
ADELPHICOS LATIFASCIATUM (SQUAMATA: DIPSADIDAE)

OCCURS IN CHIAPAS, MEXICO, AND IS IMPERILED

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Abstract.—Because of their secretive behavior, the distribution and ecology of snakes and other herpetofauna are often comparatively understudied, which can impede conservation decision-making. The snake genus *Adelphicos* is one such poorly known group from the Mesoamerica biodiversity hotspot. Within this genus, an especially mysterious species is the currently named Oaxacan Burrowing Snake (*Adelphicos latifasciatum*), which is endemic to southern Mexico and known from just seven specimens. Moreover, what little information that is available for this species is sometimes incomplete or with details that remain unpublished. Here, we report on new material that more than doubles the number of *A. latifasciatum* specimens known to science. These new, precise records extend the range of the species by 185 km into the Mexican state of Chiapas, substantiate its presence in two protected areas, and increase the number of reptile species recognized from Chiapas to 230. Additionally, we clarify the elevational range, forest habitat associations, morphological variation, and Latin nomenclature of *A. latifasciatum*, and propose a new common name: Broad-striped Burrowing Snake. We conclude by recommending the re-categorization of the species as Vulnerable (criteria B1ab[iii]+B2ab[iii]) on the Red List of Threatened Species of the International Union for Conservation of Nature, and as Threatened (criteria A[I]+B[II]+C[II]+D[II]) on the Norma Oficial Mexicana list of the Mexican federal government.

Key Words.—Chimalapas Highlands; conservation; morphology; Oaxaca; reptile; Sierra Madre de Chiapas; snake

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Resumen.—Debido a su comportamiento reservado, la distribución y ecología de las serpientes y otra herpetofauna a menudo se encuentran comparativamente poco estudiadas, lo que puede dificultar la toma de decisiones sobre su conservación. El género de serpientes *Adelphicos* es uno de esos grupos poco conocidos del hotspot de biodiversidad de Mesoamérica. Dentro de este género, una especie especialmente misteriosa es la actualmente llamada Ocotera de Oaxaca (*Adelphicos latifasciatum*), que es endémica del sur de México y se conoce a partir de solo siete especímenes. Además, la poca información disponible para esta especie a veces es incompleta o contiene detalles que no se han publicado. Aquí, informamos sobre material nuevo que duplica con creces el número de especímenes de *A. latifasciatum* conocidos para la ciencia. Estos nuevos y precisos registros extienden la distribución de la especie en 185 km hacia el estado mexicano de Chiapas, corroboran su presencia en dos áreas naturales protegidas y aumentan el número de especies de reptiles reconocidas en Chiapas a 230. Adicionalmente, aclaramos el intervalo de altitud, asociaciones de hábitats forestales, variación morfológica y nomenclatura científica de *A. latifasciatum*, y proponemos un nuevo nombre común: Ocotera de Rayas Anchas. Concluimos recomendando la reclasificación de la especie como Vulnerable (criterios B1ab[iii]+B2ab[iii]) en la Lista Roja de Especies Amenazadas de la Unión Internacional para la Conservación de la Naturaleza, y como Amenazada (criterios A[I]+B[II]+C[II]+D[II]) en la lista de la Norma Oficial Mexicana del gobierno federal mexicano.

Palabras Clave.—Tierras altas de los Chimalapas; conservación; morfología; Oaxaca; reptil; serpiente; Sierra Madre de Chiapas

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INTRODUCTION

The distribution of many reptiles and amphibians remains poorly known. This pattern is most pronounced in species with secretive life histories that occur in inaccessible habitats, which makes targeted sampling difficult (Campbell and Frost 1993; Mendelson et al. 2015; Wallach 2016). For such elusive animals, documenting just a few new individuals can substantially increase scientific knowledge. Both serendipitous field encounters (Percino-Daniel et al. 2012; Bouzid et al. 2015; Pavón-Vázquez et al. 2015; Quah et al. 2018) and careful inspection of museum collections (Nishikawa 2009; Valdez-Villavicencio et al. 2016; Wylie and Grünwald 2016) can yield valuable biogeographical data. These opportunities are especially common in remote, little-explored tropical regions subject to pressing conservation concerns (Meiri et al. 2018). Globally, the tropics encompass all or most of 16 of the 25 recognized biodiversity hotspots, which have high rates of species endemism but also suffer from high levels of habitat loss and degradation (Myers et al. 2000). Within these hotspots, knowledge of regional species assemblages and even the fauna within protected areas is often far from complete.

