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New records, notes on distribution and species diversity of Carabidae (Coleoptera) from Tunisia National Parks

Nuevos registros, notas de distribución y diversidad de especies de Carabidae (Insecta: Coleoptera) de Parques Nacionales de Túnez

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Abstract: Tunisia is a very important World Natural Heritage Site, and no scientific exploitation of its resources regarding insect fauna has taken place. In this study, we present the first work on Carabidae collected fromexpeditions to theIchkeul and El Feidja national parks between 2012 and 2013. A total of 52 species classified into 33 genera, 14 tribes, and 6 subfamilies were found. Five of the captured species are endemic to North Africa; and two species, *Acinopus haroldi* Schaum, 1863 and *Cryptophonus litigiosus litigiosus* (Dejean, 1829) were recorded for the first time in Tunisia.

Key words: Endemic. Ichkeul National Park. El Feidja National Park. Tunisia fauna.

Resumen: Túnez es un país muy importante del Patrimonio Mundial Natural del cual poco se conoce sobre sus recursos en fauna de insectos. En este estudio, se presenta el primer trabajo sobre Carabidae muestreados durante 2012-2013 en los parques nacionales Ichkeul y El Feidja. Se encontró un total de 52 especies, clasificadas en 33 géneros, 14 tribus y seis subfamilias. Cinco especies son endémicas para el África del Norte, y dos se registran por primera vez en Túnez.

Palabras clave: Endemismo. Parque Nacional d'Ichkeul. Parque Nacional El Feidja. Fauna de Túnez.

Introduction

The family Carabidae, or ground beetles, currently includes about 40,000 (Thiele 1977) to 50,000 species (Desender 1987) but Gaston 1991 consider it could be about 60,000 species. This family is characterized by a very wide adaptive success on the multiple ecological conditions encountered worldwide. They are able to colonize almost all terrestrial habitats and represent an important part of the ground-dwelling invertebrate predators. Furthermore, Carabidae are a relevant indicator group which was used for biodiversity research, ecological surveillance, and research in the domain of environmental change (Latty 2006). Besides that, ecologists employ endangered and endemic species to prioritize the creation of protected areas (Brooks *et al*. 2006). Studies on the distribution and survival of many Carabidae species along different habitats serve to consolidate our level of knowledge of the effects of environmental and climate change (Vaibhao *et al.* 2013; Kerr *et al.* 2007). Species checklists are effective tools in the domain of natural science. They are directly related to any program of species conservation. Carabidae fauna from Tunisia is rather unknown in comparison to other zoogeographical areas such as Europe. Only a few studies cover the topic of ground beetles in Tunisia so far Bedel (1895), Peyerimhoff (1909) and Normand (1933), or recently leading to the discovery of new species (Guéorguiev 2012; Quéinnec and Ollivier 2012; Ghannem *et al.* 2014). In general, no Tunisian or African law, referring to insects' protection exists, and, Tunisia does not have a red list of threatened species adapted to its territory. Only the International Red List of Threatened Species (IUCN) exists as a baseline data. It is, therefore, essential to determine a list of species requiring urgent protection measures. In addition, natural heritage sites play an important role in the conservation ecological systems and biodiversity. This survey aims to update the Carabidae checklist in order to improve the knowledge on ground beetles in Tunisia, particularly in case of two national parks Ichkeul and El Feidja, and in order to establish a first list of heritage species (endemic and new species to the country).

Material and methods

Study area. Specimens were collected from El Feidja national park and Ichkeul national park during 2012-2013. The study areas were located in the northern Tunisia.

Site 1. Ichkeul National Park (37'08'51.31''N 9°40' 03.18''E, altitude: 46 masl).

Situated 25 km to the southeast of Bizerte and 15 km from the cities of Menzel Bourguiba and Mateur, it surrounds a wetland, with lake Ichkeul in the middle, occupying a surface of 150 km^2 being one of the most important bird sanctuaries of North Àfrica. Vegetation of the park is characterized mainly by *Olea europaea* L.

Ichkeul has been registered since 1977 as a Biosphere Reserve under the UNESCO MAB program, in 1979 as a World Heritage Site Natural and Cultural and in 1980 as a Wetland of International Importance under the RAMSAR Convention. It is important to mention that Ichkeul station was the first national park in the world that has benefit from this international status. In Tunisia, the value of Ichkeul National Park is linked to its diversity of habitats and taxonomic groups (Hollis *et al.* 1986).

