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MUZEUL JUDEȚEAN MUREȘ

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ENTOMOFAUNA AS COMPONENT OF FOREST ECOSYSTEMS IN REPUBLIC OF MOLDOVA

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Abstract: This paper includes the analysis of species diversity and importance of some invertebrates (Collembola, Homoptera and Coleoptera) for the forest ecosystems. At the present time in the Republic of Moldova there can be found 350 species of Homoptera (aphids). Among them – 145 produced “honey dew” for 31 species of ants. They represented source of food for several species of insects. There are some species of aphids that are pests of agricultural plants, but they are not dangerous for the forests. Coleopterans have been studied in the landscape reserve “Codrii Tigheciului” (160 species) and in other forests (20 edaphic and dendrophylous species) collected in the central area and northern zones of the Republic of Moldova. After the trophic spectrum the recorded phytophagous coleopterans aren't dangerous for forest ecosystems, although in drought years the dendrophylous species *Galerucella luteola* was very abundant in elm forest. In forest ecosystems were registered various trophic groups of coleopterans: predatory, necrophagous, coprophagous and saprophagous, which have a positive role in the maintenance of sanitary status of woods. An important role for forest ecosystems is also represented by the collembolans that decompose the organic matter and participate to the formation of the humus and soil structure. Collembolan fauna was analyzed on the basis of material collected in the State Nature Reserve “Plaiul Fagului”, where 118 species were recorded, which constitute more than half of total number of collembolan species registered for the Republic of Moldova.

Keywords: forest ecosystems, Collembola, Homoptera, Coleoptera, species diversity, Republic of Moldova

Introduction

The forest is a natural complex in community of which dominate several species of trees, shrubs and herbaceous plants. Many animal species inhabit the forest ecosystems, including invertebrates. One of the main problems in forest study is the knowledge and conservation of biodiversity. Typically, natural forests are characterized by a relatively stable equilibrium. In Moldova, forest ecosystems have suffered drastic modifications because of human intervention, which led to pest outbreaks appearance and as result changed their biodiversity. To regulate the number of forest pests it is necessary to know not only dendrophylous insects, but also the whole complex of insects.

In scientific literature on forest entomology, including specialized academic books are usually included only insects living on trees and shrubs and particularly the pest species and their entomophagans, which creates a false and incomplete impression about the role of insects in forest ecosystems. Such data are included in manuals for university forestry, for example: Forest entomology (Voronțov, 1975), Biological basis of forest protection (Vorontsov, 1963, 1975); Biogeocenological study of phytophagous forest insects (Rafes, 1980). In the last book there is no data on phytophagous insects of herbaceous plants in forests. However, among the great diversity of dendrophylous insects, the pests, including the potential ones, represent a very small percentage; the other species are only one component of forest ecosystems that maintain their ecological balance.

Material and methods

The material discussed in the paper was collected during many years of scientific research (1960–2010), within various forest ecosystems of the Republic of Moldova. In order to obtain rich faunistic material different entomological methods of collection, preservations, treatment, preparation of museum collection were used for the studied groups (Collembola, Homoptera, Coleoptera), with the specific procedures for each group of invertebrates.

Results and discussions

A result of accomplished studies in forest zones of the Republic of Moldova invertebrates from 3 orders were collected and identified (Collembola, Homoptera and Coleoptera).

Order Homoptera (order to which belong the aphids) is a very important group of insects, widespread and very diverse. In deciduous forests of the Republic of Moldova there are no harmful aphids species. Aphids are only one of the components of the food chain. In total, according to data accumulated over many years of research, on the territory of Republic of Moldova 350 species of aphids are known at present, including 190 species that develop on 209 species of herbaceous plants, which occur mainly in forests and their outskirts, of which 156 are perennial plant. Aphids are numerous, varied and quite widespread, are an important component of forest entomofauna serving in general as food source for many other groups of insects.

The flora of Moldova includes 2000 species of vascular plants [8], but currently the natural vegetal cover has only been preserved on an area of approximately 10% of the country territory [6, 7]. The most rare and vulnerable species of flora are included in the Red Book of Moldova [4], second edition, where 117 plant species are cited. We have to mention that without considering the human impact on ecosystems, due to the diversity of habitats, the diversity of flora and climatic features; in Moldova can be meet approximately 12,000 species of insects, of which about 1,400 species are dendrophylous.