The dipsadid snake genus *Adelphicos* is one such understudied, endemic component of the Mesoamerica biodiversity hotspot. Members of the genus are predominantly fossorial, occur from eastern Mexico to northern Nicaragua, and are usually restricted to highland forests (Wallach et al. 2014). Among the most rarely seen species is the Oaxacan Burrowing Snake (*Adelphicos latifasciatum*). This taxon is endemic to southern Mexico in Oaxaca and possibly Chiapas, being known from two localities in the southeastern Chimalapas Highlands (Campbell and Ford 1982; Campbell and Brodie 1988) and an additional vague record in the western Sierra Madre de Chiapas (Heimes 2016). Only seven specimens of *A. latifasciatum* have ever been reported in the literature (Lynch and Smith 1966; Campbell and Ford 1982; Campbell et al. 2018), and no records exist on public online platforms such as iNaturalist or HerpMapper as of December 2021. Accordingly, the Red List of Threatened Species of the International Union for Conservation of Nature (IUCN) currently categorizes *A. latifasciatum* as Data Deficient (Flores-Villela et al. 2007).

Not only is *A. latifasciatum* an enigmatic taxon, but available information is sometimes incomplete, inconsistent, or unpublished. For example, some recent authors do not list the species as occurring in the Mexican state of Chiapas (Wallach et al. 2014; Johnson et al. 2015), whereas many others do so without providing precise supporting information (Núñez Orantes and Muñoz Alonso 2000; Muñoz Alonso et al. 2004; Flores-

Villela et al. 2007; Luna-Reyes et al. 2013; Heimes 2016; Luna-Reyes 2019). These and other sources also differ in their treatment of the elevational range and occupied habitat types of *A. latifasciatum*. The scientific nomenclature of the species is conflicted as well, with some recent workers using the name *A. latifasciatus* (Núñez Orantes and Muñoz Alonso 2000; Köhler 2008; Heimes 2016; Campbell et al. 2018), an issue that we explore herein. To resolve these and other uncertainties and offer an update, we reviewed pertinent literature and unpublished museum records, motivated largely by our recent good fortune in encountering several *A. latifasciatum* in the wild. Based on our review, we here validate a much broader geographic distribution for the species, and clarify its elevational range, forest habitat associations, morphological variation, and nomenclature before re-visiting its categorization on both national and international imperiled species lists.

MATERIALS AND METHODS

We assembled museum-vouchered localities by querying the online VertNet specimen portal (<http://vertnet.org>) and GBIF portal (<http://gbif.org>), together with queries directed to the specimen holdings of the Colección Zoológica Regional Herpetológica of the Secretaría de Medio Ambiente e Historia Natural (CZR-HE, formerly IHNHERP), the Museo de Zoología “Alfonso L. Herrera,” Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC-HE), and the University of Texas at Arlington (UTA R). A query of the Colección Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México (CNAR) did not return relevant data, and we were unable to access the Colección Herpetológica of El Colegio de la Frontera Sur, San Cristóbal de Las Casas (ECSO-SC-H). Subsequently, we cross-referenced this dataset with literature from queries to Web of Science (<http://webofscience.com>), using the Latin name of *A. latifasciatum* and all synonyms as search terms. We independently corroborated georeferenced localities returned from these museum- and literature-based searches using the Mapa Digital de México (<http://gaia.inegi.org.mx>), following the point-radius georeferencing protocol described by Wieczorek et al. (2004). We define a locality as being at least one airline km from any other locality. When two or more records were less than one airline km from each other, we selected a single point approximately midway between them for reporting herein. Conversely, when elevation data for multiple records from the same mountain clearly separated those records by over one airline km, we considered them different localities.

We supplemented this dataset with our personal field records for *A. latifasciatum* from 1993, 1995, 2014, and

2018. Some of these records were previously referenced (Núñez Orantes and Muñoz Alonso 2000; Luna-Reyes et al. 2013; Luna-Reyes 2019) but we here provide detailed, vouchered data for the first time. For each record we deposited either (1) a physical voucher at the CZR-HE; (2) a physical voucher at the MZFC-HE that included both liver tissue and a whole-body specimen; or (3) digital photographic vouchers at the Natural History Museum of Los Angeles County, California, USA (LACM PC; the PC indicates photographic collection).

To determine which georeferenced localities for *A. latifasciatum* lie within a protected area, we referenced the World Database on Protected Areas (available from Protected Planet at <http://www.protectedplanet.net>). We then re-evaluated the IUCN Red List categorization of *A. latifasciatum* using guidelines from the IUCN Standards and Petitions Committee (2019). For geographic range calculations, we drew a minimum convex polygon around all *A. latifasciatum* localities to estimate its extent of occurrence, and we summed all grid cells containing one or more of these localities across a 2×2 km grid to estimate its area of occupancy. Additionally, we revisited the Environmental Vulnerability Score for *A. latifasciatum* (see Mata-Silva et al. 2015) and its national protected status in Mexico under the Norma Oficial Mexicana list (Secretaría de Medio Ambiente y Recursos Naturales [SEMARNAT] 2010).

