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Une deuxième espèce de Vietbocap Lourenço & Pham, 2010 (Scorpiones : Pseudochactidae) pour le Vietnam

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ABSTRACT

A second species of scorpion belonging to the family Pseudochactidae and to the genus *Vietbocap* is described from two specimens collected in the Thien Duong cave, which belongs to the Vom cave system, in the Phong Nha - Ke Bang National Park, Quang Binh Province, Vietnam. Like the previously described species of *Vietbocap*, the new species is also a true troglóbite element, the second known for the family Pseudochactidae. This represents the fourth known record of a pseudochactid, and the second from Vietnam.

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R É S U M É

Une deuxième espèce de scorpion appartenant à la famille des Pseudochactidae et au genre *Vietbocap* est décrite à partir de deux exemplaires collectés dans la grotte Thien Duong laquelle appartient au système des grottes Vom dans le Parc National Phong Nha - Ke Bang dans la Province de Quang Binh, Vietnam. Ainsi que la première espèce décrite dans le genre *Vietbocap*, la nouvelle espèce est également un élément troglóbite; le deuxième connu pour la famille des Pseudochactidae. La nouvelle espèce est la quatrième connue pour la famille des Pseudochactidae et la deuxième pour le Vietnam.

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1. Introduction

The family Pseudochactidae Gromov, 1998 contains some of the most remarkable scorpions described in recent years. The first species to be discovered was *Pseudochactas ovchinnikovi* Gromov, 1998, found in an

isolated mountainous region of southeastern Uzbekistan and southwestern Tajikistan, in Central Asia [1]. A second genus and species, *Troglökhammouanus steineri* Lourenço, 2007, was described from karst caves in Laos [2]. Although this species was found inside a cave, its morphological characteristics do not correspond to a troglóbite element. This Laotian species reopened the question about the origins and affinities of the Pseudochactidae and led to new biogeographical interpretations [2].

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Very recently, scorpions have been prospected in karst cave systems in Vietnam, and several specimens of a new pseudoscorpion were collected in the Tien Son cave, which belongs to the Phong Nha system. These were described as a new genus and species, *Vietbocap canhi* Lourenço & Pham, 2010, which represents a true troglobitic element [3]. In recent months, new surveys in the cave systems of Vietnam have been carried out and again, another pseudoscorpion was collected in the Thien Duong cave, which belongs to the Vom cave system. The new species also belongs to the genus *Vietbocap*, and shows features of a true troglobitic element. The fact that three pseudoscorpion elements originating from caves within the same karst system have already been found in Laos and Vietnam, suggest that this region of Southeast Asia may represent a refuge or centre of endemism for this family.

New phylogenetic or biogeographical considerations are not proposed here, since these aspects have already been largely discussed by Lourenço [2]. More detailed information on the orogeny and geodynamics of South East Asia, and on the location, ecology and climate of the national park and caves, can be found in Lourenço & Pham [3].

2. Tien Son cave in the Phong Nha cave system and Thien Duong cave in the Vom cave system

Tien Son cave, where *Vietbocap canhi* was found is located in Son Trach Commune, Bô Trạch District (Fig. 1). The entrance is located 1 km from Phong Nha cave, at an altitude of 200 m. Tien Son cave is 980 m in length. A 10 m

deep hole is situated 400 m from the entrance, after which a 500 m long underground cave is open solely to professional scientists. According to British speleologists, Tien Son Cave was created tens of millions years ago, when a water current holed this limestone mountain in Ke Bang. Following a series of rock movement, this mass was levered or lowered, blocking the current and creating what is now Tien Son Cave, while the flow of the underground river was redirected to Phong Nha Cave. Although Phong Nha and Tien Son Caves are located next to each other, there are no passages linking them [4].

Thien Duong cave (Paradise cave), where the new species was found, is situated in Phong Nha-Ke Bang National Park, 60 km northwest of Đông Hói city (Fig. 1). Thien Duong cave is at an elevation of 200 meters above sea level, near the west branch of Ho Chi Minh Highway, in Son Trach Commune, Bo Trạch District, Quang Binh Province, Vietnam. The cave was discovered by a local inhabitant in 2005 and initially the first 5 km of this cave were explored by scientists from the British Cave Research Association in 2005. More recently the whole extension of the cave was explored by the same Association. The cave is 31 km long, and in parts can reach 100 meters in height and 150 meters in width. There are two cave systems in Phong Nha-Ke Bang region: Phong Nha cave system and Vom cave system. However, these systems are totally isolated, with no geological connections being known between them [5].

