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A new genus and species of scorpion from Burma [Myanmar] (Scorpiones: Scorpipidae): Implications for the taxonomy of the family

Un nouveau genre et espèce de scorpion de Birmanie [Myanmar] (Scorpiones : Scorpipidae) : implications dans la taxonomie de la famille

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ABSTRACT

Plethoscorpions profusus gen. n., sp. n., belonging to the family Scorpipidae Kraepelin, 1905 is described on the basis of two specimens, one adult female and one male juvenile collected in the Saddam Cave, in Kayin State, Hpa-An, Burma (Myanmar). This new scorpion taxon most certainly represents an endemic element for the fauna of Burma and seems to be strictly distributed inside the cave system. The new genus is characterized by a previously unknown and totally unique plethotaxic trichobothrial pattern within the family Scorpipidae.

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RÉSUMÉ

Plethoscorpions profusus gen. n., sp. n., appartenant à la famille des Scorpipidae Kraepelin, 1905 est décrit sur deux spécimens, une femelle adulte et un mâle juvénile, collectés dans la grotte Saddam, située dans l'État de Kayin, Hpa-An, Myanmar. Ce nouveau taxon scorpionique représente très certainement un élément endémique pour la faune de Myanmar et semble strictement inféodé dans le système cavernicole. Le nouveau genre est caractérisé par un modèle trichobothriotaxique, pléthotaxique, encore inconnu et certainement unique parmi les scorpions de la famille des Scorpipidae.

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1. Introduction

As already outlined in previous papers [1,2], the subfamily Scorpipinae was first proposed by Kraepelin

[3] as Scorpipsinae, a subfamily of Vaejovidae. Since the correct Latinized subfamily name, derived from the type genus *Scorpions*, is Scorpipinae, it was subsequently emended [4]. Starting in the 1970s, Francke [5] drew attention to the inconvenient classification of Kraepelin [3] and suggested that Scorpipsinae should no longer be

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incorporated in the Vaejovidae. In a non-published PhD thesis, Stockwell [6] raised Scorpiopsinae to a family level (as 'Scorpiopsidae'), and this decision was confirmed by Lourenço [7]. Subsequently, Söleglad and Sissom [8] downgraded Scorpiopidae as a subfamily of Euscorpidae, grouped its Asian genera into the tribe Scorpiopini, and also included in this subfamily the North American genus *Troglocormus* (tribe Troglocormini). The subfamily was then defined as a monophyletic group within Euscorpidae, sharing no synapomorphies with North American Vaejovidae [8]. More recently, the Scorpiopidae were again recognized as a separated family [9,10], and presently this *status quo* remains.

Vachon [11] revised the genus *Scorpiops* and described three new subgenera, *Alloscorpops*, *Euscorpops*, and *Neoscorpops*, in addition to the nominotypical subgenus *Scorpiops*. These four subgenera were later elevated to generic rank by Lourenço [7], who added the monotypic genera *Parascorpops* Banks 1928 and *Dasyscorpops* Vachon, 1974, thus bringing the total number of genera to six. More

recently two new taxa of the generic level were added to the family Scorpiopidae: *Laoscorpops* Lourenço, 2013, as a subgenus of *Alloscorpops* and *Vietscorpops* Lourenço and Pham, 2015 as a subgenus of *Scorpiops* [1,2]. This last subgenus was subsequently raised to genus status [12].

In the present note, a remarkable new genus and species belonging to the family Scorpiopidae are described from Sattan Cave, located in Kayin State, Hpa-An, Burma-Myanmar (Figs. 1–5). This new scorpion taxon is the fourth species of Scorpiopidae [13–15] to be discovered in cave systems and the first one belonging to a new genus. It is most certainly another endemic element in the fauna of Burma.

The present composition of the family Scorpiopidae can be summarized as follows: Genus *Scorpiops* Peters, 1861, Genus *Parascorpops* Banks, 1928 Genus *Dasyscorpops* Vachon, 1974, Genus *Alloscorpops* Vachon, 1980 (Subgenus *Alloscorpops* Vachon, 1980 and Subgenus *Laoscorpops* Lourenço, 2013), Genus *Euscorpops* Vachon, 1980, Genus *Neoscorpops* Vachon, 1980, Genus *Vietscorpops* Lourenço & Pham, 2015, Genus *Plethoscorpops* n. gen. (Fig. 1).

