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Ecological types of riparian's insects Carabidae beetles of Lake Dayat Aoua (Atlas Morocco)

Khalid BOURAADA*(1), Mariam ESSAFI(1,2), Guy CHAVANON(3) AND Abdelatif JANATI IDRISSI (1)

(1) University of Sidi Mohamed Ben Abdellah, Faculty of Science Dhar El Mehraz Fes (F.S.D.M.), Department of Biology, Morocco.
(2) Regional Department of Health Fes-Meknes of the Ministry of Health, Department of Public Health and Epidemiological Surveillance Regional, Laboratory of Epidemiology and Environmental Hygiene, Morocco.
(3) Faculty of Science of Oujda. Mohammed Premier University, Morocco.

*Auteur correspondant
Courriel: *khbouraada@laposte.net*

Abstract

In our inventory, the majority of species are of Mediterranean origin :this is the case of *Amara (Amara) aenea, Brachinus (Brachynidius) SchopandaFabricius, Chlaenius (Chlaenius) festivusvelutinus, Harpalus (Harpalus) attenuatus.*.etc. While European species come in second place and are present for a simple proportion :*Chlaenius (Chlaeniellus) olivieri, Chlaenius (Trichochlaenius) chrysocephalus, Harpalus (Harpalus) oblituspatruelis,*… etc.The analysis of the global faunistic composition of the Dayat Aoua carabics species is characterized by the determination of a collection of 1129 individuals belonging to 34 species unequally represented between 9 subfamilies and 11 tribes. The intervention of the regional climate the physicochemical characteristics of the soil can be the main factors which determine the composition of this biocenosis and its local and regional distribution and also the origin of its heterogeneity. The ecological type of the fauna we encountered is composed of a mixture of riparian species sensu-stricto : (*Acupalpus (Acupalpus) maculatus, Paranchusalbipes, Bembidion (Mandallina) lampros,*…etc and hygrophilous species (*Chlaenius (Chlaenites) spoliatusspoliatus, Chlaenius (Chlaenius) festivusvelutinus, Chlaenius (Chlaeniellus) olivieri*…etc.

Keywords: Biotypology, carabidae species, Dayat Aoua.

Introduction

Morocco is North Africa's best-endowed country in continental waters. The great spatial variability of the climatic and geological conditions accentuates this richness by creating very varied types of aquatic ecosystems such as lakes rivers and calcareous mountain springs up to 'merjas' and the Saharan sebkhas.

Through its different ecological and national and socioeconomic roles mainly in the field of ecotourism, the lake Daya Aoua is one of the most important wand lands in the Middle Atlas of Morocco (Chilasse and *al*. 1999, 2001).

The beetlescarabidae riparian ripicols are part of the diversity of this lake and belong to the family Carabidae the richest species(Bouraada and Essafi 2017).

The Carabicdae beetles are part of the animal kingdom phylum Arthropoda class Insects order beetles and family Carabidae.

The cycles of seasonal activity are also very variable from one species to another.Thiele (1977) suggests at least three categories of breeding periods:

a) Larval wintering species divided into species that go dormant during the summer and those who do not celebrate.

b) The second group of species is a species that has a very flexible annual cycle and breeds in both spring and autumn.

c) The last group consists of species whose life cycle is spread over several years Larsson (1939) and Lindroth (1945).

There are more than 40 000 widely distributed species in the world (Loreau 1984,Agray and Bigot 1984, Bigot 1978).

Material and Methods

Study site

The water lakeDayat Aoua is located in the West part of the Middle Atlas. It is the most reputed lake of Morocco it is located 15 km from the city of Ifrane and belongs to the rural town Dayat Aoua (Ifrane Province). It has an area of 157 ha and a maximum depth of 4.5m (Khodari 1983) and is part of the great water basin of Sebou which is one of the largest basins of Morocco because it contains nearly one third (1/3) of the surface water and 20% of the groundwater of the country (Khodari 1983;Chillasseand*al*. 2001).Their coordinates are 32° 58'Northand 05° 27'West and at 1462m of altitude.