Among insects as rare species are included 37 species of eight orders of insects. Aphids are not included in this list, but among them are already identified 32 rare species whose host plants are not only rare, but also common species. All the aphids are phytophagous. The biocenologic role of aphids in the regional fauna is characterized by a variety of functions; they are not only consumers in the first degree. The sweet excrements eliminated by aphids after their biochemical qualities represent valuable natural food for many parasite species and entomophagous predators of the orders Hymenoptera and Diptera (especially Syrphidae and Tachinidae). In Moldova there are 145 species of aphids that produce sweet excrements (honey dew), which is a trophic resource exploited by 31 species of ants.

Along with harmful aphids there are also many aphid species that aren't harmful and serve as hosts for aphidophagous species. In our forests can be met many non-harmful aphid species with increased density and widely spread on many plants (on *Artemisia* sp. – aphid species: *Macrosiphoniella absinthii* (L.), *M. artemisiae* (B. d. F.), on *Cichorium intybus* L. – *Aphis intybi* Koeh, on *Salvia* sp. – *Aphis salviae* Walk., on *Tanacetum vulgare* L. – *Metopeurum fuscoviride* Stroy, on *Tragopogon* sp. – *Brachycaudus tragopogonis* (Kalt.).

As conclusions, the aphids influence upon the structure of entomofauna and the regional aphidofauna must be preserved as component of the whole forest entomofauna.

Among the biggest, most colored and important for forest ecosystems are the insects from order Coleoptera. As result of studies accomplished in landscape reserve „Codrii Tigheci” (2003 – 2007), there were registered 160 species of edaphic coleopterans from 75 genera and 8 families (Carabidae, Silphidae, Staphylinidae, Scarabaeidae, Geotrupidae, Trogidae, Lucanidae, Tenebrionidae). Also, researches on edaphic coleopterans from central and northern zones of the republic were performed [1]. As result another 20 coleopteran species were identified typical for forest ecosystems.

Coleopterans have the role of nature sanitars, by maintaining the circuit of energy and matter. Among them there are necrophagous, coprophagous and saprophagous species. Coleopterans from genera *Trox*, *Nicrophorus*, *Silpha* etc. are necrophagous and contribute to the decomposing of corpses, some species from genera *Onthophagus*, *Aphodius*, *Philonthus*, *Atheta*, *Aleochara* etc. participate at decomposing of manures. Very important for the circuit of energy and matter in nature are the xylophagous insects, which intensify the process of dead wood decomposing. Among xylophagous insects can be mentioned the species of family Cerambycidae: *Rhagium sycophanta* (Schr), *Prionus coriarius* (L.), but also many other smaller species from the family Staphylinidae: *Habrocerus capillaricornis* (Grav), *Sepedophilus immaculatus* (Steph), *S. marshami* (Steph), *S. obtusus* Luze. In order to maintain the number of pest insects the predatory coleopterans have a significant role, they use for food eggs, larvae and small insects. The carabids and staphilinids have a high species diversity and at the same time have an important role in the structure and functioning of forest ecosystems. Being agile predators, they use for food various invertebrates – nematodes, acarians, collembolans for smaller species, larvae and adults of coleopterans, as well as other insects and also mollusks for the larger species. In forest ecosystems inhabit many phytophagous species, but harmful for the forestry are only few of them, among which the species *Lytta vesicatoria* (L.) and *Galerucella luteola* (Müll.) are.

Another abundant group of forest soil, with a high species and trophic diversity is the order Collembola. The collembolans are a group of pedobiont invertebrates, which play a key role in the processes of humification and recycling of matter and energy in nature. Being mostly destructors of second degree, they decompose all types of plant and animal remains, excrements of other creatures, participate actively in the processes of humus and soil structure formation. Being closely related to soil the collembolans react rapidly to any changes in their living environment and are used in recent years as indicators of ecological status of ecosystems.

