

Some poorly known and rarely reported terrestrial arthropods (Insecta, Coleoptera, Carabidae) in Morocco

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El Harche, H., Chavanon, G., El Yahyaoui, O., Dahmani, J., Fadli, M., 2023. Some poorly known and rarely reported terrestrial arthropods (Insecta, Coleoptera, Carabidae) in Morocco. *Arxius de Miscel·lània Zoològica*, 21: 1–12, Doi: <https://doi.org/10.32800/amz.2023.21.0001>

Abstract

Some poorly known and rarely reported terrestrial arthropods (Insecta, Coleoptera, Carabidae) in Morocco. The Carabidae play an increasing role in biodiversity conservation and ecological monitoring, making a faunistic update all the more necessary. Carabids, however, are poorly known considering their diversity in the world. Also known as ground beetles, they are the fourth most diverse group within the Coleoptera, but the amount of published data sets from Morocco is disproportionately small; many species and regions have yet to be well researched. In an effort to fill this gap, we studied the faunistic composition of the carabidae in the north-west of Morocco between spring 2019 and summer 2020 at three different habitat types using two types of traps. Here we present new data on some rare and poorly known Carabidae in Morocco: *Pterostichus (Sterocorus) globosus* ssp. *globosus* (Fabricius, 1792), *Poecilus (Parapedius) decipiens* ssp. *decipiens* (Waltl, 1835), *Harpalus neglectus alluaudi* (Antoine, 1922), *Graniger cordicollis* (Audinet Serville, 1821), *Brachinus (Brachinus) efflans* (Dejean, 1830), *Brachinus (Brachinidius) angustatus* (Dejean, 1831), *Carabus (Macrothorax) rugosus* ssp. *rugosus* (Fabricius, 1792) and *Siagona dejeani* (Rambur, 1838). Our results contribute to the knowledge of the Moroccan carabid fauna by introducing eight new localities of terrestrial insects that were poorly unknown and infrequently reported in Morocco over the past 20 years.

Dataset published through [Zenodo](https://zenodo.org/record/7665486) (Doi: [10.5281/zenodo.7665486](https://doi.org/10.5281/zenodo.7665486))

Key words: Carabidae, Inventory, New localities, New data, Morocco

Resumen

Algunos artrópodos (Insecta, Coleoptera, Carabidae) poco conocidos y con escasos registros en Marruecos. Los Carabidae desempeñan un papel cada vez más importante en la conservación de la biodiversidad y la monitorización ecológica, por lo que su actualización faunística es altamente necesaria. Son poco conocidos en comparación con la diversidad de este grupo en el mundo, el cuarto más diverso dentro de los coleópteros, pero la cantidad de conjuntos de datos publicados en el país es proporcionalmente pequeña y sigue habiendo muchas especies y regiones del mismo que no están bien investigadas. En un esfuerzo por llenar este vacío se investigó la composición faunística de los Carabidae en el noroeste de

Marruecos entre la primavera de 2019 y el verano de 2020 en tres tipos de hábitats diferentes y utilizando dos clases de trampas. En este artículo presentamos los nuevos datos sobre algunos Carabidae raros y poco conocidos en Marruecos: *Pterostichus (Sterocorus) globosus* ssp. *globosus* (Fabricius, 1792), *Poecilus (Parapedius) decipiens* ssp. *decipiens* (Waltl, 1835), *Harpalus neglectus alluaudi* (Antoine, 1922), *Graniger cordicollis* (Audinet Serville, 1821), *Brachinus (Brachinus) efflans* (Dejean, 1830), *Brachinus (Brachinidius) angustatus* (Dejean, 1831), *Carabus (Macrothorax) rugosus* ssp. *rugosus* (Fabricius, 1792) y *Siagona dejeani* (Rambur, 1838). Los resultados contribuyen al mejor conocimiento de la fauna de carábidos marroquíes al introducir ocho nuevas localizaciones de insectos terrestres poco conocidas hasta ahora y raramente reportadas en Marruecos en los últimos 20 años.

