

ECOLOGICAL MODELING OF *LOCUSTA MIGRATORIA* L. BREEDING CONDITIONS IN SOUTH-EASTERN KAZAKHSTAN

D. V. Malakhov

National Center for Space Research and Technology, Almaty, 050010, Republic of Kazakhstan

E-mail: d_malakhov_73@mail.ru

N. Yu. Tsyhuyeva

National Center for Space Research and Technology, Almaty, 050010, Republic of Kazakhstan

E-mail: d_malakhov_73@mail.ru

V. E. Kambulin

Zhyembayev's Institute of Plant Protection and Quarantine, Almaty, 040920, Republic of Kazakhstan

E-mail: d_malakhov_73@mail.ru

Abstract. *Background.* The method of ecological niche modeling (ENM) was applied to reconstruct the nesting conditions of one of the most widely-known pest species, *Locusta migratoria asiatica*, with a focus of nesting in Balkhash-Alakol basin. The ENM uses a set of input environmental variables to analyze and select the key factors from the entire input set. The key factors are the climatic variables which define the wellbeing of an organism; and the range of these variables may be calculated with statistical and GIS approaches. *Materials and methods.* The method of ENM used in current paper is referred to as “presence-only” since it utilizes the known localities of the animal (in our study, egg-clutches) to develop a model. The model outlines the area where the successful development of locust egg-boxes is most probable, rather than the actual nesting area. Further analysis of the identified key variables allows definition of the most vulnerable stages of the locust life-cycle. *Results.* The most important factors, influencing the development of the locust over its life-cycle, are: the ambient air temperature; the temperature of the soil during the cold season of the year; and soil moisture. The locust is an ectotherm organism, which has a restricted ability to regulate its body temperature; and the ambient temperature thus serves as a major factor affecting the animal's behavior. Wintering egg-boxes are immobile and face even more environmental challenges than nymphs or adults do. The soil temperature may not depend upon a single variable, like the air temperature, but is a function of the complex relationship between the thermal properties of the air and soil. The process of the energy flux between soil and atmosphere includes many factors, particularly related to soil-moisture content and the physical properties of the soil. The analysis of key variables should not be performed without an understanding of the complex relationships between the abiotic components of the environment. *Conclusions.* Comparative analysis of published data on locust adult and embryo physiology and key-variables, revealed by the model, confirmed the usefulness of the ENM approach for the study of the ecological peculiarities of a living species. Further development of this model with additional variables, gathered with remote sensing, should result in a probabilistic forecasting model aimed to withstand the locust outbreaks.

Key words: Asiatic locust, breeding sites, ecological niche model.