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BIOECOLOGICAL FEATURES OF HOCKWAYS OF THE BUTTERFLY FAMILY OF THE LOWER AMU DARYA DELTA (LEPIDOPTERA, SPHINGIDAE) AND PREVENTIVE MEASURES FOR PROTECTION AGAINST THEIR HARM

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ABSTRACT
The article examines the bioecological features of hawk moths of the family Sphingidae in the Lower Amu Darya delta. Their species composition, distribution, life cycle, food connections and ecological role have been studied. It has been established that hawk moths are important pollinators and components of the entomofauna of the Aral Sea region, however, some species in the larval stage can damage agricultural and ornamental plants. The factors influencing their numbers are analyzed and preventive measures to reduce harmfulness are proposed based on the principles of integrated plant protection.
KEY WORDS*: Sphingidae, Hawk Moths, Lower Amudarya, Bioecology, Aral Region, Plant Pests, Pollinators, Integrated Plant Protection.*

INTRODUCTION

The Lower Amu Darya Delta is a unique natural region of Central Asia, home to a combination of desert, tugai, floodplain, and agro-landscape ecosystems. In recent decades, the shrinking of the Aral Sea, desertification, soil salinization, and climate change have significantly transformed the region's natural ecosystems, affecting biodiversity and the distribution of many insect species.

Among the Lepidoptera order, hawk moths of the family Sphingidae occupy a special place. These large nocturnal butterflies are distinguished by their high mobility and their important role in plant pollination. In the Lower Amu Darya region, they are a constant component of natural and agroecosystems. However, some species, during their caterpillar stage, can damage agricultural, fruit, and ornamental crops.

Despite the ecological and economic importance of hawk moths, their bioecological characteristics in the Lower Amu Darya region remain insufficiently studied. Therefore, research into their species composition, developmental characteristics, ecological role, and economic significance is of considerable scientific and practical importance. The aim of the study was to investigate the bioecological characteristics of hawk moths (Family Sphingidae) in the Lower Amu Darya Delta and to develop preventive measures for protecting agricultural crops from harmful species.

MATERIALS AND METHODS

The studies were conducted during 2023–2025 in the Lower Amu Darya Delta, covering various types of natural and anthropogenic landscapes of the Republic of Karakalpakstan. Adult specimens were collected during the warm season, from April to October, using light traps, ultraviolet lamps, and entomological nets. Observations were carried out mainly during evening and nighttime hours, when the activity of most species reaches its peak.

To study the larval stages, route surveys of host plants were conducted, followed by the collection and identification of the caterpillars found. The collected specimens were identified based on morphological characteristics using standard entomological keys and taxonomic literature. Data on species distribution, habitat preferences, host plant associations, and seasonal occurrence were recorded and analyzed. The obtained results were used to assess the species diversity, ecological characteristics, and economic significance of hawk moths in the Lower Amu Darya Delta. During the study, the flight periods of hawk moths, the duration of individual developmental stages, feeding behavior characteristics, species abundance, and the nature of plant damage were recorded. Species identification was carried out using modern taxonomic keys for Lepidoptera of Central Asia and international taxonomic catalogs. To assess the ecological characteristics of the species, climatic factors, including air temperature, relative humidity, precipitation, and the condition of the host plant base, were analyzed. The collected data were processed statistically using methods of variation statistics, which allowed the identification of patterns in species distribution, abundance, and developmental characteristics under the environmental conditions of the Lower Amu Darya Delta.

RESULTS AND DISCUSSION

Research has shown that the hawk moth fauna of the Lower Amu Darya is represented by a number of species well adapted to the region's arid conditions. The most common are the bindweed hawk moth (Agrius convolvuli), the striped hawk

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moth (Hyles livornica), the spurge hawk moth (Hyles euphorbiae), and the poplar hawk moth (Laothoe populi). The distribution of each species is closely linked to the availability of food plants and landscape features.

The most common species was the bindweed hawkmoth (Agrius convolvuli), found in both natural habitats and agricultural fields. Its caterpillars feed on plants of the bindweed family, including field bindweed, which is widespread in the irrigated lands of Karakalpakstan. Due to its high ecological flexibility, this species can thrive even under conditions of significant fluctuations in temperature and humidity.

