

# The Zoogeographic Composition of the Insect Fauna (Odonata, Coleoptera, Macrolepidoptera) in the Raised Bogs of the Belarusian Lakeland

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Received April 10, 2013

**Abstract**—The zoogeographic composition of insects in the raised bogs of the Belarusian Lakeland was investigated. The boundaries of this region coincide with those of the last glaciation and the distribution of raised bogs on the East European Plain. By the example of three model groups (Odonata, Coleoptera, and Macrolepidoptera) it was found that the insect fauna complexes in the bogs of the Belarusian Lakeland had a typical boreal pattern with prevalence of species with Euro-Siberian ranges, and also included large fractions of species with Circumboreal and Circum-Arctoboreal ranges. The environmental conditions of bogs in the temperate zone of Europe facilitate the southward expansion of many cold-adapted species.

**DOI:** 10.1134/S0013873814010059

The Belarusian Lakeland is the youngest natural region in the north of Belarus characterized by peculiar climatic conditions, soils, flora, and fauna. Its specific features are determined by the fact that the region was shaped by the latest glaciation which embraced only the northern part and a small site in the west of the Belarus territory. The boundary of the Lakeland coincides with that of the latest Valdai Glaciation. The territories of raised bogs are abruptly reduced towards the south of Belarus (Yakushko, 1971; Geltman, 1982). The Belarusian Lakeland is adjoined by the Mazur Lakeland (Poland) in the west and by the Smolensk Lakeland in the east, also of the glacial origin.

The distribution of raised bogs over the whole East European Plain coincides with the maximal spread of the Valdai Glaciation (Denisenkov, 2000). Bogs of this type are insular ecosystems with azonal vegetation which has preserved the tundra aspect of the early postglacial epoch. The insect fauna of the raised bogs of Belarus and the main trends of its development have been little studied up till now. At the same time, the climate, vegetation, and geomorphologic conditions of these ecosystems are favorable to a number of more northern, psychrophilic animal species which are represented in the raised bogs of the Belarusian Lakeland by isolated local populations far beyond their main ranges.

## THE GENERAL PHYSIOGRAPHIC AND BOTANICAL CHARACTERISTIC OF THE RAISED BOGS OF THE BELARUSIAN LAKELAND

According to the regionalization of European bogs, the territory of Belarus belongs to two large bog provinces: the Ladoga-Ilmen-Western Dvina Province of domed ridge-pool bogs and the Middle-Dnieper-Pripyat Province of eutrophic and oligotrophic pine-sphagnum bogs (Geltman, 1982). Three zonal belts can be distinguished in the territory of Belarus: the southern, corresponding to the Belarusian Polesye, the central, embracing the uplands of the Belarusian Ridge and the adjacent plains, and the northern one, covering the Belarusian Lakeland (Pidoplichko, 1961).

The most abundant raised bogs are to be found in the Belarusian Lakeland (the area of Valdai Glaciation), which is determined by the presence of different landscape forms: hilly-moraine uplands and moraine ridges, rolling and undulating-moraine plains, aqueoglacial plains, and glaciolacustrine lowlands. Most of these bogs belong to the Baltic type of domed peatlands with central elevations up to 6 m high (Geltman, 1982). The total area of raised bogs is 184 200 ha, which amounts to almost 5% of the Lakeland territory (Yakushko, 1971).

The climate of the Belarusian Lakeland differs from that of the other natural regions of Belarus in lower



Fig. 1. The study localities; the line marks the boundary of the Belarusian Lakeland.

temperatures throughout the whole year. The mean temperature of June does not rise above 18°C, whereas that of January often drops below –8°C. The lowest winter temperatures in Belarus (down to –44°C) were recorded in the Lakeland. The annual precipitation is non-uniform: 650–700 mm on the uplands and 50–80 mm less in the lowlands (Pidoplichko, 1961; Geltman, 1982).

The flora of the Belarusian raised bogs typically includes such higher vascular plants species as *Eriophorum vaginatum* L., *Scheuchzeria palustris* L., *Rhynchospora alba* L., *Drosera anglica* Huds., *D. obovata* Mert. et W.D.J. Koch, *D. rotundifolia* L., *Calluna vulgaris* (L.) Hull, *Ledum palustre* L., *Andromeda polyfolia* L., *Oxycoccus palustris* Pers., *O. microcarpus* Turcz. ex Rupr., *Chamaedaphne calyculata* (L.) Moench, *Vaccinium uliginosum* L., *Empetrum nigrum* L., the bog pine forms (*Pinus sylvestris* f. *uliginosa*, *P. sylvestris* f. *litwinowii*, *P. sylvestris* f. *willkommii*), *Betula pubescens* Ehrh., and *B. nana* L. The dominant species of mosses are *Sphagnum magellanicum* Brid., *S. angustifolium* (C. Jens. ex Russ.) C. Jens, *S. fuscum* (Schimp.) Klinggr., *S. rubellum*

Wils., and *S. cuspidatum* Ehrh. ex Hoffm.; *Polytrichum strictum* Brid. is also common. Vegetation is represented by the pine forests, open dwarf-shrub-cottongrass-sphagnum and cottongrass-sphagnum associations, ridge-pool and ridge-hollow complexes. There are also mineral outcrops of various size and post-pyrogenic phytocenoses with impoverished heather vegetation (Geltman, 1982).

#### MATERIALS AND METHODS

Insects were collected from 1998 to 2012 on 14 raised bogs in 10 administrative districts of Vitebsk and Minsk Provinces of Belarus. The area of the studied bogs varied from several hectares to tens of thousands of hectares. Most of these bogs are regarded as specially protected natural territories (SPNT) of different levels and experience insignificant anthropogenic impact (Fig. 1).

Collections were carried out by standard entomological methods: Barber traps, net-sweeping, and light trapping using a SH/F6TSD fluorescent lamp powered by a 6V/4AH battery. In addition, the Malez trap material provided by colleagues was analyzed.