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First record of a cave species of *Euscorpiops* Vachon from Viet Nam (Scorpiones, Euscorpiidae, Scorpiopinae)

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ABSTRACT

Euscorpiops cavernicola sp. n., belonging to the family Euscorpiidae Laurie, is described on the basis of two male and two female specimens collected in the Hua Ma cave located in the Quang Khe commune, Ba Be district of Bac Kan province in Viet Nam. The new species presents most features exhibited by scorpions within the genus *Euscorpiops*, however it may represent the first discovered Scorpiopinae species exhibiting certain adaptations to cave life.

RÉSUMÉ

Euscorpiops cavernicola sp. n., appartenant à la famille des Euscorpiidae Laurie, est décrite à partir de deux mâles et deux femelles collectés dans la grotte Hua Ma, laquelle est localisée dans la commune de Quang Khe, district de Ba Be, dans la province de Bac Kan au Viet Nam. La nouvelle espèce présente globalement les caractères qui définissent les scorpions du genre *Euscorpiops* ; cependant, elle pourrait représenter la première espèce de Scorpiopinae, avec des caractéristiques d'adaptation à la vie cavernicole.

1. Introduction

The subfamily Scorpiopinae can be estimated as complex. Scorpiopinae was first proposed by Kraepelin [1] as Scorpiopsinae, a subfamily of Vaejovidae. Lourenço [2] confirmed a previous decision by Stockwell [3] about raising Scorpiopinae to family level. Subsequently, Soleglad & Sissom [4] downgraded Scorpiopidae to a subfamily of Euscorpiidae, and grouped the Asian genera into the tribe Scorpiopini, and also included in this subfamily the North American genus *Troglocormus* (tribe Troglocormini). According to morphological assessments, the subfamily Scorpiopinae currently forms a monophyletic group within Euscorpiidae, and does not share any synapomorphies with North American Vaejovidae [4]. The tribe Scorpiopini includes six Asian genera, mainly from the Southern and Southeastern regions of the continent. This composition is mainly due to Vachon [5] who revised *Scorpiops* and described three new subgenera in addition to the nominotypical subgenus *Scorpiops*; *Alloscorpiops*, *Euscorpiops*, and *Neoscorpiops*. These four subgenera were later elevated to generic rank by Lourenço [2], who added the monotypic genera *Parascorpiops* Banks, 1928, and *Dasyscorpiops* Vachon, 1974, bringing the total number of genera to six. Soleglad & Sissom [4] then supported the validity of *Euscorpiops* based on the position of chela trichobothrium

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Eb_3 and the presence of an annular ring on the telson. Recently, Lourenço [6] divided the genus *Alloscorpiops* into two subgenera with the creation of the subgenus *Laoscorpiops*. Since most historical aspects around these decisions have been consistently synthesized by Lourenço [6] they will not be further discussed here. In the present note, a new species belonging to the genus *Euscorpiops* is described from Viet Nam.

2. Cave scorpions

Cave scorpions, or more precisely true troglobitic scorpions (i.e. species which complete their entire life cycle within caves) are rare across the World. Vandel [7] stated 'Aucun scorpion ne mène une vie vraiment cavernicole' [no scorpion leads a strictly cavernicolous existence]. It was not until the late 1960s that the first truly troglobitic scorpions were described from Mexican caves [8]: *Typhlochactas rhodesi* Mitchell, 1968 and *Typhlochactas reddelli* Mitchell, 1968. By the mid-1980s the number of troglobite species had increased from 2 to 13 species [9]. Of these, eleven are from Mexico, and belong primarily to the families Diplocentridae Karsch, 1880, Euscorpiidae Laurie, 1896, Typhlochactidae Mitchell, 1971, and Vaejovidae Thorell, 1876. The two non-Mexican species belong to the families Troglotayosicidae Lourenço, 1998 and Chaerilidae Pocock, 1893 and are from Ecuador and Sarawak, respectively. Subsequently, other troglobitic scorpions have been described from Mexico and Sulawesi, most belonging to the families Typhlochactidae and Chaerilidae. More recent descriptions of troglobitic species included some belonging to the family Hormuridae Laurie 1896 from Christmas Island in the Indian Ocean [10] and Madagascar [11], and species within other families, such as the Urodacidae Pocock, 1893, the Buthidae C. L. Koch, 1837 and the Akravidae Levy, 2007 [12–14]. Even more remarkable, however was the discovery of new troglobitic species belonging to the family Pseudochactidae Gromov 1998, from Viet Nam and Laos [15–18].

