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Further comments on the elements of the family Palaeoburmesebuthidae Lourenço, 2015 with description of a new species of *Spinoburmesebuthus* Lourenço, 2017 from Early Cretaceous Burmite amber (Scorpiones)

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- ZooBank : <http://zoobank.org/58448BD6-79D7-46CE-AFDD-91EFF2B7D4EF>

Keywords:

scorpion; *knodelorum*;
fossil; amber;
Early Cretaceous; Myanmar;
Palaeoburmesebuthidae; new species;
Spinoburmesebuthus; description.

Abstract. – New comments are proposed on the diversity and morphological variability found within the elements, genera and species, of the Early Cretaceous scorpion family Palaeoburmesebuthidae Lourenço, 2015. A new species belonging to the genus *Spinoburmesebuthus* Lourenço, 2017 is described rising the total number of species in this family to 13.

Lourenço W. R., 2021. – Further comments on the elements of the family Palaeoburmesebuthidae Lourenço, 2015 with description of a new species of *Spinoburmesebuthus* Lourenço, 2017 from Early Cretaceous Burmite amber (Scorpiones). *Faunitaxys*, 9(17): 1 – 6.

ZooBank: <http://zoobank.org/E923F65B-F9FB-4A8F-97B2-51E74048EE59>

Introduction

Among the fossil arthropods found trapped in amber, scorpions can be considered rare. Nevertheless, the very first records can be dated from the early XIX century. New pieces started to become available during the 1980s and in particular the 1990s. These concerned basically scorpions from the Middle and Late Tertiary, from Baltic, Dominican and Mexican amber. Due to the more or less recent age of the amber pieces, the discoveries achieved did not lead to remarkable findings. In fact, many of the scorpions trapped in these types of amber could be easily accommodated in extant groups (for precise details refer to Lourenço, 2009, 2016).

About twenty years ago, the first scorpion trapped in Burmite (Early Cretaceous Burmese amber) became available for study. The specimen was largely incomplete and led only to the creation of a new genus and species, *Palaeoburmesebuthus grimaldii* Lourenço, 2002 (Lourenço, 2002). This preliminary study was followed by many others since more and more specimens from Burmite started to become available leading to a much better view about this Early Cretaceous scorpion fauna (Lourenço, 2016).

The clarification of the familial status of the genus *Palaeoburmesebuthus* was only possible several years later after the study of much better preserved specimens. The genus was placed in its own family, Palaeoburmesebuthidae Lourenço, 2015 and a second genus *Betaburmesebuthus* Lourenço, 2015 was equally created to accommodate a new lineage of this group (Lourenço, 2015; Lourenço & Beigel, 2015). The number of new species started to progress in an important pace. Indeed in only 16 years 4 species of *Palaeoburmesebuthus*, 7 of *Betaburmesebuthus* and a third genus, *Spinoburmesebuthus* Lourenço, 2017 was created (see check-list for the species and associated references). The study of several specimens that are almost perfectly preserved, clearly attested their relationship to the buthoids, in particular based on their trichobothrial patterns, which are almost identical to those of several extant buthoids (Lourenço, 2016). Presently the family Palaeoburmesebuthidae is composed of three genera, *Palaeoburmesebuthus*, *Betaburmesebuthus* and

Spinoburmesebuthus. A new specimen of Burmite scorpion is presently studied. It leads to the description of a second species belonging to the genus *Spinoburmesebuthus*. This specimen is remarkably well preserved and brings not only further support to the validity of the genus *Spinoburmesebuthus*, but also to the relations of the family Palaeoburmesebuthidae to extant lineages.