Datos publicados en [Zenodo](https://zenodo.org/doi/10.5281/zenodo.7665486) (Doi: [10.5281/zenodo.7665486](https://zenodo.org/doi/10.5281/zenodo.7665486))

Palabras clave: Carabidae, Inventario, Nuevas localidades, Nuevos datos, Marruecos

Resum

Alguns artròpodes (Insecta, Coleoptera, Carabidae) poc coneguts i amb escassos registres al Marroc. Els Carabidae tenen un paper cada vegada més important en la conservació de la biodiversitat i el monitoratge ecològic, per la qual cosa és molt necessari fer-ne una actualització faunística. Són poc coneguts en comparació amb la diversitat d'aquest grup al món, el quart més divers dins dels coleòpters, però la quantitat de conjunts de dades publicats al país és proporcionalment petita i encara hi ha moltes espècies i regions que no estan ben investigats. En un esforç per omplir aquest buit es va investigar la composició faunística dels Carabidae al nord-oest del Marroc entre la primavera de 2019 i l'estiu de 2020 en tres tipus d'hàbitats diferents utilitzant dues classes de paranys. En aquest article presentem les noves dades sobre alguns Carabidae rars i poc coneguts al Marroc: *Pterostichus (Sterocorus) globosus* ssp. *globosus* (Fabricius, 1792), *Poecilus (Parapedius) decipiens* ssp. *decipiens* (Waltl, 1835), *Harpalus neglectus alluaudi* (Antoine, 1922), *Graniger cordicollis* (Audinet Serville, 1821), *Brachinus (Brachinus) efflans* (Dejean, 1830), *Brachinus (Brachinidius) angustatus* (Dejean, 1831), *Carabus (Macrothorax) rugosus* ssp. *rugosus* (Fabricius, 1792) i *Siagona dejeani* (Rambur, 1838). Els resultats contribueixen al millor coneixement de la fauna de caràbids marroquina amb la introducció de vuit noves localitzacions d'insectes terrestres poc conegudes fins ara i rarament reportades al Marroc durant els darrers 20 anys.

Dades publicades a [Zenodo](https://zenodo.org/doi/10.5281/zenodo.7665486) (Doi: [10.5281/zenodo.7665486](https://zenodo.org/doi/10.5281/zenodo.7665486))

Paraules clau: Carabidae, Inventari, Noves localitats, Noves dades, Marroc

Received: 07/11/2022; Conditional acceptance: 01/02/2023; Final acceptance: 10/02/2023

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Introduction

Ground beetles (Coleoptera, Carabidae) are one of the largest beetle families with about 40,000 species worldwide (Bouchard et al., 2017). They play an increasing role in biodiversity conservation and in the functioning of ecosystems. The margined pronotum, large head, prominent mandibles, and striate elytra help characterize this family. They are present in almost every possible ecosystem worldwide, and due to their predatory habits they are frequently used as bioindicators in ecological studies or as control agents against agricultural pests (Latty et al., 2006; Choi et al., 2019; Kwon et al., 2021). This natural pest suppression could be enhanced by creating favorable habitats for natural enemies in agricultural landscapes (Landis et al., 2000). The beetles are usually found under rocks and other debris, but some groups inhabit trees and shrubs (Erwin, 2000; Triplehorn and Johnson, 2005). Due to their abundance, taxonomical, ecological diversity, and sensitivity to human–caused disturbances, carabid beetles are good ecological indicators of environmental change (Avgin and Luff, 2010). They have been extensively studied in terms of biogeography and conservation surveys, reactions to environmental factors, gradients of disturbance, succession stages and regeneration in both agroecosystems and natural habitats (Latty et al., 2006; Ghannem et al., 2017). Studies on the distribution and persistence of Carabidae help to increase our understanding of the impacts of environmental and climate change (Kerr et al., 2007).

Over the last century, knowledge of Moroccan fauna has made amazing progress. Due to the variety of its geographical and geological location, the country has a remarkable diversity of terrestrial beetles. However, studies carried out on the fauna of Morocco are few in comparison to other zoogeographical areas. Our understanding of the Moroccan Carabidae fauna is primarily based on studies by Bedel (1895) and Antoine (1955, 1957, 1959, 1961, 1962). Other research, such as that of Chavanon et al. (1995), Zitouni and Chavanon (1996, 2000, 2005), Bouraada et al. (2015, 2020) and El Harche et al. (2021a, 2021b) have followed these efforts. However, we still know very little about the biodiversity of ground beetles throughout the country and many species and regions have not yet been well studied.

