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A new species of the rare buthid scorpion genus *Lissothus* Vachon, 1948 from Central Algeria (Scorpiones, Buthidae)

Une nouvelle espèce du rare scorpion Buthidae genre Lissothus *Vachon, 1948 d'Algérie centrale (Scorpiones, Buthidae)*

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ABSTRACT

Taxonomic considerations are given for the genus *Lissothus* Vachon, 1948 (Scorpiones, Buthidae). Two species are currently known, *Lissothus bernardi* Vachon, 1948 from Libya and *Lissothus occidentalis* Vachon, 1950 from Mauritania. In this contribution, a new species, *Lissothus chaambi* sp. n., is described from the desert of Central Algeria. The new species is most closely related to *L. bernardi*. The geographical distribution of the genus is discussed.

RÉSUMÉ

Des considérations taxonomiques sont proposées pour le genre *Lissothus* Vachon, 1948 (Scorpiones, Buthidae). Deux espèces sont à présent connues pour ce genre : *Lissothus bernardi* Vachon, 1948 de Lybie et *Lissothus occidentalis* Vachon, 1950 de Mauritanie. Dans la présente note, une nouvelle espèce, *Lissothus chaambi* sp. n., est décrite pour le désert de la région centrale de l'Algérie. La nouvelle espèce montre des affinités avec les deux autres espèces du genre, et en particulier avec *L. bernardi*. Quelques considérations sur la répartition géographique du genre sont également proposées.

1. Introduction

As discussed in recent publications [1–3], scorpion diversity is particularly great in deserts and arid formations. The scorpions of North Africa, particularly those

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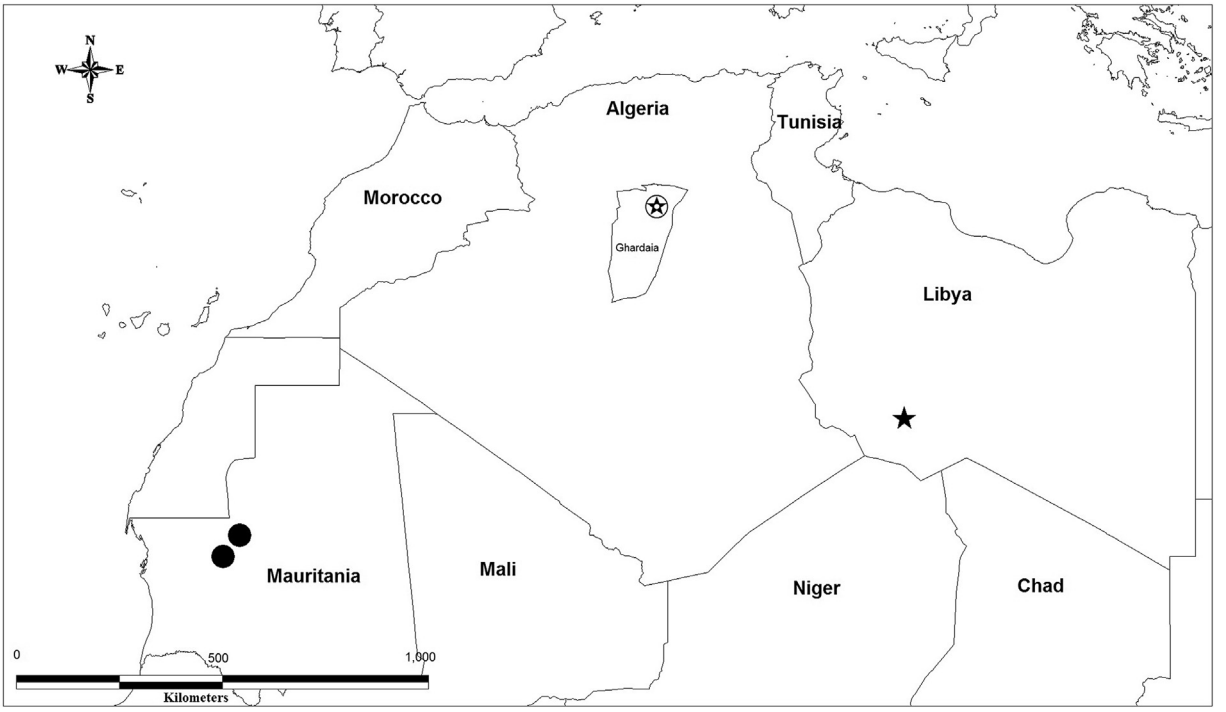