We measured collected specimens immediately after euthanasia using dial calipers (MZFC-HE specimens), or post-preservation by tracing string along the midline of coiled specimens before measuring the string (CZR-HE specimens). We rounded all reported measurements to the nearest 1 mm. We followed Campbell and Brodie (1988) for scale nomenclature, and Dowling (1951) for counting ventral scales. We attributed new *Adelphicos* material to the *veraepacis* group based on the presence of a third infralabial scale that is unreduced, being as large or larger than the second infralabial; and unexpanded chinshields not in contact with the lip. Past authors have considered both traits diagnostic of this group (Smith 1942; Campbell and Brodie 1988). We further identified our new material as *A. latifasciatum* based on four diagnostic characters recognized by Campbell and Ford (1982) and/or Campbell and Brodie (1988): (1) presence of a wide, dark vertebral stripe involving the paravertebral scale rows; (2) absence of dark dorsolateral stripes; (3) presence of a wide, dark ventrolateral stripe involving scale row 3 and adjacent halves of rows 2 and 4; and (4) subcaudal scales > 42 (males) or > 32 (females). For new *Adelphicos* material vouchered only from photographs, we could not verify the condition of the infralabials/chinshields and/or the subcaudal scales, but all other characters were clearly visible and matched *A. latifasciatum*.

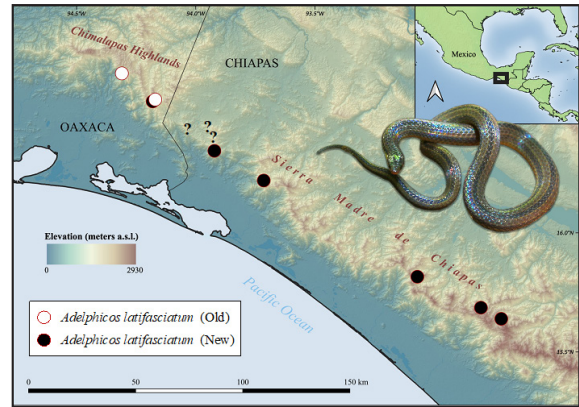


FIGURE 1. Geographic distribution of the Broad-striped Burrowing Snake (*Adelphicos latifasciatum*) based on a review of the literature and museum collections. Question marks indicate possible locations for an imprecise record (Heimes 2016) discussed in the text. Note that the Oaxaca/Chiapas state boundary is politically contested. Inset illustrates *A. latifasciatum* voucher from Cerro La Palmita, Chiapas in life (LACM PC 2516–2518, juvenile male). (Photographed by Adam G. Clause).

RESULTS

We identified nine new records, more than doubling the *A. latifasciatum* material known to science. These records originate from six localities scattered across the Chimalapas Highlands and the Sierra Madre de Chiapas, Mexico, increasing the total number of known localities to eight (Fig. 1). Within these mountainous areas, known localities for the species exist on both the Gulf of Mexico (interior) and Pacific (coastal) slopes (Table 1). The federally protected Reserva de la Biósfera La Sepultura and Reserva de la Biósfera El Triunfo contain two and three of the new localities of *A. latifasciatum*, respectively (Table 1). These are the first precise, vouchered reports of the species from the reserves, although several earlier authors had indicated the presence of the species there without providing specifics (Luna-Reyes 1997; Muñoz Alonso et al. 2004; Flores-Villela et al. 2007; Heimes 2016; Luna-Reyes 2019).

Our new material shows notable variability in six morphological features, some of which were previously considered of diagnostic value by Campbell and Ford (1982) and Campbell and Brodie (1988), as follows: (1) in preservative and to a lesser extent in life, the wide dark vertebral stripe sometimes fades along the dorsal midline (particularly on the anterior half of the body) to nearly take the form of two paravertebral dark pinstripes (Fig. 2); (2) in life one adult female (MZFC-HE 33492) has an unusually dark brown dorsal ground color (Fig. 2); (3) both in life and preservative, four specimens (three females and one male) have limited to moderate dark flecking or spots on the pale ventral scales, often concentrated along the midline and the posterior two-

TABLE 1. Vouchered localities for *Adelphicos latifasciatum*, based on a review of the literature and museum collections. Datum WGS 84 for all coordinates. All elevation values rounded to the nearest 5 m. Note that Belisario Domínguez is a newly-designated Municipality; previously the area was considered by Chiapanecos to be part of the Municipality of Cintalapa. Abbreviations are REBISE = Reserva de la Biósfera La Sepultura; REBITRI = Reserva de la Biósfera El Triunfo; CZR-HE = Colección Zoológica Regional Herpetológica de la Secretaría de Medio Ambiente e Historia Natural; LACM PC = Natural History Museum of Los Angeles County photographic collection; MZFC-HE = Museo de Zoología “Alfonso L. Herrera,” Facultad de Ciencias, Universidad Nacional Autónoma de México; UTA R = University of Texas at Arlington.

