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FURTHER CONSIDERATIONS ON THE *BUTHUS* LEACH, 1815 SPECIES PRESENT IN ALGERIA WITH DESCRIPTION OF A NEW SPECIES (SCORPIONES: BUTHIDAE)

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Abstract: From the beginning of the 1950s until the early 2000s the composition of the genus *Buthus* Leach, 1815 remained extremely conservative. Following the preliminary revisions by Lourenço in 2002 and 2003 an increasing number of studies were published, concerning mostly the species associated to the '*Buthus occitanus*' complex. The status of many populations previously considered as subspecies or varieties of *Buthus occitanus* (Amoreux, 1889) has been reviewed, and these have been raised to the rank of species. A considerable number of new species have also been described. The majority of the species considered in these studies come from North Africa, but only five new species have been recorded from Algeria. Nevertheless, only the studies conducted in Algeria have been done with precise methods and a clear definition of the populations. In order to stabilise the nomenclature, a new diagnosis is here proposed for the classical species found in Algeria, *Buthus paris* (C. L. Koch, 1839). One more new species of *Buthus* is also described, from the region of Sidi Bel Abbès, in the north-western mountains of the country. This new species may represent a possible vicariant element of *Buthus saharicus* Sadine, Bissati & Lourenço, 2016, known from the central deserts of Algeria. The number of confirmed species of *Buthus* in Algeria is thus raised to eight.
Key words: Scorpiones, Buthidae, *Buthus*, new species, Algeria, north-western mountain ranges.

Consideraciones adicionales sobre las especies de *Buthus* Leach, 1815 de Argelia y descripción de una especie nueva (Scorpiones: Buthidae)
Resumen: Desde el principio de la década de 1950 hasta los primeros años de la década de 2000, la composición del género *Buthus* Leach, 1815 permaneció extremadamente conservadora. A raíz de las revisiones preliminares de Lourenço, en 2002 y 2003, se han ido publicando un número creciente de estudios, principalmente sobre las especies asociadas al grupo de '*Buthus occitanus*'. El estatus de muchas poblaciones previamente consideradas como subespecies o variedades de *Buthus occitanus* (Amoreux, 1889) se ha replanteado, y éstas se han elevado al rango de especies. Igualmente, se han descrito diversas especies nuevas. La mayoría de las especies recogidas en esos estudios proceden del norte de África, pero sólo se han citado cinco especies nuevas de Argelia. Sin embargo, únicamente los estudios llevados a cabo en Argelia se han realizado con métodos precisos y una definición clara de las poblaciones. A fin de estabilizar la nomenclatura se propone aquí una nueva diagnosis para la especie clásica que vive en Argelia, *Buthus paris* (C. L. Koch, 1839). También se describe otra especie nueva de *Buthus*, de la región de Sidi Bel Abbès, en las montañas del noroeste del país. La especie nueva puede representar un posible elemento vicariante de *Buthus saharicus* Sadine, Bissati & Lourenço, 2016, conocido de los desiertos centrales de Argelia. El número de especies confirmadas de *Buthus* presentes en Argelia se eleva así a ocho.
Palabras clave: Scorpiones, Buthidae, *Buthus*, especie nueva, Argelia, cordilleras noroccidentales.

Taxonomy / Taxonomía: *Buthus apiatus* **sp. n.**

Introduction

As already outlined in several previous papers, from the beginning of the 1950s, which saw the monographic contribution of Vachon (1952), and until the early 2000s the composition of the genus *Buthus* Leach, 1815 remained extremely conservative. However, during the last 20 years, the situation changed considerably. All started with the preliminary revisions of the genus *Buthus* Leach, 1815 proposed by Lourenço (2002, 2003), in which several new species were described, mostly associated to the '*Buthus occitanus*' complex (e.g. Lourenço, 2013, 2017; Lourenço & Sadine, 2016; Lourenço *et al*., 2018; Sadine *et al*., 2016). The majority of the described new species have been discovered in North African countries (e.g. Lourenço, 2003, 2013, 2017; Lourenço & Cloudsley-Thompson, 2012; Lourenço & Sadine, 2016; Lourenço *et al*., 2018; Sadine *et al*., 2016; Rossi *et al*., 2013) or from sub-Saharan regions (Lourenço, 2015, 2016; Lourenço & Leguin, 2012), with a few exceptions for European and Middle East new species (e.g. Lourenço, 2008; Lourenço & Vachon, 2004; Lourenço & Rossi, 2013; Lourenço *et al*., 2010; Rossi, 2012; Yağmur *et al*., 2011). More recently, a first attempt of a global analysis for the genus *Buthus* was published by Sousa *et al*. (2017). This contribution in the form of a mini-catalogue, although having some merits, is biased however, by a number of gaps. In most cases the presented data is merely a compilation of previous publications and most of the original type material was not consulted (Lourenço, 2017; Lourenço *et al*., 2018).