Site 2. El Feidja (36°46'09.17"N 8°39'00.14"E; altitude: 571 masl).

This national park is located 100 km to the south of Mediterranean Sea, near the frontier with Algeria. The park is the natural environment of the Kroumirie, which is the wettest region of Tunisia. The soil is rich in humus and slightly acid and the most important component of vegetation are *Quercus faginea* Lam., 1785, *Ilex aquifolium* L., *Celtis*

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australis L., *Salix pedicellata* Desf., 1799, *Ficus carica* L., and *Populus alba* L. (Rossler 1996).

Sampling methods. Ground beetles were sampled using 20 pitfall traps. Traps were installed in different sites. Each trap was filled with acetic acid diluted to 30 % in order to kill and preserve samples. Additionally, some other specimens were collected by hand. Once the beetles were entrapped, the samples were separated and stored in plastic sacs. Dates, locations, and number of carabids were recorded. The specimens were identified using the guides by: Jeannel (1941; 1942) and Antoine (1955; 1957; 1959; 1961; 1962) and later confirmed by Mr. Olegario Del Junco (Jerez de la Frontera, Spain), and Pr. Ildefonso Ruiz-Tapiador (Universidad Politécnica de Madrid, Spain). The permanent preparations of the collected material were deposited in the collections of the Faculty of Science of Bizerte, Tunisia.

In general, we followed the classification suggested by Bouchard *et al.* (2011).

Results and discussion

There were found 52 species from 33 genera and 6 subfamilies found in Northern Tunisia parks represented in 274 individuals. All registered species belong to the following subfamilies: Nebriinae (one tribe, two genera, and two species), Omophroninae (one tribe, one genus, and one species), Apotominae (one tribe, one genus, and two species), Trechinae (two tribes, nine genera, and nine species), Brachininae (one tribe, one genus, and six species), and Harpalinae (eight tribes, 21 genera, and 32 species). The registered taxa are listed below.

Subfamily NEBRIINAE Laporte, 1834
Tribe Nebriini Laporte, 1834

***Nebria* (str.) *andalusia* Rambur, 1837**
Material examined. El Feidja: 1♂♂, 2♀♀; 27.III.2013.
Collection sites. Fresh place, under stones, and under dead leaves.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Italy, Portugal, Spain (Antoine 195; Löbl and Smetana, 2003).

***Nebria* (str.) *rubicunda* Quensel, 1806**
Material examined. El Feidja: 3♀♀; 27.III.2013.
Collection sites. Fresh environment near streams, under fragments of dead leaves and wood.
Distribution. North Africa: Algeria, Morocco, Tunisia (Bedel 1895; Antoine 1955). Europe: Spain (Löbl and Smetana 2003). This species exists in Andalusia, and is considered an insect of Betic-riffian origin insect that spread eastward until Tripolitania (Antoine 1955).

Subfamily OMOPHRONINAE Bonelli, 1810
Tribe Omophronini Bonelli, 1810

***Phrator variegatum seurati* Alluaud, 1935**
Material examined. El Feidja: 3♂♂, 2♀♀; 27.III.2013.
Collection sites. Under pieces of wood and dead leaves.
Distribution. Subspecies endemic to Tunisia (Valainis 2009).

Subfamily APOTOMINAE Le Conte, 1853
Tribe Apotomini LeConte, 1853

***Apotomus rufithorax* Pecchioli, 1838**
Material examined. El Feidja: 1♂♂, 3♀♀; 27.V.2012.
Collection sites. Under stones.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Spain, Italy (Sardinia, Sicily), France, Corsica, Greece (Antoine 1955; Löbl and Smetana 2003).

***Apotomus clypeonitens canadensis* Jedlicka, 1961**
Material examined. El Feidja: 7♂♂, 3♀♀; 27.V.2012; 4♂♂, 1♀♀; 27.III.2013.
Collection sites. Clayey ground under stones in a damp environment.
Distribution. North Africa: Algeria, Tunisia. Europe: Italy (Sicily) (Löbl and Smetana 2003).