Materials and methods

The new specimen investigated here is preserved in a rectangular piece of clear yellow amber measuring 35.0 x 25.0 x 17.0 x 5.0 mm. Some organic inclusions and bubbles are present as well as one Acarian element and some micro-Coleopteran. The piece shows a totally complete scorpion and a remarkable number of characters, including the totality (or almost the totality) of trichobothria, are visible in this specimen, including all the bothria, allowing a very precise investigation. Just a few characters, such as the pectines, are less well observable. The schematic drawings provided here are interpretations of what was observable. Illustrations and measurements were produced with the aid of a Wild M5 stereomicroscope equipped with a drawing tube and an ocular micrometer. Measurements follow Stahnke (1970) and are given in mm, and morphological terminology mostly follows Hjelle (1990). Trichobothrial notations follow Vachon (1974). Trichobothria were definitely recorded only when their bothria (areoles) were observed. No supplementary trichobothria was suggested, for example by the presence of transverse hairs.

Comments on the genera and species of the family Palaeoburmesebuthidae

Although the number of contributions to the Burmite scorpions starts to be significant, no previous attention was paid to the possible existence of morphological-type-groups within the genera of the family Palaeoburmesebuthidae. A recent analysis of all described species in the known three genera suggested

the possible existence of morphological-type-groups. Some composed by species with short chelae and telsons and others composed by species with long chelae and telsons. The ratio of chela length vs chela width/depth and telson length vs telson width/depth indicates species distributed over a large range of values (Fig. 1). Naturally, the samples used in the analysis are composed exclusively of the known type material, what is extremely weak. All species are rare and generally only known for a single sex. Nevertheless, the observed existence of possible species-groups seems to be clear. Naturally, all these morphological-type-groups remain totally informal.

Palaeoburmesebuthidae Lourenço, 2015
Genus <i>Palaeoburmesebuthus</i> Lourenço, 2002
– <i>Palaeoburmesebuthus grimaldii</i> Lourenço, 2002
– <i>Palaeoburmesebuthus ohlhoffi</i> Lourenço, 2015a
– <i>Palaeoburmesebuthus longipalpis</i> Lourenço & Rossi, 2017
– <i>Palaeoburmesebuthus knodeli</i> Lourenço, 2018
Genus <i>Betaburmesebuthus</i> Lourenço, 2015 (Lourenço & Beigel, 2015)
– <i>Betaburmesebuthus kobberti</i> Lourenço, 2015 (Lourenço & Beigel, 2015)
– <i>Betaburmesebuthus muelleri</i> Lourenço, 2015b
– <i>Betaburmesebuthus bidentatus</i> Lourenço, 2015b
– <i>Betaburmesebuthus fleissneri</i> Lourenço, 2016 (Lourenço & Velten, 2016a)
– <i>Betaburmesebuthus bellus</i> Lourenço, 2016
– <i>Betaburmesebuthus larafleissnerae</i> Lourenço, 2016 (Lourenço & Velten, 2016b)
– <i>Betaburmesebuthus joergi</i> Lourenço & Rossi, 2017
Genus <i>Spinoburmesebuthus</i> Lourenço, 2017 (Lourenço & Velten, 2017)
– <i>Spinoburmesebuthus pohli</i> Lourenço, 2017 (Lourenço & Velten, 2017)
– <i>Spinoburmesebuthus knodelorum</i> sp. n.

Systematic description

Superfamily **Buthoidea** C. L. Koch, 1837

Family **Palaeoburmesebuthidae** Lourenço, 2015

Genus ***Spinoburmesebuthus*** Lourenço, 2017

(Fig. 2-5)