Most of the new species from North Africa, were recorded and described from countries such as Morocco, Mauritania, Tunisia, Sudan, Libya, Chad and Egypt (Lourenço, 2003, 2015, 2016, 2017; Lourenço & Cloudsley-Thompson, 2012; Rossi *et al*., 2013), but only five new species were recently recorded from Algeria (Lourenço, 2002, 2003, 2013; Lourenço & Sadine, 2016; Lourenço *et al*., 2018; Sadine *et*

al., 2016). The studies performed in Algeria present however a major advantage since these are the only done with precise methods and a clear definition of the populations.

Recent field work performed by two of the authors (ME and SES) in the Region of Sidi Bel abbès, NW range of Algeria (Fig. 1), habitat located in the Steppe and Forest ecosystems of the country, lead to the collection of some distinct *Buthus* specimens. Precise analysis confirmed that they were different from *Buthus tunetanus* (Herbst, 1800) and *Buthus paris* (C. L. Koch, 1839), which are the two species currently distributed in the North of Algeria. This population seems to show some affinities with *Buthus aures* Lourenço & Sadine, 2016, described however from the NE range of Algeria. Both species may yet correspond to a possible case of vicariance between these two populations. A number of marked differences can however be outlined, mainly for their pigmentation patterns, consequently, a new species of *Buthus* is described at present. A new diagnosis if proposed for *Buthus paris*, one of the classical species presented in North of Algeria, in order to stabilise its taxonomic position.

Methods

Illustrations and measurements were made with the aid of a Wild M5 stereo-microscope 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 Vachon (1952) and Hjelle (1990).

List of the *Buthus* species present in Algeria

Buthus tunetanus (Herbst, 1800)
Buthus paris (C. L. Koch, 1839)
Buthus tassili Lourenço, 2002
Buthus pusillus Lourenço, 2013
Buthus saharicus Sadine, Bissati & Lourenço, 2016
Buthus aures Lourenço & Sadine, 2016
Buthus boussaadi Lourenço, Chichi & Sadine, 2018
Buthus apiatus **sp. n.**

Taxonomic treatment

Family **Buthidae** C. L. Koch, 1837

Genus ***Buthus*** Leach, 1815

Buthus paris (C. L. Koch, 1839) *Androctonus paris* C. L. Koch, 1839: 25-28, pl. CLI, fig. 352.

Revised diagnosis. For this revised diagnosis we only take in account the populations ranging from the Tunisian Coastal Massifs to the region of Alger, defined by Vachon (1952) as the group I and which corresponds to the typical form of *Buthus paris*. The other two groups defined by Vachon (1952) from W Algeria and Morocco most certainly correspond to different species (Lourenço, 2017).

Scorpion of moderate to large size, with a total length ranging from 65 to 75 mm in both females and males. General coloration yellow to pale yellow carapace densely spotted; tergites with conspicuous confluent spots; metasomal segments without spots, excepted by the ventral carinae which are slightly brownish; pedipalps and legs without spots; chelicerae yellow, without variegated spots. Carinae and granulations strongly marked on carapace, tergites and metasomal segments. Fixed and movable fingers with 11-13 rows of granules. Pectines with 20 to 25 and 27 to 30 teeth in females and males, respectively. Tibial spurs moderately to strongly develop.

Material examined. Algeria, Tiaret, V/2014 (S. E. Sadine), 3 males, 1 female; to be deposited in the Muséum national d'Histoire naturelle, Paris.

***Buthus apiatus* sp. n.**

Fig. 2-9, 12-13.

Algeria, NW, region of Sidi Bel abbès, Station Ras Elma, 1/VIII/2019 (M. El Bouhissi), male holotype; 1 male juvenile paratype. Station Merine, 29/X/2018 (M. El Bouhissi), 2 male pre-adults paratypes; 29/X/2018 (El Bouhissi), 2 female paratypes.

Holotype and 3 paratypes deposited in Muséum national d'Histoire naturelle, Paris; 2 paratypes deposited in the University of Ghardaïa, Algeria.

Etymology: The specific name refers to the punctuated somewhat alveolar pigmentation presented in the pedipalps and chelicerae of the new species.