Fig. 1. Map of North Africa, showing distribution of the known *Lissothus* species. *Lissothus bernardi* (black star), *Lissothus occidentalis* (black circles) and *Lissothus chaambi* sp. n. (circle with star).

specifically adapted to the Sahara desert, have been the subject of intensive study. This was synthesised in the monographic work of Vachon [4]. Nevertheless, more detailed inventory work, and the revision of classical groups has revealed an increasing number of new species and even new genera. A summary is available in Lourenço and Duhem [1] and in Lourenço et al. [2]. Thus, it is apparent that our knowledge of this fauna is still far from complete. Many additional species and probably even genera await discovery.

Here, we describe an interesting addition to the family Buthidae C.L. Koch, 1837, a new species of the rare genus *Lissothus* Vachon from the desert of the Central region of Algeria. This new *Lissothus* provides a link between the two previously known species of *Lissothus*, found in the South of Libya and in Central Mauritania (Fig. 1).

2. The genus *Lissothus* Vachon, 1948

During his studies about the North African scorpion fauna, Vachon [5,6] described a number of new genera for this region. These results were subsequently synthesized in his monographic work [4]. Consequently, in one of his partial contributions on the North African scorpions, Vachon [5] described a new genus *Lissothus* Vachon, 1948, having as type species *Lissothus bernardi* Vachon, 1948, collected by Prof. F. Bernard in El Abiod, Fezzan, Libya during March 1944. At that time, this south-western part of Libya was under French administration.

Just two years later, Vachon [7] described a second species for the genus, *L. occidentalis* Vachon, 1950, based on a juvenile female (which later proved to be a male – see Lourenço [8]) collected on 25 October 1948 by A. Villiers in Akjoujt, Mauritania. The collection, by P.L. Dekeyser and A. Villiers, of two additional specimens of this species (one male and one female from Atar, on 13 March 1951), allowed Vachon [9] to bring several complements to the description of this species. Since then, however, no new specimens of *L. bernardi* have been found. In fact, the genus *Lissothus* remains extremely rare and the few references found in the later literature concern compilations. In the *Catalog of the Scorpions of the World* [10], *Lissothus* occupies only half a page. Only Lourenço [8] discussed *Lissothus* while describing an associated new genus *Pseudolissothus* from the Mountains of the Tassili N'Ajjer in the South of Algeria, giving precise details about the type material of the genus *Lissothus*. Until now, only very few specimens of *Lissothus* were known, all of which are deposited in the Natural History Museum in Paris. Despite a multitude of field trips in North African deserts, no new material of this genus had been found during the past 60 years.

3. Methods

Illustrations and measurements were made with the aid of a Wild M5 stereomicroscope, equipped with a drawing tube (camera lucida) and an ocular micrometer. Measurements follow Stahnke [11] and are given in millimeters. Trichobothrial notations follow Vachon [12], while morphological terminology mostly follows Vachon [4] and Hjelle [13].

4. Taxonomic treatment

Family BUTHIDAE C.L. Koch, 1837
Genus ***Lissothus*** Vachon, 1948.
Lissothus chaambi sp. n. (Figs. 2 and 3)

Diagnosis. Small scorpions, male 22.5 mm and female 25.6 mm in total length (including telson). Coloration yellow to pale yellow, marbled with reddish-orange to dark pigment. Carapace acarinate and shagreened, almost smooth. Tergites shargreened, almost smooth, with one vestigial median carina. Dentate margins of fixed and movable fingers of pedipalpal chela composed of a linear series of small granules, almost forming a single row; two/three small spinoid granules located on distal third of fingers; outer and inner accessory granules absent from both fingers; two strong spinoid granules located at the tip of each finger, forming a forceps. Sternum sub-triangular. Pectinal tooth count 16–17 in male, 14–16 in females; fulcra present but weakly marked; basal middle lamellae not dilated. Spiracles linear but very short. Chelicera with two well-marked basal denticles on movable finger. Metasomal segment V with the anal arc composed of 10–11 strongly reduced ventral teeth and 3–4 lateral lobes. Telson strongly granular with a rounded shape; aculeus slightly shorter than vesicle; subaculear tooth absent. Tarsi with one row of moderately long setae. Trichobothrial pattern A-β (beta), minorante-neobothriotaxy [12,14]. Trichobothrium $\mathbf{d_2}$ of femur and **esb** of chelal hand both absent.

