

Ecological Estimation of Weevil Species Diversity in the Altai

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ABSTRACT

In recent years interest for biodiversity has been increasing in ecology. A very interesting group among beetles in this respect is weevils (the superfamily Curculionoidea) which feed on plant tissues of herbaceous and woody-shrubby plants that are abundant in the wild and inhabit most biotopes. However, neither the composition nor the structural placement of this huge beetle taxon in the Altai has been studied so far.

In the Altai territory, 305 Curculionoidea species have been found. The Altai fauna is close to that of the West Siberian Plain. The differences are determined mainly by the appearance of a large number of representatives of mountain genera in the Altai. The species composition of various parts of the Altai is peculiar. The basis of the Altai fauna is made up by palearctic and eastern palearctic species groups. Together with western palearctic ones, they make up about 95 % of the fauna. As compared to the West Siberian Plain, here endemics are of great importance. About a half of representatives of the superfamily are oligophages, the second place is occupied by polyphages, and the third one — by monophages. A large part of the Altai fauna are hortobionts (73.2 %). Dendrobionts occupy the third place by the number of species. Most species feed on roots and vegetative parts of plants, and very few do so on fruits and buds.

INTRODUCTION

The first reviews on weevil fauna of the Altai and neighboring territories were published in the last century [1–4]. In the catalog of palearctic Coleoptera [5], only 30 species referred to the Altai. In this century, many authors [6–11] have reported fragmentary data on Altaian weevils and

described some new species. There are no reviews on weevils of the Altai, and its fauna has not been analyzed. As a result of the proposed review, the species diversity of weevils of the Altai may be estimated in the first approximation at 305 species.

MATERIAL, METHODS AND ECOLOGICAL CONDITIONS OF THE REGION

The work is based on the materials of the Zoological Museum at the Institute of Animal Systematics and Ecology; weevils contained in the materials of the Tomsk State University were also examined, and bibliographic data [1–11] were used.

The Altai is subdivided into 5 provinces: the North, Central, South-East, West, and South Altai [12, 13].

In the Altai, several types of vegetation can be distinguished: coniferous and deciduous forests, steppes, meadows, solonchak vegetation, circumaquatic vegetation, etc. Steppes of the Altai occupy a wide band in its western and southern foothills. They go up as high as 300–350 m, pene-

trating into the mountains as narrow bands along river valleys. Large areas are occupied by steppes in intermountain hollows. The solonchak vegetation in the Altai covers very small areas and is concentrated mainly in the Chuya steppe. Altaian meadows are divided into low- and high-mountain. Low-mountain meadows can be found all over the territory, while high-mountain ones are widely represented in western, northern, and central Altai provinces. Forests play the leading role in the formation of the vegetation cover and occupy up to 50 % of the territory. These are mainly coniferous forests, the deciduous ones being derivatives from some or other radical formations, birch forests are

estimating the degree of originality of the conditions that have arisen. The Altai weevil species composition may be divided into 4 main arealographic groups: holarctic (species spread in Holarctics), palearctic (species widespread in Palearctics and found in its western and eastern parts), western palearctic (species spread in North Africa, Europe, West Siberia, Minor and Middle Asia, Kazakhstan, and Caucasus), and eastern palearctic (species spread in the east of West Siberia, in East Siberia, in the mountains of South Siberia, in Mongolia, North China, and Far East) [15-17].

The largest specific weight in the Altai fauna belongs to palearctic species (43.2 % or 131 species). Characteristic of the Altai weevil fauna is the considerable specific weight of eastern palearctic species (109 species or 35.8 %) which occupy the second place in the specific proportion of arealographic groups. Therein, as compared to the West Siberian Plain, Altaian (15.8 %) and Altai-Sayan (12.5 %) endemics acquire a great importance. The third place is occupied by western palearctic species (15.1 % or 46 species). The smallest group in the Altai is made up by holarctic species (18 species or 5.9 %).

Vegetation type structures of weevil diversity are composed of several components: trophical relations, life forms, landscape placement, and others. The range of trophical relations is different in different weevil species. In the superfamily there are both monophages and polyphages. As the larvae of the youngest *Sitoninae* and *Polydrusinae* subfamilies pass to living in the soil and give up certain plants, there appear the largest numbers of oligo- and polyphages among them. Mono-, oligo-, and polyphages are distinguished [18].

Monophages are species associated with one or several related plant species within a genus. These make up 12.5 % of the fauna. Oligophages are species that develop on one or several related genera within a family. About a half (51 %) of Altaian weevils are oligophages. Polyphages are species attached in their development to plants from several families. In the Altai, there are 102 of them (36.5 %).

Unlike the West Siberian fauna of Curculionioidea, the specific weight of polyphages (in the West Siberian Plain they make up 13.8 %) sharply increases, mainly at the expense of species of the genus *Otiorhynchus* Germ. The number of monophages (in the West Siberian Plain they make up 30.6 %) also decreases almost 3-fold.

Weevils are represented by several life forms (dendro- thamo-, and hortobionts) distinguished by the attachment to definite plants. The basis of the

Altaian fauna is made up by hortobionts (73.2 %). By the number of species, dendrobionts occupy the third place (17.7 %). As compared to West Siberian fauna, the proportion of thamnobionts increases (9.1 %).

Closely related to feeding specialization is the distribution of larvae of the superfamily species by the parts of fodder plants. The largest number of species feed on roots (143 or 55.4 %) and vegetative parts (leaves — 5.8 %, stalks, twigs, and other parts — 26.0 %). Very few species feed on fruits and buds (10.9 % and 1.9 %, respectively).

