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## A new scorpion fossil from the Cretaceous amber of Myanmar (Burma). New phylogenetic implications

*Un nouveau scorpion fossile de l'ambre Crétacé de Myanmar (Birmanie). Nouvelles implications phylogénétiques*

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### ABSTRACT

A fossil scorpion belonging to a new family, genus and species, *Chaerilobuthus complexus* gen. n., sp. n., is described from Cretaceous amber of Myanmar (Burma). This is the third species and the fourth scorpion specimen to have been found and described from Burmese amber. The new family seems quite distinct from the family Archaeobuthidae Lourenço, 2001 described from Cretaceous amber of Lebanon.

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### RÉSUMÉ

Un scorpion fossile, appartenant à une nouvelle famille, un nouveau genre et une nouvelle espèce, *Chaerilobuthus complexus* gen. n. sp. n. est décrit de l'ambre Crétacé de Myanmar (Birmanie). Il correspond à la troisième espèce et au quatrième spécimen découverts et décrits de l'ambre de Myanmar. La nouvelle famille apparaît comme largement distincte de la famille des Archaeobuthidae Lourenço, 2001 décrite de l'ambre Crétacé du Liban.

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## 1. Introduction

Scorpions are rare among the arthropods fossilised in amber. Nevertheless, several specimens have recently

been described, mainly from Dominican and Baltic amber (Lourenço, 2009a,b; Lourenço and Weitschat, 2009). Cretaceous amber scorpions are even rarer than those found in Tertiary amber. Five such specimens 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.

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The first Cretaceous amber scorpion to be described was *Archaeobuthus estephani* 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, it was placed as *incertae familiae*. The third Cretaceous amber scorpion described was *Palaeoescorpius gallicus* Lourenço, 2003 from France. It was also placed in a new family, Palaeoescorpiidae (Lourenço, 2003). Finally, a second new genus and species of scorpion, *Electrochaerilus buckleyi* Santiago-Blay, Fet, Soleglad and Anderson, 2004 was described from Burmese amber and accommodated in a new subfamily, Electrochaerilinae, of the extant family Chaerilidae Pocock, 1893 (Santiago-Blay et al., 2004a). Two redescrptions were also proposed, those of *Palaeoburmesebuthus grimaldii* Lourenço and *Archaeobuthus estephani* Lourenço, bringing some new insights about these taxa (Baptista et al., 2006; Santiago-Blay et al., 2004b).

The specimen described below represents the third distinct scorpion to be found in Burmese amber. It presents some taxonomic characteristics allying it to both extant buthids and chaerilids. A new family, genus and species are described. The new family seems noticeably distinct from the family Archaeobuthidae Lourenço, 2001 described from Cretaceous amber of Lebanon, however, only the study of new specimens will allow a precise definition of its phylogenetic position.

## 2. Subjects and methods

The specimen investigated is preserved in a very clear block of yellowish amber that measures 15 × 8 × 4 mm. The scorpion is almost complete, since only the ventral aspect suffered when the specimen was “crushed” by the resin. Many characters, in both dorsal and ventral view, are clearly visible and allow detailed investigation. The schematic drawings provided are an interpretation of what was observable. Illustrations and measurements were produced with the aid of a Wild M5 stereomicroscope and a Leica microscope DMLB, both 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.

## 3. The age of Burmite

As discussed previously (Lourenço, 2002), there is considerable confusion in the literature as to the probable age of Burmese amber (Zherikhin and Ross, 2000). 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 and Ross, 2000).

According to Zherikhin and Ross (2000) and Grimaldi et al. (2002), the age of Burmese amber is probably

Turonian–Cenomanian (90–100 Ma). Most 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 (Cruikshank and Ko, 2003; Penney, 2010; Santiago-Blay et al., 2004b).

## 4. Systematic description

Family Chaerilobuthidae fam. n.

Genus *Chaerilobuthus* gen. n.