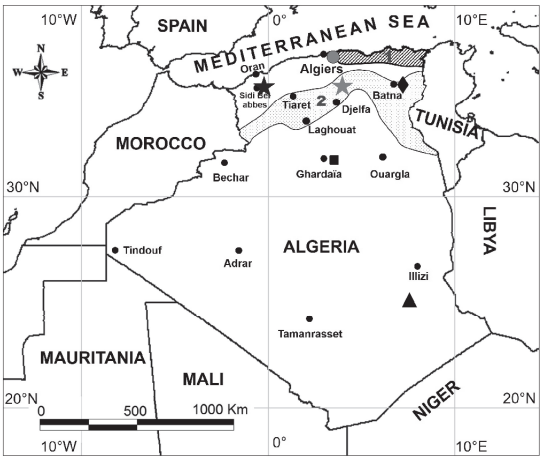
Diagnosis: Scorpion of moderate to large size, with a total length ranging from 55 to 61 mm in both females and males. General coloration orange-yellowish; carapace and tergites densely spotted; three longitudinal stripes over tergites; lateral stripes formed by individual confluent spots over each tergite; legs and pedipalps densely spotted; particularly conspicuous on patella and chelae of pedipalps with some of the spots having a more or less alveolar shape. Carinae and granulations strongly marked on carapace, tergites and metasomal segments. Fixed and movable fingers with 10-11 to 11-11 rows of granules. Pectines with 27 to 30 and 30 to 33 teeth in females and males, respectively. Tibial spurs moderately developed.

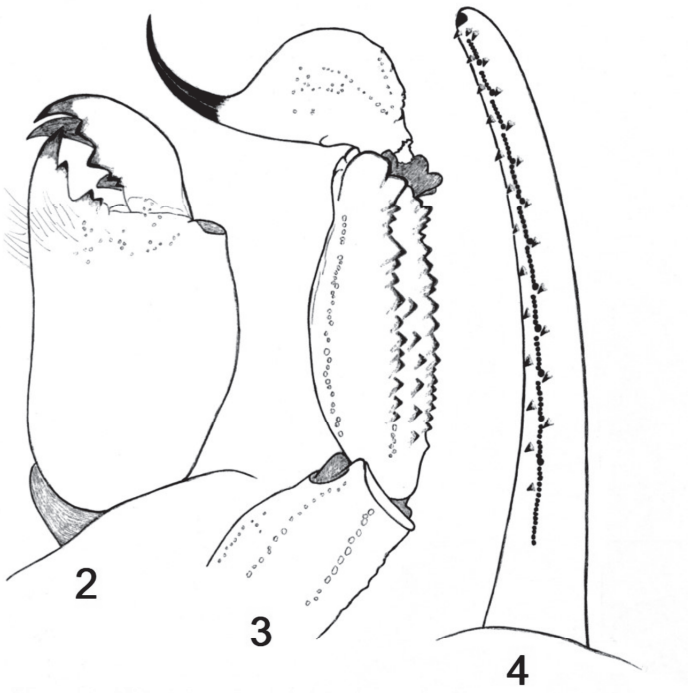
Description based on male holotype and paratypes

Measurements following the description.

Coloration basically yellow to orange-yellowish. Prosoma: Carapace yellow with carinae and ocular tubercle marked by dark pigment. Mesosomal tergites yellow to orange-yellow with three longitudinal stripes; the median one narrower than the laterals which are formed by confluent spots over each tergite. Metasomal segments yellow with some brown spots over carinae; vesicle yellow with faded lateral stripes; aculeus yellowish at its base and dark red at its extremity. Venter yellow; genital operculum and pectines pale yellow. Chelicerae yellowish with a particular pattern of reticular to alveolar spots covering the anterior 2/3 of the total surface; fingers yellow with almost blackish teeth. Pedipalps yellow with strongly marked brown spots, in particular on patella and chela-hand; fingers with the oblique rows of granules dark red. Legs yellow with conspicuous brown spots over proximal segments.

Morphology. Carapace strongly granular; anterior margin with a weak concavity, almost straight. Carinae strongly marked; anterior median, central median and posterior median carinae strongly granular, with 'lyre' configuration. All furrows moderate. Median ocular tubercle located in the centre of the carapace, almost slightly posterior to this centre. Eyes separated by more than two ocular diameters. Three pairs of lateral eyes of moderate size in relation to median eyes; a





