Copeia, 2005(3), pp. 461–469

Two New Species of *Pseudoeurycea* (Caudata: Plethodontidae) from the Mountains of Northern Oaxaca, Mexico

GABRIELA PARRA-OLEA, MARIO GARCÍA-PARÍS, JAMES HANKEN, AND DAVID B. WAKE

We describe two new species of salamanders of the genus *Pseudoeurycea* from mountains in the northern part of the state of Oaxaca, Mexico. *Pseudoeurycea papenfussi*, a large, muscular member of the *P. gadovii* group, occurs near the peaks (just below 3000 m) of the highest mountains of the Sierra de Juárez. It is related to *P. smithi*, a more southerly species, and possibly to *P. aquatica*, another species from Oaxaca. *Pseudoeurycea obesa*, a rotund member of the *P. leprosa* group, is known only from the type locality in the Sierra Mazateca at the northernmost extremity of Oaxaca. It is related to *P. werleri* and *P. mystax*, which are known from more southern parts of Oaxaca. These descriptions bring to 27 the number of species of salamanders known from Oaxaca. Most of these species are endemic to the state and are known only from regions that are undergoing rapid habitat modification and destruction.

Describimos dos especies nuevas de salamandras del género *Pseudoeurycea* de las montañas del norte del Estado de Oaxaca, Mexico. *Pseudoeurycea papenfussi* es una especie de gran tamaño, de aspecto musculoso, incluida en el grupo de *P. gadovii*, que se encuentra cerca de las cumbres (justo por debajo de los 3000 m) de las montañas más altas de la Sierra de Juárez. Está relacionada con *P. smithi*, que se encuentra en regiones más meridionales, y posiblemente con *P. aquatica*, también de Oaxaca. *Pseudoeurycea obesa*, es una especie rechoncha del grupo de *P. leprosa*, que únicamente se conoce la localidad típica en la Sierra Mazateca del extremo noroccidental de Oaxaca.

THE mountains of northern Oaxaca, including the Sierra de Juárez, Sierra Aloapaneca, and Sierra Mazateca, contain one of the largest assemblages of plethodontid salamanders in Mexico (Casas-Andreu et al., 1996). This fauna includes six genera: *Bolitoglossa*, *Chiropterotriton*, *Cryptotriton*, *Lineatriton*, *Pseudoeurycea*, and *Thorius*. Species diversity is especially high for *Pseudoeurycea*, which is represented by members of all four recognized species groups (e.g., Parra-Olea, 2002; Canseco-Márquez and Parra-Olea, 2003; Parra-Olea et al., 2004). Indeed, one of these, the *P. juarezi* species group, is endemic to the region. The large number of groups and endemic species in northern Oaxaca indicates that this region has been an important center for the diversification of plethodontid salamanders. In this paper we enhance the known diversity of this region by the description of two new species of *Pseudoeurycea*, one from the Sierra de Juárez, the other from the Sierra Mazateca, and each representing a different species group (Fig. 1). We also briefly discuss the conservation status of salamanders along these two cordilleras.

The *P. gadovii* species group is represented in northern Oaxaca by *P. cochranae* and *P. smithi*, and by the recently described *P. aquatica* (Wake and Campbell, 2001). The first new taxon described here is another morphologically distinct species of this group. Although herpetologists have been aware of its existence for many years (see below), the species was never formally described because some of its most conspicuous morphological characters are also present, albeit to a lesser extent, in two nearly sympatric species, *P. smithi* and *P. unguidentis*. Indeed, morphological analysis alone could not exclude the possibility that these extreme features simply represented aberrant specimens of named taxa. Our recent field surveys yielded fresh samples from both the Sierra Aloapaneca and Sierra de Juárez, including the type locality of *P. smithi*, which were included in a molecular phylogenetic analysis of the genus *Pseudoeurycea* based on DNA sequences of several mitochondrial genes (Parra-Olea, 2002). These data confirmed the distinctiveness of the long-suspected new taxon from the Sierra de Juárez and its differentiation from all other named forms.

The *P. leprosa* group is morphologically diverse. It is represented in northern Oaxaca by *P. mystax* and *P. werleri* (Wake et al., 1992), and by the extremely derived form *Lineatriton orchileucus* (Brodie et al., 2002), which is nested within *Pseudoeurycea* (Parra-Olea and Wake, 2001;

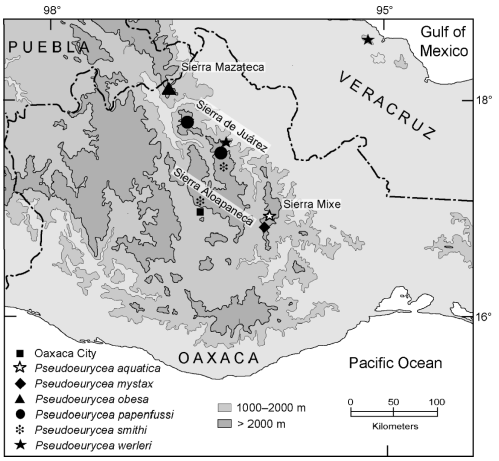

Fig. 1. Map depicting localities of two new species of *Pseudoeurycea* from northern Oaxaca, Mexico, plus localities of related species in Oaxaca and adjacent Veracruz. Several species are known only from their respective type localities (discussed in text). Cerro San Felipe, the type locality of *P. smithi*, is located immediately north of Oaxaca City. Light shading denotes low-elevation areas (< 1000 m).