The Phong Nha-Ke Bang karst is the oldest major karst area in Asia. It has been subjected to massive tectonic changes and comprises a series of rock types that are

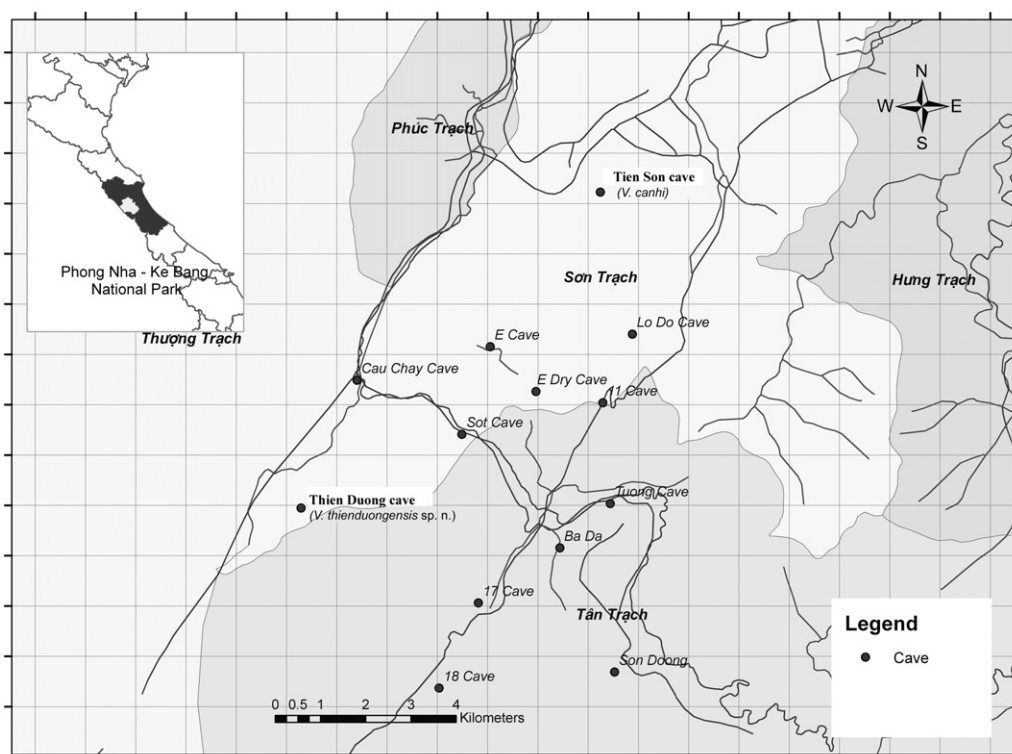


Fig. 1. Map of the Phong Nha - Ke Bang National Park showing the locations of Tien Son and Thien Duong caves.

interbedded in complex ways. Probably as many as seven major levels of karst development have occurred as a result of tectonic uplift and changing sea levels, thus the karst landscape of PNKB is extremely complex with high geodiversity and many geomorphic features of considerable significance [3,5].

3. Methods

Scorpions were collected by scientists of the IEBR and the Phong Nha-Ke Bang National Park, while exploring the caves with the help of standard electric torches. They were found on the cave walls, approximately 1800 m from the main cave entrance (while *V. canhi* was found, under rocks, 200 m from the main entrance of Tien Son Cave). This is a new distance record from a cave entrance for a scorpion (Fig. 2). Measurements and illustrations were made using a Wild M5 stereomicroscope with a drawing tube and an ocular micrometer. Measurements follow those of Stahnke [6] and are given in mm. Trichobothrial notations are those developed by Soleglad and Fet [7] and the morphological terminology mostly follows that of Hjelle [8] and Lourenço [2,9].

4. Taxonomic treatment

Family Pseudochactidae Gromov, 1998
Genus *Vietbocap* Lourenço & Pham, 2010
Vietbocap thienduongensis sp. n. (Fig. 3)



Fig. 2. Thien Duong cave, interior view, showing the walls where the new species was found.

