

Remarkable discovery in a cave of south west Morocco: *Siagona taggadertensis* n.sp. (Carabidae: Siagoninae)

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Abstract. Five species of the genus *Siagona* Latreille 1804 (Carabidae: Siagoninae) are known from Morocco. *Siagona taggadertensis* n. sp., a remarkable species of Carabidae from a Moroccan cave is described. This insect is spectacular by its large size (one of the largest species of the genus), its external morphology, which isolates it from all the north african representant of the genus, and for the conditions of its discovery: its only known from the remains of six specimens, all of them found in the cave of Taggadert, western Atlas. Hypotheses concerning the ecology of this species are discussed.

Résumé. Découverte remarquable dans une grotte du sud-ouest du Maroc : *Siagona taggadertensis* n.sp. (Carabidae : Siagoninae). Le genre *Siagona* Latreille 1804 (Carabidae : Siagoninae), compte 5 espèces au Maroc. *Siagona taggadertensis* n. sp., remarquable espèce collectée dans une grotte marocaine est décrite. Cet insecte est spectaculaire tant par sa grande taille, sa morphologie externe qui l'isole au premier coup d'œil des représentants nord africains du genre *Siagona*, que par les conditions de sa découverte : aucun des spécimens n'ont été collectés en dehors de la grotte de Taggadert, Atlas occidental. Des hypothèses concernant l'écologie de cette espèce sont fournies.

Keywords: Atlas, Taggadert, Win-Timdouine, biospeleology.

During Summer 2008 the international expedition Win-Timdouine 2008, composed of Moroccan and French speleologists, hydrogeologists and biologists explored numerous caves in the area of the Tasroukht massif, 70 kilometers north-east of Agadir. The aim of the biospeleological part of the expedition was to inventory the biodiversity of the Win-Timdouine cave and other cavities in the area, in order to improve the knowledge of the biodiversity of the Win-Timdouine cave, considered to be the longest cave of the African continent (Bouchaou *et al.* 2002). Caves of the Tasroukht massif and others karstic entities were sampled in order to compare their faunistic specific richness. Ifri Taggadert, one of the caves explored, is located 800 meters at the west of the main entrance of the Win-Timdouine cave and belongs to the same karstic system (fig. 1). This cavity, known by local people, was already explored by speleologists, especially the Spanish team who rediscovered it and gave it the name *Al-Andalus* (García-Dils 1997). Although

the speleological connection with the main cavity is not completed and that is still not possible to enter Win-Timdouine through this way, the two caves are in direct contact. Despite of these connections, and the apparent geological continuity, the fauna observed in Ifri Taggadert appears to be different to that of the Win-Timdouine. In the former, we collected five dead specimens of a remarkable new species of the genus *Siagona* Latreille 1804. Despite of meticulous sampling in the main cave (Win-Timdouine) and other caves of the Tasroukht massif, no other specimens were found.

The genus *Siagona* was created by Latreille in 1804 to group some species with a characteristic shape: flat pedunculate body, large head with strong mandibles. This genus occurs in Africa, Europe and Asia, with about fifty known species (Jeannel 1942). Five of them are known from Morocco (Baehr 2003): *Siagona europaea* Dejean 1826, widespread in the Palearctic; *Siagona dejeani* Rambur 1837 and *S. jenissoni* Dejean 1826 which also occur in Spain; *S. rufipes* Fabricius 1792, a North African endemic; and *S. rifensis* Alluaud 1932, which was until know the only species endemic to Morocco and was first described as a subspecies of

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S. jenissoni before being considered as a species by Antoine (Alluaud 1932; Antoine 1933).

The North African species form a well defined group, distinct from the sub-Saharan species, but the phylogenetic affinities among them are not clear and need to be further studied (Lecordier 1980). All the species occurring in Morocco belong to the phyletic series of *Siagona brunnipes* Dejean, characterized by the twisted and strongly sclerotized median lobe of the edeagus, paramers amply setose, and neck superficially accused, except *Siagona europaea* Dejean, considered by Lecordier to belong to the phyletic series of *Siagona senegalensis* Dejean (Lecordier 1977, 1978a, 1978b).