### 4.1. Diagnosis

General morphology shows similarities with both buthoid and chaeriloid scorpions. For this reason, the new taxon is assigned to the new family Chaerilobuthidae fam. n., distinct from the family Archaeobuthidae Lourenço, 2001 described from Cretaceous amber of Lebanon. The following combination of features can be used to diagnose the new family and genus: a trichobothrial pattern related to both those of buthoid and chaeriloids, types A and B (Vachon, 1974); at least two internal, four or five dorsal and three to five external trichobothria on the femur; three to five dorsal and one ventral trichobothria on the patella (one bothrium was observed); pecten small, bulky with five teeth; sternum most probably subpentagonal (only one side is visible); spiracles very small and oval to rounded; chelicerae with very long distal teeth which overlap for about one half of their length; movable finger with one basal and one median tooth; a bulbous vesicle, resembling those of some extant chactoids, but with a very long aculeus.

Type species: *Chaerilobuthus complexus* sp. n.

### 4.2. Description

*Chaerilobuthus complexus* gen. n. et sp. n. (Figs. 1–11).

Holotype: juvenile (sex unknown). Considering the slender pedipalps, the morphology of the mesosoma, the size and structure of the pecten, it might be a female specimen.

Type locality and horizon: Myanmar (Burma), Kachin; precise locality unknown; Lower Cretaceous.

*Derivatio nominis*: the generic name indicates characteristics shared with both Chaerilidae and Buthidae. The specific name refers to the complex characters presented by the new species.

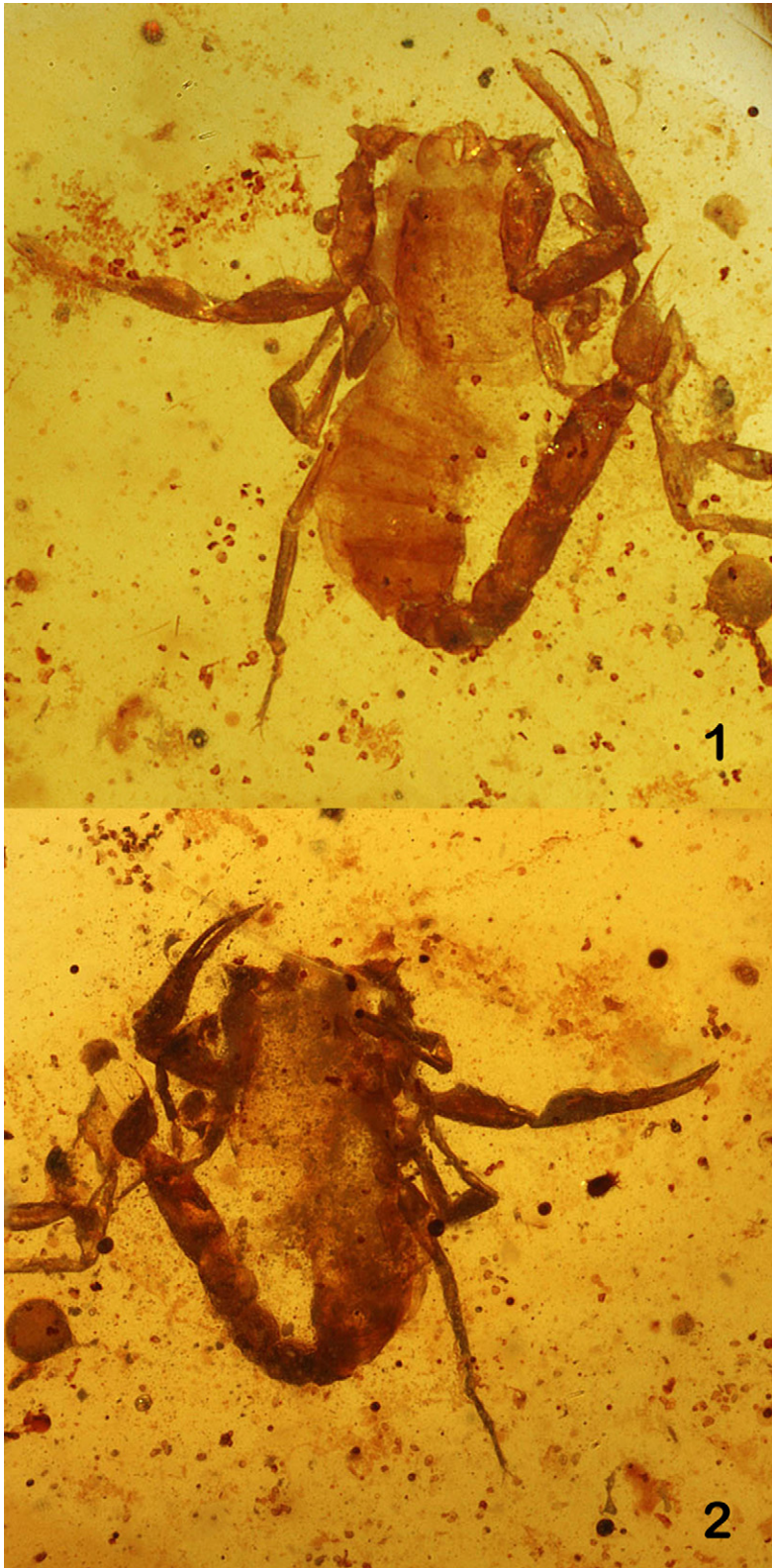
Depository: the type specimen is presently in the junior author's collection. It will subsequently be deposited in the collections of the Senckenberg Museum, Frankfurt.

