

## CHARACTERIZATION OF SNAKEBITES IN THE MUNICIPALITY OF TABATINGA, IN THE WEST OF THE BRAZILIAN AMAZON

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### ABSTRACT

In Brazil there are more than 60 species of venomous snakes and a greater diversity is found in the Amazon. In the last two decades, more than 440,000 cases of snakebites have been recorded in Brazil, averaging more than 20,000 a year, in greater quantity and lethality in the northern region of the country. In western Brazilian Amazonia studies of ophidic accidents are more frequent in the Colombian Amazon, with little information for Brazilian territory. In order to reduce this information gap, this study analyzed available data on snakebites for this region and carried out information collection in the field to make an initial characterization of ophidic accidents in the city of Tabatinga, Amazonas state, Brazil. Our results showed that the Upper Solimoes River region represents one of the largest species diversity of venomous snakes in the Brazil, with the occurrence of 16 species from more than 25 species registered to the Amazonas state. In spite of this high diversity, the interviews pointed to a prevalence of the *Bothrops atrox* snake in local cases of snakebites, in agreement with the pattern of bothropic accident already described for the south of the Colombian Amazon and for the Amazonas state of Brazil. However, future studies on ophidic accidents in the Upper Solimoes River region should reveal a greater participation of arboreal pit vipers snakes, such as *Bothrops bilineatus*, and the bushmaster snake *Lachesis muta*, as reported in analyzes of snakebites in the Brazilian Amazon and the southern Colombian Amazon.

**KEYWORDS:** epidemiology; ophidic accident; public health

### INTRODUCTION

Accidents with venomous snakes are considered by the World Health Organization (WHO) a disease

largely neglected by tropical and subtropical developing countries (WHO, 2017). Harrison et al. (2009) analyzed a hundred countries and found a strong negative relationship (the increase of one variable influences the decrease of the other) between deaths caused by snakebites accidents and public spending on health. In these countries, ophidic accidents mainly affect the rural population, mainly to agricultural workers in the performance of labor activities, and is therefore considered an occupational disease that has a negative impact on food production and the economy of these countries (Harrison et al., 2009; Warrel, 2010; WHO, 2017).

In Brazil, more than 60 species of venomous snakes from the families Elapidae (true corals) and Viperidae (rattlesnake, pit vipers and bushmaster) (Costa & Bérnils, 2015) were reported for the Amazon (Bernade, 2014). In the last two decades, more than 440,000 cases of ophidic accidents have been recorded in Brazil, an average of more than 20 thousand a year, and the historical series of the last 16 years has shown an occurrence of snakebite accidents in more quantity and lethality in the North region of the country, where the incidence of these accidents (/100,000 inhabitants) was more than twice the national average (Ministerio da Saude, 2017).

In the northern region of the country, the state of Amazonas stands out because it presents some of the highest rates of incidence and mortality related to snakebites in Brazil (Feitosa, Sampaio et al., 2015; Ministerio da Saude, 2017). These numbers reflect the difficulties to provide preventive measures and antiofidic serum treatment to the traditional Amazonian people (caboclos and indigenous people) who survive from farming, hunting, fishing and logging and non-timber products, usually organized in communities far from urban areas and in difficult to reach places, which increases the underreporting of ophidic accidents in this region (Bernade, 2014).

In the western Brazilian Amazon, in the microregion of the Upper Solimoes River, triple frontier region of Brazil with Colombia and Peru, studies of ophidic accidents are more frequent in the Colombian Amazon (Silva-Haad, 1982; 1994; Pineda et al., 2002), with little information for the Brazilian territory (see Oliveira, 2014; 2015). In order to reduce this information gap, this study analyzed available data on snakebites for this region and carried out data collection in the field to reveal an initial characterization of ophidic accidents in the municipality of Tabatinga, Amazonas, Brazil.

## MATERIALS AND METHODS

To generate an updated list of snakes of medical interest that occur in the Upper Solimoes River region, we systematized the records of venomous snakes made by the authors during several field works, carried out since 2010 in the surroundings of Tabatinga-AM. These records were added with the species cited by the specialized literature for western region of the Brazilian Amazon (Bernade, 2014; Feitosa, Sampaio et al., 2015; Feitosa et al., 2015), for the southern Colombian Amazon (Silva-Haad, 1982; 1994; Pineda et al., 2002) and those related to the region in the online database The Reptile Database (Uetz et al., 2017).

In order to collect information about how ophidic accidents affect the socioeconomic conditions of family farmers in this region, we conducted a field survey in the municipality of Tabatinga-AM in the year 2015, where farmers and their families were interviewed with a semi-structured questionnaire previously prepared.

Finally, in order to establish a pattern of ophidic accidents in the Upper Solimoes River region, secondary data on accidents with venomous animals made available in the epidemiological bulletin of the municipal health secretariat of Tabatinga (Oliveira, 2014; 2015) and on the national system of notification diseases - SINAN (Ministerio da Saude, 2017). The information obtained in these databases was standardized and compared with recent analyzes of snakebites in the state of Amazonas (Feitosa, Sampaio et al., 2015), in the northern region of Brazil (Bernade, 2014) and in the southern Colombian Amazon (Silva-Haad, 1982; 1994; Pineda et al., 2002).

