New data on the distribution of aquatic beetles from Morocco (Coleoptera, Adephaga: Gyrinidae, Haliplidae and Dytiscidae)

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New faunistic and distributional data on aquatic beetles (Adephaga: Gyrinidae, Haliplidae and Dytiscidae) from the Oriental Region of Morocco and the basin of Moulouya River are presented. A check-list of 55 species of three families and 25 genera is provided. Eight species are new records for the basin of Moulouya River and nine species for the Oriental Region of Morocco.

Key words: Aquatic coleoptera, inventory, Northeastern of Morocco.


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INTRODUCTION

Morocco gathers a high biodiversity because of its great landscape and climate heterogeneity (Dakki 1997). Unfortunately, this biodiversity is threatened, particularly that inhabiting aquatic ecosystems. The Moulouya’s watershed and Oriental Morocco are suffering a severe deterioration (Dakki & El Hamzaoui 1998). The major causes are resources exploitation and land use changes (Marañon et al. 1999). Indeed, this degradation is becoming more worrying because of the proliferation of many pollution sources from domestic, industrial and agricultural origins (Mabrouki et al. 2016a, 2017a; Taybi et al. 2016a). These anthropic pressures combined with drought episodes, typical of semi-arid regions such as the study area, results in an important loss of aquatic habitats (Mabrouki et al. 2016b; Taybi et al. 2016b, 2017).

Within aquatic ecosystems, macroinvertebrates, and particularly water beetles, are one of the main components of total biodiversity (Jäch & Balke 2008), playing a key role in the ecosystem functioning (Wallace & Webster 1996). This group of organisms is also very sensitive to environmental changes, making them very useful for monitoring the ecological integrity of aquatic habitats (Barbour et al. 1999; Millán et al., 2006). In this sense, Berrahou
Taybi A. F., Mabrouki Y., Chavanon G., Berrahou A., Millán A. (1995) was the first researcher proposing a biotypology based on benthic macroinvertebrates of the Moulouya’s river to identify aquatic ecosystems alterations. Later, other studies regarding monitoring of aquatic ecosystems have emerged from Oriental Morocco (Belouali, 1999; Chergui et al. 1999; Berrahou et al. 2001a et b; Mabrouki et al. 2016b; Taybi et al. 2016b).

Concerning faunistic works, Bedel (1925) and Alluaud (1926) were the first researchers studying aquatic beetles belonging to the suborder Adephaga from the regions of Oujda, Beni Snassen and Figuig. Posteriorly, Kocher (1958) added the zone of Fritissa in the Middle Moulouya, and several decades later, the Adephaga of the Oriental Región and Moulouya’s river were studied again by Chavanon et al. (2004). Finally, Bennas & Sainz-Cantero (2006) and, recently, Benamar (2015) in their studies about aquatic coleopteran included also important information for Adephaga beetles in the study area.

In this framework, information of the presence and distribution of water beetles species seems of special concern for any purpose of conservation and/or manage of aquatic ecosystems and their biodiversity in the study area. Thus, the main goal of this work is to contribute to the improvement of the knowledge of the presence and distribution of aquatic beetles (suborder Adephaga) from the Oriental Morocco and Moulouya basin.

MATERIAL AND METHODS

Study area

Morocco is currently divided, according to the new administrative division, into 12 regions including the Oriental Region (Fig. 1), which occupies the entire eastern side of the country and covers an area of 90,127 km². This area is bounded to the north by the Mediterranean Sea, to the east and south by the Morocco-Algerian

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Fig 1. The studied localities of the Oriental Region of Morocco and the basin of Moulouya River
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The Oriental region includes the wilaya of Oujda (Oujda-Angad prefecture) and the provinces of Berkane, Taourirt, Jerada, Nador, Figueig, Driouch and Guercif. The watershed of the Moulouya (Fig. 1), which includes nearly 55,860 km² to the east of Morocco, covers much of the Oriental region. It is located between the parallels 36 and 39 degrees North and the meridians 5.5 and 7 degrees West. With a length of 520 km, the Moulouya is the largest North African river flowing into the Mediterranean. It starts at the junction of the High and Middle Atlas chains, and flows primarily south-west - northeast axis. Its main tributaries are perennial: Anzegmir Wadi, Melloulou Wadi and Za Wadi, others flow only during the floods (3-5 floods on average per year). The river flows through various Mediterranean bioclimatic zones (Berrahou, 1995).

Sampling

The field surveys were conducted between 2011 and 2016, in which 45 localities have been carried along the watershed of the great Moulouya, with large permanent rivers: Oued Anzegmir (side of the High Atlas) Oued Melloulou (Middle Atlas side) and Oued Za (High Plates) visited at least during three sampling campaigns. This survey was completed sampling 43 more localities distributed all over Oriental Morocco, from the regions of Nador and Saidia North, Figueig southeast, Talessint and Bouanane southwest (See Appendix xx, for the complete list of localities). The samples of benthic fauna, essentially qualitative, were carried out by a kick net, landing nets and clamps.

The recorded species were preserved in alcohol at 70 or 96 % in duly labeled tubes and deposited in the collection of aquatic macroinvertebrates at the Laboratory of Water Sciences, Environment and Sustainable Development of the University Mohammed Premier from Oujda.

Chorological study

The different chorological categories proposed for the 55 Adephaga species of eastern Morocco and the Moulouya’s watershed were ranked according to Greca (1964, 1975) and Taglianti et al. (1992) for the classification of western Palearctic fauna.

Abbreviations

SIBE: Site of Biological and Ecological Interest. The species new for Moulouya basin are marked by #, for the entire area by *

RESULTS

Family Dytiscidae Leach, 1815

Subfamily Hydroporinae Aubé, 1836

Hyphydrus Illiger, 1802

Hyphydrus aubei Ganglbauer, 1891#

Material examined. Ait Oha Ohaki: 14.07.2014, 1 larva; Arbalou: 03.05.2014, 1 male, A.F. Taybi & Y. Mabrouki leg.

Distribution. Mediterranean species, known from North Africa to Central Europe; widely distributed in the Iberian Peninsula (Millán et al. 2014). It was recorded from the north-eastern Morocco (Benamar 2015). A new species for the basin of Moulouya River: one larva of H. aubei was found among the macrophytes in the High Moulouya at Ait Boulmane and one adult was sampled during the summer at Irhdis (Fig. 10).

Hydrovatus Motschulsky, 1853

Hydrovatus clypealis Sharp, 1876

Distribution. Atlantic-Mediterranean species, widely distributed in the Iberian Peninsula (Millán et al. 2014). It was recorded from the north-eastern Morocco (Benamar 2015). It was cited (Chavanon et al. 2004; Bennas & Sánz-Cantero 2006) for the Oriental Region at the mouth of Moulouya River (Fig. 9).

