Acta entomologica serbica, 1997, 2 (1/2): 37-46 UDC 577.484:595.768

THE WEEVILS (COLEOPTERA: CURCULIONIDAE) OF UPLAND MEADOWS IN THE KRAGUJEVAC BASIN, SERBIA

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The weevils of upland meadows were peliminary surveyed in the Kragujevac Basin, Serbia. A total of 175 adult specimens belonging to 52 species were taken in the meadows, with steppe plant elements at the elevation of 300-500 m. Ecological processing indicated a high degree of characteristicness and specificity of the assemby of weevils in these meadows.

KEY WORDS: Curculionidae, upland meadows, Kragujevac, Serbia.

INTRODUCTION

Investigations on weevils of upland meadows in the Kragujevac Basin were initiated in 1988, and lasted till 1994. The adult weevil specimens were collected, and regularly sampled in the xerothermic meadows with some steppe characteristics.

The purpose of the present paper was to record the weevil species inhabiting the upland meadows, and to ecologically process the species found, in order to get a more correct notion about the settlement of weevils in the habitat examined.

AREA EXAMINED

Kragujevac is the main town of the Šumadija region of Serbia. The town of Kragujevac lies at 183 m above sea level, on the bottom of the Kragujevac Basin, drained by the river Lepenica and its tributaries (Fig. 1). The Kragujevac Basin has an area of 452 square kilometres. The highest peak is Dulenski Crni Vrh (897 m) on the southern rim of the Basin. The lowest point (130 m) of the area is located where

the river Lepenica leaves the Kragujevac Basin. The whole area is gently sloped to the north, where the Basin is open toward the Pannonian Lowland, receiving so a strong influence of the Continental climate from the Lowland (VELJOVIĆ, 1967).

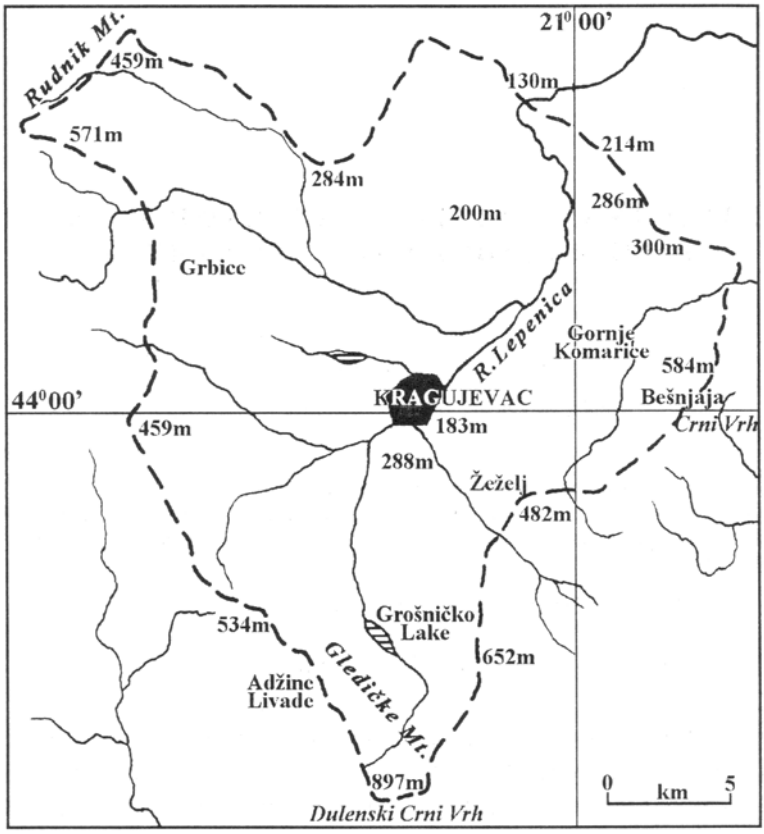

Fig. 1. A sketch map showing some altitudes and the sites investigated in the Kragujevac Basin, Serbia.

Prof. dr Vladimir VELJOVIĆ (1967) published the most detailed survey of vegetation in the Kragujevac Basin.

Upland meadows are to be found in the hilly area, from 200 m to 500 m, of the western, southern and eastern parts of the Kragujevac Basin. Weevils were collected and examined at the following sites: Grbica, Adžine Livade, Grošnica Lake, Žeželj, Bešnjaja, and Gornje Komarice.

Two plant associations, belonging to the same alliance *Festucion vallesiacae* Klika, were described in those upland meadows.

