

About the scorpion fossils
from the Cretaceous amber of Myanmar (Burma) with
the descriptions of a new family, genus and species

Sobre escorpiões fosseis do âmbar
do Cretáceo de Myanmar (Burma) com as descrições
de uma família, um gênero e uma espécie novos

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As noted by LOURENÇO & BEIGEL (2011), scorpions are rare among the arthropods fossilized in amber. Nevertheless, several specimens have been described since the 1980s, mainly from Dominican and Baltic amber (LOURENÇO, 2009a,b; LOURENÇO & WEITSCHAT, 2009). Cretaceous amber scorpions are even rarer than those found in Tertiary amber. Six such species have been described or redescribed in recent years and represent distinct new families, subfamilies and genera that can be only approximately associated with extant groups.

The first Cretaceous amber scorpion to be described was *Archaeobuthus stephani* Lourenço, 2001, from Lebanon. It was accommodated in a new family, Archaeobuthidae (LOURENÇO, 2001). This was followed by the description of *Palaeoburmesebuthus grimaldii* Lourenço, 2002 from Burmese amber (LOURENÇO, 2002). Because of the incompleteness of the specimen used in the description, *P. grimaldii* was placed as *incertae familiae*. The third Cretaceous amber scorpion to be described was *Palaeoescorpius gallicus* Lourenço, 2003, from France. This was also placed in a new family, Palaeoescorpiidae (LOURENÇO, 2003). Subsequently, a second new genus and species of scorpion, *Electrochaerilus buckleyi* SANTIAGO-BLAY, FET, SOLEGLAD & ANDERSON, 2004, was described from

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Burmese amber and assigned to a new subfamily, Electrochaerilinae, of the extant family Chaerilidae Pocock, 1893 (SANTIAGO-BLAY *et al.*, 2004a). Redescriptions were also published for *Palaeoburmesebuthus grimaldii* Lourenço and *Archaeobuthus estephani* Lourenço, providing some new insights about these taxa (BAPTISTA *et al.*, 2006; SANTIAGO-BLAY *et al.*, 2004b). Finally, a new family, Chaerilobuthidae LOURENÇO & BEIGEL, 2011, and a new genus and species, *Chaerilobuthus complexus* Lourenço & Beigel, 2011, were recently described, from Burmese amber (LOURENÇO & BEIGEL, 2011).

The specimen described here represents the fourth distinct scorpion species to be found in Burmese amber. It presents taxonomic characteristics allying it to extant buthids, chaerilids and pseudochactids. A new family, genus and species are described. The new family seems distinct from the families Chaerilobuthidae and Electrochaerilinae, as well as from Archaeobuthidae, described from Cretaceous amber of Lebanon. *Palaeoburmesebuthus*, previously described from Burmese amber, was based only on rather incomplete fragments, hence very little information about this genus is available. It remains placed as *incertae familiae*, until new elements are discovered. Because very few characters of the new scorpion species show similarities to those of *Palaeoburmesebuthus*, I prefer not to associate the latter with the new family.

MATERIAL AND METHODS

The specimen investigated is preserved in a moderately clear block of yellowish to reddish amber that measures 50 x 43 x 10/13 mm. Consequently, the piece is quite thick, which renders observation difficult. Also included in the piece is some vegetal debris. The scorpion is complete and only a few structures are compromised by fractures of the resin, and/or the presence of vegetal inclusions. Many characters, in both dorsal and ventral view, are clearly visible and allow detailed investigation. Right and left pedipalps present important differences for the femur, patella and chela (see measurements). These cannot be explained by a possible pressure of the resin. Consequently, this raises questions about the possible significance of the asymmetry of this specimen. The schematic drawings provided here are an interpretation of what was observable. Illustrations and measurements were produced with the aid of a Wild M5 stereomicroscope equipped with a drawing tube (camera lucida) and an ocular micrometer. Measurements follow STAHNKE (1970) and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows HJELLE (1990). Trichobothria were definitely recorded only when their bothria

(areoles) could be observed. Other trichobothria may be suggested by the presence of transverse hairs. However, since the body and appendages of the scorpion are strongly hirsute, some misinterpretations are possible.