The new species has some remarkable morphological characters isolating it from the other species of the

genus, but still it seems to have affinities with the species of the *brunnipes* group.

Taxonomy

Siagona taggadertensis Junger & Faille n. sp. (figs. 2–4)

Diagnosis. The species is remarkable by some morphological characteristics: its size (near 30 mm), a strong sexual dimorphism, with males with a strong outgrowth on the upper part of the mandibles, and the presence of a lateral carena on the elytral margin, forming a right angle between the elytral disk and the lateral margin, giving to the species a very particular aspect (figs. 2–4).

Description. Species of large size, slender and strongly flattened, pubescent, blackish brown with apical third of elytra and femora reddish. Lengths given are measurements of the holotype. Length from elytral apex to point of mandibles: 29 mm.

Head. Very large, as broad as pronotum in its anterior part and about twice longer than it (fig. 3). Punctures of vertex double, becoming denser along frontal carenae. Neck constriction accused, neck furrow superficial. Frontal tubercles well developed, supraorbital carena continuous all along the head and ending in a blunt point. Clypeo-frontal suture straight, clypeus concave, labrum bisinuate, W-shaped. Mentum bifide. Antennae of known exemplars incomplete, but probably reaching half of elytra, scape elongate and cylindrical. *Microsculpture.* Dorsal surface with isodiametrical meshes. Deep frontal depression in middle of the head, transversally finely wrinkled. Mandibles large, nearly half of head length, asymmetrical, right mandible bidentate, arcuate, male mandibular process strongly accused, forming a prominent tubercle weakly convergent in upper part of mandibles (*hyperplasie mandibulaire*, Lecordier 1977). Eyes small, representing a fifth of temples length.

Prothorax. Lateral margin of pronotum slightly developed, anterior crenulated; setose, transversal, 1.3 times wider than long, strangled at base, widest point before middle. Fine punctures denser than on head; meshes of microsculpture slightly impressed on all surface. Anterior margin curved, with strongly prominent anterolateral angles; sides finely bordered in two anterior thirds. Posterior edge concave, without bead. Median longitudinal depression strongly accused, with deep linear depressions posteriorly along each side of midline, initiated from two laterobasal impressions and limited by two wide impressions in anterior part (fig. 2). Stridulating files under lateral margins of prothorax present in both sexes.

Elytra dark rufous, with lateral edges and sutura brownish; very long, slightly broader than pronotum, with lateral edges parallel in anterior half, widest approximately at posterior third, each with a distinct, short plica above the humerus, directed backward and outward; elytral surface rather finely punctate, punctures sparse on disk, more dense near base, apex and along lateral carinas; pubescence stiff and scattered. Lateral carinas strongly developed, forming a right angle at two elytral edges and effacing before apex (fig. 4). These two carinas makes the two lateral margins to look like « pseudepipleuras », strongly setose. Ventral part brownish, punctate and finely setose.

Appendices. Antennae setose, scape long and punctate. Legs long and thin, pubescent, length of metatarsi equal to width of elytra. Tibias with very long and dense reddish pubescence.

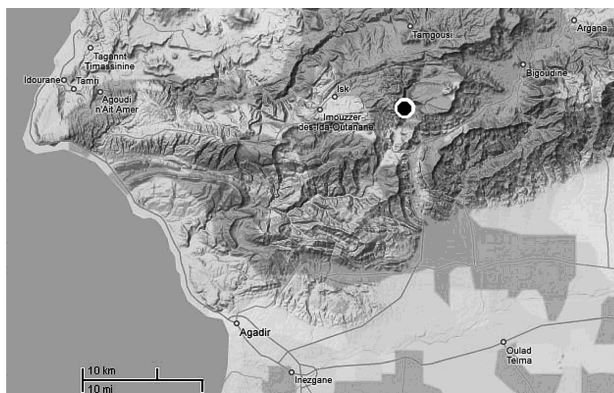


Figure 1
Location of Ifri Taggadert, Tizgui N'Chorfa (30°40' 55"N 9°20'56"W), type locality of *Siagona taggadertensis* n. sp. **A**, map of the whole Morocco; **B**, detail.



