

Two new species of Pitviper from Middle America (Serpentes:Viperidae:Crotalinae).

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ABSTRACT

The nominal species *Bothrops xanthogrammus* (Cope, 1868), also known as *B. asper* (Garman, 1884) has long been known to be composite. For the first time, this paper gives formal taxonomic recognition to three regional forms.

The population from the Pacific Coast of Costa Rica, long known to be distinct from the nominal form of *B. xanthogrammus* is accorded full species status, described herein as *B. lenhoseri* sp. nov..

The population from Nuclear Central America, mainly near the Atlantic Coast, being the region generally north from Nicaragua to southern Mexico, including the lowland zone adjacent to the Gulf of Mexico and the border with Guatemala and Belize is herein described as *B. mexicoiensis* sp. nov.

The population of snakes north of Mexico City in the area of San Luis de Potosí, Mexico is in turn formally named as a subspecies of *B. mexicoiensis* sp. nov., namely *B. mexicoiensis maccartneyi* subsp. nov..

All are defined according to the Zoological Code (Ride *et al.* 1999) on the basis of consistent colouration and scalation differences between these forms and the nominal form of *B. asper*, herein restricted to the region generally south of Nicaragua, including the Atlantic coast of Costa Rica and including the north of South America.

Keywords: Taxonomy; pitviper; nomenclature; *Bothrops*; *xanthogrammus*; *asper*; Costa Rica; new species; *lenhoseri*; *mexicoiensis*; new subspecies; *maccartneyi*.

INTRODUCTION

The Pitvipers of the genus *Bothrops* Wagler, 1824 have been the subject of intense collecting, research and taxonomic interest over many decades, with new forms being described or validated from older descriptions on a regular basis.

Molecular methods of analysis have been incorporated into morphological studies to confirm differences between populations at various levels, ranging from genera to species and subspecies.

Papers are published on the taxonomy of these snakes on a regular basis and the taxonomy of the genus *Bothrops sensu lato* is anything but stable.

Pitviper genera and species have been recently described by myself (see for example Hoser 2012a, 2012b and 2013) and this paper continues the process of taxonomic recognition of unnamed or improperly classified forms.

At the genus level, further divisions within the subfamily Crotalinae Oppel, 1811 are made in a separate paper

published at the same time as this one.

The species *Bothrops xanthogrammus* also widely known as *B. asper* (Garman, 1884), the latter name being a junior synonym, has long been known to be composite. Widely differing phenotypes are detailed in Campbell and Lamar (2004) and sources cited therein.

In preparing this paper, in excess of 100 specimens were examined from most parts of Middle America and nearby South America.

One of the distinctive regional populations includes the heavily studied and apparently isolated population from the Pacific Coast of Costa Rica. Separated from the main Central American population that is mainly found on the Atlantic Coast, by several physical barriers, studies have shown the Pacific Coast population to have been isolated for about 3.5 million years and therefore worthy of taxonomic recognition (Saldariaga and Sasa, unpublished results as cited by Alape-Giro *et al.* 2008).

Besides the phenotypical differences in specimens of this population as detailed by Campbell and Lamar (2004),

the significant venomous differences have been well detailed in the literature (Alape-Giro *et al.* 2008, Aragon and Gubensek 1981, Jimenez-Porras 1964, Gutierrez *et al.* 1980).

In the absence of an available name for this population, I herein assign a name to this population according to the Zoological Code (Ride *et al.* 1999) at the level of full species, named *Bothrops lenhoseri sp. nov.*

I note herein that Alape-Giro *et al.* (2008) indicated in their paper that they thought a subspecies designation was appropriate.

My difference of opinion is based on the geological evidence cited by these authors in their paper, that being a potential population division in the range of up to 5-8 MYA in line with the uplifting of mountain barriers between the populations and mtDNA results indicating a 3.5 million year separation of the two Costa Rica populations (east and west) (Alape-Giro *et al.* 2008), both time frames being well in excess of that required for full speciation to occur, generally regarded by most authors as being less than 2 million years.