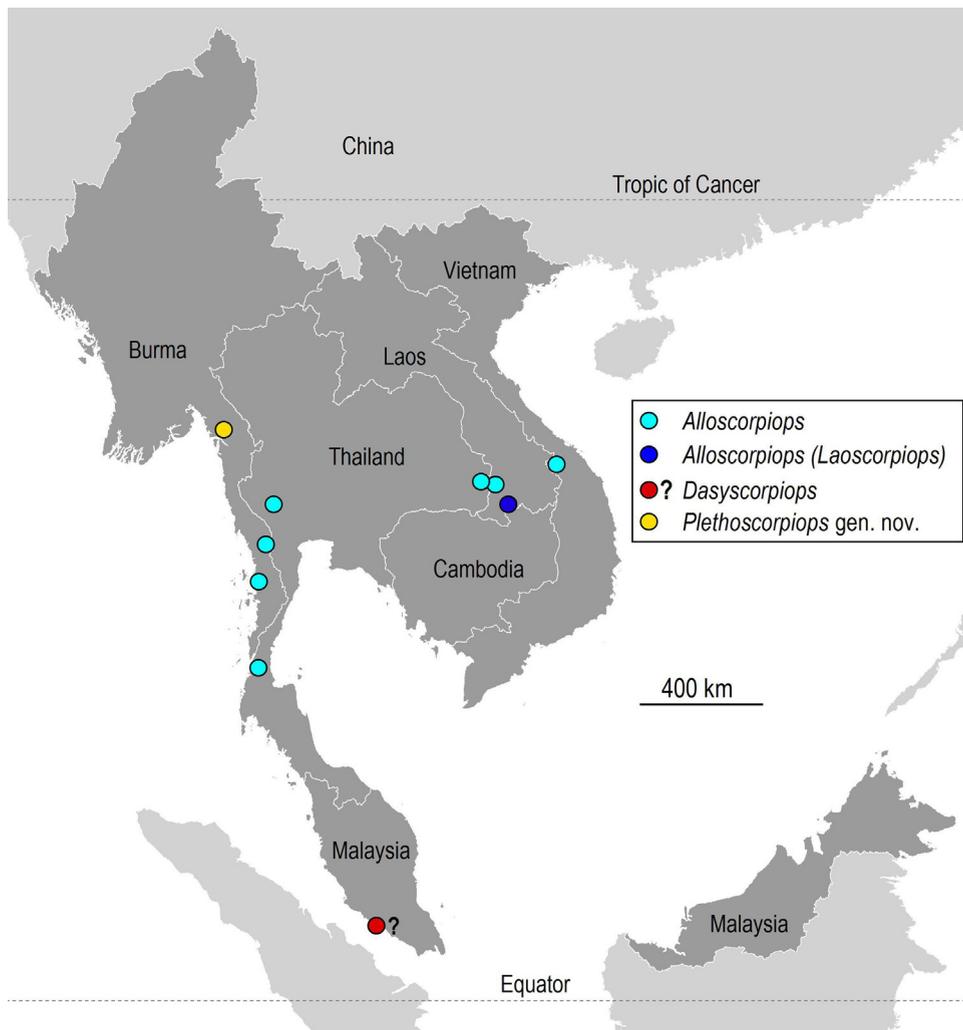


Fig. 1. Map of Southeast Asia showing the known distribution of genera *Alloscorpops*, *Dasyscorpops* and *Plethoscorpops*. Notice that the type locality of *Dasyscorpops grandjeani*, Malacca is dubious (according to Fage's personal notes).



Fig. 2. The region where is located the Saddan Cave, showing the outside relief and typical vegetation (photo A. Kury).



Fig. 3. Idem Photo 2, showing another aspect of the same region (photo: F. Bréhier).



Fig. 4. Interior view of the Saddan Cave, showing the limestone walls with the crevices where the specimens were found (photo A. Kury).