AGE OF BURMITE

As discussed previously (LOURENÇO, 2002; LOURENÇO & BEIGEL, 2011), there is considerable confusion in the literature concerning the probable age of Burmese amber. Also, confusion exists regarding the precise sites in Myanmar where the amber pieces were mined. There are five regions in Myanmar where fossil resins have been found; however, Burmite only occurs in the Hukawng Valley (ZHERIKHIN & ROSS, 2000).

According to ZHERIKHIN & ROSS (2000) and GRIMALDI *et al.* (2002), the age of Burmese amber is probably Turonian-Cenomanian (90–100 Mya). More recent age estimates for Burmese amber deposits date these as being from the Lower Cretaceous (Upper Albian), based on ammonites and palynomorphs for at least one amber location (CRUICKSHANK & KO, 2003; PENNEY, 2010; SANTIAGO-BLAY *et al.*, 2004b).

Systematic description

(Family Palaeotrilineatidae fam. n.)

DIAGNOSIS

General morphology shows similarities with buthid, chaerilid and pseudochactid scorpions. The following combination of features can be used to diagnose the new family and genus: Anterior margin of carapace with a very strong median concavity, as observed in some extant scorpionids. Pectines very long, with 19-19 teeth; distal tooth not rounded; fulcra absent; sternum subpentagonal to pentagonal; spiracles very small and oval to rounded in shape; chelicerae with very long distal teeth which overlap for about one third of their length; movable finger with one basal and one median tooth. Vesicle very long, with a pear-like shape, resembling those of some extant buthids; with a very long aculeus. Trichobothrial pattern combining elements of those of the buthid, chaerilid and pseudochactid types, respectively A, B and D (Vachon, 1974; Soleglad & Fet, 2001, 2003). For this reason, a new type, G, is defined here for the new family: at least 1 internal, 3 to 6 dorsal and 3 external trichobothria on the femur; 1 internal, 3 or 4 dorsal, 3 or 4 ventral (one may be a displaced internal trichobothrium) and 9 or 10 external trichobothria on the patella; 5 or 7 dorso-external, 3 ventral on chelal hand and 5 on fixed finger.

Genus *Palaeotrilineatus* gen. n.

DIAGNOSIS (as for the family).

Derivatio nominis: generic name refers to the characteristics of three extant lineages that can be seen in the new genus. Gender masculine.

TYPE SPECIES: *Palaeotrilineatus ellenbergeri* sp. n.

DESCRIPTION

Palaeotrilineatus ellenbergeri sp. n. (Figs 1-14)

HOLOTYPE — Adult male. Based on the very slender pedipalps, the morphology of the mesosoma and metasoma, and the size and structure of pectines, the specimen is a male.

TYPE LOCALITY AND HORIZON — Myanmar (Burma), Kachin; precise locality unknown; Lower Cretaceous.

PATRONYM — The specific name honours Mr Sieghard Ellenberger, Kassel, Germany, who made possible the study of the new amber species.

DEPOSITORY — The type specimen is presently in the personal collection of Mr. Sieghard Ellenberger, Kassel, Germany.

DIAGNOSIS — as for the family and genus.

COLORATION — the scorpion is reddish to reddish-yellow; carapace, tergites and sternites reddish-yellow; metasomal segments and telson, pedipalps and legs yellow to reddish-yellow. The ventral aspect of the specimen is dark yellow to reddish-yellow.

MORPHOLOGY. — Carapace weakly granulated to smooth; anterior margin with a very strong median concavity, as observed in some extant scorpionids. Carinae and furrows weak to absent. Median ocular tubercle clearly anterior to centre of carapace; median eyes moderate to large in size. Three lateral eyes clearly visible. Sternum subpentagonal to pentagonal. Mesosomal tergites weakly granular, with one median carina; VII with five well marked carinae. Pectines rather long, distal tooth not rounded; 19-19 teeth, no fulcra can be observed; zone with peg sensilla can be perceived on some teeth. Sternites smooth and acarinate; VII with 5 carinae (the central carina, however, may be an artefact); spiracles semi-oval to rounded in shape. Metasomal segment I with ten carinae; segments II to IV with eight carinae; segment V with five carinae; dorsal carinae of segments I-IV with one minute spinoid granule; dorsal aspect of segments I-V weakly depressed; setation on segments I to V moderately to strongly marked. Telson with a very long pear-shaped vesicle, flattened laterally, as in some extant buthids; weakly granular to smooth; aculeus very long and moderately curved. Cheliceral dentition only partially visible; movable finger with one basal