ZooBank: <http://zoobank.org/ECCE73FF-B596-4699-84E3-65414F380F71>

Revised diagnosis for the genus *Spinoburmesebuthus*. – The general morphology is similar to the other two genera of the family Palaeoburmesebuthidae, but also recalls that of some extant buthoid scorpions. The genus *Spinoburmesebuthus* is however defined on the basis of a combination of characters: A medium to large global size compared to the other elements of the family Palaeoburmesebuthidae with total lengths ranging from 17.62 to 21.76 mm. The two known species are slightly bulk with short pedipalps and metasoma or slender with elongated pedipalps and metasoma; however this can be probably due to sexual dimorphism since the only known specimens are respectively a female and a male. Carapace moderately granular; anterior margin with moderate to strong emargination. Sternum pentagonal in at least one species. Tergites with one median carina and two inconspicuous lateral carinae. Sternites with spiracles ranging from slit-like to oval in one species and semi-oval to almost round in the second species. Metasomal segments I with 10 carinae; segments II to IV with 8 carinae; segment V with 5 carinae; telson short in female and strongly elongated in male; in all cases with strongly marked spinoid granules and one or two subaculear tooth; setation on metasomal segments moderately to weakly marked. Fixed and movable fingers of pedipalp chela with 9 to 10 series of rounded granules in one species and very sharp granules in the second species; in both cases separated by very conspicuous accessory granules. Trichobothrial pattern shows elements extremely similar to those of extant buthid type A (Vachon 1974): The dorsal trichobothria of femur in beta configuration (Vachon, 1975). For the new species described here almost all

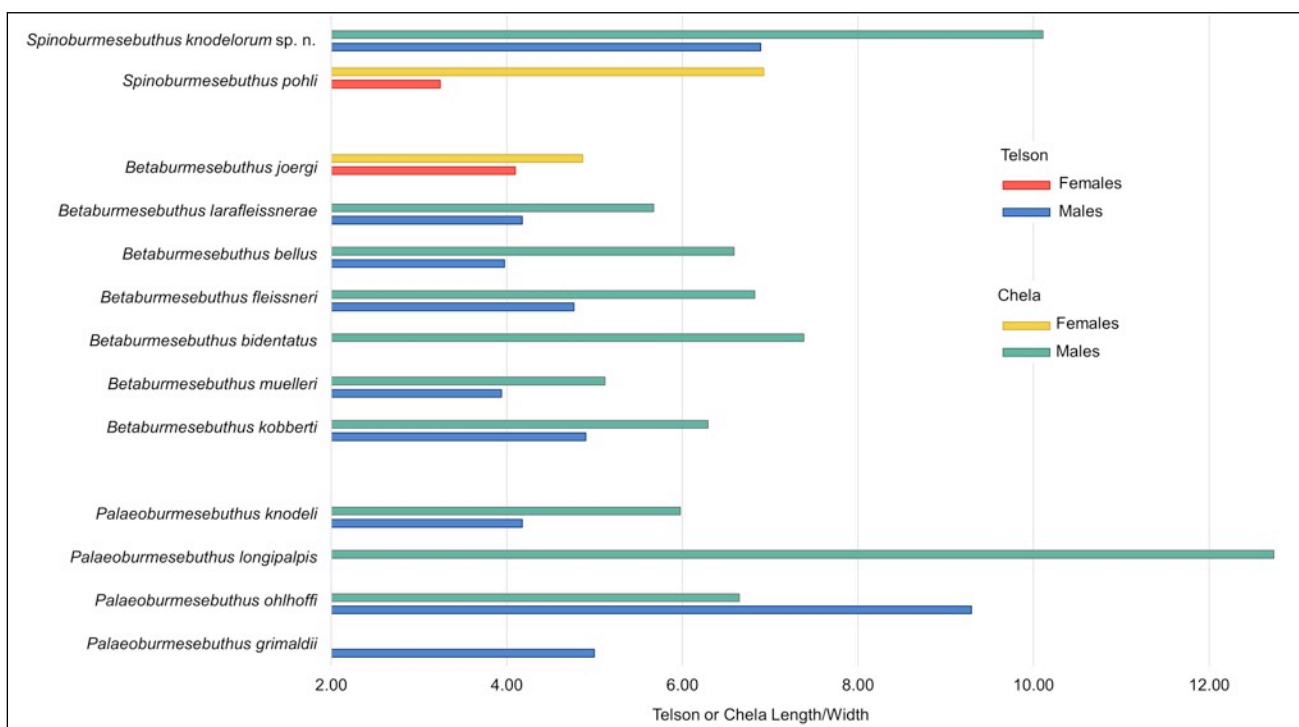


Fig. 1. Distribution of the species of the family Palaeoburmesebuthidae according to the ratio of length vs width/depth of their chela and telson. See also Table I.