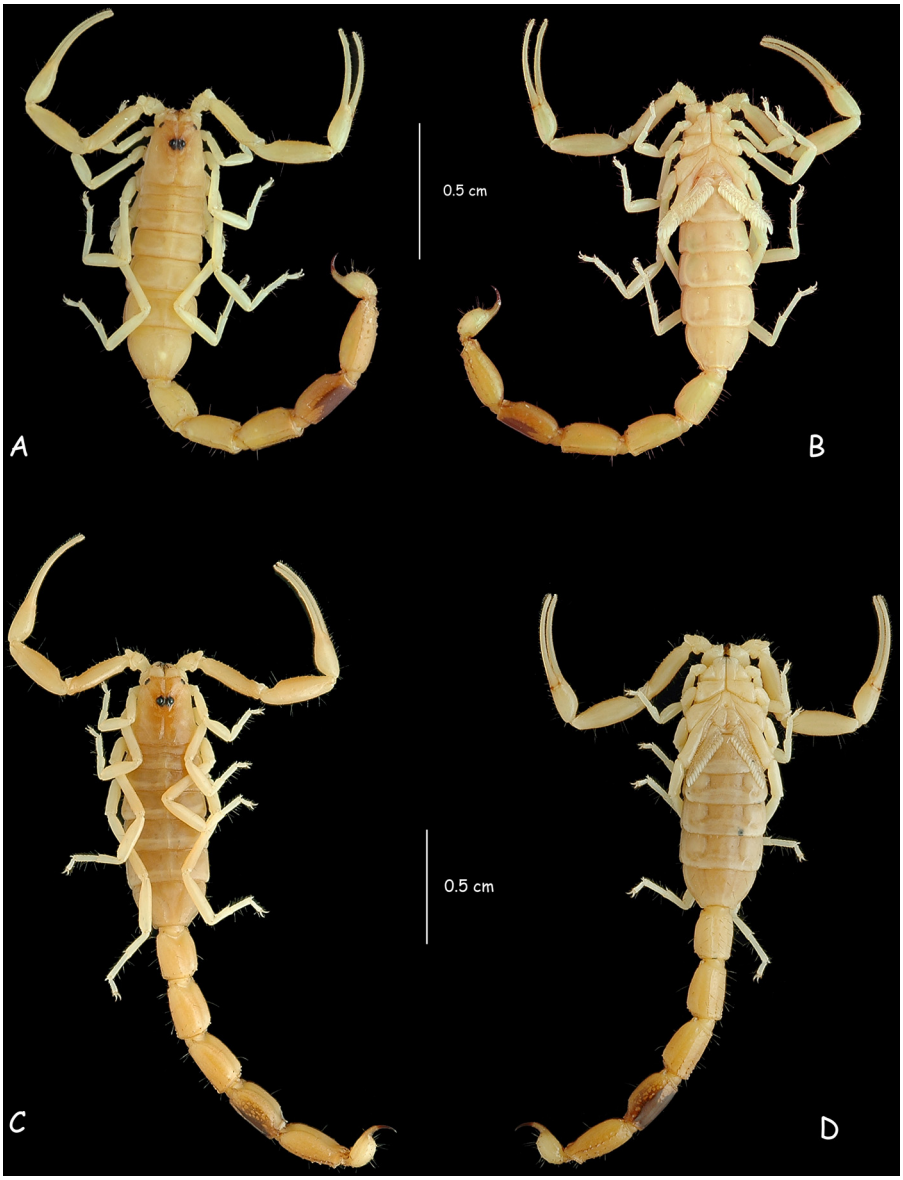

Fig. 2. (Colour online.) *Lissothus chaambi* sp. n. A–B. Male holotype. C–D. Female paratype, dorsal and ventral aspects.