and one median tooth; distal teeth very long and overlapping for about one third their length (see Vachon, 1963 as reference). Pedipalp femur pentacarinata; with very strong spinoid granules on internal face; patella with dorso-internal, ventro-internal, dorso-external, external and ventral carinae; internal face with very strong spinoid granules. Chela with moderately to strongly marked carinae; all faces weakly granular. Fixed and movable fingers each with one series of small rounded granules, divided in 8–9 subseries by slightly larger granules; extremity of fingers with stronger spinoid granules; setation of pedipalps very strongly marked, particularly the distal extremity. Trichobothriotaxy of type G (see diagnosis of family): at least 1 internal, 3 to 6 dorsal and 3 external trichobothria on the femur; 1 internal, 3 or 4 dorsal, 3 or 4 ventral (one may be a displaced internal trichobothrium) and 9 or 10 external trichobothria on the patella; 5 or 7 dorso-external, 3 ventral in chela hand and 5 on fixed finger.

MORPHOMETRIC VALUES (in mm) of male holotype of *Palaeotrilineatus ellenbergeri* sp. n.

Total length 31.05 (including telson). Carapace: length 3.73, anterior width 2.00, posterior width 3.27. Mesosoma length 6.94. Metasomal segments. I: length 2.40, width 1.60; II: length 2.47, width 1.34; III: length 2.53, depth 1.33; IV: length 3.13, depth 1.27; V: length 5.10, depth 1.26. Telson length 4.75. Vesicle: width 0.63, depth 0.60. Right pedipalp: femur length 2.80, width 1.13; patella length 4.47, width 0.93; chela length 5.13, width 1.13, depth -; movable finger length 4.33. Left pedipalp: femur length 3.20, width 0.80; patella length 3.40, width 1.20; chela length 6.27, width 0.53, depth -; movable finger length 4.87.

TAXONOMIC REMARKS

According to some of the characters visible – particularly the trichobothrial pattern – the new scorpion seems to be allied to buthoids chaeriloids and pseudochactids. Some trichobothrial characteristics of the three extant families and those of Palaeotrilineatidae fam. nov., are presented in Table 1. These three lineages are today represented in Southeast Asia. Even so, the assignment of the new family to one of the superfamilies, Buthoidea or Chaeriloidea (LOURENÇO, 2000), remains difficult. This is due to the incompleteness of the data currently available about these Burmese amber scorpions. A new family Palaeotrilineatidae is described since the new fossil scorpion is noticeably distinct from the families Chaerilobuthidae and Electrochaerilinae, previously described from Cretaceous Burmese amber, as well as from Archaeobuthidae, described from Cretaceous amber of Lebanon. The genus

Palaeoburmesebuthus remains as *incertae familiae*, until new elements are discovered.

Table 1. Some trichobothrial characteristics of the families Buthidae, Chaerilidae and Pseudochactidae compared to those of Palaeotrilineatidae fam. nov. (defined here as type G).

	Buthidae	Chaerilidae	Pseudochactidae	Palaeotrilineatidae
Femur:				
Internal	4	1	4	1
Dorsal	5	4	5	3(5-6)
External	2(3-5)	4	3	3
Ventral	0	0	0	0
Patella:				
Internal	1	2	1	1
Dorsal	5	2	3	3(4)
External	7	7	6	9(10)
Ventral	0	3	0	3(4)
Chela hand:				
Internal	0	0	0	0
Dorsal	0	0	0	0
External	6	5	4	5(7)
Ventral	2	1	1	3
Fixed finger:				
Internal	1	2	3	?
Dorsal	2	2	2	2
External	4	4	3	2(3)
Ventral	0	0	0	0