Here we investigated the faunal composition of ground beetles in the north–west of Morocco. We present new localities of eight terrestrial ground beetles that were poorly known and rarely reported in the last 20 years in Morocco, thereby contributing new data and updating the list of ground beetles in the country.

Material and methods

Collection data

The study site is located in the Sidi Kacem region of Morocco. Samples were taken at three different habitat types (fig. 1): Site 1 is a field of beans (*Vicia faba* L., Fabaceae), located at 34° 12.5' N and 5° 42.31' E. Site 2 is a field of cereal crops (*Triticum aestivum* L., Poaceae), located at 34° 14.41' N 5° 42.14' E. Site 3 is an uncultivated land, located at 34° 13.50' N 5° 40.12' E. The dominant plant species at this station are *Nicotiana glauca* Graham (Solanaceae), *Ferula communis* L. (Apiaceae), *Cynara humilis* L. (Asteraceae), and *Ammi visnaga* (L.) (Apiaceae). The predominant soil type at all three study sites is silty clay.

Taxon sampling and identifications

Ground beetles were sampled by sight hunting and using the pitfall traps (in the form of plastic cups of 10 cm in diameter and 17 cm high pots, placed in a systematic random plot). The sampling was carried out between spring 2019 and summer 2020. The specimens were preserved in alcohol at 70% for identification. Identification was based on descriptions of

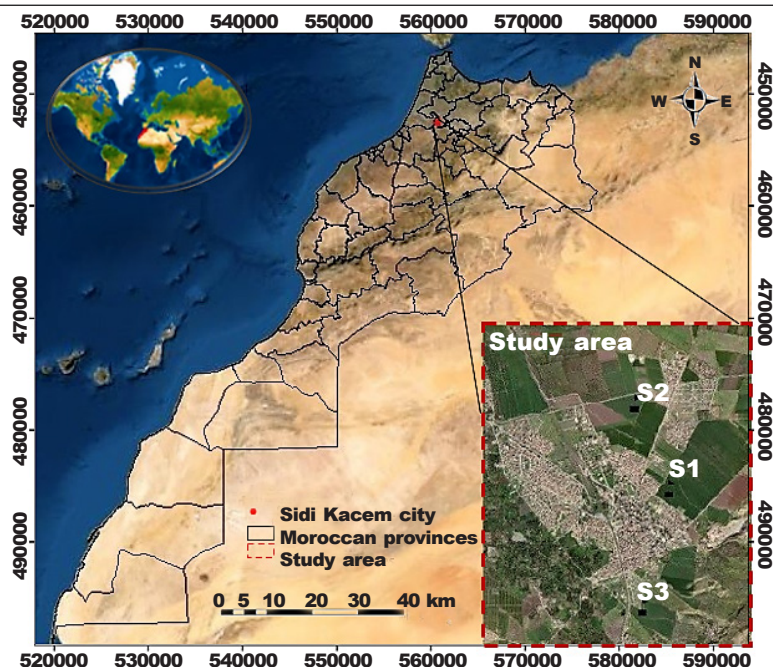


Fig. 1. Map of the geographic area, and sampling location of the study area.

Fig. 1. Mapa de la localización geográfica y puntos de muestreo del área de estudio.

Moroccan carabid beetles by Antoine (1955, 1957, 1959, 1961, 1962) and French carabid fauna by Jeannel (1941, 1942). The National Museum of Natural History in Paris (France) and Antoine's collection at the Scientific Institute of Rabat (Morocco) were consulted for validation.

Results

The study provided data concerning eight species belonging to four sub-families, five tribes, and seven genera. The checklist that follows give details of each species collected in the area during the study period, including its habitat, taxonomic composition, and regional and worldwide range.