## RESULTS

For the Upper Solimoes River region, 16 species of venomous snakes, six species from Viperidae family and 10 species from Elapidae family (Table 1) were collected.

**Tabla 1.** List of venomous snakes species occurring in the Upper Solimoes River region, on the triple border of Brazil with Colombia and Peru, in western Brazilian Amazonia.

Species	Family	Registry Source
<i>Bothrops atrox</i> (Linnaeus, 1758)	Viperidae	SILVA-HAAD (1982)*
<i>Bothrops bilineatus</i> (Wied, 1821)	Viperidae	SILVA-HAAD (1982)*
<i>Bothrops brazili</i> Hoge, 1954	Viperidae	SILVA-HAAD (1982)
<i>Bothrops hyoprora</i> (Amaral, 1935)	Viperidae	SILVA-HAAD (1982)
<i>Bothrops taeniatus</i> Wagler in Spix, 1824	Viperidae	SILVA-HAAD (1982)
<i>Lachesis muta</i> (Linnaeus, 1766)	Viperidae	SILVA-HAAD (1982)
<i>Micrurus filiformis</i> (Günther, 1859)	Elapidae	SILVA-HAAD (1994)
<i>Micrurus hemprichii</i> (Jan, 1858)	Elapidae	SILVA-HAAD (1994)*
<i>Micrurus langsdorffi</i> Wagler in Spix, 1824	Elapidae	SILVA-HAAD (1994)
<i>Micrurus lemniscatus</i> (Linnaeus, 1758)	Elapidae	SILVA-HAAD (1994)*
<i>Micrurus narducci</i> (Jan, 1863)	Elapidae	SILVA-HAAD (1994)
<i>Micrurus ornatissimus</i> (Jan, 1858)	Elapidae	SILVA-HAAD (1994)
<i>Micrurus scutiventris</i> (Cope, 1869)	Elapidae	SILVA-HAAD (1994)
<i>Micrurus spixii</i> Wagler in Spix, 1824	Elapidae	SILVA-HAAD (1994)
<i>Micrurus surinamensis</i> (Cuvier, 1817)	Elapidae	SILVA-HAAD (1994)*
<i>Micrurus tikuna</i> Feitosa, Da Silva Jr, Pires, Zaher & Costa-Prudente, 2015	Elapidae	FEITOSA et al. (2015)

\*Species observed in the field

In the perception of the 16 families of farmers interviewed, there was a decrease in cases of snakebites attributed to prevention actions (basically access to information), and especially to the use of personal protective equipment, such as high boots and gloves. Also, due to the local practice of cutting with the machete the invading vegetation of the crops, using a wooden handle to support the vegetation, instead of using their own hands. The farmers interviewed cited the white-tailed pit viper (*Bothrops atrox*) as the main local poisonous species, which caused most of the accidents in the region.

All families reported that today events of ophidic accidents cause eventual damages that cause losses in agricultural production, mainly by weakening the family workforce, moving away the worker victimized for a long period of his work activities. However, in all cases of snakebite (N= 5) reported by these family farmers, the victims were treated with the antiofidic serum, which was accessible to this population due to the presence of the military hospital for more than 40 years in this region of international border.

Another interesting quote by the farmers was related to the medium and large species of non-venomous snakes from Boidae family (anaconda, common boa and rainbow boa), referred to as ravenous predators of poultry (chickens, ducks and geese), an event which often causes economic losses for these breeders.

The epidemiological bulletins of the municipal health secretariat of Tabatinga, from the years 2014 and 2015, reported about 40 cases/ year of ophidic accidents attended at health units in the city, distributed in number of cases per month, sex and age group (Oliveira, 2014; 2015). Without presenting the species of venomous snake and the type of serology, these data showed a higher incidence in the month of January (10 cases) in the age group between 15-44 years (>50%) and with the same frequency between sexes.

Data from the National System of Notification Diseases - SINAN (Ministerio da Saude, 2017) pointed out that in Brazil male sex is the most affected in snakebites, mainly in the economically active age, between 20-49 years. These events occurred predominantly in rural areas and impacted mainly on rural workers, with accidents involving pit viper snakes (bothropic accident) and bushmaster snake (lathetic accident), those that could cause more severe damage in their ability to work because they have the capacity to cause limb amputation in the victims.

Feitosa, Sampaio et al. (2015) analyzed 9,174 ophidic accidents in the state of Amazonas, between 2007 and 2012, and observed one of the lowest mean incidence rates in the state in the municipality of Tabatinga (<31 cases/ 100,000). These snakebites occurred mostly in rural areas during the rainy season and mainly affected rural workers in the exercise of labor activities.