Parra-Olea, 2002). During field surveys in the Sierra Mazateca in 2002, we discovered yet another morphologically distinct species, which possesses marked diagnostic characters that are unique among *Pseudoeurycea*. These include its overall robust appearance, which superficially resembles that of certain species of the North American ambystomatid genus *Ambystoma*.

Materials and Methods

Species descriptions follow the standard format for *Pseudoeurycea* and include the same basic characters and measurements (Lynch and Wake, 1989). Larger measurements were taken by using a dial caliper (to the nearest 0.1 mm); smaller measurements (e.g., feet, toes, several head dimensions) and all tooth counts (ankylosed teeth only) were made with the aid of a dissecting microscope. Standard length (SL) equals the distance from the tip of the snout to the posterior end of the vent. Numbers of maxillary and vomerine teeth in each holotype are provided separately for right and left sides; these counts are summed for other individuals. Gender was assessed externally by morphology of the cloacal glands: papillate (males) vs. lamellate (females). Sexually mature males were readily recognized externally by the presence of a discrete mental gland. Adult females always lack a mental gland. Institutional abbreviations are as listed in Leviton et al. (1985).

Pseudoeurycea papenfussi, new species

Muscular Salamander
Salamandra Escaladora
Figure 2A, B

Holotype.—IBH 14198, an adult female, Mexico, Oaxaca, 52.3 km N of Guelatao along Mex. Hwy. 175, from the north slope of Cerro Pelón, (17°34.75′N, 96°30.59′W), 2800 m elevation, G. Parra-Olea, M. García-París, and D. B. Wake, 9 October 1997.

Paratypes.—All from Oaxaca, Mexico: MVZ 112198, 52 km NE of Guelatao along Mex. Hwy. 175, T. J. Papenfuss, 5 August 1974; MVZ 132865–67, 132871 and 132873, 48 km NE of Guelatao along Mex. Hwy. 175, 9100 ft elevation (= 2774 m), T. J. Papenfuss, 12 August 1975; MVZ 143809 and 143812–13, 52–54 km N (by road) of Guelatao along Mex. Hwy. 175, N slope of Cerro Pelón, 2675 m elevation, J. F. Lynch, November 1974; MVZ 146787, Mex. Hwy. 175, 100 yd S of summit of Cerro Pelón, J. E. Cadle, July 1977; MVZ 146793–94, San Pedro Yolox Rd., 1.2 mi S and 0.5–1.5 mi W of summit of Cerro Pelón, J. E. Cadle, 15 July 1977; MVZ 147297, Cerro Pelón, 52 km NE of Guelatao along Mex. Hwy. 175, T. J. Papenfuss, 22 August 1974; MVZ 167181, at and above Mex. Hwy 175, 51 km (by rd) N of Guelatao, 9250 ft elevation (= 2819 m), J. F. Lynch, T. J. Papenfuss, and D. B. Wake, 1 December 1974; UIMNH 64073, 7.9–17.5 mi S of Vista Hermosa, M. J. Landy and E. Liner, 16 July 1975; UTA A–3580, 69 mi N of Oaxaca (17.58°N, 96.50°W), J. A. Campbell, 18 August 1971; KU 136516, 28.6 km S of Vista Hermosa, 2350 m elevation, J. A. Caldwell, 11 June 1970; IBH 14199 and 14201, 0.5 km N of El Mirador, Cerro Pelón, 2900 m elevation; IBH 14200, 1.6 km S of El Mirador, Cerro Pelón (17°34.75′N, 96°30.59′W), 2870 m elevation, G. Parra-Olea, M. García-París, R. Bello, and T. J. Papenfuss, 7 August 1999. IBH 14199–200 provided tissue for mtDNA analyses.

Diagnosis.—This is a plethodontid salamander of the genus *Pseudoeurycea* that is closely related to *P. smithi*. It is a relatively large, robust species with long limbs, large hands and feet, and long digits. Mean SL is 77 mm in eleven males (range 70–84.8) and 80.4 in ten females (72–89.4). The species differs from all other bolitoglossine salamanders in its heavily muscularized form, which features greatly enlarged jaw muscles and well-developed, sharply defined superficial musculature. It differs further from two apparently close relatives. It has relatively longer limbs and more teeth than *P. smithi*: combined fore- and