Figure 2
Siagona taggadertensis n. sp., habitus of the holotype male (left) and female (right) from Ifri Taggadert (Tizgui N'Chorfa, Morocco) (photo C. Schott). Scale bar: 1 cm.

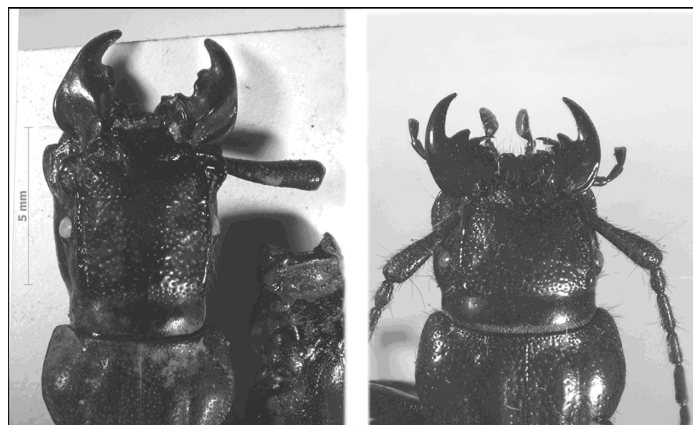


Figure 3
Siagona taggadertensis n. sp. (1) and *S. dejeani* Rambur (2), detail of the head.

Apex of tibiae and first tarsomere with a crown of dense setae. Meso- and metatibiae seamed with carinae on the external side.

Male genitalia. Median lobe broad, parallel in its median part, with round apex. Basal lamina rounded; Parameres long and setiferous (fig. 5).

Female genitalia. Unknown.

Holotype. ♂ : Ifri Taggadert, Tizgui N'Chorfa, Morocco. (N30°40,915', W9°20,938'). (head, pronotum, elytra and abdomen). Coll. MNHN. **Paratypes.** Incomplete bodies of 5 exemplars: 1♂, 1♀ and rests of three other exemplars with last sternites lacking. Coll. MNHN, rests of two exemplars in coll. B. Junger.

Material examined for comparison

***Siagona dejeani* Rambur 1837.** SPAIN : 2 specimens of playa Bolonia, Tarifa, 5.I.1989, ZAF-UMU 198 (Collection Dep. Biol. de Murcia) – MOROCCO : 2 exemplars of Arbaoua, IV.1917, and 1 exemplar of Il Ouezzane (Chechaouène), I.1959 (Collection Antoine, MNHN).

***Siagona europaea* Dejean 1826.** ESPAGNE : 2 exemplars « La Alcaina. Murcia. 1-VII-1989.

***Siagona jenissoni* Dejean 1826.** SPAIN : 5 exemplars of Algeciras, Cadiz, 20.I.1990, J. Ferrer leg., ZAF-UMU 218 and 2 exemplars of Cortijo Salomón, S. Roque CA prado, 8.I.1993, J. Serrano col. ZAF-UMU 237 (Collection Dep. Biol. De Murcia). MOROCCO : 1 exemplar of Camp Boulhaut, 1 exemplar from « Jto, IV.1932 », 1 exemplar labelled « Rif, Chechaouen, 1500, III.61 » (Collection Antoine, MNHN).