Figure 1.Location of Lake Dayat Aoua (*in* Bouraada and *al.*, 2018)

Faunistic and floristic characteristics of the Lake Dayat Aoua

The water lake Dayat Aoua is in the vicinity of Jbel Aoua which is characterized by the presence of the Green oak (*Quercus Ilex*). The edges of the lake are planted by the poplar tree and a few willow feet that form a belt around the lake. The Dayat Aoua water lake presents a very diversified and emergee flora especially during the spring season such as *Myriophyllum spicatum, Juncus bufonicas, carex* sp., *Polygonum amphibium, Ranunculus millifoliatus, Scirpus lacustris, Phragmits communus* and *Typha* sp. The aquatic fauna from Lake has significant biological diversity fish fauna and birdlife.

The Ecosystem Dayat Aoua is classified among the Sites of Organic and Ecological Interest (SIBE) at the national and international scale. The fish fauna of the lake presents varied populations. The specific composition of the fish populations classifies Lake Dayat Aoua among the *Cyprinoesoxiens* lakes. It should be noted that the native fish fauna of the various Middle Atlas lakes was poor and limited to a species of cyprinid (*Barbuscallensis*) and two species of salmonids (*Salmofario v. macrostigma* and *Salmofario v.pallaryi*). For enrichment of the biodiversity of lakes the administration of water and forests has acclimated since 1921 several species including 26 species of fish and two species of crayfish (Mouslih 1987).

Of the different species introduced only 11 are acclimated to the natural waters of the lakes of the Middle Atlas but the acclimatization of the cyprinids has resulted in the disappearance of the *Salmofario v.pallaryi* trout formerly very abundant at the two lakes of Sidi Ali and Tiguelmamines (Vivier 1948).

Mandhod of sampling beetles

To have a faunistic image as complete as possible of the beetle fauna in Dayat Aoua Lake. We used a few techniques such as :

View Hunting

View Hunting Day View allows you to collect live species Carabidae invertebrates seen on the ground under the litter under stones and all parts of the plants in place and thus offer the possibility of releasing them in the case where their identification can be carried out on the spot. However, this technique has the disadvantage of missing discrete species, rare or well located too deep in the soil (Bouraada and *al*. 2018).

Pieging

The use of interception traps (Barber traps) (Bouraada 2003) is a commonly used method for capturing insects that move on the soil surface, particularly the carabidae beetles. These are pots (plastic drink cups) buried so that their edges are flush with the ground the insects are intercepts and fall directly into them. These pots may also contain a liquid mixture. The attractive liquid used is a mixture of beer salt and water (Figure 2).

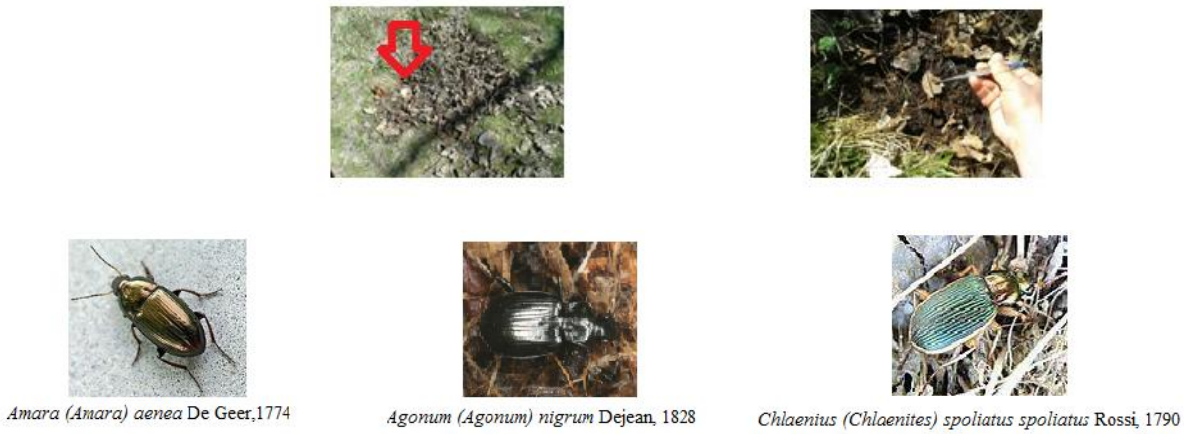

Figure 2. Harvest and Barber Ground Pike (Bouraada and *al*. 2018)

The effectiveness of this method has been demonstrated by many authors: (Agray and Bigot (1984),Ramade (1987),Chavanon (1992),Chavanon and Chavanon (1992),Bouraada (1994),Bouraada (1999).It makes it possible to know very complex stands and to obtain an image of the numerical variation of insects (Bouraada and *al.* (2018),Bouraada and *al*. (2016), Bouraada and *al*. (2015), Bouraada and *al*. (2014), Bouraada (2003), Chavanon and Bouraada (1996), Southwood (1966), Malfait and Beart (1969), Mathey and *al*. (1984), Holopainem and Koponen (1986), Agray and Bigot (1984), Remade (1987), Chavanon (1992), Chavanon and Chavanon, (1992), Bouraada (1994), Bouraada (1996), Bouraada (1999).

