Muzeul Olteniei Craiova. *Oltenia. Studii şi comunicări. Ştiinţele Naturii.* Tom. 39, No. 2/2023 ISSN 1454-6914

GENERAL CONSIDERATIONS ON EPIGEIC INVERTEBRATES AND COLEOPTERA OF THE HERBACEOUS LAYER OF THE RIPARIAN AREA OF THE MANGU STREAM (ILFOV COUNTY, ROMANIA)

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Abstract. The study of the riparian fauna (at epigeic level and herbaceous layer level) of Mangu stream was a part integrated in a wider study focused on emphasizing the ecological aspects of conservation importance for the studied area. The epigeic invertebrates were sampled with Barber traps in the riparian area, upstream (at the springs) and downstream. The coleoptera fauna of herbaceous layer was sampled using the mowing method with the entomological net and manual collecting, directly from the plants, through visual control of the vegetation, was also used. The invertebrate fauna we collected is represented by 18 superspecific taxa at the epigeic level, of which the Coleoptera level is represented by 10 families, while species belonging to 5 families of Coleoptera were identified at the level of herbaceous layer. The structural aspects of the fauna we studied are: the taxonomical composition, the structure of numerical dominance of taxa, the ecological spectra of the identified Coleoptera. The structural characteristics of the epigeic riparian invertebrates of Mangu stream are similar to counterparts from other lowland riparian ecosystems we studied. The ground beetle fauna (Coleoptera: Carabidae) identified along the Mangu stream comprises both riparian species and typical terrestrial ones (forests and meadows). The nine species of ground beetles we identified vary as presence, most of them are accessory species in the habitat. This study demonstrates the existence of a mature and stable structure of the invertebrate fauna, where all invertebrate taxa are trophically interconnected and represent food sources for other trophic levels.

Keywords: epigeic invertebrates, Coleoptera, riparian area, Mangu stream.

Rezumat. Considerații generale privind fauna de nevertebrate epigee și coleoptere din stratul ierbos de pe malul pârâului Mangu (Jud. Ilfov, România). Studiul faunei ripariene (la nivel epigeu și al stratului ierbos) al pârâului Mangu este parte integrată într-un studiu mai complex care se concentrează pe evidențierea aspectelor ecologice cu importanță conservativă pentru zona studiată. Nevertebratele epigee au fost eșantionate în zona ripariană în amonte (la izvoare) și în aval, cu capcane Barber. Fauna de coleoptere din stratul ierbos a fost eșantionată utilizând metoda cosirii cu fileul entomologic și suplimentar, colectarea manuală, direct de pe plante, după un control vizual al vegetației. Fauna de nevertebrate colectată la nivel epigeu este reprezentată de 18 taxoni supraspecifici, dintre aceștia, Ordinul Coleoptera este reprezentat de 10 familii, în timp ce la nivelul stratului ierbos au fost identificate specii aparținând la 5 familii. Aspectele structurale studiate la fauna ripariană sunt: compoziția taxonomică, structura dominanței numerice a taxonilor, spectrele ecologice ale coleopterelor identificate. Caracteristicile structurale ale nevertebratelor epigee ripariene ale pârâului Mangu sunt similare zonelor omoloage din alte ecosisteme ripariene de câmpie studiate de noi. Fauna de carabide (Coleoptera: Carabidae) identificată de-a lungul pârâului Mangu cuprinde atât specii tipic ripariene cât și tipic terestre (silvicole și de pajiște). Cele nouă specii de carabide identificate variază ca prezență, cele mai multe fiind specii accesorii în habitat. Acest studiu demonstrează existența unei structuri mature și stabile a faunei de nevertebrate, în care toți taxonii sunt trofic interconectați și reprezintă sursă de hrană pentru alte nivele trofice.

Cuvinte cheie: nevertebrate epigee, Coleoptera, zonă ripariană, pârâul Mangu.

