

MATERIALS ABOVE ECOLOGY AND DISTRIBUTION OF ORTHOPTERA ORDER FROM LANDSCAPE RESERVE “ONE HUNDRED KNOLLS” (REPUBLIC OF MOLDOVA)

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Abstract. *In this work are given the dates concerning to the diversity of orthopterans species from landscape reserve "One Hundred of Knolls" (Republic of Moldova), which were collected in period of summer of 2007. The landscape has 1027 hectares and is situated at 200 km North from Chisinau, on the left side of Prut River. In paper are done biological-ecological structure of a complex of grasshoppers, also are calculated the index of diversities Shannon-Wiener, theoretic variety and Equitability. In the result of investigations were collected 274 specimens from 31 orthopterans species which belong to 7 families and 11 genera: Phaneroptera, Decticus, Metrioptera, Conocephalus, Oecanthus, Pteronemobius, Gryllus, Tridactylus, Tetrax, Calliptamus, Dociostaurus, Chrysochraon, Stemobothrus, Omocestus, Chortippus, Euchorthippus, Myrmeleotettix, Aiolopus and Oedipoda.*

Keywords: *Orthoptera, landscape reserve "One Hundred of Knolls".*

Rezumat. Materiale asupra ecologiei și distribuției ortopterelor din Rezervația Peisagistică “Suta de Movile” (Republica Moldova). *În această lucrare sunt prezentate datele referitoare la fauna ortopterelor colectate în perioada de vară a anului 2007 din rezervația „Suta de Movile”. „Suta de Movile” este o rezervația peisagistică cu o suprafață de 1027 hectare, situată la 200 km depărtare de capitala țării, pe partea stângă a râului Prut. În lucrare este redată structura bio-ecologică a saltatorienilor înregistrați, deasemenea sunt calculați indicii de diversitate Shannon-Wiener, variabilitatea teoretică și echitabilitatea. În urma cercetărilor au fost identificate 31 de specii de ortoptere care aparțin la 7 familii și 11 genuri: Phaneroptera, Decticus, Metrioptera, Conocephalus, Oecanthus, Pteronemobius, Gryllus, Tridactylus, Tetrax, Calliptamus, Dociostaurus, Chrysochraon, Stemobothrus, Omocestus, Chortippus, Euchorthippus, Myrmeleotettix, Aiolopus și Oedipoda.*

Cuvinte cheie: *Orthoptera, rezervația peisagistică „Suta de Movile”.*

INTRODUCTION

"One Hundred of Knolls" presents a landscape of great scientific and esthetic value and is the unique place in Europe, where is concentrated a quite big number of submarine reefs of the Mediterranean Sea - water tertiary basin that those times covered the actual territory of the Republic of Moldova with approximately 20 millions of years ago.

This landscape is situated at 200 km distance from Chișinău, on the left downstream of Prut, at South-East of Braniste and Cobani villages' Glodeni district. "One Hundred of Knolls" has an 8 km length and 2,3-1,7 km breadth with more than 3500 of hills, very pronounced, with steep slopes from 1-3 m up to 30 m ("Movila Tiganului") or in translation (Hill of Rom). The landscape includes six terraces of Prut River, with a height from 50-60 m to 160-170 and with a surface about 1027 hectare.

The first certify which belong to this places dated from 1716 in paper of Dimitrie Cantemir "Description of Moldova", which had named this landscape „Centum monticulli”.

The insects' diversity is poorly studied and till present above grasshoppers and katydids from landscape reserve "One Hundred of Knolls" was published only one paper (STAHİ & DERJANSCHI, 2007) where were quote 18 species.

