

## A New Species of *Abronia* (Squamata: Anguidae) from the Sierra Madre del Sur of Oaxaca, Mexico

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**ABSTRACT.**—A newly discovered species of arboreal alligator lizard of the genus *Abronia* is described from the Sierra Madre del Sur of Oaxaca, Mexico. It appears to be most closely related to *A. mixteca* and *A. oaxacae*, but differs from these species (and others in the subgenus *Abronia*) in a number of features, including the combination of having two primary temporals contacting the postocular series, the anterior superciliary contacting the cantholoreal, six to eight nuchals in a transverse row across the nape, minimally seven to eight scales between large nuchals and ventral scales on neck, and 32–35 transverse rows of dorsal scales. This new species is the only species of *Abronia* known from the central and western portions of the Sierra de Miahuatlán in the southern part of the Sierra Madre del Sur, although *A. oaxacae* occurs to the east in this range. Many of the arboreal and secretive species of *Abronia* have avoided discovery until relatively recently, with about a third of known species described in the last 3 decades.

**RESUMEN.**—Se describe una nueva especie de lagartija lagarto arbórea del género *Abronia* de la Sierra Madre del Sur de Oaxaca, México. Parece estar más relacionada a *A. mixteca* y *A. oaxacae*, pero difiere de estas especies y de otras del subgénero *Abronia* en varios caracteres, incluyendo la combinación de tener dos temporales primarias contactando la serie postocular, la superciliar anterior en contacto con la cantoloreal, 6–8 nucales en hilera transversal sobre la nuca, un mínimo de 7–8 escamas entre las nucales grandes y las escamas ventrales del cuello, y 32–35 hileras transversales de escamas dorsales. Esta nueva especie es la única del género *Abronia* conocida de las porciones central y occidental de la Sierra de Miahuatlán en la región sur de la Sierra Madre del Sur, aunque *A. oaxacae* ocurre al oriente de esta serranía. Muchas de las especies de *Abronia* con hábitos secretos y arbóreos han evadido ser descubiertas hasta hace poco, aproximadamente una tercera parte de las especies han sido descritas en las últimas tres décadas.

Many species of the genus *Abronia* are infrequently encountered members of the Middle American highland forest herpetofauna. Their arboreal habits and cryptic coloration often allow them to escape detection. They occur on the Atlantic versant from northeastern Mexico (Tamaulipas) southward across the Isthmus of Tehuantepec through northern Chiapas to the departments of Alta and Baja Verapaz (and almost certainly into Izabal and Zacapa), Guatemala (Campbell and Frost, 1993). The genus occurs in central Mexico along the southern edge of the Transverse Volcanic Cordillera in the states of Morelos, México, and Michoacán (Campbell and Frost, 1993; Flores-Villela and Sánchez-Herrera, 2003; Centeno-Alcalá et al., 2009). On mountains bordering the Pacific coastal plain, one species is known from the highlands of Guerrero, several species in Oaxaca, and several species to the east of the Isthmus of Tehuantepec in Chiapas, Guatemala, El Salvador, and Honduras (Campbell and Frost, 1993).

An interesting aspect of distribution is the almost invariable allopatry of species throughout the extensive range of the genus. Campbell and Frost (1993) discussed the possible instances of sympatry, but were able to document with certainty only one instance of overlap between *A. gaiophantasma* and *A. fimbriata* in Baja Verapaz, Guatemala. The locality data borne by several museum specimens representing three species all collected by a single collector reputedly in 1937 near “Santa Rosa,” Chiapas was questioned by Campbell and Frost (1993), and information relating to these specimens and their collector was further elucidated by Peterson and Nieto-Montes de Oca (1996).

Another feature of the distribution of *Abronia* is the relatively small ranges of most species. Most occur in single montane forests and often only on a single exposure in those mountains; therefore, for one species to inhabit cloud forest on the windward side and another to occur in pine–oak forest on the drier leeward side is not unusual.

With its diverse topography and climate, along with the diverse historical influxes of fauna (Savage, 1982), Oaxaca harbors more herpetofaunal species than any other state in Mexico (Casas-Andreu et al., 1996, 2004; Campbell, 1999; Ochoa-Ochoa et al., 2013). The extensive highland forests of this state have a temperate climate but the biota is a complex admixture of species of temperate and tropical origin. Hot, humid lowlands bound the state on three sides: the Atlantic Coastal Plain to the north, the Pacific Coastal Plain to the south, and the Isthmus of Tehuantepec to the east. In the west, the highlands of the Sierra Madre del Sur extend into Guerrero, but in western Guerrero this highland corridor is broken by ridgeline elevations that dip to 1,500 m or less. The highlands of Oaxaca often are simplistically regarded as all pertaining to the Sierra Madre del Sur–Mesa del Sur complex (West, 1964). This obscures a complex physiographic picture of many isolated mountain ranges trending in diverse directions and many isolated uplifts. The physiography includes several impressive highlands in the north such as the Sierra de Juárez, Sierra Aloapaneca, the Sierra Mazateca, and the Sierra de Monteflor. Across the extensive central Oaxacan central plateau region, which tends to be xerophytic at lower elevations, there are several isolated ranges including the Sierra de Cuatro Venados, and also many isolated peaks such as the Cerro de Tres Cruces, the Cerro Piedra de Lumbre, and the Cerro Piedra del Sol, all of which have pine–oak forests. Finally, the southern portion of the

