

## New prey items in the diet of snakes from the Yucatán Peninsula, Mexico

Rubén Alonso Carbajal-Márquez<sup>1,2</sup>, Christian M. García-Balderas<sup>1,2</sup>, Tania Ramírez-Valverde<sup>1</sup>, J. Rogelio Cedeño-Vázquez<sup>1</sup>, Nidia Gabriela Blanco-Campos<sup>1</sup>

<sup>1</sup> El Colegio de la Frontera Sur, Departamento de Sistemática y Ecología Acuática, Unidad Chetumal, Avenida Centenario Km 5.5, C.P. 77014 Chetumal, Quintana Roo, México.

<sup>2</sup> Conservación de la Biodiversidad del Centro de México, A.C. Andador Torre de Marfil No. 100, C.P. 20229, Aguascalientes, Aguascalientes, México.

Recibida: 24 Enero 2019  
Revisada: 30 Abril 2019  
Aceptada: 07 Mayo 2019  
Editor Asociado: M. Cabrera

### ABSTRACT

New prey items are reported in snakes that were found run over during night road trips, belonging to the families Colubridae, Dipsadidae, Elapidae and Viperidae from the Yucatán Peninsula, Mexico.

Key Words: Colubridae; Elapidae; Viperidae; Yucatán; Mexico.

doi: 10.31017/CdH.2019.(2019-008)

The reptilian fauna of the Mexican Yucatán Peninsula is comprised of 120 species, including two crocodylians, 102 squamates, and 16 turtles. Part of this diversity is represented by snakes, with nine families and 57 species (González-Sánchez *et al.*, 2017). The diet of the snakes of this region is varied, consuming mollusks, arthropods, fishes, amphibians, reptiles, birds, and mammals, including species with exclusive diet in some type of prey such as *Dipsas brevifacies* (Cope, 1866) and *Sibon sanniolus* (Cope, 1866) that feed upon snails and slugs (Lee, 1996; Campbell, 1998). Although the diet of most species is known in other parts of its distribution, there is still lack of detailed information about diet and ecology of many snakes from the Yucatán Peninsula. Here we report prey items from snakes belonging to the Colubridae, Dipsadidae, Elapidae and Viperidae families that were found during night road trips (20:00 – 00:00 hrs) between 2015–2016 in the Yucatán Peninsula. All the snakes were found dead by being run over. The specimens were deposited in individual containers in 70% ethanol and transported to the laboratory where they were dissected in search of contents in their digestive tracts. The preys were identified with the aid of specialized literature (e.g. Lee, 1996; Köhler, 2008). Snake measurements reported herein correspond to snout to vent length (SVL) and tail length (TL). The snakes and their respective preys were deposited in the Herpetological Collection of

El Colegio de la Frontera Sur, Unidad Chetumal (ECO-CH-H) in Quintana Roo, México, and the Herpetological Collection of the Museu Paraense Emílio Goeldi “Osvaldo Rodrigues da Cunha” (MPEG), Belém City, Pará State, Brazil. Specimens not collected were deposited in the photographic collection of the San Diego Natural History Museum (SDNHM\_HerpPC).

### Colubridae

*Lampropeltis abnorma* (Bocourt, 1886) feeds on frogs, lizards, snakes, and small mammals, but in the Yucatán Peninsula small mammals apparently predominate (Lee, 1996; Campbell, 1998). Köhler *et al.* (2017b) reported one specimen with *Heteromys gaumeri* (Rodentia: Heteromyidae) in the gastrointestinal tract and several specimens with undigested mammal hairs. Here we report a male *L. abnorma* (SVL = 340 mm; TL = 43 mm; 12 g; ECO-CH-H-4545), found on 28 February 2015 at 0.6 km south of Señor, Felipe Carrillo Puerto, Quintana Roo (19.835352° N, 88.132723° W; WGS84; elevation 19 m a.s.l), that had fed on a neonate *Holcosus gaigeae* (Squamata: Teiidae), which represents a new prey item.