2. Methods

Illustrations and measurements were produced using a Wild M5 stereomicroscope with a drawing tube and an ocular micrometer. Measurements follow Stahnke [16] and are given in millimeters. The trichobothrial notations follow Vachon [17] and the morphological terminology mostly follows Vachon [18] and Hjelle [19].

3. Taxonomic treatment

Family Scorpiopidae Kraepelin, 1905
Genus *Plethoscorpiops* gen. nov.

Diagnosis for the new genus: The new genus presents most of the characteristics already defined for the family

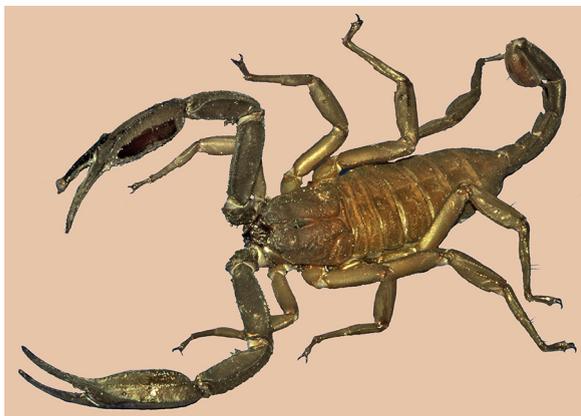


Fig. 5. *Plethoscorpiops profusus* sp. n. Female holotype alive (photo A. Kury).

Scorpiopidae and several of these characters associate it with both *Alloscorpiops* and *Dasyscorpiops* [8,11]. It can, however, be characterized by a very particular trichobothrial pattern of some ‘territories’ or series. Femur with three trichobothria: dorsal, internal and external. Patella with two dorsal, one internal, 23 ventral and a very high number of 41 external trichobothria (up to 42–43 in the male paratype). Most outstanding are the values found for chela-hand with 25 ventral, two dorsal (**Dt**, **Db**), two internal (**ib**, **it**), 3 **Est**, 6 **Et**, **Esb** and a very high number of 19 trichobothria in the **Eb** series. This latter number is particularly unusual, because in the other genera of the family, only three (or five) trichobothria are observed on **Eb** series [1,11,17]. See the following taxonomic comments.

Type species: *Plethoscorpiops profusus* sp. n.

Etymology: The generic name is an association of plethos with *scorpiops* and refers to the very high numbers of trichobothria found in the chela of pedipalps. From Latin *plethora*, originate from ancient Greek $\pi\lambda\eta\theta\acute{\omega}\rho\eta$ (*plēthārē*) = plenty.

4. Description of the new species

P. profusus sp. n. (Figs. 6–10)

Burma (Myanmar), Kayin State, Hpa-An, Saddan Cave (16.739735°–097.718175°), 250 m alt., about 90 m from the entry, hidden in wall crevices, 31/VII/2016 (A. Giupponi & A. Kury leg.). Female holotype, deposited in the Museu Nacional, Rio de Janeiro; male juvenile paratype deposited in the ‘Muséum national d’histoire naturelle’, Paris.

Etymology: The specific name refers to the very high number of trichobothria presented by the new species.

