

BIOECOLOGY OF LEPIDOPTERA SPECIES IN BRASSICACEAE AGROBIOCENOSSES

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Abstract. The present study investigated the bioecological characteristics, species composition, dominance, population density, and fecundity of Lepidoptera pest species distributed in Brassicaceae agrobiocenoses of the Tashkent region of Uzbekistan. The research was conducted during 2025-2026 in cabbage (*Brassica oleracea*), turnip (*Brassica rapa*), radish, and other cruciferous crop fields. Scientific observations were carried out using light traps (BUF-30), sex pheromone traps, route surveys, and stationary observation methods. The distribution, seasonal dynamics, dominance, and developmental characteristics of pest species depending on climatic factors were analyzed.

The research results revealed 14 major Lepidoptera pest species belonging to the families Pieridae, Plutellidae, Pyralidae, and Noctuidae in Brassicaceae agrobiocenoses. Among them, *Pieris brassicae* L., *Pieris rapae* L., *Plutella maculipennis* Curt., *Mamestra brassicae* L., and *Agrotis segetum* Den. et Schiff were identified as dominant species. Under the conditions of the Tashkent region, the occurrence rate of *Pieris brassicae* ranged from 43.4% to 61.6%, whereas in the Syrdarya region this indicator varied between 27.1% and 47.9%. The population density of *Mamestra brassicae* reached 60.2-65.8%, while *Agrotis segetum* accounted for 34.6-36.8%. Female individuals of the cabbage moth *Plutella maculipennis* laid an average of 215 eggs, while *Pieris brassicae* and *Mamestra brassicae* laid up to 260 and 180 eggs, respectively. The longevity of these pest species was recorded as 11.6, 17.5, and 13.8 days, respectively. The large white butterfly (*Pieris brassicae*) caused up to 50.4% economic damage in cabbage crops. The turnip moth (*Agrotis segetum*) and cabbage armyworm (*Mamestra brassicae*) were evaluated as the most destructive pest species affecting early cabbage seedlings. The obtained results demonstrated that air temperature and relative humidity directly influenced the distribution and fecundity of Lepidoptera pest species. In particular, high oviposition activity of the second generation of *Mamestra brassicae* was observed under conditions of $+31.1 \pm 2^{\circ}\text{C}$ temperature and 48.2% relative humidity. During the research, the bioecological characteristics of dominant pest species in Brassicaceae agrobiocenoses and their importance in agroecosystems were determined. The findings may serve as an important scientific basis for improving Integrated Pest Management (IPM) systems

against Lepidoptera pests, enhancing the effective use of parasitic entomophages, and developing environmentally safe biological control strategies.

Keywords. Brassicaceae, Lepidoptera, bioecology, dominant species, *Pieris brassicae*, *Pieris rapae*, *Plutella maculipennis*, *Mamestra brassicae*, *Agrotis segetum*, cabbage agrobiocenosis, population density, fecundity, damage level, pheromone trap, biological control, IPM, agroecosystem.

Introduction. In recent years, the rapid growth of the global population and the increasing demand for food security have necessitated the expansion of agricultural production, particularly vegetable crops. Among vegetable crops, members of the family Brassicaceae, including cabbage (*Brassica oleracea* L.), turnip (*Brassica rapa* L.), radish (*Raphanus sativus* L.), and other cruciferous plants, are considered highly important due to their nutritional and economic value. These crops serve as essential sources of vitamins, minerals, and biologically active compounds in human nutrition. At the same time, cruciferous crops are characterized by high productivity and require intensive agrotechnological practices. However, during the cultivation of Brassicaceae crops, numerous phytophagous insects cause serious economic damage. In particular, pest species belonging to the order Lepidoptera represent one of the major phytosanitary problems in cruciferous agrobiocenoses. Species belonging to the families Noctuidae, Pieridae, Plutellidae, and Pyralidae damage leaves, stems, and generative organs of crops, significantly reducing both yield quantity and quality. In some years, yield losses caused by these pests may reach up to 40-45%.