Yola Gozis, 1886

Yola bicarinata (Latreille, 1804)

Distribution. This West Mediterranean species is widely distributed in North Africa, Iberian Peninsula and Central Europe (Millán et al. 2014). It was recorded from the northern Morocco by Benamar (2015). It was recorded for the studied area by Bedel (1925), Alluaud (1926), Chavanon et al. (2004) and Bennas & Sàinz-Cantero (2006). *Y. bicarinata* was found between macrophytes at the High Moulouya in stagnant water ponds adjacent to the lower reach of the river, and in stagnant waters of the abandoned quarry near Oujda (Fig. 7).

*Bidessus* Sharp, 1882

*Bidessus coxalis* Sharp, 1882

Distribution. West Mediterranean species, known from France, western regions of Iberian Peninsula (Millán et al. 2014). It was recorded from north-eastern Morocco by Benamar (2015) and from the southeast of the Oriental Region at Figuig (Fig. 9) by Chavanon et al. (2004).

*Bidessus goudotii* (Laporte de Castelnau, 1835)

Distribution. West Mediterranean species. It is distributed in the north-western part of Morocco and was recorded for the region of Berkane in eastern Morocco (Fig. 9) by Benamar (2015).

*Bidessus minutissimus* (Germar, 1824)

Material examined. Irhdis: 13.06.2014, 1 male; Amont Taourirt: 19.07.14, 1 female; Confluence Zobzit O. El Bared: 15.08.2014, 2 females; Abbou Lekhal: 22.05.2016, 1 male, 1 female, A.F. Taybi & Y. Mabrouki leg.

Distribution. West Mediterranean species, known from the Iberian Peninsula (Millán et al. 2014) and northern Morocco (Benamar 2015). It is a common species in the Oriental Region and the Moulouya basin (Berrahou et al. 2001b; Chavanon et al. 2004; Bennas & Sàinz-Cantero 2006). At the Middle Melloulou it is recorded for the first time (Fig. 2).

*Hydroglyphus* Motschulsky, 1853

*Hydroglyphus major* (Sharp, 1882)

Distribution. Afrotropical-South Mediterranean species (Nilsson & Hájek 2013). It was recorded from the Figuig region of (Fig. 9) by Benamar (2015).

*Hydroglyphus gominus* (Fabricius, 1792)


Distribution. It is a palaearctic species, widely distributed in the Iberian Peninsula (Millán et al. 2014) and the northern part of Morocco (Benamar 2015). It has already been recorded in the eastern region and the Moulouya basin (Berrahou et al. 2001a; Chavanon et al. 2004; Bennas & Sàinz-Cantero 2006; Millán et al. in press). The distribution of the species in the studied region as in Fig. 4.

*Hydroglyphus signatellus* (Klug, 1834) #


Distribution. Afrotropical-South Palearctic species. It is widely distributed in the entire Mediterranean region, including Iberian Peninsula (Millán et al. 2014). It was recorded in North Africa from Senegal and Morocco to Egypt, Sudan, Ethiopia and Kenya (Biström 1986). It has been previously recorded in the Oriental Region of Morocco between Bouarfa and Figuig (Chavanon et al. 2004). The distribution of the species in the studied region as in Fig. 4.

*Hygrotopus* Stephens, 1828
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**Hygrotus (Coelambus) confluens** (Fabricius, 1787)

**Material examined.** O. Charef: 19.03.2014, 1 male; O. Charef: 07.08.2014, & 1 larva; Pond O. Charef: 19.03.2014, 2 males, 3 females; Oued lakhrout: 07.08.2014, 1 female; Mare À Debou: 27.04.2016, 1 female; Bassin Oujda: 20.02.2016, 2 males, 3 females, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** Palaearctic species extending to the Afrotropic Region; it is known from the Iberian Peninsula (Millán et al. 2014). It is a common species in the northern Morocco (Benamar 2015) and known from the basin of Moulouya River and Oriental Region of Morocco (Alluaud 1926; Berrahou et al. 2001a; Chavanon et al. 2004; Benamar, 2015). The distribution of the species in the studied region as in Fig. 4.

**Hydroporus Clairville, 1806**

**Hydroporus marginatus** (Duftschmid, 1805)

**Distribution.** West Palaearctic species. It is usually associated with the main mountain ranges in the Iberian Peninsula (Millán et al. 2014) and Morocco (Benamar 2015). It was recorded from the basin of the Oued Za (Fig. 9), at Ain Benimathar and Guefaït in the eastern part of the basin of Moulouya River (Alluaud 1926; Chavanon et al. 2004).

**Hydroporus lucasi** Reiche, 1866

**Material examined.** Anzar Oufounas: 15.07.2014, 1 male, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** West Mediterranean species. It is distributed in southern Europe and North Africa; the Iberian and central systems represent the northern limit of its range (Millán et al. 2014). It is known from the northwestern Morocco (Benamar 2015). Indeed, all bibliographic records of *H. planus* must be corresponds with *H. lucasi*, since its distribution is limited to Europe (Millán et al. 2014). This species was recorded for the studied area (Chavanon et al. 2004; Bennas & Sáinz-Cantero 2006). The distribution of the species in the studied region as in Fig. 5.

**Hydroporus pubescens** Gyllenhal, 1808

**Material examined.** Anzar Oufounas: 15.07.2014, 1 male, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** West Palaearctic species, with diffusive distribution throughout the mountain systems of the Iberian Peninsula (Millán et al. 2014) and mountain regions of the northern Morocco (Benamar 2015). It was recorded from the mouth of the Moulouya River (Chavanon et al. 2004). During the sampling period, only one adult of *H. pubescens* was found in source of Anzar Oufounas (Fig. 5), belonging to Oued Anzegmir (High Atlas).

**Hydroporus discretus** Fairmaire & Brisout de Barneville 1859 #

**Material examined.** Sources O. El Bared: 11.07.2014, 1 male, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** West Palaearctic species, widely distributed in the western Asia and North Africa. It is one of the most common species in the Iberian Peninsula (Millán et al. 2014). It was recorded from the Rifian Area of Morocco (Benamar 2015) and from Nador in the eastern region (Bennas & Sáinz-Cantero 2006). It is a new species for the basin of the Moulouya River, being collected upstream of Wadi Melloulou (Fig. 5), corresponding to the Middle Atlasic part (see study area section).

**Graptodytes Seidlitz, 1887**

**Graptodytes ignotus** Mulsant & Rey, 1861 #


**Distribution.** West Mediterranean species, known from the southern Europe and North Africa; it is widely distributed in the Iberian Peninsula (Millán et al. 2014). It was recorded
for the Rifian area of Morocco by Benamar (2015) and for Nador, Oriental Region (Bennas & Sáinz-Cantero 2006; Benamar 2015). It is recorded for the Moulouya for the first time (Fig. 7).