Ass. *Trifolio-Chrysopogonetum grylli* Veljović a xerothermic community with steppe characteristics. This community is developed on gentle slopes with southern exposures in rolling areas and regions of low hills (180-300 m) in habitats of cut-back oak forests with deep, warm, almost neutral soil (primarily vertisol) rich in humus. This is the most stable and floristically richest (98 plant species, including 19 legumes and grasses) type of meadow in the region. The species *Chrysopogon gryllus* is absolutely dominant. With its strong root system, it achives deep penetration (the active part of roots extends to a depth of 2.5-5 m), while its extensively developed bushes cover the ground, protecting it from desiccation and thereby making possible the appearance of other plants in the community. The optimal phase of the community is sustained only by regular mowing. Without it, these meadows undergo degradation, gradually become overgrown, and pass over for the most part into forests of a climatogenic community. Their economic significance is considerable, although their yield is less than that of valley meadows. Meadows of this community are intensively plowed under because they constitute terrains suitable for agriculture.

At elevations greater than 300 m (high hills and low mountains), these meadows pass into the community *Agrostido-Andropogonetum ischaemi* Veljović, which belongs to the same alliance. This is a xerothermic meadow association, which occupies warm and dry habitats with soil of the lowest quality (shallow, skeletoid, acidic), often eroded. Its transformation into forests is difficult or impossible due to basic alteration of ecological conditions in relation to the time when such meadows arose through clearing of the community *Carpinetum orientalis serbicum* Rud. This community is also formed on abandoned plowlands. Meadows of this community are frequently plowed under and plowed land converted to meadow, so that their floristic composition is different from site to site. The greatest significance of these meadows is in prevention of erosion, since *Andropogon ischaeumum* binds soil with its root clods.

Transformation of meadows of the type *Trifolio-Chrysopogonetum grylli* Veljović into ones of the type *Agrostido-andropogonetum ischaemi* Veljović is irreversible.

Subjected as it is to dynamic permanent alteration (due to both climatic and anthropogenic influences), the rich floristic base of upland meadows in the vicinity of Kragujevac provided grounds for speculating that they are also characterized by a specifi aggregation of weevils.

MATERIAL AND METHODS

Investigations on weevils of upland meadows in the vicinity of Kragujevac were initiated in 1988.

In eight mainly summer registrations, meadows at elevations of 300-500 m above sea level were investigated at the following localities: Gornje Komarice, Adžine Livade, Grbice, Bešnjaja, Žeželj, and near Grošničko Lake. Material was gathered for the most part using the technique of mowing and hand collection.

The sequence from the Winkler's catalog (WINKLER, 1924-1932) was followed in establishing the order of species in the list, except for the genera *Bradybatus* and *Miarus* after FREUDE *et al.*, (1983) and *Tychius* according to CALDARA (1990).

Ecological analysis encompassed dominance, frequency, and characteristicness (exclusive linkage with the oak forest biotope) for each species, in addition to a survey of life forms and the spectrum of nutrition. Mathematical processing was performed according to formulas from SCHWERDTFEGER (1975) and ODUM (1974).

In keeping with the calculated values of dominance, i.e., the percentage representation, species are assigned to the five usual categories established by TISCHLER (1949) and HEYDEMANN (1953) (from SCHWERDTFEGER, 1975) slightly modified for precision of computer analysis: eudominant (more than 10%); dominant (5.1-10%); subdominant, i.e., influential (2.1-5%); recedent (1.1-2%); and subrecedent (up to 1%). The abbreviations ED, D, SD, R, and SR, respectively, are used for these categories in the ecological part of the tables.

Frequency or finding frequency (*occurrence* to be more precise, since registrations, i.e., samples, were not of the same size) and species *constancy* (invariability of finding at the same place) were calculated according to the formulas given by MERKMALE. In keeping with the calculated values, species are assigned to the four (slightly modified) classes of TISCHLER (1949): euconstant (75.1-100%); constant (50.1-75%), accessory (auxiliary) (25.1-50%), and accidental (coincidental) (0-25%). The symbols EC, C, As, and Ac, respectively, are used for these classes in ecological processing. It should be noted that not all findings were taken into account in determining these values for the total material (accidental, i.e., unplanned, findings and donated specimens were excluded).

The ecologically very significant index of *species characteristicness* served as confirmation or denial of a division of biotopes and habitats of weevils in investigated Kragujevac Basin into twenty-one types. Species which occurred exclusively in one type of biotope (habitat) were considered characteristic. In contrast to them, the category of indifferent species encompassed those found in more than half (11 or

more) of the investigated biotopes (habitats), while species that occurred in more than one, but less than half of the biotope types, were considered transitional. The abbreviations assemblof these categories are Ch, I, and T, respectively.

