

## BIODIVERSITY OF WEEVILS (CURCULIONOIDEA) ON MEADOWS OF MT. GOČ

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**ABSTRACT:** As a result of research on the fauna of adult weevils on meadows in the vicinity of Kraljevo during the period May-August 1997 and in May of 1998, a total of 322 specimens of adult weevils (Curculionoidea) were collected in 30 samplings (six at each of the following five localities at different elevations above sea level: a natural valley meadow alongside the Western Morava River; an alfalfa field; an artificial meadow; a natural upland meadow; and a mountain meadow).

The greatest number of species (31) was registered on the natural upland meadow, which is phytocenologically the richest. The fewest species (16) were collected on the mountain meadow, which is under the direct influence of subalpine climate.

The most specimens (85) were collected on the alfalfa field (which has the greatest production of plant mass among the examined meadows), the fewest specimens (31) on the mountain meadow. To judge from the Shannon biodiversity index, the colony of weevils on the natural upland meadow is the most stable. Even though it has the smallest number of species, the mountain meadow did not manifest the lowest stability. Instead of this, the valley meadow had the lowest biodiversity index.

### INTRODUCTION

The superfamily Curculionoidea (weevils) is a part of the order Coleoptera. With respect to the number of species, it is the largest group (about 60000, CALDARA and O'BRIEN, 1995) in the entire animal kingdom. The large number of species is of practical significance to man, whether they appear as pests of spontaneously growing or cultivated plants or as useful species that feed on weeds.

The absence of research on weevils in the township of Kraljevo was the factor that prompted us to work with this group of insects. In view of its diversity and occurrence in all biocenoses (forests, meadows, man-made habitats), study of the overall fauna of the given region would be a job requiring a long-term investigative effort. The purpose of the present paper



was therefore restricted to study of the weevil fauna of meadow communities, both those of valley meadows and ones of upland and mountain meadows.

Several tasks were accomplished in the course of the work:

1 - taxonomic registration, including identification of collected and prepared specimens of adult weevils and their classification.

2 - Ecological analysis from a number of aspects:

- analysis of weevil colonies by localities, which encompasses analysis of the number of species and specimens, as well as the value of biodiversity at each locality;
- establishment of similarity between weevil communities at the examined localities.

### INVESTIGATED LOCALITIES

The part of Kraljevo surrounding were investigated. The city of Kraljevo lies at an elevation of approximately 200 m, surrounded by spurs of the Kotlenik, Gledičke planine, Starovlaške planine and Kopaonik mountains. Its coordinates are 43°43' N latitude and 20°43' E longitude.

Five meadows at localities from the Western Morava River to peaks of Mt. Goč (Fig. 1) were chosen for purposes of the present work. The first three localities are on land of the village of Vrba, the fourth is on land of the village of Kamenica at the foot of Mt. Goč, and the fifth locality is on Mt. Goč. Located on the right-hand side of the river, Vrba is one of a series of settlements in the valley of the Western Morava. It is situated 10 km southeast of Kraljevo. Rising behind it are the mountains Goč and Stolovi (ĐUROVIĆ, 1987).

Locality 1 (L1 in the text hereafter) is a natural meadow beside the Western Morava in that part of the village of Vrba known as Šangaj. It lies at an elevation of 182 m a.s.l. During the investigated period, the meadow was mowed only once, at the end of July.

Locality 2 (L2) is an alfalfa field in the part of the village of Vrba known as Krušak. It lies at an elevation of 204 m a.s.l. Alfalfa (*Medicago* sp.) was planted at this locality about 10 years ago. Plants from neighboring meadows have intruded since then, but they are not dominant. The field was mowed twice during the investigated period, at the end of May and in the middle of July.

Locality 3 (L3) is an "artificial meadow" in the part of the village of Vrba known as Brđanija (at 248 m a.s.l.). It faces north and is gently sloping. The meadow is planted with a grass mixture in which the prevailing components are perennial rye grass (*Lolium perenne*), bird's-foot trefoil (*Lotus corniculatus*), and white clover (*Trifolium* sp.). As at locality 2, plants of







neighboring meadows have intruded into this meadow, but to a lesser extent than in the case of L2 due to the meadow's surroundings (a stand of deciduous trees on one side and an orchard on the other). It was mowed in the first half of June and at the end of July.

Locality 4 (L4) is a natural upland meadow at the foot of Mt. Goč at an elevation of 319 m a.s.l. It is characterized by a fairly strong slope and faces southeast. The meadow is subject to mild influence of the subalpine climate that prevails on Mt. Goč. This affects its vegetation, which is "tardy" in relation to localities 1, 2, and 3. The meadow was mowed in the middle of July.