State	Municipality	Locality	Slope (Versant)	Protected Area	Latitude	Longitude	Elevation (m)	Voucher/Source
Oaxaca	San Miguel Chimalapa or Santo Domingo Zanatepec	Sierra Madre north of Zanatepec	unknown	none	16.67	-94.31	unknown	UIMNH 56147; Lynch & Smith 1966
Chiapas or Oaxaca	Belisario Domínguez or San Miguel Chimalapa	Cerro Baúl	Interior (Gulf of Mexico)	none	16.56	-94.17	1530–1830	UTA R-6213, 8793–8794, 12244–12246; Campbell & Ford 1982, Campbell et al. 2018
Chiapas or Oaxaca	Belisario Domínguez or San Miguel Chimalapa	Southeast edge of Colonia Rodolfo Figueroa, 1.9 km S and 1.3 km W (airline) of the peak of Cerro Baúl	Interior (Gulf of Mexico)	none	16.55225	-94.18079	1350	MZFC-HE 28859; this work
Chiapas	Cintalapa	La Sepultura	unknown	REBISE	unknown	unknown	1200	color photograph in Heimes 2016
Chiapas	Arriaga	Predio El Recuerdo II, 2.5 km S and 0.6 km W (airline) of the peak of Cerro La Palmita	Coastal (Pacific)	REBISE	16.345	-93.922	1125–1130	MZFC-HE 33492, LACM PC 2516–2518; this work
Chiapas	Villaflores	Ejido Tierra y Libertad, Cerro El Chumpipe	Interior (Gulf of Mexico)	REBISE	16.221	-93.715	1270–1290	CZR-HE 2992, 2997; this work
Chiapas	La Concordia	Predio Bélgica	Interior (Gulf of Mexico)	REBITRI	15.8158	-93.0706	1680	CZR-HE 1965, 2004; this work
Chiapas	Ángel Albino Corzo	Ejido Santa Rita, ca. 600 m S of the rancharía, 13 km S and 5 km W (airline) of Nueva Palestina	Interior (Gulf of Mexico)	REBITRI	15.686	-92.804	1300	LACM PC 2708–2711; this work
Chiapas	Montecristo de Guerrero	Ejido Toluca, Barrio Río Negro	Interior (Gulf of Mexico)	REBITRI	15.639	-92.719	1350	CZR-HE 2556; this work

thirds of the body (Fig. 2); (4) the tail length in four female specimens ranges from 13.1–14.4% of total length, extending the lower bound of the previously documented range of 14.6–15.6% (Campbell and Brodie 1988); (5) subcaudal scale counts in five female specimens range from 33–35, extending the lower bound of the previously documented range of 37–41 (Campbell and Brodie 1988); (6) ventral counts in

female specimens range from 127–141, expanding the previously documented range of 133–138 (Campbell and Brodie 1988). A reddish to pale brown ground color, immaculate ventral scales, and a tail length > 14% of total length in females were previously considered diagnostic of *A. latifasciatum* among members of the *veraepacis* group (Campbell and Ford 1982; Campbell and Brodie 1988). Notably, the variation documented