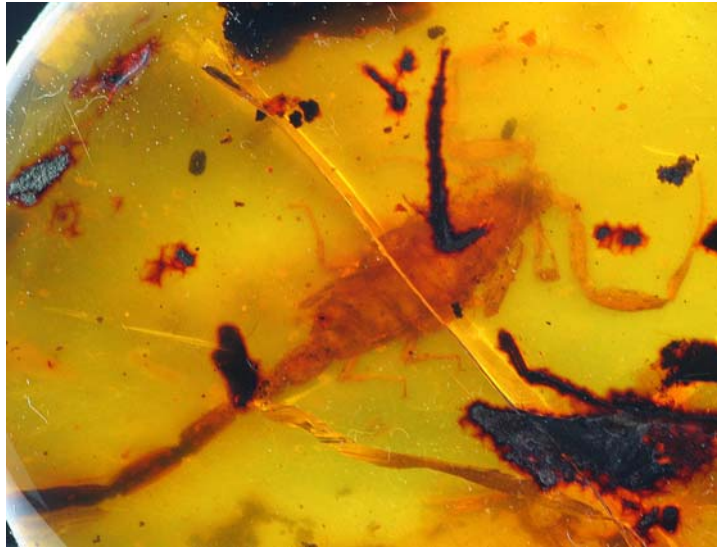


Fig. 1. *Palaeotrilineatus ellenbergeri* sp. n., male holotype. 1, habitus, dorsal aspect.

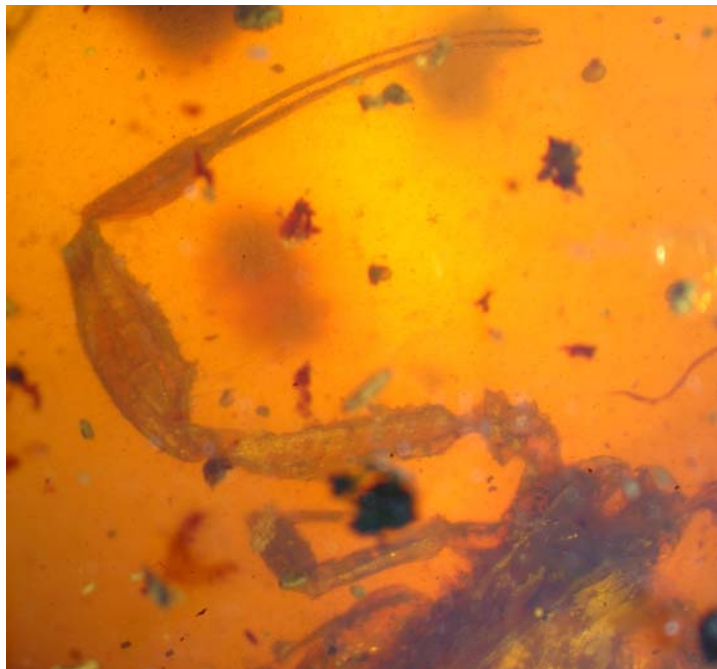


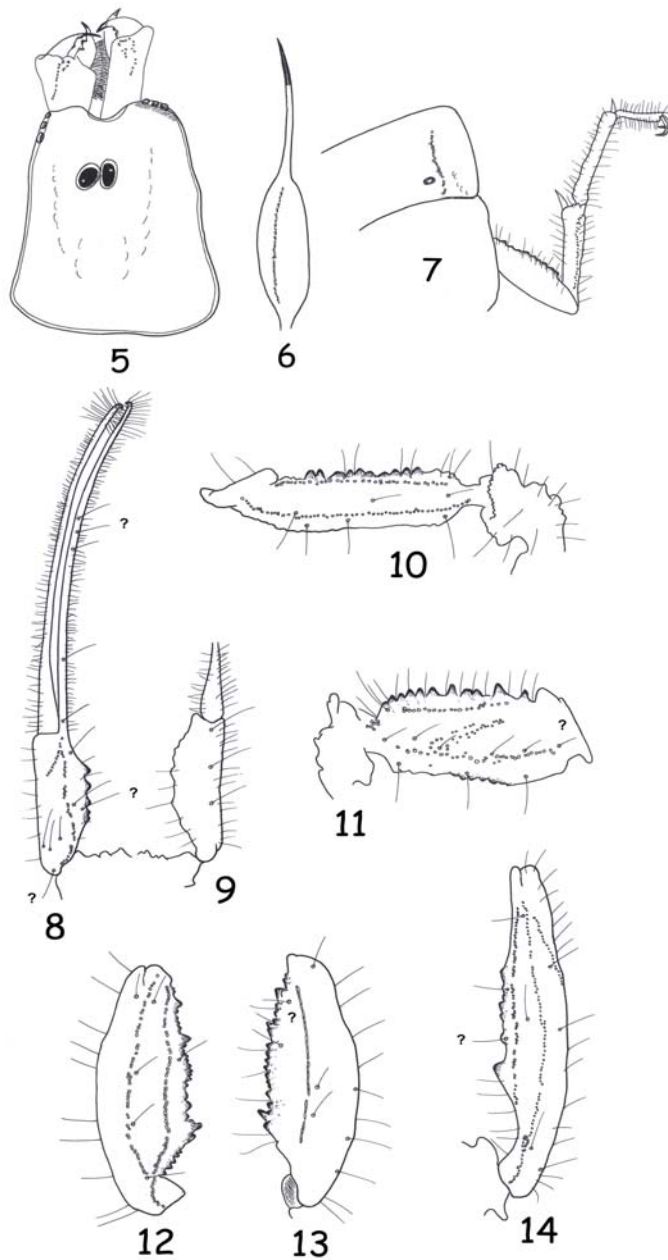
Fig. 2. *Palaeotrilineatus ellenbergeri* sp. n., male holotype. Left pedipalp.