Locality 5 (L5) is a natural mountain meadow on Mt. Goč at an elevation of 824 m a.s.l. It is located on land belonging to an instructional facility of the Faculty of Forestry in Belgrade. Vegetation is tardy in relation to all the preceding localities due to the direct influence of subalpine climate. During the investigated period, the meadow was mowed only once, at the end of July.

## MATERIAL AND METHODS

Field work was performed during the period from May to August of 1997 and in May of 1998. Six samplings were conducted, on the following dates: 19 May 1997, 01 June 1997, 14 June 1997, 06 July 1997, 03 Aug 1997, and 02 May 1998.

In view of the fact that the meadows are of rectangular shape, insects were collected by the transect method along the diagonal (for quantitative ecological analysis, 100 sweeps with a "catcher" net were performed on each meadow).

Species identification was realised by using "the keys" - ANGELOV, 1976, 1978, 1979, 1980, 1981; FREUDE *et al.*, 1981, 1983. Species are listed according the ABBAZZI *et al.* (1995).

Ekological aspect of work included calculation of index of general diversity according to the Schannon's formula (SCHANNON & WEAVER, 1949 from SCHWERDTFEGER, 1975) and Jaccard's index of similarity, like in PEŠIĆ, 1997.

## RESULTS AND DISCUSSION

Thirty samplings were conducted during the period of investigation (six at each of the five localities). These samplings yielded 322 specimens. Sixty-four species belonging to 36 genera and three families (Attelabidae, Apionidae and Curculionidae) of the superfamily Curculionoidea were identified.

Table 1 gives a summary of the number of species and specimens found at each locality.

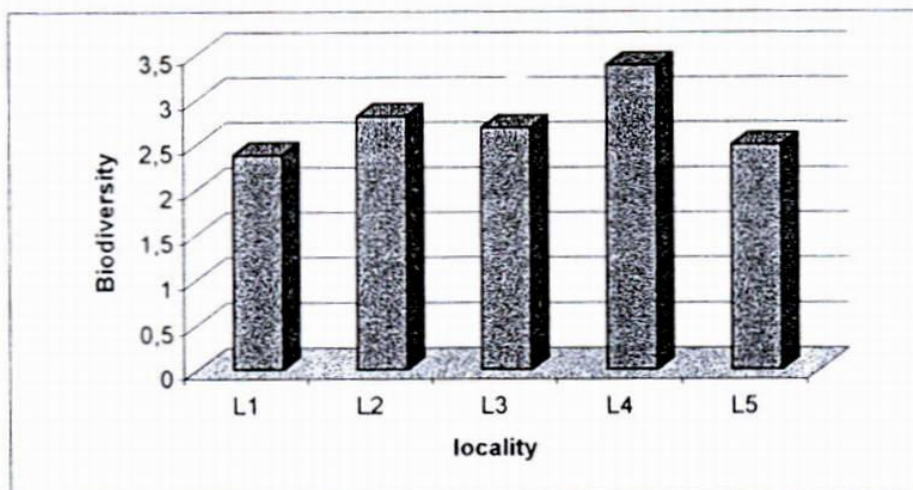
Tab. 1. Number of species registered and specimens collected at each locality

Locality	L1	L2	L3	L4	L5
Number of species	22	24	22	31	16
Number of specimens	73	85	69	64	31

It can be seen from the data presented that the greatest number of species was found on the natural upland meadow (L4). This can be attributed to the fact that it has the most stable and floristically the richest plant community, which has been present at the given locality for a number of decades already. It can also be ascribed to weak anthropogenic influence.

The smallest number of species and specimens was recorded on the mountain meadow (L5). This can be attributed to the influence of subalpine climate, which dictates weaker development and slowed growth of mountain meadow vegetation, with a consequent small quantity of plant biomass. Few species of food plants tolerate such a climate, which results in a small number of species of weevils as exclusive phytophages.

The alfalfa field (L2) was in first place with respect to the number of specimens of adult weevils collected. The main reason for this presumably lies in the quantity of plant mass produced there.



Comparison of the biodiversity index (Fig. 2) shows it to be highest on the natural upland meadow (L4), which means that the most stable weevil colony is found there.

Fig. 2. Biodiversity by localities.

Even though it has the smallest number of species, the mountain meadow (L5) does not manifest the lowest stability. This is a consequence of the fact that it is a natural meadow with



weakly expressed anthropogenic influence, with the result that the presence of both plant and weevil species is firmly established.

