
MORPHOLOGICAL SIMILARITY IN A ZONE OF SYMPATRY BETWEEN TWO *ABRONIA* (SQUAMATA: ANGUIDAE), WITH COMMENTS ON ECOLOGY AND CONSERVATION

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Abstract.—Allopatry among closely related congeners is common, but is sometimes an artifact attributable to geographic sampling bias. In newly recognized zones of sympatry, congeneric species pairs may show character displacement or, alternatively, may show reduced differentiation suggesting ongoing gene flow. The arboreal alligator lizards *Abronia graminea* and *A. taeniata* are secretive, montane-adapted, presumably allopatric species whose taxonomy and biogeography have long been controversial. Through contemporary field surveys and examination of museum specimens we show that, contrary to existing literature, these two taxa are broadly sympatric. Furthermore, our analysis of diagnostic morphology shows that the two taxa lack obvious character displacement and are poorly differentiated in the zone of sympatry. Pending more robust geographic sampling and incorporation of multilocus genetic analysis, we refrain from advocating taxonomic revision and urge additional surveys and specimen collection. We conclude with comments on novel ecological data relevant to the conservation of this genus, which is highly imperiled.

Key Words.—*Abronia graminea*; *Abronia taeniata*; arboreal alligator lizard; character displacement; identification; taxonomy

Resumen.—Entre congéneres estrechamente relacionados es común que exista alopatría, sin embargo este patrón puede ser atribuible a un sesgo en el muestreo. En las zonas de simpatria recién reconocidas, los pares de especies congénicas pueden mostrar divergencia de caracteres o, alternativamente, puede existir poca diferenciación, lo que podría sugerir flujo génico. Los dragoncitos *Abronia graminea* y *A. taeniata* son especies de hábitos secretivos, de adaptación montana, cuya taxonomía y biogeografía han sido polémicas desde hace tiempo. A través de estudios de campo realizados en los últimos años y la revisión de especímenes de museos mostramos que, contrariamente a lo que se menciona en la literatura existente, los dos taxones tienen una amplia zona de simpatria. Además, nuestro análisis de los caracteres diagnósticos muestra que los dos taxones carecen de desplazamiento de caracteres evidentes y que en la zona de simpatria están poco diferenciados morfológicamente. Hasta no tener un muestreo geográfico más representativo y/o contar con un análisis genético multilocus, nos abstenemos de proponer cambios a la taxonomía e instamos a realizar un mayor esfuerzo de muestreo y recolección de muestras. Concluimos con comentarios de datos ecológicos nuevos que podrían ser relevantes para la conservación de este género, que está gravemente en peligro.

Palabras Claves.—*Abronia graminea*; *Abronia taeniata*; dragoncito; desplazamiento de caracteres; identificación; taxonomía

INTRODUCTION

Although allopatric speciation is a common evolutionary pattern (Barraclough and Vogler 2000; Weins 2004), localized geographic sampling of

continuously distributed organisms can create the illusion of allopatry. Such sampling bias can contribute to inappropriate biogeographic and taxonomic conclusions (e.g., Köhler et al. 2014). The eventual discovery of intervening populations can show that

presumed interspecific geographic isolation was an artifact, thus complicating otherwise accepted biogeographic arrangements (Neill 1957; Mercado-Silva et al. 2016). Character displacement (see Pfennig and Pfennig 2010 for a review) in zones of sympatry can indirectly bolster acceptance of the taxonomic validity of the component species (Dyan and Simberloff 2005). Conversely, reduced differentiation in areas of sympatry can suggest ongoing gene flow, and even motivate taxonomic revisions (Neill 1950; Camacho et al. 2016). When reporting range extensions that narrow the distance between closely related allopatric species, it is imperative to emphasize diagnostic morphology and be transparent when identifying the novel material (Clause et al. 2016a).