The term *assembly* (GILLER, 1984) is adopted as the most adequate expression for the settlement of weevils in a given type of biotope (habitat).

The life form represents the ecological identity card of a species. For this reason, analysis of assembly structure in the present paper contains a survey of the life forms of species constituting the assembly. The division is based on the classification of orthopteroids (BEÍBIENKO & MISHCHENKO, 1951). For weevils, apart from the standard division into adelognaths (A) - forms with a short snout and phanerognaths (Ph) - forms with a long one, there is no standardized groupation on the basis of life forms. For this reason, we selected a system employed previously for weevils of Kragujevac vicinity (PEŠIĆ, 1990), one that is based on the habitus and ecological niche, but which is here supplemented. In addition to phytophiles including thamnobionts (T), which prefer woody plants, and hortobionts (H), which are linked with grassy plants, and geophiles (G, ground dwellers), the category of hygrophiles (Hy) is isolated for lovers of aquatic plants and damp terrains. The group of geophiles, in addition to cryptobiontic ground dwellers, also includes xylobionts or xylomycobionts, which live among or in fallen branches (SPRICK & WINKELMANN, 1993).

The breadth of the spectrum of nutrition for each species significantly affects the picture of the whole assembly. Here we adopt the widely employed division into monophages (M) - forms which feed on one plant species exclusively, oligophages (O) - forms which consume several related plants, and polyphages (P) - forms which feed on more than five plant species, sometimes of different genera.

In order to illustrate the wealth of assemblies and realize the possibility of comparing them, the index of general diversity was calculated for each, according to the SCHANNON'S formula (SCHANNON & WEAVER, 1949 from SCHWERDTFEGER, 1975).

To compare settlements of weevils in different biotopes (habitats) and define assemblies, we used the SORENSEN index of similarity (SORENSEN, 1948 from ODUM, 1974).

RESULTS AND DISCUSSION

In the course of investigating upland meadows in the Kragujevac basin, eight outings were made for collecting purposes from 1988 to 1994 (on 25 June 1988, 11 July 1991, and 21 May 1994 at Žeželj; on 05 July 1989 at Bešnjaja; on 23 July 1992 at Gornje Komarice; on 30 April 1992 near Grošničko Lake; on 16 July 1994 at Adžine Livade; and on 23 July 1994 at Grbice. Eighty-one findings yielded 175 adult specimens of weevils (84 males, 91 females). Identification established 52 species belonging to 17 genera and nine subfamilies (Tab. I).

Table I

Assembly of weevils in upland meadows of the Kragijevav Basin.

- Dominancy: ED = eudominant, D = dominant, SD = subdominant, R = recedent, SR = subrecedent; - Frequency: EC = euconstant, C = constant; As = accessory, Ac = accidental; - Characteristicness: Ch = characteristic, I = indifferent, T = transitional; - Life form: A - adelognaths, Ph = phanerognaths, T = thamnobionts, H = hortobionts; - Nutrition types: M = monophages, O = oligophages, P = polyphages.

SPECIEC	nr. males	nr. fem.	nr. indiv.	dominancy		frequency		character.	I. form I		I. form II	nutrition
1	2	3	4	5		6			7	8	9	10
Apion brevirostre	1	2	3	R	1,71%	Ac	12,50%	T	9,52%	Ph	H	O
Apion violaceum	1	0	1	SR	0,57%	Ac	12,50%	T	19,05%	Ph	H	O
Apion simum	0	1	1	SR	0,57%	Ac	12,50%	Ch	4,76%	Ph	H	O
Apion hoffmanni	0	4	4	SD	2,29%	Ac	12,50%	Ch	4,76%	Ph	H	O
Apion seniculus	3	5	8	SD	4,57%	As	37,50%	I	57,14%	Ph	H	O
Apion ononiphagum	1	0	1	SR	0,57%	Ac	12,50%	T	33,33%	Ph	H	O
Apion pubescens	1	0	1	SR	0,57%	Ac	12,50%	T	33,33%	Ph	H	O
Apion carduorum	0	1	1	SR	0,57%	Ac	12,50%	T	14,29%	Ph	H	O
Apion loti	1	4	5	SD	2,86%	As	25,00%	T	33,33%	Ph	H	O
Apion punctigerum	0	1	1	SR	0,57%	Ac	12,50%	T	47,62%	Ph	H	O
Apion pavidum	4	0	4	SD	2,29%	As	25,00%	T	19,05%	Ph	H	O
Apion nigritarse	2	3	5	SD	2,86%	As	37,50%	I	71,43%	Ph	H	O
Apion filirostre	0	1	1	SR	0,57%	Ac	12,50%	T	28,57%	Ph	H	O
Apion trifolii	2	0	2	R	1,14%	As	25,00%	I	57,4%	Ph	H	O
Apion apricans	3	1	4	SD	2,29%	As	25,00%	I	66,67%	Ph	H	O
Apion ononicola	0	3	3	R	1,71%	As	25,00%	T	47,62%	Ph	H	O
Apion dissimile	1	0	1	SR	0,57%	Ac	12,50%	Ch	4,76%	Ph	H	M
Otiorhynchus fullo	0	1	1	Sr	0,57%	Ac	12,50%	T	14,29%	A	T	O
Sciaphobus caesius	0	1	1	SR	0,57%	Ac	12,50%	T	28,57%	A		
Eusomus ovulum	0	9	9	D	5,14%	C	50,00%	T	38,10%	A	H	P
Sitona sulcifrons	0	1	1	SR	0,57%	Ac	12,50%	T	42,86%	A	H	O
Sitona puncticollis	1	0	1	SR	0,57%	Ac	12,50%	T	28,57%	A	H	O
Sitona humeralis	1	1	2	R	1,14%	Ac	12,50%	T	33,33%	A	H	P