Systematics

Phylum Arthropoda
Subphylum Hexapoda
Class Insecta
Order Coleoptera
Subfamily Harpalinae Bonelli, 1810
Tribe Pterostichini Bonelli, 1810
Genus *Pterostichus* Bonelli, 1810

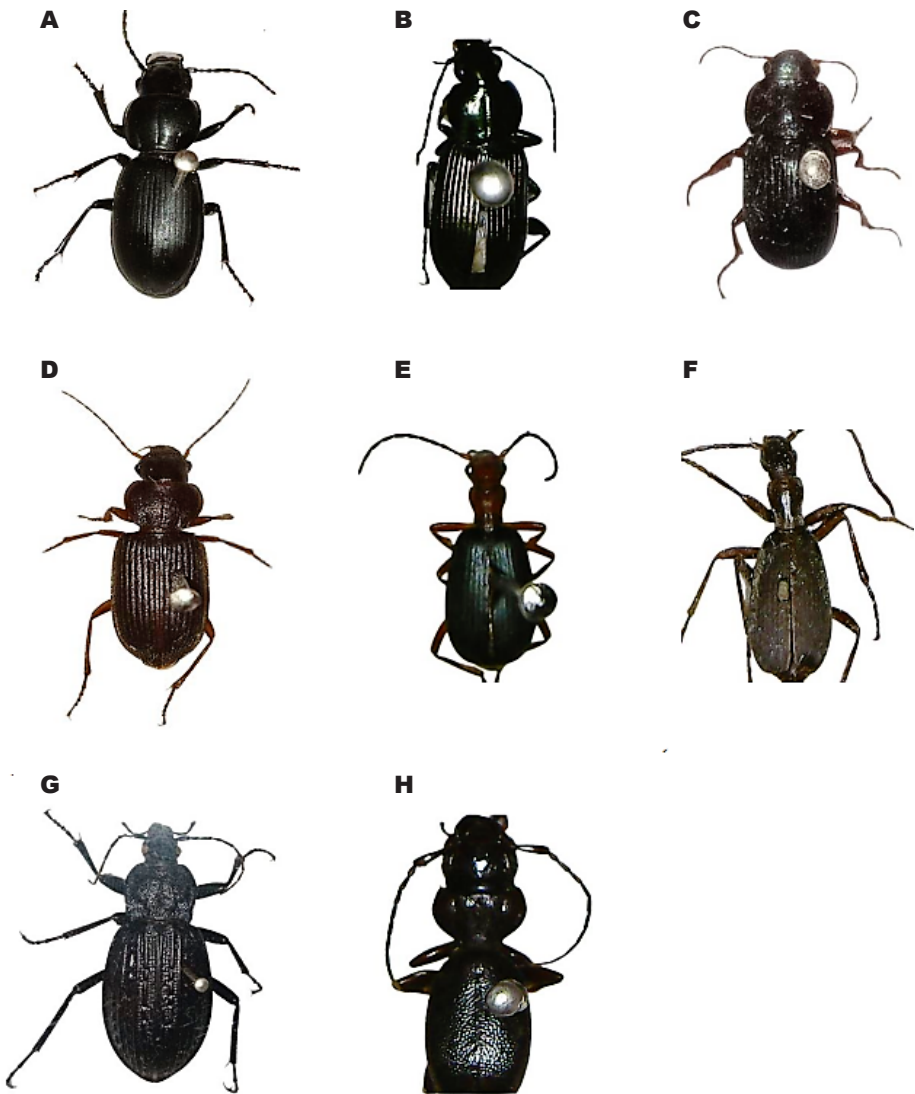


Fig. 2. Carabidae species, dorsal view: A, *Pterostichus (Sterocorus) globosus* ssp. *globosus* Fabricius, 1792; B, *Poecilus (Parapedius) decipiens* ssp. *decipiens* Waltl, 1835; C, *Harpalus neglectus alluaudi* Antoine, 1922; D, *Graniger cordicollis* Audinet Serville, 1821; E, *Brachinus (Brachinus) efflans* Dejean, 1830; F, *Brachinus (Brachinidius) angustatus* Dejean, 1831; G, *Carabus (Macrothorax) rugosus* ssp. *rugosus* Fabricius, 1792; H, *Siagona dejeani* Rambur, 1838.