*Leptophis mexicanus* Duméril, Bibron & Duméril, 1854 feeds on frogs, lizards, and small snakes (Lee, 1996). Stuart (1935, 1948) reported *Tripurion petasatus* (Anura: Hylidae), *Bolitoglossa rufescens*

(Caudata: Plethodontidae) and *Tlalocohyla loquax* (Anura: Hylidae). Oliver (1948) reported *Thecadactylus rapicauda* (Squamata: Phyllodactylidae). Duellman (1963) reported a *Smilisca baudinii* (Anura: Hylidae). Henderson (1976) found an *Anolis sagrei* (Squamata: Dactyloidae). Henderson and Hoevers (1977) reported *Trachycephalus typhonius* (currently *T. vermiculatus*) (Anura: Hylidae), and *Ninia sebae* (Squamata: Dipsadidae). Henderson *et al.* (1977) reported *Incilius valliceps* (Anura: Bufonidae). Henderson (1982) reported *Smilisca baudinii*, *Anolis*, tadpoles and bird eggs. Here we report a female *L. mexicanus* (SVL = 620 mm; TL = 390 mm; 33 g; ECO-CH-H-4550) found on 30 May 2015 at Calderitas, Othón P. Blanco, Quintana Roo (18.603473° N, 88.227006° W; WGS84; elevation 5 m a.s.l) that had fed on an adult specimen of the exotic gecko *Hemidactylus frenatus* (Squamata: Gekkonidae), which represents a new prey item.

*Oxybelis fulgidus* (Daudin, 1803) feeds on a great variety of vertebrates like frogs, lizards, birds and small mammals (Lee, 1996; Savage, 2002). Here we report a male *O. fulgidus* (SVL = 1198 mm; TL = 580; 139 g; ECO-CH-H-4547) found on 19 June 2016 at Chetumal, Othón P. Blanco, Quintana Roo (18.541826° N, 88.271490° W; WGS84; elevation 15 m a.s.l) that fed on an adult *Marisora brachypoda* (Squamata: Scincidae), which represents a new prey item.

### Dipsadidae

*Coniophanes imperialis* (Baird & Girard, 1859) feeds on insects (Henderson and Hoevers, 1977), lizards (Alvarez del Toro, 1983; Campbell, 1998), and frogs like *Scinax staufferi* (Anura: Hylidae) (Lee, 1996). Frazier *et al.* (2007) reported *Anolis lemurinus* (Squamata: Dactyloidae) as part of the diet, including their eggs. Köhler *et al.* (2017a) reported several specimens with undigested parts of arthropods. Here we report a male *C. imperialis* (SVL = 206 mm; TL = 42 mm; 4.5 gr; SDNHM\_HerpPC\_05392-93; not collected) found on 10 April 2015 at Calderitas, Othón P. Blanco, Quintana Roo (18.58104°N, 88.23837°W; WGS84; elevation 10 m a.s.l) that fed on an adult *Tantillita lintoni* (Squamata: Colubridae), which represents a new prey item.

*Coniophanes schmidti* Bailey, 1937. Lee (1996) suggest that probably feeds on frogs and lizards. Köhler *et al.* (2017a) reported undigested parts of arthropods, remains of *Coleonyx elegans* (Squamata: Eublepharidae) and one egg. Here we report a female

*C. schmidti* (SVL = 370 mm; TL = 67 mm, incomplete tail; 16 g; ECO-CH-H-4546) found on 08 June 2016 at 4.6 km southwest of Laguna Guerrero, Othón P. Blanco, Quintana Roo (18.648306°N, 88.294343°W; WGS84; elevation 7 m a.s.l), that had fed on a neonate *Mesoscincus schwartzei* (Squamata: Scincidae). An additional male *C. schmidti* (SVL = 380 mm; TL = 100 mm, incomplete tail; 23 g; ECO-CH-H-4544) found on 07 April 2015 at 3.1 km southwest of Laguna Guerrero, Othón P. Blanco, Quintana Roo (18.664954°N, 88.296235°W; WGS84; elevation 8 m a.s.l), that contained a partially digested adult *C. elegans* (Squamata: Eublepharidae). Therefore, *M. schwartzei* represents a new prey item.