The valley meadow (L1) manifests the lowest stability. This is possibly a consequence of its floristic state, which is largely dictated by fluctuation of moisture content in the substrate (the meadow is located on sandy terrain, with a pronounced moisture deficit during summer).

The other two upland meadows, the alfalfa field (L2) and the artificial meadow (L3), show high stability.

This can be considered a consequence of the fact that these communities have been present at the given localities for a greater number of years. Moreover, a certain number of species of meadow plants have been introduced from neighboring meadows, which promoted the arrival of new species of weevils as well. On the other hand, it was possible to discern certain species of weevils from the surrounding vegetation, both herbaceous and arboreal, such species having found temporary "refuge" on these meadows (for reasons associated with feeding and probably also with microclimatic conditions).

Tab. 2. List of weevil species registered and number of specimens collected at locality 1

	SPECIES	NR. OF SPECIMENS
1.	<i>Neocoenorrhinus germanicus</i>	1
2.	<i>Protapion apricans</i>	2
3.	<i>Protapion nigrirtarse</i>	3
4.	<i>Holotrichapion pisi</i>	1
5.	<i>Eutrichapion punctigerum</i>	3
6.	<i>Eutrichapion vorax</i>	1
7.	<i>Phyllobius viridearis</i>	2
8.	<i>Polydrusus tibialis</i>	1
9.	<i>Polydrusus sericeus</i>	2
10.	<i>Eusomus ovulum</i>	13
11.	<i>Parafoucartia squamulata</i>	26
12.	<i>Sitona hispidulus</i>	2
13.	<i>Sitona lineatus</i>	3

14.	<i>Sitona macularius</i>	2
15.	<i>Sitona puncticollis</i>	1
16.	<i>Sitona sulcifrons</i>	1
17.	<i>Ceutorhynchus floralis</i>	1
18.	<i>Ceutorhynchus thalspi</i>	1
19.	<i>Trichosirocalus troglodytes</i>	1
20.	<i>Acalyptus carpini</i>	1
21.	<i>Mecinus pyraster</i>	4
22.	<i>Gymnetron pasquorum</i>	1

It can be seen from the data presented in Tab. 2 that the species *Parafoucartia squamulata* stands out with 26 specimens collected, which makes up 35.62% of the total number on the natural valley meadow. The high representation of this species of weevil can be attributed to diversity of the plant fund and, among other things, to significant presence of *Lotus corniculatus* as food plant of the weevil in question.

Tab. 3. List of weevil species registered and number of specimens collected at locality 2

	SPECIES	NR. OF SPECIMENS
1.	<i>Taeniapion urticarium</i>	1
2.	<i>Protapion apricans</i>	1
3.	<i>Protapion fulvipes</i>	10
4.	<i>Protapion trifolii</i>	15
5.	<i>Protapion varipes</i>	4
6.	<i>Perapion violaceum</i>	4
7.	<i>Catapion seniculus</i>	5
8.	<i>Stenopterapion tenue</i>	9
9.	<i>Ischnopterapion loti</i>	2
10.	<i>Ischnopterapion virens</i>	1
11.	<i>Holotrichapion pisi</i>	5



12.	<i>Eutrichapion viciae</i>	1
13.	<i>Sitona hispidulus</i>	5
14.	<i>Sitona humeralis</i>	3
15.	<i>Sitona lineatus</i>	1
16.	<i>Sitona puncticollis</i>	1
17.	<i>Sitona waterhousei</i>	1
18.	<i>Hypera nigrirostris</i>	4
19.	<i>Hypera postica</i>	5
20.	<i>Ceutorhynchus floralis</i>	2
21.	<i>Ceutorhynchus pectoralis</i>	3
22.	<i>Glocianus punctiger</i>	2
23.	<i>Tychius picirostris</i>	2
24.	<i>Stereonychus fraxini</i>	1

As can be seen, on the alfalfa the species *Protapion trifolii* and *P. fulvipes* are conspicuous, with 15 specimens (17.65% of those recorded in four findings) and 10 specimens (11.76%), respectively. Other registered species of the family Apionidae lag insignificantly behind these two, while species not belonging to the given family are represented by a still smaller number of specimens. The reason for this is that plants of the family Fabaceae are dominant here, which is especially favorable to colonization by weevils of the family Apionidae, who feed on them.