Fig. 3. *Palaeotrilineatus ellenbergeri* sp. n., male holotype. right pedipalp.



Fig. 4. *Palaeotrilineatus ellenbergeri* sp. n., male holotype. Telson, ventro-lateral aspect.



Figs 5-14. *Palaeotrilineatus ellenbergeri* sp. n., male holotype. 5, carapace and chelicerae, dorsal aspect; 6, telson, ventro-lateral aspect; 7, sternites VI-VII with spiracle and leg IV showing spurs. 8-14, trichobothrial pattern. 8-9, left pedipalp chela, dorso-external and ventral aspects; 10-11, left and right pedipalp femur; 12-14, left and right pedipalp patella, dorsal and ventral aspects. Note on morphometric differences for femur and patella. Dubius trichobothria are indicated by a ? mark.

SUMMARY

A fossil scorpion belonging to a new family, Palaeotrilineatidae fam. n., and to a new genus and species, *Palaeotrilineatus ellenbergeri* sp. n., is described from Cretaceous amber of Myanmar (Burma). This is the fourth species and the fifth scorpion specimen to be described from Burmese amber. In the light of the previously described families, Electrochaerilinae and Chaerilobuthidae, the description of the new family Palaeotrilineatidae brings further evidence to the phylogenetic position of Burmese Cretaceous amber scorpions, lying at the base of the extant families Buthidae, Chaerilidae and Pseudochactidae.

KEY-WORDS: scorpion; fossil; new-family; Cretaceous; amber; Myanmar.

RESUMO

Um escorpião fóssil pertencente a uma nova família, (Palaeotrilineatidae fam. n.), a um novo gênero e espécie, (*Palaeotrilineatus ellenbergeri* sp. n.), é descrito do âmbar Cretácico de Myanmar (Birmania). Esta é a quarta espécie e o quinto espécime de escorpião descrito do âmbar Cretácico de Myanmar. Com base nas famílias previamente descritas desse mesmo âmbar (Electrochaerilinae e Chaerilobuthidae), a descrição da nova família (Palaeotrilineatidae) traz novas evidências para sustentar a posição filogenética dos escorpiões encontrados no âmbar Cretácico de Myanmar, como estando numa posição basal as famílias atuais dos Buthidae, Chaerilidae e Pseudochactidae.

PALAVRAS-CHAVE: Escorpião; fóssil; nova-família; Cretáceo; âmbar; Myanmar.

RÉSUMÉ

Un scorpion fossile appartenant à une nouvelle famille, Palaeotrilineatidae fam. n., et à un nouveau genre et espèce, *Palaeotrilineatus ellenbergeri* sp. n., est décrit de l'ambre Crétacé de Myanmar (Birmanie). Il correspond à la quatrième espèce et le cinquième spécimen de scorpion décrit de l'ambre Crétacé de Myanmar. A la lumière des familles préalablement décrites, Electrochaerilinae et Chaerilobuthidae, la description de la nouvelle famille Palaeotrilineatidae apporte un nouveau soutien à la position phylogénétique des scorpions de l'ambre Crétacé de Myanmar, comme étant situés dans une position basale par rapport aux familles actuelles des Buthidae, Chaerilidae e Pseudochactidae.

MOTS-CLÉS: Scorpion ; fossile, nouvelle-famille ; Crétacé; ambre ; Myanmar.

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