The identification of the sample takes place then by the use of specialized works and publications (Antoine 1955-1962,Bedel 1895, Chatenand 2005 and Jeannel 1941, 1942) by comparison with reference samples where possible. Some species are difficult to identify because they are part of large, very homogeneous groups, and in this case, the determination by specialists (Chavanon 1994).

Results and Discussion

Biogeographic gradient of inventory species

The analysis of the global faunal composition led to the determination of a collection of 1129 individuals belonging to 34 species equally represented between 9 subfamilies and 11 tribes. All the species inventoried in this study are mostly determined up to the specific level (Table I) (Bouraada and *al*. 2018,Bouraada and *al*. 1999, Bouraada 1996, Bigot and Aguesse 1984).

Table I, distribution of inventories according to the biogeographic gradient.

Family	**Subfamily**	**Tribe**	**species**	**Repartition**
RABIDAE	PLATYNINAE	PLATYNINI	*Agonum (Agonum) nigrum* Dejean, 1828	Atlanto-Mediterranean
CARABIDAE	PTEROSTICHINAE	PTEROSTICHINI	*Poecilus (Poecilus) quadricollis* Dejean, 1828	bandicoMaghreb
CARABIDAE	PTEROSTICHINAE	PTEROSTICHINI	*Corax (Sterocorax) globosus* Fabricius, 1792 (s. lat.)	Extensive bandico-rifain (Ibero-Moroccan)
CARABIDAE	CALLISTINAE	CHLAENIINI	*Chlaenius (Chlaenites) spoliatusspoliatus* Rossi, 1790	from the Canaries to Central Asia
CARABIDAE	PLATYNINAE	SPHODRINI	*Calathus (Neocalathus) melanocephalusantoinei*Puel, 1939	Endemic to the Moroccan Atlas
CARABIDAE	HARPALINAE	HARPALINI	*Harpalus (Harpalus) landhierryiazrouanus* Emden andSchauberger, 1932	Endemics of Middle and High Atlas
CARABIDAE	PTEROSTICHINAE	PTEROSTICHINI	*Pterostichus (Melanius) aterrimussurcoufi* Antoine, 1933	Endemics of Middle and High Atlas
CARABIDAE	HARPALINAE	HARPALINI	*Harpalus (Harpalus) distinguendusdistinguendus*Duftschmid, 1812	Eurasia
CARABIDAE	TRECHINAE	BEMBIDIINI	*Bembidion (Mandallina) lampros*Herbst, 1784	Eurasia
CARABIDAE	PTEROSTICHINAE	ZABRINI	*Amara (Amara) aenea* De Geer, 1774	Euro-Maghreb
CARABIDAE	BRACHININAE	BRACHININI	*Brachinus (Brachynidius) sclopanda* Fabricius, 1792	Euro-Mediterranean
CARABIDAE	CALLISTINAE	CHLAENIINI	*Chlaenius (Chlaenius) festivusvelutinus*Duftschmid, 1812	Euro-Mediterranean
CARABIDAE	HARPALINAE	HARPALINI	*Harpalus (Harpalus) attenuatus* Stephens, 1828	Euro-Mediterranean
CARABIDAE	PLATYNINAE	PLATYNINI	*Paranchusalbipes Fabricius*, 1792	Euro-Mediterranean
CARABIDAE	HARPALINAE	HARPALINI	*Stenolophus (Egadroma) marginatum* Dejean, 1829	Europe, Mediterranean and Asia