INTRODUCTION

Riparian zones have been and are being studied worldwide, especially because of the importance of the ecological services they provide. In the conditions of current climate changes, there is a need to reevaluate these ecological structures, which are among the most subject to alteration.

We can state that, at least with regard to the riparian zones, to the alteration of the flood regime due to climate changes, which affect all the coenotic elements of the ecosystem (HUDSON, 2002), the anthropogenic impact is also added; all these together can lead to breaks in the structural and functional heterogeneity of riparian zones from upstream to downstream, with major ecological consequences on a large scale (at the landscape level) (ZAIMES 2020; ZAIMES & IAKOVOGLOU, 2021).

The study of riparian fauna (at epigeic and herbaceous layer level) is part of a larger study focused on the highlighting the ecological aspects of conservation importance for the studied area.

The invertebrate fauna is an important coenotic component both structurally and functionally in any terrestrial ecosystem, and in the case of riparian areas, its importance is even greater, making the connection with the adjacent aquatic environment.

In Romania, numerous studies of riparian areas have been carried out (PAUCĂ et al., 1997; 2000a; b; 2002; 2004; e.g. FALCĂ et al., 2004), but quite few in the lowland and even fewer so close to and urban area. Hence, along the ecological importance of the riparian areas themselves, the scientific interest for the present study.

MATERIAL AND METHODS

The study of the epigeic invertebrate fauna (mobile fauna on the soil surface) was carried out through field observations and on the basis of the material collected using the method of Barber traps filled with a mixture (1:3 vol.) of formalin 4% and ethylene glycol. We selected two sampling sites: one upstream, in the upper sector of the stream (which we will refer as Upper Mangu) and one downstream (which we will refer as Lower Mangu). 20 traps were installed in each sampling site, with a distance of 5 meters between them. The material was analysed qualitatively (taxonomic composition) and quantitatively (structural indices of populations were studied: absolute and relative numerical abundances, frequencies, taxonomical richness). The Coleoptera fauna of the herbaceous layer was sampled in the both sectors of the stream, by the mowing method with the entomological net, as well as manual collection, directly from the plants, after a visual control of the vegetation. Ten samples were taken in each sampling site, consisting of 20 mowings with the entomological net.

The sampling was carried out in May - July 2019 on the shore without human habitation.

The studied area. The Mangu stream is situated in the part of N. and NE. of Chitila and is tributary of Colentina river. The stream is 5.4 km long, with a steep bed, typical for the lowland watercourses and shores completely covered by vegetation. The shores have great specific diversity; the vegetation is represented by 41 species to which 13 woody species (trees and shrubs) are added. At a first investigation, the Mangu stream appears as a well-defined natural resource, with a high degree of conservation, although close to the populated area the shores are polluted by wastes.

The geographical coordinates of the Mangu stream are:

East: N44°30'47,1" E25°59'70"

West: N N44°30'41,3" E25°57'7,09"

North: N N44°30'9,08" E25°58'9,10"

South: N N44°30'25,9" E25°58'37,0"

REZULTS AND DISCUSSIONS

At the epigeic level, 19 suprataxa were identified in the upper sector of Mangu stream and respectively 16 in the lower sector.

The differences are small between the two sampling sites in terms of the absolute and relative numerical abundances as well as the taxonomical composition (Table 1).

However, the structure of the numerical dominance and the classes of constancy of the populations in the two sampling sites differ in several aspects: the structure of numerical dominance emphasizes slightly higher proportions of the taxa with eudominant and dominant status in the upper sector compared to the situation in the lower sector, but higher proportions of the subdominant and subrecedent taxa in the lower sector (Table 1; Fig. 1).

Table 1. The taxonomical composition and structural indexes of epigeic invertebrates in the studied sites (N – absolute numerical abundances; % relative numerical abundances; F% frequency in samples).