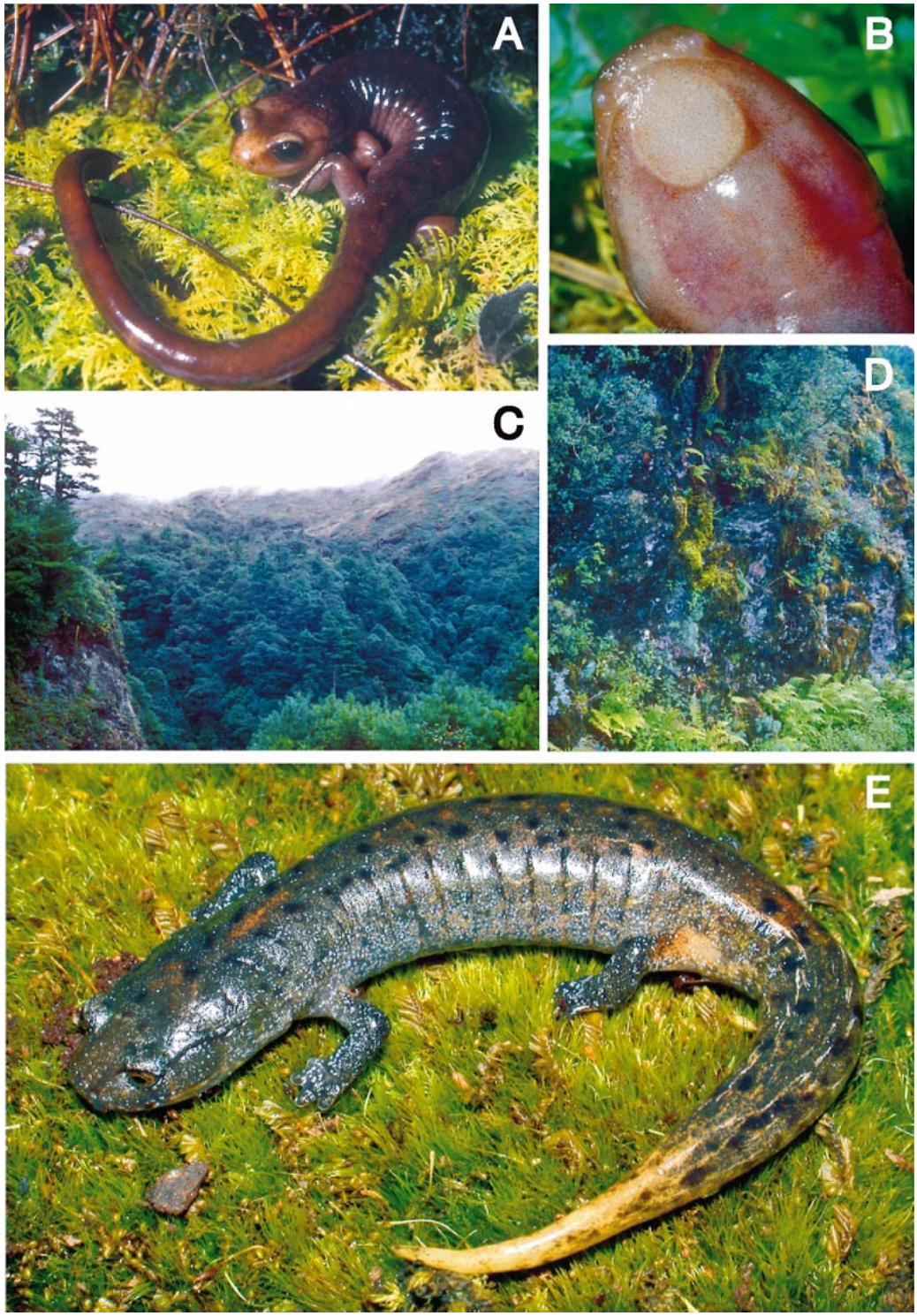

Fig. 2. (A) Holotype of *Pseudoeurycea papenfussi* in life: IBH 14198, an adult female from the north slope of Cerro Pelón, Sierra de Juárez, Oaxaca, Mexico. (B) Chin and throat of a live male *Pseudoeurycea papenfussi* (IBH 14199), showing the prominent mental gland. (C) Forest near the peak of Cerro Pelón, showing typical habitat of *Pseudoeurycea papenfussi.* (D) Road bank along Mexican Hwy. 175 at Cerro Pelón. Virtually all specimens of *Pseudoeurycea papenfussi* known from this region have been collected at night from rock surfaces such as this one. (E) Holotype of *Pseudoeurycea obesa* in life; IBH 14195, an adult male from Plan de Guadalupe, Sierra Mazateca, Oaxaca, Mexico.

hind limb length averages 49% SL in males and 48% SL in females, versus 41% and 43%, respectively, in *P. smithi*; mean numbers of maxillary teeth 47 in males (range 40–53) and 43 in females (35–55), versus 38 and 33 teeth, respectively, in *P. smithi*; vomerine teeth average 23 in both sexes (range 19–31 males, 18–27 females), versus 19 and 17 in male and female *P. smithi*, respectively. In comparison to *P. aquatica*, the new species has shorter limbs and digits, a less depressed head with an open (vs. closed) nostril, and more maxillary teeth. Finally, *Pseudoeurycea papenfussi* is distinct from these and other species in the *P. gadovii* species group (Parra-Olea, 2002) in several molecular features, including proteins (allozymes) and mtDNA sequences.

Description.—This is a robust, strongly built, and extremely muscular species that reaches moderately large size (Fig. 2A); maximum recorded SL is 84.8 mm in males and 89.4 mm in females. The prominent head is large, with a well-developed snout and bulging jaw muscles. In the most extreme individuals all superficial muscles appear to bulge out from the body. Along the trunk, segmental muscles are prominent between the intermyotomal septa, which form the costal grooves. On the head, massive muscles stand out between the grooves that mark intermyotomal septa and regions of muscle insertion. The jaw line is sinuous, ascending posteriorly, thus resembling a smile. Eyes are well developed and protrude beyond the outline of the head in dorsal view, but they are barely, if at all, visible when viewed ventrally. Nostrils are small but open. The head is broad and moderately long: head width averages 16.0% of SL in males (range 14.8–17.5) and 15.1% SL in females (13.5–18.1); mean head length equals 23.7% and 22.6% of SL in males and females, respectively. Maxillary teeth are relatively large but vomerine teeth are small; tooth numbers are moderate. Mental glands, present only in males, are prominent and nearly round (Fig. 2B); the smallest specimen with a mental gland is 57 mm SL. Parotoid glands are not evident.