CARABIDAE	HARPALINAE	HARPALINI	*Acupalpus (Acupalpus) maculatus*Schaum, 1860	Europe, Mediterranean and Maghreb
CARABIDAE	CALLISTINAE	CHLAENIINI	*Chlaenius (Chlaeniellus) olivieri* Crotch, 1871	Western Europe Maghreb
CARABIDAE	CALLISTINAE	CHLAENIINI	*Chlaenius (Trichochlaenius) chrysocephalus* Rossi, 1790	Europe occidentale, Maghreb
CARABIDAE	HARPALINAE	HARPALINI	*Harpalus (Harpalus) oblituspatruelis* Dejean, 1829	Europe occidentale, Maghreb
CARABIDAE	TRECHINAE	BEMBIDIINI	*Asaphidionrossii*Schaum, 1857	Europe NorthAfrica
CARABIDAE	PLATYNINAE	PLATYNINI	*Agonum (Agonum) marginatum*Linnaeus, 1758	Europe, Maghreb, Canaries Madeira, Azores
CARABIDAE	NEBRIINAE	NEBRIINI	*Nebria (Nebria) andalusia*Rambur, 1837	Ibero-Maghreb
CARABIDAE	HARPALINAE	HARPALINI	*Anisodactylus (Anisodactylus) heros* Fabricius, 1801	Ibero-Maghreb
CARABIDAE	LEBIINAE	GRAPHIPTERINI	*Graphipterusexclamationisexclamationis* Fabricius, 1792	Maghrebine
CARABIDAE	PLATYNINAE	SPHODRINI	*Calathus (Calathus) fuscipesalgiricus* Gautier des Cottes, 1866	Maghrebine
CARABIDAE	PLATYNINAE	SPHODRINI	*Calathus (Baandicocalathus) opacus* Lucas, 1846	Maghrebine
CARABIDAE	HARPALINAE	HARPALINI	*Ophonus (Ophonus) rotundicollis*FairmaireandLaboulbène, 1854	Western Mediterranean
CARABIDAE	PTEROSTICHINAE	PTEROSTICHINI	*Poecilus (Carenostylus) purpurascenspurpurascens* Dejean, 1828	Western Mediterranean
CARABIDAE	PTEROSTICHINAE	ZABRINI	*Amara (Amara) subconvexa*Putzeys, 1865	Western Mediterranean
CARABIDAE	HARPALINAE	HARPALINI	*Stenolophus (Stenolophus) teutonus*Schrank, 1781	Palaearctic
CARABIDAE	CARABINAE	CARABINI	*Calosoma (Caminara) olivieri* Dejean, 1831	south-mediterraneanregion
CARABIDAE	HARPALINAE	HARPALINI	*Pseudoophonusrufipes* De Geer, 1774	south-mediterraneanregion
CARABIDAE	TRECHINAE	BEMBIDIINI	*Bembidion (Notaphus) varium* Olivier, 1795	wide distribution

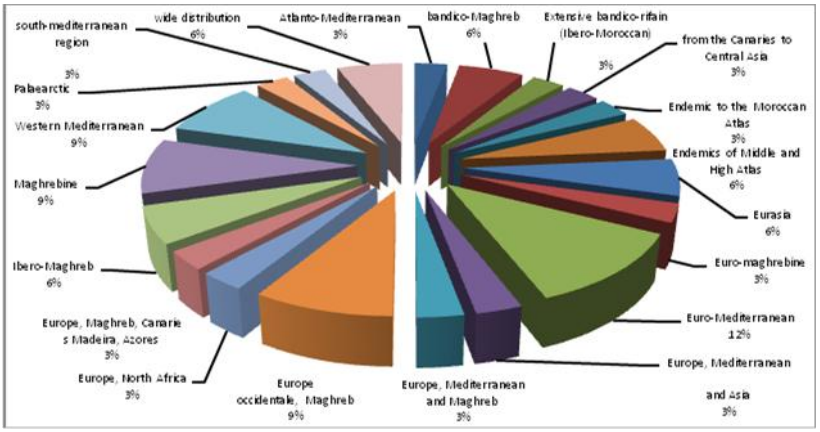

Figure 3. Spectrum of the biogeographic representation of inventoried species

The Figure 3 shows these results in the form of a spectrum that specifies the importance of this geographical distribution. In Base Durance, European species represent 55, 81%, on the other hand, the Mediterranean species are poorly represented with only 25,59% (Favand 1984). It seems normal, for communities with a high water requirement, that their majority is of European rather than Mediterranean origin, the species of which are generally adapted to a dry climate.