4.1. Diagnosis

Anterior margin of carapace only slightly depressed, with a weak concavity. Lateral ocelli absent. Pair of circumocular sutures complete in the posterior region to median ocular tubercle with a broad U-shaped configuration. Median ocelli absent; median tubercle represented by a smooth but not depressed zone. Anterosubmedial carinae absent from zone delimited by circumocular sutures. Type D trichobothrial pattern [7,10] with 35 trichobothria per pedipalp: 12 on femur, of which 5 dorsal, 4 internal and 3 external (**d**₁, **d**₄, **d**₅ and **i**₄ extremely reduced); 10 on patella, of which 3 dorsal, 1 internal and 6 external (**est** extremely reduced); ventral surface without trichobothria; 13 trichobothria on chela, of which 5 on manus, 8 on fixed finger (**ib**₂ extremely reduced); dorsal trichobothria of femur with 'beta-like' configuration. Sternum pentagonal, type 1 [11], strongly compressed horizontally, slightly longer than wide, external aspect not flat, with a concave region, posteromedian depression round. Telotarsi each with several spinular setae, not clearly arranged in rows. Metasomal segment V with a weakly marked pair of ventrosubmedian carinae; no ventromedian carina between ventrosubmedian carinae. Fixed and movable fingers strongly curved; dentate margins each with median denticle row comprising seven oblique granular sub-rows; internal and external accessory granules at base of each sub-row. Respiratory spiracles small, semi-oval to round. Pro- and retrolateral pedal spurs present on legs I-IV. Tibial spurs absent from all legs.

4.2. Type material

Male holotype, male paratype. Vietnam, Quang Binh Province, Phong Nha - Ke Bang National Park, Thien Duong cave (106° 22'E-17° 52'N), mid section of cave (1800 m from cave entrance), 9/VIII/2011 (N.-K. Dang). Holotype deposited in the Muséum national d'Histoire naturelle, Paris. Paratype deposited in the Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, Hanoi.

4.3. Etymology

Specific name refers to Thien Duong cave, where the new species was found.

Description based on male holotype and male paratype (measurements given after the description).

4.4. Colour

General coloration yellow, less pale than *V. canhi*; cheliceral teeth, telson tip and rows of granules on pedipalp fingers dark reddish.

4.5. Morphology

Chelicerae: dorsal edge of fixed finger with four denticles (basal, medial, subdistal, distal); ventral edge with 3–4 very reduced denticles; movable finger with