Allopatric speciation is often considered a hallmark of the evolutionary history of arboreal alligator lizards (Squamata: Anguillidae: *Abronia*), a Mesoamerican clade that has diversified across a discontinuous landscape of high-elevation forest habitats (Campbell and Frost 1993). However, several recent studies have revealed exceptions to this pattern (e.g., Aldape-López and Santos-Moreno 2016a; Thesing et al. 2017). The closely related *Abronia taeniata* (Wiegmann, 1828) and *A. graminea* (Cope, 1864) also present a problematic exception to the allopatry narrative for the genus (de la A. Pérez y Soto 2016; Woolrich-Piña et al. 2017). These two arboreal taxa are montane forest-adapted and are presently considered broadly allopatric in eastern Mexico (Campbell and Frost 1993; Zaldivar Riverón et al. 2002; Canseco-Márquez and Mendoza-Quijano 2007; Flores-Villela and Santos-Barrera 2007). Nevertheless, the supposed geographic gap between these taxa spans uninterrupted, appropriate forest habitat along the southern escarpments of the Sierra Madre Oriental, which suggests a sampling artifact. Further complicating the picture is the long-known presence of seeming morphological intermediates between the two taxa, along a highland corridor between the towns of La Joya and Las Vigas de Ramírez, Veracruz, Mexico (Werler 1951). These intermediates roughly represent the currently accepted northern range limit of *A. graminea*. However, they lie some 50 km to the southwest of the nearest reported populations of *A. taeniata* near Atalpa, Puebla, Mexico (Solano-Zavaleta et al. 2007).

The taxonomic history of these two taxa has been accordingly unstable. Tihen (1949) was the first to relegate *A. graminea* to the status of a subspecies of *A. taeniata*. This taxonomic arrangement was followed by all subsequent authors (Smith and Taylor 1950; Werler 1951; Smith et al. 1952; Werler and Smith 1952; Tihen 1954) until Martin (1955) re-elevated *A. graminea* to full species status. Since then, nearly all workers have considered the two to be distinct species-level lineages,

albeit closely related members of the subgenus *Abronia* (e.g., Campbell and Frost 1993; Liner and Casas-Andreu 2008). A notable exception is Bogert and Porter (1967), who cited Tihen (1954) and their own analysis of 20 undesigned specimens to justify their conclusion that *A. graminea* should remain a subspecies of *A. taeniata*. It is possible that Bogert and Porter (1967) were unaware of the work of Martin (1955).

The morphological features upon which various researchers have based their opposing taxonomic views regarding *A. graminea* and *A. taeniata* were reviewed by Martin (1955). The three features considered diagnostically important are as follows, with the *A. graminea* character state listed first and the *A. taeniata* character state in parentheses: (1) 25–29 transverse dorsal scale rows (30–36 transverse rows in *A. taeniata*); (2) 4–6 longitudinal nuchal scale rows (6 longitudinal rows); and (3) adult dorsal body coloration uniform or sometimes with faint transverse dark bands, particularly in females (adults of both sexes always with dramatic transverse dark bands, occasionally fused along the dorsal midline). Martin (1955) also suggested that dorsal scale keeling and ventral coloration could be used to separate the two species. However, this is not borne out in our recent samples of *A. taeniata* from the core of its range in Hidalgo (Israel Solano-Zavaleta et al., unpubl. data). Conclusions by Martin regarding these two features are likely attributable to sampling bias, because all *A. taeniata* material he analyzed originated from the northern extreme of the range of the species in Tamaulipas.

Despite this seeming morphological differentiation between *A. graminea* and *A. taeniata* (see Bogert and Porter 1967 for an alternative view) there is growing recognition of substantial morphological and genetic diversity within both lineages (Clause et al. 2016b; Israel Solano-Zavaleta unpubl. data). Campbell and Brodie (1999) further suggested that *A. taeniata* might be a composite of multiple species. For these reasons, the biogeography and taxonomy of *A. graminea* and *A. taeniata* remains unsettled.

In this contribution, we present novel distribution records for both species and analyze their morphology and that of historical museum specimens. Our objective is to touch upon the synergistic issues associated with sampling artifacts, specimen identification, and incomplete biogeography and taxonomy, using this system as a case study. We also comment on notable ecological observations related to our new material and briefly discuss their implications for conservation.

MATERIALS AND METHODS

From 2011–2015, we undertook opportunistic and targeted field expeditions for *Abronia* along the south-