**Graptodytes varius** Aubé, 1838

**Material examined.** Ait Oha Ohaki: 14.07.2014, 2 female; Arbalou: 13.06.2014, 1 female; Irhdis: 13.06.2014, 1 male; Tamadefelt: 15.07.2014, 2 males, 7 females; Missour: 15.07.2014, 5 males, 5 females; Pont Hassan II: 23.06.2014, 1 male, 9 females; Aval Anzar Oufouanas: 15.07.2014, 5 males 3 females; O. Charef: 07.08.2014, 9 female; Pond O. Charef: 07.08.2014, 6 males, 4 females; Amont Gafait: 07.08.2014, 4 females; Douar Ifrane: 07.08.2014, 3 males, 2 females; Douar Imzaghrou: 08.06.2014, 2 males; Pont Taddarte: 08.06.2014, 1 male, 2 females; A.F. Taybi & Y. Mabrouki leg.

**Distribution.** This species is widely distributed in southern Europe and North Africa; it was recorded for the Iberian Peninsula (Millán et al. 2014), for the northwestern part of the Rifian area of Morocco (Benamar 2015). It was cited for the studied area by Kocher (1958) and Chavanon et al. (2004). The distribution of the species in the studied region as in Fig. 7.

**Graptodytes flavipes** Olivier, 1795*

**Material examined.** Ait Oha Ohaki: 14.07.2014, 3 males, 7 females; Irhdis: 14.07.2014, 4 males 7 females; Tamadefelt: 15.07.2014, 5 females; Missour: 15.07.2014, 2 males; Pont Hassan II: 23.06.2014, 2 females; Pré-Estuaire: 23.06.2014, 5 males, 13 females; O. Charef: 07.08.2014, 1 male, 2 females; Pond O. Charef: 17.05.2014, 3 males, 3 females; Petite Cascade: 07.08.2014, 2 males, 2 females; Oued Lakhrouf: 07.08.2014, 4 females; Grandes Cascades: 07.08.2014, 1 male, 6 females; Amont Gafait: 07.08.2014, 1 male, 1 female; Douar Ifrane: 07.08.2014, 1 male; Pont Taddarte: 08.06.2014, 2 females, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** Turanic-Euro-Maghrebian species; common in the Iberian Peninsula, absent from the Mediterranean side (Millán et al. 2014) and northern Morocco (Benamar 2015). In the eastern region it was recently reported at Debdou (Benamar, 2015). Like its congener *G. flavipes*, *G. ignotus* was found on the Moulouya River and in the upper regions of the Oued Za, in addition to Oued Melloulou (Fig. 11).

**Scarodytes Gozis, 1914

**Scarodytes halensis halensis** (Fabricius, 1787)

**Distribution.** West Palearctic species, widely distributed in the Iberian Peninsula and absent in the arid areas (Millán et al. 2014). It is a quite rare species in Morocco, known from the northern part (Benamar 2015). It was recorded in the area of Oujda, Oriental Region (Bedel 1925; Kocher 1958).

**Herophydrus Sharp, 1882

**Herophydrus musicus** Klug, 1833

**Material examined.** O. Charef: 17.05.2014, 1 female; Barrage Sfissef: 21.05.2016, 1 male 3 females, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** South Palearctic species. It is known from the southern part of the Mediterranean region of the Iberian Peninsula (Millán et al. 2014) and northeastern Morocco.
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(Benamar 2015). It is a very common species in the studied area (Kocher 1958; Berrahou et al. 2000b; Chavanon et al. 2004). The distribution of the species in the studied area is show in Fig. 4.

Stictonectes Brinck, 1943

Stictonectes optatus (Seidlitz, 1887)


Distribution. West Mediterranean species, known from the southern and eastern parts of the Iberian Peninsula (Millán et al. 2014) and northern Morocco (Benamar 2015). It was recorded for the studied area by Berrahou et al. (2000) and Chavanon et al. (2004). The distribution of the species in the studied region as in (Fig. 7).

Stictonectes escheri (Aubé, 1838)*


Distribution. West Mediterranean species, known from the southwestern part of the Iberian Peninsula (Millán et al. 2014) and from the Atlantic coast and the Rifian domain in Morocco (Benamar 2015). It is recorded here from the Upper Moulouya and the Upper Oued Za for the first time (Fig. 11).

Stictotarsus Zimmermann, 1919

Stictotarsus procerus (Aubé, 1838)

Distribution. Maghrebian species, known from Corsica, Sardinia and Sicily (Mazzoldi & Toledo 1998). It is known from the northern Morocco (Benamar 2015) and from Oujda near Oued Isly (Kocher 1958), Oriental Region (Fig. 9).

Stictotarsus maghrebinus (Mazzoldi & Toledo, 1998)*


Distribution. It was described from Maghreb. This species is known from the Tassili Region of Algeria (Mazzoldi & Toledo 1998) and the Rif and Atlas regions of Morocco (Benamar 2015). It is a new species for the studied area: a single male of S. maghrebinus was collected at Boumia (Fig. 10), corresponding to the High Moulouya and the Middle Atlasic slope.

Deronecetes Sharp, 1882

Deronecetes moestus (Fairmaire, 1858)


Distribution. West Mediterranean species; it is distributed in the Iberian Massif with some Mediterranean influence (Millán et al. 2014) and widely distributed in the northern Morocco (Benamar 2015). It was recorded for Nador, Oriental Region (Bennas & Sáinz-Cantero 2006) and in the basin of the Moulouya in the Zeghzel complex (Chavanon et al. 2004). The distribution of the species in the studied region as in Fig. 3.

Deronecetes fairmairei Lepieur, 1876

Material examined. Irhdis: 13.06.2014, 2 females; Boumia: 15.07.2014, 1 female; Sources O. El Bared: 27.03.2014, 2 females; Amont O. El Bared: 07.08.2014, 1 male, 1 female; Sources Berkine: 15.06.2014, 1 female; Douar Imzaghrou: 15.08.2014, 1 male; Aval Zeghzel: 28.04.2016, 2 females; Amont Himer: 18.11.2015, 1 male, 3 females; Source Zeghzel: 01.02.2015, 4 males, 2 females; O. Anwal: 21.01.2016, 1 male, A.F. Taybi & Y. Mabrouki leg.

