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INVERTEBRATES OF HERB LAYER OF MEADOWS IN ILMENSKY RESERVE (SOUTH URAL)

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Introduction

Invertebrate animals communities, inhabiting herb layer in forests zone of South Ural, is the great interest of synecologers, since they have high species riches. At the same time, study of this group has some difficulties. The greatest one is variety of taxonomic groups. The aim of this work is an attempt of synecological analysis of invertebrate mesofauna of herb layer as definite layer of animals population.

History of synecological researches of herb layer population numbers about 100 years (Shelford, 1913; Vestal, 1913, 1914; Adams, 1915 and others), but only in last decades this direction became independent. Special investigations on structure and dynamics of herb layer population were conducted in different natural plant communities (Roth, 1971; Chernov, 1971, 1984; Chernov, Rudenskaya, 1975; Shalapenok, Zapolskaya, Chumakov, 1979; Shalapenok, Zapolskaya, 1981; Brown, 1982; Brown, Southwood, 1983; Gillon, 1983; Veselova, 1984, 1986, 1988; Lagunov, 1990, 1994 and many others).

Material and methods

Three types of grasslands have been studied (dry meadow, forb meadow and mountain spring meadow by standard sweep net and biocenometer. Over 200 thousands of specimens (about 600 species from twenty orders) were examined from 1981 to 2001 in Ilmensky reserve. Obtained quantitative data have been analyzed by original computer program “BIODIV” (Baev, Penev, 1990).

Results and discussion

General review of fauna

Specific structure of Mollusca, Aranei, Orthoptera, Cicadinea, Hemiptera and Coleoptera has been studied in detail as of invertebrate complex of herb layer. Diptera and Hymenoptera haven′t been defined to species.

Columella edentula Drap. and *Bradybaena fruticum* Mull. were dominant among 9 snail species in mountain–spring meadow (table 1). Population of Aranei was very rich (98 species, 15 families). Linyphiidae, Araneidae and Clubionidae were the richest.

Maximal biodiversity of Orthoptera took place in dry meadow (12 species, dominant: *Chorthyppus dorsaltus* Zett.). *Megadelphax sordidulus* Stal.*, Eurybregma nigrolineata* Scott.*, Stiroma bicarinata* H.–S.*, Phylaemus spumarius* L.*, Empoasca sp., Emelyanoviana mollicula* Boh.*, Diplocolenus abdominalis* F. were dominant among 82 species of Cicadinea.

The richest Hemiptera families were Miridae (dominants: *Chlamydatus pulicarius* Fall., *Halticus apterus* L., *Labops sahlbergi* Fall., *Lygus adspersus* Schill., *L. wagneri* Rem.), Lygaeidae (dominants: *Nythecus jacobaeae* Schill.), Tingidae, Pentatomidae (dominants: *Carpocoris purpureipennis* Deg., *Dolycoris baccarum* L.).

Table 1

Number of species in the main taxonomic groups, inhabiting the herb layer

Taxonomic groups	Dry meadow	Mountain spring meadow	Forb meadow	Total
Mollusca	3	4	6	9
Aranei	72	38	51	98
Orthoptera	12	5	3	14
Homoptera	62	42	47	82
Hemiptera	101	62	64	131
Coleoptera	222	115	129	318
Total	472	266	300	652

Three hundred of species of beetles from 36 families have been recorded. Chrysomelidae and Curculionidae as phytophagous beetles were represented by the highest number of species and specimens (dominants: *Chaetocnema concinna* Marsh., *Longitarsus luridus* L., *Sitona ambiguus* Gyll., *S. sulcifrons* Thunb., *Apion gracilipes* Dictr., *A. ononicola* Gr., *A. seniculus* Kby.).

Taxonomic structure

Every layer of invertebrate population had specific set of groups of dominants. Lumbricidae dominated in number and biomass among geobionts, Coleoptera among herpetobionts. Diptera were the most numerous in the herb layer (20—27 % of specimens), and there were a lot of Homoptera (12—34 %), Hemiptera (5—27 %), Coleoptera (10—19 %). Caterpillars were not numerous, but their mass were maximal. In the same time Hymenoptera had minimal mass and maximal number.

Species from 20 most rich families compounded 80% of the all species in dry meadow, 78 % in mountain–spring meadow, 76% in forb meadow (table 2).