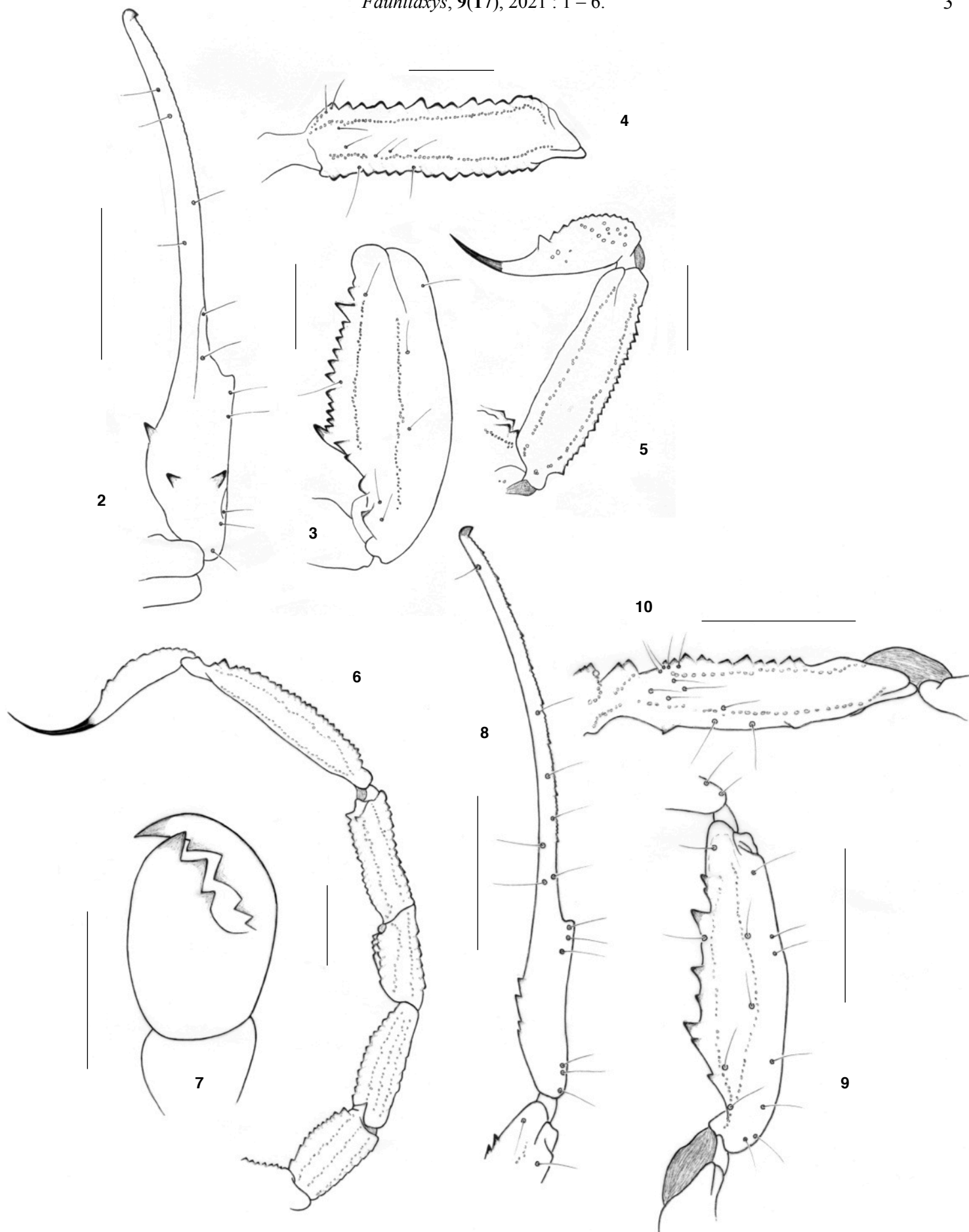


Fig. 2-5. *Spinoburmesebuthus pohli*, ♀, holotype, type species of the genus (scale bars = 1 mm).