Sasa (2002), provided a body of evidence to suggest that the population of *B. xanthogrammus* from Nuclear Central America, the region generally north of Costa Rica, commencing in Nicaragua has consistent colouration and scalation differences as compared to the nominal form of *B. xanthogrammus* from further south and including the northern part of South America. On that basis, the northern form is herein described as a new species as well, namely, *B. mexicoiensis sp. nov.*

Within this species group, the northernmost specimens, those being from the area of San Luis de Potosí, Mexico, do in fact have significant and consistent differences as compared to those from regions immediately south of there.

As a result it is accorded subspecies status within *B. mexicoiensis sp. nov.*, being described herein as *B. mexicoiensis maccartneyi subsp. nov.*

The body of literature relevant to these new species is significant and the detail is not repeated here.

However it is worth noting that numerous aspects of these newly described species taxa, venom properties and relationship to others in the *B. xanthogrammus* group is well-known.

Key published references in terms of *B. xanthogrammus sensu lato* and the newly described taxa *B. lenhoseri sp. nov.* and *B. mexicoiensis sp. nov.* (including *B. mexicoiensis maccartneyi subsp. nov.*) described below include the following: Boada *et al.* (2005), Campbell and Lamar (2004), Carrera *et al.* (2009), Castro-Herrera and Vargas-Salinas (2008), Castro-Herrera *et al.* (2005), Cisneros-Heredia and Touzet (2004), Cope (1868), Corteis Goimez *et al.* (2010), Dehling and Dehling (2008), Dempfle (2012), Dixon and Lemos-Espinal (2010), Fenwick *et al.* (2009), Folleco-Fernández (2010), Freire and Kuch (1994), Garman (1884), Garrett (1997), Gutierrez Mayen *et al.* (2007), Hoge (1966), Koller (2005), Leenders (1995), McCranie (2011), McCranie and Castañeda (2005), McDiarmid *et al.* (1999), Monzel and Wüster (2008), Mora and Merchán (2001), Müller (1885), Nicholson *et al.* (2000), Parkinson (1999), Pérez-Santos

and Moreno (1988), Porras and Solórzano (2006), Rivas *et al.* (2012), Saldarriaga-Córdoba *et al.* (2009), Sasa (1996, 2002), Sasa and Barrantes (1998), Savage (2002), Schätti and Kramer (1993), Scott and Limerick (1983), Sethao (2008), Taylor (1949), Townsend *et al.* (2012), Urbina-Cardona *et al.* (2006), Wasko and Sasa (2010, 2012), Wirth (2011) and sources cited therein.

BOTHRUPS LENHOSERI SP. NOV.

Holotype: A specimen held at the Texas Cooperative Wildlife Collection (TCWC), specimen number: TCWC Herps 83385, collected from 1.9 mi S Rio Tarcoles, Hwy 34, north branch of Quebrada Bonita, Puntarenas, Costa Rica. The Texas Cooperative Wildlife Collection allows access to its collection by scientists.

Paratypes: Two more specimens held at the Texas Cooperative Wildlife Collection (TCWC), specimen numbers: TCWC Herps 83386 and 83387, collected from 1.9 mi S Rio Tarcoles, Hwy 34, north branch of Quebrada Bonita, Puntarenas, Costa Rica. The Texas Cooperative Wildlife Collection allows access to its collection by scientists.

Diagnosis: The species *Bothrops lenhoseri sp. nov.* would until now have been diagnosed as *Bothrops xanthogrammus* (Cope, 1868), also known as *B. asper* (Garman, 1884), the species *Bothrops lenhoseri sp. nov.* being the form restricted to the northern region of the Pacific Coast (west coast) region of Costa Rica, Central America, and separated by habitat from the main population of *B. xanthogrammus* to the north, south and east.

All species within the *B. xanthogrammus* species group are strongly sexually dimorphic.

Females of the species *Bothrops mexicoiensis sp. nov.* are readily separated from *B. xanthogrammus* and *B. lenhoseri sp. nov.* by their consistently higher average number of dorsal blotches (triangles), being 23 with an SD of 2.0 versus, 17 with an SD of 1.4 in *B. lenhoseri sp. nov.* and 19.2 with an SD of 2.8 in *B. xanthogrammus*. The only exception to this is for females of the subspecies *B. mexicoiensis maccartneyi subsp. nov.* which has an average of 20 with an SD of 1.4.