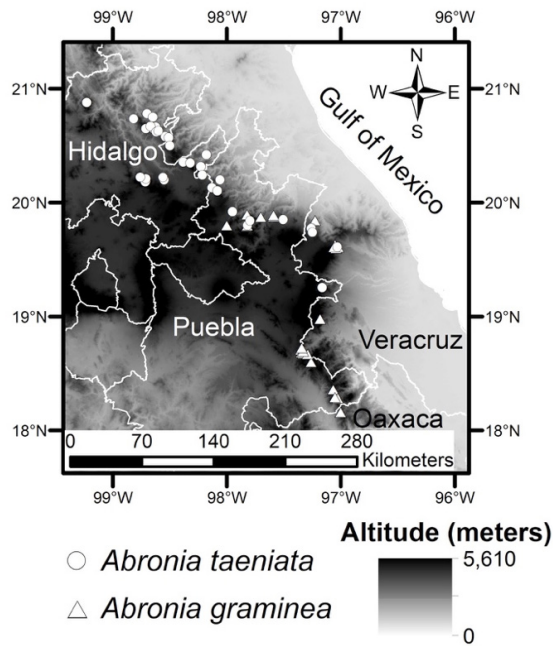


FIGURE 1. *Abronia graminea* and *A. taeniata* localities in the Mexican states of Hidalgo, Puebla, Veracruz, and Oaxaca. This map does not illustrate additional, more northerly *A. taeniata* localities in the states of San Luis Potosí, Queretaro, and Tamaulipas.

ern Sierra Madre Oriental of eastern Mexico. Whenever possible, we collected vouchers from individuals that we encountered. These vouchers typically included whole-body specimens, genetic tissues, and photographs in life. We followed all appropriate guidelines for collecting and preserving specimens recommended by Beaupre (2004). We fixed whole-body vouchers in 10% formalin, preserved them in 70% ethanol, and deposited them in the Museo de Zoología “Alfonso L. Herrera,” Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC-HE). A few specimens are being maintained alive in naturalistic enclosures for community education and captive breeding. These specimens are currently assigned only a field collector number (denoted herein with a hyphen connecting the acronym and the number, e.g., ISZ-900). Upon death, they will also be fixed, preserved, and deposited in the MZFC-HE collection. We deposited photographic vouchers at the Natural History Museum of Los Angeles County (LACM PC; the PC indicates photo collection). We determined sex of adults by manual eversion of hemipenes in life or post-mortem, when possible.

We supplemented our field collections with a review of the published distribution literature for both species. Furthermore, we queried the online VertNet specimen database and the collection holdings of the Colección Nacional de Anfibios y Reptiles (CNAR), Facultad de Ciencias Biológicas, Benemérita Universidad Autónoma de Puebla (EBUAP), Universidad Autónoma del Es-

tado de Hidalgo (UAEH), Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional (ENCB-IPN) and the MZFC-HE to reveal previously unpublished localities. Queries directed to the curators at a comprehensive list of additional Mexican museum collections not published on VertNet failed to yield any additional pertinent records.

Subsequently, we georeferenced and mapped all localities for *A. graminea* and *A. taeniata* from the state of Hidalgo southward. We defined a locality as being at least 1 km distant from any other locality; we treated records < 1 km apart as a single locality. After identifying a geographic region in which *A. taeniata* and *A. graminea* appeared to overlap (roughly corresponding to the area north of Acultzingo, Veracruz and south of Huauchinango, Puebla), we examined nearly all available specimens in that region to evaluate evidence of morphological intergradation. Our unrelated studies of dozens of wild *A. graminea* and *A. taeniata* found outside of this region (where the two species are not known to overlap) have revealed a complete lack of intermediate morphologies (Israel Solano-Zavaleta et al., unpubl. data). Scale definitions and counts follow Bogert and Porter (1967). For animals with divergent counts of complete transverse dorsal scale rows on either side of the dorsal midline (due to aberrant fission/fusion), we express this count as right/left. Museum abbreviations follow Sabaj (2016). Although we give names and municipalities for all *Abronia* localities from our identified region of overlap (north of Acultzingo and south of Huauchinango), we refrain from providing GPS coordinates to help forestall illegal collecting of wild *Abronia* for the pet trade (Altherr 2014; Auliya et al. 2016).

RESULTS

Our new records for both *A. graminea* and *A. taeniata* completely fill the former gap in their respective ranges (Fig. 1). More importantly, the records reveal a broad zone of sympatry between the two taxa that stretches across some 100 km of the southern Sierra Madre Oriental. Animals morphologically attributable to *A. graminea* occur as far west as the vicinity of Chignahuapan, Puebla (CNAR 2713), and animals attributable to *A. taeniata* occur as far east as the vicinity of Ahuatla, Puebla (ISZ-579; Table 1 and 2, Fig. 1). Within the zone of sympatry, we document the first *Abronia* populations of either species from the Veracruz municipality of Atzalan, and from the Puebla municipalities of Ajalpan, Huauchinango, Quimixtlán, and Zacapoaxtla (Table 1 and 2). Furthermore, we confirm the first *A. taeniata* populations from the state of Veracruz, at three localities: Ejido la Selva, in the municipality of Huayacocotla (CNAR 2714); WNW of Altotonga, in the municipality of Altotonga (MZFC-HE

TABLE 1. Morphology of known-locality *Abronia graminea* from the zone of sympatry. Abbreviations are LNSR = longitudinal nuchal scale rows and TDSR = transverse dorsal scale rows.

