Studies on riparian communities in eastern Morocco: coastal dayas at the mouth of the Moulouya River

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Abstract. This paper aims to study the riparian community of coastal dayas at the mouth of the Moulouya River in the northeast of Morocco. We carried out a monthly sampling of riparian fauna on two dayas (EMDI & EMDII) on the Mediterranean coast. Banks of these dayas are an ecotone where terrestrial, riparian, and aquatic species mix. Riparian species dominate the population in richness and abundance: most species are either sporadic (EMDI) or accidental (EMDII). The dominant species are halophilous. Interesting species have been collected from these dayas: *Gonocephalum yelamosi*, new species for Morocco, *Blaps nitens*, *Dyschirius tensicollis,* and D*yschirius africanus,* which dayas is a new distribution in the region. Species with the same ecological niches that can compete with each other seem to share the occupation of this environment. The same phenomenon seems to occur for species of the genus *Pogonus* and *Pogonistes*, which have populations that reach their maximum expansion at different periods.

1 Introduction

Riparian communities are made up of species that colonize the wet banks of aquatic environments (ocean, river, torrent, the body of water, dayas, etc.) whatever its size and as long as it is not dried up.

They are colonized by a diversified population, a mixture of terrestrial, riparian, and aquatic origins. They are highly migratory species that can leave the environment as soon as conditions become unfavorable and recolonize others just as quickly. These communities depend on their environment and have rigorous ecological and ethological requirements, making them very originals. They are a diversified mixture of species of terrestrial, riparian, and aquatic origins. The temporary nature and instability of the colonize environments have led them to adapt both ethologically, ecomorphological, and ecophysiologically. This gives them certain originality.

The limited Spatio-temporal position of these habitats allows a comprehensive study of the functioning of their communities. The results thus obtained can easily be extrapolated to more significant situations and applied to more general ecological theories [1].

This particular environment will be the subject of this study. It aims to contribute to the knowledge of riparian environments in general and coastal environments in particular.

2 Materials and methods

2.1 Study area

The two dayas studied are temporary coastal water bodies fed mainly by rainwater (EMDI and EMDII) and groundwater. They dry up in summer (EMDI). They are located near the mouth of the Moulouya (Fig. 1).

Embouchure's Daya I (EMDI) is 200m long and 70m wide and is relatively deep. Its water is salty with a neutral pH, and the substrate is sandy to sandy-silt with a neutral pH. It appears in winter (January) and dries up in summer (July). The riparian vegetation consists mainly of *Salicornia sp*. The banks are narrow and sloping at the beginning and become more comprehensive as it dries out.

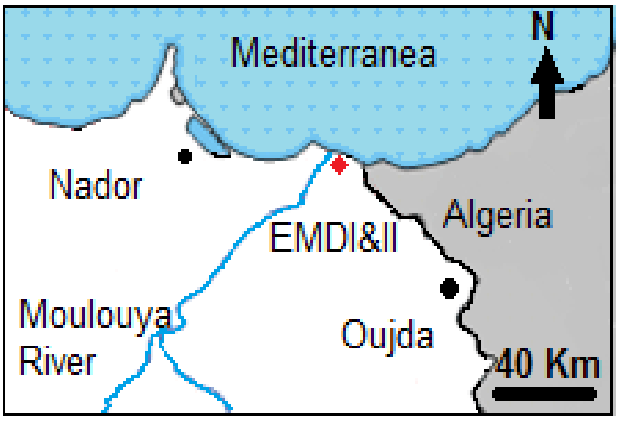

Fig. 1. The geographical location of the study area

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Embouchure's Daya II (EMDII) is a very shallow daya, which reaches a maximum length of 90m and a width of 35m (January) and dries out in late spring (May). It has salty water with a neutral pH and a silty to a sandy-silty substrate with a neutral pH. Its banks are affluent in organic matter and plant debris.

2.2 Sampling

Surveys were carried out monthly for two consecutive years (two sampling campaigns).