Female *B. mexicoiensis sp. nov.* are also separated from *B. xanthogrammus* and *B. lenhoseri sp. nov.* by their consistently higher average number of ventrals being an average of 209 with an SD of 5, versus 197 with an SD of 8.7 in *B. xanthogrammus* and 196 with an SD of 4 in *B. lenhoseri sp. nov.*

B. mexicoiensis sp. nov. females usually have 10-11 interoculars, versus 8-9 in *B. xanthogrammus* and 9 in *B. lenhoseri sp. nov.*

Males of the species *Bothrops mexicoiensis sp. nov.* are readily separated from *B. xanthogrammus* and *B. lenhoseri sp. nov.* by their consistently higher average number of dorsal blotches (triangles), being 23 with an SD of 1.5 versus, 19.6 with an SD of 1.5 in *B. lenhoseri sp. nov.* and 19.0 with an SD of 2.1 in *B. xanthogrammus*. The only exception to this is in males of the subspecies *B. mexicoiensis maccartneyi subsp. nov.* which has an average of 20.5 dorsal blotches with an SD of .47.

Male *Bothrops mexicoiensis sp. nov.* average 209 ventrals, SD4, versus 196 SD6 in *B. xanthogrammus* and

186 SD23 in *B. lenhoseri* sp. nov..

B. mexicioensis sp. nov. males usually have 10 interoculars, versus 8-9 in both *B. xanthogrammus* and *B. lenhoseri* sp. nov..

In terms of scalation characters, *B. mexicioensis maccartneyi* subsp. nov. approaches the characteristics of both *B. xanthogrammus* and *B. lenhoseri* sp. nov. but can be separated from both by the fact that the dorsal blotches do not as a rule merge on the mid-dorsal line, with the potential exception of a small number on the neck, versus a sizeable number of blotches merging along the body *B. lenhoseri* sp. nov., and occasionally in specimens of *B. xanthogrammus*.

The top of the head of *B. xanthogrammus* and *B. lenhoseri* sp. nov. is mainly a dark chocolate brown in colour, whereas the same markings are a light brown colour in Mexican *B. mexicioensis* sp. nov. including for the subspecies *B. mexicioensis maccartneyi* subsp. nov.. On the lower flanks of Mexican *B. mexicioensis* sp. nov. there is a greater amount of white as opposed to darker scales as viewed from the side. This is not the case in either *B. xanthogrammus* and *B. lenhoseri* sp. nov. where the reverse is the case.

This enables one to separate *B. mexicioensis maccartneyi* subsp. nov. from *B. xanthogrammus* and *B. lenhoseri* sp. nov. in the absence of accurate locality data.

In all three species (and the subspecies), the dorsal body pattern consists of a series of pale edged, dark brown to blackish triangles on each side with their wide bases directed ventrally and their apices either opposite or juxtaposed at the vertebral line, generally joining in *B. lenhoseri* sp. nov. to form X-like markings along most of the body. In the other species only a small number of blotches merge, this usually being restricted to the forebody region. Exceptionally, *B. xanthogrammus* may have a similar dorsal pattern to *B. lenhoseri* sp. nov. however the two can be separated by other means as described herein.

In *B. xanthogrammus* and *B. mexicioensis* sp. nov. these triangles are invaded by a light ash gray ground colour. By contrast in *B. lenhoseri* sp. nov. these markings are a distinctive pinkish grey, readily separating this taxon from the other two species.

A detailed diagnosis of the three species *Bothrops mexicioensis* sp. nov., *B. lenhoseri* sp. nov. and *B. xanthogrammus* described singly as *B. xanthogrammus* is provided by Campbell and Lamar (2004), on pages 371-376, as part of Volume 1, with further diagnostic information on the taxon group elsewhere in the same volume.

Distribution: *B. lenhoseri* sp. nov. is restricted to the Pacific Coast (west coast) region of Costa Rica, Central America, and separated by habitat from the main population of *B. xanthogrammus* to the north-east, south and east.

The most obvious physical barrier is the central cordillera of Costa Rica.

Etymology: Named in honour of my now deceased father, Len Hoser, born in the UK for many contributions to herpetology.

BOTHROPS MEXICIOENSIS SP. NOV.