MATERIAL AND METHOD

Under the hills, the freatic water and water proceeded from atmospheric precipitation forming a lot of small lakes with abundant vegetation typical or humid midway. Also on the territory, where the hills are located, many plant species extremely rare have found their refuge: *Dianthus campestris*, *Hyacinthella leucophaea*, different species from *Linum* genus etc. In sectors with steppe vegetations were present the vegetation of Balti steppe: *Festuca valesica*, *Euphorbia stepposa*, *Poa angustifolia*, *Elytrigia repens*, *Bromopsis inermis* (POSTOLACHE, 1995).

Beginning with the blossom of the first pervernal flowers up in the torrid days of July, the multitude of plants steppe blossom phasing which are giving every day till November different colors and new issues.

The researches in the landscape reserve "One Hundred of Knolls" were effectuated in summer of 2007, in steppe and moist meadows vegetation.

The collecting of grasshoppers was effectuated by net with a sweep-net and by hand direct on the grasses.

The entomological materials were distinguished using the guides elaborates by KIS (1962, 1976, 1978), KNECHTEL & POPVICI-BIZNOSEANU (1959), BEL-BIENKO (1964), AVAKEAN (1968).

RESULTS AND DISCUSSIONS

In the result of research effectuated on the territory of landscape reserve "One Hundred of Knolls" were collected 274 specimens (Table 2) which belong to 31 species of insects from Orthoptera order. These species belong to 7 families Tettigoniidae, Grillidae, Oecanthidae, Tridactylidae, Tetrigidae, Catantopidae, Acrididae and 11 genera *Phaneroptera*, *Decticus*, *Metrioptera*, *Conocephalus*, *Oecanthus*, *Pteronemobius*, *Gryllus*, *Tridactylus*, *Tetrix*, *Calliptamus*, *Dociostaurus*, *Chrysochraon*, *Stenobothrus*, *Omocestus*, *Chorthippus*, *Euchorthippus*, *Myrmeleotettix*, *Aiolopus* and *Oedipoda* (Table 1). The richer families are Acrididae with 15 species and Tettigoniidae with 6 species.

Here were collected species which prefer a meadows and very damp meadows like: *Pteronemobius heydeni*, *Tridactylus variegatus*, *Chrysochraon dispar*, *Aiolopus thalassinus* and species from genus *Tetrix*.

Table 1. The list of othopterans species and their index of dominance from landscape reserves "One Hundred of Knolls" of the Republic of Moldova.

Tabelul 1. Lista si indicele lor de dominanță a speciilor de ortoptere din rezervația peizajistica "Suta de Movile" din Republicii Moldova.