Subfamily TRECHINAE Bonelli, 1810
Tribe Bembidiini Stephens, 1827

***Asaphidion stierlini* (Heyden, 1880)**
Material examined. El Feidja: 2♂♂, 1♀♀,22.V.2012.
Collection sites. Edges of running water
Distribution. North Africa: Morocco, Tunisia. Europe: Austria, Belgium, France, Great Britain, Germany, Greece, Italy, Netherlands, Spain (Bedel 1895; Antoine 1955; Löbl and Smetana 2003).

***Nepha genei* (Küster, 1847)**
Material examined. El Feidja: 2♂♂; 27.III.2013.
Collection sites. Edge of ponds, rivers and streams. Hydrophilic species.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Greece, Italy (Sardinia), Portugal, Spain, (Bonavita and Taglianti 2005).

***Ocyturanes dudichi* (Csiki, 1928)**
Material examined. El Feidja: 2♂♂, 3♀♀, 27.III.2013.
Collection sites. Edge of the sand of streams. According Zaballos (1984) is a Europhilic species.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Spain, France, Portugal (Antoine 1955. Löbl and Smetana 2003).

***Nejacirtense* Netolitzky, 1914**
Material examined. El Feidja: 1♂♂, 2♀♀, 27.III.2013.
Collection sites. Edge of rivers and streams.
Distribution. Endemic species for North Africa, distributed in Algeria and Tunisia (Löbl and Smetana 2003).

Subtribe Tachyina Motschulsky, 1862

***Tachys scutellaris* Stephens, 1828**
Material examined. El Feidja: 1♂♂, 3♀♀, 27.III.2013.
Collection sites. Salt ground, along the ponds and streams.
Distribution. North Africa: Algeria, Canary Island, Egypt, Morocco. Europe: France, Italy, Portugal, Spain (Löbl and Smetana 2003).

***Polyderis algiricus* (Lucas, 1848)**
Material examined. El Feidja: 2♂♂, 1♀♀, 27.III. 2013.
Collection sites. Edge of a stream.

Distribution. North Africa: Algeria, Canary Island, Egypt, Morocco, Mauritania, Tunisia. Europe: France, Italy (Sicilia), Spain (Antoine 1955; Löbl and Smetana 2003).

***Sphaerotachys haemorrhoidalis* Ponza, 1805**
Material examined. El Feidja: 2♂♂, 1♀♀, 27.III. 2013.
Collection sites. Sand banks of running water and under stones in a very humid salty ground.
Species heavily hygrophile (Thérond 1975; Zaballos 1984).
Distribution. North Africa: Tunisia, Morocco, Canary Island, Egypt. Europe: Spain, Italy, France (Löbl and Smetana 2003; Antoine 1955).

Tribe Trechini Bonelli, 1810

Subtribe Trechina Bonelli, 1810

***Trechus rufulus* Dejean, 1831**
Material examined. El Feidja: 1♂♂, 2♀♀, 27.III. 2013.
Collection sites. Wet field, under stone at the edge of a stream.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Italy (Sicily and Sardinia), Spain (Antoine 1955; Löbl and Smetana 2003).

***Trechus obtusus* Erichson, 1837**
Material examined. El Feidja: 1♂♂, 2♀♀, 27.III. 2013.
Collection sites. Species collected under dead leaves.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Italy, Spain (Zaballos 1993; Löbl and Smetana 2003).

Subfamily BRACHININAE Bonelli, 1810
Tribe Brachinini Bonelli, 1810

Subtribe Brachinina Bonelli, 1810

***Brachinus* (str.) *efflans* Dejean & Boisduval, 1829**
Material examined. El Feidja: 3♂♂, 1♀♀, 08.III.2012.
Collection sites. Under stones near a permanent watercourse.
The former citations of *B. efflans* from Tunisia are included as a variety of *Brachinus crepitans* Linné, 1758 (Bedel 1895) from Haïdra and under the synonym *Brachinus etslans* Dejean, 1830 in 2003 (Löbl and Smetana 2003). However the new record confirms the presence of this elusive species.
Distribution. North Africa: Western Morocco (from Casablanca to Tangier and the Middle Atlas), Algeria, Tunisia. Europe: Bulgaria, Italy, Portugal, Spain (Machard 1993; Ruiz and Zaballos 2001; Löbl and Smetana 2003).