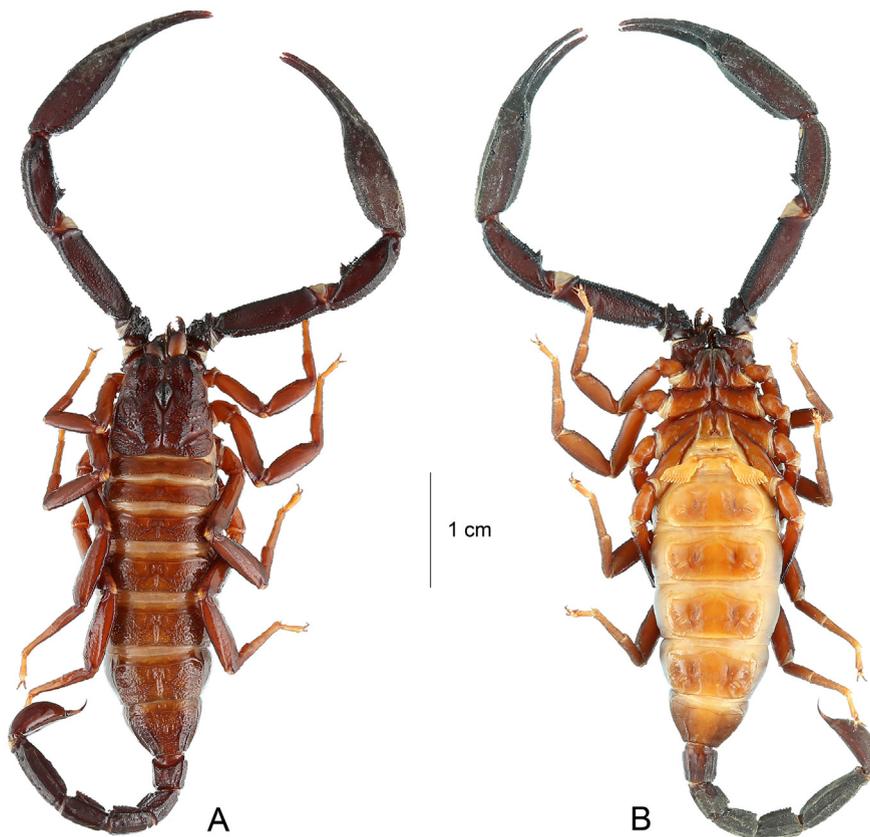


Fig. 6. *Plethoscorpions profusus* sp. n. Female holotype. A. and B. Dorsal and ventral aspects.

Diagnosis: Species of moderate size relative to other species of the family Scorpiones, adult female 61.8 mm in total length. Coloration dark reddish-brown; three pairs of lateral eyes, the third pair reduced; pectines with 9–9 teeth in the female holotype and 12–13 teeth in the male paratype; fulcra reduced to vestigial. Annular ring clearly marked in the telson. Trichobothrial pattern as in generic diagnosis.

Description based on adult female and male juvenile. The presence of a spermatocleutrum (Fig. 6B) confirms the adult stage of the female [21]. Coloration. Dark reddish to reddish-brown. Carapace dark reddish-brown. Tergites reddish-brown, paler than the carapace (Figs. 6 and 7). Metasomal segments dark brown; telson dark reddish-brown; base of the aulecus reddish and tip blackish. Chelicerae reddish-brown with blackish variegated spots; fingers dark brown to blackish, with reddish teeth. Pedipalps dark reddish-brown; extremities of fingers slightly red. Legs reddish-brown. Venter. Coxapophysis and sternum reddish-brown; sternites reddish-yellow; genital operculum and pectines yellow.

Morphology. Carapace strongly granular, furrows moderately to strongly deep. Median eyes anterior to the centre of carapace; three pairs of lateral eyes, the third pair reduced and situated behind the first two. Sternum pentagonal, longer than wide. Tergites moderately to strongly granulated, but less marked than carapace; VII with four carinae. Pectinal tooth count 9–9 in the female

holotype and 12–13 in the male paratype (Figs. 6 and 7); fulcra reduced to vestigial. Sternites smooth and shiny; VII with four moderately marked carinae. Metasomal segment I wider than long; segments II to V longer than wide; 10–10–8–8–7 carinae present on segments I to V; dorsal carinae on segments II–IV with a series of small spinoid granules and a single, stronger, posterior spinoid granule; metasomal tegument moderately granulated; ventral carina on segment V with spinoid granules. Telson vesicle flattened dorsally without granulations and with some punctuations. Pedipalps: femur with dorsal internal, dorsal external, ventral internal and ventral external carinae strongly marked; tegument moderately to strongly granular. Patella with dorsal internal, ventral internal, dorsal external, ventral external and external carinae strongly marked; two very strong apophyses and several moderate to small spinoid granules present on the internal aspect, the interno-ventral apophysis being much larger than the interno-dorsal one; 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 outer accessory granules; inner stronger. Chelicerae dentition as in Fig. 8 [22]; five teeth on ventro-internal face of movable finger. Trichobothriotaxy type C, as in Figs. 9 and 10 [11,17]: see also generic diagnosis.