Distribution. West Mediterranean species. It is known from the Mediterranean mountain regions of the Iberian Peninsula (Millán et al. 2014) and widely distributed in the northern Morocco (Benamar 2015) and in the studied area (Berrahou 1995; Chavanon et al. 2004; Bennas & Sáinz-Cantero 2006). The distribution of the species in the studied region as in Fig. 3.
Nebrioporus Régimbart, 1906
Nebrioporus (Nebrioporus) clarkii Wollaston, 1862

Material examined. Ait Oha Ohaki: 14.07.2014, 1 male, 1 female; Anzegmir Avant Barrage: 14.06.2014, 1 male; Tindint: 14.06.2014, 2 females; O. Charef: 17.05.2014, 23 males, 38 females 15 larvae; Pond O. Charef: 19.03.2014, 14 males, 16 females. 22 larvae; Petite Cascade: 19.03.2014, 2 males; Oued Lakhrouf: 07.08.2014, 5 males, 2 females; Pont Gafait: 19.03.2014, 3 males, 14 larvae; Pont Gafait: 07.08.2014, 20 males, 22 females, 6 larvae; Gafait: 17.05.2014, 6 males, 7 females, 6 larvae; Amont Taourirt: 19.07.14, 2 females; Amont O. El Bared: 07.08.2014, 3 males, 1 larva; Amont Berkine: 15.08.2014, 2 females; Pont O. Zobit: 15.08.2014, 2 females, 1 larva; Confluence Zobit O. El Bared: 08.06.2014, 3 larvae; Douar Imzaghour: 15.08.2014, 3 females, 1 larva; Pont Taddarte: 15.08.2014, 1 female; Aval Melloulou: 15.08.2014, 4 males, 5 females; Mare à DebDou: 27.04.2016, 2 females; Amont Himer: 18.11.2015, 1 male; Source Zeghzel: 01.02.2015, 1 female; Raknat Naam: 21.05.2016, 1 female; Barrage Zriga: 21.05.2016, 1 male; Barrage Sfissef: 21.05.2016, 4 males, 2 females, 3 larvae; Abbou Lekhal: 22.05.2016, 1 male, 3 females, A.F. Taybi & Y. Mabrouki leg - Aït Aïssa: 9.05.2014, 3 males, 4 females, L. Daoudi leg.

Distribution. Holomediterranean species. It is known from the southern coastal part of Iberian Peninsula, (Millán et al. 2014) and widely distributed in Morocco (Benamar 2015). It was recorded for the studied area (Alluaud 1926; Kocher 1958; Chavanon et al. 2004), where the species inhabit river systems near the coast and the saline waters of the Oriental Desert. It was collected from Nador and saline habitats of the Figuig Region (Fig. 6).

Nebrioporus nemethi Guignot, 1950*

Material examined. Oued Lakhrouf: 07.08.2014, 1 male, 1 female; Marchica (1): 22.05.2015, 1 male, A.F. Taybi & Y. Mabrouki leg.

Distribution. It is an endemic of the northern Morocco (Benamar 2015) and new species for the basin of Moulouya River and the Oriental Region. We collected specimens at Oued Lakhrouf, a tributary of the Oued Za, and near Nador Lagoon (Fig. 11) in a small saltwater pond resulting from the rising of the level of groundwater.

Subfamille Laccophilinae Gistel, 1856

Laccophilus Leach, 1817
Laccophilus hyalinus testaceus Aubé, 1837

Material examined. Irhdis: 14.07.2014, 1 male; Boumia: 14.06.2014, 3 males, 1 female, 1 larva; Pont Hassan II: 23.06.2014, 2 females; Pré-Estuaire: 18.05.2014, 1 male, 1 female; Petite Cascade: 17.05.2014, 1 female; Grandes Cascades: 17.05.2014, 1 female; Amont Gafait: 19.03.2014, 2 females; Pont Gafait: 17.05.2014, 3 males, 2 females; Gafait: 17.05.2014, 1 female; Amont Taourirt: 19.07.14, 3 males; Amont Berkine: 15.06.2014, 2 males, 3 larvae; Douar Ifrane: 07.08.2014, 1 female; Pont O. Zobit: 15.08.2014, 1 male, 2 females; Confluence Zobit O. El Bared: 15.08.2014, 3 males; Douar Imzaghour: 15.08.2014, 2 males, 1 female; Entrée Guercif: 15.08.2014, 1 female; Aval Melloulou: 15.08.2014, 3 males; Mare à DebDou: 27.04.2016, 5 males, 2 females; Source Himer: 22.05.2016, 1 male, 1 female, A.F. Taybi & Y. Mabrouki leg.

Distribution. West Mediterranean species, extending to the Canary Islands and Turkey. It is distributed in the southeastern Iberia (Millán et al. 2014) and northern Morocco (Benamar 2015) and was recorded for the studied region as in Fig. 6.

Nebrioporus (Zimmermannius) ceresi Aubé, 1838

Material examined. Dardoura: 2.05.2016, 1 male; Oumassine: 12.05.2016, 7 males, 2 females; Kert: 12.05.2016, 5 males, 11 females; Barrage Zriga: 15.08.2014, 1 male, 3 females, A.F. Taybi & Y. Mabrouki leg.
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18.11.2015, 19 males, 20 females; Amont Himer: 18.11.2015, 15 males, 9 females; Dardoua: 2.05.2016, 1 female; Oued Ouzej: 30.04.2016, 5 males, 8 females; OMessoussite: 2.05.2016, 1 male; Mont Gourougou: 5-6-7.02.2015, 1 female; Oued Tifassour: 12.05.2016, 1 female; Oumassine: 12.05.2016, 1 male, 1 female; Mariouari:12.05.2016, 2 males; Barrage Sfissef: 21.05.2016, 1 male; Abbou Lekhal: 22.05.2016, 6 males, 5 females, A.F. Taybi & Y. Mabrouki leg.

Distribution. West Mediterranean species, widely distributed in the Iberian Peninsula (Millán et al. 2014) and northern Morocco (Benamar 2015). It is one of the most widely distributed species in the studied area (Berrahou 1995; Chavanon et al. 2004; Bennas & Sàinz-Cantero 2006). The distribution of the species in the studied region as in Fig. 6.

Laccophilus minutus Linnaeus, 1758


Distribution. Palaearctic species; widely distributed in the Iberian Peninsula (Millán et al. 2014) and Morocco (Benamar 2015). It was cited for several localities of the studied region (Chavanon et al. 2004; Bennas & Sàinz-Cantero 2006). The distribution of the species in the studied region as in Fig. 6.

Subfamily Colymbetinae Erichson, 1837

Agabus Agabus (Gourodytes) bipustulatus (Linnaeus, 1767)


Distribution. Palaearctic species, with an extension into the Afrotropical Region and widely distributed in the Iberian Peninsula (Millán et al. 2014) and northern Morocco (Benamar, 2015). It was recorded for Tendrara, Oriental Region by Alluaud (1926). It is a new record for the basin of the Moulouya River (Fig. 2), where it was collected in the marshy system of Cherraba (Saidia).

Agabus (Gourodytes) biguttatus Olivier, 1795

Material examined. Anzar Oufounas: 14.06.2014, 1 male, 1 female; Aval Anzar Oufounas: 14.06.2014, 1 male; Anzegmir Avant Barrage: 14.06.2014, 1 male; Aval Anzegmir: 14.06.2014, 2 males, 4 females; Sources O. El Bared: 11.07.2014, 4 males, 4 females; Amont O. El Bared: 07.08.2014, 1 male, 3 females; Douar Ifrane: 07.08.2014, 3 males; Sources Berkine: 15.06.2014, 4 males, 7 females; Sources Berkine: 15.06.2014, 6 males, 4 females; Amont Berkine: 15.06.2014, 2 males, 3 females; Amont Berkine: 15.06.2014, 1 male, 4 females; Pont O. Zobzit: 08.06.2014, 4 females; Confluence Zobzit O. El Bared: 15.08.2014, 2 females, A.F. Taybi & Y. Mabrouki leg.