Fig. 2. *Especies de Carabidae, visió dorsal*: A, *Pterostichus (Sterocorus) globosus* ssp. *globosus* Fabricius, 1792; B, *Poecilus (Parapedius) decipiens* ssp. *decipiens* Waltl, 1835; C, *Harpalus neglectus alluaudi* Antoine, 1922; D, *Graniger cordicollis* Audinet Serville, 1821; E, *Brachinus (Brachinus) efflans* Dejean, 1830; F, *Brachinus (Brachinidius) angustatus* Dejean, 1831; G, *Carabus (Macrothorax) rugosus* ssp. *rugosus* Fabricius, 1792; H, *Siagona dejeani* Rambur, 1838.

Pterostichus (Sterocorus) globosus ssp. globosus (Fabricius, 1792) (fig. 2A)

Site of collection

Sidi Kacem Province, Sidi Kacem city (Sites 1, 2, and 3).

Material examined

Site 1, 10/06/2020, L (length) = 16–17.5 mm, coll. H. El Harche, by pitfall traps. Site 2, 16/04/2019, L = 17 mm, coll. H. El Harche, by pitfall traps. Site 3, 20/05/2020, L = 16 mm, coll. H. El Harche, by pitfall traps and sight hunting.

External morphology

Body length 16.5–17 mm. Black with black or brown antennae. Legs black. Elytra with less marked shoulders and therefore ovoid. Convex. Pronotum narrow, tapering towards the back. Lateral canal moderately wide (fig. 2A).

Geographic range

Species mentioned from northern, central and western Morocco (Kocher, 1963; Machard, 2018). Portugal, Spain and Algeria (Lorenz, 2017).

Habitat

According to Cardenas and Bach (1988), Ortuño (1990) and Oliveira (2013), *Pterostichus globosus* can be found in a variety of agro–forestry settings, agrosystems and grasslands, typically hiding behind stones and in leaf litter.

Genus *Poecilus* Bonelli, 1810

Poecilus (Parapedius) decipiens ssp. decipiens (Waltl, 1835) (fig. 2B)

Site of collection

Sidi Kacem Province, Sidi Kacem city (Sites 2 and 3).

Material examined

Site 2, 20/04/2019, L = 8.5–12 mm, coll. H. El Harche, by pitfall traps and sight hunting. Site 3, 25/05/2020, L = 8 mm, coll. H. El Harche, by pitfall traps.

External morphology

Body length 9–12 mm long. The antennae are reddish brown. The abdomen is generally bronze, coppery colored, sometimes black. The elytra are broad, only weakly convex and finely striped and speckled. The legs are black. The prothorax is much wider than long (fig. 2B).

Geographic range

Species mentioned from the Rif to the Middle Atlas (Antoine, 1957; Machard, 2018). Spain (Andalusia), Algeria and Tunisia (Bedel, 1895; Löbl and Smetana, 2003; Ouchtati et al., 2012; Saouache et al., 2014; Ghannem et al., 2017).

Habitat

This species can be found under stone in field crops, especially cereals (wheat, barley, oats,...) (Saouache et al., 2014).

Tribe Harpalini Bonelli, 1810
Genus *Harpalus* Latreille, 1802

***Harpalus neglectus alluaudi* (Antoine, 1922) (fig. 2C)**

Site of collection

Sidi Kacem Province, Sidi Kacem city (Site 3).

Material examined

Site 3, 05/05/2019, L = 6.5 mm, coll. H. El Harche, by pitfall trap.

External morphology

Body length 6–8 mm. Black, with antennae and legs black, prothorax equal to or wider than elytra, rounded at posterior corners, elytra broad and striped. The back corners of the body are obtuse and completely rounded.

Geographic range

Species mentioned from the Atlantic coast from Tanger to Oum–er–Rbia, from the region of Meknès and Middle Atlas (Kocher, 1963; Machard, 2018). A large part of Europe (type form) and Maghreb (sub–species *alluaudi*) (Bedel, 1895; Jeannel, 1941; Löbl and Smetana, 2003; Ghannem et al., 2015).