Voucher Number	Locality	Municipality and State	Dorsal Pattern	LNSR	TDSR	Sex, Age
FMNH 71001	1.2 mi SW of La Joya	Acajete, Veracruz	Uniform	6	28 / 27	Female, adult
UMMZ 105007 (UMFS AB2652)	2 mi W of La Joya	Acajete or Las Vigas de Ramírez, Veracruz	Uniform	6	28 / 29	Male, adult
UMMZ 105007 (UMFS AB2653)	2 mi W of La Joya	Acajete or Las Vigas de Ramírez, Veracruz	Uniform	6	28	Male, adult
UIMNH 21835	3 mi E of Las Vigas de Ramírez	Las Vigas de Ramírez, Veracruz	Uniform	4	26	Adult (female?)
UIMNH 21836	3 mi E of Las Vigas de Ramírez	Las Vigas de Ramírez, Veracruz	Uniform	4	27 / 26	Female, adult
UIMNH 21837	3 mi E of Las Vigas de Ramírez	Las Vigas de Ramírez, Veracruz	Uniform	4	25 / 26	Male, adult
CNAR 12844	Barrio de la Soledad	Tetela de Ocampo, Puebla	Uniform	6	28	Male, adult
LACM PC 2334	Cascada la Gloria, N of Zacapoaxtla	Zacapoaxtla, Puebla	Uniform	5	29	Male, adult
ISZ-544	Cinco Señores	Ajalpan, Puebla	Uniform	6	26	Male, adult
ISZ-545	Cinco Señores	Ajalpan, Puebla	Transverse dark bands, indistinct	6	28	Female, adult
RPS-31	La Cañada, SW of Tetela de Ocampo	Tetela de Ocampo, Puebla	Uniform	6	29	Subadult
MZFC-HE 20024	La Joya	Acajete, Veracruz	Uniform, but with dark longitudinal stripe and irregular marks on flanks	6	29	Adult (female?)
RPS-41	SW of San Esteban Cuautempan	Cuautempan, Puebla	Uniform	6	28	Juvenile
ISZ-741	Rancho El Jacal, NNE of Atzalan	Atzalan, Veracruz	Uniform	6	24	Male, adult
ISZ-971	Texexácatl	Tetela de Ocampo, Puebla	Uniform	6	31	Male, adult
MVZ 191068	W of La Joya	Acajete, Veracruz	Uniform	6	27	Adult
USNM 224801	Xometla, Pico de Orizaba	La Perla, Veracruz	Uniform	6	24 / 25	Adult (female?)
USNM 224802	Xometla, Pico de Orizaba	La Perla, Veracruz	Transverse dark bands	6	27	Neonate
USNM 224803	Xometla, Pico de Orizaba	La Perla, Veracruz	Uniform	6	27 / 26	Adult (female?)
KU 105834	Xometla, Pico de Orizaba	La Perla, Veracruz	Uniform	damaged	25	Male, adult
MZFC-HE 20599	Zacapoaxtla	Zacapoaxtla, Puebla	Uniform	6	30	Adult (male?)

28231, LACM PC 2332); and Reserva Ecológica del Río Pancho Poza, in the municipality of Altotonga (LACM PC 2333). Many earlier authors (Flores-Villela and Gerez 1988; Lambert-Izquierdo 2000; Zaldívar Riverón et al. 2002; Canseco-Márquez and Mendoza-Quijano 2007; Fierro Estrada 2013) had reported or suggested the presence of *A. taeniata* at these or other areas in Veracruz, but they never provided vouchers or other supporting evidence. An earlier work had also reported *Abronia* from the Puebla municipalities of Cuautempan and Tetela de Ocampo (de la A. Pérez y Soto, 2016), but we provide the first vouchers here (Table 1 and 2). In addition, the *A. graminea* documented at Rancho El Jacal, NNE of the municipality of Atzalan (1,170 m

elevation) is the lowest ever reported for the species. The previous lower elevation limit was 2,000 m (Campbell and Frost 1993).