The tail is stout with a well-marked constriction at the base and is relatively blunt-tipped in many individuals. It is longer in males than in females; mean tail length equals 100.5% versus 92.1% of SL, respectively. Limbs are long and robust; combined fore- and hind limb length averages 49% of SL in both males (range 44–54) and females (44–53). Adpressed limbs approach closely, meet, or even overlap in males (mean limb interval [M] equals 0.4), but they are somewhat shorter in females (M = 0.65). Hands and feet are relatively broad; digits are long and relatively slender. The longest digit (third) is 0.07–0.08 times SL; the fifth toe is much shorter, but still prominent. Subterminal pads are small but well developed. Webbing ranges from slight to absent and is limited to the metatarsal region.

Coloration in life.—The general coloration is chestnut-brown (Fig. 2A). It is lighter towards the head, which has pale areas that include the snout, eyelids, jaw margins, and the parotoid-temporal region. Coloration is darker towards the tail, where the reddish hue is brighter. Costal grooves are a dark brown-gray color, which extends onto the venter. Otherwise, the venter is pale tan with a soft chestnut hue. Some specimens show a marbled dorsal pattern that is similar to the coloration of *P. aquatica*.

Coloration in alcohol.—The holotype is a rich golden brown. The dorsum of the trunk has the darkest pigmentation, especially in the costal grooves and in grooves between other bulging muscles. Dark pigment in the costal grooves continues to the ventral midline and stands out prominently. The venter is much paler than the dorsum and is marked with abundant small brown spots or smaller flecks. The head is relatively unpigmented, and the snout, upper and lower jaw margins, facial area, eyelids, and temporal areas are all pale cream in coloration. Limbs also are relatively light, especially the hands and feet, but muscle edges are defined by darker pigmentation.

Coloration of the holotype is typical for the species, including even small juveniles. Some conspecific individuals, however, differ so dramatically in coloration that we suspected they might be *P. smithi* or an unknown species before their identity was confirmed with mtDNA sequence data. A large male paratype (IBH 14199) is less muscular in appearance and has a darker, blackish brown ground color that is mottled with lighter and darker markings in no particular pattern. The mental gland and area immediately behind the eyes are unpigmented, and the gular region is pale. Behind the gular fold, however, the animal is dark gray, becoming lighter on the tail, which is covered with light colored spots. A large female paratype (IBH 14200) also is very dark, but it is mottled with lighter brown dorsally. Its head is fully pigmented. Ventrally, it resembles the male paratype described above, except that it has more pigment in the gular region.

Measurements of the holotype (in mm).—Head width 12.3; head depth 7.5; eyelid length 5.0; eyelid width 3.0; anterior rim of orbit to snout 3.4; inter-orbital distance 3.0; distance between corners of eyes 6.2; snout to forelimb 24.9; nostril diameter 0.4; distance between external nares 3.6; projection of snout beyond mandible 1.7; snout to gular fold 19.3; width across shoulders 10.2; snout to anterior angle of vent 75.8; snout to posterior angle of vent (standard length, SL) 85.3; axilla to groin 44.1; tail length 77.2; tail depth at base 6.4; tail width at base 6.1; forelimb length 19.4; hand width 7.2; hind limb length 20.9; foot width 9.4; length of longest (third) toe 5.0; length of fifth toe 2.7. Numbers of teeth: premaxillary 6, maxillary 23–24, vomerine 11–12.

Distribution.—Pseudoeurycea papenfussi is known from among the highest elevations of the Sierra de Juárez, from the vicinity of Cerro Pelón and Cerro Humo to Cerro Peña Verde and the Pápalo region in the State of Oaxaca, Mexico (Fig. 1). All recorded specimens have been found within a narrow elevational range between 2800 and 2900 m (possibly as low as 2650 m; see Remarks, below). The maximum geographic distance between confirmed populations is 45–50 km.

Natural history.—This species occurs within pine forest and on the barren rocky slopes at or above the upper limit of cloud forest (Fig. 2C). Individuals move slowly, often actively climbing on vertical rock surfaces on humid, misty, or rainy nights, regardless of cold or wind (Fig. 2D). Sympatric species of salamanders in different parts of the geographic range include *Pseudoeurycea juarezi*, *P. aurantia*, *Thorius boreas*, *T. aureus*, *T. macdougalli*, and *T. papaloae*. *Pseudoeurycea saltator* and another taxon currently referred to *P. unguidentis* are found in close proximity.