TAXA	UPPER MANGU			LOWER MANGU		
	N	%	F%	N	%	F%
GASTROPODA	33	3.03	0.625	46	4.31	1
OLIGOCHAETA	14	1.28	0.625	9	0.84	0.07
ACARINA	236	21.7	1	311	29.12	1
OPILIONES	14	1.28	0.5	8	0.75	0.42
PSEUDOSCORPIONES	4	0.36	0.16			
ARANEAE	38	3.48	1	46	4.31	0.83
CRUSTACEA Isopoda	12	1.1	0.5	28	2.62	0.83
COLLEMBOLA	311	28.53	1	256	23.76	1
MYRIAPODA - Chilopoda	8	0.72	0.31	7	0.65	0.42
MYRIAPODA-Diplopoda	18	1.66	0.44	11	1.03	0.5
HETEROPTERA	12	1.1	0.25	5	0.47	0.17
HYMENOPTERA var.	68	6.24	1	49	4.58	1
HYMENOPTERA - Formicoidea	61	5.6	1	39	3.65	1
DERMAPTERA	6	0.54	0.187	4	0.37	0.17
BLATTODEA	8	0.72	0.375			
ORTHOPTERA	9	0.82	0.25	4	0.37	0.17
COLEOPTERA	211	19.36	1	166	13.83	1
DIPTERA	86	7.9	1	118	11.05	1
LEPIDOPTERA	2	0.18	0.625			
TOTAL	1151	100		1107	100	

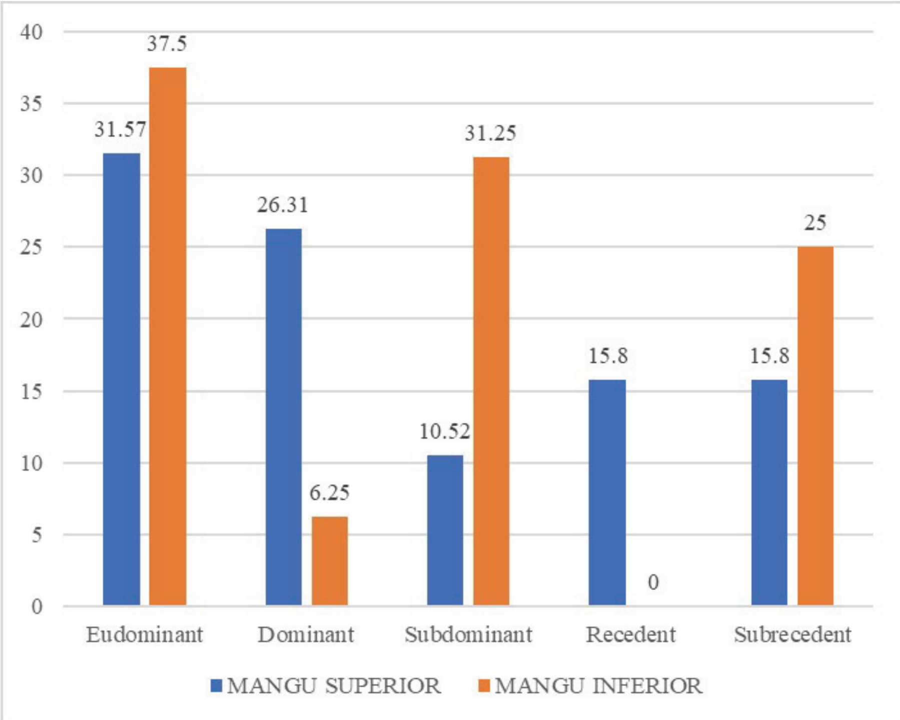

Figure 1. The proportions (%) of epigeic major taxa in the numerical dominance structure.

The pattern of the distribution of taxa in the classes of constancy is relatively similar in the studied areas. In both riparian areas we found high proportions of taxa with euconstant, constant and relatively constant status. The taxa with accidental status were present only in the lower sector of the Mangu stream (Fig. 2).