Indeed, new species I notice in our inventory that the majority of specimens are of Mediterranean origin, which is the case of *Amara (Amara) aenea, Brachinus (Brachynidius) SchopandaFabricius, Chlaenius (Chlaenius) festivusvelutinus, Harpalus (Harpalus) attenuatus, Paranchusalbipes, Stenolophus (Egadroma) marginatum, Acupalpus (Acupalpus) maculatus, Chlaenius (Chlaeniellus) olivieri, Chlaenius (Trichochlaenius) Chrysocephalus*. Then that the European species are present for a simple proportion :*Chlaenius (Chlaeniellus) olivieri, Chlaenius (Trichochlaenius) chrysocephalus, Harpalus (Harpalus) oblituspatruelis, AsaphidionRossii, Agonum (Agonum) marginatum,* who is logical of the geographical point of view of the location of our station of study and are part of to the bio-climatic stage Euro-Mediterranean.

The vast majority of riparian species encountered are carnivorous, phytophagous or scavenger; be omnivorous. Hence the problem of trophic relations that arises within biocenosis taken in a broad sense.The presence of Collembola, Diptera larvae, stranded aquatic animals and phytophagous insects that have fallen from the nearby ripicilve may constitute a significant contribution of food. But many remains and various debris (legs, elytra etc. prove that predation within the community is important.

With respect to environmental factors Den boer (1980, 1985, 1986) believes that biotic factors such as competition play only a minor role and that we should do well to talk about the principle of coexistence rather than that of competition-exclusion. On the other hand, in turn, Loreau (1984, 1987) and Müller (1985, 1987) observe a sharing over time of the resources of ecologically close species. Loreau (1990) considers that only dominant species would be subject to competition pressures. Other species would be influenced by other factors such as predation and temporal variability of environmental factors.

The characterization of a zoocenosis using only its zoological groups is insufficient. Each group may have a small number of high-abundance species or conversely a large number of species with few individuals. Consideration of ecological criteria is necessary. The inventory thus made also made it possible to check the durability of certain species in the region and to improve the knowledge of the bio-geography of certain others while completing the regional inventory.

Different ecological types of inventory species

Table II, Distribution of riparian carabics according to the type of biotope

Family	Subfamily	Tribe	Species	Biotope
CARABIDAE	CALLISTINAE	CHLAENIINI	*Chlaenius (Chlaenites) spoliatusspoliatus* Rossi, 1790	hygrophilous
CARABIDAE	CALLISTINAE	CHLAENIINI	*Chlaenius (Chlaenius) festivusvelutinus*Duftschmid, 1812	hygrophilous
CARABIDAE	CALLISTINAE	CHLAENIINI	*Chlaenius (Chlaeniellus) olivieri*Crotch, 1871	hygrophilous
CARABIDAE	HARPALINAE	HARPALINI	*Harpalus (Harpalus) distinguendusdistinguendus*Duftschmid, 1812	hygrophilous
CARABIDAE	HARPALINAE	HARPALINI	*Stenolophus (Egadroma) marginatum* Dejean, 1829	hygrophilous
CARABIDAE	HARPALINAE	HARPALINI	*Harpalus (Harpalus) oblituspatruelis* Dejean, 1829	hygrophilous
CARABIDAE	HARPALINAE	HARPALINI	*Anisodactylus (Anisodactylus) heros* Fabricius, 1801	hygrophilous
CARABIDAE	HARPALINAE	HARPALINI	*Ophonus (Ophonus) rotundicollis*FairmaireandLaboulbène, 1854	hygrophilous
CARABIDAE	HARPALINAE	HARPALINI	*Stenolophus (Stenolophus) teutonus*Schrank, 1781	hygrophilous
CARABIDAE	PLATYNINAE	PLATYNINI	*Agonum (Agonum) nigrum* Dejean, 1828	hygrophilous
CARABIDAE	PLATYNINAE	PLATYNINI	*Agonum (Agonum) marginatum*Linnaeus, 1758	hygrophilous
CARABIDAE	PTEROSTICHINAE	PTEROSTICHINI	*Poecilus (Poecilus) quadricollis* Dejean, 1828	hygrophilous
CARABIDAE	PTEROSTICHINAE	PTEROSTICHINI	*Poecilus (Carenostylus) purpurascenspurpurascens* Dejean, 1828	hygrophilous
CARABIDAE	HARPALINAE	HARPALINI	*Acupalpus (Acupalpus) maculatus*Schaum, 1860	riparian
CARABIDAE	PLATYNINAE	PLATYNINI	*Paranchusalbipes* Fabricius, 1792	riparian
CARABIDAE	TRECHINAE	BEMBIDIINI	*Bembidion (Mandallina) lampros*Herbst, 1784	riparian
CARABIDAE	TRECHINAE	BEMBIDIINI	*AsaphidionrossiiSchaum*, 1857	riparian
CARABIDAE	TRECHINAE	BEMBIDIINI	*Bembidion (Notaphus) varium* Olivier, 1795	riparian
CARABIDAE	BRACHININAE	BRACHININI	*Brachinus (Brachynidius) sclopanda* Fabricius, 1792	terrestrial
CARABIDAE	CARABINAE	CARABINI	*Calosoma (Caminara) olivieri* Dejean, 1831	terrestrial
CARABIDAE	HARPALINAE	HARPALINI	*Harpalus (Harpalus) landhierryiazrouanus* Emden andSchauberger, 1932	terrestrial
CARABIDAE	HARPALINAE	HARPALINI	*Harpalus (Harpalus) attenuatus* Stephens, 1828	terrestrial
CARABIDAE	HARPALINAE	HARPALINI	*Pseudoophonusrufipes* De Geer, 1774	terrestrial
CARABIDAE	LEBIINAE	GRAPHIPTERINI	*Graphipterusexclamationisexclamationis* Fabricius, 1792	terrestrial
CARABIDAE	NEBRIINAE	NEBRIINI	*Nebria (Nebria) andalusia*Rambur, 1837	terrestrial