Species of the family Buthidae are commonly found in caves. In most situations however, these are proved to be only trogloxenes (i.e. species which occasionally penetrate into caves, but complete the majority of their life cycle outside), or troglophilic elements (i.e. species that are regularly found outside caves) [9,19]. Unequivocal troglobitic characteristics have been observed for two buthid species: *Troglotityobuthus gracilis* (Fage, 1946) and *Troglorhopalurus translucidus* Lourenço, Cerqueira Baptista & Giupponi, 2004 [11,13].

Scorpions of the subfamily Scorpiopinae have never been reported inhabiting cave environments. The new species described here represents the first known species of cave-dwelling scorpion belonging to this subfamily and most certainly the first species of this group exhibiting an adaptation to cave life.

3. Methods

Several scorpions were collected by DSP, while exploring the caves with the help of standard electric flashlights. Scorpions were found on the cave walls, approximately 120 m from the main cave entrance. Measurements and illustrations were made using a Wild M5 stereo-microscope with a drawing tube and an ocular micrometer. Measurements follow those of Stahnke [20] and are given in mm. Trichobothrial notations are those developed by Vachon [5,21] and the morphological terminology follows that of Hjelle [22].

4. Taxonomic treatment

Family: EUSCORPIIDAE Laurie, 1896.
Subfamily: SCORPIOPINAE Kraepelin, 1905.
Genus: ***Euscorpiops*** Vachon, 1980.
Euscorpiops cavernicola sp. n. (Figs. 1–3).

Viet Nam, Bac Kan province, Ba Be district, Quang Khe commune, Hua Ma cave (22°22′20.52″N–105°42′02.36″E), 12/VIII/2011 (Pham Dinh-Sac). Male holotype and one female paratype were deposited in the Muséum national d'histoire naturelle, Paris. Two paratypes, one male and one female, were deposited in the Viet Nam Academy of Science and Technology (VAST), Hanoi.

Etymology: The specific name refers to the cave environment where the new species was found.

Diagnosis: The new species exhibits the general characteristics defined for species within the genus *Euscorpiops* [4,5]. Total body length medium to small when compared to other species within the genus. Maximum total length observed for adults, males and females 42 and 43 mm respectively. Body and pedipalps moderately slender. Internal aspect of patella with two very strong spinoid tubercles; the interno-ventral being larger than the interno-dorsal tubercle. Trichobothrial pattern with three trichobothria on femur: dorsal, internal and external. Patella with two dorsal trichobothria, one internal, 11 ventral and 17 external trichobothria on males and 15 to 17 on females. Chela-manus with four ventral, two dorsal (*Dt*, *Db*), two internal (*ib*, *it*), one *Est*, five *Et*, one *Esb* and three trichobothria in the *Eb* series. Trichobothrium EB_3 is distal in relation to Eb_2 [21].

Ecological notes: Hua Ma cave is located in Quang Khe commune in Ba Be district. This cave was only recently discovered, and remains almost completely preserved and remains poorly prospected. The Hua Ma cave has been naturally shaped during the several-million-years process of geological changes. It is 700 m in length and in some places opening is very impressive reaching up to 50 m in height. Inside the cave, there are thousands of stalagmites and stalactites. Scorpions were located with the help of standard electric flashlights and were found about 120 m from the main entrance, on the walls of the cave. Scorpions do not show, however, major signs of a full adaptation to cave life.

Description: Coloration reddish-yellow to reddish-brown. Carapace reddish with paler zones on furrows. Tergites reddish-yellow. Metasomal segments reddish-brown; telson yellow to reddish-yellow; base of aculeus yellow and tip reddish. Chelicerae yellow with dark variegated spots. Pedipalps reddish-brown; extremities of fingers slightly paler. Legs yellow to reddish-yellow. Venter reddish-yellow; genital operculum, pectines and sternites yellow without infuscations.