Holotype: A specimen at the American Museum of Natural History, (AMNH), New York, USA, specimen number 160653 collected from Quintana Roo, Mexico. The American Museum of Natural History is a facility that allows access to its specimens by scientists.

Paratypes: Specimen numbers UTA-R 17031 and UTA-R 17095 held at the University of Texas, Arlington, Texas, USA, collected from Quintana Roo, Mexico. The University of Texas, Arlington is a facility that allows access to its specimens by scientists.

Diagnosis: The species *Bothrops lenhoseri* sp. nov. would until now have been diagnosed as *Bothrops xanthogrammus* (Cope, 1868), also known as *B. asper* (Garman, 1884), the species *Bothrops lenhoseri* sp. nov. being the form restricted to the northern region of the Pacific Coast (west coast) region of Costa Rica, Central America, and separated by habitat from the main population of *B. xanthogrammus* to the north, south and east.

All species within the *B. xanthogrammus* species group are strongly sexually dimorphic.

Females of the species *Bothrops mexicioensis* sp. nov. are readily separated from *B. xanthogrammus* and *B. lenhoseri* sp. nov. by their consistently higher average number of dorsal blotches (triangles), being 23 with an SD of 2.0 versus, 17 with an SD of 1.4 in *B. lenhoseri* sp. nov. and 19.2 with an SD of 2.8 in *B. xanthogrammus*. The only exception to this is for females of the subspecies *B. mexicioensis maccartneyi* subsp. nov. which has an average of 20 with an SD of 1.4.

Female *B. mexicioensis* sp. nov. are also separated from *B. xanthogrammus* and *B. lenhoseri* sp. nov. by their consistently higher average number of ventrals being an average of 209 with an SD of 5, versus 197 with an SD of 8.7 in *B. xanthogrammus* and 196 with an SD of 4 in *B. lenhoseri* sp. nov..

B. mexicioensis sp. nov. females usually have 10-11 interoculars, versus 8-9 in *B. xanthogrammus* and 9 in *B. lenhoseri* sp. nov..

Males of the species *Bothrops mexicioensis* sp. nov. are readily separated from *B. xanthogrammus* and *B. lenhoseri* sp. nov. by their consistently higher average number of dorsal blotches (triangles), being 23 with an SD of 1.5 versus, 19.6 with an SD of 1.5 in *B. lenhoseri* sp. nov. and 19.0 with an SD of 2.1 in *B. xanthogrammus*.

The only exception to this is in males of the subspecies *B. mexicioensis maccartneyi* subsp. nov. which has an average of 20.5 dorsal blotches with an SD of .47.

Male *Bothrops mexicioensis* sp. nov. average 209 ventrals, SD4, versus 196 SD6 in *B. xanthogrammus* and 186 SD23 in *B. lenhoseri* sp. nov..

B. mexicioensis sp. nov. males usually have 10 interoculars, versus 8-9 in both *B. xanthogrammus* and *B. lenhoseri* sp. nov..

In terms of scalation characters, *B. mexicioensis maccartneyi* subsp. nov. approaches the characteristics of both *B. xanthogrammus* and *B. lenhoseri* sp. nov. but can be separated from both by the fact that the dorsal blotches do not as a rule merge on the mid-dorsal line, with the potential exception of a small number on the

neck, versus a sizeable number of blotches merging along the body *B. lenhoseri sp. nov.*, and occasionally in specimens of *B. xanthogrammus*.

The top of the head of *B. xanthogrammus* and *B. lenhoseri sp. nov.* is mainly a dark chocolate brown in colour, whereas the same markings are a light brown colour in Mexican *B. mexicoiensis sp. nov.* including for the subspecies *B. mexicoiensis maccartneyi subsp. nov.*

On the lower flanks of Mexican *B. mexicoiensis sp. nov.* there is a greater amount of white as opposed to darker scales as viewed from the side. This is not the case in either *B. xanthogrammus* and *B. lenhoseri sp. nov.* where the reverse is the case.

This enables one to separate *B. mexicoiensis maccartneyi subsp. nov.* from *B. xanthogrammus* and *B. lenhoseri sp. nov.* in the absence of accurate locality data.