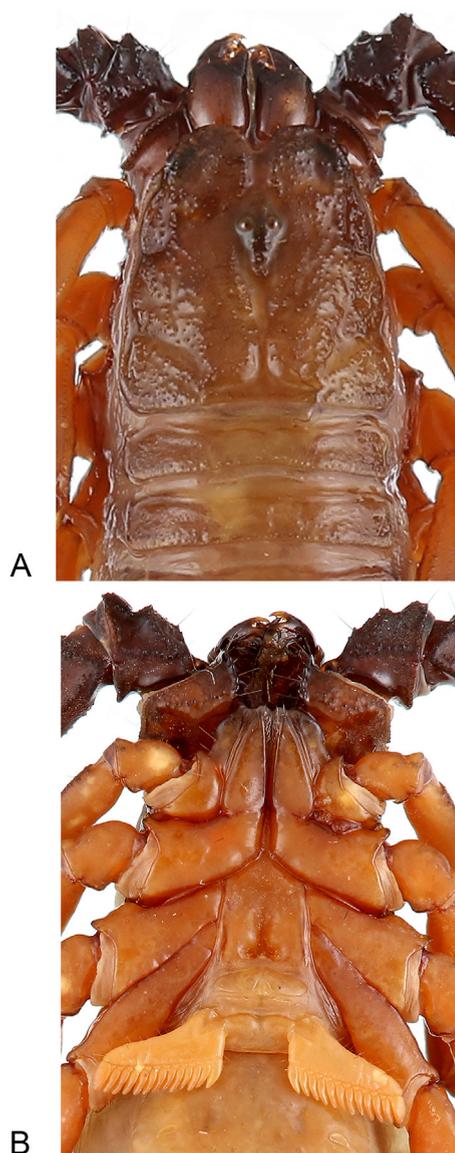


Fig. 7. *Plethoscorpions profusus* sp. n. Male paratype. A. and B. Details of dorsal and ventral aspects.

Morphometric values (in mm) of the female holotype. Total length (including telson) 61.8. Carapace: length 9.1; anterior width 5.4; posterior width 9.6. Mesosoma length 22.8. Metasomal segment I: length 2.9, width 3.0; II: length 3.4, width 2.7; III: length 3.7, width 2.5; IV: length 4.1, width 2.3; V: length 7.2, width 2.1, depth 2.3. Telson length 8.6. Vesicle: width 2.4, depth 2.2. Pedipalp: femur length 10.4, width 2.9; patella length 8.5, width 3.2; chela length 19.3, width 3.9, depth 3.4; movable finger length 9.2.

5. Taxonomic comments

In a recent paper [1], I proposed a new subgenus of *Alloscorpions*–*Laoscorpions*–on the basis of a different trichobothrial pattern, not yet observed for elements of the family Scorpiones. My argumentation was proposed

as follows: “The unusual number of trichobothria in the **Eb** series of the new subgenus allows a nomenclatural question to be addressed. Vachon [17] defined this ‘territory’ or series as always having only three trichobothria: **Eb**₁, **Eb**₂, and **Eb**₃. In the case of certain genera showing the type-C trichobothrial pattern, Vachon [17] suggested a possible ‘displacement’ of some ventral trichobothria to the external surface. However, this was only postulated for groups presenting ‘plethotaxic patterns’ [17]. In the case of Scorpiones, and in particular of the genus *Alloscorpions*, the ventral trichobothria of the chela are clearly delimited by the ventro-external carina [11,18]. If a correlation can be established between the distal trichobothrium **Eb**₃, as defined by Vachon [11,17], and **Eb**₅, as defined here for the new subgenus *Laoscorpions*, then it can be suggested that the presence of only three **Eb** trichobothria in most taxa is due to one or more losses during the evolutionary history of the group.”

