ABSTRACT

of the dissertation work of Tanabekova Gulzhanat Bakytovna on the topic "Ecological and faunistic peculiarities of insects damaging wild populations of Sievers Apple (*Malus sieversii*) in Northern Tien Shan" submitted for the Doctor of Philosophy degree (PhD) Specialty 6D060800-Ecology

Relevance of the research theme:

The Sievers apple tree (*Malus sieversii* (Ledeb.) M. Roem.) is one of the main protected objects in the Ile-Alatau and Zhongar-Alatau State National Natural Parks. The species is especially valued as a keeper of the unique germplasm, the ancestor of many cultivars.

The research activity is driven by the need to preserve in the Northern Tien Shan the genetic diversity of wild populations of the Sievers apple tree, which are under the influence of the local faunal complex of insect pests, as well as due to the threat of the introduction of extremely dangerous alien species of insects from the territory of foreign countries.

Among the main threats to the threat of wild populations of the Sievers apple tree in the last 20 years, a local complex of species of suspects has become. One of the basic conditions for protecting the body from the bearer is the modern.

Unfortunately, at the present time, there is no current data on the feared pests of the Sievers apple tree in the Northern Tien Shan, and they have not been studied in full and in every way and in every way. In general, there are some mountainous areas in the south-east of Kazakhstan, in particular, the Ile-Alatau State National Natural Park and Zhongar-Alatau State National Natural Park only a few systematic groups (Cicadinea, Aphidinea, Psyllinea, Coccinea, Orthoptera, Macrolepidoptera, Crabronidae, Carabidae, Curculionidae, Chrysomelidae, Staphylinidae, Cecidomyiidae) have been studied for a good enough, other groups of insects have been studied very poorly, and many groups have generally gone without attention. Between themes, for the assessment of the biological diversity of mountain ecosystems, it is necessary to provide sufficient information on the composition, purity, good biological and ecological characteristics of all groups of insects.

For this reason, the study of the current species composition, ecological and biological characteristics of dominant and potential species of the Sievers apple is an insignificant research problem, which has a great working knowledge.

Extraneous species that can be accidentally introduced into South and South-East Kazakhstan render a particular danger. One of these species is the apple buprestid *Agrilus mali* Matsumura (Coleoptera, Buprestidae), a fairly common stem pest in the Far East, but which has successfully expanded its range westward to the Upper Ili River valley in Western China in 20 years. This species in the territory of the PRC, bordering Kazakhstan, has destroyed more than 70% of endemic apple forests in the valley of the Ili River (Xinjiang), China. An outbreak of this pest was first seen in wild apple forests of Western China in the 1990s, but by 2013, ten thousand of the *M.sieversii* trees were found dead or weakened due to massive infestation of wild apple populations by this beetle in the Ile River valley in Xinjiang.

Currently, this serious apple pest is known in Korea, Mongolia, Russia, China and poses a significant threat to all types of wild apple trees in Central Asia, as well as domestic varieties of apples along the Silk Road. In this regard, in Iley and Zhetysu Alatau, it is necessary to carry out the pest detection research in our territory and develop recommendations for monitoring control of conditions of wild populations of the Sievers apple tree in order to timely detect the invasive pest *Agrilus mali* and control the most significant insect pest populations, affecting the health of the Sievers apple tree.

The aim of the dissertation research is to study the ecology and biology of insect pests damaging wild populations of the Sievers apple tree (*Malus sieversii*) in the Northern Tien Shan.

Research objectives:

1) to reveal insect pests of the Sievers apple tree in the Iley and Zhetysu Alatau;

2) to provide ecological and biological characteristics of the insect pests of the Sievers apple tree;

3) to identify species which play the most important pest role in wild populations of the Sievers apple tree and the cycle of their development;

4) to propose measures for protection of wild populations of the Sievers apple tree from local pests and to identify potential threats from possible extraneous species noted in neighboring countries.

Research methods: methods of field and laboratory research, such as methods of route and stationary registration of insects (mowing with an entomological net, shaking off on a catching cloth, catching insects in the light), cultivation of larvae in cages, systematic observation of phenological changes in dominant species, phenodate method, analytical method, cartographic method, digital method of processing satellite images, GIS methods.

Basic provisions for defence

- In the Northern Tien Shan, fauna of species of insect pests of the Sievers apple tree has been identified, consisting of 117 species, among which noted were also species from the orders of Lepidoptera (54 species), Coleoptera (30 species) and Homoptera (19 species) dominate, Hymenoptera (6 species), Diptera (5 species), Thysanoptera (2 species) and Hemiptera (1 species).

- The most important dominant species of the Sievers apple tree insect pests in the Northern Tien Shan are 3 species: apple ermine moth (*Yponomeuta malinella* Zell.), rose leaf roller (*Archips rosana* L.) and hawthorn leaf roller (*Cacoecia crataegana* Hb.). The phenological features of the development of three dominant species in the conditions of the Northern Tien Shan are: one generation per year, postembryonic development occurs from April to October, a particularly dangerous period for the apple tree begins from the second decade of April to the second decade of June with the appearance of caterpillars, which begin to actively feed. The development of dominant insect pest species is influenced by abiotic, biotic and anthropogenic factors.

- Iley and Zhetysu Alatau have a difference in the damage and prevalence of dominant insect pest species. Maps of the distribution and embedding of the apple ermine moth (*Yponomeuta malinella* Zell.), rose leaf roller (*Archips rosana* L.) and

hawthorn leaf roller (*Cacoecia crataegana* Hb.) on the territory of Ile-Alatau GNPP and Zhongar-Alatau GNPP and schematic maps by the degree of value of the dominant species show the degree of distribution and value of the monitoring sites set up on the territory of Iley and Zhetysu Alatau.