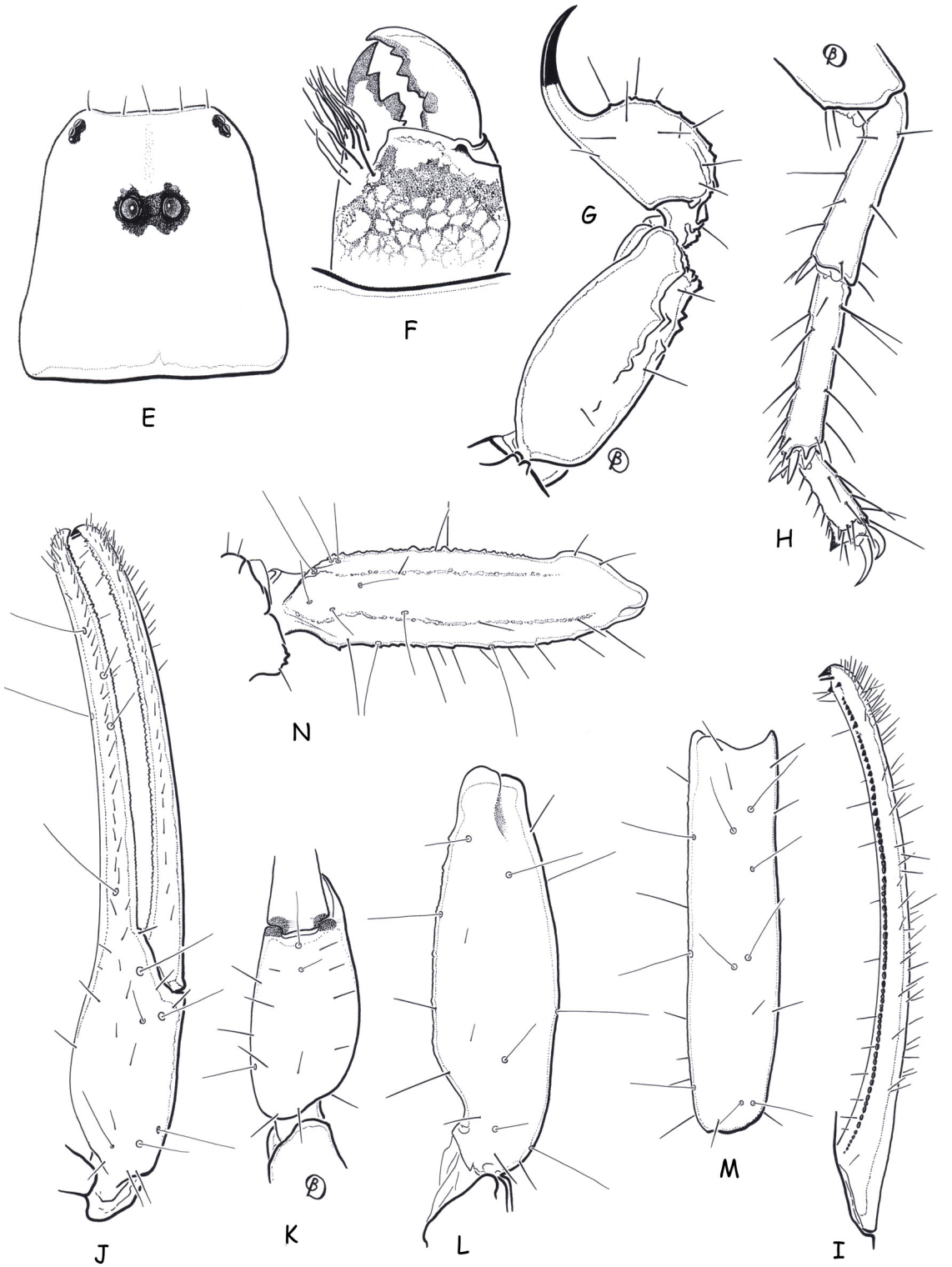

Fig. 3. *Lissothus chaambi* sp. n., female paratype. E. Carapace showing eyes. F. Chelicera, dorsal aspect. G. Metasomal segment V and telson, lateral aspect. H. Leg IV, showing setation and spurs. I. Cutting edge of movable finger, showing rows of granules. J–N. Trichobothrial pattern. J–K. Chela, dorso-external and ventral aspects. L–M. Patella, dorsal and external aspects. N. Femur, dorsal aspect.