In all three species (and the subspecies), the dorsal body pattern consists of a series of pale edged, dark brown to blackish triangles on each side with their wide bases directed ventrally and their apices either opposite or juxtaposed at the vertebral line, generally joining in *B. lenhoseri sp. nov.* to form X-like markings along most of the body. In the other species only a small number of blotches merge, this usually being restricted to the forebody region. Exceptionally, *B. xanthogrammus* may have a similar dorsal pattern to *B. lenhoseri sp. nov.* however the two can be separated by other means as described herein.

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A detailed diagnosis of the three species *Bothrops mexicoiensis sp. nov.*, *B. lenhoseri sp. nov.* and *B. xanthogrammus* described singly as *B. xanthogrammus* is provided by Campbell and Lamar (2004), on pages 371-376, as part of Volume 1, with further diagnostic information on the taxon group elsewhere in the same volume.

Distribution: *Bothrops mexicoiensis sp. nov.* is found in Central America from Nicaragua (on the east coast), as far north as Mexico.

The nominate form of *B. xanthogrammus* occurs in the region from Costa Rica or slightly north in Nicaragua, along the Atlantic coast south through Costa Rica's eastern side and then south through the Panama Isthmus and into northern South America. *B. lenhoseri sp. nov.* is found in the north-west section of Costa Rica along the Pacific Coast and nearby areas.

B. mexicoiensis maccartneyi subsp. nov. is restricted to the area of San Luis de Potosí, Mexico.

Etymology: Named in reflection of where the taxon occurs noting it is the only *Bothrops* species or subspecies known from that country (Mexico).

BOTHRUPS MEXICOIENSIS MACCARTNEYI SUBSP. NOV.

Holotype: A specimen at the American Museum of Natural History, New York, USA, specimen number: AMNH 67315 from Chapulhuaco, Hidalgo, Mexico. The

American Museum of Natural History is a facility that allows access to its specimens by scientists.

Paratype: A specimen at the American Museum of Natural History, New York, USA, specimen number: AMNH 93434 from 2 miles west of Tamuin, Mexico. The American Museum of Natural History is a facility that allows access to its specimens by scientists.

Diagnosis: The species *Bothrops lenhoseri sp. nov.* would until now have been diagnosed as *Bothrops xanthogrammus* (Cope, 1868), also known as *B. asper* (Garman, 1884), the species *Bothrops lenhoseri sp. nov.* being the form restricted to the northern region of the Pacific Coast (west coast) region of Costa Rica, Central America, and separated by habitat from the main population of *B. xanthogrammus* to the north, south and east.

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The top of the head of *B. xanthogrammus* and *B.*

lenhoseri sp. nov. is mainly a dark chocolate brown in colour as a distinct large blotch, whereas the same markings are a light brown colour in *B. mexicoiensis* sp. nov. including for the subspecies *B. mexicoiensis maccartneyi* subsp. nov..

On the lower flanks of Mexican *B. mexicoiensis* sp. nov. there is a greater amount of white as opposed to darker scales as viewed from the side. This is not the case in either *B. xanthogrammus* and *B. lenhoseri* sp. nov. where the reverse is the case.

This, along with the scalation and dorsal blotches characters just outlined, enables one to separate *B. mexicoiensis maccartneyi* subsp. nov. from *B. xanthogrammus* and *B. lenhoseri* sp. nov. in the absence of accurate locality data.

In all three species (and the subspecies), the dorsal body pattern consists of a series of pale edged, dark brown to blackish triangles on each side with their wide bases directed ventrally and their apices either opposite or juxtaposed at the vertebral line, generally joining in *B. lenhoseri* sp. nov. to form X-like markings along most of the body. In the other species only a small number of blotches merge, this usually being restricted to the forebody region. Exceptionally, *B. xanthogrammus* may have a similar dorsal pattern to *B. lenhoseri* sp. nov. however the two can be separated by other means as described herein.

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B. mexicoiensis maccartneyi subsp. nov. is restricted to the area of San Luis de Potosí, Mexico.

Etymology: Named in honour of Peter McCartney, from Doncaster, Victoria, Australia, at times an office bearer at the public interest organisations "Whistleblowers Australia" and "Law Watch", both of whom seek to expose and correct corruption in government in Australia. In the 1990's in particular, after exposing severe judicial corruption involving corrupt County Court Judge and former police prosecutor, Thomas Neesham in 1995, McCartney was exposed to intense harassment by the Victoria Police and other arms of government. The

harassment included bashing, fines and all the usual stuff they get up to. Further relevant details can be found in Hoser (1999).