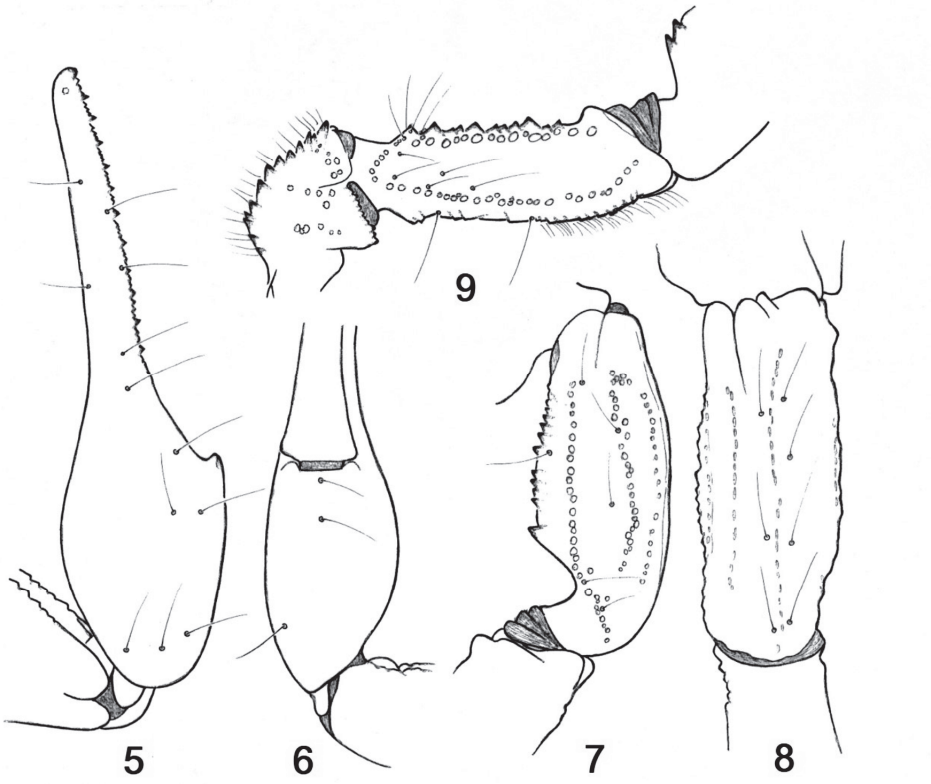


Fig. 1. Map of Algeria, showing the distribution of the known *Buthus* species. *Buthus paris* (dashed area 1). *Buthus tunetanus* (dashed area 2). *Buthus tassili* (black triangle). *Buthus pusillus* (black circle). *Buthus saharicus* (black square). *Buthus aures* (black rhombus). *Buthus boussaadi* (gray star) and *Buthus apiatus* **sp. n.** (black star). **Fig. 2-4**. *Buthus apiatus* **sp. n.** Male holotype. **2**. Chelicera, dorsal aspect. **3**. Metasomal segment V and telson, lateral aspect. **4**. Cutting edge of chela movable finger with rows of granules. **Fig. 5-9**. *Buthus apiatus* **sp. n.** Male holotype. Trichobothrial pattern. **5-6**. Chela, dorso-external and ventral aspects. **7-8**. Patella, dorsal and external aspects. **9**. Femur, dorsal aspect.

fourth reduced pair may be present. Sternum triangular, weakly narrowed; slightly wider than long. Mesosoma: tergites moderately granular. Three longitudinal carinae moderately to strongly crenulate in all tergites; lateral carinae reduced in tergites I and II. Tergite VII pentacarinate. Venter: genital operculum divided longitudinally, which plate with a semi-oval to semi-triangular shape. Pectines: tooth count 32-30 in male holotype (see diagnosis for variation); middle basal lamella of the pectines not dilated. Sternites without granules, smooth with elongated spiracles; four weak carinae on sternite VII; two on VI; other sternites almost acarinated and with two vestigial furrows. Metasomal segments with a weak to moderate setation; segments I to III with ten crenulated carinae; intermediate incomplete on II and III; ventral slightly better



Fig. 10-11. Natural habitats of the new species in the region of Sidi Bel abbès, NW range of Algeria. **10**. Ras Elma station. **11**. Merine station. **Fig 12-13.** *Buthus apiatus* **sp. n.** alive in its natural habitat. **12**. Male holotype in Ras Elma station. **13**. Female paratype in Merine station.