***Brachinus* (str.) *crepitans* Linné, 1758**
Material examined. Ichkeul: 3♂♂, 2♀, 17.I.2013.
Collection sites. Under a stone in a wet limestone terrain and in a humus soil.
Distribution. North Africa: Algeria, Morocco, Tunisia. Medium Europe and Southern Asia: Syria (Bedel 1895; Antoine 1955; Löbl and Smetana 2003).

***Brachinus (Brachynolomus) immaculicornis* Dejean, 1825**
Material examined. Ichkeul: 3♂♂, 5♀, 17.I.2013; El Feidja: 2♂♂, 1♀, 26.II.2012.
Collection sites. Under stones in a clay-wet ground.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Spain, Italy, France (Bedel 1895; Antoine 1955; Machard 1993; Löbl and Smetana 2003).

***Brachinus (Brachynidius) sclopeta* (Fabricius, 1792)**
Material examined. Ichkeul: 3♂♂, 2♀♀, 17.I.2013; El Feidja: 1♂♂, 2♀♀, 21.III.2013.
Collection sites. Wet clay soil in a coastal ground under stones.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Greece, Germany, Italy, Spain (Serrano *et al.* 1990; Löbl and Smetana 2003).

***Brachinus* (*Brachynoaptinus*) *mauretanicus* Bedel, 1914**
Material examined. Ichkeul: 4♂♂, 2♀, 17.II.2013; El Feidja: 3♂♂, 1♀♀, 21.III.2013.
Collection sites. Under stones and under plant debris in wet clay soil.
Distribution. North Africa: Morocco, Tunisia (Bedel 1895; Antoine 1955). Endemic to North Africa.

***Brachinus (Cnecostolus) exhalans* Rossi, 1792**
Material examined. Ichkeul: 4♂♂, 1♀♀, 18.I.2013.
Collection sites. Salty marshy ground.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Albania, Armenia, Croatia, France, Germany, Italy, Spain (Antoine 1955; Löbl and Smetana 2003).

Subfamily HARPALINAE Bonelli, 1810
Tribe Chlaeniini Brullé, 1834

Subtribe Chlaeniina Brullé, 1834

***Chlaenites spoliatus spoliatus* (Rossi, 1792)**
Material examined. Ichkeul: 3♂♂, 1♀♀, 21.II.2012; 2♂♂, 2♀♀, 16.I.2013; El Feidja: 5♂♂, 2♀♀, 13.V.2013.
Collection sites. Found in the flooded fields, live under stones and under plant debris
Distribution. North Africa: Algeria, Canary Island, Egypt, Libya, Morocco, Tunisia. All temperate Europe and South and Central Asia (Bedel 1895; Antoine 1955; Löbl and Smetana 2003).

***Chlaenius velutinus auricollis* Géné, 1839**
Material examined. Ichkeul: 2♂♂, 3 ♀♀, 16. I.2013; El Feidja: 2♂♂, 1♀♀, 13.V.2013.
Collection sites. Under stones and roots of plants. It is a coastal species bound with running water (Bonadona 1971; Thérond 1975; Novoa 1975). In the park El Feidja, its behavior is similar, but also appears on the shores of lakes (Ichkeul case).
Distribution. North Africa: Algeria, Morocco, Mauritania, Tunisia. Europe: France, Greece, Germany, Italy (Sicily and Sardinia), Portugal, Spain, (Bedel 1895; Serrano *et al.* 1990; Machard 1993; Löbl and Smetana 2003).

***Trichochlaenius chrysocephalus* (Rossi, 1790)**
Material examined. Ichkeul: 3♂♂, 2♀♀, 11.II.2012; 1♂♂, 3♀♀, 16.I.2013.
Collection sites. Collected at theedges of stagnant water. It is a species of meso-hygrophilous behavior. In the study area we sometimes noticed a herd behavior and are frequently captured by living together with various species of *Brachinus* Weber.

Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Greece, Italy, Portugal, Spain, (Bedel 1895; Antoine 1955; Löbl and Smetana 2003).

***Trichochlaenius aeratus varvasi* Laporte, 1834**
Material examined. El Feidja: 1♂♂, 3♀♀, 27.III.2013.
Collection sites. Under stones in a wet clay soil.
Distribution. Endemic to North Africa: Algeria, Morocco, Tunisia (Antoine 1955; Serrano 2003).