*Leptodeira frenata* (Cope, 1886) feeds largely on frogs, toads and lizards (Lee, 1996). Barbour and Cole (1906) reported *Ctenosaura similis* (Squamata: Iguanidae) and *Tripurion petasatus* (Anura: Hylidae). Lee (1996) reported an *Anolis lemurinus* (Squamata: Dactyloidae). Gaige (1936) a partially digested *Anolis* sp., Henderson and Hoevers (1977) reported an *Incilius valliceps* (Anura: Bufonidae), *Smilisca baudinii* (Anura: Hylidae) and *Sceloporus* sp. from northern Belize. Köhler *et al.* (2016), found the remains of *Sceloporus*, presumably *S. chrysostictus* (Squamata: Phrynosomatidae), *I. valliceps* and *S. baudinii*. Here we report a male *L. frenata* (SVL = 575 mm; TL = 147 mm; 58 g; ECO-CH-H-4549) found on 04 August 2016, at 4.8 km southwest of Laguna Guerrero, Othón P. Blanco, Quintana Roo (18.645563°N, 88.294077°W; WGS84; elevation 15 m a.s.l), that ingested an adult *I. valliceps* (Anura: Bufonidae), which confirm this toad is a common prey item of this snake species. Although *I. valliceps* had already been reported in the diet of *L. frenata*, this snake represents the record of maximum length. Previous maximum length reported was 512 mm SVL and 203 mm TL (Lee, 1996; Köhler, 2008; Köhler *et al.*, 2016).

*Imantodes gemmistratus* (Cope, 1861) feeds predominantly upon lizards, especially anoles (Lee, 1996; Savage, 2002). Here we report a male *I. gemmistratus* (SVL = 405 mm; TL = 165 mm; 11.6 g; MPEG-27044) found on 04 April 2015 at Santa Rosa, Felipe Carrillo Puerto, Quintana Roo (19.975839°N, 88.264391°W; WGS84; elevation 25 m a.s.l) that had fed on an adult *Sceloporus chrysostictus* (Squamata: Phrynosomatidae), which represents a new prey item.

*Imantodes tenuissimus* (Cope, 1867). Nothing is known about the diet of this species, but Lee

(1996) suggested that probably eats lizards and frogs. Köhler *et al.* (2017b) reported remains of *Anolis* sp. from specimens found in Chetumal, Quintana Roo. Here we report a female *I. tenuissimus* (SVL = 430 mm; TL = 185 mm; 6.9 g; MPEG-27046) found on 13 January 2015 at 3.19 km southwest of Laguna Guerrero, Othón P. Blanco, Quintana Roo (18.672657°N, 88.294177°W; WGS84; elevation 6 m a.s.l.) that had fed on an adult *Anolis rodriguezi* (Squamata: Dactyloidae). Additionally, a male *I. tenuissimus* (SVL = 620 mm; TL = 300 mm; 16 g; MPEG-27045) found on 13 January 2015 at 5.81 km southwest of Laguna Guerrero, Othón P. Blanco, Quintana Roo (18.640342°N, 88.294177°W; WGS84; elevation 7 m a.s.l.) that had fed on a juvenile *Anolis lemurinus* (Squamata: Dactyloidae). Both lizards represent new prey items.

#### Elapidae

*Micrurus diastema* (Duméril, Bibron & Duméril, 1854). The diet reported to date for this species consists on snakes belonging to the family Colubridae, Leptotyphlopidae, Typhlopidae and Elapidae, lizards of the genus *Lepidophyma* (Squamata: Xantusiidae), mud eels of the genus *Synbranchus* and *Ophisternon* (Symbrachiformes), and caecilians of the genus *Gymnopsis* (Caecilidae) (Campbell and Lamar, 2004; Köhler *et al.*, 2016). Here we report a male *M. diastema* (SVL = 403 mm; TL = 78 mm; 16 g; ECO-CH-H-4548) found on 17 July 2015 at 6.5 km southwest of Santa Rosa, Felipe Carrillo Puerto, Quintana Roo (19.926310°N, 88.295.076°W; WGS84; elevation 29 m a.s.l.) that fed upon adult *Ninia sebae* (Squamata: Dipsadidae). Additionally, a male *M. diastema* (SVL = 455 mm; TL = 80 mm; 28 g; ECO-CH-H-4626) found on 23 June 2016 at 5.3 km north of Calderitas, Othón P. Blanco, Quintana Roo (18.608896°N, 88.255919°W; WGS84; elevation 13 m a.s.l.) that fed on an adult female *Dipsas brevifacies* (Squamata: Dipsadidae). *Ninia sebae* had already been reported as prey of *M. diastema* by Seib (1985), but *D. brevifacies* represents a new prey item.