- The ecological characteristics of the insect pests of the Sievers apple tree in the Northern Tien Shan are reflected in trophic relationships, life cycles, reproduction cycles, life forms and food specializations.

Description of the main results of the study.

The contemporary pest fauna of the Sievers apple tree in the Northern Tien Shan has been established; it consists of 117 insect species, of which dominant are orders of Lepidoptera (54 species), Coleoptera (30 species) and Homoptera (19 species). There are also orders with a small number of species: Hymenoptera (6 species), Diptera, 5 species), Thysanoptera (2 species) and Hemiptera (1 species).

A check list of identified 117 insect species of the Sievers apple tree in the Northern Tien Shan with ecological and biological characteristics for each species has been compiled;

The ecological and biological features of the three most important and dominant insect pests have been analyzed: apple ermine moth (*Yponomeuta malinella* Zell.), rose leaf roller (*Archips rosana* L.) and hawthorn leaf roller (*Cacoecia crataegana* Hb.) and new data on phenological development were obtained and narrow stages of their development were identified for the organization of timely and effective measures to control these pests; the incidence and degree of colonization of apple trees by insect pests have been studied; a comparative analysis of the Iley and Zhetysu Alatau on the damage rate and prevalence of dominant insect pest species was carried out.

Maps of the distribution and embedding of the apple ermine moth (*Yponomeuta malinella* Zell.), rose leaf roller (*Archips rosana* L.) and hawthorn leaf roller (*Cacoecia crataegana* Hb.) on the territory of the Ile-Alatau GNPP and Zhongar-Alatau GNPP have been compiled, and schematic maps have also been compiled by the degrees of value of the dominant species, in which the degrees of value are reflected by monitoring sites set up on the territory of Iley and Zhetysu Alatau for the development of complex systems of protective measures in the study area.

In the course of our own and joint research with colleagues from the Xinjiang Institute of Ecology and Geography of the Academy of Sciences of the People's Republic of China, exploratory studies were carried out to identify the malicious pest *Agrilus mali* known in border areas of Kazakhstan and Xinjiang; this species has not been found in Kazakhstan in 2018-2020.

A phenological calendar has been compiled for the three most important species of insect pests of the Sievers apple tree in the Northern Tien Shan, which show the influence of the main abiotic factors, such as the temperature indicators and the relative humidity of the air, since temperature and humidity as environmental factors have a huge impact on the development of insects, moreover, different at different stages of development of the latter. The influence of biotic and anthropogenic factors on the development of insect pests is also considered.

The ecological and biological characteristics of the insect pests of the Sivers apple tree in the Northern Tien Shan are given, namely, trophic relationships, life cycles, reproduction cycles and life forms, as well as food specializations of all identified insect pests of the Sivers apple tree. The degree of harmfulness of the local fauna in the territory of the Iley and Zhetysu Alatau in 2018-2019 was also determined.

Measures are proposed to reduce the risk of threats from the side of pests for the Civerca apple in the Northern Tien Shan, such as recommendations for the preservation of natural pests of apple trees against wild populations and and specific recommendations in the fight against pests typical for the Sievers apple tree.

Justification of the novelty and importance of the results obtained:

- The fauna of insect pests of the Sievers apple tree in the Iley and Zhetysu Alatau has been revealed;

- A phenological calendar was compiled, taking into account the influence of abiotic factors, and ecological and biological features were identified for the three dominant species of insect pests in the Northern Tien Shan: apple ermine moth (*Yponomeuta malinella* Zell.), rose leaf roller (*Archips rosana* L.) and hawthorn leaf roller (*Cacoecia crataegana* Hb.).

- For the first time, the development of maps of the distribution and embedding of the apple ermine moth (*Yponomeuta malinella* Zell.), rose leaf roller (*Archips rosana* L.) and hawthorn leaf roller (*Cacoecia crataegana* Hb.) on the territory of Ile-Alatau GNPP and Zhongar-Alatau GNPP, as well as schematic maps according to the degree of value of the three dominant values in Iley and Zhetysu Alatau.

- For the first time, prospecting studies have been implemented in 2018-2020 in the Northern Tien Shan to identify a possible invasive species (apple buprestid *Agrilus mali*), representing a malicious pest of wild populations of the Sievers apple tree in the regions of Western China, bordering Kazakhstan.

- Recommendations to reduce the number of main insect pests of the Sievers apple tree in the Northern Tien Shan have been proposed.

This study is aimed at identifying the modern pest fauna of the Sievers apple tree in the Northern Tien Shan, as well as identifying the ecological and faunal features of the dominant insect pest species, which allowed us to further propose a set of recommendations to reduce the risk of developing insect pests of the Sievers apple tree. They will allow controlling the occurrence of foci of local and invasive insect pest species and preserving unique ecosystems in the Northern Tien Shan.

Compliance with the directions of scientific development or state programs:

Rational use of natural resources, ecology, entomology, study of biological diversity, Earth science.

Description of the doctoral student's contribution to the preparation of each publication.

The doctoral student collected, processed and analyzed data, participated in field research, developed thematic maps, and prepared scientific articles. The results obtained in the course of the study allowed us to develop protected provisions, publish scientific publications on the subject of the study to the applicant in co-

authorship. The main provisions of scientific articles are reflected in the chapters of the dissertation for the PhD degree.

The main content of the dissertation is reflected in 14 printed works, including 1 article published in international scientific journal, including in the Scopus database, 1 article is included in the Scopus proceedings database, 1 article published in scientific journal of China, 4 articles in republican specialized editions recommended by the Committee for Control in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 7 theses in proceedings of international conferences, of which 4 were held abroad.