5. Affinities of the new species

L. chaambi sp. n. shows affinities with the other two known species of the genus, and in particular with *L. bernardi* described from Libya. It can, however, be distinguished by a combination of characters:

(i) anterior margin of carapace emarginated;
(ii) telson granulated;
(iii) carinae on metasomal segment V more strongly granulated;
(iv) less slender pedipalps, with different morphometric values (see below).

Type material: Algeria, Province de Ghardaïa, Metlili (32°15′N, 003°48′E), 419 m alt., in Wadi bed, 6/XII/2013 (S.E. Sadine), one male holotype; Hassi L'Fhel (31°43′N, 003°44′E), 436 m alt., in Reg, 22/I/2014 (S.E. Sadine), 3 female paratypes; 25/I/2014, 1 female paratype; (31°43′N, 003°42′E), 446 m alt., in Reg, 8/III/2014 (S.E. Sadine and A. Houtia), 1 male, 1 female, 1 juvenile paratypes; Sebseb, in Reg, 7/II/2014 (S.E. Sadine and A. Houtia), 2 female, 1 juvenile paratypes. Holotype and four paratypes deposited in the collection of the "Muséum national d'histoire naturelle", Paris, six paratypes deposited at the University of Ghardaïa, Algeria.

Etymology: The specific name is placed in apposition to the generic name and refers to the Chaambi, members of the Châamba tribe who inhabit the North of the Algerian Sahara.

Description based on male holotype and female paratypes (Measurements after the description).

Coloration yellow to pale yellow, marbled with reddish-orange to dark pigment. Carapace yellow marbled with reddish-orange pigment on anterior and central zones; pigmentation better marked in male. Tergites yellow with posterior edge reddish. Metasomal segments yellow; IV and V marbled with dark pigment in female, only IV in male; telson yellow with the tip of aculeus reddish. Pedipalps yellow with reddish-orange zones; granules on cutting edges of fingers red. Legs pale yellow. Venter pale yellow. Chelicera yellow with reddish variegated spots and dark teeth.

Morphology. Prosoma: Anterior margin of carapace moderately emarginated. Carapace acarinate shagreened, almost smooth; median ocular tubercle anterior to the centre of carapace; median eyes large and separated by one ocular diameter. Three pairs of lateral eyes, the third pair may be reduced. Mesosomal tergites shagreened, almost smooth, with one vestigial median carina. Tergite VII pentacarinate, all carinae inconspicuous. Sternites smooth, acarinate, with short linear spiracles. Pectines long, with a strong setation; pectinal tooth count 16–17 for male, 14–16 for females; fulcra weakly marked; basal middle lamella not dilated in both sexes. Metasomal segments I to III with 10 carinae, weakly crenulate; segment IV rounded, with punctation; segment V also rounded, but with ventromedian carinae marked, with spinoid denticles; anal arc composed of 11–11 strongly reduced ventral teeth and 3–4 lateral lobes. Dorsal furrows of all segments shallow and smooth; intercarinal spaces smooth. Telson strongly granular; vesicle with a rounded shape; aculeus slightly shorter than vesicle; subaculear tooth absent. Chelicera with two well-marked denticles at the base of movable finger [15]. Pedipalps: Trichobothrial pattern minorante-neobothriotaxy, type A-β (beta); trichobothrium $\mathbf{d_2}$ of femur and **esb** of chela fixed finger absent [12]; dorsal trichobothria of femur in β (beta) configuration [14]. Femur pentacarinate; carinae weakly crenulate. Dorsointernal carinae of patella without spinoid granules; other carinae vestigial or absent. Chela smooth and acarinate, with moderately elongated fingers. Dentate margins of movable and fixed fingers composed of small granules almost forming a single row; outer and inner accessory granules absent on both fingers; two/three small spinoid granules, better marked in females, located proximally to terminal granule of both fingers; two strong spinoid granules located at the tip of each finger, forming a forceps. Legs: Ventral aspect of tarsi with two rows of moderately long setae. Tibial spurs present on legs III and IV, moderately marked. Pedal spurs present on all legs, weakly to moderately marked.

Geographic distribution. Only known from the Central deserts of Algeria.