Nr.	Species	Distribution	Ecology	Index of dominance
1	<i>Phaneroptera falcata</i> SCOPOLI 1763	Euro-Sib.	Bushy areas	2,19
2	<i>Decticus albifrons</i> FABRICIUS 1793	Med.	Rough grassland	2,55
3	<i>Decticus verrucivorus</i> LINNAEUS 1758	Transp.	Swath meadow	0,73
4	<i>Conocephalus fuscus</i> FABRICIUS 1793	Pal.	River grassland, high marsh grassland, rushes, damp meadow	2,19
5	<i>Metrioptera (B.) bicolor</i> PHILIPPI 1830	Transp.	Heath, grassy edges, damp and semi-damp pasture	1,09
6	<i>Metrioptera roeseli</i> HAGENBACH 1822	Hol.	Grassy margins of damp woodland	4,38
7	<i>Oecanthus pellucens</i> SCOPOLI 1763	C-A-M	Trees, bushes and tall herbage	2,92
8	<i>Pteronemobius heydeni</i> FISHER 1853	Circum-Med.	Dunes and stony rivers	1,09
9	<i>Gryllus campestris</i> LINNAEUS 1758	Pal.	Grassy places of all kinds	2,19
10	<i>Gryllus (M.) desertus</i> PALLAS 1771	C-A-P	Grassy places of all kinds	3,65
11	<i>Tridactylus variegatus</i> LATREILLE 1809	Med.	Dunes and stony rivers	1,09
12	<i>Tetrix subulata</i> LINNAEUS 1761	Transp.	Stony rivers and river grassland	2,19
13	<i>Tetrix bipuncatata</i> LINNAEUS 1758	Transp.	Riverside grassland, stony rivers and rushes	1,09
14	<i>Tetrix undulata (vittata)</i> SOWERBY 1806	Med.	Riverside grassland, stony rivers and rushes	1,83
15	<i>Calliptamus italicus</i> LINNAEUS 1758	Euro-Sib	Damp and semi-damp pasture	2,92
16	<i>Chrysochraon dispar</i> HEYER 1817	Transp.	Very damp meadows	3,65
17	<i>Myrmeleotettix maculatum</i> THUNBERG 1815	Pal.	Heaths and other dry grassy places	0,73
18	<i>Stenobothrus stigmaticus</i> RAMBUR 1838	Pal.	Dry grassland	0,73
19	<i>Stenobothrus nigromaculatus</i> HERRICH-SCHAFFER 1840	Pal.	Dry grassland	0,36
20	<i>Omocestus haemorrhoidalis</i> CHARPENTIER 1825	Transp.	Rough grassland and moorland	0,73
21	<i>Omocestus rufipes</i> ZETTERSTEDT 1821	Pal.	All kinds of grassland	14,6
22	<i>Omocestus viridulus</i> LINNAEUS 1758	Transp.	Almost any grassland except very dry areas	1,82
23	<i>Chorthippus biguttulus</i> LINNAEUS 1758	Transp.	All kinds of grassland	6,57
24	<i>Chorthippus albomarginatus</i> DE GEER 1773	Transp.	Dense grassland, in damp and dry, including salt marshes	22,99
25	<i>Chorthippus brunneus</i> THNBERG 1815	Transp.	All kinds of grassland	4,74
26	<i>Chorthippus dorsatus</i> ZETTERSTEDT 1821	Euro-Sib.	Heath, grassy margins of damp meadows	1,46
27	<i>Chorthippus parallelus</i> ZETTERSTEDT 1821	Pal.	All kinds of grassland	0,73
28	<i>Euchorthippus pulvinatus</i> FISCHER DE WALDHEIM 1846	T-C	Riverside grassland and dry field	0,36
29	<i>Dociostaurus brevicollis</i> EVERSMAAN 1848	Euro-Sib	Riverside grassland and dry field	0,73
30	<i>Aiolopus thalassinus</i> FABRICIUS 1793	Med.	Damp meadow	1,09
31	<i>Oedipoda caerulescens</i> LINNAEUS 1758	Pal.	Dry, stony and sandy places with plenty of bare ground	6,20

Abbreviations: Euro-Sib – Euro-Siberian; Med. – Mediteranean; Pal. – Palearctic; Transp. – Transpalearctic; C-A-M. – Central-Asiatico-Mediterranean; Circum-Med. – Circum-Mediterranean; C-A-P – Central-Asiatico-Pontic; Holo-Pal. – Holo-Palearctic; T-C – Turano-Caucasian.

In result of investigations also were established that *Decticus verrucivorus*, *Metrioptera (B.) bicolor*, *Pteronemobius heydeni*, *Tridactylus variegates*, *Tetrix bipuncatata*, *Myrmeleotettix maculatum*, *Stenobothrus stigmaticus*, *Stenobothrus nigromaculatus*, *Omocestus haemorrhoidalis*, *Chorthippus parallelus*, *Euchorthippus pulvinatus*, *Dociostaurus brevicollis* and *Aiolopus thalassinus* are subrecedente species, *Tetrix undulata* *Omocestus viridulus* *Chorthippus dorsatus* were recedente, *Phaneroptera. Falcate*, *Decticus albifrons*, *Conocephalus fuscus*, *Metrioptera roeseli*, *Oecanthus pellucens*, *Gryllus campestris*, *Gryllus desertus*, *Tetrix subulata*, *Calliptamus italicus*, *Chrysochraon dispar* and *Chorthippus brunneus* were subdominante, species *Chorthippus biguttulus*, *Oedipoda caerulescens* were dominante, *Omocestus rufipes* and *Chorthippus albomarginatus* were eudominante (Tabel 1).