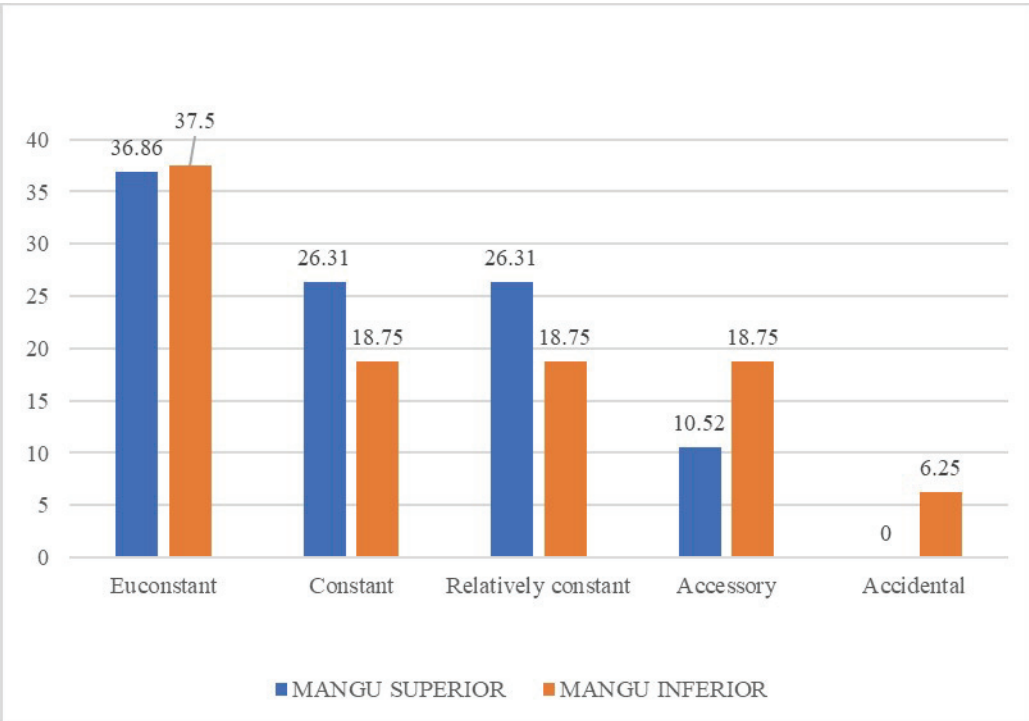

Figure 2. The proportions (%) of epigeic major taxa in classes of constancy.

At the epigeic level, the Coleoptera fauna is present in both studied areas an dis represented by ten families. Beetles (Coleoptera), although eudominant and euconstant in both sectors of the stream, show slight differences of the local ecological conditions through the status of taxa in the local coenoses (as the structure of numerical dominance and classes of constancy) (Table 2; Figs. 3-4).

As in the case of the other supraspecific taxa, Coleoptera prove to share the same structure pattern in both studied areas: the absence of the recedent and subrecedent families (as numerical dominance) but also of accidental ones (as frequencies in samples).

Table 2. The taxonomical composition and structural indexes of epigeic Coleoptera in studied sites (N – absolute numerical abundances; % relative numerical abundances; F% frequency in samples).

COLEOPTERA	**UPPER MANGU**			**LOWER MANGU**		
	N	**%**	**F%**	**N**	**%**	**F%**
	211	19.36	1	166	13.83	1
Carabidae	32	2.93	1	21	1.96	0.83
Staphylinidae	24	2.2	1	14	1.31	1
Chrysomelidae	9	0.84	0.25	3	0.3	0.17
Coccinellidae	8	0.73	0.31	5	0.47	0.17
Elateridae	14	1.3	0.44	9	0.84	0.42
Silphidae	11	1	0.5	8	0.75	0.5
Scarabaeidae	38	3.48	1	26	2.43	0.8
Cryptophagidae	21	1.93	0.8	18	1.68	0.75
Nitidulidae	30	2.75	0.8	41	3.84	1
Buprestidae	24	2.2	1	21	1.96	0.8