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Sierra Madre del Sur in Oaxaca, often referred to as the Sierra de Miahuatlán, runs parallel to the Pacific coast, with considerable areas ranging over 1,500 m that extend unbroken for about 180 km across the south-central portion of the state. Many of the Oaxacan highlands have been poorly explored, but practically all are known to harbor endemic species of amphibians and reptiles. Much of the Pacific versant of the Sierra de Miahuatlán is covered by a magnificent hardwood forest and has been particularly neglected by biologists; this region will undoubtedly provide rewarding results for subsequent field studies.

#### MATERIALS AND METHODS

Terminology for defining scales and protocols for making scale counts and measurements have been outlined in Bogert and Porter (1967), Campbell (1982, 1984, 1994), and Campbell and Frost (1993). Specimens examined were fixed in buffered formalin diluted to 10% of stock solution and subsequently transferred into 70% ethanol for permanent storage. Notes of color in life were taken from field notes and photographs of live individuals. Format for the diagnosis and description follow Campbell and Frost (1993) for ease of comparison. Museum abbreviations follow Sabaj Pérez (2014).

#### SYSTEMATIC ACCOUNT

During 2012, a field party from The University of Texas at Arlington teamed with individuals from several institutions including the Universidad Nacional Autónoma de México and the American Museum of Natural History to conduct herpetofaunal inventories of the Oaxacan highlands west of the Isthmus of Tehuantepec. During the course of fieldwork we encountered a specimen of *Abronia* that we were unable to readily identify. Further, this specimen was found in an area where members of the genus were unknown previously. This prompted careful examination and comparison of this specimen with available museum material, which in turn revealed two additional conspecifics. These lizards are distinctly different from all other known species and we propose that this new anguid lizard be known as

#### *Abronia cuetzpali* sp. nov.

(FIGS. 1–3, TABLE 1)

Sierra de Miahuatlán *Abronia*—Dragoncito de Sierra de Miahuatlán

*Holotype*.—MZFC 28761, an adult male from near San Miguel Suchixtepec, Sierra de Miahuatlán, approximately 2 km west of the Río Molino, Sierra Madre del Sur, Oaxaca, Mexico, 2,150 m (16.08439°N 96.49042°W), found by I. Caviedes-Solis on 4 November 2011 (Figs. 1–2). The individual was found at 1020 h as it crawled across a trail. The headwaters of the Río Molino occur just to the east of San Miguel Suchixtepec. Suitable habitat occurs throughout the region between 1,500 and 2,500 m.

*Paratypes* (2).—UTA R-61670, an adult female from 5.4 km east of Juquila, Sierra de Miahuatlán, Sierra Madre del Sur, Oaxaca, Mexico, 1,711 m (16.23204°N 97.25535°W), found by Oscar Olivares on 8 July 2012 (Fig. 3). The individual was found during the late morning as it crawled on the forest floor. The northward-facing slope on which the holotype was collected drains into the Río Grande, an upper tributary of the Río Verde. UCM 41057, an adult male from near San Miguel Suchixtepec, Oaxaca, Sierra Madre del Sur, Mexico, collected by Thomas



FIG. 1. Body (A) and head (B) of *Abronia cuetzpali*, holotype (MZFC 28761), adult male, 108 mm SVL, head length 27.1 mm.

MacDougal in May 1967. The specimen was reported by the collector to be from the Río Molino drainage.

*Diagnosis*.—A species of *Abronia* in the subgenus *Abronia* defined by Campbell and Frost (1993). Within this subgenus *A. cuetzpali* clearly falls within the *A. deppii* group, containing *A. deppii*, *A. martindelcampoi*, *A. mixteca*, and *A. oaxacae*, all of which have the unique condition in the genus *Abronia* of having scales oriented in oblique rows relative to the ventrolateral fold. *Abronia cuetzpali* differs from *A. deppii* (which occurs along the southern edge of the Mexican Plateau) and *A. martindelcampoi* (which occurs in the western highlands of Guerrero) in having two primary temporals contacting the postocular series (vs. one), an anterior superciliary contacting the cantholoreal (vs. usually no contact), the first postorbital supralabial not enlarged (vs. enlarged), two to three occipitals (vs. one), and 32–35 transverse rows of dorsal scales (vs. 27–29 in *A. deppii* and 24–28 in *A. martindelcampoi*). *Abronia oaxacae* (Fig. 4) and *A. mixteca* (Fig. 5) both occur in Oaxaca, but *A. cuetzpali* may be distinguished from these species by having six to eight nuchals in a transverse row across the nape (vs. four in *A. oaxacae*);