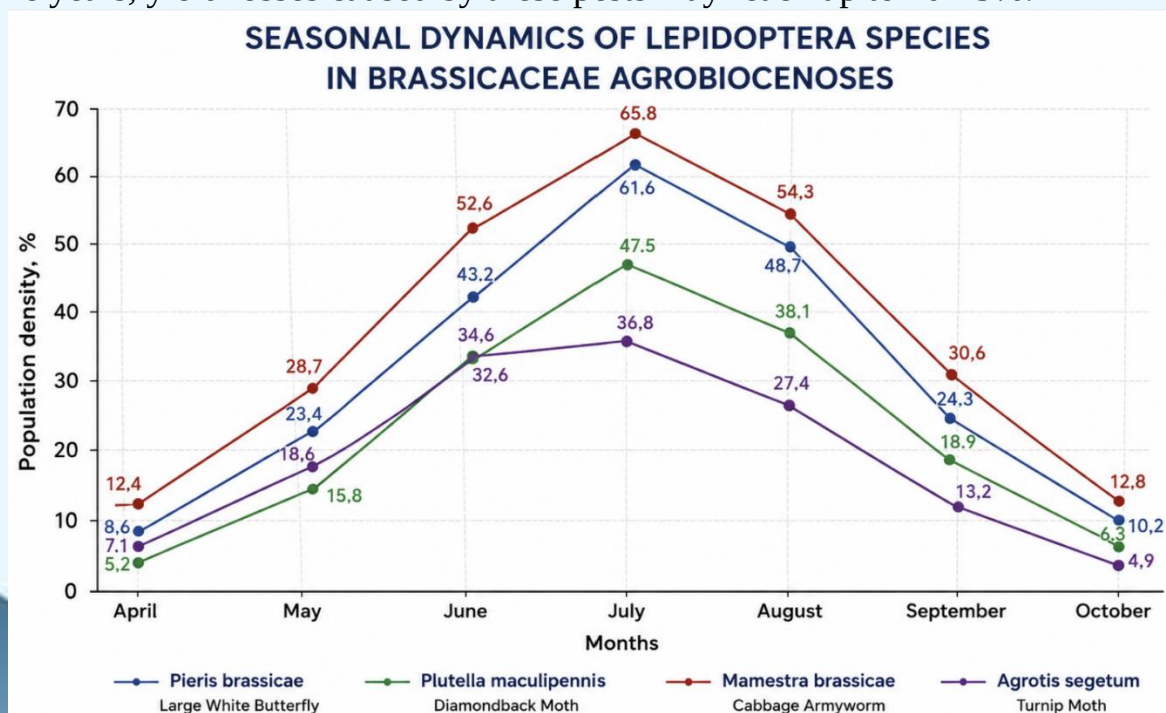


Figure 1. Seasonal dynamics of population density (%) of dominant Lepidoptera species in Brassicaceae agrobiocenoses during the vegetation period (April-October) in the Tashkent regions.

Among the most harmful species in cabbage agrobiocenoses are the large white butterfly *Pieris brassicae* L., the small white butterfly *Pieris rapae* L., the diamondback moth *Plutella maculipennis* Curt., the cabbage armyworm *Mamestra brassicae* L., and the turnip moth *Agrotis segetum* Den. et Schiff. These species are characterized by high biotic potential, rapid reproduction, and broad ecological

adaptability, producing several generations under the climatic conditions of Central Asia. For example, *Pieris brassicae* and *Plutella maculipennis* develop continuously throughout the growing season and are distinguished by their capacity for mass population outbreaks in cruciferous crops. The natural and climatic conditions of Uzbekistan are favorable for the development of these pest species. In particular, vegetable cultivation is highly developed in the Tashkent and Syrdarya regions, where the species composition and population density of Lepidoptera pests in Brassicaceae agrobiocenoses are formed at high levels. Air temperature, relative humidity, crop species, and agrotechnical measures directly influence the distribution and dominance of these pests.