***Chlaeniellus olivieri* (Crotch, 1870)**
Material examined. El Feidja: 2♂♂, 3♀♀, 27.III.2013.
Collection sites. Under stones and roots of vegetables at the edge of running water. It has a behavior similar to the previous species, is cited on the point of the current waters (Bonadona, 1971), of stagnant waters (Antoine 1955) and from swampy zones (Georges, 1994). It is a western Mediterranean element.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Greece, Germany, Croatia, Spain, Italy (Löbl and Smetana 2003).

Tribe Harpalini Bonelli, 1810

Subtribe Harpalina Bonelli, 1810

***Carterus* (str.) *rotundicollis* Rambur 1837**
Material examined. El Feidja: 4♂♂, 2♀♀, 27. III. 2013; Ichkeul: 1♂♂, 3♀♀, 16. I. 2013.
Collection sites. Under stones in clayey-wet grounds.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Italy, Portugal, Spain (Antoine 1955; Löbl and Smetana 2003).

***Carterus*(str.) *interceptus* Dejean, 1830**
Material examined. Ichkeul: 3♂♂, 1♀♀, 16. I. 2013.
Collection sites. Wet clay soil under stones.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Portugal, Spain (Bedel 1895; Antoine 1955; Löbl and Smetana 2003).

***Amblystomus mauritanicus* Dejean, 1829**
Material examined. Ichkeul: 1♀♀; 16. I.2013.
Collection sites. Clay soil under stone.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Italy, Spain (Antoine 1955; Löbl and Smetana 2003).

***Ophonus* (str.) *opacus* Dejean, 1829**
Material examined. Ichkeul: 1♂♂, 2♀♀, 16. I.2013.
Collection sites. Under limestone in a wetland.
Distribution. North Africa: Tunisia, Algeria, Morocco. Europe: France, Portugal, Italy, Spain (Bedel 1895; Antoine 1955; Löbl and Smetana 2003).

***Harpalus* (str.) *distinguendus* (Duftschmid, 1812)**
Material examined. El Feidja: 1♂♂, 1♀♀, 28. VI.2012.
Collection sites. Under stones and plant debris. Its tendency to dry and hot zones was demonstrated by Lindroth (1992); using as preference Thiele (1977) for light soils and its tolerance for a certain degree of salinity (10 %) (Verdier and Quezel 1951). Kegel (1990) affirms that 62 % of the daily activity comes true during diurnal period.
Distribution. North Africa: Algeria, Morocco. Asia Minor, Caucasus, Medium Europe (Antoine 1955; Wrase 2009).

***Harpalus* (str.) *neglectus* Serville, 1821**
Material examined. El Feidja: 1♂♂, 2♀♀, 26. VI.2012; Ichkeul: 2♂♂, 3♀♀, 16. I.2013.
Collection sites. Under stones and under leaf ltter in clay soil, sometimes in sandy soil.
Distribution. North Africa: Algeria, Morocco, Tunisia. Medium and Northern Europe (Bedel 1895; Jeannel 1941; Machard 1993; Löbl and Smetana 2003).

***Harpalus* (str.) *serripes* (Quensel, 1806)**
Material examined. Ichkeul: 3♂♂, 2♀♀, 16. I.2013.
Collection sites. Under stones and under dead leaves.
According to Lindroth (1975), this appropriate species of xerophilic zones with wide-spread herbaceous vegetation, as well as other authors associate it with sandy soils and limestone (Jeannel 1942; Jeanne 1971c; Lindroth 1975; Therond 1975).
Distribution. North Africa: Algeria, Morocco, Tunisia. Medium and Mediterranean Europe, England (Bedel 1895; Machard 1993; Löbl and Smetana 2003).

***Acinopus haroldi* Schaum, 1863**
Material examined. Ichkeul: 3♂♂, 2♀♀, 16. I.2013.
Collection sites. Wet field under stones.
Distribution. Endemic for North Africa, where it was discovered for the first time in Morocco (Atlantic coast, from Tanger to Agadir) (Antoine 1955). First record from Tunisia.

***Acinopus grassator* Coquerel, 1858**
Material examined. Ichkeul: 1♂♂, 2♀♀, 16. I.2013.
Collection sites. Sandy clay ground under stones.
Distribution. North Africa: Morocco (Melilla) (Antoine 1955), Algeria (Oran) (Bedel 1895).