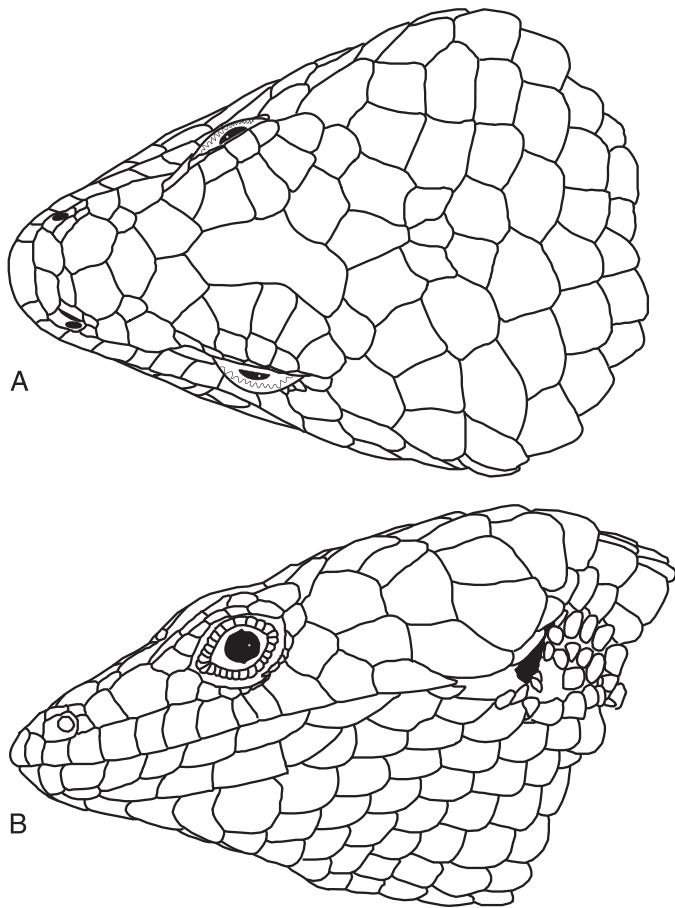


FIG. 2. *Abronia cuetzpali*, dorsal (A) and lateral (B) aspects of head of holotype (MZFC 28761); head length = 27.1 mm.

relatively small lateral neck scales—minimally seven to eight scales between ventral scales and nuchals (vs. five to six in *A. mixteca*, three to four in *A. oaxacae*; see Fig. 6); the anterior superciliary contacting the cantholoreal (usually no contact in *A. oaxacae*); 32–35 dorsal transverse scale rows (vs. 28–31 in *A. mixteca*, 27–29 in *A. oaxacae*); 39–40 ventral transverse scale rows (vs. 34–37 in *A. oaxacae*); and a more strongly developed ventrolateral fold, containing more granular scales than in *A. mixteca* or *A. oaxacae*.

*Description of Holotype*.—Adult male, snout-vent length (SVL) 108 mm, head length from rostral to upper anterior edge of auricular opening 27.1 mm, head width at broadest point 21.8 mm (width/length = 80.4%), tail unbroken and unregenerated, tail length 158 mm (1.46 times SVL), and 85 caudal whorls.

One supranasal and two postnasals on each side; upper postnasal slightly larger than lower postnasal; pair of anterior and posterior internasals situated between rostral and frontonasal, with additional scale intervening between anterior and posterior internasals on left side; prefrontals slightly larger than posterior internasals and contact each other medially, precluding frontonasal–frontal contact; single canthal scale on each side, precluding contact between posterior internasal and prefrontal; large cantholoreal extending onto dorsum of canthus rostralis, contacting canthal, prefrontal, and anterior median supraocular; five/five median supraoculars; three/three lateral supraoculars; five/five superciliaries, the anteriormost reaching cantholoreal; frontal large and azygous, fused with left frontoparietal and broadly contacting interparietal; three scales in the occipital



FIG. 3. Body (A) and head (B) of *Abronia cuetzpali*, paratype (UTA R-61670), adult female, 114 mm SVL, head length 23.7 mm.

region—the interoccipital and slightly larger occipital on either side; two transverse rows of scales separate occipital from first transverse row of nuchals; three primary temporals on each side, lower contacting postoculars, middle contacting postoculars and posterior median supraocular, upper juxtaposed between parietal and median supraoculars, and contacting the frontoparietal; four/four secondary temporals; five/five tertiary temporals; 11/11 supralabials, antepenultimate posteriormost to reach orbit; nine/eight infralabials; postmental divided, followed by four pairs of enlarged chin shields; posteriormost chin shield about half size of preceding scale; five/six sublabials, with anteriormost reaching second (right) or first (left) infralabial, and contacting postmental.