The same authors found a predominance of the bothropic accidents (67,3%), followed by the lathetic accidents (21,8%). This pattern of prevalence was also reported for the northern region of Brazil (Bernade, 2014) and for the southern Colombian Amazon (Silva-Haad, 1982; 1994; Pineda et al., 2002), where the main species of venomous snakes involved in snakebites accidents were *Bothrops atrox*, *Bothrops bilineatus* and *Lachesis muta*.

## CONCLUSIONS

The Upper Solimoes River region represents one of the largest species diversity of venomous snakes in the Brazil, with the occurrence of 16 species (Table 1) of the more than 25 species registered for the Amazonas (see Bernade, 2014; Feitosa et al., 2015; Uetz et al., 2017). In spite of this high diversity, the interviews pointed to a prevalence of the *Bothrops atrox* snake in local cases of ophidic accidents, agreeing with the bothropic accident pattern already described for the south of the Colombian Amazon (Silva-Haad, 1982; Pineda et al., 2002), for the state of Amazonas (Feitosa, Sampaio et al., 2015) and for the northern region of Brazil (Bernade, 2014).

However, it is possible that arboreal pit vipers species such as *Bothrops bilineatus*, which most frequently cause poisoning in the upper limbs and upper body of the victims, may have a greater participation in local snakebites, as has been reported for southern Amazonia Colombian (Silva-Haad, 1982; Pineda et al., 2002).

Future studies may also reveal a greater participation of the bushmaster snake *Lachesis muta* in cases of snakebites in the Upper Solimoes River region, because this venomous snake was reported as the cause of more than 20% of ophidic accidents in the Amazonas state (Feitosa, Sampaio et al., 2015) and the lathetic accident is clinically quite similar to bothropic poisoning (Bernade, 2014).

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## BIBLIOGRAPHIC REFERENCES

- Bernade, P.S. 2014. *Serpentes peçonhentas e acidentes ofídicos no Brasil*. Ed. Anolisbooks, São Paulo. 224pp.
- Costa, H.C.; Bérnils, R.S. 2015. Répteis brasileiros: Lista de espécies 2015. *Herpetologia Brasileira*, 3 (vol. 4): 75-93.
- Feitosa, D.T.; Da Silva Jr, N.J.; Pires, M.G.; Zaher, H.; Costa-Prudente, A.L. 2015. A new species of monadal coral snake of the genus *Micrurus* (Serpentes, Elapidae) from western Amazon. *Zootaxa*, 3974 (4): 538–554.
- Feitosa, E.S.; Sampaio, V.; Sachett, J.; Castro, D.B.; Noronha, M.D.N.; López Lozano, J.L.; Muniz, E.; Ferreira, L.C.L.; Lacerda, M.V.G.; Monteiro, W.M. 2015. Snakebites in the State of Amazonas: a largely neglected problem. *Revista da Sociedade Brasileira de Medicina Tropical*, 48 (Suppl. I): 34-41.
- Harrison, R.A.; Hargreaves, A.; Wagstaff, S.C.; Faragher, B.; Laloo, D.G. 2009. Snake Envenoming: A Disease of Poverty. *PLOS Neglected Tropical Diseases*, 3(12): e569.
- Ministério da Saude. 2017. Sistema de Informação de Agravos de Notificação - SINAN. Brasília: Brasil. Access in: <<http://portalsaude.saude.gov.br/index.php/o-ministerio/principal/leia-mais-o-ministerio/1025-secretaria-svs/vigilancia-de-a-a-z/animais-peconhentos-serpentes/12-animais-peconhentos-serpentes/13712-situacao-epidemiologica-dados>>.
- Oliveira, F.C.P. 2014. Acidentes por animais peçonhentos. *Secretaria Municipal de Saúde. Boletim Epidemiológico de Tabatinga*, 03: 17-18.
- Oliveira, F.C.P. 2015. Acidentes por animais peçonhentos. *Secretaria Municipal de Saúde. Boletim Epidemiológico de Tabatinga*, 01: 18-19.
- Pineda, D.; Ghotme, K.; Elvira Aldeco, M.; Montoya, P. 2002. Accidentes ofídicos en Yopal y Leticia, Colombia, 1996-1997. *Biomédica*, 22: 14-21.
- Silva-Haad, J.J. 1982. Las serpientes del género *Bothrops* en la amazonia colombiana. *Comando Unificado del Sur*, 82: 45-50.
- Silva-Haad, J.J. 1984. Los *Micrurus* de la Amazonia Colombiana. *Biología y toxicología experimental de sus venenos. Colombia Amazonica*, 7: 41–138.
- Uetz, P.; Freed, P.; Jiri, H. (eds.). 2017. The Reptile Database <<http://www.reptile-database.org>>.
- Warrel, D.A. 2010. Snake bite. *Lancet*, 375(2): 77-88.
- WHO. 2017. Snakebite <[http://www.who.int/neglected\\_diseases/diseases/snakebites/en/index.html](http://www.who.int/neglected_diseases/diseases/snakebites/en/index.html)/ World Health Organization>.

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