This decision was shortly afterwards rejected by Kovařík et al. [20], who stated as follows: “Lourenço’s (2013: 52) discussion of the trichobothrial pattern of *A. calmonti* confused some important issues concerning nomenclature and homology... *A. calmonti*, with a large number of ventral trichobothria, exhibits one or two additional accessory trichobothria that occur on the extreme external/ventral area of the palm, in line with the other ventral trichobothria. Lourenço argued that these trichobothria were part of the external basal (*Eb*) series, instead of considering them an extension of the neobothriotaxy present on the ventral surface of the palm. We consider this counterintuitive... In addition, we see that one of the accessory trichobothria designated as ‘*Eb*’ by Lourenço (2013) is located on the ventroexternal carina of the palm, further suggesting it is a continuation of the ventral series... Unfortunately, which is a more serious matter, Lourenço sequentially renumbered the *Eb* series to include these two new trichobothria, and in doing so, contradicted the homology carefully established by Vachon (1974) for the entire Type-C pattern.” Naturally, the decision to invalidate the subgenus *Laoscorpions* was sustained mainly (their trade-mark) by personal speculation and, as always, without the examination of the type material of the concerned species.

Although this argumentation by Kovařík et al. [20] was already disregarded in a recent paper [15], it seems important, however to reframe the context in which Vachon [17], attempted to define his trichobothrial nomenclature. To achieve a definitive and universal nomenclature for the trichobothrial patterns of scorpions, Vachon [17] worked during many years. Naturally, he examined most, but not all, scorpion groups known at his time. In his analysis, Vachon [17] was deeply influenced by the work of F. Grandjean on Acari and the works of J.-C. Chamberlin, and his own work, on pseudoscorpions (to notice that Vachon was originally a pseudoscorpion expert). The ontogenetic variations observed for the trichobothrial patterns of these two groups contribute with important insights to their phylogeny. Contrarily, an almost non-ontogenetic variation is observed for scorpions. This type of situation is also encountered for spiders, which show very complex trichobothrial patterns. Consequently, no stable

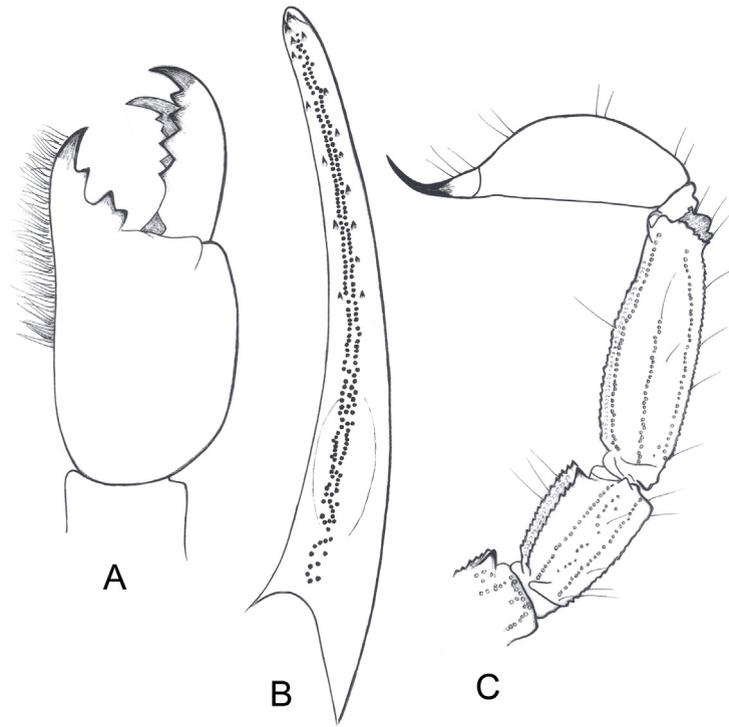


Fig. 8. *Plethoscorpions profusus* sp. n. Female holotype. A. Chelicera, dorsal aspect. B. Cutting edge of chela movable finger showing the typical granulation. C. Metasomal segments IV–V and telson, lateral aspect.