***Parophonus hispanus* Rambur, 1838**
Material examined. Ichkeul: 1♂♂, 2♀♀, 16. I.2013.
Collection sites. The specimen was found on sandy soil between the debris of vegetation.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Italy, Spain (Sciaky 1992; Zaballos and Jeanne 1994).

***Parophonus hespericus* Jeanne, 1985**
Material examined. Ichkeul: 4♂♂, 2♀♀, 16. I.2013.
Collection sites. Under stones and plant debris, most often colonization with P. *hispanus* Rambur.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Italy, Spain (Jeanne and Zaballos 1986; Sciaky 1992).

***Cryptophonus litigiosus litigiosus* (Dejean, 1829)**
Material examined. Ichkeul: 2♂♂, 2♀♀, 16. I.2013.
Collection sites. Under a stone and under plant debris.
Distribution. Palearctic region. North Africa: Algeria, Egypt. Europe: France, Italy, Portugal. Asia: Palestine; Turkey, Spain, Syria (Bedel 1895; Löbl and Smetana 2003; Serrano 2003). First record from Tunisia.

Subtribe Stenolophina Kirby, 1837

***Bradycellus lusitanicus* Dejean, 1829**
Material examined. El Feidja: 2♂♂, 1♀♀, 26. III.2013.
Collection sites. Under stone in a wet field.

Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Italy, Spain (Bedel 1895; Serrano *et al.* 1990; Löbl and Smetana 2003).

***Stenolophus teutonus* (Schrank, 1781)**
Material examined. El Feidja: 1♂♂, 2♀♀, 13. V.2013.
Collection sites. Under stones and debris in a humid place.
Distribution. North Africa: Algeria, Canary Islands, Egypt, Libya, Morocco, Tunisia. Europe: Malta, Macedonia, Moldova, Poland, Portugal, Romania, Serbia, Spain, Slovakia, Slovenia, Sweden, Turkey, Ukraine. Asia: Syria, Turkey (Bedel 1895; Antoine 1955; Zaballos 1993; Machard 1993; Löbl and Smetana 2003; Curcic and Stojanovic 2011).

Tribe Lebiini Bonelli, 1810

Subtribe Dromiusina Bonelli, 1810

***Apristuss triatipennis* Lucas, 1846**
Material examined. El Feidja: 1♀♀, 23. IV.2013.
Collection sites. Gravel at the edge of waters.
Distribution. North Africa: Algeria, Egypt, Morocco, Tunisia (Machard 1993; Löbl and Smetana 2003). It is an endemic element for North Africa.

***Microlestes corticalis* (Dufour, 1820)**
Material examined. El Feidja: 2♂♂, 3♀♀, 17.III.2013.
Collection sites. Under dead leaves and plants bass in an argilo-sandy ground. It is a species that is found in sandy soils (Zaballos 1984) and clay (Cardenas 1985).
Distribution. North Africa: Algeria, Egypt, Canary Island, Mauritania, Morocco, Tunisia. Europe: France, Germany, Greece, Italy, Portugal, Spain. Central Asia (Antoine 1955; Machard 1993; Löbl and Smetana 2003).

***Microlestes mauritanicus* Lucas, 1846**
Material examined. El Feidja: 2♂♂, 2♀, 23.V.2013.
Collection sites. Under stones and under plant debris.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Italy (Sicily), Spain (Andalusia) (Bedel 1895; Antoine 1955; Machard 1993; Löbl and Smetana 2003).

Tribe Platynini Bonelli, 1810

***Olisthopus fuscatus* Dejean, 1828**
Material examined. El Feidja: 2♂♂, 1♀♀, 24.VI.2013.
Collection sites. Under stones and plant debris in a dry field with grass. According Bonadona (1971) is completely indifferent to salinity and hides under rock and at the base of plants.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Italy, Portugal, Spain (Antoine 1955; Machard 1993; Löbl and Smetana 2003).

Tribe Pterostichini Bonelli, 1810

Subtribe Pterostichina Bonelli, 1810

***Poecilus (Parapedius) decipiens* Waltl, 1835**
Material examined. Ichkeul: 2♂♂, 3♀♀, 16. I.2013; El Feidja: 3♂♂, 1♀♀, 6. III.2012
Collection sites. Under stones and under plant debris.
Distribution. North Africa: Morocco, Tunisia. Europe: Spain (Andalusia) (Bedel 1895; Antoine 1955; Machard 1993; Löbl and Smetana 2003).