Diagnosis: as for the family and genus.

### 4.3. Description

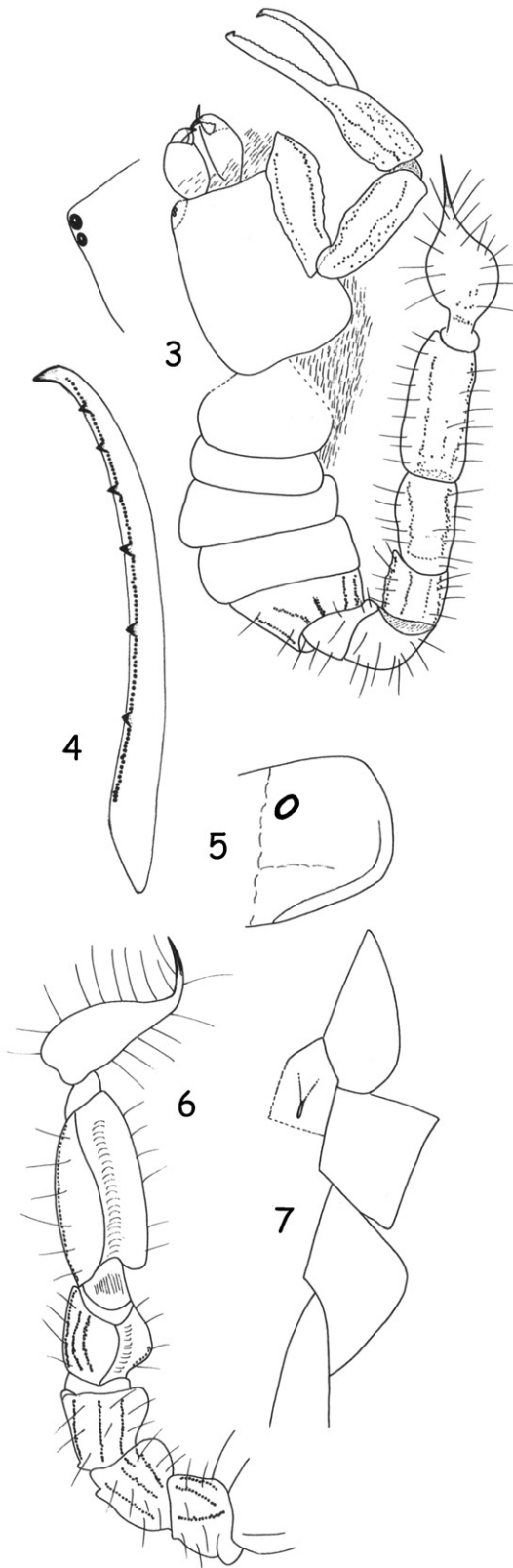
#### 4.3.1. Coloration

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



**Figs. 1 and 2.** *Chaerilobuthus complexus* sp. n., holotype. Dorsal (1) and ventral (2) aspects.  
**Fig. 1 et 2.** *Chaerilobuthus complexus* sp. n., holotype. Vues dorsale (1) et ventrale (2).





cannot be clearly observed since it has been crushed, leaving only a few fragments visible.