Morphometric values (in mm) of the male holotype/female paratype. Total length, 22.5/25.6 (including telson). Carapace: length, 2.5/2.9; anterior width, 1.5/1.9; posterior width, 2.3/3.3. Mesosoma length, 6.9/7.8. Metasomal segments: I length 1.9/2.0, width 1.5/1.8; II length 2.1/2.3, width 1.4/1.7; III length 2.2/2.4, width 1.4/1.7; IV length 2.2/2.6, width 1.2/1.6; V length 2.5/3.0, width 1.1/1.6, depth, 1.2/1.3. Telson length 2.2/2.6, width 1.0/1.3, depth 0.9/1.0. Pedipalp: femur length 2.5/2.9, width 0.7/0.9; patella length 2.8/3.3, width 0.9/1.2; chela length 4.7/5.6, width 0.9/1.1, depth 0.7/0.8; movable finger length 3.3/3.9.

Comparative morphometric values (in mm) of female holotype of *L. bernardi*. Total length 28.0 (data from Vachon [5]). Carapace: length 2.8, anterior width 1.8, posterior width 3.2. Mesosoma length 10.7. Metasomal segments: I length xx, width xx; II length xx, width xx; III length 2.5, width 1.3; IV length 2.6, width 1.2; V length 2.9, width 1.3, depth 1.2. Telson length 2.5, width 1.2, depth 0.8. Pedipalp: femur length 3.4, width 0.6; patella length 3.6, width 1.1; chela length 5.9, width 0.9, depth 0.7; movable finger length 4.2.

6. Biogeographical and ecological considerations

In earlier discussions [1,2], it was pointed out that the present composition of the Saharan and peri-Saharan faunas is, in fact, the heritage of ancient faunas present in North Africa since Early or, at least, Middle Cainozoic times [4]. North Africa has experienced numerous palaeoclimatic vicissitudes during the last few million years, some even during more or less recent Quaternary periods. The Sahara has undergone a series of wet periods, the most recent occurring 10,000–5000 years BP. It was not until about 3000 years BP that the Sahara assumed its present arid state [16]. Even though recent studies suggest that the Saharan desert may be much older than was previously

thought [17], it seems reasonable to postulate that extremely arid areas have always existed as patchy desert enclaves, even when the general climate of North Africa enjoyed more mesic conditions.

In these arid and desert regions of the North African Sahara, a specialized scorpion fauna would have evolved in response to the aridity. Several "ancient lineages" became adapted to arid conditions and undoubtedly correspond to many extant groups, some of which are typically psammophilic. It is important to emphasise the fact that these lineages must have been present in North Africa for at least 10 to 15 Myr [18,19]. In contrast, other lineages less well adapted to aridity and, previously, only present in more mesic environments, have regressed markedly in their distribution with the expansion of the desert. These populations are, in several cases, now reduced to very limited and patchy zones of distribution, sometimes with remarkable disjunctions in their biogeographic patterns.

The present patterns of distribution observed among North African scorpions can be grouped in three more or less well defined models:

1. a core Saharan region [4], defined as the "central compartment", in which only the groups best adapted to xeric conditions are distributed;
2. the peri-Saharan region which surrounds most of the central compartment. A typical element present in this region is the genus *Butheoloides* Hirst [20]. In this zone remarkable, disjunctions can occur such as the one presented by the species of the genus *Microbuthus* Kraepelin [21]. In other cases, relictual endemic lineages can also be detected;
3. zones of refugia with groups more or less well adapted to aridity. In the Saharan regions, these refugia are represented by less arid zones, in particular massifs, such as the Hoggar, Tassili N'Ajjer, Aïr and Adrar. Examples of endemic genera in these zones are *Cicileus* Vachon, 1948, *Mauritanobuthus* Qi and Lourenço, 2007, *Lissothus* and *Pseudolissothus* Lourenço, 2001 [8,22,23].

Fig. 4. (Colour online.) *Lissothus chaambi* sp. n. O–P. Male holotype and female paratype in natural habitat.

Fig. 5. (Colour online.) Natural habitat of *Lissothus chaambi* sp. n. Typical Reg formations.

The new species described here corresponds best to the third geographical model. It was collected in a zone of desert rocks and grasses (Wadis and Regs) and does not show the characteristics of a psammophilic element (Figs. 4 and 5). Even if this area of the Sahara desert, in Central Algeria, is very arid, it does not really have the characteristics of sand dunes deserts (Ergs).

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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