Minimum number of nuchals in transverse series eight with lateralmost scales reduced to about half size of more medial adjacent nuchals; 35 transverse and 14 longitudinal rows of dorsal scales arranged in oblique rows on sides of body; dorsal scales mostly flat but few middorsal scales with feeble, low, rounded ridges; 39 transverse and 14 longitudinal rows of ventral scales; lateral rows of ventral scales not enlarged from more medial ventral scales; head and several anterior rows of nuchals with well-developed osteoderms; more posteriorly on

TABLE 1. Selected transformational series of Oaxacan highland *Abronia* in the subgenus *Abronia* (character numbers pertains to those in Campbell and Frost, 1993).

	<i>A. cuetzpali</i>	<i>A. mixteca</i>	<i>A. oaxaca</i>	<i>A. fuscolabialis</i>
2. Frontonasal scale	Present	Present	Sometimes absent	Present
3. Frontonasal–frontal scale contact	No contact	Variable, usually no contact	Sometimes lacking frontonasal; when present, no contact	No contact
4. Canthal scales (absent when fused with posterior internasal)	Variable	Usually absent	Absent	Present, discrete from posterior internasals
6. Superciliary–antholoreal scale contact	Present	Present	Usually absent	Present
14. Number of occipitals	2–3	3	3	1
20. Number of transverse rows of dorsal scales	32–35	28–31	27–32	28–32
21. Dorsal scale row orientation	Oblique	Oblique	Oblique	Parallel
22. Osteoderms under first two rows of nuchal scale rows	Moderately developed	Moderately developed	Well developed	Well developed
23. Longitudinal nuchal scale row	6–8; if 8 lateral rows reduced in size	5–6	4	4–6
24. Lateral neck scales	Moderately sized	Enlarged	Enlarged	Granular
25. Ventrolateral fold	Well developed	Reduced	Reduced	Well developed

FIG. 4. *Abronia oaxaca*, adult female from San Juan Tepeuxila, Oaxaca, Mexico. Image courtesy of Luis Canseco-Márquez.

dorsum and flanks of body osteoderms appear very weakly developed or absent; supra-auricular scales granular and nonprotruding; about seven moderately sized scales between lateral nuchals and first large scales on ventrolateral surface of neck; 13 antibranchials from insertion of the forelimb to wrist; ventrolateral fold moderately well developed with small scales and granules interspersed in interstitial skin throughout ventrolateral fold; 19/18 subdigital lamellae on fourth toes.

In preservative (ethanol after formalin), the overall ground color of the dorsum is pale brown, the venter of the head is white, and the body is cream. A slight greenish sheen is present on the anterior flanks and venter. The snout is pale gray, grading to pale brown on dorsum of the head. The ground color of the neck and body is pale brown dorsally, grading to pale gray on the flanks. Darker crossbands are marked with black dots on the flanks and on the tail. The dorsal surfaces of the limbs are grayish; the ventral surfaces of the limbs are cream and the palmar–plantar surfaces and subdigital lamellae are yellowish. The venter of the head and neck are immaculate white and the venter of the body is cream with seven faint crossbands. The dorsum of the tail has 15 brown crossbands. The venter of the tail is pale gray with inconspicuous darker crossbands.

*Color in Life*.—The holotype has a grayish body ground color; there are seven pale-brown dorsal crossbands on the body, including the nape, extending ventrally to the ventrolateral fold. These crossbands are heavily flecked with black, more so laterally, and are separated from each other by about a single scale middorsally and usually about two scales laterally. The side of the neck and dorsal surfaces of the forelimbs are colored similarly to the body and marked with some black flecking. Several individual scales including the anterior internasals, the

FIG. 5. *Abronia mixteca*, adult female from near Tejocotes, Oaxaca, Mexico, 2,377 m (UTA R-12138).