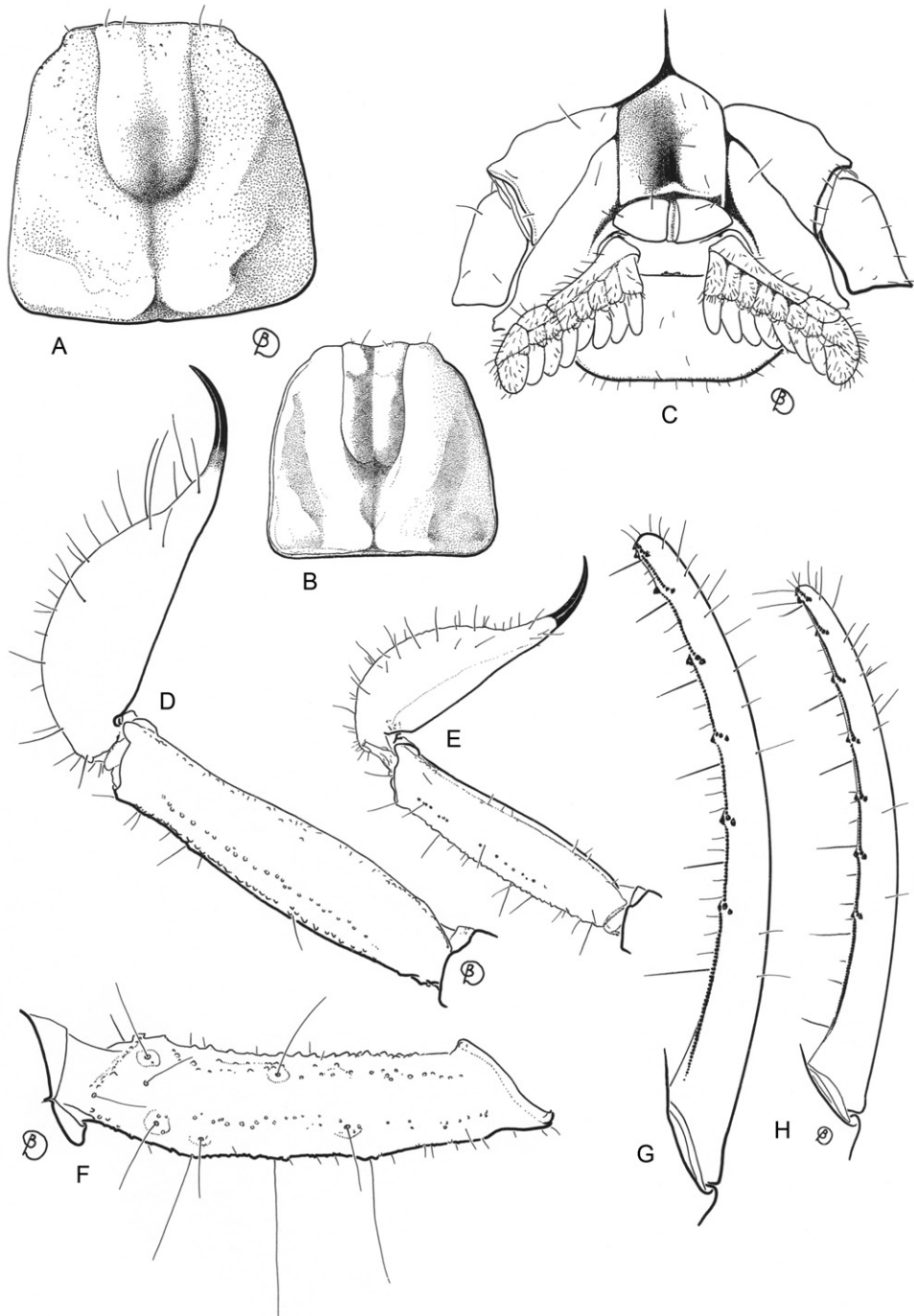


Fig. 3. A, C, D, F, G. *Vietbocap thienuongensis* sp. n., male holotype. B, E, H. *Vietbocap canhi*, male holotype (from Lourenço & Pham [3]). A–B. Carapace, dorsal aspect. C. Ventral aspect, showing sternum, genital operculum, pectines and sternite III. D–E. Metasomal segment V and telson, lateral aspect. F. Femur, dorsal aspect, showing trichobothrial pattern. G–H. Movable finger of pedipalp chela with sub-rows of granules.

three denticles (medial, subdistal, external distal) on dorsal edge, without basal denticles; ventral edge with 4–5 reduced denticles and a very weak serrula; external distal denticle smaller than internal distal denticle; ventral aspect of fingers and manus with numerous macrosetae. Carapace: anterior margin only slightly depressed with a

weakly marked concavity; lateral ocelli absent; median ocular tubercle represented by a smooth and not depressed zone; median ocelli absent; interocular furrow obsolete. One pair of weakly marked circumocular sutures with a broad U-shaped configuration, also complete behind median ocular tubercle. Anteromedian and posteromedian