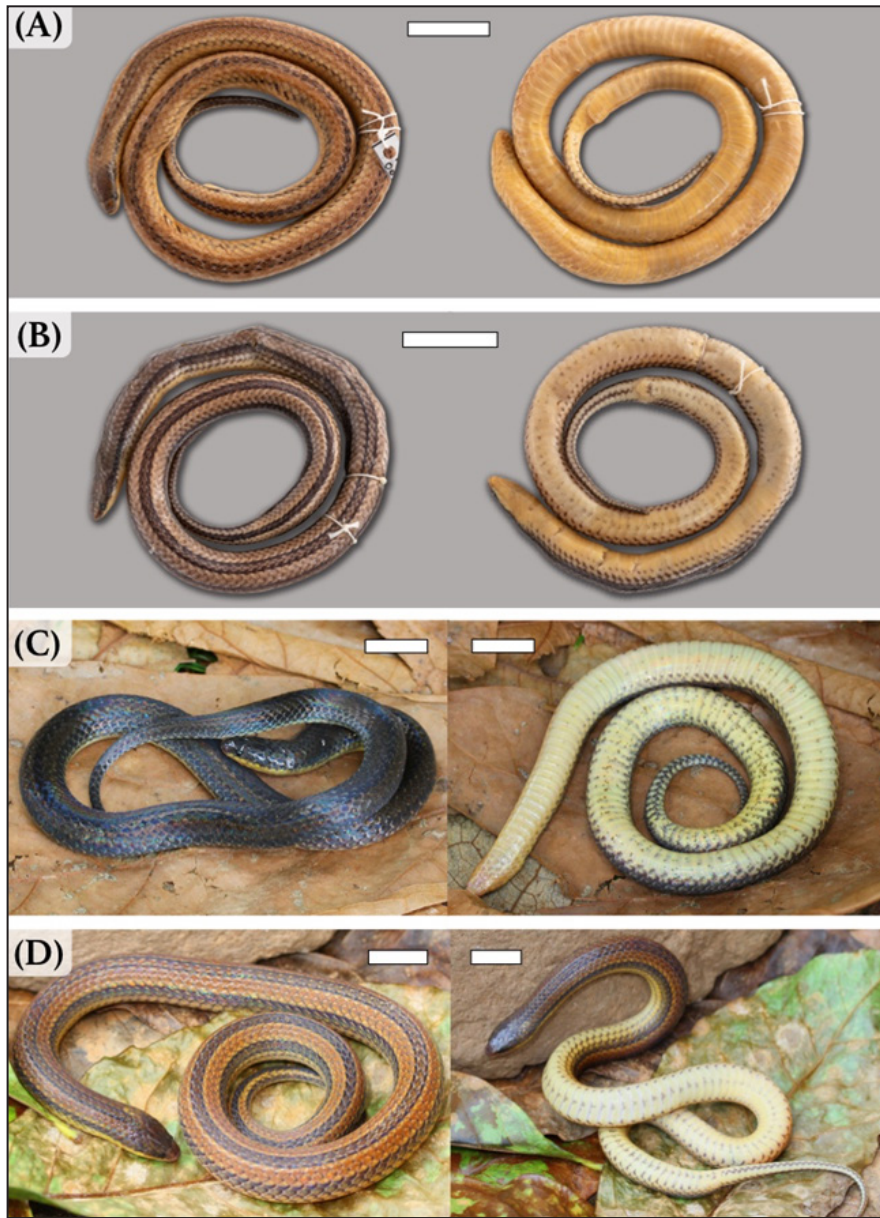


FIGURE 2. Dorsal and ventral views of four female Broad-striped Burrowing Snakes (*Adelphicos latifasciatum*) illustrating color pattern variation. From top, specimens ordered geographically from east to west: (A) CZR-HE 2556 (310 mm snout-vent-length [SVL]) from Ejido Toluca in preservative; (B) CZR-HE 2997 (246 mm SVL) from Cerro El Chumpipe in preservative; (C) MZFC-HE 33492 (358 mm SVL) from Cerro La Palmita in life; and (D) MZFC-HE 28859 (370 mm SVL) from Colonia Rodolfo Figueroa in life. Scale bar = 2 cm in all panels. (Photographs A–B by Luis Enrique Gómez Pérez, and C–D by Adam G. Clause).

in our new material indicates that these three characters are less informative or uninformative for identifying *A. latifasciatum*, because they now overlap with one or more congeners (see Table 1 in Campbell and Brodie 1988). Variation in the other three characters leaves their diagnostic usefulness unchanged, although in some cases they were never ascribed diagnostic value to begin with.

Although most populations of *A. latifasciatum* are now known from protected areas, we recommend

re-categorizing the species as Vulnerable (criteria B1ab[iii]+B2ab[iii]) on the IUCN Red List of Threatened Species, and we code this category change as Nongenuine: New Information (IUCN Standards and Petitions Committee 2019). Our recommendation differs from the suggestion by Mata-Silva et al. (2015) to re-categorize the species as Endangered, but unlike those authors we base our determination on the IUCN Red List criteria. Our recommendation is also generally consistent with the existing Environmental Vulnerability

Score (EVS) of 15 out of 20 for *A. latifasciatum*, which places it near the lower end of the High Vulnerability category (Mata-Silva et al. 2015). We advise that the EVS of the species remain unchanged. In contrast, the Mexican federal government currently categorizes *A. latifasciatum* as Sujeta a Protección Especial (Subject to Special Protection) on the Norma Oficial Mexicana list of imperiled species (SEMARNAT 2010). We recommend that the species be re-categorized as Amenazada (Threatened) on this list, based on *A. latifasciatum* meeting criteria A(I)+B(II)+C(II)+D(II) as outlined under the Anexo Normativo I (SEMARNAT 2010). In our Discussion, we offer detailed justification of our proposals to update the IUCN and SEMARNAT listings for *A. latifasciatum*.

DISCUSSION

The new records of *A. latifasciatum* that we report herein markedly expand our biogeographical knowledge of the species and have important implications for its conservation. The most recent, authoritative herpetofaunal checklist for Chiapas (Johnson et al. 2015) did not list *A. latifasciatum* as occurring in the state. Several authors before and since, however, have indicated the presence of the species in Chiapas (Luna-Reyes 1997; Muñoz Alonso et al. 2004; Flores-Villela et al. 2007; Luna-Reyes et al. 2013; Heimes 2016; Luna-Reyes 2019). A possible cause of this discrepancy is that Cerro Baúl, which is one of three historical localities for *A. latifasciatum*, is politically contested between Chiapas and the neighboring state of Oaxaca (Lamoreux et al. 2015; Clause et al. 2016). Regardless, no source has substantiated *A. latifasciatum* material from Chiapas, except for Heimes (2016) who published a color photograph attributed to the species from “La Sepultura, Municipio de Cintalapa, Sierra Madre de Chiapas, elevation 1,200 m.” The identifier “La Sepultura” presumably refers to the Reserva de la Biósfera La Sepultura (REBISE). This locality is nonetheless imprecise, because within the overlap zone of REBISE and the Municipality of Cintalapa, the 1,200 m contour is exceeded in three non-contiguous areas separated by distances of 5–15 airline km. In the distribution map, we indicated these three areas with question marks. Other authors have also previously stated that the species is known from REBISE, which lies almost entirely within Chiapas, but they offer no supporting evidence (Núñez Orantes and Muñoz Alonso 2000; Flores-Villela et al. 2007). Our new records conclusively resolve these inter-related issues by substantiating multiple *A. latifasciatum* populations in Chiapas that cumulatively extend the distribution of the species by 185 airline km to the southeast, including several populations from REBISE.

