CLIMATE CONSTRAINS FOR SIBERIAN MOTH DISTRIBUTION IN EUROPE

Yuri Baranchikov, Nadezda Tschebakova, Elena Parfenova, and Natalia Kirichenko

V.N.Sukachev Institute of Forest, Siberian Branch, Russian Academy of Science
50 Akademgorodok, Krasnoyarsk 660039, RUSSIA

ABSTRACT

A simplistic bioclimatic model of the Siberian moth Dendrolimus sibiricus Tschtvrk. (Lepidoptera: Lasiocampidae) is based on the moth's basic biological requirements, expressed through summer thermal conditions (growing-degree days above 5 °C, GDD5), moisture conditions (annual moisture index [AMI]) and the ratio of warm degree-days to annual precipitation. Siberian regional literature and moth inventory data allowed us to relate the Siberian moth distribution to climate. Climatic limits of moth ranges and outbreaks derived from these ordinations are as follow: the range limits 950-1350 °C of GDD5 and 1.3-3.0 of AMI; the outbreak limits are 1100-1250 °C of GDD5 and 2.0-2.5 of AMI.

To map the moth range and outbreak distributions, the bioclimatic model was coupled with climatic layers mapped across northern Eurasia. For the mapping, data of GDD5, NDD0 and annual precipitation from about 300 stations in Europe and 1000 weather stations in Siberia were assembled. Then, Hutchinson's (2000) thin plate splines were used to produce climate surfaces of these variables on the DEM at a resolution of 1 km. Climatic and topographic images were visualized using IDRISI32.

We found that our bioclimatic model of the Siberian moth range and outbreaks, when overlaid with the ranges of the host tree species (forest map of Russia, 1990), ideally coincide with current moth habitats and outbreak areas in Siberia and the Russian Far East. A dozen new areas with outbreak potential were found.

It was shown that European summer conditions of current climate may be considered suitable for Siberian moth north of latitudes 54-56°N within northwestern Russia, the Baltic countries, all of Finland, southern Sweden, the coasts of the North and Baltic Seas, and ranges in central Europe. In reality, the distribution of the Siberian moth to the west is limited by the absence of forest stands dominated by pests' preferred food plants (species of *Larix* and *Abies*) and mild winter conditions. Overwintering larvae of the Siberian moth require continuous winters of a continental type with no autumn thaws which are fatal for the larvae (Rozhkov 1963, Kondakov 1974).

Thus, although our bioclimatic model of the Siberian moth distribution indicates that there are good possibilities for the moth to extend its range to northwestern Europe on the basis of summer temperatures, current mild winter conditions in the regions to the west of the Urals will not allow the larval stage of the pest to overwinter successfully. There is no reason to consider Siberian moth as a future threat for Europe.

We thank Marc Kenis (CABI Europe-Switzerland) for initiation of this research. The work was supported by EU FP6 project ALARM.

Literature Cited

Kondakov, Yu P. l974. **Regularities of Siberia moth outbreaks.** In: Petrenko, Ye. S., ed. Ekologia populyatsiy lesnykh, zhivotnykh Sibiri (Ecology of forest animal populations). Novosibirsk: Nauka Publ.: 206-265.

Rozhkov, A.S. 1963. **The Siberian moth.** The Academy of Sciences of the USSR. 175 p.