Concerning to the type of geographical distribution which belong the collected species, ten are Transpaleartic and consist 32,25%, eight have Palearctic spread - 25,81%, by four species have Mediterranean and Euro-Siberian spread and consist by 12,9%, and by one has a Holoartic, Central-Asiatico-Mediteranean, Circum-Mediteranean, Central-Asiatico-Pontic, Turano-Caucasian which consist at their turn just 3,2% (Figure 1).

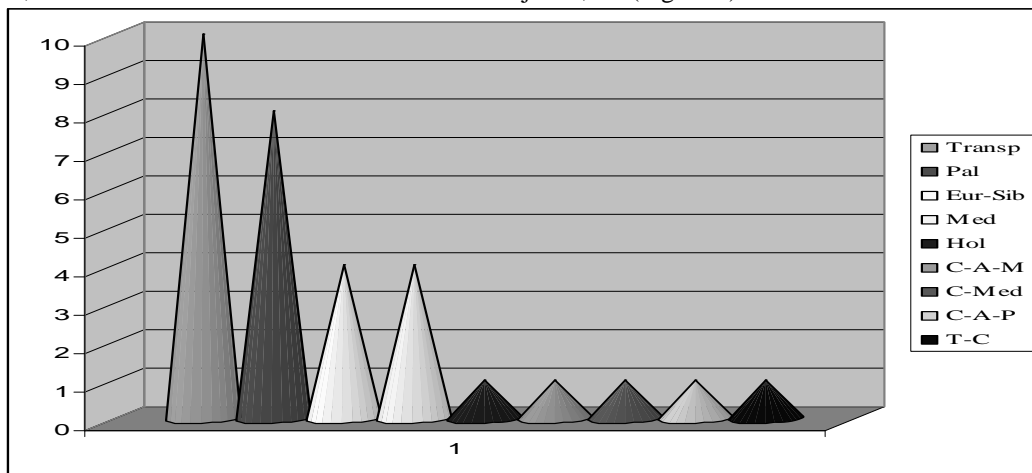


Fig. 1. Spectrum of geographical distribution of grasshoppers from landscape reserve "One Hundred of Knolls".
Fig. 1. Spectrul distribuției geografice a ortopterelor colectate din rezervația peizagistică "Suta de Movile".

Abbreviations: Transp. – Transpaleartic; Pal. – Palearctic; Euro-Sib – Euro-Siberian; Med. – Mediteranean; Hol. Holoartic; C-A-M. – Central-Asiatico-Mediteranean; C-Med. – Circum-Mediteranean; C-A-P – Central-Asiatico-Pontic; T-C – Turano-Caucasian.

Table. 2. Values of index of diversity to orthoptera species collected in landscape reserve "One hundred of Knolls".

Tabelul 2. Valorile indicilor de diversitate a ordinului Orthoptera colectate din rezervația peisagistică "Suta de Movile".