The elevational range of *A. latifasciatum* is variously reported in the literature as 1,500–1,900 m (Campbell and Ford 1982; Campbell and Brodie 1988; Flores-Villela et al. 2007), 1,500–2,000 m (Tipton 2005; Köhler 2008; Johnson et al. 2010; Wilson and Johnson 2010), 1,200–2,000 m (Heimes 2016), and 1,000–2,000 m (Wallach et al. 2014). The causes of these discrepancies are unclear, but different interpretations of the vague type-locality for *A. latifasciatum* (“Sierra Madre north of Zanatepec, Oaxaca, Mexico” [Lynch and Smith 1966]) is perhaps the most probable explanation. Regardless, our review of vouchered records confirms that precise localities for the species span 1,125–1,680 m, although historical specimens from Cerro Baúl may have been taken from as high as 1,830 m. We expect that the true elevational range of *A. latifasciatum* extends both above and below these limits, but confirmation must await the acquisition of new material.

Using the vegetation classification system of Campbell (1999), Wilson and Johnson (2010) stated that *A. latifasciatum* inhabits both Lower Montane Wet Forest and Lower Montane Moist Forest. More specifically, several authors report that *A. latifasciatum* is found only in Cloud Forest (Campbell et al. 1982; Köhler 2008), whereas others indicate that the species also occurs in Pine Forest (Flores-Villela et al. 2007), Pine-oak Forest (Johnson et al. 2010; Heimes 2016), and Pine-oak *Liquidambar* Forest (Johnson et al. 2010). The so-called Cloud Forest is sometimes a catch-all term applied to humid highland forests of many different tree assemblages in Mexico (Ruiz-Jiménez et al. 2012; Ochoa-Ochoa et al. 2017), which could explain some of these discrepancies. Our new records of *A. latifasciatum* from Cerro La Palmita demonstrate that the species also occurs in what is known regionally as *selva mediana subcaducifolia* (Miranda 2015; Fig. 3), a moist yet



FIGURE 3. Mesic, broadleaf semi-deciduous forest habitat (*selva mediana subcaducifolia*) occupied by the Broad-striped Burrowing Snake (*Adelphicos latifasciatum*) along a feeder ridge of Cerro La Palmita, Municipality of Arriaga, Chiapas, Mexico. Snakes MZFC-HE 33492 and LACM PC 2516–2518 were found in the forest tract at lower right. View looking southwest; photograph date 8 August 2018. (Photographed by Adam G. Clause).

largely epiphyte-free semi-deciduous assemblage of many different broadleaf tree species including *Ficus* and *Cecropia*. At this site, the forest is a mix of primary and secondary growth adjacent to open pastureland.

The observations from Cerro La Palmita suggest that *A. latifasciatum* is at least somewhat tolerant of habitat disturbance, a conclusion strengthened by other new records reported herein. The specimens of *A. latifasciatum* from Ejido Tierra y Libertad were taken from what the original collector called an área perturbada (disturbed area), and the specimen from Ejido Toluca was taken from a coffee plantation. Additionally, the record from Ejido Santa Rita originated in a coffee plantation grown under the shade of Cuajiniquil (*Inga micheliana*), with surrounding secondary-growth successional forest and shrub associations (Breedlove 1981) that historically would have been Pine-oak Forest. Together with our specimen of *A. latifasciatum* collected from a rural yard adjacent to disturbed Pine-oak Forest in Colonia Rodulfo Figueroa, these findings show that the species can persist in human-modified areas if some canopy cover remains or has regrown.

In both wildland areas and disturbed areas near human settlements, *A. latifasciatum* is behaviorally cryptic and difficult to locate. Each individual that we found was taken by hand while the snakes were crawling over bare ground at night (LACM PC 2516–2518) or at dawn (MZFC-HE 28859), or while they were crawling among leaf litter and low-growing herbaceous vegetation under canopy cover by day (LACM PC 2708–2711, MZFC-HE 33492). This behavioral data is generally consistent with prior authors who considered this species to have primarily fossorial habits, helping to explain why so few specimens have been encountered by scientists.

Our new *A. latifasciatum* material brings to light notable variability in color pattern and scalation. Uncovering such variation is to be expected when dealing with taxa previously known from just a small handful of specimens (e.g., Nieto-Montes de Oca and Mendelson 1997; Mendoza-Quijano et al. 2005; Clause et al. 2016; Sánchez-García et al. 2019). For three characters (ventral scale pigmentation, dorsal ground color, and proportion of female tail length to total length), our observed variation violates the diagnostic importance previously ascribed to those characters for *A. latifasciatum* relative to congeners (Campbell and Brodie 1988). Similar amounts of intraspecific variability have been reported for all three characters in other species of the *veraepacis* group (Campbell and Brodie 1988). Importantly, at least two external morphological characters continue to uniquely distinguish *A. latifasciatum* from all known congeners in the *veraepacis* group: presence of a wide, dark vertebral stripe (sometimes faded along the midline) involving the paravertebral scale rows, and subcaudal scales > 42 (males) or > 32 (females). For

these reasons, we view all of our new material as being concordant with *A. latifasciatum*, and we consider that the observed variation and geographic distribution along the Sierra Madre de Chiapas are not suggestive of a new species within our material. Future genetic sequencing involving *A. latifasciatum* and other recognized *Adelphicos* taxa would be informative for further testing this conclusion.