***Poecilus* (*Coelipus*) *crenulatus* Dejean, 1828**
Material examined. Ichkeul: 2♂♂, 4♀♀, 16. I.2013.
Collection sites. Under stones and plant debris.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Spain (Bedel 1895; Antoine 1955; Machard 1993; Löbl and Smetana 2003).

***Poecilus (Carenostylus) purpurascens* (Dejean, 1828)**
Material examined. Ichkeul: 5♂♂, 2♀♀, 16.I.2013.
Collection sites. Under stones in a marshy area.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: France, Greece, Portugal, Spain (Bedel 1895; Antoine 1955; Machard 1993; Löbl and Smetana 2003).

***Poecilus* (str.) *tyrrhenicus* Csiki, 1930**
Material examined. Ichkeul: 4♂♂, 7♀♀, 16. I.2013; El Feidja: 2♂♂, 5♀♀, 27. III.2012.
Collection sites. Under stones and plant debris.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Spain (Andalusia) (Bedel 1895; Antoine 1955; Machard 1993; Löbl and Smetana 2003).

Tribe Sphodrini Laporte, 1834

Subtribe Calathina Laporte, 1834

***Calathus* (*Bedelinus*) *circumseptus* Germar, 1824**
Material examined. El Feidja: 2♂♂, 4♀♀, 13.V.2013.
Collection sites. Under feet of trees and under stones in a wet ground and at the edge of a stream.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Albania, Croatia, France, Greece, Italy, Portugal, Spain (Antoine 1955; Machard 1993; Löbl and Smetana 2003; Serrano *et al.* 2003).

***Calathus* (*Neocalathus*) *mollis* Marsham, 1802**
Material examined. El Feidja: 3♂♂, 1♀♀, 21.V.2012.
Collection sites. Under stones and in feet of tree.
Distribution. North Africa: Morocco, Tunisia. Europe: Spain, Italy, Portugal, Croatia, Denmark, Greece, Germany, France (Bedel 1895; Antoine 1955; Serrano *et al.*1990; Machard 1993; Löbl and Smetana 2003).

Subtribe Synuchina Lindroth, 1956

***Platyderus ruficollis* Marshamm, 1802**
Material examined. Ichkeul: 1♂♂, 2♀♀, 16.I.2013.
Collection sites. Under stones.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Western Europe (Bedel 1895; Antoine 1955; Machard 1993).

Tribe Zabrini Bonelli, 1810

Subtribe Amarina Zimmermann, 1832

***Amara* (str.) *familiaris* Duftschmid, 1812**
Material examined. El Feidja: 1♂♂, 2♀♀; 22.VI.2012.
Collection sites. Under dead leaves, in fields and along ways, running to the sun.

Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Spain, Italy, France, Portugal, Germany, Greece (Bedel 1895; Löbl and Smetana 2003).

Tribe Zuphiini Bonelli, 1810

Subtribe Zuphiina Bonelli, 1810

***Zuphium* (str.) *olens* Rossi, 1790**
Material examined. El Feidja: 2♀♀; 22.VI.2013.
Collection sites. Dead leaves.
Distribution. North Africa: Algeria, Morocco, Tunisia. Europe: Spain, Italy, France, Portugal, Germany, Greece (Bedel 1895; Löbl and Smetana 2003).

The results of this study indicate that there is a highly diverse fauna of Carabidae in both parks. In this survey, a total of 52 species belonging to 6 subfamilies were collected from two different localities. Of the six subfamilies studied here, Harpalinae was the most abundant with 32 species (61.5 % of total). According to Lorenz (2005) the subfamily Harpalinae is the largest group of ground beetles with 19,000 species. Eight of the species (15.3 % in total) were common to both parks.