Distribution. West-palaearctic species, widely distributed in the Iberian Peninsula, especially in mountainous areas (Millán et al. 2014), common species for the mountains of Morocco (Benamar 2015). It was recorded from Nador (Bennas & Sàinz-Cantero 2006). It is recorded here for the basin of Moulouya River for the first time (Fig. 2).

Agabus (Gourodytes) didymus Olivier, 1795

Material examined. Ait Boumane: 13.06.2014, 1 male, 1 female; Arbalou: 13.06.2014, 1 female; Boumia: 14.06.2014, 7 males, 18 females; Anzar Oufounas: 15.07.2014, 5 males, 7 females; Aval Anzar Oufounas: 14.06.2014, 3 males; Anzegmir Avant Barrage: 02.05.2014, 1 female; Aval Anzegmir: 02.05.2014, 1 male; Sources O. El Bared: 11.07.2014, 1 male; Douar Ifrane: 07.08.2014, 1 female; Sources Berkine: 15.06.2014, 4 males, 1 female; Bassin Oujda: 1-4.12.2015, 1 female, A.F. Taybi & Y. Mabrouki leg.

Distribution. European-Mediterranean species, widely distributed in the Iberian Peninsula (Millán et al. 2014) and northern Morocco (Benamar 2015). This species was recorded for the studied area (Berrahou 1995; Chavanon et al. 2004; Bennas & Sàinz-Cantero 2006). The distribution of the species in the studied region as in Fig. 2.
**Agabus (Gaurodytes) brunneus gr. Fabricius, 1798**

**Material examined.** Amont Himer: 18.11.2015, 1 male; Mont Gourougou: 5-6-7.02.2015, 2 males, 1 female, 1 larva, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** *A. brunneus* complex is a West Mediterranean group that extends to Atlantic Europe (Hidalgo-Galiana et al. 2014). It is widely distributed in the Iberian Peninsula and North Africa, where it is represented by two species: *A. brunneus* (Fabricius, 1798) and *A. ramblae* Millán & Ribera 2001. In Morocco, *A. brunneus* as a wide distribution in the north (Benamar 2015). However, we highlighted the presence, particularly in the most eastern zone (Amont Himer) from the study area, of some mixed forms between *A. brunneus* and *A. ramblae* resembling *A. rufulus* Fairmaire, 1859. Unfortunately, we could not preserve any material in pure ethanol from such population that seems crucial to be more precise to disentangle if the studied material really corresponds to *A. brunneus*, *A. ramblae* or *A. rufulus*. It was collected in intermittent streams at the Gourougou and Jbel El Himer (Fig. 10).

**Agabus (Gaurodytes) nebulosus** (Forster, 1771)

**Material examined.** Debdou: 27.04.2016, 1 female; Bassin Oujda: 1-4.12.2015, 1 male, 1 female, 1 larva; Amont O. El Bared: 07.08.2014, 3 males; Douar Ifrane: 07.08.2014, 1 male, 3 females, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** European-Mediterranean species, widely distributed in the Iberian Peninsula (Millán et al. 2014) and northern Morocco (Benamar 2015). It was recorded for the basin of Oued Za in the Oriental Region (Chavanon et al. 2004). It is recorded here for the High Moulouya (Fig. 5) for the first time: specimens were collected in stagnant ponds near the main stream.

**Colymbetes Clairville, 1806**

**Colymbetes fuscus** (Linnaeus, 1758)

**Material examined.** Irhdis: 14.07.2014, 1 male; Mont Gourougou: 5-6-7.02.2015, 3 larvae, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** West Palaearctic species, widely distributed in the Iberian Peninsula (Millán et al. 2014) and the northern Morocco (Benamar 2015). It was recorded from Nador (Bennas & Sàinz-Cantero 2006) and the High Moulouya (Berrahou et al. 2001b). The distribution of the species in the studied region as in Fig. 3.

**Colymbetes schildknechti** Dettner, 1983*

**Material examined.** Amont Himer: 18.11.2015, 1 male, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** West Mediterranean species, known from Corsica, southern Italy including Sicily, southern part of the Iberian Peninsula (Millán et al. 2014) and northwestern Morocco (Benamar 2015). It is a new species for the studied region (Fig. 3).

**Rhantus Dejean, 1833**

**Rhantus (Rhantus) suturalis** (Macleay, 1825)*


**Distribution.** A subcosmopolitan species (Nilsson & Holmen 1995; Balke 2001; Balke & Mazzoldi 2003), known from the northwestern Morocco (Benamar 2015). The distribution of the species in the studied region as in Fig.11.
Meladema Laporte de Castelnau, 1834
Meladema coriacea Laporte de Castelnau, 1835

Material examined. Mont Gourougou: 5-6-7.02.2015, 3 males, 3 females, 3 larvae; Source Himer: 18.11.2015, 2 males, 1 female; A.F. Taybi & Y. Mabrouki leg - Aït Aïssa: 15.06.2014, 1 female; L. Daoudi leg.

Distribution. Mediterranean species, widely distributed in the southern part of the Iberian Peninsula (Millán et al. 2014) and northern Morocco (Benamar 2015). It was recorded for several localities of the studied region by Chavanon et al. (2004). The distribution of the species in the studied region as in Fig. 6.

Subfamily Dytiscinae Leach, 1817
Eretes Laporte de Castelnau, 1833
Eretes sticticus (Linnaeus, 1767)


Distribution. It is a cosmopolitan species, widely distributed in the Old World from the Middle East through North Africa to Cyprus, Cape Verde and the Canary Islands, and in the New World from Peru and the Galápagos Islands to the Virgin Islands of the United States (Miller 2002). It is known from northern Morocco (Benamar 2015), and from the studied area (Chavanon et al. 2004; Bennas & Sáinz-Cantero 2006). The distribution of the species in the studied region as in Fig. 4.

Eretes griseus (Fabricius, 1781)*


Distribution. The species is widely distributed in the Palearctic Region (Miller 2002), known from the Mediterranean parts of the Iberia (Millán et al. 2014) It was recorded from Morocco without a precise locality by Miller (2002) and from the northwestern region by Benamar (2015). It is here recorded for the Moulouya and the Oriental Region (Fig. 11).

Dytiscus Linnaeus, 1758
Dytiscus circumflexus Fabricius, 1801

Distribution. West Palearctic species, known from the Iberian Peninsula (Millán et al. 2014) and from the northern Morocco (Benamar 2015). It was recorded from three localities (Debdou, Tafghalt and the mouth of the Moulouya River (Fig. 9) of the studied region by Chavanon et al. (2004).