Nr. sp.	Specia	N ♀/♂	N-1	N(N-1)	Log10N	Nlog10N
1	<i>Phaneroptera falcata</i>	2/4	5	30	0,7781	4,6686
2	<i>Decticus albifrons</i>	3/4	6	42	0,8450	5,915
3	<i>Decticus verrucivorus</i>	2/0	1	2	0,3010	1,4313
4	<i>Metrioptera (B.) bicolor</i>	5/1	5	30	0,7781	4,6686
5	<i>Metrioptera roeseli</i>	3/0	2	6	0,4771	1,4313
6	<i>Conocephalus fuscus</i>	10/2	11	132	1,0792	12,9504
7	<i>Oecanthus pellucens</i>	3/6	8	72	0,9542	8,5878
8	<i>Pteronemobius heydeni</i>	0/3	2	6	0,4771	1,4313
9	<i>Gryllus campestris</i>	1/5	5	30	0,7781	4,6686
10	<i>Gryllus (M.) desertus</i>	6/4	9	90	1	10
11	<i>Tridactylus variegatus</i>	2/1	2	6	0,4771	1,4313
12	<i>Tetrix subulata</i>	5/1	5	30	0,7781	4,6686
13	<i>Tetrix bipunctat</i>	3/0	2	6	0,4771	1,4313
14	<i>Tetrix undulata (vittata)</i>	1/4	4	20	0,6989	3,4945
15	<i>Calliptamus italicus</i>	6/2	7	56	0,9031	7,2248
16	<i>Chrysochraon dispar</i>	8/2	9	90	1	10
17	<i>Myrmeleotettix maculatum</i>	1/0	0	0	0	0
18	<i>Stemobothrus stigmaticus</i>	2/0	1	2	0,3010	0,602
19	<i>Stemobothrus nigromaculatus</i>	1/1	1	2	0,3010	0,602
20	<i>Omocestus haemorrhoidalis.</i>	0/1	0	0	0	0
21	<i>Omocestus viridulus</i>	2/0	1	2	0,3010	0,602
22	<i>Omocestus rufipes</i>	19/21	39	1560	1,6020	64,08
23	<i>Chorthippus albomarginatus</i>	5/0	4	20	0,6989	3,4945
24	<i>Chorthippus biguttulus</i>	10/8	17	306	1,2552	22,5936
25	<i>Chorthippus brunneus</i>	42/21	62	3782	1,7993	113,3559
26	<i>Chorthippus dorsatus</i>	10/3	12	156	1,1139	14,4807
27	<i>Chorthippus parallelus</i>	1/3	3	12	0,6020	2,408
28	<i>Euchothippus pulvinatus</i>	2/0	1	2	0,3010	0,602
29	<i>Dociostaurus brevicollis</i>	2/0	1	2	0,3010	0,602
30	<i>Aiolopus thalassinus</i>	2/1	2	6	0,4771	1,4313
31	<i>Oedipoda caeruleascens</i>	13/4	16	272	1,2304	20,9168
	TOTAL	274 (N)	244	6332 (Σ)	2,4377 (log)	329,7742 (Σ)
						H(S)=4,098 Hmax=4,954 E%=82

Index of diversities Shannon-Wiener

$$H(S) = K/N \cdot (N \cdot \log_{10} N - \sum N \log_{10} N) = 3,321928 / 274 \cdot (274 \cdot 2,4377 - 329,7742) = 0,01212 \cdot (667,9298 - 329,7742) = 4,098$$

Theoretic variety:

$$H(S)_{\max} = K \log_{10} S = 3,321928 \cdot 1,4914 = 4,954$$

$$\text{Equitability } E = H(S) / H(S)_{\max} = 4,098 / 4,954 = 0,82.$$

The index of diversity Shannon-Wiener has value 4,098. Such a high value of index of diversity is so high because the vegetation is so diversity. The index of theoretic variety is equal with 4,954 and index of equitability is 82% (Table 2).

CONCLUSIONS

1. In the landscape reserve of the Republic of Moldova „One Hundred of Knolls” or in translation „Suta de Movile” were collected 31 species of grasshoppers which belong to 7 families and 19 genera. On the whole families *Acrididae* is the richer in genera - ten and in species - 15, also family *Tettigoniidae* by six genera and species.

2. In the result of researches were established that nine species were subcedente, seven recedente and ten were subdominante.

3. Species *Chorthippus biguttulus*, *Oedipoda caerulescens* are dominants and *Omocestus rufipes*, *Chorthippus albomarginatus* are eudominante.

4. The index of diversities Shannon-Wiener has a big value 4,098, value of theoretic variety was 4,954 and index of equitability was 82,0%.

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