Based on our new material and previously published data (Campbell and Ford 1982; Campbell and Brodie 1988), we offer an updated diagnosis for *A. latifasciatum* as follows. The species is a member of the *veraepacis* group, with a third infralabial scale that is unreduced and equal or larger in size than the second infralabial, and with unexpanded chinshields that lack contact with the lip. It is distinguished from all other members of the *veraepacis* group by the presence of a broad dark vertebral stripe that covers the vertebral scale row and half of each adjacent paravertebral scale row, although this stripe sometimes fades along the dorsal midline especially anteriorly; and subcaudal scales > 42 in males and > 32 in females. It has a ground color of brown, varying from pale to reddish to dark; lacks paravertebral stripes; and the lateral stripes involve scale row 3 and adjacent halves of scale rows 2 and 4. It has a ventral pattern that is immaculate or with scattered dark pigment, and has ventral scale counts of 133–138 in males and 127–141 in females. The tail length is 20.4–22.3% of the total length in males and 13.1–15.6% in females. The maximum known total length is 333 mm in males and 437 mm in females.

Diversification within the genus *Adelphicos* has been dominated by allopatric speciation (Campbell and Ford 1982). Our reported range extension of *A. latifasciatum* fits that narrative, because no other *Adelphicos* was previously known from the high-elevation central reaches of the Sierra Madre de Chiapas. The nearest reported congener is now Sargi's Earth Snake, *A. sargii* (= *A. quadrivirgatum sargii*), which is vouchered from near Montecristo (MZFC-HE 29776) in the Sierra Madre de Chiapas only 14 km east-northeast of our new record for *A. latifasciatum* from Ejido Toluca (CZR-HE 2556). *Adelphicos sargii*, however, is a member of the *quadrivirgatum* group, not the *veraepacis* group to which *A. latifasciatum* belongs. The geographically closest member of the *veraepacis* group is *A. veraepacis* itself, with a population known from the isolated Montañas del Cuilco, Huehuetenango, Guatemala, some 80 km east-southeast of Ejido Toluca (UMMZ 127233–127241; Campbell and Ford 1982). Within the interconnected highlands of the Sierra Madre de Chiapas and the Volcanic Cordillera of Guatemala, the closest member of the *veraepacis* group remains *A. ibarrorum* (no common name), which is reported from 190 km southeast of Ejido Toluca (UTA R-18696–18697;

Campbell and Brodie 1988). Improved resolution of the relative distributions of these and other *Adelphicos* taxa will necessitate further sampling. Nonetheless, the west-to-east species turnover in *Adelphicos* across the Sierra Madre de Chiapas and Volcanic Cordillera of Guatemala mirrors patterns in other herpetofaunal groups across those highlands (Wake and Lynch 1976; Duellman 2001; Rovito et al. 2012; Solano-Zavaleta and Nieto-Montes de Oca 2018; Clause et al. 2020).

The nomenclatural status of *Adelphicos* species, including *A. latifasciatum*, is inconsistent across the published literature, an issue that we here attempt to resolve. The taxon was originally described as *A. veraepacis latifasciatus* (no common name; Lynch and Smith 1966), a name that was later used by Peters and Orejas-Miranda (1970) before the taxon was elevated to the full species *A. latifasciatus* by Campbell and Ford (1982). For the next decade or so, authors continued to use the name *A. latifasciatus* (Campbell 1984; Campbell and Brodie 1988; Villa et al. 1988; Liner 1994). Subsequently, however, LaDuc (1995) noted that the genus *Adelphicos* is neuter, based on the original usage by Jan (1862). This conception necessitated modifying the specific epithets of multiple *Adelphicos* species so that they agree in gender with the genus name (International Code of Zoological Nomenclature 1999, Art. 31.2, Art. 50.3.2), including changing *A. latifasciatus* to *A. latifasciatum*. Since then, most authors have used the revised name *A. latifasciatum* to refer to this taxon (e. g., Casas-Andreu et al. 2004; Flores-Villela et al. 2007; Liner 2007; Johnson et al. 2010; Luna-Reyes 2019). Other authors, likely unaware of the work by LaDuc (1995), continued using the name *A. latifasciatus* (e. g., Luna-Reyes 1997; Muñoz Alonso et al. 2004; Köhler 2008; Heimes 2016; Campbell et al. 2018). We can identify no fault with the nomenclatural reasoning of LaDuc (1995), and because no arguments against his conclusions have since been published, we affirm that *Adelphicos latifasciatum* is the correct name for this taxon.