Harvesting was carried out by direct sight hunting during a one-hour active search [2]. All shelters were surveyed, and all fauna found on the banks were collected.

The identifications of Caraboidea were carried out using Antoine's keys [3-7], the other groups were submitted to several specialists.

3 Results and discussion

Thirty-four species were collected on the banks of the coastal dayas of the Embouchure, 27 species on EMDI (Table 1), and 18 species on EMDII (Table 2).

Table 1. Species recorded in EMDI

	Abundance
CARABOIDEA	
Tachys scutellaris dimidiatus	198
Pogonus chalceus	171
Pogonus gilvipes	143
Pogonistes gracilis	68
Syrdenus grayi	49
Emphanes normanus	34
Notaphus ephippium	24
Trichis maculata	12
Cicindela maura	10
Cephalota litorea goudoti	7
Dichirotrichus obsoletus	7
Pogonus luridipennis flavipennis	6
Dyschirus dalila	4
Lophyridia lunulata	3
Dyschirus clypeatus	2
Daptus vittatus	2
Microlestes luctuosus	1
Emphanes lais	1
TENEBRIONIDAE	
Blaps nitens	1
STAPHYLINIDAE	
Bledius bicornis	11
Bledius (Bledius) unicornis	7
Bledius (Euceratobledius) furcatus	4
Bledius (Bledius) angustus	1
Aloconota gregaria	1
DYTISCIDAE	
Agabus didymus	2
Nebrioporus ceresyi	1
HYDROPHILIDAE	
Helochares lividus	4

A new species (*Gonocephalum yelamosi*) for Morocco has been collected from these dayas. In Morocco, they also represent a new station for *Blaps nitens* and a new station, in the region, for *Dyschirius tensicollis* and *Dyschirius africanus*.

Table 2. Species recorded in EMDII

	Abundance
CARABOIDEA	
Dichirotrichus obsoletus	22
Pogonus gilvipes	12
Syrdenus grayi	10
Dyschirus numidicus	10
Tachys scutellaris dimidiatus	9
Lophyridia lunulata	4
Trichis maculata	2
Cicindela maura	2
Dyschirus clypeatus	1
Dyschirus africanus	1
Dyschirus tensicollis	1
STAPHILINIDAE	
Bledius (hesperophillus) debilis	41
Bledius (Euceratobledius) furcatus	2
Platysthetus nitens	1
TENEBRIONIDAE	
Gonocephalum yelamosi	1
Pachychila haroldi	1
Blaps nitens	1
DYTISCIDAE	
Nebrioporus ceresyi	2

The *Caraboidea*, with *Trechidae* and *Scaritidae* families, represent the main component of this type of environment, as in the case of the Spanish salt lagoons [8, 9].

Riparian species dominate the community in terms of both richness and abundance. They have an abundance of 99% (EMDI) to 93% (EMDII) of riparian species with 22 (78%) and 14 (75%) species, respectively. The remainder is distributed between species of terrestrial or aquatic origin.

The majority of species are either sporadic (EMDI, frequency<10%) or accidental (EMDII, 25%>frequency>10%) according to Facet's classification [10]. Very few of them are constant, with a frequency >50%, in the environment (table 3). These are generally halophilic species. On the other hand, diversity (according to the H index of Shannon and Wever [10]) reaches more than 3 bits, and the equitability varies between 67.2% (EMDI) and 80.5% (EMDII).

Table 3. Constant species in EMDI et EMDII

	EMDI	**EMDII**
T. scutellaris dimidiatus	+	.
P. chalceus	+	.
P. gracilis	+	.
P. gilvipes	+	.
S. grayi	+	.
D. obsoletus	.	+

Furthermore, the stability coefficient (according to Gautier [11]) is 1.65 and 1.35 in EMDI and EMDII stations, which are relatively stable communities. This indicates that the same species contingent dominates these stations and is found in successive samplings.

Despite their low abundance, tiger beetles appear successively in the banks of both dayas (Fig. 2 and 3).