CARABIDAE	PLATYNINAE	SPHODRINI	*Calathus (Neocalathus) melanocephalusantoinei*Puel, 1939	terrestrial
CARABIDAE	PLATYNINAE	SPHODRINI	*Calathus (Calathus) fuscipesalgiricus* Gautier des Cottes, 1866	terrestrial
CARABIDAE	PLATYNINAE	SPHODRINI	*Calathus (Baandicocalathus) opacus* Lucas, 1846	terrestrial
CARABIDAE	PTEROSTICHINAE	PTEROSTICHINI	*Corax (Sterocorax) globosus* Fabricius, 1792 (s. lat.)	terrestrial
CARABIDAE	PTEROSTICHINAE	PTEROSTICHINI	*Pterostichus (Melanius) aterrimussurcoufi* Antoine, 1933	terrestrial
CARABIDAE	PTEROSTICHINAE	ZABRINI	*Amara (Amara) aenea* De Geer, 1774	terrestrial
CARABIDAE	PTEROSTICHINAE	ZABRINI	*Amara (Amara) subconvexa*Putzeys, 1865	terrestrial
CARABIDAE	CALLISTINAE	CHLAENIINI	*Chlaenius (Trichochlaenius) chrysocephalus* Rossi, 1790	terrestrial

At the level of wetlands: The fauna we have encountered consists of a mixture of species of different ecological origins.

We have been able to distinguish sensu-stricto riparian species (Bigot and Gautier, 1981): strictly subordinated to the waterfront wand zone the case of *Acupalpus (Acupalpus) maculatus, Paranchusalbipes, Bembidion (Mandallina) lampros, Asaphidionrossii, Bembidion (Notaphus) varium*.

Terrestrial species : Are no-hygrophilous species, their presence is linked to the studied biotope proximity of frankly "terrestrial" environments as well as to the presence, in the biotope, of many ecologically different microhabitats : dung, dung, pebbles, rubbish, vegetation, pieces of wood stranded dry some presence of small corpses (birds and Amphibians).

Hygrophilous species : species requiring soil moisture, but without being closely related to the wetland edge. These species are also found in other well-watered places and in shelters with sufficient moisture (under large pebbles, vegetation debris, at the foot of plants, etc.). The case of *Chlaenius (Chlaenites) spoliatusspoliatus, Chlaenius (Chlaenius) festivusvelutinus, Chlaenius (Chlaeniellus) olivieri, Harpalus (Harpalus) distinguendusdistinguendus, Stenolophus (Egadroma) marginatum, Harpalus (Harpalus) oblituspatruelis, Anisodactylus (Anisodactylus) heros, Ophonus (Ophonus) rotundicollis, Stenolophus (Stenolophus) teutonus, Agonum (Agonum) nigrum, Agonum (Agonum) marginatum, Poecilus (Poecilus) quadricollis, Poecilus (Carenostylus) purpurascenspurpurascens*.