A brief nomenclatural discussion of the common name for *A. latifasciatum* is also warranted. Liner (1994) first published the common name of Oaxacan Burrowing Snake, which was adopted by later authors (Tipton 2005; Flores-Villela et al. 2007; Liner and Casas-Andreu 2008) and by popular online sources like The Reptile Database and iNaturalist, whereas Heimes (2016) instead used the name Oaxacan Earth Snake. Notably, the use of the adjectival form of a state name (Oaxacan) instead of the equivalent attributive noun (Oaxaca) diverges from dominant common-name conventions in vertebrates (Chesser, R.T., S.M. Billerman, K.J. Burns, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovette, N.A. Mason, P.C. Rasmussen, and J.V. Remsen, Jr., et al. 2020. Check-list of North

American Birds (online). American Ornithological Society. Available from <http://checklist.aou.org/taxa> [Accessed 1 March 2021]; <https://ssarherps.org/cndb/>). Perhaps more importantly, *A. latifasciatum* is not the only *Adelphicos* species found in Oaxaca (Heimes 2016), and it is now known to be only marginally distributed in Oaxaca relative to Chiapas, factors that make the existing common name misleading. Although we recognize the value of nomenclatural stability (Pauly et al. 2009), in our view an improved common name for *A. latifasciatum* would solve more problems than it creates. We thus propose a new name: Broad-striped Burrowing Snake, which highlights the diagnostic wide, dark vertebral stripe that is unique to *A. latifasciatum* among all congeners.

The revised distribution of *A. latifasciatum*, together with greater clarity regarding threats to its survival, lead us to recommend its re-categorization on the IUCN Red List of Threatened Species and the Norma Oficial Mexicana list of SEMARNAT. We estimate the current Extent of Occurrence (EOO) and Area of Occupancy (AOO) for *A. latifasciatum* at 960 km² and 28 km², respectively. Although these estimates lie well within the thresholds for IUCN Endangered categorization, available information on habitat breadth and adaptability to disturbance by *A. latifasciatum* lead us to tentatively infer that the conditions of severely fragmented range and extreme fluctuations in range/population are unmet and unlikely for the foreseeable future. Thus, the most severe category for which the species qualifies is Vulnerable, based on the IUCN criteria (IUCN Standards and Petitions Committee 2019). Given that our estimated range encompasses < 5% of the territory of Mexico, this further qualifies *A. latifasciatum* as having a *muy restringida* (very restricted) distribution under the SEMARNAT criteria. Regarding threats, deforestation continues to reduce the area, extent, and quality of forest habitat for *A. latifasciatum* rangewide, even within the two protected areas it occupies (Cortina-Villar et al. 2019; Godínez-Gómez and Mendoza 2019; Elsen et al. 2020). From 2010–2015, the La Sepultura and El Triunfo reserves lost over 13% and 3% of their forest cover, respectively (Godínez-Gómez et al. 2020). Socioeconomic problems complicate the enforcement of forest protections within these reserves, and some forms of land conversion inside the reserve buffer zones remain legal (Figuroa and Sánchez-Cordero 2008; García-Amado et al. 2013). Expansion of mining activity in and near the reserves is another concern (Godínez-Gómez et al. 2020). Importantly, climate change modeling for the Sierra Madre de Chiapas forecasts over 90% loss of Cloud Forest by 2080 (Ponce-Reyes et al. 2012; Rojas-Soto et al. 2012). Despite suitable forest habitat for *A. latifasciatum* extending well beyond Cloud Forest, Elsen et al. (2020) predict similarly severe range

reductions for hypothetical species in these mountains as climate change pushes them upslope to smaller land areas. Climate change is also worsening human-caused wildfires in many areas where *A. latifasciatum* occurs (Myers 2011; Godínez-Gómez et al. 2020). Such fires can cause substantial above- and below-ground ecological damage (Asbjornsen et al. 2005), which presumably could reduce populations of *A. latifasciatum* both directly and indirectly. For these interconnected reasons, we consider that the comparatively small geographic range of *A. latifasciatum*, coupled with current and inferred future habitat loss, strongly justifies its threatened status despite limited available data.

With the addition of *A. latifasciatum*, the reptile fauna known from Chiapas is increased to 230 recognized species (see overviews by Clause et al. 2020; Lara-Tufiño and Nieto-Montes de Oca 2021). This count ranks Chiapas third behind the Mexican states of Veracruz (236 species; Torres-Hernández et al. 2021) and Oaxaca (321 species; Mata-Silva et al. 2021). We conservatively exclude the snake *Cenaspis aenigma* (no common name) from both the Chiapas and Oaxaca tallies because it is known only from Cerro Baúl (Campbell et al. 2018), which is politically contested as mentioned earlier. This remarkably rich diversity, coupled with the rapid pace of discoveries like those reported herein, underscores the continued need to prioritize field surveys in the understudied, difficult-to-access mountains of southern Mexico, both within and outside of protected areas. Informed conservation decision-making depends on the acceleration of such efforts.

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Herpetological Conservation and Biology



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