2-4) Trichobothrial pattern. 2) Chela dorso-external aspect. 3) Patella, dorsal aspect. 4) Femur, dorsal aspect. 5) Metasomal segment V and telson, lateral aspect. To notice the strong spinoid granules present in all segments.

Fig. 6-10. *Spinoburmesebuthus knodelorum* sp. n., ♂, holotype (scale bars = 1 mm (6, 8-10); 0.5 mm (7)).

6) Metasomal segments and telson, lateral aspect, showing the spinoid granulations. 7) Chelicera, dorsal aspect. 8-10) Trichobothrial pattern. 8) Chela dorso-external aspect. 9) Patella, dorsal aspect. 10) Femur, dorsal aspect.

trichobothria can be observable; 4 internal, 2 external and five dorsal trichobothria in the femur; 1 internal, 5 dorsal and 7 external trichobothria on patella; no ventral are present; 6 dorso-external and two ventral on chelal hand and 7 on fixed finger can be clearly observed including the internal one. Based on this number it can be suggested that the trichobothrial pattern is orthobothriotaxique. The position of several trichobothria is however quite distinct for the two known species. Tibial spurs present on legs III and IV.

Spinoburmesebuthus knodelorum sp. n.

(Fig. 6-10, 11-16)

ZooBank: <http://zoobank.org/A286ECF9-BB65-496D-8555-DC8C953D7258>

Holotype, ♂, probably adult. Included in a rectangular clear block of pale yellow amber that measuring 35.0 x 25.0 x 17.0 x 5.0 mm. Type locality and horizon: Myanmar (Burma), Kachin; precise locality unknown; Lower Cretaceous.

Patronym. – The specific name honors Mr and Mrs Herbert Knodel (Rotonda, USA) who arranged facilities for the study of the type specimen.

Repository. – The type specimen is deposited in the collection of Mr H. Knodel (Rotonda, USA).

Diagnosis. – The new species combines most characters already described for the genus, but can be further diagnosed by the following features: a very slender body and appendages with a total length of 17.62 mm. Marked spinoid granules on femur, patella and chela of pedipalps and dorsal carinae of metasomal segments. Sternum pentagonal. Sternites with small semi-oval to round spiracles. Setation on metasomal segments moderately to strongly marked. Telson granular with two moderately to strongly developed subaculear tubercles. Pectines large with 15-16 teeth. Trichobothrial pattern of buthid type A with a beta configuration (Vachon, 1974, 1975), most certainly orthobothriotaxic. Femur with 5 dorsal 2 external and 4 internal trichobothria; patella with one internal, 5 dorsal and 7 external trichobothria; no supplementary trichobothria are suggested by the observation of fine setae; chela with 8 trichobothria, 6 dorso-external and two ventral; fixed finger with 7 trichobothria, including one internal; trichobothria **eb** and **esb** of fixed finger almost at the same level. Tibial spurs present on legs III and IV, strongly marked; tarsi with several thin setae similar to that of some extant buthids such as the genus *Ananteris* Thorell. Fixed and movable fingers of the pedipalps with sharped granulations recalling diminutive 'knives'; accessory granulation very strongly sharped, recalling those of *Archaeobuthus estephani* Lourenço, 2001 from Lebanon Cretaceous amber (Lourenço, 2001).