REFERENCES CITED

- Alape-Giro, A., Sanz, L., Escolano, J., Flores-Diaz, M., Madrigal, M., Sasa, M. and Calvete, J. J. 2008. Snake Venomics of the Lancehead Pitviper *Bothrops asper*. Geographic, Individual, and Ontogenetic Variations. *Journal of Proteome Research* 2008 (7):3556-3571.
- Aragon, F. and Gubensek, F. 1981. *Bothrops asper* venom from the Atlantic and Pacific zones of Costa Rica. *Toxicon* 19:797-805.
- Boada, C. and Salazar, V., Freire Lascana, A. and Kuch, U. 2005. The diet of *Bothrops asper* (Garman, 1884) in the Pacific lowlands of Ecuador [Short Note]. *Herpetozoa* 18.
- Campbell, J. A. and Lamar, W. W. 2004. *The Venomous Reptiles of Latin America*. Comstock Publishing/Cornell University Press, Ithaca (Volume 1).
- Carrera, C. et al. 2009. Guía de Campo de los Pequeños Vertebrados del Distrito Metropolitano de Quito (DMQ). *Publicación Miscelánea N° 5. Serie de Publicaciones del Museo Ecuatoriano de Ciencias Naturales (MECN) - Fondo Ambiental del MDMQ*. Imprenta Nuevo Arte. Quito-Ecuador:89 pp.
- Castro-Herrera, F. and Vargas-Salinas, F. 2008. Anfibios y reptiles en el departamento del Valle del Cauca, Colombia. *Biota Colombiana* 9(2):251-277.
- Castro-Herrera, F., Ayerbe, S., Calderón, J. J. and Cepeda, B. 2005. Nuevo registro para Colombia de *Bothrocophias campbelli* y notas sobre *B. colombianus* y *B. myersi* (Serpentes:Viperidae). *Novedades Colombianas* 8(1):57-64.
- Cisneros-Heredia, D. F. and Touzet, J. M. 2004. Distribution and conservation status of *Bothrops asper* (Garman, 1884) in Ecuador. *Herpetozoa* 17(3/4):135-141.
- Cope, E. D. 1868. An examination of the Reptilia and Batrachia obtained by the Orton Expedition to Ecuador and the Upper Amazon, with notes on other species. *Proc. Acad. Nat. Sci. Philadelphia* 20:96-140.
- Corteis Goimez, A. M., Aguilar, A. V., Domínguez, D. M. T. and Mariñ, L. 2010. *Guía de los anfibios y reptiles. Airea en conservaciön de la microcuenca Quebrada Pericos*. Corporaciön Autoñoma Regional del Valle del Cauca, Santiago de Cali:37 pp.
- Dehling, D. M. and Dehling, M. J. 2008. Die Rauschuppige Lanzenotter - *Bothrops asper* (Garman, 1884). *Draco* 8(33):28-34.
- Dempfle, C. E. 2012. Defibrinogenierungs-Syndrom nach Schlangenbiss von Grubenottern - Diskussion der Effekte anhand eines Fallberichtes. *Draco* 13(51):67-71.
- Dixon, J. R. and Lemos-Espinal, J. A. 2010. *Amphibians and reptiles of the state of Queretaro, Mexico*. Tlalnepantla UNAM:428 pp.
- Fenwick, A. M., Gutbertlet, R. J. Jr., Evans, J. A. and Parkinson, C. L. 2009. Morphological and molecular evidence for phylogeny and classification of South American pitvipers, genera *Bothrops*, *Bothriopsis*, and *Bothrocophias* (Serpentes: Viperidae). *Zoological Journal of the Linnean Society* 156 (3):617-640.