Character displacement is not evident in the zone of sympatry (Table 1 and 2). Instead, morphological differentiation is reduced, with intergrades being widespread across the broad zone of sympatry. The minimum number of longitudinal nuchal scale rows appears to be largely uninformative for separating *A. graminea* and *A. taeniata* in this zone. Most *A. graminea* (16 of 20) and nearly all *A. taeniata* (13 of 14) presented with counts of six. One *A. graminea* had a count of five and three *A. graminea* plus one *A. taeniata* had a count of four. Moreover, transverse dorsal scale row counts

TABLE 2. Morphology of known-locality *Abronia taeniata* from the zone of sympatry. Abbreviations are LNSR = longitudinal nuchal scale rows and TDSR = transverse dorsal scale rows.

Voucher Number	Locality	Municipality and State	Dorsal Pattern	LNSR	TDSR	Sex, Age
ISZ-200	Atalpa	Tlatlauquitepec, Puebla	Transverse dark bands, some fused middorsally	6	34	Female, adult
ISZ-201	Atalpa	Tlatlauquitepec, Puebla	Transverse dark bands, some fused middorsally	6	34	Female, adult
CNAR 12845	Barrio de la Soledad	Tetela de Ocampo, Puebla	Transverse dark bands	6	29	Female, adult
ISZ-579	E of Ahuatla	Quimixtlán, Puebla	Transverse dark bands, indistinct	6	26	Subadult
UIMNH 19512	La Joya	Acajete, Veracruz	Transverse dark bands, indistinct	6	26	Old juvenile
UIMNH 19513	La Joya	Acajete, Veracruz	Transverse dark bands	6	27 / 28	Old juvenile
CHJ-1029	Teopancingo	Huauchinango, Puebla	Transverse dark bands	6	29	Female, adult
MZFC-HE 6291	Totolapa	Huauchinango, Puebla	Transverse dark bands, fused middorsally	6	30	Male, adult
LACM PC 1825	WNW of Altotonga	Altotonga, Veracruz	Transverse dark bands	6	29 / 30	Subadult
ISZ-739	WNW of Altotonga	Altotonga, Veracruz	Transverse dark bands, some fused middorsally	6	28	Male, adult
ISZ-740	WNW of Altotonga	Altotonga, Veracruz	Transverse dark bands, some fused middorsally	6	34	Female, adult
ISZ-991	WNW of Altotonga	Altotonga, Veracruz	Transverse dark bands, some fused middorsally	6	32	Male, adult
ISZ-992	WNW of Altotonga	Altotonga, Veracruz	Transverse dark bands, some fused middorsally	6	28	Male, adult
RPS-131	ENE of Tetela de Ocampo	Tetela de Ocampo, Puebla	Transverse dark bands	4	30 / 29	Subadult

overlap between the two taxa, although on average they remain divergent. Across the zone of sympatry, *A. graminea* counts ranged from 24–31 (mean = 27.3, n = 21), while *A. taeniata* counts ranged from 26–34 (mean = 29.8, n = 14). Only dorsal body coloration (Fig. 2) remains generally reliable for identifying *Abronia* in this geographic area. However, even this character is challenging. It cannot be used to identify neonates or juveniles, which possess distinct transverse bands in both species. Moreover, as our own data indicates, subadults and adult females of both species often retain various degrees of transverse banding on the body. Species-level attribution is also difficult for *A. graminea* undergoing the ontogenetic transition from the banded juvenile pattern to the more uniform adult pattern.

DISCUSSION

Our documentation of sympatry between *A. graminea* and *A. taeniata* builds upon a growing body of literature showing sympatry to be more widespread in the genus than previously believed. We consider congeneric populations sympatric if they occur within 10 airline km of each other on the slopes of the same mountain or massif. Aside from *A. graminea/A. taeniata*, six other cases of sympatry have been documented in *Abronia*, representing six independent species pairs. However,

only two of these six cases involve syntopy, with the species occurring side-by-side (Campbell and Frost 1993; Aldape-López and Santos-Moreno 2016a). For the other four cases, evidence suggests that the species are segregated from each other by forest type and/or elevation (Campbell and Frost 1993; Torres et al. 2013; Clause et al. 2016c; Thesing et al. 2017). In contrast to the 100-km zone of sympatry in *A. graminea* and *A. taeniata*, most cases of congeneric sympatry in *Abronia* involve small areas of documented range overlap. The sole exception is that of *A. fimbriata* and *A. gaiophasma*, which occur in sympatry across a roughly 50-km arc of the Sierra de Xucaneb and western Sierra de las Minas of eastern Guatemala (Acevedo et al. 2014; Ariano-Sánchez et al. 2014).