The largest number (90 species or 32.4 %) of weevils live in steppes. The steppe complex includes some species of Apionidae, the majority of Cleoninae, and species from the genera *Ceutorhynchus* Germ., *Mononychus* Germ., *Sibinia* Germ., *Macrotarrhus* Bed., *Eremochorus* Zasl., *Sitona* Germ., *Tanymecus* Germ., *Cycloderes* C., Sahlb., *Eusomus* Germ., *Euidosomus* Reitt., *Eusomatulus* Reitt., *Paophilus* Fst., *Catapionus* Schoenh., *Foucartia* du Val, and others. Only 4 species (1.4 %) are attached to solonchaks: *Megamecus argentatus* (Gyll.) and 3 species of *Phacephorus* Schoenh. The meadow complex of *Curculionioidea* occupies the second place and is represented by 85 species (30.9 %). Attached to meadows are some of Attelabidae, Apionidae, species of the genera *Larinus* Germ., *Lixus* F., *Zacladus* Reitt., tribes of *Ceutorhynchini*, *Tychius* Germ., *Hypera* Germ., *Sitona* Germ., and others. In high-mountain meadows *Hylobius gebleri* Boh., *Glanis* sp., *Hypera diversipunctata* (Schrank), *H. ornata* (Cap.), *Phyllobius fessus* Boh., *Ph. viridiaeris* (Laich.), *Otiorhynchus politus* Gyll., *O. grandineus* Germ., *Dactylotus globosus* (Gehl.), and others are found. Practically all of these species penetrate into low-mountain meadows of the forest belt. In forests, 59 forest species (21.2 %) of the superfamily have been observed. In coniferous forests, the smallest number of species — 17 (6 %) — are found. These are widespread transpalearctic, transeurasian, and eurosiberian species: some of *Magdalis* Germ., *Pissodes* Germ., *Hylobius* Germ., *Rhyncolus* Germ., *Euryommatus maria* Roger, *Anthonomus phyllocola* (Herbst), and others. To typical deciduous forest ones belong 42 (15.1 %) species: *Apoderus coryli* (L.), *Trichapion simile* (Kby.), *Acythopeus tatjanae* (A. Eg.), some of *Rhamphini*, *Anoplus plantaris* Naez., *Phyllobius* Germ., *Polydrusus* Germ., and others. Attached to circumaquatic grassy vegetation are 16 species: *Sphenophorus abbreviatus* (F.), *Notaris* Germ., *Lepidonotaris petax* (C. Sahlb.), *Bagous* Germ., two *Lixus* F. species, several *Phytobiini* species, and others. Associated with osier beds are 24

species: *Lepyrus* Germ., *Cryptorhynchus lapathi* (L.), *Elleuscus* Dejean, *Dorytomus* Germ., *Rhamphini*, *Curculio* L., *Chlorophanus* C. Sahlb., *Polydrusus* Germ., *Pseudomylocerus dorsalis* (Mann.) and others. It is noteworthy that many weevil species can penetrate into various types of vegetation.

Altitudinal zonal placement of weevils has been studied at length in the North-East Altai. In deciduous forests, 54, in coniferous ones — 12, and in tundra — 8 Curculionoidea species have been found, the largest number of common species hav-

ing been noted in deciduous and coniferous forests (6 species). In deciduous forests and tundra, and in coniferous forests and tundra, there are 3 common species in each pair of belts. The most similar with respect to fauna are tundra and coniferous forests ($K = 0.18$), deciduous and coniferous forests ($K = 0.1$). In the tundra belt there are practically no species that do not penetrate from deciduous forests to coniferous ones. Very different from each other are the faunas of deciduous forest and tundra ($K = 0.05$).

CONCLUSIONS

1. Weevil faunas of the Altai and West Siberian Plain are similar to each other. Differences between them are mainly determined by the presence of a large number of representatives of mountain genera in the Altai.

2. In the territory of the Altai, 305 Curculionoidea species from 6 families (Nemonychidae — 1, Anthribidae — 1, Attelabidae — 15, Apionidae — 21, Dryophthoridae — 1, Curculionidae — 264) have been found. The species composition of each part of the Altai is peculiar. The considerable peculiarity of the South-East Altai manifested in analysis of species composition similarity is determined by desertification of the territory and possibility of penetration of arid species from Mongolia and Tuva.

3. In the Altai, one may distinguish three groups of provinces. In two of them, steppe landscapes prevail. The third group comprises provinces with prevalence of forests. The forest group may be divided into 3 subgroups according to dominance of either coniferous or deciduous forests and their respective faunas, and of either forest or steppe landscapes.

4. The bulk of the Altaian fauna is made up by palearctic and east-palearctic species groups. Together with west-palearctic ones, they make up about 95 % of the fauna. Holarctic species have a very small specific weight. As compared to the West Siberian Plain, endemics play a great role in the Altai fauna.

5. About a half of representatives of the superfamily are oligophages; next come polyphages, and the least numerous are monophages. As compared to the West Siberian Plain, in the Altai the specific weight of polyphages is sharply increased, and the proportion of monophages is decreased almost 3-fold. This is due to the great number of species of mountain genera present in the Altai whose majority are polyphages.

6. The basis of the Altai weevil fauna is horto-bionts. Dendrobionts occupy the third place with respect to the number of species. As compared to the West Siberian fauna, the numbers of thamnobionts are drastically increased.

7. The greatest number of Curculionoidea species feed on roots and vegetative parts of plants. Very few species are attached to fruits and buds.

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