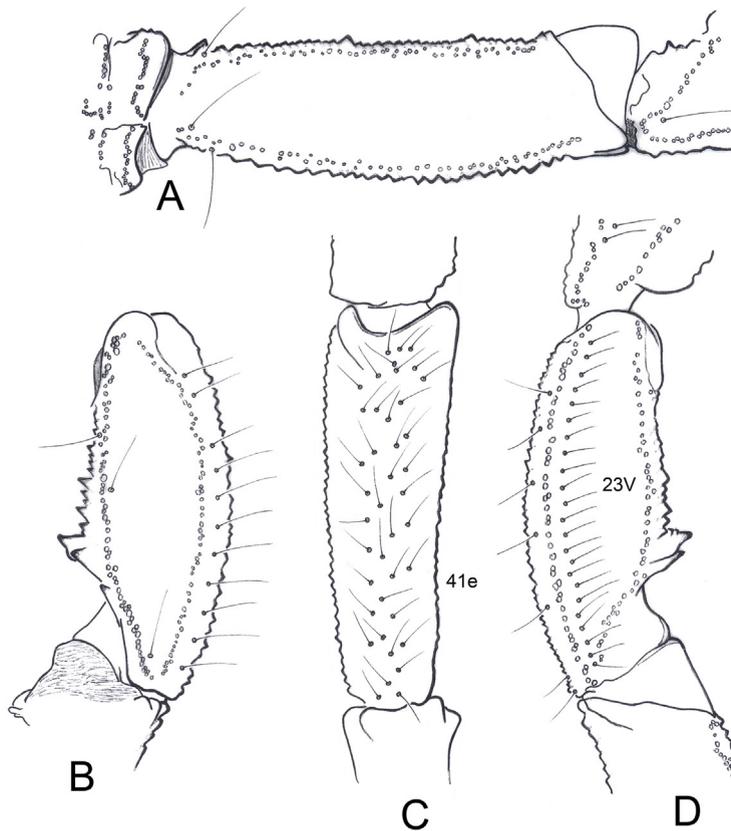


Fig. 9. *Plethoscorpions profusus* sp. n. Female holotype. Trichobothrial pattern. A. Femur, dorsal aspect. B–D. Patella, dorsal, external and ventral aspects.