#### Viperidae

*Bothrops asper* (Garman, 1883) is a diet generalist, with an ontogenetic diet shift from a greater percentage of ectotherms in juveniles to a higher percentage of endotherms, particularly small mammals, in adults (Martins, 2002; Farr and Lazcano, 2017). Records in the diet of *B. asper* include a great variety of vertebrates like eels, frogs, caecilians, amphibiae-

nians, lizards, birds and small mammals (shrews and rodents) as well as invertebrates like centipedes, insects and crayfish (Greene, 1992; Campbell and Lamar, 2004; Köhler, 2008; Segovia-Núñez *et al.*, 2014; Farr and Lazcano, 2017). Here we report a neonate *B. asper* (SVL = 308 mm; TL = 44 mm; 7 g; ECO-CH-H-4543) found on 7 February 2015 at 2.98 km north of X-Pichil, Felipe Carrillo Puerto, Quintana Roo (19.71719°N, 88.39594°W; WGS84; elevation 37 m a.s.l.), that fed upon adult *Scincella cherriei* (Squamata: Scincidae). Another female *B. asper* (SVL = 452 mm; TL = 63 mm; 24 g; ECO-CH-H-4551) found on 4 April 2015 at 13.5 km southwest of Santa Rosa, Felipe Carrillo Puerto, Quintana Roo (19.867479°N, 88.322728°W; WGS84; elevation 26 m a.s.l.) had fed on a *Ninia sebae* (Squamata: Dipsadidae). An additional female *B. asper* (SVL = 530 mm; TL = 70 mm; 25 g; ECO-CH-H-4552) found on 13 June 2016 at 6 km north of Calderitas, Othón P. Blanco, Quintana Roo (18.614962°N, -88.255184°W; WGS84; elevation 9 m a.s.l.) had fed on an adult *Mus musculus* (Rodentia: Muridae). The prey species we recorded had been previously reported in the diet of *B. asper* (see Farr and Lazcano, 2017). However, they had not been reported from specimens of the Yucatán Peninsula.

In most of the cases, the preys found in the digestive tract presented a high degree of digestion, and sometimes fragmented, as well as the snakes that prey upon them were found run over and damaged, so it was not possible to add more information. Although some prey items had been previously reported elsewhere, most of our findings represent new records, evidencing the lack of research in the ecology of the snakes of the Yucatán Peninsula, which is necessary to attain a better understanding of the trophic webs, as well as to record rare prey species and in this way better document their distribution, and, also as an indicator of the presence of exotic species.

#### Acknowledgements

We thank to Alexandre Missassi for providing voucher numbers from specimens housed at the Herpetological Collection of the Museu Paraense Emílio Goeldi "Oswaldo Rodrigues da Cunha" (MPEG), Belém City, Pará State, Brazil. We also thank Bradford D. Hollingsworth who provided the photo voucher number from the Herpetology Photo Collection of the San Diego Natural History Museum. We appreciate the comments from the

reviewers that resulted in a remarkable improvement of this manuscript. Collecting permits were provided by Dirección General de Vida Silvestre SEMARNAT (SGPA/DGVS/02570/15; SGPA/DGVS700950/16).