Description

Coloration. – The scorpion is yellow to slightly reddish-yellow; carapace and tergites yellow to reddish-yellow; metasomal segments reddish to dark reddish; telson reddish with aculeus yellow at the base and reddish at the tip; pedipalps and legs yellow. Ventral aspect dark yellow.

Morphology. – Carapace moderately to strongly granular; anterior margin with a moderately to strongly marked median concavity; posterior edge almost without any emargination. Carinae conspicuous; furrows moderate. Median ocular tubercle clearly anterior to the centre of carapace; median eyes moderate in size and separated by about one ocular diameter. Three pairs of lateral eyes of large size. Sternum pentagonal. Mesosomal tergites moderately to weakly granular, with one median carina; lateral carinae totally inconspicuous; VII with five strongly marked carinae and spinoid granules laterally. Pectines large, with 15-16 teeth; fulcra absent. Sternites

weakly granular with small semi-oval to round spiracles. Metasomal segment I to IV with 10-10-8-8 strongly marked carinae; segment V slender with five carinae; dorsal carinae of segments I-IV with spinoid granules; ventral carina on segment V equally with spinoid granules; dorsal aspect of segments I to V weakly depressed; setation on all segments strongly marked. Curiously, metasomal segment III is shorter than segments I and II (see measurements after the description). Telson with a marked elongated vesicle; moderately granular; aculeus as long as the vesicle and moderately curved; setation strongly marked. Cheliceral dentition only partially visible; fixed and movable fingers with one and two basal tooth; distal teeth moderately long (Vachon, 1963). Pedipalp femur pentacarinata; patella with 6-7 carinae; internal face of femur and patella with strongly marked spinoid granules. Chela with moderately marked carinae; all faces weakly granular; internal face with 2-3 spinoid granules. Fixed and movable fingers each with one series, divided in 9-10 sub-series, of small knife-shaped granules separated by conspicuous knife-shaped accessory granules; extremity of fingers with stronger knife-shaped granules; setation of pedipalps moderately marked. Trichobothriotaxy of type A (Vachon, 1974) defined for extants buthids; dorsal trichobothria disposed in beta (β) configuration (Vachon, 1975). General pattern most certainly orthobothriotaxic. Femur with 5 dorsal 2 external and 4 internal trichobothria; patella with one internal, 5 dorsal and 7 external trichobothria; no supplementary trichobothria are suggested by the observation of fine setae; chela with 8 trichobothria, 6 dorso-external and two ventral; fixed finger with 7 trichobothria, including one internal; trichobothria **eb** and **esb** of fixed finger almost at the same level. Tibial spurs present on legs III and IV, strongly marked; tarsi with several thin setae.

Morphometric values (mm), holotype.

– *Total length*: 17.62 (including telson).

– *Carapace*: length 2.24, anterior width 1.07, posterior width 2.17.

– *Mesosoma*: length 4.54.

– *Metasomal segments*

I: length 1.37, depth 0.67;

II: length 1.50, depth 0.54;

III: length 1.14, depth 0.57;

IV: length 1.71, depth 0.60;

V: length 2.57, depth 0.60.

– *Telson*: length 2.55.

– *Vesicle*: depth 0.37.

– *Pedipalp*

femur length 1.94, width 0.47;

patella length 2.10, width 0.57;

chela length 3.74, width 0.37;

– *Movable finger*: length 2.95.