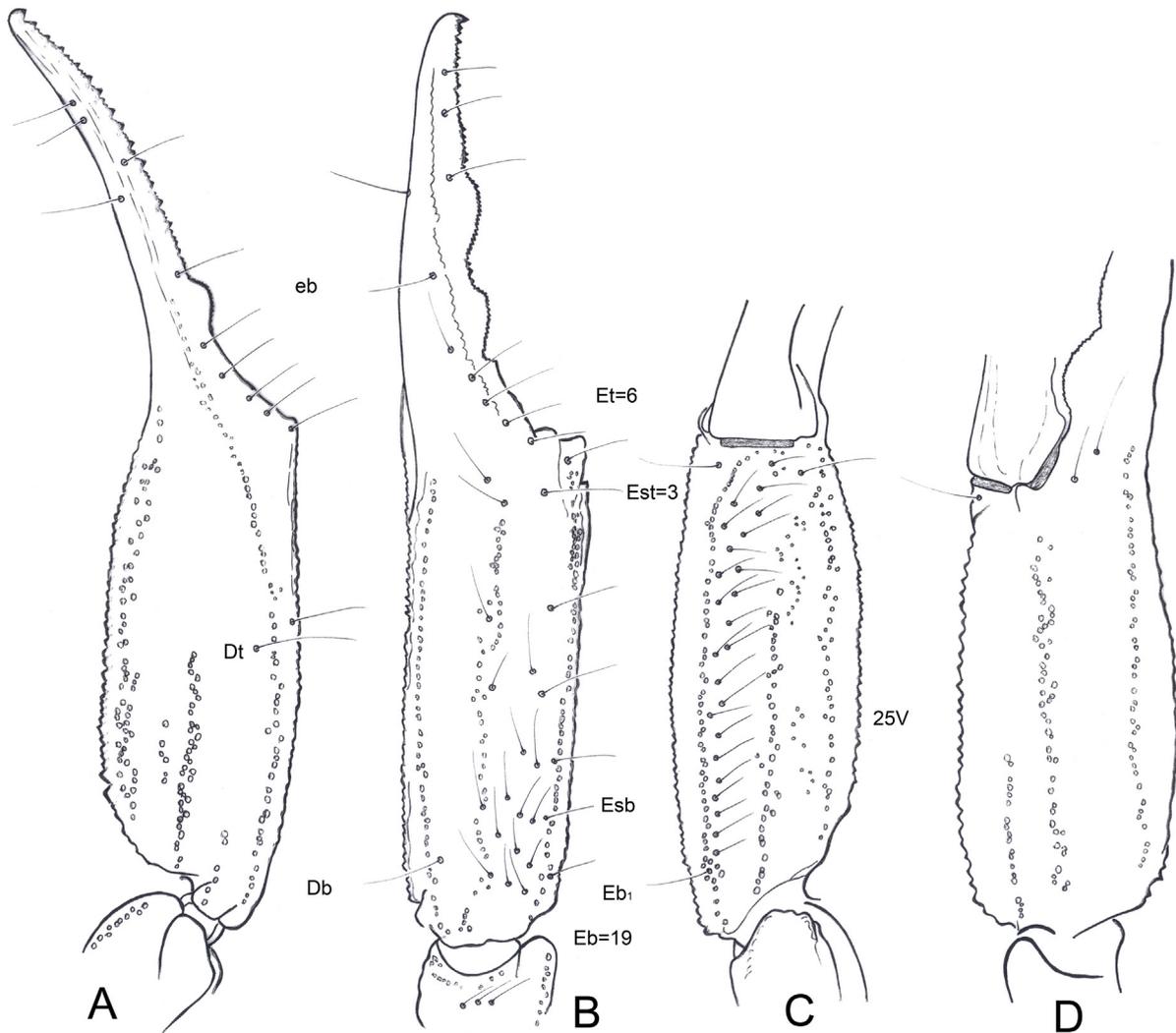


Fig. 10. *Plethoscorpions profusus* sp. n. Female holotype. Trichobothrial pattern. A–D. Chela, dorso-external, external, ventral and internal aspects.

nomenclature is available for this latter group. As long as Vachon [17] focused on the most basic or simple patterns as the A and B defined for buthids and chaerilids, he faced no problems to explain small variations in the patterns. However, once he faced the much more complex type C, he encountered some major exceptions, which proved difficult to be fitted in his theoretical model. He was particularly troubled by the patterns presented by species belonging to genera such as *Hadogenes* and *Urodacus* (Vachon, [17]; pp. 922–924) with typical plethotaxies. Consequently, Vachon [17] strongly suggested the possible migration and/or displacement of several trichobothria from one face to another (see Vachon [17]; figures 131–133).

In fact, Vachon [17] was very uncertain about all these issues and even after the publication of his work, he often discussed with several people of his laboratory about the possible incoherence of his nomenclature (to be noticed that Vachon was my mentor from 1972 to 1978). Already in his publication, he expressed serious doubts, as those

stated in several sections: on page 871: “*L’idionymie est-elle une simple vue de l’esprit ? Nous ne le pensons pas.*” Concerning the acquisition of accessory trichobothries (neobothriotaxy), on page 883: “*Certes, nous nous rendons compte de l’aspect théorique de nos interprétations car, selon les spécimens, le nombre des trichobothries de cette face tibiale varie.*” For the use of trichobothriotaxy in systematics, page 937: “*C’est à chaque taxonomiste que revient le soin de lui donner, en classification, la place que lui convient...*” Among some of his conclusions on page 944, Vachon states: “*Il importe donc de souligner que les termes d’orthobothriotaxie et de néobothriotaxie n’ont qu’une valeur didactique et ne sauraient en rien être la preuve que nous admettons l’existence d’une évolution progressive de la trichobothriotaxie chez les Scorpions.*” In conclusion, and to make it not too long, the trichobothrial nomenclature proposed by Vachon [17], was globally well accepted by most scorpion experts. However, it must not be accepted as a *dogma*, but rather as one useful model that may yet require several adjustments. The new genus proposed here

could probably be rejected by several “philatelic taxonomists”. Nevertheless, its validity is unquestionable in the light of other well-accepted genera. One example is *Dasyscorpions*, which was equally based mainly on an extraordinary number of trichobothria [17].

Disclosure of interest

The author declares that he has no competing interest.

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