *scandens* has proved much the most numerous.

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PLATE I

Variation in pattern of *Pseudoeurycea scandens*.

PLATE I