Table 2

Species riches of common grassland families

Family orders	Dry meadow	Mountain spring meadow	Forb meadow	Total
Curculionidae, Coleoptera	84	43	47	118
Chrysomelidae, Coleoptera	52	26	24	71
Cicadellidae, Homoptera	43	32	35	60
Miridae, Hemiptera	38	25	31	55
Linyphiidae, Aranei	11	9	13	22
Coccinellidae, Coleoptera	15	11	9	20
Thomisidae, Aranei	16	7	11	19
Lygaeidae, Hemiptera	14	9	6	16
Helodidae, Coleoptera	10	5	10	14
Tingidae, Hemiptera	8	4	2	14
Pentatomidae, Hemiptera	12	8	5	13
Delphacidae, Homoptera	11	5	7	13
Staphylinidae, Coleoptera	5	5	7	13
Cantharidae, Coleoptera	10	1	3	12
Acrididae, Orthoptera	10	3	2	11
Carabidae, Coleoptera	7	2	4	10
Elateridae, Coleoptera	5	3	1	10
Clubionidae, Aranei	8	2	4	8
Rhopalidae, Hemiptera	7	3	4	8
Total	378	207	228	524

Dominant species

Phytophageous *Diplocolenus abdominalis* (Homoptera) and *Halticus apterus* (Hemiptera) were most abundant in herb layer of studied meadows (table 3). The group of subdominants on dry meadow included 4 species of phytophagous and one predator (*Nabis brevis* Scholtz.). On mountain–spring meadow this group included 2 species of phytophagous (Mollusca) and one species of micetophagous (*Corticarina gibbosa* Hbst.). On forb meadow the group of subdominants included 5 species of suctorial phytophagous (Cicadinea), one species of phytophagous (*Bradibaena fruticum*) and one species of mycetophagous (*Corticarina gibbosa*).

Table 3

Dominatns and subdominants in herb layer

Dry meadow	Mountain spring meadow	Forb meadow
Dominants		
Diplocolenus abdominalis (Homoptera)	Diplocolenus abdominalis (Homoptera)	—
Halticus apterus (Hemipera)		
Subdominants		
Megadelphax sordidulus (Homoptera)	Bradybaena fruticum (Mollusca)	Bradybaena fruticum (Mollusca)
Emelyanoviana mollicula (Homoptera)	Columella edentula (Mollusca)	Eurybregma nigrolineata (Homoptera)
Nabis brevis (Hemiptera)	Corticarina gibbosa (Coleoptera)	Stiroma bicarinata (Homoptera)
Plagiognathus chrysanthemi (Hemiptera)		Philaemus spumarius (Homoptera)
Longitarsus luridus (Coleoptera)		Empoasca sp. (Homoptera)
		Diplocolenus abdominalis (Homoptera)
		Corticarina gibbosa (Coleoptera)

Among species, forming the group of ordinary herb layer population, phytophagous are also in greatest number. Thus, dominants are first of all phytophagous, and suctorial are most numerous of them (Cicadinea and Hemiptera). As a whole herb layer population has regular species structure and great variety of species. Indices PIE (probability of interspecific encounters) for basic groups of grassy invertebrate were, as rule, 0,7.

Ratio of adaptive forms

Specific environmental conditions in herb layer caused various morphological, physiological, ecological adaptations of invertebrate. Many inhabitants of this layer have elongated body, it is important for moving in herbage. Elongated legs or jumping legs are also useful instrument. Herb inhabitants have often green, yellowish or dismembering coloration. Some of them have bright cover of body or bright spots and stripes, reflected solar rays and protected body against overheating. Paws of many species have special instruments for cohesion with inclined and vertical surfaces (bunches of hairs, suckers, claws, bristles).

We have studied morphological peculiarities of Hemiptera inhabiting the grass layer. 25 usual hemipteran species common to herb layer were examined. The traits assessed were the body shape, relative length of legs thickness of hind legs, and special indices were developed.

Morphological analysis led to divided the species into 3 groups. Species of the first group (*Nabicula flavomarginata* Scholtz*., N. limbata* Dhlb*., Nabis ferus* L*., N. rugosus* L*., Berytinus clavipes* F.) were characterized by an elongated body. The main method of movement in grass is stepping. The species of this group are closely associated with the grass layer.

The second group of species (Chlamydatus pulicarius Fall., Ch. pullus Reut., Halticus apterus L., Turyopicoris nitidus M.–D., Lygus adspersus Schill., L. wagnery Rem., Polymerus unifasciatus Fall., Stenotus binotatus F.) were characterized by a round body, long high legs and thic hind femula. the main method of moving in grass is jumping.

The third group united the inter–strata species (Kleidocerys resedae Pz., Anthocoris nemorum L., Nithecus jacobeae Schill., Geocoris dispar Waga., Stygnocoris pedestris Fall., Carpocoris purpureipennis Deg., Dolycoris baccarum L. et al.). The body is not elongated, the hind legs are relatively short. Thus there appears to be a relationship between the morphology of the species location and use of various levels with in the herb layer.

Summary

1. Invertebrate mesofauna of herb layer of Ilmensky reserve is very diverse. It includes about 600 species from 20 orders.

2. Diptera, Homoptera, Hemiptera, Coleoptera and Hymenoptera prevail by number of specimens. Coleoptera, Hemiptera, Homoptera, Orthoptera, Mollusca, Aranei and larva Lepidoptera predominate by biomass.

3. Phytophagous prevail in herb layer both by biomass and number. Most of dominant species are also phytophagous.

4. By analysis of morphological peculiarities of Hemiptera, most common in herb layer, adaptive groups have been picked out, concerned with modes of moving.

5. Peculiar properties of invertebrate communities of herb layer gives grounds to consider the chortobiont complex as definite layer of invertebrate population as a whole.

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