Acknowledgements

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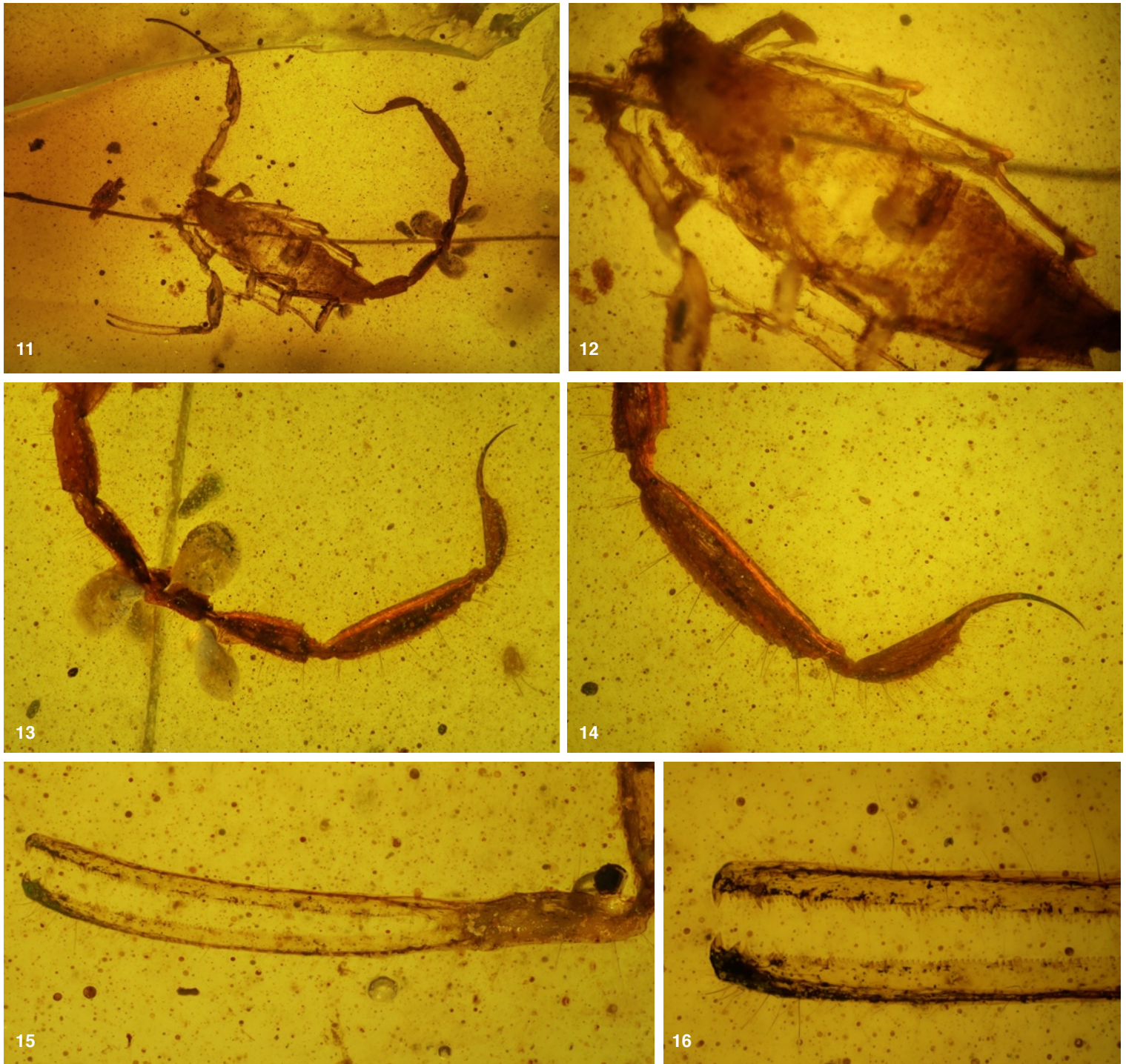


Fig. 11-16. *Spinoburmesebuthus knodelorum* sp. n., ♂, holotype.

11) Habitus, dorsal aspect. 12) Ventral aspect, showing pectines. 13) Metasomal segments and telson, lateral aspect. 14) Segment V and telson in detail. 15) Left Chela, showing the spinoid granulations on fixed and movable fingers. 16) Extremity of the fingers, in detail, showing the conspicuous knife-shaped accessory granules.