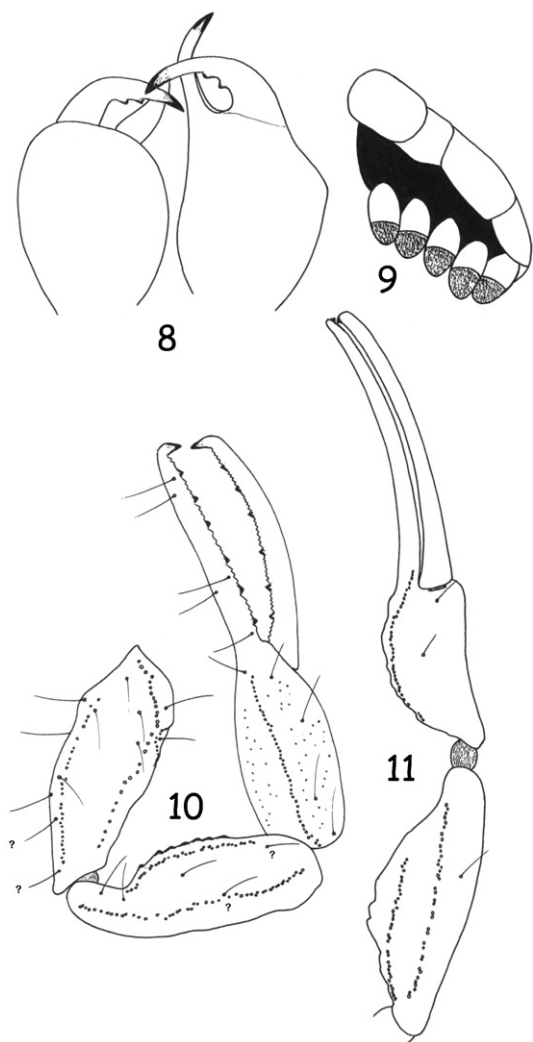
#### 4.3.2. Morphology

Carapace smooth, not granular; anterior margin with a minute median concavity; almost straight. Carinae and furrows absent. Median ocular tubercle indistinct; probably absent; median eyes, if present, are so small that they cannot be distinguished from bubbles in amber that hamper observation. Two lateral eyes visible. Sternum most probably subpentagonal (only one side visible). Mesosomal tergites III to VI (I–II destroyed) not granular and acarinate; VII with five weakly marked carinae. Left pecten small, very bulky, with five teeth and without fulcra; the zone with peg sensilla can be observed on each tooth. Only fragments of the sternites can be observed; one semi-oval to rounded spiracle is visible. Metasomal segments I and II with ten carinae; segments III and IV with eight carinae; segment V with five carinae; ventral carinae on segments III–V inconspicuous; dorsal carinae of segments I–IV with minute spinoid granules; dorsal aspect of segments I–V strongly depressed; setation on segments I to V strongly marked. Telson with a bulbous vesicle, flattened dorso-ventrally, as in some extant chactid species; weakly granular to smooth; aculeus very long and moderately curved. Cheliceral dentition not well visible; movable finger with one basal and one median tooth; distal teeth very long and overlapping for about one half of their length (Vachon, 1963). Pedipalp femur pentacarinate; no spinoid granules on internal face; patella with dorso-internal, ventro-internal, dorso-external, external and ventral carinae; internal face without spinoid granules. Chela with moderately marked carinae; all faces weakly granular. Fixed and movable fingers with 6–7 longitudinal to semi-oblique rows of small, rounded granules, separated by slightly spinoid accessory granules; extremity of fingers with one stronger spinoid granule. Trichobothriotaxy: a trichobothrial pattern related to those of both buthoid and chaeriloids, types A and B (Vachon, 1974), was observed. At least two internal, four or five dorsal and three to five external trichobothria on the femur; three to five dorsal and one ventral trichobothria on the patella (one bothrium was observed); two ventral and four or five dorso-external trichobothria on chela hand; five or six trichobothria on fixed finger. Leg tarsi with long, thin ventral setae. Pedal spurs present and moderately marked; tibial spurs absent.