The Striped Hawk-moth (Hyles livornica) is also characterized by high abundance and a wide distribution range. This species is a typical migrant capable of covering considerable distances during seasonal movements. In certain years, mass migrations of the Striped Hawk-moth are observed, resulting in a temporary increase in its population within the Aral Sea region.

The caterpillars feed on a variety of herbaceous plants, including representatives of the families Amaranthaceae (formerly Chenopodiaceae), Convolvulaceae, and Vitaceae. Due to its high ecological adaptability and migratory behavior, H. livornica is considered one of the most widespread and ecologically significant species of the family Sphingidae in the Lower Amu Darya Delta.

The Euphorbia hawk moth (Hyles euphorbiae) is primarily associated with desert and semi-desert landscapes in the region, where it thrives on various species of milkweed. Its ability to accumulate toxic substances from its host plant makes its caterpillars unattractive to many predators, which contributes to their survival.

Research has shown that the life cycle of most species includes egg, larval, pupal, and adult stages. Overwintering typically occurs as pupae in the soil at a depth of 5–15 cm. In spring, when air temperatures rise to 15–18°C, adult moths begin to emerge. The mass flight period occurs in May–June and August–September. Depending on climatic conditions, individual species can develop from one to three generations per year.

Observations have shown that hawk moth populations vary significantly by season. Maximum numbers are observed in summer, when most host plants are in active bloom. Populations are significantly affected by air temperature, precipitation, and the state of preservation of natural habitats.

Hawk moths play a vital ecological role in the ecosystems of the Lower Amu Darya. Thanks to their long proboscis, adult moths are able to pollinate plants with deep-seated nectaries, inaccessible to most other insects. In this way, they ensure cross-pollination of many wild species and support the stability of plant communities.

In addition to their role in plant pollination, hawk moths play a vital role in the food chains of natural ecosystems. Caterpillars serve as food for insectivorous birds, reptiles, and small mammals, while adults are used as a food resource by bats and nocturnal birds of prey. Consequently, a decline in hawk moth populations can have a negative impact on the functioning of ecosystems as a whole.

Despite the ecological value of members of the Sphingidae family, some species can cause significant damage to agriculture. The larvae of the bindweed and striped hawk moths pose the greatest threat. In large numbers, they can almost completely destroy plant foliage, leading to reduced photosynthesis, stunted growth, and reduced crop yields. Vegetable crops, vineyards, melons, and ornamental plantings are particularly susceptible to damage.

Observations indicate that climate change may increase the risk of mass outbreaks of certain species. Rising average annual temperatures contribute to longer insect activity periods and create conditions for the formation of additional generations during the season. This requires constant monitoring of hawk moth populations in the region's agroecosystems.

The most effective approach to reducing hawk moth damage is an integrated plant protection system based on a combination of agronomic, biological, and organizational measures. Regular monitoring of pest populations is a crucial element of prevention, allowing for the timely identification of outbreaks.

Weed control, which serves as an additional food source for caterpillars, is crucial. Autumn plowing of the soil helps destroy overwintering pupae and reduce pest numbers in the following season. Hawk moths' natural enemies—parasitic wasps, predatory insects, birds, and bats—play a significant role. Therefore, preserving the biodiversity of agricultural landscapes is essential for natural pest control.

Under current conditions, special attention should be paid to the use of biological products based on the bacterium Bacillus thuringiensis, which are effective against Lepidoptera caterpillars while being virtually safe for humans and the environment. Chemical insecticides should be used only when the economic threshold for harmfulness is reached and in strict compliance with environmental regulations.

CONCLUSION

Research has shown that members of the Sphingidae family are an important component of the Lower Amu Darya Delta's biodiversity. The most common species are Agrius convolvuli, Hyles livornica, Hyles euphorbiae, and Laothoe populi. The ecological significance of hawk moths is determined by their role in plant pollination and maintaining the stability of natural ecosystems. However, some species in the larval stage can cause significant damage to agricultural crops and ornamental plantings. Hawk moth abundance has been determined by a combination of climatic factors, food availability, and the degree of anthropogenic habitat transformation.

With ongoing climate change, the population of certain species may increase, increasing their harmfulness. Therefore, systematic environmental monitoring of hawk moth populations, improved biological plant protection methods, and the implementation of environmentally friendly pest management technologies are necessary.

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