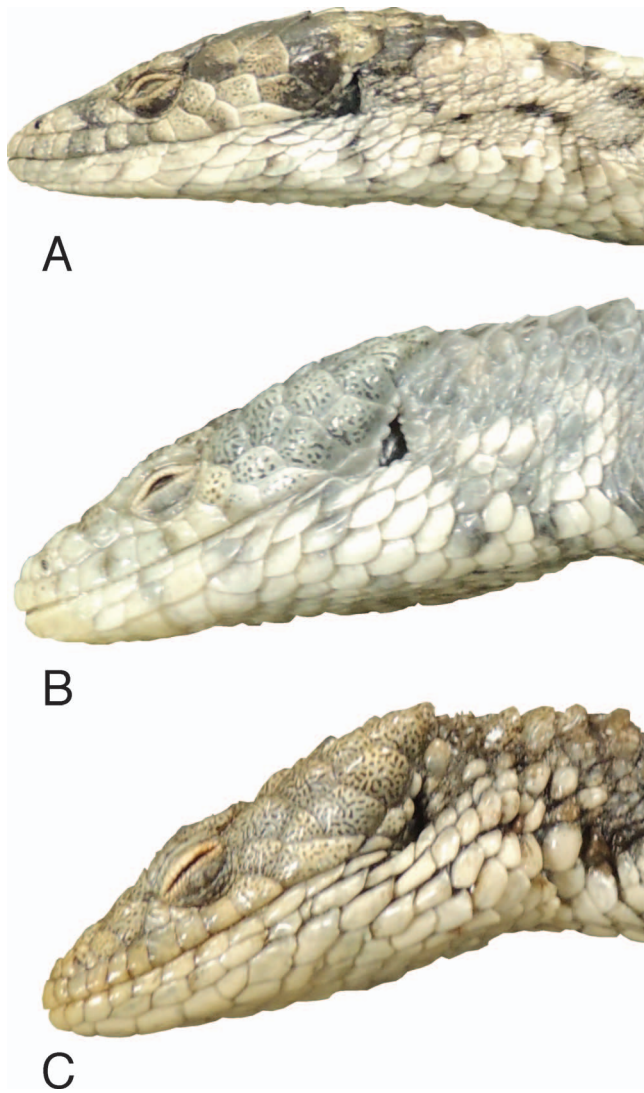


FIG. 6. Variation of lateral neck scales of several species of *Abronia* in the *deppii* group. (A) *A. cuetzpali*, UTA R-61670. (B) *A. mixteca*, UTA R-19650. (C) *A. oaxacae*, UTA R-31197, exposed dark interstitial skin with tiny granules below the nuchals is typical of this species.

left prefrontal, and several scales on the back of the head have a greenish yellow overcast. The top and sides of the head are rugose and accentuated with heavy black vermiculations. The tail is gray with 15 slightly irregular crossbands containing black flecking within their fields. The lower jaw and venter of the head and neck are immaculate white; the venter of the body is very slightly darker than the neck. The iris is whitish with a slight yellowish green sheen.

*Variation.*—In most respects the two paratypes agree with the holotype. The adult female paratype (UTA R-61670) has a SVL of 114 mm. The length of the head from the rostral to the upper anterior edge of the auricular opening is 23.7 mm, and the head width at the broadest point is 17.8 mm (width/length = 75.1%). The tail is unbroken and unregenerated, having a length of 163 mm and 94 caudal whorls. The upper postnasal is about one-half (left) to two-thirds (right) the size of the lower postnasal. The prefrontals are about 1.5 times the size of the posterior internasals. A large cantholoreal extends onto the dorsum of the canthus rostralis, contacting the internasal, prefrontal, and anterior median supraocular; no canthal scale is present. There

are five/six superciliaries. The frontal narrowly contacts the interparietal; there are two scales in the occipital region—the interoccipital and a somewhat smaller occipital on the right side; the posterior portion of the left parietal is highly asymmetrical and extends posteriorly, probably owing to a fusion with the left occipital scale; the usual condition in this species is almost certainly three occipital scales including the interoccipital. There are four/four secondary temporals and five/five tertiary temporals. There are 12/11 supralabials and 8/10 infralabials. There are four/five sublabials, with the anteriormost reaching only the third infralabial. Similar to the holotype the minimum number of nuchals in a transverse series is eight, with the lateralmost scales reduced to about half the size of more medial adjacent nuchals. There are 35 transverse and 14 longitudinal rows of dorsal scales and 40 transverse and 14 longitudinal rows of ventral scales. About eight moderately sized scales occur between the lateral nuchals and the first large scales on the ventrolateral surface of the neck (Fig. 6); there are 12 antebranchials from the insertion of the forelimb to the wrist. There are 19/18 subdigital lamellae on the fourth toes. In preservative (ethanol after formalin) the overall ground color of the dorsum is pale brown and that of the venter of the head and body is cream. A slight greenish sheen is present on the anterior flanks and venter. The dorsum of the head is heavily blotched and mostly dark brown with two irregular crossbands across the snout at the levels of the anterior portion of the internasals and frontonasal. The neck and body are marked with six wide crossbands that extend to the ventrolateral fold. These crossbands have edges of highly irregular dark brown spots. Within the field of the dorsal blotches, a few scattered dark spots are present. The dorsal surfaces of the limbs are mostly pale brown with a few dark brown markings; the ventral surfaces of the limbs are cream and the palmar–plantar surfaces and subdigital lamellae are brown. The venter of the head and neck are immaculate cream and the venter of the body is cream heavily suffused with tan or brown, becoming darker on the lateral portion of the venter. The dorsum of the tail has 15 brown crossbands that are edged with irregular dark brown to black spots. The venter of the tail is mostly gray-brown, marked with only moderately conspicuous, irregular, narrow dark brown and white crossbands, which often do not extend across the venter. In life, UTA R-61670 had a body ground color of tan to pale brown; there were six medium brown dorsal crossbands that extend ventrally to the ventrolateral fold; these crossbands have irregular edges of dark brown to black and are separated from each other by no more than a single scale width middorsally and usually about two scales laterally. The dorsal crossbands also are marked with a few dark spots. The side of the neck and dorsal surfaces of the forelimbs are whitish tan marked with a few small dark spots; the hind limbs are a slightly darker pale brown. The top and sides of the head are medium brown and heavily blotched with dark brown. The tail is medium brown with 15 irregularly blackish edged crossbands; irregular dark spots are scattered within and between the crossbands. The lower jaw and venter of the head and neck are immaculate white; the venter of the body is suffused with brown pigment and darker than the neck but without markings. The iris was whitish silver.