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Table I. Ratios (R) between Telson length (L) and width or depth (W) and Chela length (L) and width or depth (W)

<p><i>Palaeoburmesebuthus grimaldii</i> Lourenço, 2002 Telson – L = 1.45, W = 0.29 – R = 5.00</p> <p><i>Palaeoburmesebuthus ohlhoffi</i> Lourenço, 2015 Telson – L = 3.16, W = 0.34 – R = 9.29 Chela – L = 2.26, W = 0.34 – R = 6.65</p> <p><i>Palaeoburmesebuthus longipalpis</i> Lourenço & Rossi, 2017 Chela – L = 2.42, W = 0.19 – R = 12.74</p> <p><i>Palaeoburmesebuthus knodeli</i> Lourenço, 2018 Telson – L = 1.67, W = 0.40 – R = 4.18 Chela – L = 2.81, W = 0.47 – R = 5.98</p> <p><i>Betaburmesebuthus kobberti</i> Lourenço, 2015 Telson – L = 1.47, W = 0.30 – R = 4.90 Chela – L = 2.14, W = 0.34 – R = 6.30</p> <p><i>Betaburmesebuthus muelleri</i> Lourenço, 2015 Telson – L = 1.34, W = 0.34 – R = 3.94 Chela – L = 1.74, W = 0.34 – R = 5.12</p> <p><i>Betaburmesebuthus bidentatus</i> Lourenço, 2015 Chela – L = 3.47, W = 0.47 – R = 7.38</p>	<p><i>Betaburmesebuthus fleissneri</i> Lourenço, 2016 Telson – L = 1.62, W = 0.34 – R = 4.76 Chela – L = 2.32, W = 0.34 – R = 6.82</p> <p><i>Betaburmesebuthus bellus</i> Lourenço, 2016 Telson – L = 1.47, W = 0.37 – R = 3.97 Chela – L = 2.24, W = 0.34 – R = 6.59</p> <p><i>Betaburmesebuthus larafleissnerae</i> Lourenço, 2016 Telson – L = 1.67, W = 0.40 – R = 4.17 Chela – L = 2.27, W = 0.40 – R = 5.68</p> <p><i>Betaburmesebuthus joergi</i> Lourenço & Rossi, 2017 Telson – L = 2.54, W = 0.62 – R = 4.10 Chela – L = 3.60, W = 0.74 – R = 4.86</p> <p><i>Spinoburmesebuthus pohli</i> Lourenço, 2017 Telson – L = 2.27, W = 0.70 – R = 3.24 Chela – L = 3.74, W = 0.54 – R = 6.93</p> <p><i>Spinoburmesebuthus knodelorum</i> sp. n. Telson – L = 2.55, W = 0.37 – R = 6.90 Chela – L = 3.74, W = 0.37 – R = 10.10</p>
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Résumé

Lourenço W. R., 2021. – Considérations supplémentaires sur les éléments de la famille des Palaeoburmesebuthidae Lourenço, 2015 et description d'une nouvelle espèce de *Spinoburmesebuthus* Lourenço, 2017 de l'ambre du Crétacé inférieur de la Birmanie (Scorpiones). *Faunitaxys*, 9(17) : 1 – 6.

Des nouvelles considérations sont proposées sur la diversité et la variabilité morphologique retrouvée chez les éléments, genres et espèces, de la famille Palaeoburmesebuthidae Lourenço, 2015, du Crétacé inférieur de la Birmanie. Une nouvelle espèce appartenant au genre *Spinoburmesebuthus* Lourenço, 2017 est décrite, élevant ainsi le nombre total d'espèces connues à 13.

Mots-clés. – Scorpion, fossile, Crétacé inférieur, Palaeoburmesebuthidae, *Spinoburmesebuthus*, *knodelorum*, ambre, Myanmar, nouvelle espèce, description.

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Illustration de la couverture : *Spinoburmesebuthus knodelorum* Lourenço **sp. n.** dans l'ambre du Crétacé inférieur de la Birmanie.

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