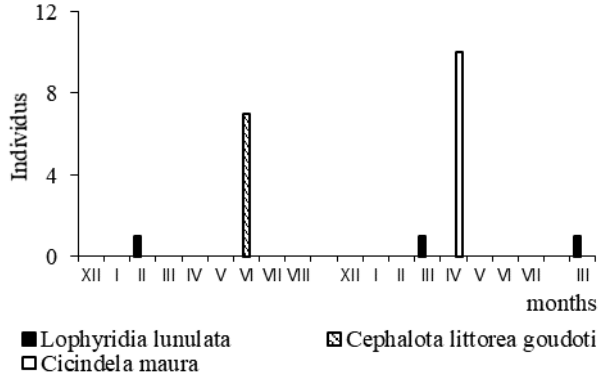

Fig. 2. Presence of Tiger beetles on the banks of daya EMDI depending on the month

Thus, *L. lunulata* is present during February and March, *C. maura* during April, and *C. littorea goudoti* during July. However, this succession was not noted by Chavanon [12], who observed the coexistence of tiger beetles on the banks of Moulouya River in perennial stations very close to ours.

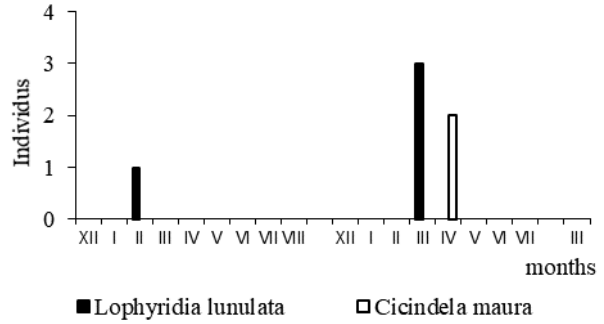

Fig. 3. Presence of Tiger beetles on the banks of daya EMDII depending on the month

A similar phenomenon occurs for species of genus *Pogonus* and *Pogonistes*. Indeed, it can be seen that despite an overlap in their period of presence on the banks of the EMDI daya, the populations reach their maximum expansion at different periods (Fig. 4).

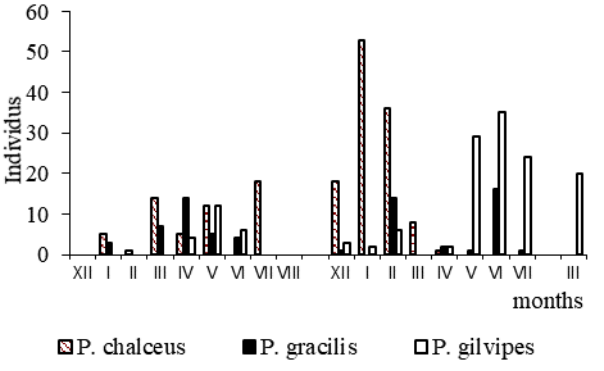

Fig. 4. Presence of some species on the banks of daya EMDI depending on the month

In the campaign I, *P. chalceus* dominates during July, while *P. gilvipes* peaks in May and *P. gracilis* during April.

In campaign II, a clear division of the proliferation period between P. chalceus dominates from December to March, and *P. gilvipes*, which proliferates from May onwards. *P. gracilis* is dominant in the middle of the cycle in both campaigns.

4 Conclusion

Banks of coastal dayas at the mouth of Moulouya are colonized by a diversified community, a mixture of species of terrestrial, aquatic and riparian origin. The latter dominate by their richness and abundance. They belong to *Trechidae* and *Scaritidae* families (*Caraboidea*) specialized in this type of environment [8, 9].

Constant species are not numerous and are halophilic species adapted to extreme conditions of these hypersaline environments.

Another type of adaptation characterizes these environments. It appears as a precise succession of tiger Beetles, as described in Spain [13], and a separate proliferation in time for Pogonus and Pogonistes. This is a particular phenomenon specific to temporary riparian environments. Indeed, these biotopes are very limited in space and time, and they force their populations to accelerate their life cycles so that species with the exact ecological requirements can succeed without competing.

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