Within our documented zone of sympatry, there is no obvious signal of *A. graminea* and *A. taeniata* being segregated by elevation or forest type, although *A. taeniata* appears to occupy a more restricted elevational range. In the zone of sympatry, *A. graminea* is found at 1,170–2,520 m elevation, while *A. taeniata* is found at 1,810–2,090 m elevation. Nonetheless, syntopic co-occurrence of these two taxa remains undocumented except for the forests surrounding Barrio de la Soledad and La Cañada, in the municipality of Tetela de Ocampo, Puebla. In this area, one adult male and one subadult attributable to *A. graminea* (CNAR 12844 and RPS-31,



FIGURE 2. *Abronia graminea* and *A. taeniata* in life from the southern Sierra Madre Oriental of Mexico, in the zone of sympatry. Clockwise from top: *A. graminea*, Tepexácatl, Puebla (ISZ-971); *A. graminea*, Zacapoaxtla, Puebla (LACM PC 2334), *A. graminea*, Rancho El Jacal, Veracruz (ISZ-741); *A. taeniata*, WNW of Altotonga, Veracruz (LACM PC 2332); *A. taeniata*, ENE of Tetela de Ocampo, Puebla (RPS-131). (Photographed by clockwise from top, Israel Solano-Zavaleta, Peter Heimes, Luis Felipe Vázquez-Vega, Karlo A. Soto-Huerta, and Rosalía de la A. Pérez y Soto).

respectively) and a single adult female attributable to *A. taeniata* (CNAR 12845) are available. More samples from this and other areas are needed to resolve whether these taxa are usually spatially segregated by habitat features, or if they regularly occur in syntopy across the zone of sympatry.

Lack of obvious character displacement, indeed the reduction of morphological differentiation, between *A. graminea* and *A. taeniata* in the zone of sympatry is pronounced. This result suggests that these two taxa interbreed in this region. Nonetheless, due to sparse geographic coverage and limited sample size, and pending the availability of multilocus genetic data, we refrain from claiming that hybridization occurs and do not advocate any nomenclatural changes. In the

interest of taxonomic stability (Pauly et al. 2009), and in keeping with recent suggestions for species delimitation (Carstens et al. 2013), we consider it best to cautiously retain *A. graminea* and *A. taeniata* as species-level entities for now.

Multilocus sequence data is currently being developed to more accurately characterize these taxa and clarify their degree of reproductive isolation. Until this data becomes available, we strongly emphasize the difficulty associated with species-level identification of *Abronia* within our mapped zone of sympatry. Indeed, we ourselves consider our species-level attribution to be highly tentative for all specimens from this zone. We encourage other authors to be similarly transparent in

their allocation of any new *Abronia* material from this area in the future.

Substantial additional sampling is needed to rigorously resolve the taxonomy and biogeography of *Abronia* in the southern Sierra Madre Oriental. However, securing sufficient material is challenging due to the general difficulty in encountering these lizards. This difficulty is largely a consequence of their elusive, arboreal habits. We intend for this report to raise awareness of identification issues associated with these two *Abronia* lineages and bring attention to the existence of a broad zone of sympatry unsurpassed in scale within the genus. Our hope is that our contribution will stimulate additional field efforts and research. To that end, we reiterate Clause et al. (2016a) and strongly encourage both vocational and avocational herpetologists who encounter *A. graminea* or *A. taeniata* at a novel locality to deposit physical material (especially a DNA sample) in a reputable museum, when permits allow.

Our new *Abronia* material also sheds light on the ecology and conservation status of this poorly known taxon. Although little natural history information is available for any species of *Abronia*, members of the genus are generally considered to be solitary. However, Dixon and Lemos-Espinal (2010) reported a discovery of five *A. taeniata* clustered in a crevice between two limestone boulders in winter, at an undisclosed location. This same observation was reiterated by Lemos-Espinal and Dixon (2013). Stephenson et al. (2008) had earlier suggested that in forests with few large epiphytes, *A. taeniata* might rely upon terrestrial refugia for shelter during poor weather conditions.