Habitat

This species can be found in an area of sand dunes, grassland area (Thomas and Dauphin, 2001) or forest ecosystems (Barbaro et al., 2006).

Genus *Graniger* Motschulsky, 1864

***Graniger cordicollis* (Audinet–Serville, 1821) (fig. 2D)**

Site of collection

Sidi Kacem Province, Sidi Kacem city (Sites 1, 2, and 3).

Material examined

Site 1, 19/06/2020, L = 6.5 mm, coll. H. El Harche, by pitfall trap, measurements. Site 2, 20/04/2019, L = 7 mm, coll. H. El Harche, by pitfall trap. Site 3, 25/05/2020, L = 7.5 mm, coll. H. El Harche, by pitfall trap and sight hunting.

External morphology

Body length 6–8 mm. Brown to reddish brown. Antennae, palps and legs reddish–brown. The elytra with parallel sides are strongly striated and the inter–striae have a strong and very dense punctuation and a short pubescence.

Geographic range

Sporadic in northern and central Morocco (Kocher, 1963; Machard, 2018). This species is widespread, mainly in southern Europe, from Spain to the Balkan Peninsula, and in some eastern countries. It is also present in Asia Minor, South Asian Middle East and in the Maghreb (Guéorguiev and Guéorguiev, 1995; Löbl and Smetana, 2003; Cosimi, 2011; Ghannem and Boumaiza, 2017).

Habitat

This species lives in the deep cracks of clayey soils, especially in salty soils (Allegro, 2017). Also found in cultivated fields (Cosimi, 2011).

Subfamily Brachininae Bonelli, 1810

Tribe Brachinini Bonelli, 1810

Genus *Brachinus* Weber, 1801

***Brachinus (Brachinus) efflans* (Dejean, 1830) (fig. 2E)**

Site of collection

Sidi Kacem Province, Sidi Kacem city (Sites 2 and 3).

Material examined

Site 2, 20/05/2019, L = 7.5 mm, coll. H. El Harche, by pitfall traps and sight hunting. Site 3, 28/05/2020, L = 10 mm, coll. H. El Harche, by pitfall traps, measurements.

External morphology

Body length 7–10 mm, this species has a completely black abdomen, a completely red or orange head and prothorax. The third or fourth antennal article may be black or tinged with black. The elytra are blue or greenish, convex and slightly enlarged towards the back. They have a rather strong and regular punctation and a sparse pubescence. The apical edge of the elytra is formed by long and sparse setae.

Geographic range

Species mentioned in the Atlantic region by Antoine (1961) and Kocher (1963) and in the Western Morocco (from Casablanca to Tangier) and the Middle Atlas by Machard (2018). It is also present in Bulgaria, Italy, Portugal, Spain, North Algeria and Tunisia (Ruiz–Tapiador and Zaballos, 2001; Löbl and Smetana, 2003; Saouache et al., 2014; Ghannem et al., 2017).

Habitat

This species can be found under stone in a wet field, near cultivated fields and a permanent water course (Ghannem et al., 2015; Ghannem and Boumaiza, 2017).

***Brachinus (Brachinidius) angustatus* (Dejean, 1831) (fig. 2F)**

Site of collection

Sidi Kacem Province, Sidi Kacem city (Site 3).

Material examined

Site 3, 15/04/2019, L = 6.5 mm, coll. H. El Harche, by pitfall traps.

External morphology

Body length 6–8 mm. Color brown to reddish brown. Prothorax, legs, antennae, and lower part of the body also reddish brown. Elytra black with fine longitudinal bands but punctate interstices almost flat, hardly visible, very fine, short, rather densely pubescent.

Geographic range

Species mentioned from North–western Morocco (Machard, 2018). Widespread mainly in the Iberian Peninsula (Serrano et al., 2003).

Habitat

Species that inhabits cultivated land, it is found in meadows and on many herbaceous crops.

Subfamily Carabinae Latreille, 1802

Tribe Carabini Latreille, 1802

Genus *Carabus* Linnaeus, 1758

***Carabus (Macrothorax) rugosus ssp. rugosus (Fabricius, 1792)* (fig. 2G)**

Site of collection

Sidi Kacem Province, Sidi Kacem city (Sites 1, 2, and 3).