Riparian species : dominate widely everywhere. But the importance of this dominance varies widely. It therefore seems that, under the conditions of our study, the confluence zones support the most characteristic stands of the riparian environment. The Increasing the representation of hygrophilous species with the increasing importance of the areas occupied by the biotopes likely to host them (ripisilves, riparian macrophytes).

The presence of terrestrial species : *(Nebria (Nebria) andalusia, Calosoma (Caminara) olivieriDejean, Harpalus (Harpalus) landhierryiazrouanus Emden and Schauberger, Harpalus (Harpalus) attenuatus Stephens, Pseudoophonusrufipes, Graphipterus exclamationisexclamationis, Calathus (Neocalathus) melanocephalusantoinei, Calathus (Calathus) fuscipesalgiricus, Calathus (Baandicocalathus) opacus, Corax (Sterocorax) globosus Fabricius, Amara (Amara) aenea, Pterostichus (Melanius) aterrimussurcoufi, Amara (Amara) subconvexa, Chlaenius (Trichochlaenius) chrysocephalus)* represented by fairly open stands and contain a much smaller proportion. We therefore deduce that transition wetlands (ripisilves, sansouires, etc.) are much more effective barriers to the penetration of terrestrial species (Chavanon, 1994).

The shoreline of dayat Aoua is home to a much more stable and constant stand. This stability of the riparian environment can be explained by the confinement of the forest-type biotope and therefore has all the characteristics of such a medium with, in particular, a strong attenuation in the variations of the various parameters that make it up (temperature, humidity, lighting etc.). It is remarkable to note that when the ripisilve light up by felling of the trees, the stability of the settlement which it lodges is attenuated clearly.

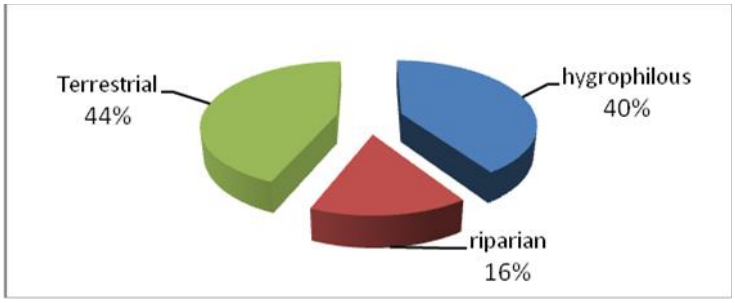

Figure 4. Spectrum of the representation of species inventoried according to the biotope

The edaphic factors determined the distribution patterns of Carabidae and especially the degree of humidity of the substrate, which explains the distribution of species between the different habitats. The dynamics and distribution of these are also dependent on climatic variables (Hengeveld and Hogeweg 1979, Hengeveld 1985). The presence of semi-permanent and temporary water bodies causes a change in the dominance of theterrestrial species in favor of the aquatic species. This ecological factor is also that which Luff and *al.* (1989), Eyre and Luff (1990) recognize in open habitats.

Soil moisture is the key factor (limiting factor) of the distribution of Carabidae and not the composition of vegetation (Quezel and Verdier 1953), Kooijman and Hengeveld (1979, Desender and *al.* (1984), Chavanon(1994), Bouraada(1996), Tischler(1955), Heydemann 1955), Andersen (1983), Desender(1989) Lindroth (1949, 1953).

The intervention of the regional climate, the physicochemical characteristics of the soil are at the origin of particular microclimates which determine their local distribution.

ANNEXE

Calathus melanocephalus

Calathus fuscipes

Brachynus sclopanda

Conclusion

The study of the riparian Carabidae beetles of Lake Dayat Aoua, revealed a total of 34 species. The collected species are unequally distributed into 9 subfamilies and 11 tribes. The assemblages of Carabidae species in our station are characterized by a large number of Mediterranean species and terrestrial spaces. These observations suggest that assemblages of Carabidae species are open systems, where local equilibrium is rarely achieved. For all these reasons, the realization of a real inventory is utopian in entomology, even in a very simple ecosystem.

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