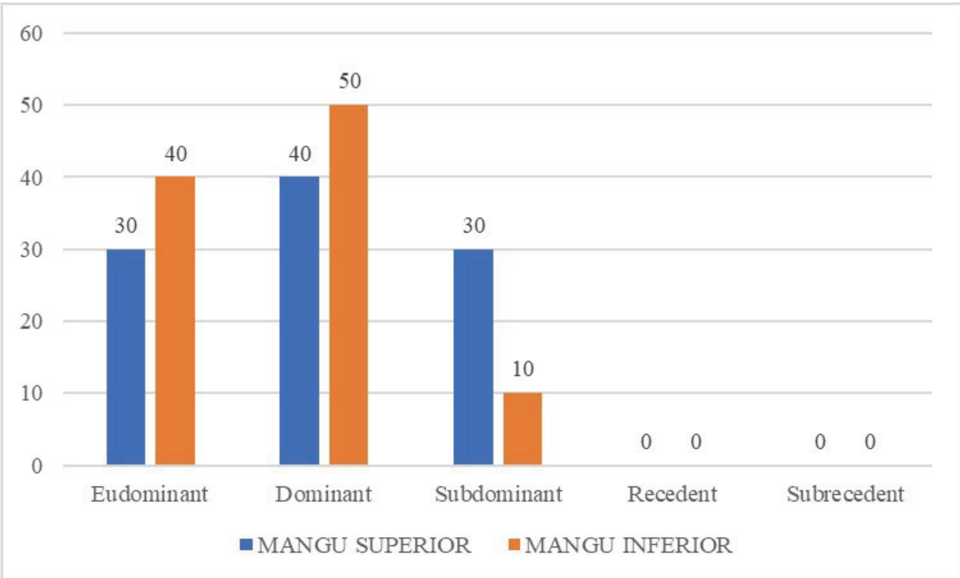

Figure 3. The proportions (%) of epigeic Coleoptera in the numerical dominance structure.

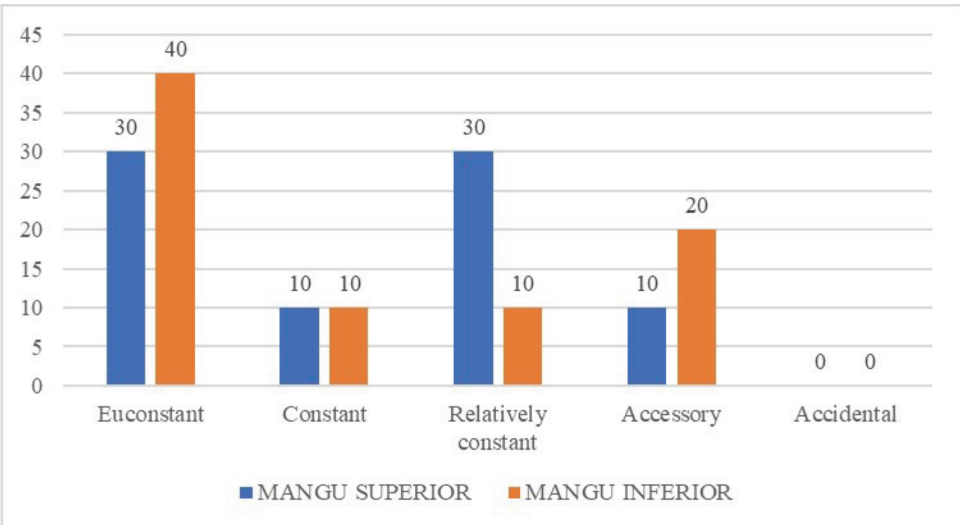

Figure 4. The proportions (%) of epigeic Coleoptera in classes of constancy.

The degree of similarity (Sørensen index of similarity) of the epigeic Coleoptera fauna is 100% between the two studied areas; the taxonomical composition of Ord. Coleoptera highlights a heterogenous structure from the point of view of the trophic classification of taxa in the local coenoses.

Among the most numerous Coleoptera, the ground beetles (Coleoptera: Carabidae) are present in both studied areas with a number of 9 species, belonging to genera *Abax, Bembidion, Carabus, Harpalus, Nebria şi Pterostichus*.