Cybister Curtis, 1827
Cybister (Scaphinectes) lateralimarginalis lateralimarginalis (De Geer, 1774) #


Distribution. Ponto-Mediterranean subspecies, widespread in most of the western part of the Palearctic (Kalniņš 1999). The typical form lives in the west Europe and the Mediterranean Region, with the exception of the Middle East and the Crimea, where the typical form mixed with others (Zaitzev 1953). It was recorded by Lindberg (1939) in the vicinity of Oujda (Oriental Region); after 80 years we have rediscovered it in the vicinity of Saidia, in the wetland of Cherraba, which forms part of the SIBE (Sites d’Intérêts Biologique et Ecologique) of Moulouya (Fig. 3).

Cybister (Cybister) tripunctatus africanus Laporte de Castelnau, 1834*

Material examined. Barrage Zelmou: 12.06.2011, 1 male, C. Landsmann leg.

Distribution. Afrotropical-Mediterranean subspecies, distributed mainly in the southern and eastern coastal regions of the Iberian Peninsula (Millán et al. 2014) and northwestern Morocco (Benamar 2015). It is recorded here for the Oriental Region for the first time: the single specimen was collected in the extreme south of the eastern desert at Bouanane (Fig. 10).

Gyrinidae Latreille, 1810
Aulonogyrus Motschulsky, 1853
Aulonogyrus (Aulonogyrus) striatus Fabriciens, 1792

Material examined. Anzar Oufounas: 02.05.2014, 2 larvae; Aval Anzegmir: 02.05.2014, 1 male; MISSOUR: 02.05.2014, 1
female; Moulouya Amont Melloulou: 24.05.2014, 4 males, 2 females; Moulouya Aval Melloulou: 07.06.2014, 2 females; Moulouya Aval Za: 03.04.2014, 2 males, 1 female; O. Charef: 17.05.2014, 2 males; Oued Lakhrouf: 17.05.2014, 3 males, 1 females Pont Gafait: 07.08.2014, 3 males, 2 females; Amont Taourirt: 07.06.2014, 6 males, 2 females; Melg El Ouidane: 19.07.14, 2 females; Sources O. El Bared: 01.06.2014, 2 males, 2 females; Amont O. El Bared: 23.03.2014, 2 males, 2 females, 1 larva; Oued Lakhrouf: 19.07.14, 2 females; Sources Berkine: 27.03.2014, 2 males; Amont Berkine: 15.08.2014, 3 females; Pont O. Zobzit: 23.03.2014, 6 larvae; Confluence Zobzit O. El Bared: 15.08.2014, 2 males, 3 females, 3 larvae; Douar Imzaghrou: 15.08.2014, 2 males; Pont Taddarte: 15.08.2014, 2 males, 1 female; Entrée Guercif: 15.08.2014, 1 male; Oued Ouzej: 30.04.2016, 1 male; Oumassine: 12.05.2016, 1 female; Ain Chabbak: 28.04.2016, 5 males, 6 females; Douar Ifrane: 23.03.2014, 1 male, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** Holomediterranean species; in Iberia it is mainly distributed in the Mediterranean Basin (Millán et al. 2014). It is known from the northern part of Morocco (Benamar 2015) and widely distributed in the studied area (Berrahou et al. 2001b; Chavanon et al. 2004). The distribution of the species in the studied region as in Fig. 7.

**Gyrinus Müller, 1764**

**Gyrinus (Gyrinus) dejeani Brullé, 1832**

**Material examined.** Oued Tifassour: 12.05.2016, 1 female; Debdou: 8.06.2013, 2 males, 1 female, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** Holomediterranean species. It is known from the southern part of the Iberian Peninsula (Millán et al. 2014) and the northern Morocco (Benamar 2015), and widely distributed in the studied area (Bedel 1925; Berrahou et al. 2001b; Chavanon et al. 2004). The distribution of the species in the studied region as in Fig. 8.

**Family Haliplidae C. G. Thomson, 1860**

**Haliplus Latreille, 1802**

**Haliplus (Lyaphlus) mucronatus Stephens, 1832**

**Distribution.** Mediterranean species, known from the eastern part of Iberia (Millán et al. 2014) and northern Morocco (Benamar 2015). It was recorded for Oujda, Oriental Region by Kocher (1958) (Fig. 9).

**Haliplus (Neohaliplus) lineatocollis Marsham, 1802**

**Material examined:** Ait Boulmane: 14.07.2014, 1 larva; Ait Oua Oah: 14.07.2014, 2 males, 2 females, 3 larvae; Arbalou: 03.05.2014, 2 males; Irhdis: 13.06.2014, 4 males, 5 females, 7 larvae; Boumia: 02.05.2014, 2 larvae; Anzar Oufoouns: 02.05.2014, 1 larva; Aval Anzar Oufoouns: 24.05.2014, 4 males, 2 females; Moulouya Aval Melloulou: 07.06.2014, 6 males, 2 females; Moulouya Aval Za: 03.04.2014, 2 males, 1 female; O. Charef: 17.05.2014, 2 males; Oued Lakhrouf: 17.05.2014, 3 males, 1 females Pont Gafait: 07.08.2014, 3 males, 2 females; Amont Taourirt: 07.06.2014, 6 males, 2 females; Melg El Ouidane: 19.07.14, 2 females; Sources O. El Bared: 01.06.2014, 2 males, 2 females; Amont O. El Bared: 23.03.2014, 2 males, 2 females, 1 larva; Oued Lakhrouf: 19.07.14, 2 females; Sources Berkine: 27.03.2014, 2 males; Amont Berkine: 15.08.2014, 3 females; Pont O. Zobzit: 23.03.2014, 6 larvae; Confluence Zobzit O. El Bared: 15.08.2014, 2 males, 3 females, 3 larvae; Douar Imzaghrou: 15.08.2014, 2 males; Pont Taddarte: 15.08.2014, 2 males, 1 female; Entrée Guercif: 15.08.2014, 1 male; Oued Ouzej: 30.04.2016, 1 male; Oumassine: 12.05.2016, 1 female; Ain Chabbak: 28.04.2016, 5 males, 6 females; Douar Ifrane: 23.03.2014, 1 male, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** Holomediterranean species with an extension to the Atlantic Region and central part of the Eastern Europe; it is widely distributed in the Iberian Peninsula (Millán et al. 2014). It was recorded for the northern Morocco (Benamar 2015) and the basin of Zegzel river and Oujda Region (Bedel 1925; Chavanon et al. 2004). We recorded it for the Mediterranean coast of the Oriental Region Morocco and the eastern Middle Atlas (Fig. 8) for the first time.