Phylogenetic relationships.—Phylogenetic relationships between *Pseudoeurycea papenfussi* and congeneric species have been inferred using DNA sequence data from three mitochondrial genes, 16S ribosomal mtDNA, cytochrome b (CYTB), and NADH dehydrogenase subunit 4 (ND4; Parra-Olea and Wake, 2001; Parra-Olea, 2002; *P. papenfussi* identified as ''*P.* sp. nov. 3'' or ''*P.* sp. 3''). In addition to previously published data, we sequenced more individuals for 16S (three samples, AY762350–52) and CYTB (two samples, AY762355–56) to assess variation within the new species. Sequences for CYTB are invariant, whereas sequences for 16S show one change in one base pair in one individual. *Pseudoeurycea papenfussi* consistently is the sister taxon of *P. smithi*; sequence divergence between these species equals 3.3% for 16S, 6.9% for CYTB, and 5.0% for ND4 (values are corrected using Kimura 2-parameter model; k2-p). This species pair clusters subsequently with remaining members of the *P. gadovii* group. The above sample of *P. smithi* is from Llano de las Flores, Oaxaca, which is about 25 km by road north of the type locality of *P. papenfussi*, also in the Sierra de Juárez (Fig. 1). Sequence divergence (k2-p) between this sample and a second population of *P. smithi* from Cerro San Felipe, north of Oaxaca City in the Sierra Aloapaneca, approximately 50 km to the southwest (Fig. 1), is 0.2% for 16S and 5.5% for CYTB (Parra-Olea and Wake, 2001; Parra-Olea, 2002).

Remarks.—The robust body shape, large size and disproportionately large jaw muscles of *P. papenfussi* are similar to but even more pronounced than those of *P. smithi* and *P. aquatica*. However, all three species are morphologically variable, with some specimens more exaggerated than others. The three taxa also share a similar, variable coloration: reddish gray-brown more or less mottled, with darker costal grooves. The geographic ranges of these three species are complementary; they have not been found in sympatry (Fig. 1). *Pseudoeurycea smithi* occurs along the Sierra Aloapaneca, which includes its type locality near Cerro San Felipe, and in southern portions of the Sierra de Juárez, in the vicinity of Llano de las Flores. The range of *P. papenfussi* apparently extends over most of the Sierra de Juárez, although most known specimens–including the entire type series–are from the vicinity of Cerro Humo and Cerro Pelón. Additional salamanders from the Pápalo and Peña Verde areas to the north and west (Hanken and Wake, 2001; Canseco-Marquez and Parra-Olea, 2003) morphologically resemble *P. papenfussi* and are herein assigned to that species, although this identification remains to be confirmed by genetic analysis. *Pseudoeurycea aquatica* is known only from the type locality, south of Totontepec (Wake and Campbell, 2001; Fig. 1). Salamanders that resemble *P. papenfussi* and *P. smithi* occur near this locality, as well as in the mountains south of Oaxaca City (Bogert, 1967). Preliminary mtDNA sequence data from the former populations suggest that these specimens may represent yet another undescribed species (Parra-Olea, unpubl. data), but too few specimens are available to prepare a proper diagnosis at this time. The recently described *P. aurantia*, from the Peña Verde area, is a close relative of *P. juarezi*, which is sympatric

with *P. papenfussi* on Cerro Pelón (Canseco-Marquez and Parra-Olea, 2003).

Initial results of an electrophoretic analysis of proteins provide information regarding the degree of genetic differentiation among these species (S. Yang and D. Wake, unpubl. data). This study, which examined 18 allozyme loci (Lynch et al., 1977; Lynch and Wake, 1989), compared topotypic samples of *P. papenfussi* (n = 9), *P. unguidentis* (n = 21), and *P. smithi* (n = 26), as well as two unidentified samples from near Machín, a site 6 km southwest of Cerro Pelón/Cerro Humo, ca. 2650 m elevation, in the Sierra de Juárez (n = 2 and n = 6). Samples of *P. papenfussi* and *P. smithi* differ substantially: there are fixed differences at six loci and major differences at two others; Rogers' coefficient of genetic distance (D_R) equals 0.46. There are seven fixed and two major differences between *P. papenfussi* and *P. unguidentis* (D_R = 0.42). The two unidentified samples from near Machín appear to be conspecific; there are no fixed differences between them. These samples, though somewhat similar morphologically to *P. unguidentis*, are unlikely to be that species (6–8 fixed differences, D_R = 0.45–0.47). Instead, they differ from *P. papenfussi* by one fixed and three-to-four major differences (D_R = 0.25–0.3) and from *P. smithi* by two fixed and five major differences (D_R = 0.30–0.32), and thus appear to be somewhat intermediate between these two named species. We tentatively assign these samples to *P. papenfussi*, pending additional study to determine if they represent yet another species. A sample referred to *P. unguidentis* and sequenced by Parra-Olea (2002) also is from near Machín. However, it proved impossible to obtain mtDNA sequences from the long-frozen and ground tissue samples of the problematic form that were used in the above allozyme analysis, and no protein data are available for Parra-Olea's specimen. Nevertheless, we believe that two species of this complex are present in the Machín area.

Specimens of *P. papenfussi* have been included in *P. smithi* by some previous authors (e.g., Bogert, 1967; Hanken and Wake, 2001). Other accounts have regarded them as a likely undescribed species that resembles *P. smithi* and *P. aquatica* (Hanken and Wake, 1994; Wake and Campbell, 2001). *Pseudoeurycea papenfussi* corresponds to *Pseudoeurycea* n. sp. 2 (Wake, 1987; Wake et al., 1992) and *Pseudoeurycea* n. sp. 3 (Parra-Olea and Wake, 2001; Parra-Olea, 2002; Canseco and Parra-Olea, 2003) of earlier authors.

Etymology.—This species honors Theodore J. Papenfuss, our friend and colleague, who first drew this species to our attention. Ted's collecting skills and expertise, as well as his generosity and unselfish assistance, have enriched our knowledge of the world's herpetofauna and enabled many research projects.