The nine species of Carabidae we identified vary as presence in habitats, most of them having status of accessory species.

It is already known that the diversity and densities of insects in riparian areas may depend on the vegetation type and the width of the buffer area (COLE et al., 2012a, b; GILBERT et al., 2015; COLE et al., 2020; FORIO et al., 2020). The ground beetles (Coleoptera: Carabidae) for example, most of them among the predatory invertebrates, prefer the riparian areas covered with woody vegetation that provide a microclimate (as shadow and humidity) favourable for most of species (PEARCE et al., 2003; LITAVSKÝ et al., 2021).

On the other hand, the well-represented herbaceous layer in the riparian areas is unfavourable to ground beetles because their movement is hindered by the presence of grasses. The decrease in the activity of epigeic ground beetles with increasing vegetation density was also reported by HEYDEMANN (1957), HONEK (1988), HUMPHREY et al. (1999) and THOMAS et al. (2006).

Regarding the low species richness of ground beetles in our studied areas was to be expected taking into account such a short period of time for sampling, given that, from previous studies (ŠUSTEK, 1994), it is known that the number of ground beetle species in natural riparian areas could reach 25-35.

The Coleoptera fauna (Insecta: Coleoptera) of herbaceous layer (Maican S., unpublished data)

The taxonomical analysis of the collected material highlighted the presence of some species belonging to the families Melyridae, Lagriidae, Coccinellidae, Oedemeridae and Chrysomelidae.

The Coleoptera are under expectations as species richness (Table 3).

Table 3. Species of Coleoptera from the herbaceous layer of the riparian area of Mangu stream.

Coleoptera Family	**Species**
Chrysomelidae	*Cryptocephalus octacosmus* (Bedel, 1891)
	Galerucella pusilla (Duftschmid, 1825)
Coccinellidae	*Cryptocephalus octacosmus* (Bedel, 1891)
	Galerucella pusilla (Duftschmid, 1825)
Melyridae	*Anthocomus equestris* (Fabricius, 1781)
Lagriidae	*Lagria hirta* (Linnaeus, 1758)
Malachidae	*Malachius bipustulatus* (Linnaeus, 1758)

The situation presented here is, however, far from expressing the real existing Coleoptera fauna of the studied areas. The diversity of vegetation of this region implies a much higher biodiversity of Coleoptera, and further studies will prove this fact for sure.

CONCLUSIONS

The invertebrate fauna is very rich, much more diverse than we would have expected for a place so close to the city centre, two roads with intense traffic and a railway line of national importance. The high proportions of taxa with euconstant, constant and relatively constant indicate the existence of stable coenoses.

The Coleoptera fauna is well represented in the studied areas, both as taxonomical richness and numerical abundances and are found at all tropic levels of the local coenoses. The predators (mainly Araneae and Coleoptera Carabidae), well represented both in the structure of numerical dominance and constancy classes, once more prove the existence of mature coenoses.

The small qualitative and quantitative differences between the two coenoses we studied do not necessarily indicate a homogeneity of the landscape, because we are talking about a watercourse relatively short (5.4 km) which support a high diversity of habitats, species of plants and animals (as we demonstrated in the complex study from which we presented now a part regarding fauna); it is actually about the common status of the two riparian areas we studied, that of stable and complex habitats, related to a short period of time of study.

Although no species of invertebrates of conservation interest were identified, the structure of the studied invertebrate communities together with the other coenotic characteristics of the riparian area of the Mangu stream prove the presence of a valuable natural capital and of conservative interest.

The existence of greater differences between the riparian coenoses, thus of greater heterogeneity, will certainly be proven future longer-term studies.

ACKNOWLEDGEMENT

This study was carried out in the framework of RO1567-IBB01/2019 project, from the Bucharest Institute of Biology of the Romanian Academy.

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Received: April 15, 2023
Accepted: August 29, 2023