furrows shallow; posterolateral furrow shallow, weakly curved; posteromarginal furrow narrow, shallow. Carapace almost totally smooth, except for some isolated granules anteriorly. Pedipalp segments apilose. Femur with five discernible carinae, all weak; intercarinal surfaces smooth. Patella with six discernible carinae; ventrointernal carinae with some spinoid granules; intercarinal surfaces smooth. Chela with dorso-external and ventral carinae weakly marked; tegument smooth. Fixed and movable fingers strongly curved; dentate margins, each with median denticle row comprising seven oblique granular sub-rows; each sub-row comprising several small granules and internal and external accessory granules. Trichobothria orthobothriotaxic, Type D [7,10], 'beta-like' configuration, **d**₂ situated on dorsal surface, **d**₃ and **d**₄ in same axis of the femur, parallel and closer to dorso-external carina than is **d**₁, angle formed by **d**₁, **d**₃ and **d**₄ opening toward internal surface; totals: femur, 12 (5 dorsal, 4 internal, 3 external); patella, 10 (3 dorsal, 1 internal, 6 external); chela, 13 (5 on manus, 8 on fixed finger). Legs I to IV: tibiae without spurs; basitarsi each with a pair of pro- and retrolateral spurs; telotarsi each with several spinular setae, not clearly arranged in rows. Sternum pentagonal, type 1 [11], strongly compressed horizontally, slightly longer than wide, external aspect not flat, with a concave region, posteromedian depression round. Pectines each with 3–4 distinct marginal lamellae and 7–8 well-delineated median lamellae in male. Fulcra absent or vestigial. Pectinal tooth count: 8–8 in males. Genital operculum completely divided longitudinally; genital plugs observed in male. Mesosoma: pre-tergites smooth and shiny; post-tergites II–VI smooth, apart from some minute granules; VII with a few granules and a pair of dorso-submedian and dorsolateral carinae, reaching posterior edge of segment. Sternites almost entirely smooth, acarinate; surfaces with scattered macrosetae; distal margins with sparse row of macrosetae; respiratory spiracles small, semi-oval to round. Metasoma with a few short macrosetae. Ten carinae on segments I to III; eight carinae on segment IV; four on segment V. Dorso-submedian carinae moderately developed on segments I–IV, absent on segment V; spinoid granules absent. Other carinae moderately to weakly developed on segments I–V. Telson long and slightly bulbous; vesicle smooth on all faces; aculeus shorter than vesicle and weakly curved, without a subaculear tubercle ventrally. Form of venom

glands unknown. Geographic distribution: only known from the type locality.

4.6. Measurements (in mm) of male holotype of *Vietbocap canhi* and male holotype of *Vietbocap thienduongensis* sp. n.

Total length 22.4/27.3. Carapace: length 2.9/3.6; anterior width 2.0/2.2; posterior width 3.2/3.5. Mesosoma length 5.5/6.7. Metasomal segments: I, length 1.2/1.4, width 1.4/1.6; II, length 1.4/1.7, width 1.3/1.4; III, length 1.5/2.0, width 1.2/1.4; IV, length 2.1/2.3, width 1.1/1.3; V, length 3.9/4.8, width 1.1/1.3, depth 0.9/1.2. Telson length 3.9/4.8; vesicle length 2.4/3.6, width 1.3/1.6, depth 1.2/1.4. Pedipalp: femur length 3.8/4.5, width 0.9/0.9; patella length 3.6/4.3, width 1.1/1.2; chela length 7.1/8.3, width 1.2/1.3, depth 1.0/1.2; movable finger length 4.2/4.6.

5. Relationships

Vietbocap canhi and *Vietbocap thienduongensis* sp. n. are rather similar in morphology. However, the new species can be distinguished from *V. canhi* by a number of features: (i) bigger size and distinct morphometric values; (ii) complete and more strongly marked circumocular sutures; (iii) chela fingers proportionally shorter (ratios of chela length/movable finger length 7.1/4.2 = 1.69 for *V. canhi* and 8.3/4.6 = 1.80 for *V. thienduongensis* sp. n.) and with 8 sub-rows of granules vs. 7 sub-rows; (iv) sternum only slightly longer than wide (ratio 1.15 for *V. canhi* and 1.30 for *V. thienduongensis* sp. n.); (v) metasomal segments less carinated and granulated and with a weaker chaetotaxy; (vi) pedipalp carinae better marked; (vii) pectines shorter and more bulkier with 8 teeth.

Moreover, the caves where the species have been found are totally isolated from one other and belong to distinct cave systems. Given that the two caves are only a few kilometres apart, it can be suggested that both *Vietbocap* species may have a common epigeal ancestor that colonized the caves independently.

6. Key to the known genera and species of *Pseudochactidae*

This is shown in Fig. 4.

- 1. Median and lateral ocelli present; leg tibial spurs present 3
- Median and lateral ocelli absent; leg tibial spurs absent..... 2
- 2. Circumocular sutures incomplete; chela fingers with 8 sub-rows of granules *Vietbocap canhi*
- Circumocular sutures complete; chela fingers with 7 sub-rows of granules *Vietbocap thienduongensis* sp. n.
- 3. Circumocular sutures incomplete; peg sensillae of pectines rounded *Troglokhammouanus steineri*
- Circumocular sutures complete; peg sensillae of pectines spatula *Pseudochactas ovchinnikovi*

Fig. 4. Key to the known genera and species of *Pseudochactidae*.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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