We now add additional observations of this species congregating in the wild. On 12 February 2015 in the Reserva Ecológica del Río Pancho Poza in the municipality of Altotonga, Veracruz, one of our collaborators (Miguel Ángel Enríquez Pita) encountered 15 individual *A. taeniata* congregating in the hollow of a dead, recently fallen tree. This group consisted of four adult males, six adult females, and five juveniles. In addition, on an unrecorded date in December 2012, this same observer documented several *Abronia taeniata* hiding in a nearly vertical crack in a bedrock cliff within the Reserva Ecológica del Río Pancho Poza. Although similarly anecdotal, we have also received two independent first-hand accounts of *A. taeniata* congregating in hollows within oak trees, in the vicinity of La Mojonera, in the municipality of Zacualtipán de Ángeles, Hidalgo. These lizards were discovered when the trees were felled by carboneros (coal workers). Cumulatively, this data suggests that during inclement weather and/or during the non-breeding season, *A. taeniata* occasionally congregate in available tree or rock cavities for shelter. We predict that similar behavior will eventually be documented in congeners.

Conservation of *Abronia* is an urgent concern. The restricted extent of their montane forest habitat (Ruiz-Jiménez et al. 2012), ongoing decline of this habitat (Toledo-Aceves et al. 2011) and expected habitat contractions under climate-change scenarios (Rojas-Soto et al. 2012) all contribute to the imperilment of *Abronia*. Nonetheless, available literature is spotty, inconsistent, and largely anecdotal regarding the sensitivity of *Abronia* to anthropogenic modification or fragmentation of their forest habitat. Canseco-Márquez and Mendoza-Quijano (2007) indicated that *A. taeniata* does not occur in modified areas. Flores-Villela and Santos-Barrera (2007) considered it unlikely that degraded habitat is suitable for *A. graminea*, and similar claims exist for congeners *A. deppii*, *A. martindelcampoi*, *A. michelli*, *A. montecristoi*, and *A. ornelasi* (International Union for the Conservation of Nature [IUCN] 2016). Campbell (2000) stated that *A. fimbriata* and *A. gaiophasma* “tend to be eliminated” or become “drastically reduced” in abundance by human alteration of untouched forest. Campbell and Brodie (1999) described a 50-y history of severe disturbance to the isolated montane forests inhabited by *A. meledona*, which this species has survived possibly due to the establishment of private nature reserves (Torres-Almazán and Urbina-Aguilar 2011). However, *A. frosti* and *A. mixteca* have been recorded in disturbed forest subjected to ongoing logging (Ariano-Sánchez et al. 2011; Aldape-López and Santos-Moreno 2016b). Similarly, *A. oaxacae* has been documented in “moderately disturbed areas” and areas modified for agricultural use (Campbell 2007; Illescas-Aparicio et al. 2016). Some authors also suggest that both *A. lythrochila* and *A. smithi* are adaptable to selective logging (Campbell and Muñoz-Alonso 2007a, 2007b). A recently re-discovered population of *A. campbelli* is known to persist in large oak trees (*Quercus peduncularis* and *Q. brachystachys*) isolated in a matrix of cattle pastures (Ariano-Sánchez and Torres-Almazán 2010), providing the first clear evidence that *Abronia* can persist for decades in highly human-modified landscapes.

We now report similar observations for *A. taeniata* at two rural ranches WNW of Altotonga, Veracruz. At one ranch, we captured two lizards (LACM PC 1825, 2332) in a large, epiphyte-laden hardwood tree isolated in a pasture. At the second ranch, we captured a pair of adult lizards (ISZ-739 and ISZ-740) in a disturbed Loquat (*Eriobotrya japonica*) orchard adjacent to a mosaic of pastures, maize fields, open Avocado (*Persea americana*) orchards, and highly fragmented cloud forest dominated by alders (*Alnus* sp.). We emphasize that more data are needed to evaluate if such populations show equivalent densities and demographics relative to populations inhabiting intact forest. Moreover, we hypothesize that highly human-altered habitats

might be population sinks, and thus could be unviable for long-term persistence of *Abronia*. These caveats aside, existing information now indicates that forest disturbance and fragmentation might not, in fact, be as serious a threat to certain *Abronia* as some have believed.

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