Within the other subfamilies, two species, *Acinopus haroldi* Schaum, 1863 and *Cryptophonus litigiosus litigiosus* (Dejean, 1829) from Ichkeul national park are new records for the fauna of Tunisia. Endemic species represent a particular class of rare species (Gaston 1994). Five species are endemic to the North Africa: *Neja cirtense* Netolitzky, 1914, *Apristus striatipennis* Lucas, 1846, *Trichochlaenius aeratus varvasi* Laporte, 1834 (El Feidja national park), *Acinopus haroldi* Schaum, 1863 (Ichkeul National Park) and *Brachinus (Brachynoaptinus) mauretanicus* Bedel, 1914 (both parks). Hence, one subspecies, *Phrator variegatum seurati* Alluaud, 1935 (El Feidja National Park) is endemic to Tunisia. The global species richness of ground beetles varied between sampling sites (Fig. 1); the highest value was recorded in El Feidja national park (37 species); in Ichkeul national park were recorded 24 species. Also, the higher abundance of specimens was observed in El Feidja with 146 individuals; where the most representative species were: *Apotomus clypeonitens canadensis* Jedlicka, 1961*, Chlaenites spoliatus spoliatus* (Rossi, 1792) and *Poecilus* (str.) *tyrrhenicus* Csiki, 1930. In Ichkeul the abundance obtained was 126 individuals, where the most abundant species were: *Poecilus* (str.)*tyrrhenicus* Csiki, 1930*, Trichochlaenius chrysocephalus* (Rossi, 1790), *Chlaenites spoliatus spoliatus* (Rossi, 1792), *Brachinus (Brachynolomus) immaculicornis* Dejean, 1825 and *Poecilus (Carenostylus) purpurascens* (Dejean, 1828). In other study sites, Ghannem *et al.* (2014) recorded five species of Carabidae, from Bou Hedma National Park southern Tunisia. Dajoz (1982) recorded eight Carabidae species, from southern Tunisia. In addition, in Algeria, in Mont Babor National Park, Benkhlil and Doumandji (1992) have been captured 28 species of Carabidae. Remini (2007) sampled in Ben Aknoun National Park, five species of Carabidae. Within Fezzan (desertic area of 15,000 km^2 located in Libya), 19 Carabidae were recorded by Peyerimhoff (1948). In comparison with the previous sites, the high species richness refers to the sites seems to be related to altitude, vegetation, soil, availability of trophic resources, structural complexity of the environment and the degree of disturbance. Different abiotic factors can influence the activity of carabid beetles and associated taxa in different climates (Moraes *et al.* 2013). The difference can attribute to the affinity and adaptation by local species to their habitats (Erwin *et al.* 2005). According to Loreau (1978) deciduous litter can provide favorable microclimatic conditions, and creates a complex spatial structure through generating stratification that may allow the coexistence of some ground beetle species.

In this study, we noticed that there is no great difference in species richness sorted by abundance specific level, which proliferates despite the study sites are geographically distant from each other. This will demonstrate the importance of the conservation of these sites (national parks since 1980 and 1956) which are relevant for the entire ecosystem and in particular the species of Carabidae.

This study constitutes a guide for future taxonomical and ecological research of Tunisian species. With more long-term and periodic work the checklist of Carabidae from Tunisia can be updated with new findings of different species.

The presence of such ground beetles' biodiversity at the El Feidja and the Ichkeul National Parks can only approve their heritage significance. Managers of this biodiversity hot spot are required to entrust more interest and conservation efforts, reducing the unsustainable practices (overgrazing, fire...) that exist in these "protected" area. Sustainable management of these heritages requires taking into account all functions and uses that the both parks have to offer (ecological, economic, tourism...) and their integration to management reflections undertaken by the different concerned parties.

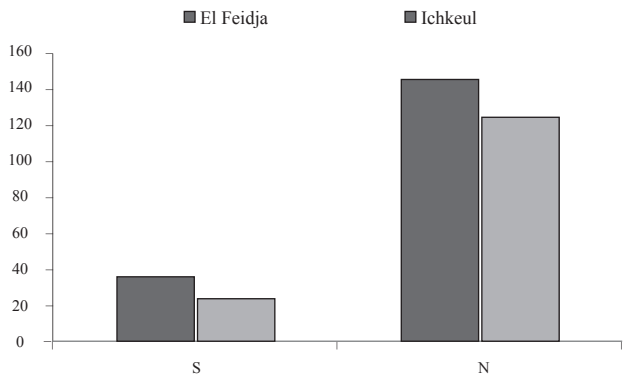

Figure 1. Abundance (N) and species richness (S) variation in sampling sites.

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