***Siagona rufensis* Alluaud 1932.** 1 exemplar « Taza 4/5/32 » (Collection Antoine, MNHN).

***Siagona rufipes* Fabricius 1792.** MOROCCO : 1 exemplar « Mahdar près Saïdia III 51 » (Collection Antoine, MNHN). 305XM6118. J. Serrano leg. ZAF-UMU 207», 1 exemplar « Vos Beatos, Cartagena (MU). 305XG8670. 6-VII-1986. J. Galian leg. ZAF-UMU 202 » (Collection Dep. Biol. De

Murcia). MOROCCO : 2 exemplars « Hassi Mahjez, Sah. mar. Reymond. », 1 exemplar « Hassi Mahjez, Maroc (Antoine) vallée de la Daoura, III.50 »

Etymology. Specific epithet derived of the name Taggadert, one of the names of the cavity where the exemplars of the new species were found.

Geographic distribution. *Siagona taggadertensis* n. sp. is only known from Ifri taggadert, a small cavity of the Tasroukht massif, Tizgui N'Chorfa, 70 kilometers north-east of Agadir (fig. 1).

Discussion.

Siagona taggadertensis n. sp. shares some morphological characters with the representants of the « série phylétique de *S. brunripes* » as defined by Lecordier (1978a), including nearly all the species of *Siagona* occurring in Morocco: *S. dejeani*, *S. rufensis*, *S. rufipes* et *S. jenissoni*, with the only exception of *S. europaea* (Lecordier 1980): lack of neck furrow, supra-ocular carenae well developed, median lobe of edeagus large, long, twisted and highly chitinized and parameres setulated. Moreover, the mandibular hyperplasy is common in the phyletic serie of *S. brunripes*, whereas is lacking in the two others phyletic series of the genus *Siagona*, which do not have secondary sexual characters (Lecordier 1977). In spite of its deviating external morphology, we decided to include the new species in the widespread genus *Siagona* to avoid converting it in paraphyletic taxa. A revision of the genus should lead to better defined groups of species, but this work is out of the scope of this paper. The presence of stridulating files under the lateral margins of prothorax in some species of *Siagona* has been known for long (Chaudoir 1876). The systematic examination

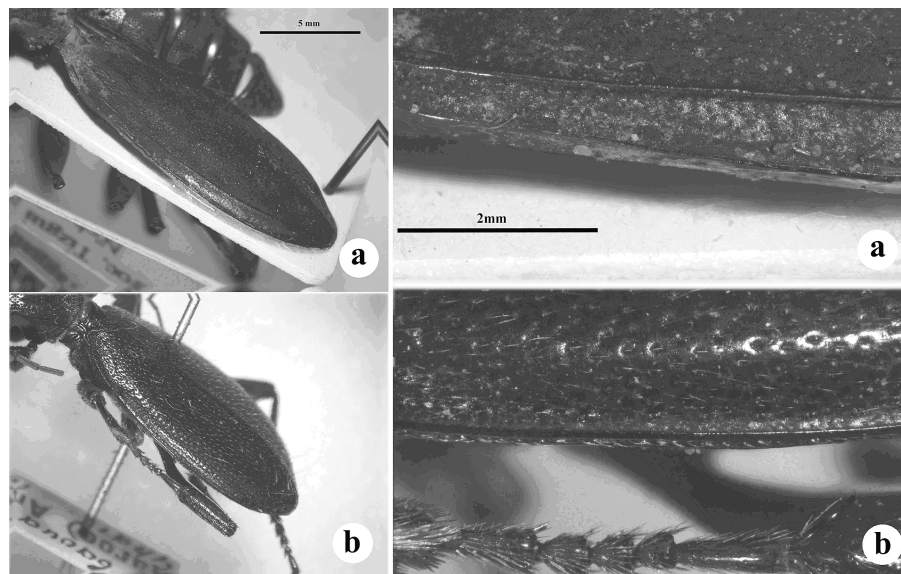


Figure 4
Siagona taggadertensis n. sp. (a) and *S. dejeani* Rambur (b), left lateral view showing the carena in the new species.

of this character in all Moroccan species allowed us to see that such structure is present in *S. jenissoni* from Morocco and Spain, *S. rufipes* and *S. rifensis*, and lacking in two species: *Siagona dejeani* and *S. europaea*, as noted by Antoine (1955).