**Gyrinus urinator Illiger, 1807**

**Material examined.** Arbalou: 13.06.2014, 1 male, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** West Palearctic species, with an extension to the Maghreb. It was recorded from several localities in the northern and southern parts of the Iberian Peninsula (Millán et al. 2014). It was recorded from the northern Morocco by Benamar (2015). The distribution of the species in the studied region as in Fig. 8.

**Gyrinus (Gyrinus) subsstriatus Stephens, 1829**

**Material examined.** Arbalou: 13.06.2014, 1 male, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** West Palearctic species, with an extension to the Maghreb. It was recorded from several localities in the northern and southern parts of the Iberian Peninsula (Millán et al. 2014). It was recorded from the northern Morocco by Benamar (2015). The distribution of the species in the studied region as in Fig. 8.
14.06.2014, 1 female; 7 larvae; Anzegmir Avant Barrage: 15.07.2014, 1 female; Aval Anzegmir: 14.06.2014, 18 males, 25 females; 17 larvae; Pont Hassan II: 18.05.2014, 5 females; Pond O. Charef: 17.05.2014, 1 female; Oued Lakhrouf: 07.08.2014, 1 male; Amont Gafait: 07.08.2014, 2 males, 3 larvae; Pont Gafait: 07.08.2014, 1 male, 2 females, 1 larva; Gafait: 07.08.2014, 3 females; Barrage Za: 17.05.2014, 1 male, 2 females; Confluence Zbzt O. El Bared: 08.06.2014, 2 larvae; Douar Imzaghrou: 15.08.2014, 5 females; Entrée Guercif: 15.08.2014, 3 males, 3 females; Source Zeghzel: 01.02.2015, 2 males, 2 larvae; Oued Ouzej: 30.04.2016, 1 larva; Mariouari: 12.05.2016, 2 males, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** Palaearctic-Afrotropical species. It is one of the most common aquatic beetles in the Iberian Peninsula (Millán et al. 2014) and the northern Morocco (Benamar 2015). The species was recorded for Oujda in the Oriental Region (Bedel 1925; Chavanon et al. 2004).

**Peltodytes Régimbart, 1878**

**Peltodytes caeus (Duftschmidt, 1805)**

**Distribution.** Palaearctic species, with a very fragmented distribution in the Iberia (Millán et al. 2014) and the northern part of Morocco (Benamar 2015). The species was recorded for Oujda in the Oriental Region (Bedel 1925; Chavanon et al. 2004).

**Peltodytes rotundatus (Aubé, 1836)**

**Material examined.** Arbalou: 14.07.2014, 1 male 1 female 10 larvae; Bounia: 15.07.2014, 4 larvae; Aval Anzegmir: 15.07.2014, 4 larvae; Confluence Zobzit O. El Bared: 15.08.2014, 1 male; Douar Imzaghrou: 15.08.2014, 1 male, 1 female, A.F. Taybi & Y. Mabrouki leg.

**Distribution.** Holomediterranean species, widely distributed in Iberia (Millán et al. 2014) and northern Morocco (Benamar 2015). It was recorded for the studied area by Bedel (1925) and Chavanon et al. (2004). The distribution of the species in the studied area as in Fig. 8.

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**Fig. 2.** Distribution of *A. bipustulatus, A. biguttatus, A. didymus, A. nebulosus* and *B. minutissimus* (new records in red, old records in black).
Fig. 3. Distribution of *C. fuscus*, *C. schildknechti*, *C. lateralimarginalis*, *D. fairmairei* and *D. moestus* (new records in red, old records in black)

Fig. 4. Distribution of *E. sticticus*, *H. confluens*, *H. geminus*, *H. signatellus* and *H. musicus* (new records in red, old records in black)
New data on the distribution of aquatic beetles from Morocco (Coleoptera, Adephaga: Gyrinidae, Halip lidae...)

Fig. 5. Distribution of *H. lucasi*, *H. pubescens*, *H. discretus* and *I. chalconatus* (new records in red, old records in black).

Fig. 6. Distribution of *L. hyalinus*, *L. minutus*, *M. coriacea*, *N. clarkii* and *N. cercysyi* (new records in red, old records in black).
Fig. 7. Distribution of *G. varius*, *G. ignotus*, *S. optatus*, *Y. bicarinata* and *A. striatus* (new records in red, old records in black).

Fig. 8. Distribution of *G. substriatus*, *G. urinator*, *G. dejeanii*, *H. lineatocollis* and *P. rotundatus* (new records in red, old records in black).
Fig. 9. Distribution of *B. coxalis*, *D. circumflexus*, *H. marginatus*, *H. clypealis*, *H. mucronatus*, *P. caeus*, *S. halensis*, *H. major* and *S. procerus* (literature data; not confirmed by a new material).

Fig. 10. Distribution of *A. brunneus*, *C. africanus*, *G. flavipes*, *H. aubei* and *S. maghrebinus*
Fig. 11. Distribution of *E. griseus*, *G. aequalis*, *N. nemethi*, *R. suturalis* and *S. escheri*

Fig. 12. Chorological categories of the studied species.
DISCUSSION

Based on the new and published data, Oriental Region of Morocco and the basin of Moulouya River is inhabited by 55 species of aquatic adephagous beetles (excluding Noteridae).

The most interesting species are Hydroglyphus signatellus, Hydroporus planus, H. discretus, Graptodytes ignotus, Agabus biguttatus, Gyrinus substriatus are new to the watershed of the Moulouya. While Graptodytes flavipes, G. aequalis, Stictonectes escheri, Rhantus suturalis, Cybister tripunctatus africanus, Eretes griseus and the Moroccan endemic Nebrioporus nemethi are new to the entire study area. Finally, Agabus bipustulatus and Cybister laterimarginalis laterimarginalis are rediscovered after 90 and 80 years of absence respectively.

The stand composition of the Oriental Morocco and the watershed of the Moulouya, can be subdivided into three main chorological categories (Fig. 12): the Mediterranean that are slightly dominant and which constitute 42% of the recorded species; Followed by the Palearctic corotype which constitutes 37%. While the Cosmopolitan elements and those whose distribution extends beyond the Mediterranean either in India or in the Afrotropicale region comes in the third place (21%). Within the Mediterranean Hydradephaga’s elements, it has a clear predominance of the West-Mediterranean corotype (55%), followed by the Holomediterranean corotype (27%) and finally the Endemic in the broadest sense (18%). Despite being a Maghrebian country, the Ibero-Maghrebian endemics outweigh the Maghrebian endemics; this same remark was made for the Adephaga of all the Moroccan territory (Benamar, 2015).

A dozen species mentioned early in the Oriental region have not been found (Fig. 9), our study clearly demonstrates that a reduction in permanent water bodies, notably with the drying up of several wadis between 80-90 years (Isly wadi, source of Sidi Yahya and its tributary, etc.). With the drying up goes the disappearance of all the wildlife that characterized these environments. Many species of beetles see their regional distribution greatly reduced, this same finding was observed for other macroinvertebrates (Mabrouki et al. 2016b, 2017b; Taybi et al. 2017).