### Literature cited

- Alvarez del Toro, M. 1983. Los reptiles de Chiapas. 3er ed. Instituto de Historia Natural, Tuxtla Gutiérrez, Chiapas, México.
- Barbour, T. & Cole, L.J. 1906. Vertebrata from Yucatán. Reptilia, Amphibia, Pisces. *Bulletin of the Museum of Comparative Zoology at Harvard University* 50: 146-159.
- Campbell, J.A. 1998. Amphibians and Reptiles of Northern Guatemala, the Yucatán, and Belize. University of Oklahoma Press, Norman, Oklahoma.
- Campbell, J.A. & Lamar, W.W. 2004. The Venomous Reptiles of the Western Hemisphere. Comstock. Ithaca and London.
- Duellman, W.E. 1963. Amphibians and reptiles of the rainforest of southern El Petén, Guatemala. *University of Kansas Publications. Museum of Natural History* 15: 205-249.
- Farr, W.L. & Lazcano, D. 2017. Distribution of *Bothrops asper* in Tamaulipas, Mexico and a review of prey items. *The Southwestern Naturalist* 62: 77-84.
- Frazier, J.A.; Montgomery, C.E.; Boback, S.M. & Reed, R.N. 2007. Natural History Notes. *Coniophanes imperialis* (Black-striped Snake). Diet. *Herpetological Review* 38: 86.
- Gaige, H.T. 1936. Some reptiles and amphibians from Yucatán and Campeche, Mexico. *Carnegie Institution of Washington Publication* 457: 289-305.
- González-Sánchez, V.H.; Johnson, J.D.; García-Padilla, E.; Mata-Silva, V.; DeSantis, D.L. & Wilson, L.D. 2017. The herpetofauna of the Mexican Yucatan Peninsula: composition, distribution, and conservation. *Mesoamerican Herpetology* 4: 264-380.
- Greene, H.W. 1992. The ecological and behavioral context for pitviper evolution: 107-117. *En: Campbell, J.A. & Brodie Jr., E.D. (eds.), Biology of the pitvipers. Selva, Tyler, Texas.*
- Henderson, R.W. 1976. A new insular subspecies of the colubrid snake *Leptophis mexicanus* (Reptilia, Serpentes, Colubridae) from Belize. *Journal of Herpetology* 10: 329-331.
- Henderson, R.W. 1982. Trophic relationships and foraging strategies of some New World tree snakes (*Leptophis*, *Oxybelis*, *Uromacer*). *Amphibia-Reptilia* 3: 71-80.
- Henderson, R.W. & Hoevers, L.G. 1977. The seasonal incidence of snakes at locality in northern Belize. *Copeia* 1977: 349-355.
- Henderson, R.W.; Nickerson, M.A. & Hoevers, L.G. 1977. Observations and comments on the feeding behavior of *Leptophis* (Reptilia, Serpentes, Colubridae). *Journal of Herpetology* 11: 231-232.
- Köhler, G. 2008. Reptiles of Central America. 2nd edition. Herpeton Verlag. Offenbach.
- Köhler, G.; Cedeño-Vázquez, J.R.; Spaeth, M. & Beutelspacher-García, P.M. 2016. The Chetumal Snake Census: generating biological data from road-killed snakes. Part 3. *Leptodeira frenata*, *Ninia sebae*, and *Micrurus diastema*. *Mesoamerican Herpetology* 3: 930-947.
- Köhler, G.; Cedeño-Vázquez, J.R.; Myat Tun, A. & Beutelspacher-García, P.M. 2017a. The Chetumal Snake Census: generating biological data from road-killed snakes. Part 4. *Coniophanes imperialis*, *C. meridanus* and *C. schmidtii*. *Mesoamerican Herpetology* 4: 528-542.
- Köhler, G.; Cedeño-Vázquez, J.R.; Kraus, E.D.; Beutelspacher-García, P.M. & Domínguez-Lepe, J.A. 2017b. The Chetumal Snake Census: generating biological data from road-killed snakes. Part 5. *Imantodes tenuissimus*, *Lampropeltis triangulum*, and *Stenorrhina freminvillii*. *Mesoamerican Herpetology* 4: 774-789.
- Lee, J.C. 1996. The Amphibians and Reptiles of the Yucatán Peninsula. Comstock Publishing Associates, Cornell University Press, Ithaca, New York.
- Martins, M.; Marques, O.A.V. & Sazima, I. 2002. Ecological and phylogenetic correlates of feeding habits in Neotropical pitvipers of the genus *Bothrops*: 307-328. *En: Schuett, G.W., Höggren, M.; Douglas, M.E. & Greene, H.W. (eds.), Biology of the vipers. Eagle Mountain Publishing, Eagle Mountain, Utah.*
- Oliver, J.A. 1948. The relationships and zoogeography of the genus *Thalerophis* Oliver 1947. *Bulletin of the American Museum of Natural History* 92: 157-280.
- Savage, J.M. 2002. The Amphibians and Reptiles of Costa Rica. University of Chicago Press. Chicago.
- Segovia-Nuñez, G.; De Osmá, A. & Ramírez-Barajas, P.J. 2014. *Bothrops asper* (terciopelo) Diet. *Herpetological Review* 45: 512-513.
- Seib, R.L. 1985. Feeding ecology and organization of Neotropical snake faunas. Ph.D. dissertation, University of California, Berkeley.
- Stuart, L.C. 1935. A contribution to knowledge of the herpetofauna of a portion of the savanna region of central Petén, Guatemala. *Miscellaneous Publications Museum of Zoology University of Michigan*. No. 29.
- Stuart, L.C. 1948. The amphibians and Reptiles of Alta Verapaz Guatemala. *Miscellaneous Publications Museum of Zoology University of Michigan*. No. 69.