Morphometric values (in mm) of the juvenile holotype of *Chaerilobuthus complexus* sp. n.

**Figs. 3–7.** *Chaerilobuthus complexus* sp. n. 3. Dorsal aspect, showing carapace, tergites, metasoma and right pedipalp; in detail, lateral eyes. 4. Cutting edge of movable finger with granulation. 5. Fragmented sternite V with spiracle. 6. Metasoma and telson, dorso-lateral aspect. 7. Fragmented coxapophysis delimitating sternum.

**Fig. 3–7.** *Chaerilobuthus complexus* sp. n. 3 : vue dorsale, avec la plaque prosomienne, tergites, metasoma et pédipalpe droit; en détail, les yeux latéraux ; 4 : tranchant du doigt mobile avec granulations ; 5 : fragment du sternite V, avec stigmate ; 6 : metasoma et telson, vue latéro-dorsale ; 7 : fragments de la hanche avec délimitation du sternum.



**Figs. 8–11.** *Chaerilobuthus complexus* sp. n. 8. Chelicerae, dorsal aspect. 9. Pecten. 10–11. Right and left pedipalps, dorsal and ventral aspects, showing trichobothria.

**Fig. 8–11.** *Chaerilobuthus complexus* sp. n. 8. Chélicères, vue dorsale; 9: peigne; 10–11: pédipalpes droit et gauche, vues dorsale et ventrale, avec des trichobothries.

Total length 3.38 (including Telson). Carapace: length 0.66, anterior width 0.51, posterior width 0.60. Chelicera length 0.20. Mesosoma length 0.94. Metasomal segments. I: length 0.11, width –; II: length 0.14, width –; III: length 0.20, width 0.11; IV: length 0.31, width 0.14; V: length 0.48, width –, depth 0.14. Telson length 0.54. Vesicle: length 0.31, width 0.26, depth 0.17. Pedipalp: femur length 0.48, width 0.16; patella length 0.51, width 0.17; chela length 0.80, width 0.14, depth 0.17; movable finger length 0.54.

#### 4.4. Taxonomic remarks

According to some of the characters visible – particularly the trichobothrial pattern – the new scorpion seems to be allied to both the buthoids and chaeriloids.

These two lineages are today represented in Southeast Asia. Even so, the assignment of the new family to one of two superfamilies, Buthoidea or Chaeriloidea (Lourenço, 2000) remains difficult. This is due to the incompleteness of the data currently available about these Burmese amber scorpions. Taking into account the geological horizon (Lower Cretaceous), a new family is described, since it seems distinct from the family Archaeobuthidae Lourenço, 2001 described from Cretaceous amber of Lebanon. However, only the study of new specimens will allow a precise definition of its phylogenetic position.

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