***Pseudoeurycea obesa*, new species**
Ridge Tail Salamander
Salamandra de Cola Estriada
Figure 2E

Holotype.—IBH 14195, an adult male collected at Plan de Guadalupe, Oaxaca, Mexico (18°08.386′N, 96°57.397′W), 2150 m elevation, J. Hanken, G. Parra-Olea, M. García-París, and D. B. Wake, 26 March 2003.

Paratypes.—All from Oaxaca, Mexico: MVZ 241574, same data as the holotype; IBH 14196–97 and MCZ A–136430 (three specimens, all juveniles), Plan de Guadalupe (18°08.714′N, 96°57.354′W), 2155 m elevation, J. Hanken, M. García-París, G. Parra-Olea, and D. B. Wake, 13 January 2002. IBH 14196–97 provided tissue for mtDNA analyses.

Diagnosis.—This is a species of plethodontid salamander of the genus *Pseudoeurycea* that is most similar in its robust morphology and shape of the hands and feet to its close relatives, *P. werleri* and *P. mystax*. It is distinguished from these two species by its more robust body and by a pair of distinctive yellow-brown glandular ridges on the dorsolateral parts of the pelvic region and tail base. These traits, along with the short, stout, strongly tapered tail, distinguish this species from all other *Pseudoeurycea*. The color pattern further distinguishes this species from most other members of the genus, especially the conspicuously pale yellow color of the distal third of the tail and the dark gray dorsum, with mottled paler flanks and reddish marks at the base of the limbs.

Description.—The following account is based mostly on the holotype, which is the only known adult. This is a very robust species of medium size (58.2 mm SL). The head is relatively broad and moderately long (head width and length equal 17% and 24% of SL, respectively) and the neck region is poorly defined. The dorsal surface of the head is pitted; the snout is long and pointed. Eyes are of moderate size and placed dorsally. Parotoid glands are not evident. The tail is short (tail length equals 70% of SL) and stout with a well-marked constriction at the base. It is sharply tapered, with a convergent series of dorsal glandular ridges. Limbs are short and robust; combined fore- and hind limb

length equals 24.5 mm, which is 42% of SL. Hands and feet are relatively broad with very pointy digits. Maxillary and vomerine teeth are moderate in number (47 and 22 teeth, respectively); vomerine teeth are small. Mental gland is present.

Coloration in life.—The head is grayish brown (Fig. 2E). The dorsum is slate gray marbled with diffuse chocolate brown to rusty areas. Rusty markings along the mid-dorsal line are broader in the nape and pelvic region. Small black spots are unevenly distributed along the dorsum of the body and tail. These spots are variable in size but become larger and more elliptic on the tail. Light gray to silver dots present on the head and trunk are more widely scattered on the dorsum and more densely represented on the sides. Limbs are dark gray dorsally, with many small bluish-silver dots. Rusty-orange spots are present on the posterior side of each limb insertion. The tail is dark brown anteriorly, progressively becoming yellow by the terminal third. Glandular ridges are yellow-brown. The iris is reddish brown with dark brown reticulation.

Coloration in alcohol.—Coloration of preserved specimens is similar to that in life, albeit darker and with the mid-dorsal rusty marks faded.

Measurements of the holotype (in mm).—Head width 10.2; head depth 5.5; eyelid length 3.1; eyelid width 1.9; anterior rim of orbit to snout 4.0; inter-orbital distance 3.9; distance between corners of eyes 8.0; snout to forelimb 16.1; nostril diameter 0.3; distance between external nares 2.9; projection of snout beyond mandible 0.9; snout to gular fold 14.1; width across shoulders 9.0; snout to anterior angle of vent 53.6; snout to posterior angle of vent (standard length, SL) 58.2; axilla to groin 29.0; tail length 40.8; tail depth at base 5.6; tail width at base 5.1; forelimb length 11.8; hand width 3.0; hind limb length 12.7; foot width 4.3; length of longest (third) toe 1.5; length of fifth toe 0.7. Numbers of teeth: premaxillary 6, maxillary 23–24, vomerine 11–12.

Variation.—Body proportions differ considerably between adults and juveniles; the latter have proportionately larger heads, shorter and even more sharply tapered tails, and less prominent glandular caudal ridges. Dark dorsal dots are less pronounced in juveniles, which otherwise resemble adults in coloration.

Distribution.—*Pseudoeurycea obesa* is known only from the mountain pass of Plan de Guadalupe and its immediate surroundings, along the road from Teotitlán del Valle to Huautla, Oaxaca, Mexico (Fig. 1). All specimens have been found at 2150–55 m elevation.

Natural history.—The type locality lies within almost totally deforested hills, near remnants of cloud forest consisting mostly of oaks (*Quercus*). All specimens were found in January and March under small rocks and schist slabs among roadside talus. Salamanders were slow moving and barely moved when disturbed.