REFERENCES


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Appendix. The prospected stations with indications of the locality, altitude, geographic coordinates and type of the aquatic environment (pp. 105 - 106)
New data on the distribution of aquatic beetles from Morocco (Coleoptera, Adephaga: Gyrinidae, Halipidae...)

<table>
<thead>
<tr>
<th>Stations</th>
<th>GPS</th>
<th>Alt (m)</th>
<th>Sampling dates</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aït Bouلمane</td>
<td>32°36'56.6&quot; N 5°19'49.2&quot; W</td>
<td>1650</td>
<td>03.05.14-13.06.14-14.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Aït Oha Ohaïki</td>
<td>32°37'28.7&quot; N 5°18'32.8&quot; W</td>
<td>1640</td>
<td>03.05.14-13.06.14-14.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Source Arbalou</td>
<td>32°40'33.4&quot; N 5°17'20&quot; W</td>
<td>1670</td>
<td>03.05.14-13.06.14-14.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Krouchene-Ifridis</td>
<td>32°44'49.6&quot; N 5°10'17.1&quot; W</td>
<td>1616</td>
<td>03.05.14-13.06.14-14.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Boumia</td>
<td>32°43'3.4&quot; N 5°55'2.7&quot; W</td>
<td>1515</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Zaïda</td>
<td>32°49'3&quot; N 4°57'33&quot; W</td>
<td>1455</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Anzar Oufounas</td>
<td>32°25'45&quot; N 5°9'24.8&quot; W</td>
<td>1895</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>NS</td>
</tr>
<tr>
<td>Aval Anzar Oufounas</td>
<td>32°28'41.66&quot; N 5°8'53.42&quot; W</td>
<td>1780</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Anzegmir avant barrage</td>
<td>32°31'4.1&quot; N 5°5'3.2&quot; W</td>
<td>1702</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Aval Anzegmir</td>
<td>32°44'32&quot; N 4°54'51&quot; W</td>
<td>1455</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Tamatlalt</td>
<td>32°52'43.86&quot; N 4°14'16.4&quot; W</td>
<td>985</td>
<td>02.03.14-14.06.14-15.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Missour</td>
<td>33°3'7.96&quot; N 3°58'41.7&quot; W</td>
<td>870</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>RV</td>
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<tr>
<td>Outat Al Haj</td>
<td>33°19'46.8&quot; N 3°42'14.2&quot; W</td>
<td>770</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>RV</td>
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<td>Tindint</td>
<td>33°39'11&quot; N 3°35'20.6&quot; W</td>
<td>640</td>
<td>02.05.14-14.06.14-15.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Moulouya amont Mellouliou</td>
<td>34°12'59.3&quot; N 3°21'6.8&quot; W</td>
<td>362</td>
<td>23.03.14-24.05.14-07.07.14</td>
<td>RV</td>
</tr>
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<td>Moulouya Aval Mellouliou</td>
<td>34°14'29.86&quot; N 3°19'13.4&quot; W</td>
<td>355</td>
<td>23.03.14-24.05.14-07.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Moulouya Amont Za</td>
<td>34°33'36.3&quot; N 3°2'33.4&quot; W</td>
<td>230</td>
<td>23.03.14-24.05.14-07.07.14</td>
<td>RV</td>
</tr>
<tr>
<td>Moulouya aval Za</td>
<td>34°33'41.09&quot; N 3°1'49.77&quot; W</td>
<td>222</td>
<td>03.04.14-24.05.14-22.06.14</td>
<td>RV</td>
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<tr>
<td>Sebra</td>
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<td>60</td>
<td>03.04.14-24.05.14-22.06.14</td>
<td>RV</td>
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<tr>
<td>Safsaf</td>
<td>34°54'27.53&quot; N 2°38'8.86&quot; W</td>
<td>50</td>
<td>18.03.14-18.05.14-23.06.14</td>
<td>RV</td>
</tr>
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<td>Pont Hassan II</td>
<td>35°35'7.5&quot; N 2°25'42.4&quot; W</td>
<td>9</td>
<td>18.03.14-18.05.14-23.06.14</td>
<td>RV</td>
</tr>
<tr>
<td>Pré-Estuaire</td>
<td>35°5'51.4&quot; N 2°23'19&quot; W</td>
<td>3</td>
<td>18.03.14-18.05.14-23.06.14</td>
<td>RV</td>
</tr>
<tr>
<td>Sources O. El Bared</td>
<td>33°54'40.2&quot; N 4°24'0.7&quot; W</td>
<td>931</td>
<td>27.03.14-01.06.14-11.07.14</td>
<td>RV+NS</td>
</tr>
<tr>
<td>Amont O. El Bared</td>
<td>33°58'59.01&quot; N 3°52'15.8&quot; W</td>
<td>630</td>
<td>23.03.14-08.06.14-07.08.14</td>
<td>RV</td>
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<tr>
<td>Douar Ifrane</td>
<td>34°22'0.8&quot; N 3°46'34.1&quot; W</td>
<td>570</td>
<td>23.03.14-08.06.14-07.08.14</td>
<td>RV</td>
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<tr>
<td>Sources Berkine</td>
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<td>1150</td>
<td>22.03.14-14.06.14-07.08.14</td>
<td>RV+NS</td>
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<td>Amont Berkine</td>
<td>33°48'58.2&quot; N 3°47'7.4&quot; W</td>
<td>970</td>
<td>27.03.14-15.06.14-15.08.14</td>
<td>RV</td>
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<tr>
<td>Pont O. Zbbit</td>
<td>34°1'36.6&quot; N 3°45'38.6&quot; W</td>
<td>595</td>
<td>23.03.14-08.06.14-15.08.14</td>
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<td>Confluence Zbbit O. El Bared</td>
<td>34°3'02.5&quot; N 3°46'34.1&quot; W</td>
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<td>23.03.14-08.06.14-15.08.14</td>
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<td>Douar Izmaghrou</td>
<td>34°5'15.75&quot; N 3°53'14.7&quot; W</td>
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<td>RV</td>
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<td>34°12'53.5&quot; N 3°23'34.1&quot; W</td>
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<td>925</td>
<td>19.03.14-17.05.14-07.08.14</td>
<td>RV+NS</td>
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<td>Pond O. Charef</td>
<td>33°59'33.1&quot; N 2°4'11&quot; W</td>
<td>918</td>
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<td>Medium</td>
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<td>542</td>
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</table>

**Abbreviations.** M: station at the Moulouya Wadi; S: station at Melloulou River; Z: station at ZA river; N: station at Nador province; O: station at Oujda province; F: station at Figuiu province; DM: dam; AQ: abandoned quarry; AC: artificial channel; AP: artificial pond; RV: river; LG: Lagoon; PD: pond; AS: arranged source; NS: natural source.  

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