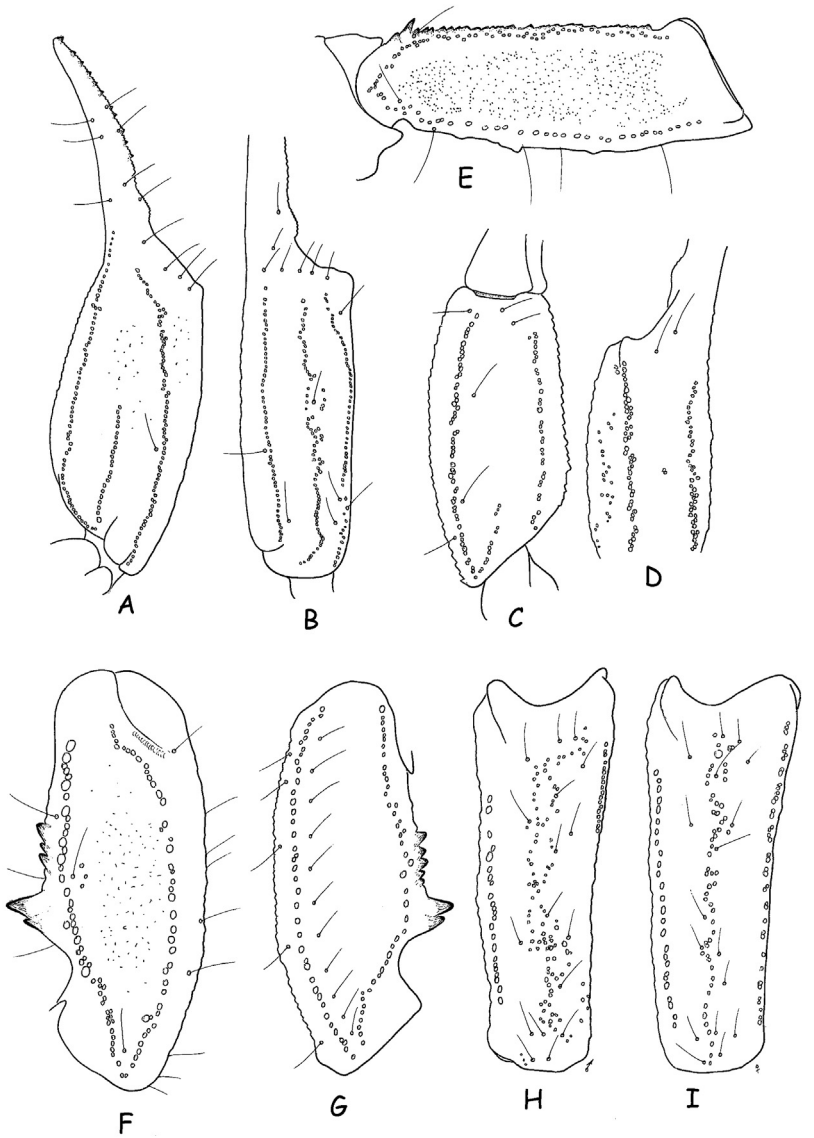

Fig. 1. *Euscorpiops cavernicola* sp. n. Male holotype. A–H. Trichobothrial pattern. A–D. Chela, dorso-external, external, ventral and internal aspects. E. Femur, dorsal aspect. F–I. Patella, dorsal, ventral and external (male & female) aspects.

Morphology. Carapace strongly granular, furrows moderately deep. Median eyes anterior to centre of carapace; three pairs of lateral eyes, the third pair only slightly smaller than the first two. Sternum pentagonal, longer than wide. Tergites moderately to strongly granulated; VII with five carinae, inconspicuous in female. Pectines large on males, reduced on females; pectinal tooth count 7-7 in both sexes; fulcra reduced on males, absent on females. Sternites almost smooth and punctated; sternite VII with four weakly marked carinae and few granulations. Metasomal segment I wider than long; segments II to V longer than wide; 10-8-8-8-7 carinae present on segments I to V; dorsal carinae on segments II–IV with a single, strong, posterior spinoid granule, better marked on male; metasomal tegument weakly granulated; ventral carina on segment V with inconspicuous spinoid granules. Telson vesicle smooth and without granulations. Setation on metasomal segments and telson moderate. Pedipalps: femur with dorsal internal, dorsal external, ventral internal and ventral external carinae strongly marked; tegument moderately granular. Patella with dorsal internal, dorsal external, ventral internal, ventral external and external carinae strongly marked; one strong and one weaker spinoid granule present on internal aspect, the interno-ventral being larger than the interno-dorsal granule; tegument moderately granular. Chela with dorsal marginal, external secondary, ventral internal and ventral carinae strongly marked; other carinae moderately marked; tegument granulated dorsally and ventrally. Chelal fingers with two longitudinal series of granules and a few inner and several outer accessory granules. Chelicerae dentition as in Fig. 2J [23]; 5–6 teeth on