SPECIEC	nr. males	nr. fem.	nr. indiv.	dominancy		frequency		char acter.	I. form I	I. form II		nutrition
1	2	3	4	5		6			7	8	9	10
Sitona inops	1	0	1	SR	0,57%	Ac	12,50%	T	19,05%	A	H	M
Larinus turbinatus	0	1	1	SR	0,57%	Ac	12,50%	T	19,05%	Ph	H	O
Larinus minutus	5	6	11	D	6,29%	As	37,50%	Ch	4,76%	Ph	H	O
Larinus obtusus	0	5	5	SD	2,86%	As	25,00%	T	9,52%	Ph	H	O
Larinus canescens	0	1	1	SR	0,57%	Ac	12,50%	Ch	4,76%	Ph	H	M
Lixus elongatus	1	0	1	SR	0,57%	Ac	12,50%	T	19,05%	Ph	H	O
Lixus scolopax	0	1	1	SR	0,57%	Ac	12,50%	Ch	4,76%	Ph	H	O
Cyphocleonus trisulcatus	0	1	1	SR	0,57%	Ac	12,50%	Ch	4,76%	Ph	H	O
Pachytychius sparsutus	1	1	2	R	1,14%	Ac	12,50%	Ch	4,76%	Ph	H	O
Smicronyx reichi	1	0	1	SR	0,57%	Ac	12,50%	Ch	4,76%	Ph	H	O
Smicronyx jungermanniae	1	1	2	R	1,14%	Ac	12,50%	T	38,10%	Ph	H	O
Smicronyx nebulosus	1	0	1	SR	0,57%	Ac	12,50%	T	9,52%	Ph	H	O
Tychius quinquepunctatus	1	0	1	SR	0,57%	Ac	12,50%	T	38,10%	Ph	H	O
Tychius squamulatus	2	4	6	SD	3,43%	As	25,00%	T	28,57%	Ph	H	M
Tychius kulzeri	1	1	2	R	1,14%	As	25,00%	T	9,52%	Ph	H	O
Tychius medicaginis	3	2	5	SD	2,86%	As	25,00%	T	23,81%	Ph	H	O
Tychius junceus	1	1	2	R	1,14%	Ac	12,50%	T	23,81%	Ph	H	P
Tychius meliloti	6	2	8	SD	4,57%	As	25,00%	T	14,29%	Ph	H	O
Tychius breviusculus	9	6	15	D	8,57%	Ac	12,50%	Ch	4,76%	Ph	H	O
Tychius lineatulus	1	0	1	SR	0,57%	Ac	12,50%	Ch	4,76%	Ph	H	O
Tychius stephensi	1	2	3	R	1,71%	Ac	12,50%	T	23,81%	Ph	H	O
Tychius cuprifer	1	0	1	SR	0,57%	Ac	12,50%	T	42,86%	Ph	H	O
Anthonomus rubi	1	0	1	SR	0,57%	Ac	12,50%	T	38,10%	Ph	H	O
Ceutorhynchus punctiger	0	1	1	SR	0,57%	Ac	12,50%	T	23,81%	Ph	H	M
Gymnaetron pascuorum	4	2	6	SD	3,43%	As	37,50%	T	38,10%	Ph	H	M
Gymnaetron tetrum	12	9	21	ED	12,00%	C	50,00%	T	14,29%	Ph	H	O
Cionus thapsus	5	2	7	SD	4,00%	As	25,00%	T	14,29%	Ph	H	O
Cleopus solani	2	3	5	SD	2,86%	Ac	12,50%	T	9,52%	Ph	H	O
Rhynchaenus fagi	1	0	1	SR	0,57%	Ac	12,50%	T	14,29%	Ph	T	O

Eusomus ovulum, Larinus minutus, and *Tychius breviusculus* are dominant species.