Phylogenetic relationships.—*Pseudoeurycea obesa* is a member of the *P. leprosa* group (Parra-Olea, 2002). DNA sequences for three mitochondrial genes (1833 bp) were compared to published sequences of all species groups of *Pseudoeurycea* (Parra-Olea, 2002): 16S ribosomal mtDNA (two samples, AY762353–54); cytochrome b (CYTB; two samples, AY762357–58); and NADH dehydrogenase subunit 4 (ND4; AY762359). The smallest sequence divergence between *P. obesa* and any other species is to *P. mystax*–4.6% for 16S, 11.0% for CYTB, and 10.9% for ND4 (values are corrected using Kimura 2-parameter model; k2-p). A preliminary parsimony phylogenetic analysis (not shown) suggests that *P. obesa* is sister taxon to a clade formed by *P. mystax* and *P. werleri*. More extensive phylogenetic analyses among members of the *P. leprosa* group, including the newly discovered populations, are in progress.

Remarks.—*Pseudoeurycea obesa* is the first member of the *P. leprosa* group to be recorded from the Sierra Mazateca, which comprises an area of overlapping patterns of salamander distribution. For example, the two apparently closest relatives of *P. obesa* occur in distinct mountain ranges to the south and east (Fig. 1). One of these species, *P. mystax*, is known only from the vicinity of Totontepec in the Sierra Mixe. The second species, *P. werleri*, has a disjunct distribution, with salamanders recorded from Valle Nacional in the Sierra de Juárez and from the isolated Sierra de Los Tuxtlas in southeastern Veracruz. On the other hand, two species of *Thorius* (including one undescribed) recently discovered in the Sierra Mazateca appear to show closest affinities to *T. schmidti* and allied species in Puebla and Veracruz to the north (Parra-Olea et al., 2004; unpubl. data). Sierra Mazateca is yet to be comprehensively inventoried for plethodontid salamanders. Limited fieldwork has already yielded two new species of *Pseudoeurycea* from this range—*P. obesa* (*leprosa* group; this report) and *P. ruficauda* (*juarezi*

group; Parra-Olea et al., 2004)—and one likely new species of *Thorius* (see above). We anticipate the discovery of additional species of these or other genera as the result of future collecting efforts.

Etymology.—The specific epithet *obesa* is derived from Latin. It refers to the general shape of adult and juvenile specimens, which are more robust and apparently heavier than any other species of *Pseudoeurycea* in northern Oaxaca.

Discussion

The cordilleras of northern Oaxaca display an impressive diversity of lungless salamanders (Plethodontidae; Casas-Andreu et al., 1996). The two new taxa described here bring to 27 the total number of species known from the region, where most are endemic (e.g., Wake and Campbell, 2001; Canseco-Márquez and Parra-Olea, 2003; Parra-Olea et al., 2005). Some newly described species, such as *P. papenfussi*, have been known to field herpetologists for several years. Others, such as *P. obesa*, *P. aurantia* (Canseco-Marquez and Parra-Olea, 2003), and *P. ruficauda* (Parra-Olea et al., 2004), were discovered only during recent surveys. Moreover, we know of at least two more species each of *Thorius* and *Chiropterotriton* that await formal description (Darda, 1994; Parra-Olea, 2003; unpubl. data).

Use of molecular techniques for taxonomy facilitates the recognition and diagnosis of taxa poorly differentiated at the morphological level, which frequently results in an increase in the total number of species recognized. However, this is not the case with *Pseudoeurycea* in the mountains of northern Oaxaca, where most newly described taxa are easily diagnosed on morphological grounds and are very distinct from all other known species. This is especially surprising because the region was explored by herpetologists interested in salamanders as early as 1938, when Taylor described *P. unguidentis*, *P. cochranae*, and *P. smithi*, for which he chose Cerro San Felipe as the type locality. Fieldwork in this area, including the nearby Sierra de Juárez, was intensive from the late 1970s to the 1980s when large collections were made and many species were described (e.g., Caldwell, 1974; Campbell, 1982; Papenfuss and Wake, 1987). Discovery of our new species indicates that the area is still far from fully explored and that more new species likely exist, although in large portions of the region, forests are being devastated by uncontrolled logging.

Recent fieldwork on Cerro San Felipe and on some of the main peaks of the Sierra de Juárez (Cerro Humo, Cerro Pelón) reveals a dramatic and sustained decline in salamander populations. The decline is especially noteworthy in the Cerro San Felipe area, where plethodontid salamanders were once extremely abundant (Parra-Olea et al., 1999; unpubl. data). We have visited this area once or twice each year since 1999 and have found population levels to be at most a tiny fraction of what researchers documented two decades earlier. Thorough evaluation and formal recognition of the morphological and genetic diversity of salamanders in the cordilleras of northern Oaxaca is now, more than ever, a must.

Acknowledgments

We thank T. Papenfuss, R. Bello, and the late J. Lynch for their assistance with fieldwork and L. Márquez for help in obtaining DNA sequences. This work has been partially funded by the David Rockefeller Center for Latin American Studies, Harvard University (to JH), UC-MEXUS CN-02–74 (GP-O and DBW), SEMAMAT-CONACYT 2002-C01–0015 (GP-O), CSIC-CONACYT 2004MX0011 (GP-O and MG-P), and by NSF EF-0334846 (JH) and EF-0334939 (DBW). SEMARNAT provided collecting permits (FAUT.0106, to GP-O). Animal use was approved by the University of California, Berkeley, protocol R093–0205 (to DBW).

Literature Cited

Bogert, C. M. 1967. New salamanders of the plethodontid genus *Pseudoeurycea* from the Sierra Madre del Sur of Mexico. Amer. Mus. Novit. 2314:1–27.