- Folleco-Fernández, A. J. 2010. Taxonomía Del Complejo *Bothrops asper* (Serpentes: Viperidae) en el sudoeste Colombia. Revalidación de la especie *Bothrops rhombeatus* (García, 1896) Y Descripción de una nueva especie. *Revista Novedades Colombianas*, 10(1):33-70.
- Freire, L. A. and Kuch, U. 1994. A note on the geographical distribution of *Bothrops asper* (Garman, 1883) in Ecuador. *The Snake* 26(2):135-139.
- Garman, S. 1884. The reptiles and batrachians of North America. *Mem. Mus. comp. Zool*, Cambridge (Massachusetts), 8(3):xxxiv+185 pp. [1883]
- Garrett, C. M. 1997. Eternal spring: A glimpse of Guatemala. *Fauna* 1(1):54-63.
- Gutierrez Mayen, M. A., Chaves, F. and Bolanos, R. 1980. Estudio comparativo de venenos de ejemplares recién nacidos y adultos de *Bothrops asper*. *Rev. Biol. Trop.* 28:341-351.
- Gutierrez Mayen, M. A., Guadalupe, J. and Arenas, S. 2007. Herpetofauna de Los Municipios de Camocautla, Zapotitlan de Mendez Y Huitzilán de Serdán, De La Sierra Norte De Puebla. Herpetofauna de Tres Municipios De La Sierra Norte De Puebla, pp. 197-223 in Henderson, C. L. 2010. *Mammals, Amphibians, and Reptiles of Costa Rica - A field guide*. University of Texas Press, Austin, Texas, USA:198 pp.
- Hoge, A. R. 1966. Preliminary account on Neotropical Crotalinae (Serpentes: Viperidae). *Mem. Inst. Butantan* 32[1965]:109-184.
- Hoser, R. T. 1999. *Victoria Police Corruption-2: Including what the media didn't tell you*. Kotabi Publishing, Doncaster, Victoria, Australia:800 pp.
- Hoser, R. T. 2012a. A new genus of Jumping Pitviper from Middle America (Serpentes: Viperidae). *Australasian Journal of Herpetology* 10:33-34.
- Hoser, R. T. 2012b. A new genus of Pitviper (Serpentes: Viperidae) from South America. *Australasian Journal of Herpetology* 11:25-27.
- Hoser, R. T. 2013. *Adelynhoserserpene wellsi*, a new species of Jumping Pitviper from Mexico (Serpentes: Viperidae). *Australasian Journal of Herpetology* 16:27-30.
- Jimenez-Porrás, J. M. 1964. Venom proteins of the Fer-de-Lance, *Bothrops atrox*, from Costa Rica. *Toxicon* 2:155-158.
- Koller, R. 2005. Herpetologische waarnemingen in Belize, deel 2: reptielen. *Lacerta* 63(1):4-19.
- Lee, J. C. 2000. *A field guide to the amphibians and reptiles of the Maya world*. Cornell University Press, Ithaca.
- Leenders, T. 1995. The snakes of Rara Avis, Costa Rica II. Pit vipers (Crotalinae). *Litteratura Serpentiologia* 15(1):4-12.
- McCranie, J. R. 2011. *The snakes of Honduras*. SSAR, Salt Lake City:725 pp.
- McCranie, J. and Castañeda, F. E. 2005. The herpetofauna of Parque Nacional Pico Bonito, Honduras. *Phyllomedusa* 4(1):3-16.
- McDiarmid, R. W., Campbell, J. A. and Touré, T. A. 1999. *Snake species of the world. Vol. 1*. Herpetologists' League:511 pp.
- Monzel, M. and Wüster, W. 2008. Neotropische Grubenottern - Evolution, Biogeographie und Ökologie. *Draco* 8(33):4-27.
- Mora, J. M. and Merchán, M. 2001. *Bothrops asper* in Costa Rica. Part 1 - Description and distribution. *Reptilia* (GB) (18):56-61.
- Müller, F. 1885. Vierter Nachtrag zum Katalog der herpetologischen Sammlung des Basler Museums. *Verh. naturf. Ges. Basel* 7:668-717.
- Nicholson, K. E., McCranie, J. R. and Köhler, G. 2000. Herpetofaunal expedition to Parque Nacional Patuca: a newly established park in Honduras. *Herpetological Bulletin* (72):26-31.
- Parkinson, C. L. 1999. Molecular systematics and biogeographical history of pitvipers as determined by mitochondrial ribosomal DNA sequences. *Copeia* 1999(3):576-586.
- Pérez-Santos, C. and Moreno, A. G. 1988. *Ofidios de Colombia*. Museo regionale di Scienze Naturali, Torino, Monographie VI:517 pp.
- Porrás, L. W. and Solórzano, A. 2006. Die Schlangen Costa Ricas. *Reptilia* (Münster) 11(61):20-27.
- Ride, W. D. L. (ed.) et al. (on behalf of the International Commission on Zoological Nomenclature) 1999. *International code of Zoological Nomenclature*. The Natural History Museum - Cromwell Road, London SW7 5BD, UK (also commonly cited as "ICZN 1999").
- Rivas, G. A., Molina, C. R., Ugueto, G. N., Barros, C., Bar-Rio-Amoros, L. and Kok, P. J. R. 2012. Reptiles of Venezuela: an updated and commented checklist. *Zootaxa* 3211:1-64.
- Saldarriaga-Córdoba, M. M., Sasa, M. and Pardo, M. A. M. 2009. Phenotypic differences in a cryptic predator: Factors influencing morphological variation in the terciopelo *Bothrops asper* (Garman, 1884; Serpentes: Viperidae). *Toxicon* 54:923-937.
- Sasa, M. 1996. Morphological variation in the Lance-headed Snake *Bothrops asper* (Garman) from Middle America. MSc Thesis, University of Texas at Arlington, Arlington, Texas, USA.
- Sasa, M. 2002. Morphological variation in the lancehead pitviper *Bothrops asper* (Garman) (Serpentes: Viperidae) from Middle America. *Rev. Biol. Trop.* 50(1):259-271.
- Sasa, M. and Barrantes, R. 1998. Allozyme Variation in Populations of *Bothrops asper* (Serpentes: Viperidae) in Costa Rica. *Herpetologica* 54(4):462.
- Savage, J. M. 2002. *The Amphibians and Reptiles of Costa Rica: A Herpetofauna Between Two Continents, Between Two Seas*. University of Chicago Press, 934 pp.
- Schättli, B. and Kramer, E. 1993. Ecuadorianische Grubenottern der Gattungen *Bothriechis*, *Bothrops* und *Porthidium* (Serpentes: Viperidae). *Revue Suisse de Zoologie* 100(2):235-278.
- Scott, N. J. Jr. and Limerick, S. 1983. Reptiles and Amphibians. In: Janzen, D. H. (ed.) *Costa Rican Natural History*. University of Chicago Press, pp. 351-367.
- Sethao, R. 2008. Haltung, Pflege und Nachzucht neotropischer Lanzentottern der Gattung *Bothrops* am