Tab. 4. List of weevil species registered and number of specimens collected at locality 3

	SPECIES	NR. OF SPECIMENS
1.	<i>Protapion apricans</i>	6
2.	<i>Protapion fulvipes</i>	1
3.	<i>Protapion nigrifarse</i>	1
4.	<i>Protapion ononicola</i>	1
5.	<i>Protapion trifolii</i>	5



6.	<i>Protapion varipes</i>	5
7.	<i>Apion frumentarium</i>	1
8.	<i>Catapion seniculus</i>	6
9.	<i>Stenopterapion tenue</i>	1
10.	<i>Ischnopterapion loti</i>	3
11.	<i>Ischnopterapion virens</i>	9
12.	<i>Holotrichapion pisi</i>	1
13.	<i>Sitona sulcifrons</i>	4
14.	<i>Sitona waterhousei</i>	13
15.	<i>Hypera nigrirostris</i>	1
16.	<i>Hypera plantaginis</i>	3
17.	<i>Glocianus punctiger</i>	2
18.	<i>Tychius cuprifer</i>	1
19.	<i>Tychius picirostris</i>	2
20.	<i>Tychius squamulatus</i>	1
21.	<i>Tychius stephensi</i>	1
22.	<i>Rhynchaenus fagi</i>	1

At this locality, the species *Sitona waterhousei* and *Ischnopterapion virens* stand out with respect to the number of specimens.

Tab. 5. List of weevil species registered and number of specimens collected at locality 4

	SPECIES	NR. OF SPECIMENS
1.	<i>Pseudoprotapion astragali</i>	2
2.	<i>Protapion apricans</i>	10
3.	<i>Protapion assimile</i>	1
4.	<i>Protapion fulvipes</i>	2
5.	<i>Protapion nigritarse</i>	6
6.	<i>Protapion trifolii</i>	5



7.	<i>Protapion varipes</i>	3
8.	<i>Perapion curtirostre</i>	1
9.	<i>Perapion violaceum</i>	2
10.	<i>Catapion seniculus</i>	1
11.	<i>Ischnopterapion loti</i>	1
12.	<i>Holotrichapion pisi</i>	1
13.	<i>Hemitrichapion pavidum</i>	1
14.	<i>Cyanapion spencei</i>	2
15.	<i>Phyllobius betulae</i>	1
16.	<i>Eusomus ovulum</i>	8
17.	<i>Sciaphobus caesius</i>	1
18.	<i>Parafoucartia squamulata</i>	1
19.	<i>Sitona hispidulus</i>	3
20.	<i>Sitona lineatus</i>	1
21.	<i>Sitona puncticollis</i>	1
22.	<i>Sitona sulcifrons</i>	1
23.	<i>Hypera meles</i>	1
24.	<i>Hypera nigrirostris</i>	1
25.	<i>Donus tessellatus</i>	1
26.	<i>Ceutorhynchus hirtulus</i>	1
27.	<i>Oprochinus suturalis</i>	1
28.	<i>Trichosirocalus troglodytes</i>	1
29.	<i>Tychius picirostris</i>	1
30.	<i>Mecinus pyraster</i>	1
31.	<i>Cionus gebleri</i>	1

The list of weevil species registered and number of specimens collected on the natural upland meadow (L4) (Tab. 5) indicates that the species *Protapion apricans* and *Eusomus ovulum* were recorded in each of four outings. It is also possible to separate *Protapion nigritarse*, with six specimens (9.38%) found. The small number of specimens of other recorded species is a



result of the delayed growth of vegetation and slower succession of food plants, and they were in most cases recorded in only one outing each.

Tab. 6. List of weevil species registered and number of specimens collected at locality 5

	SPECIES	NR. OF SPECIMENS
1.	<i>Exapion difficile</i>	1
2.	<i>Protapion assimile</i>	2
3.	<i>Protapion fulvipes</i>	2
4.	<i>Protapion interjectum</i>	1
5.	<i>Protapion nigritarse</i>	1
6.	<i>Protapion trifolii</i>	3
7.	<i>Ischnopterapion virens</i>	1
8.	<i>Phyllobius pyri</i>	1
9.	<i>Polydrusus impar</i>	1
10.	<i>Sitona lineatus</i>	1
11.	<i>Sitona macularius</i>	1
12.	<i>Sitona sulcifrons</i>	1
13.	<i>Larinus jaceae</i>	5
14.	<i>Ceutorhynchus floralis</i>	1
15.	<i>Rhynchaenus fagi</i>	7
16.	<i>Mecinus pyraeter</i>	2

It can be seen that the species *Rhynchaenus fagi*, with seven specimens (22.58%), stands out in regard to the number of specimens. Published data indicate that this species is not a member of the meadow fauna, but instead is found on species of the genera *Fagus*, *Quercus*, and *Crataegus*. Its presence on the mountain meadow is a consequence of the forest surroundings. Of meadow species, the species *Larinus jaceae* is represented by the greatest number of specimens (five).