The widest variety of species, the largest number of individuals is formed by the complexes of collembolans from protected forest areas. Here the anthropogenic influence is minimal, the vegetation layer is abundant and the litter is present in advanced state of decomposition. In such areas collembolan species number and density reach peak values in autumn months up to 40,000 individuals/m².

To justify the above mentioned we present the results of multiannual study of collembolans from the State Natural Reserve „Plaiul Fagului”. Between the years 2004 – 2010 studies in State Natural Reserve „Plaiul Fagului” were accomplished, where soil, litter, moss, decayed wood

samples were collected, and multi-seasonal dynamics of collembolans was studied. To highlight a wider range of species moss samples were collected on decomposed logs, soil on the banks of ponds, from wetlands and meadows and hydrophilous species on the water surface and aquatic vegetation [2, 3, 5].

As result of performed research in the State Natural Reserve „Plaiul Fagului” 118 species of collembolans were recorded belonging to 57 genera and 17 families, which constitute more than half of the total number of species identified in the Republic of Moldova. Among these species of greatest interest are the rare ones from the genera *Karlstejnina*, *Deutonura* and *Vertagopus*. Approximately 70% of the total number of species identified in the reserve can be met in sapro-ilicolous and saprolignicolous microhabitats. The most densely populated are the mosses and decaying logs. For some species the decomposed wood or wet sector are the only inhabiting place, while others are found only in the area of contact between soil and decayed wood.

The results of studies accomplished on the three invertebrate groups emphasize the abundance of species present in forest ecosystems and their importance for biodiversity conservation.

Conclusions

The forest is a natural ecosystem that includes the flora, fauna and soil together with an entire complex of invertebrates, of which importance is major and varied for the natural balance. To know and maintain the forest entomofauna is important to see the forest as a complex and functional biocenosis. The dendrophilous insects constitute only a small part among the diversity of forest species, the density of which is regulated by entomophagous species and don't need special control measures.

The invertebrates represent an important link of the trophic chain within the forest ecosystems and at the same time have an essential role in the processes of humification and recycling of matter and energy in nature.

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**ENTOMOFAUNA CA ȘI COMPONENT AL ECOSISTEMELOR FORESTIERE
DIN REPUBLICA MOLDOVA
(Rezumat)**

Una din componentele de bază ale ecosistemelor forestiere o constituie entomofauna. În lucrarea de față au fost analizate nevertebrate ce aparțin ordinilor: Collembola, Homoptera (afidele) și Coleoptera. În Republica Moldova se cunosc, până în prezent, 350 specii de afide. Din numărul total de specii, 145 produc „roua de miere” pentru 31 specii de furnici. Afidele servesc în general ca sursă de hrană pentru multe alte grupe de insecte. Există și unele specii de afide dăunătoare culturilor agricole, dar pentru ecosistemele forestiere ele nu prezintă nici un pericol. Coleopterele au fost analizate în baza materialului colectat din cadrul rezervației peisagistice „Codrii Tigheciului” (160 specii), dar și a altor coleoptere forestiere (20 specii) edafice și dendrofile, colectate din zonele de centru și nord a Republicii Moldova. Conform spectrului trofic, coleoptere fitofage periculoase pentru ecosistemele silvice practic nu există, totuși în anii secetoși a fost semnalată din abundență, în pădurea de ulm, specia dendrofilă *Galerucella luteola*. Folositoare pentru ecosistemele forestiere sunt considerate speciile prădătoare, care contribuie la diminuarea efectivelor insectelor dăunătoare; de asemenea un rol pozitiv îl au și speciile sanitare (necrofage, coprofage și saprofage), care participă la descompunerea cadavrelor, dejecțiilor și a materiei vegetale moarte, repunând materia organică în circuit. Un rol important pentru ecosistemele forestiere îl dețin și colebolele; ele reprezintă destructori de gradul II, descompun materia vegetală și animală și participă activ la formarea humusului și a structurii solului. Fauna de colebole a fost analizată pe baza materialului colectat din cadrul Rezervației Naturale de Stat „Plaiul Fagului”; s-au înregistrat 118 specii, ceea ce constituie mai mult de jumătate din numărul total de colebole cunoscute în Republica Moldova.