Material examined

Site 1, 09/04/2019, L = 22 mm, coll. H. El Harche, by pitfall traps. Site 2, 23/05/2019, L = 21.5 mm, coll. H. El Harche, by pitfall traps. Site 3, 15/06/2020, L = 21 mm, coll. H. El Harche, by pitfall traps and sight hunting.

External morphology

Body 20–24 mm. Robust. Color black or brown. Elytra black. Thin black legs. Antennae blackish brown. Pronotum a little wider than long. Eyes black or grey.

Geographic range

Species mentioned in Tanger, Larache, Rabat and Tetouan and near Sidi Slimane, Oued Cherrat and in Casablanca by Alluaud (1930) and Deuve (2004). Its distribution includes Atlantic Morocco from Tanger to Tensift wadi, the Rif, and the High and Middle Atlas (Machard, 2018).

Habitat

This species can colonize many different environments from the coast to the mountains (Prunier and Marcilhac, 2011).

Subfamily Siagoninae Bonelli, 1813

Tribe Siagonini Bonelli, 1813

Genus *Siagona* Latreille, 1804

***Siagona dejeani (Rambur, 1838)* (fig. 2H)**

Site of collection

Sidi Kacem Province, Sidi Kacem city (Sites 2 and 3).

Material examined

Site 2, 20/04/2019, L = 23 mm, coll. H. El Harche, by pitfall traps and sight hunting. Site 3, 18/03/2020, L = 24.5 mm, coll. H. El Harche, by pitfall traps.

External morphology

Body length 23,5–25 mm. Color reddish–brown. Pronotum with smooth or sparsely punctate dorsal plates. Elytra very shiny, often more pronounced in males, with irregular punctation. Forehead separated from vertex by shallow transverse impression. Head often dilated. Eyes small and hardly protruding and its first antennomere very large.

Geographic range

Species mentioned in Arbaoua and Ouezzane (Antoine, 1955), between Tanger, Azrou and El Jadida (Machard, 2018). France (Tronquet, 2014; Bouyon et al., 2018), Spain (beach Bolonia, (Tarifa) and distributed in a small area from Barbate (Cadiz) to Casares (Malaga) (Junger and Faille, 2011). Its distribution is Ibero–Maghrebi in type (Serrano et al., 2003).

Habitat

These carabids have a stenotopic life style in Mediterranean clayey soils, inhabiting the ground fissure system formed during the dry season (Verdú et al., 2011).

Remarks

This species differs from *Siagona europea* in that the latter is smaller (about 12 mm) and black.

Discussion

Faunistic studies are a useful tool to obtain better knowledge of the distribution of carabids in different localities and ecosystems of Morocco. The present study provides new faunistic data and increases knowledge on the biogeography of the carabidae species by adding new localities of eight terrestrial insects that were poorly known and rarely reported in the last 20 years in Morocco. The findings thus constitute a guide for future taxonomical and ecological research of Moroccan species. A new, revised and updated list of the carabid species is provided, recognizing eight species belonging to four sub-families, five tribes, and seven genus: *Pterostichus (Sterocorus) globosus* ssp. *globosus* (Fabricius, 1792), *Poecilus (Parapedius) decipiens* ssp. *decipiens* (Wattl, 1835) *Harpalus neglectus alluaudi* (Antoine, 1922), *Cordicollis Graniger* (Audinet Serville, 1821), *Brachinus (Brachinus) efflans* (Dejean, 1830), *Brachinus (Brachinidius) angustatus* (Dejean, 1831), *Carabus (Macrothorax) rugosus* ssp. *rugosus* (Fabricius, 1792) and *Siagona dejeani* (Rambur, 1838).

Our findings provide new knowledge concerning Morocco's ground beetle fauna. To help identify and locate endemic species and rare or endangered species for conservation, greater effort must be made to collect information, and continuous observations are needed to complete and update the species list of Carabidae in the country. We hope our research will serve as a foundation for future taxonomic and ecological studies of the Carabids in Morocco.

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