Brodie, E. D., Jr., J. R. Mendelson, III, and J. A. Campbell. 2002. Taxonomic revision of the Mexican plethodontid salamanders of the genus *Lineatriton*, with the description of two new species. Herpetologica 58:194–204.

Caldwell, J. 1974. A re-evaluation of the *Hyla bistincta* species group, with descriptions of three new species (Anura: Hylidae). Occ. Pap. Mus. Nat. Hist., Univ. Kans. 28:1–37.

Campbell, J. A. 1982. A new species of *Abronia* (Sauria, Anguidae) from the Sierra de Juárez, Oaxaca, Mexico. Herpetologica 38:355–361.

Canseco-Márquez, L., and G. Parra-Olea. 2003. A new species of *Pseudoeurycea* (Caudata: Plethodontidae) from northern Oaxaca, Mexico. Herpetol. J. 13:21–26.

Casas-Andreu, G., F. Méndez de la Cruz, and J. L. Camarillo-Rangel. 1996. Anfibios y reptiles de Oaxaca. Lista, distribución y conservación. Acta Zool. Mex. (n.s.) 69:1–35.

Darda, D. M. 1994. Allozyme variation and morphological evolution among Mexican salamanders of

the genus *Chiropterotriton* (Caudata: Plethodontidae). Herpetologica 50:154–187.

HANKEN, J., AND D. B. WAKE. 1994. Five new species of minute salamanders, genus *Thorius* (Caudata: Plethodontidae), from northern Oaxaca, Mexico. Copeia 1994:573–590.

———, AND ———. 2001. A seventh species of minute salamander (*Thorius*: Plethodontidae) from the Sierra de Juárez, Oaxaca, Mexico. Herpetologica 57:515–523.

LEVITON, A. E., R. H. GIBBS, JR., E. HEAL, AND C. E. DAWSON. 1985. Standards in herpetology and ichthyology: part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Copeia 1985:802–832.

LYNCH, J. F., AND D. B. WAKE. 1989. Two new species of *Pseudoeurycea* (Amphibia: Caudata) from Oaxaca, Mexico. Contrib. Sci., Nat. Hist. Mus. Los Angeles Co. 411:11–22.

———, S. Y. YANG, AND T. J. PAPENFUSS. 1977. Studies of neotropical salamanders of the genus *Pseudoeurycea*. I: Systematic status of *Pseudoeurycea unguidentis*. Herpetologica 33:46–52.

PAPENFUSS, T. J., AND D. B. WAKE. 1987. Two new species of plethodontid salamanders (genus *Nototriton*) from Mexico. Acta Zool. Mex. (n.s.) 21:1–16.

PARRA-OLEA, G. 2002. Molecular phylogenetic relationships of neotropical salamanders of the genus *Pseudoeurycea*. Mol. Phylogenet. Evol. 22:234–246.

———. 2003. Phylogenetic relationships of the genus *Chiropterotriton* (Caudata: Plethodontidae) based on 16S ribosomal mtDNA. Can. J. Zool. 81:2048–2060.

———, M. GARCÍA-PARÍS, AND D. B. WAKE. 1999. Status of some populations of Mexican salamanders (Amphibia: Plethodontidae). Rev. Biol. Trop. 47:217–223.

———, ———, J. HANKEN, AND D. B. WAKE. 2004. A new species of arboreal salamander (Caudata: Plethodontidae: *Pseudoeurycea*) from the mountains of Oaxaca, Mexico. J. Nat. Hist. 13:2126–2138.

———, ———, T. J. PAPENFUSS, AND D. B. WAKE. 2005. Systematics of the *Pseudoeurycea bellii* (Caudata: Plethodontidae) species complex. Herpetologica 61:145–158.

———, AND D. B. WAKE. 2001. Extreme morphological and ecological homoplasy in tropical salamanders. Proc. Nat. Acad. Sci., USA 98:7888–7891.

WAKE, D. B. 1987. Adaptive radiation of salamanders in Middle American cloud forests. Ann. Missouri Bot. Gard. 74:242–264.

———, AND J. A. CAMPBELL. 2001. An aquatic salamander from Oaxaca, Mexico. Herpetologica 57: 509–514.

———, T. J. PAPENFUSS, AND J. F. LYNCH. 1992. Distribution of salamanders along elevational transects in Mexico and Guatemala. Tulane Stud. Zool. Bot., Suppl. Publ. no. 1:303–319.

(GP-O) INSTITUTO DE BIOLOGÍA, UNAM, AP 70–153, CP 04510, CIUDAD UNIVERSITARIA, MEXICO D.F.; (MG-P) MUSEO NACIONAL DE CIENCIAS NATURALES, CSIC, C. JOSÉ GUTIÉRREZ ABASCAL, 2, 28006 MADRID, SPAIN; (JH) DEPARTMENT OF ORGANISMIC AND EVOLUTIONARY BIOLOGY AND MUSEUM OF COMPARATIVE ZOOLOGY, HARVARD UNIVERSITY, 26 OXFORD STREET, CAMBRIDGE, MASSACHUSETTS 02138; (DBW) DEPARTMENT OF INTEGRATIVE BIOLOGY AND MUSEUM OF VERTEBRATE ZOOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA 94720–3160. E-mail: (GP-O) gparra@ibunam.ibiologia.unam.mx. Send reprint requests to GP-O. Submitted: 13 Apr. 2004. Accepted: 22 Jan. 2005. Section editor: T. W. Reeder.