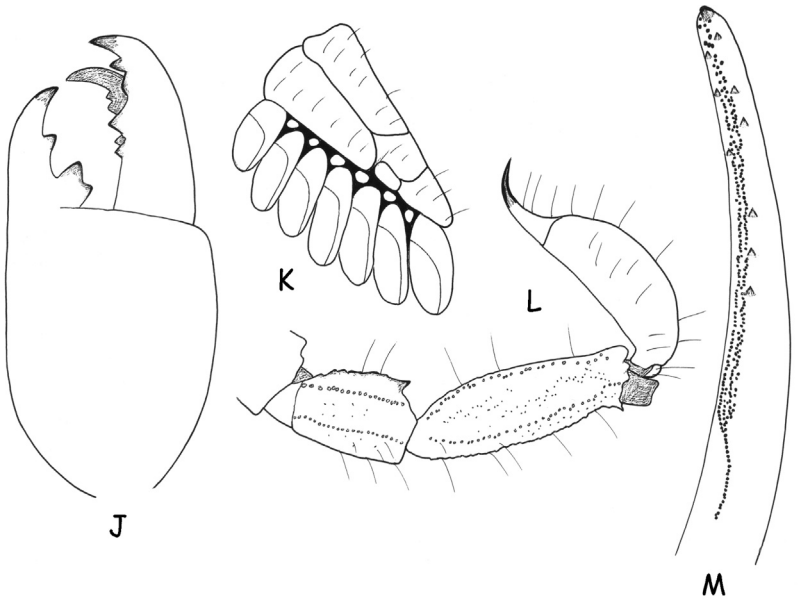

Fig. 2. *Euscorpiops cavernicola* sp. n. Male holotype. J. Chelicera. K. Pecten. L. Metasomal segments IV–V and telson, lateral aspect. M. Cutting edge of movable chelal finger.

ventro-internal face of movable finger. Trichobothriotaxy type **C**, as on Fig. 1-A-I [21]: see diagnosis for additional details.

Morphometric values (in mm) of male holotype and female paratype. Total length (including telson) 42.2/43.3. Carapace: length 6.8/7.1; anterior width 4.2/4.3; posterior width 7.4/7.8. Mesosoma length 14.1/15.3. Metasomal segment I: length 2.1/1.9, width 2.3/2.3; II: length 2.2/2.3, width 2.1/2.1; III: length 2.6/2.6, width 2.0/2.0; IV: length 3.0/3.1, width 1.9/1.9; V: length 5.3/4.8, width 1.9/1.8, depth 1.5/1.6. Telson length 6.1/6.2. Vesicle: width 1.9/1.9, depth 1.7/1.6. Pedipalp: femur length 7.9/8.0, width 2.4/2.6; patella length 6.6/7.0, width 2.6/2.6; chela length 15.4/15.8, width 3.7/3.8, depth 3.0/3.2; movable finger length 7.6/7.7.

Fig. 3. Hua Ma cave, interior view, showing the walls where the new species was found.

Relationships: Few species of *Euscorpiops* have been described from Viet Nam or nearby countries. Namely, *E. kaftani* (Kovařík, 1993), *E. sejnai* (Kovařík, 2000) and *E. thaomischorum* Kovařík, 2012 from Viet Nam, *E. kubani* Kovařík, 2004 from Laos and *E. binghamii* (Pocock, 1893) from Myanmar. The new species appears to be related with *E. thaomischorum*, but can be distinguished from this species by the following characters:

- smaller adult size and quite distinct morphometric values;
- chela of pedipalps proportionally narrower with a significant difference of length/width ratios, particularly in males;
- 15 to 17 external trichobothria on patella; these numbers being slightly different from those found in *E. thaomischorum*;
- paler coloration pattern;
- very strong tubercles on the internal face of patella.

Taxonomic remarks:

This new cave species appears to be related to *E. thaomischorum* described from a site in Lao Cai province, about 160–200 km in distance from the caves in Bac Kan province. It has been hypothesized that the population of epygean elements which colonized the cave environment, in more or less 'recent past times', have connections with the present population of *E. thaomischorum*. In fact, the moderately marked morphological differences observed between the two populations may reflect an adaptation to cave life. For the moment, however, not much more can be said about these two populations. To date, any comparative analysis is biased by an incomplete description of *E. thaomischorum*. Most characters are not illustrated, or mentioned in the original description. In addition, the

type material is deposited in a private collection and is not available for a comparative study.

Disclosure of interest

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

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