The parthenogenetic, polyphagic species *Eusomus ovulum* and the species *Gymnaetron tetrum* are constant.

A basic feature of the assembly of weevils in upland meadows of the Kragujevac Basin is a high degree of species characteristicness (11 species, i.e., 21.1%, are characteristic, while only four or 7.6% are indifferent).

Only 5.8% (three species) are polyphagous.

Just two species are thamnobionts (*Otiorhynchus fullo*, which according to published data can be linked with *Quercus, Crataegus, Prunus spinosa*, and *Syringa vulgaris*; and *Rhynchaenus fagi*, whose development is linked exclusively with *Fagus sylvatica*, but whose feeding is linked with *Quercus* and *Crataegus* as well). Having arrived from surrounding forests, one specimen was found in the case of each of the indicated two species.

All of these facts suggest that the weevil assembly of upland meadows is specific in relation to others that have been investigated in Kragujevac Basin.

The greatest similarity to the weevil assembly of upland meadows is exhibited by the assemblies of artificial meadows (0.3652) and ruderal vegetation (0.3590).

The index of biodiversity (3.4838) is lower than for most other meadow assemblies in the Kragujevac Basin (PEŠIĆ, 1997). It indicates sensitivity of this weevils assembly.

These preliminary results warn that caution is needed in realization of further anthropogenic activities in upland meadows. They also confirm the already established permanent alteration of the fauna in the direction of increasing occurrence of steppe forms (MILOJEVIĆ, 1984; STOJANOVIĆ, 1989).

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CURCULIONIDAE (COLEOPTERA) БРДСКИХ ЛИВАДА КРАГУЈЕВАЧКЕ КОТЛИНЕ

С. ПЕШИЋ

Извод

На основу адултног куркулионидног материјала сакупљеног у периоду од 1988. до 1994. године у Крагујевачкој котлини, дат је прелиминарни приказ фауне и еколошког стања асамблеје ових инсеката констатоване на брдским ливадама.

У осам, махом летњих снимака, истраживане су ливаде на надморским висинама 300-500 м, на локалитетима Горње Комарице, Аџине Ливаде, Грбице, Бешњаја, Жежељ и код Грошничког језера. Све су суве, са елементима степе (припадају асоцијацијама *Chrysopogonetum-Festucetum vallesiacae* Вељовић и *Agrostido-Andropogonetum ischaemi* Вељовић).

Укупно 81 налаз је садржао 175 јединки (84 мужјака, 91 женка) из 52 врсте (17 родова, 9 подфамилија).

Еколошка обрада је показала висок степен карактеристичности. Карактеристично је 11 врста, тј. 21,1%; индиферентних врста има свега 4 (7,6%).

Доминантне врсте су *Eusomus ovulum, Larinus minutus* и *Tychius breviusculus*.

У погледу присутности константне су партеногенетска, полифага врста *Eusomus ovulum* и *Gymnaetron tetrum*.

Специфичност асамблеје куркулионида брдских ливада Крагујевачке котлине потврђују и следећи подаци. Полифаго је само 5,8% (3 врсте). Тамнобионти су тек две врсте (*Otiorhynchus fullo*, који се по литературним подацима може везати за *Quercus, Crataegus, Prunus spinosa, Syringa vulgaris* и *Rhynchaenus fagi* развићем искључиво везан за *Fagus silvatica*, а исхраном и за *Quercus* и *Crataegus*) нађене са по једном јединком приспелом из околних шума.

Паралелно истраживање је омогућило компарацију ове и асамблеја куркулионида са других биотопа или станишта. Најсличније брдској су асамблеје куркулионида вештачких ливада (0,3652) и рудералне вегетације (0,3590).

Нижи индекс биодиверзитета (3,4838) у односу на већину других ливадских асамблеја у Крагујевачкој котлини опомиње на осетљивост асамблеје куркулионида брдских ливада.

Ови прелиминарни резултати упозоравају на опрез у даљим антропогеним активностима на брдским ливадама, а и потврда су већ констатованог перманентног мењања фауне у смеру степифизације.

Received October 7, 1997
Accepted December 8, 1997