marked on II-III but without lobate granules; segment IV with eight carinae, crenulated; the first four segments with a smooth dorsal depression; segment V with five carinae; the latero-ventral carinae crenulate with 3-4 lobate denticles posteriorly; ventral median carina not divided posteriorly; anal arc composed of 10-11 ventral teeth, and two lateral lobes. Intercarinal spaces weakly granular. Telson with some granulations ventrally and laterally; aculeus curved and slightly shorter than the vesicle, without a subaculear tubercle. Cheliceral dentition as defined by Vachon (1963) for the family Buthidae; external distal and internal distal teeth approximately the same length; basal teeth on movable finger small to moderate and not fused; ventral aspect of both fingers and manus covered with long dense setae. Pedipalps with a weak to moderate setation; femur pentacarinate; patella with nine carinae, strongly marked; all faces weakly granular; chela smooth, with vestigial carinae. Fixed and movable fingers with 10-11 oblique rows of granules. Internal and external accessory granules present, moderately strong; three accessory granules on the distal end of the movable finger next to the terminal denticle. Legs: tarsus with two longitudinal rows of moderately long setae ventrally; tibial spurs strong on legs III and IV; pedal spurs strong on legs I to IV. Trichobothriotaxy: trichobothrial pattern of Type A, orthobothriotaxic as defined by Vachon (1974). Dorsal trichobothria of femur arranged in β (beta) configuration (Vachon, 1975).

Morphometric values of the male holotype of *Buthus aures* and male holotype of *Buthus apiatus* **sp. n.** Total length including the telson, 60.9/61.4. Carapace: length 6.6/6.9; anterior width 4.6/4.9; posterior width 7.5/7.6. Mesosoma length: 16.7/16.3. Metasomal segments. I: length 4.9/5.2, width 5.3/5.2; II: length 5.6/5.9, width 5.0/5.0; III: length 5.8/6.0, width 4.7/4.9; IV: length 6.5/7.0, width 4.4/4.1; V: length, 8.0/7.8, width 3.8/3.7, depth 3.5/3.2. Telson length 6.8/6.3; vesicle: width 3.2/3.3, depth 2.9/3.0. Pedipalp: femur length 5.8/5.9, width 1.9/1.8; patella length 6.4/6.3, width 2.7/2.5; chela length 10.8/10.9, width 2.5/2.3, depth 2.5/2.4. Movable finger length 7.1/7.3.

Female paratypes are only pre-adults and show total lengths of 46.2 and 45.5 mm respectively.

RELATIONSHIPS: *Buthus apiatus* **sp. n.** belongs to the '*Buthus occitanus*' complex of species. By a number of characters the new species shows similarities with *Buthus aures* originally described from northeast of Algeria. It can, however, be distinguished from this last species and from other species of *Buthus* such as *B. paris*, also distributed in the north range of Algeria, by a number of characters: (i) It is smaller in size than *B. paris* which can measured up to 65-75 mm in total length; global size is similar to *B. aures*, but morphometric values can show some slight differences (see measurements), (ii) the new species shows a unique pattern of pigmentation with conspicuous reticular to alveolar spots on chelicerae and pedipalps; this character is precisely diagnostic (iii) the number of rows of granules on the pedipalp chela fingers of the new species is reduced to 10-11, while in *B. aures* this number is 11-12 or 12-12 (iv) ocular tubercle in the

new species is located slightly posteriorly to the centre of the carapace, while in *B. aures* it is slightly anterior to this centre of the carapace (v) ventral carina of metasomal segments V is not divided in the new species.

ECOLOGICAL CONSIDERATIONS ABOUT THE REGIONS OF DISTRIBUTION OF *BUTHUS APIATUS* SP. N. AND *BUTHUS AURES*

Region of Sidi Bel abbès. Location, 34-35° N, 0-1° W; average altitude, 768 m; type of bioclimat, semi-arid (Ouici *et al*., 2015); temperatures, max 24.6°C, min 4°C, average 15.7°C; rainfall, 442 mm/year; type of biotope, steppe with transition to forest with the presence among others of *Stipa tenacissima*, *Artemisia herba-alba*, *Pinus halepensis*, *Quercus ilex*, *Pistacia lentiscus* (Ouici *et al*., 2015); soil typology formed by brown calcareous soils with sandy clay and reddish brown calcareous soils (Baroudi *et al*., 2011). See also figures 10-11.

Region of Batna. Location 35-36° N, 4-7° E; average altitude, 648 m; type of bioclimat, semi-arid (Berkane & Yahiaoui, 2007); temperatures, max 35°C, min 0°C, average 18.2°C (Chenchouni *et al*., 2010); rainfall, 350 mm/year (Chenchouni *et al*., 2010); type of biotope, high plains in mountainous massif with the presence among others of *Cedrus atlantica*, *Quercus ilex*, *Juniperus phoenicea*, *Juniperus oxycedrus*, *Fraxinus dimorpha*, *Pinus halepensis* (Chenchouni *et al*., 2008); soil typology formed by clay soils with limestone boulders, Rendzina soils and brownish poorly calcareous soils (Abdessemed, 1981).

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