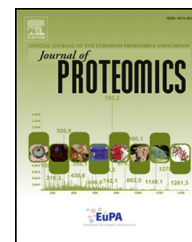


Available online at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/jprot

Proteomic and functional profiling of the venom of *Bothrops ayerbeii* from Cauca, Colombia, reveals striking interspecific variation with *Bothrops asper* venom

Q1 Diana Mora-Obando^a, Jimmy Alexander Guerrero-Vargas^b, Rodrigo Prieto-Sánchez^c,
 6 José Beltrán^d, Alexandra Rucavado^a, Mahmood Sasa^a, José María Gutiérrez^a,
 7 Santiago Ayerbe^d, Bruno Lomonte^{a,*}

8 ^aInstituto Clodomiro Picado, Facultad de Microbiología, Universidad de Costa Rica, San José, Costa Rica

9 ^bDepartamento de Biología, Grupo de Investigaciones Herpetológicas y Toxinológicas, Museo de Historia Natural, Universidad del Cauca, Popayán, Colombia

10 ^cDepartamento de Biología, Universidad del Tolima, Ibagué, Colombia

11 ^dCentro de Investigaciones Biomédicas, Universidad del Cauca, Popayán, Colombia

ARTICLE INFO

Article history:

27 Received 9 October 2013

28 Accepted 1 November 2013

Keywords:

29 Snake venom

30 *Bothrops ayerbeii*

31 *Bothrops asper*

32 Venomics

33 Toxicity

ABSTRACT

Bothrops ayerbeii, a pitviper inhabiting the Patía River's basin (Valle Alto del Río Patía) in the Southwestern Department of Cauca, Colombia, was considered as a variant form of *Bothrops asper* prior to being proposed as a new species in 2010, on the basis of subtle morphological differences. This study reports the proteomic and functional profiling of *B. ayerbeii* venom. Its most striking feature is an almost complete absence (0.7%) of phospholipases A₂ (PLA₂), which is in contrast to the high proportion of these enzymes (25.3%) in the venom of *B. asper* from Cauca, as well as in other species of *Bothrops*. The predominant proteins in *B. ayerbeii* venom are metalloproteinases (53.7%), in agreement with its higher hemorrhagic and lethal activities compared to *B. asper* venom. Moreover, the negligible content of PLA₂s in *B. ayerbeii* venom correlates with its weaker myotoxic effect, in contrast to *B. asper* venom, here shown to contain abundant Asp49- and Lys49-type PLA₂s responsible for its strong myotoxic activity. Other components identified in *B. ayerbeii* venom include bradykinin-potentiating-like peptides and proteins belonging to the C-type lectin/lectin-like, serine proteinase, L-amino acid oxidase, disintegrin, cysteine-rich secretory protein, nerve growth factor, and phosphodiesterase families. The venom composition of *B. ayerbeii* resembles that of neonate specimens of *B. asper*, which shows a predominance of metalloproteinases, with only low amounts of PLA₂s. Therefore, the present findings suggest that the expression of venom proteins in *B. ayerbeii*, in contrast to *B. asper*, might retain a marked 'paedomorphic' condition. Altogether, the proteomic and toxicological characterization of the venom of *B. ayerbeii* here reported argues in favor of its taxonomical separation from *B. asper* in Cauca, Colombia.

Biological significance

B. ayerbeii, a pitviper found in Cauca, Colombia, had been considered as a variant form of *B. asper*, but was recently described as a new species on the basis of subtle morphological

* Corresponding author at: Instituto Clodomiro Picado, Facultad de Microbiología, Universidad de Costa Rica, San José 11501, Costa Rica. E-mail address: bruno.lomonte@ucr.ac.cr (B. Lomonte).

differences. Our study provides the first detailed proteomic and functional analysis of the venom of *B. ayerbei*, revealing striking interspecific variation from *B. asper*, thus arguing in favor of their taxonomical separation. In addition, the observed composition of the venom of *B. ayerbei* correlates well with its functional and toxicological properties, helping to predict the main clinical manifestations in envenomings by this species, which inflicts a considerable number of snakebites in the Southwestern regions of Colombia.

© 2013 Published by Elsevier B.V.

1. Introduction

Neotropical pitvipers classified within the genus *Bothrops* (*sensu lato*) are responsible for the vast majority of snakebite envenomings and fatalities in Latin America [1]. The taxonomy and phylogenetic relationships within this genus are still under intense study, with a variable number of species according to different authors and sources ([2–4]; reptile-database.org). In Colombia, *Bothrops* species inflict nearly 90% of the 2000–4500 snakebites recorded annually, resulting in a death rate of 0.8–5% [5–8]. In the Southwestern Department of Cauca, Colombia, a retrospective epidemiological survey spanning the period 2000–2008 attributed 43% of all snakebite envenomings to the species currently recognized as *Bothrops ayerbei*, 27% to *Bothrops rhombeatus*, and 8% to *Bothrops asper* [9]. *B. ayerbei*, locally known as “equis patiana” or “cacica”, had formerly been considered as a variant form of *B. asper* [3,10,11], but on the basis of subtle morphological differences it was recently described as a new species [12]. Due to its medical relevance in Cauca, Colombia, and considering its newly proposed taxonomical status, *B. ayerbei* represents an interesting case for the proteomic and toxicologic characterization of its venom. It was hypothesized that a comparison of its compositional and functional

profiles against those of the venom of *B. asper* from a nearby region could provide additional elements to assess the proposed divergence between these two pitviper species. This hypothesis is based upon the premise that venom composition may reflect, to some extent, phylogenetic relationships [13,14]. Therefore, a detailed analysis of the protein composition of the venom of *B. ayerbei* is reported for the first time, in combination with an assessment of its main toxic activities in comparison to the venom of *B. asper* from the Pacific coast of the Department of Cauca, Colombia.

2. Materials and methods

2.1. Snake venoms

The venom of *B. ayerbei* was a pool obtained from 30 adult specimens collected in Valle Alto del Río Patía, Department of Cauca, Colombia (Fig. 1). For comparative experiments, venom from thirteen *B. asper* adults collected in El Tambo, in the Pacific coast of the Department of Cauca (Fig. 1) were obtained and pooled. All snakes were maintained at the serpentarium of Centro de Investigaciones Biomédicas, Universidad del Cauca (CIBUC) and classified as adults on the basis of body



Fig. 1 – (A) Geographical distribution of *Bothrops ayerbei* (red) and *Bothrops asper* (blue) in Colombia. Black dots represent localities in the Department of Cauca of specimens studied here. (B) Specimen of *B. ayerbei* collected in Valle Alto del Río Patía, Cauca, Colombia, at 1400 m of altitude. Insert in (B): the characteristic “arrow-like” shape of the dark pigmentation of the head is a frequently found morphological trait of this species. Photographs by S. Ayerbe and D. Mora-Obando.

Download English Version:

<https://daneshyari.com/en/article/7636770>

Download Persian Version:

<https://daneshyari.com/article/7636770>

[Daneshyari.com](https://daneshyari.com)