The adult male paratype (UCM 41057) is 115 mm in SVL and has an incomplete tail 114 mm in length; head length 24.6 mm; head width 19.5 mm; head width/length ratio 79.3%; tibia length 12.8 mm; and fourth toe length 11.2 mm. Overall, the specimen agrees in most aspects of scalation, except for the



FIG. 7. Habitat of *A. cuetzpali*, trail through forest 5.4 km east of Juquila, Sierra Madre del Sur, Oaxaca, Mexico, ca. 1,700 m. Photo by Carl Franklin.

following: three scales in occipital region (one interoccipital and two occipitals with the interparietal slightly larger than the flanking occipitals); fewest number of nuchals in transverse row six (all scales in series subequal in size); three/three suboculars and four/four postoculars; nine/nine supralabials and 10/9 infralabials; four/four anterior temporals; about seven lateral neck scales from nuchal row to ventrolateral scales on the neck; 32 dorsal transverse rows and 39 ventral transverse scale rows; 16 ventral longitudinal scale rows; and 19/20 subdigital lamellae on fourth toes. The preserved specimen is uniformly brown dorsally; under magnification each scale on dorsum is finely mottled. The venter of the head and throat are yellow and the venter of the body is yellowish tan. Most of the scales on the chest and belly are black flecked on their anterior portion.

*Etymology.*—The specific name is a noun in apposition taken from the Nahuatl word for lizard, “cuetzpali,” although there are various alternative spellings.

*Habitat and Distribution.*—On the basis of the three known specimens of *A. cuetzpali*, its distribution extends in the Sierra Madre del Sur of Oaxaca from near Santa Catarina Juquila to San Miguel Suchixtepec, a distance of about 70 km. The known elevational distribution is from 1,711 to 2,150 m. Suitable elevations above 1,500 m and temperate forest are continuous between these localities. There is no reason to believe that *A. cuetzpali* does not range farther to the west and east, where suitable habitat also exists. The area inhabited by *A. cuetzpali* is covered by pine–oak forest (sensu Leopold, 1959) that may have

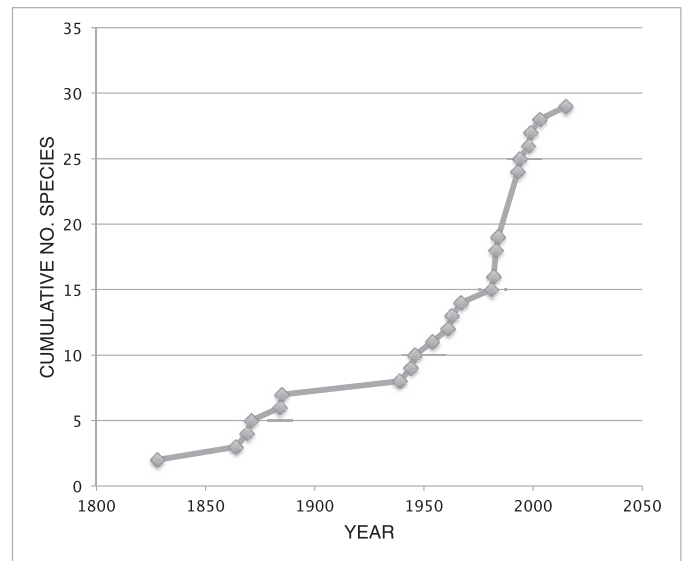


FIG. 8. Accumulation curve for descriptions of new *Abronia* species.

a prominent hardwood component including oaks and a heavy broadleaf understory in some places (Fig. 7).

#### DISCUSSION

Since the description of the first two species of *Abronia* by Wiegmann (1828), the history of discovery of species in this genus has followed a sigmoid path, increasing exponentially over about the last half century (Fig. 8). As recently as 1938, only 7 species were known; by 1984, some 19 species were recognized; and now, with the addition of *A. cuetzpali*, 29 species are known. Over one-third of *Abronia* species were discovered within the past 30 yr. A cursory examination of the species accumulation curve (Fig. 8) suggests that it is beginning to reach an asymptote, but we are aware of at least two, and possibly up to four, species that await description. One of these is a member of the *A. bogerti* group (subgenus *Scopaeabronia*, sensu Campbell and Frost, 1993) that was mentioned in Campbell and Frost (1993) and Campbell (1994), and another is a member of the subgenus *Auriculabronia* (sensu Campbell and Frost, 1993). Recent collections suggest that additional undescribed species possibly occur in Guerrero and Oaxaca, but we have not examined this material. No other Mexican or Central American lizard genus has experienced a comparable recent surge in known species.