Although the new species could be distinguished at first glance from the five other Moroccan species of *Siagona*, the interspecific frontiers between the other species, especially between the *rufipes-jenissoni-rifensis* group, are not clear as early noticed by Rambur (1837). The study of this group should be worth considering, including a more abundant material as well as the northeast African species of the lineage of *S. brunnipes* Dejean (sensu Lecordier 1978a), trying to clarify the affinities between these species and the rest of the Mediterranean and African fauna.

Ecology. The Taggadert cave is located 800 meters west of the re-emergence of the Win-Timdouine cave and at the same altitude (1200m) (García-Dils 1997). Its

Karstic formations are dated from Jurassic (upper Lias – Kimmeridgien) (Angelova *et al.* 2005).

All exemplars were found in the cave, more or less close to the entrance. One of them was floating at the surface of the lake; others were lying on the ground. Although none of these exemplars was found alive, the particular conditions of the discovery of this insect and its particular morphology allow drawing some assumptions on its ecology. The ecology of the species of *Siagona* is virtually unknown, but several studies and observations on a reduced number of Palearctic species suggest that they live in soil crevices, and morphological features seems to be closely related to their feeding behaviour: exclusive myrmecophagy (Bauer *et al.* 2005; Zetto Brandmayr & Pizzolotto 1994; Giglio *et al.* 2005; Zetto Brandmayr *et al.* 1998, 2000a, 2007).

The studies on the epicuticular chemical profile of *S. europaea* suggested that this species uses some kind of chemical mimicry to reduce ant's recognition and agres-



Figure 5
Siagona taggadertensis n. sp., aedeagus (a), detail of parameres showing distribution of setae on all the length (b).

sivity (Zetto Brandmayr *et al.* 2000b, 2002). No ants were observed in the area, neither in nor out the cave. The size and degree of development of the mouthparts of the new species seems to reflect an adaptation to a different feeding behaviour, but that is all that can be said at this stage. It was suggested that the strong and wide mandibles of some species of the genus *Siagona* could be a defensive adaptation against « *les scorpions, les scolopendres et autres animaux semblables* » (Chaudoir 1876). Although all the specimens were found in the cavity, all morphological features of *S. taggadertensis* suggest that it does not live in it. It could be suggested that this insect is more a « fissuricolous » species, living in the cracks of deep soil or superficial fissures of the karst. Such hypothesis could explain the complete lack of exemplars alive in the cave, as the remains of the beetles could have been carried out of the fissure by water. This hypothesis could be supported by the fact that the thickness of the organic cover of the area is very weak. Indeed, the Tasroukht plateau is a mature karst without dense vegetation cover, and the litter is virtually absent. Other species of the genus *Siagona* are known to be found under stones in the early spring, when the soil is humid enough, and then go deeper in soil crevices during the dry season (Bauer *et al.* 2005). The fact that no specimen was found out of the cave is not surprising, as the prospections occurred in July and August, which is the dry season. Finally, except for the reduction of the eyes, which is not necessarily a troglobiomorphic feature as it is shared with a lot of hypogean (endogean or cavernicolous) invertebrates, the species do not harbour any troglobiomorphic character (depigmentation, elongation of appendages). In order to increase our knowledge of the ecology and feeding behaviour of this remarkable species, it is necessary to visit the area and surroundings earlier in the season. Some scanning electron microscopy investigations on antennomeres should be necessary to indicate if this new species share the five kinds of sensilla involved in tactil, chemical and thermal reception recently described on three of the species of *Siagona* occurring in Morocco (Giglio *et al.* 2008).

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