Beispiel von *Bothrops asper* und *Bothrops venezuelensis*. *Draco* 8(33):35-38.

Taylor, E. H. 1949. A preliminary account of the herpetology of the state of San Luis Potosi, Mexico. *Univ. Kansas Sci. Bull.* 33(2):169-215.

Townsend, J. H., Wilson, L. D., Medina-Flores, M., Aguilar-Urbina, E., Atkinson, B. K. *et al.* 2012. A premontane hotspot for herpetological endemism on the windward side of Refugio de Vida Silvestre Texíguat, Honduras. *Salamandra* 48(2):92-114.

Urbina-Cardona, J. N., Olivares-Pérez, M. and Reynoso, V. H. 2006. Herpetofauna diversity and microenvironment correlates across a pasture-edge-interior ecotone in tropical rainforest fragments in the Los Tuxtlas Biosphere Reserve of Veracruz, Mexico. *Biological Conservation*

132:61-75.

Wasko, D. K. and Sasa, M. 2010. Habitat selection of the Terciopelo (Serpentes: Viperidae: *Bothrops asper*) in a tropical lowland rainforest in Costa Rica. *Herpetologica* 66(2):148-158.

Wasko, D. K. and Sasa, M. 2012. Food resources influence spatial ecology, habitat selection, and foraging behavior in an ambush-hunting snake (Viperidae: *Bothrops asper*): An experimental study. *Zoology* 115(3):179-187.

Wirth, M. 2011. Lohnende Reiseziele für Amphibien- und Reptilienfreunde in Costa Rica. *Draco* 12 (45):22-39.

CONFLICT OF INTEREST

The author has no conflicts of interest in terms of this paper or conclusions within.

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