Seven species of *Abronia* are currently recognized from Oaxaca. One species (*A. ramirezi*) is known from an adjacent state and we would not be surprised if it were eventually discovered within the borders of Oaxaca. Two Oaxacan species, *A. bogerti* and *A. ornelasi*, occur east of the Tehuantepec Depression and belong to distinct subgenera (*Scopaeabronia* and *Abaculabronia*, respectively) and are not considered further here. The sole specimen of *A. mitchelli* known from the dense Atlantic versant cloud forest of the Sierra Juárez possesses several unique features and is placed in its own subgenus *Aenigmabronia*. All four remaining Oaxacan species are members of the subgenus *Abronia*; two of these (*A. mixteca*, *A. oaxacae*) are members of the “*deppii*” group characterized by dorsal scales on the flanks that are oriented in oblique rows; these scales are in parallel rows in *A. fuscolabialis* and *A. graminea*. The distributions of species of the subgenus *Abronia* in Oaxaca are as

follows: *A. mixteca* inhabits relatively dry habitat varying from relatively low oak forests with abundant *Tillandsia* and other arboreal bromeliads to pine–oak forests. It occurs from near Tejocotes (Bogert and Porter, 1967), where it occurs on both sides of the Continental Divide northward through the Mixteca Alta region to near the Puebla border and west to the Malinaltepec region of extreme eastern Guerrero (Campbell and Frost, 1993; Canseco-Márquez and Gutiérrez-Mayén, 2010; Martín-Regalado et al., 2012). *Abronia fuscolabialis* is known from several ranges in the northern highlands of Oaxaca, the Sierra Mixe, and the Sierra Juárez (Campbell, 1982; Campbell and Frost, 1993). In the Sierra Mixe it is known from the vicinity of Totontepec and Cerro Zempoaltepec. *Abronia graminea* has been reported from the Sierra Mazateca in extreme northern Oaxaca (Schmidt-Ballardo, 1991).

The distribution of the *A. deppii* group is not without biogeographic peculiarities. All of the species of the group are restricted to the Sierra Madre del Sur and adjacent highlands in Oaxaca and Guerrero, with the exception of *A. deppii*, which occurs along the southern edge of the Mexican Plateau north of the Río Balsas Depression. The closest relative of *A. deppii* appears to be *A. martindelcampoi* in the highlands of Guerrero. The exact nature of how ancestral populations broached the formidable rain-shadow barrier presented by the Balsas Basin remains an open question.

The type locality for *A. oaxacae* is “Oaxaca” and, on the basis of Günther’s (1885) description and illustrations of an adult and young (plate 24), there is little doubt that his species pertains to the species that is relatively abundant in the mountains surrounding Oaxaca de Juárez. *Abronia oaxacae* has been reported to range over much of Oaxaca from the mountains north of Oaxaca de Juárez southward into the Sierra de Miahuatlán. Most of the available material of *A. oaxacae* has come from north of the Valley of Oaxaca, particularly in the vicinity of El Punto and Ixtlán de Juárez (Bogert and Porter, 1967; Campbell and Frost, 1993); however, several specimens are known just to the south of Oaxaca de Juárez from near Zaachila and San Vicente Lachixio. Given two obvious aspects of distribution of members of the genus *Abronia* (namely allopatry and confinement to relatively small montane areas), the range of *A. oaxacae*, as previously delimited (Bogert and Porter, 1967; Campbell and Frost, 1993), might have been regarded as suspect. In their analyses, these authors used specimens from several isolated regions in Oaxaca, including the Sierra Aloapaneca, the Sierra de Juárez, and the eastern portion of the Sierra Madre del Sur (Sierra de Miahuatlán). Subsequently, the species was reported from the Sierra de Monteflor (Canseco-Márquez and Gutiérrez-Mayén, 2010). The discovery during the summer of 2012 of *Abronia* in the Sierra de Miahuatlán portion of the Sierra Madre del Sur to the southwest of previous records prompted the re-examination of two specimens available of *A. oaxacae* from this range. This led to the discovery of one of the paratypes of *A. cuetzpali*, which had languished on museum shelves for half a century under the name *A. oaxacae*, and additionally a specimen that had been allocated to *A. mixteca*, here designated as the holotype of *A. cuetzpali*. Another specimen from Santo Domingo Chontecomatlán proves to be *A. oaxacae*, thereby obfuscating what would otherwise be a tidier biogeographic scenario. Perusal of detailed topographic maps show several highland ridges trending from the highlands of central Oaxaca to the east–west-trending Sierra de Miahuatlán, suggesting a possible highland corridor between the two regions.

Campbell and Frost (1993) provided a key for all species of *Abronia* known at the time. Since that publication, several new species in the subgenus *Abronia* have been described. Using the key in Campbell and Frost (1993), *A. martindelcampoi* will key to “*Abronia* species ‘Guerrero’” and *A. cuetzpali* will key to *A. mixteca*. Characteristics differentiating the latter two species are provided in the Diagnosis herein.