The similarity index calculated according to Jaccard mathematically demonstrates similarity of the weevil communities. Weevils of the alfalfa field and the "artificial meadow" manifest the greatest similarity (Tab. 7).

*Tab. 7. Similarity of weevil communities at the examined localities*

	L1	L2	L3	L4	L5
L1		0,15	0,1	0,26	0,19
L2			0,39	0,31	0,14
L3				0,26	0,19
L4					0,18

Even though the valley meadow (L1) and the "artificial meadow" (L3) have the same number of species and approximately the same number of specimens found, they show the least similarity. Despite the fact that the "artificial meadow" was formed 10 years ago (i.e., it has had enough time for introduction of plants and accompanying weevils from natural meadows to have occurred), no great number of the plant species characteristic of natural meadows have colonized it, on account of the surroundings (a stand of deciduous trees 15 years old, an orchard 25 years old, an alfalfa field, and a boundary strip), the slope of the terrain, and its northern exposure.

## CONCLUSION

In view of the short period of investigation and the fact that the dynamics of field outings was not evenly balanced over the entire period due to weather conditions and technical limitations (contrary to what was originally planned), the results obtained in the present study do not fully reflect the fauna of weevils on meadows in the vicinity of Kraljevo. For this reason, the need remains to conduct more detailed investigations on weevil communities, not only on meadows, but in forests and man-made habitats as well, together with obligatory accompanying phytocenological analysis.



## References

- [1] ABBAZZI, P., COLONNELLI, E., MASUTTI, L., OSELLA, G.: *61. Coleoptera Polyphaga XVI (Curculionoidea)*. In: MINELLI, A., RUFFO, S., LA POSTA, S.: *Cheklisť delle specie della fauna italiana*. Ministero dell'Ambiente e Comitato Scientifico per la Fauna d'Italia; Edizioni calderini, Bologna (1995) 68pp.
- [2] АНГЕЛОВ, П.: *Фауна на България; т-5; Coleoptera, Curculionidae, I част: Arioninae, Otiorrhynchinae*. БАН, София (1976) 356 стр.
- [3] АНГЕЛОВ, П.: *Фауна на България; т-7; Coleoptera, Curculionidae, II част: Brachyderinae, Brachycerinae, Танутесинае, Cleoninae, Curculioninae, Myorhininae*. БАН, София (1978) 233 стр.
- [4] АНГЕЛОВ, П.: *Фауна на България; т-9; Coleoptera, Curculionidae, III част: Calandrininae I*. БАН, София (1979) 1 стр.
- [5] АНГЕЛОВ, П.: *Фауна на България; т-10; Coleoptera, Curculionidae, IV част: Calandrininae II*. БАН, София (1980) 301 стр.
- [6] АНГЕЛОВ, П.: *Фауна на България; т-11; Coleoptera, Rhynchophora: Urodonidae, Anthribidae, Brenthidae, Rhinomaceridae, Attelabidae*. БАН, София (1981) 112 стр.
- [7] CALDARA, R., O'BRIEN, C.W.: *Curculionidae: Aquatic weevils of China (Coleoptera)*. - in Jäch, M.A. & Ji, L. (eds): *Water Beetles of China*. Wien; Vol. I (1995) 389-408.
- [8] ĐUROVIĆ, L.J.: *Sociogeografske karakteristike Vrbe*. Diplomski rad, PMF - odsek za geografiju i prostorno planiranje, Univerzitet u Beogradu (1987).
- [9] FREUDE, H., HARDE, K.W., LOHSE, G.A.: *Die Käfer Mitteleuropas; Band 10*. Krefeld (1981) 102 - 310.
- [10] FREUDE, H., HARDE, K.W., LOHSE, G.A.: *Die Käfer Mitteleuropas; Band 11*. Krefeld: (1983) 340.
- [11] MILANOVIĆ, D.: *Kraljevo i njegovo uže gravitaciono područje*. Srpsko geografsko društvo, Beograd (1973).
- [12] PEŠIĆ, S.: *Interakcije sa sredinom i dinamika surlaša (Coleoptera, Curculionidae) Kragujevačke kotline*. Doktorska disertacija, PMF, Univerzitet u Kragujevcu (1997).
- [13] SCHWERDTFEGER, F.: *Ökologie der Tiere Band 3: Synökologie*. Paul Parey Verlag, Hamburg-Berlin (1975).