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#### LITERATURE CITED

- BOGERT, C. M., AND A. P. PORTER. 1967. A new species of *Abronia* (Sauria, Anguidae) from the Sierra Madre del Sur of Oaxaca, Mexico. *American Museum Novitates* 2279:1–21.
- CAMPBELL, J. A. 1982. A new species of *Abronia* (Sauria, Anguidae) from the Sierra Juárez, Oaxaca, Mexico. *Herpetologica* 38:355–361.
- . 1984. A new species of *Abronia* (Sauria, Anguidae), with comments on the herpetogeography of the highlands of southern Mexico. *Herpetologica* 40:373–381.
- . 1994. A new species of elongate *Abronia* (Squamata: Anguidae) from Chiapas, Mexico. *Herpetologica* 50:1–7.
- . 1999. Distribution patterns of amphibians in Middle America. Pages 111–209 in W. E. Duellman (ed.), *Distribution Patterns of Amphibians: A Global Perspective*. The Johns Hopkins University Press, USA.
- CAMPBELL, J. A., AND D. R. FROST. 1993. Anguid lizards of the genus *Abronia*: revisionary notes on the species of nuclear Central America and adjacent Mexico, descriptions of four additional species, with a phylogenetic hypothesis for the genus and an identification key. *Bulletin of the American Museum of Natural History* 216:1–121.
- CANSECO-MÁRQUEZ, L., AND M. G. GUTIÉRREZ-MAYÉN. 2010. Anfibios y Reptiles del Valle de Tehuacán–Cuicatlán. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Fundación para la Reserva de la Biosfera Cuicatlán A.C., Benemérita Universidad Autónoma de Puebla, Mexico.
- CASAS-ANDREU, G., F. R. MÉNDEZ-DE LA CRUZ, AND J. L. CAMARILLO. 1996. Anfibios and reptiles de Oaxaca. Lista, distribución y conservación. *Acta Zoológica Mexicana* (n.s.) 69:1–35.
- CASAS-ANDREU, G., F. R. MÉNDEZ-DE LA CRUZ, AND X. AGUILAR-MIGUEL. 2004. Anfibios y reptiles. Pages 52–65 in A. J. García-Mendoza, M. J. Ordóñez, and M. Briones-Salas (eds.), *Biodiversidad de Oaxaca*. Fondo Oaxaqueño para la Conservación de la Naturaleza, World Wildlife Fund, Instituto de Biología, UNAM, Mexico.

- CENTENERO-ALCALÁ, E., V. H. JIMÉNEZ-ARCOS, A. ESCALONA-LÓPEZ, AND S. S. CRUZ-PADILLA. 2009. Geographic distribution: *Abronia deppii*. *Herpetological Review* 40:450.
- FLORES-VILLELA, O., AND O. SÁNCHEZ-HERRERA. 2003. A new species of *Abronia* (Squamata: Anguinae) from the Sierra Madre del Sur of Guerrero, Mexico, with comments on *Abronia deppii*. *Herpetologica* 59:524–531.
- GÜNTHER, A. C. L. G. 1885–1902. Reptilia and Batracia. In O. Salvin and F. D. Godman (eds.), *Biologica Centrali-America*. R. H. Porter and Dulau & Co., London.
- LEOPOLD, A. S. 1959. *Wildlife of Mexico*. University of California Press, USA.
- MARTÍN-REGALADO, C. N., M. C. LAVARIEGA-NOLASCO, AND R. M. GÓMEZ-UGALDE. 2012. Registros nuevos de *Abronia mixteca* (Sauria: Anguinae) en Oaxaca, México. *Revista Mexicana de Biodiversidad* 83:859–863.
- OCHOA-OCHOA, L. M., J. A. CAMPBELL, AND O. FLORES-VILLELA. 2013. Patterns of richness and endemism of the Mexican herpetofauna, a matter of spatial scale. *Biological Journal of the Linnean Society* 111: 305–316.
- PETERSON, A. T., AND A. NIETO-MONTES DE OCA. 1996. Sympatry in *Abronia* (Squamata: Anguinae) and the problem of Mario del Toro Aviles' specimens. *Journal of Herpetology* 30:260–262.
- SABAJ PEREZ, M. H. (ED.). 2014. Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an online reference. Version 5.0 (22 September 2014). Available from: <http://www.asih.org/>, American Society of Ichthyologists and Herpetologists, Washington, DC.
- SAVAGE, J. M. 1982. The enigma of the Central American herpetofauna: dispersals or vicariance. *Annals of the Missouri Botanical Garden* 69: 464–547.
- SCHMIDT-BALLARDO, W. 1991. *Abronia graminea* (Sauria, Anguinae) en la Sierra Mazateca, Oaxaca, México. *Boletín de la Sociedad Herpetológica Mexicana* 3:11–12.
- WEST, R. C. 1964. Surface configuration and associated geology of Middle America. Pages 33–83 in R. C. West (ED.), *Handbook of Middle American Indians*. Volume 1. Natural Environment and Early Cultures. University of Texas Press, USA.
- WEIGMAN, A. F. A. 1828. *Beyträge zur Amphibien-kunde*. *Isis von Oken* 21:364–383.

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