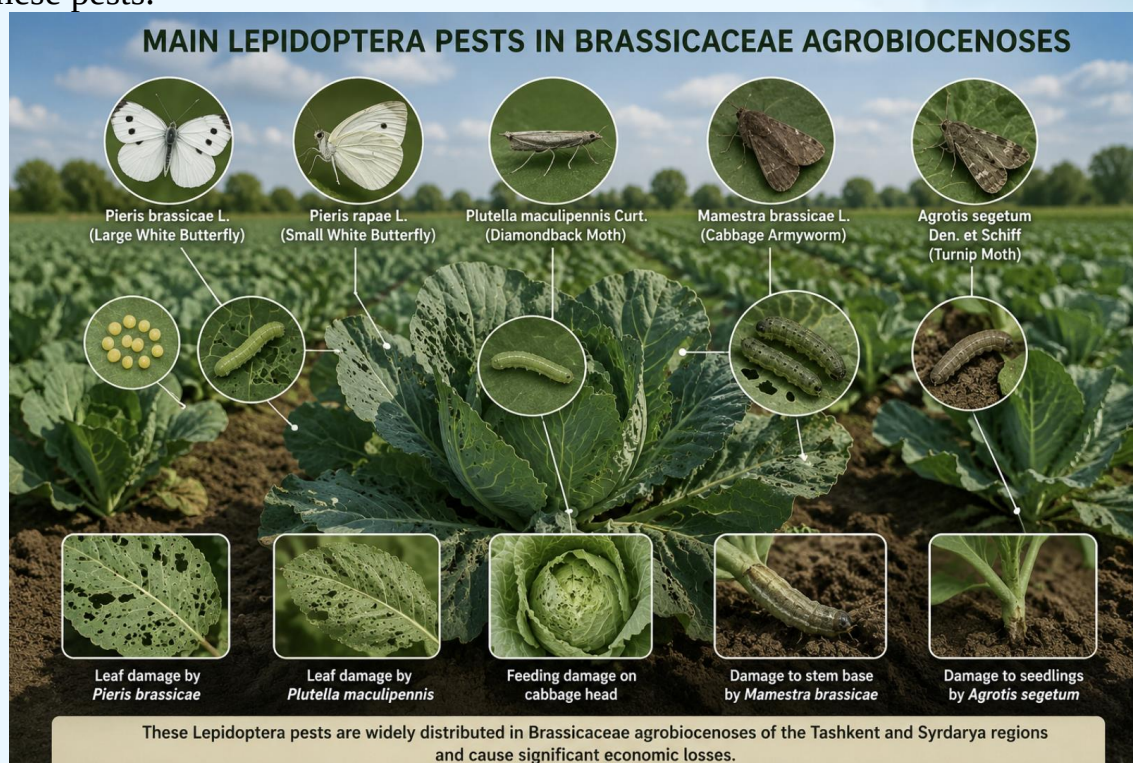


Figure 2. Main dominant Lepidoptera pest species naturally distributed in Brassicaceae agrobiocenoses and their characteristic damage symptoms under field conditions.

Currently, chemical insecticides are widely applied against these pest species. However, the continuous and uncontrolled use of pesticides leads to ecological imbalance in agrobiocenoses, reduction of beneficial entomophagous insects, development of resistance in pest populations, and environmental pollution. Therefore, comprehensive studies on the bioecological characteristics, population dynamics, and dominance of pest species are of great importance for the development of Integrated Pest Management (IPM) systems. In recent years, considerable attention has been paid worldwide to the improvement of environmentally safe biological protection systems. In particular, studies on pest bioecology, seasonal development, fecundity, and responses to climatic factors provide an important scientific basis for the development of effective biological and integrated control strategies. From this perspective, investigating the species composition, bioecology, dominance, and population characteristics of Lepidoptera species distributed in Brassicaceae agrobiocenoses is of both scientific and practical importance. The main objective of the present study was to determine the species composition, bioecological

characteristics, dominance, fecundity, and population density of Lepidoptera species occurring in Brassicaceae agrobiocenoses, as well as to evaluate their distribution patterns under agrobiocenosis conditions.

Results and Discussion. The conducted studies revealed the species composition, dominance, population density, and bioecological characteristics of Lepidoptera pest species distributed in Brassicaceae agrobiocenoses of the Tashkent and Syrdarya regions. During the observations, pest species belonging mainly to the families Pieridae, Plutellidae, Pyralidae, and Noctuidae were found to be widely distributed in cabbage agrobiocenoses. According to the research results, three species of the family Pieridae were identified in cabbage agrobiocenoses: *Pieris brassicae* L., *Pieris rapae* L., and *Synchlora daplidice* L. Among these species, the highest dominance index was observed in *Pieris brassicae*. Under the conditions of the Tashkent region, the occurrence rate of this species ranged from 43.4% to 61.6%. In particular, the highest population density of *Pieris brassicae* was recorded in the Bekabad district, where it reached 61.6%. In the Kuyichirchiq and Qibray districts, the occurrence rates were 56.2% and 57.8%, respectively. In contrast, the lowest occurrence level was observed in the Buka district, accounting for 43.4%.

Observations conducted in the Syrdarya region also confirmed that *Pieris brassicae* was one of the dominant pest species in cabbage agrobiocenoses. However, the distribution level of this species was relatively lower than in the Tashkent region. The occurrence rates were recorded as 41.6% in Saykhunobod district, 47.9% in Oqoltin district, 30.7% in Yangiyer district, and 27.1% in Bakht district. This situation may be explained by the lower relative humidity and comparatively less favorable climatic conditions for the development of *Pieris brassicae* in the Syrdarya region. During the investigations, the diamondback moth *Plutella maculipennis* Curt., the principal representative of the family Plutellidae, was found to be widely distributed in all observation areas. This pest species caused serious economic damage by injuring the leaf tissues of cruciferous crops. High population density of *Plutella maculipennis* was recorded in nearly all districts of the Tashkent region.

Representatives of the family Noctuidae occupied the leading position in species richness within cabbage agrobiocenoses. During the observations, the following species were recorded: *Mamestra brassicae* L., *Agrotis segetum* Den. et Schiff, *Agrotis exclamationis* L., *Heliothis virescens* Hufn., *Autographa gamma* L., and *Agrotis ipsilon* Hufn. Among these, *Mamestra brassicae* and *Agrotis segetum* were evaluated as dominant species. In the Tashkent region, the population density of *Mamestra brassicae* ranged from 60.2% to 65.8%, whereas *Agrotis segetum* accounted for 34.6-36.8%. The observations demonstrated that the cabbage armyworm (*Mamestra brassicae*) and the turnip moth (*Agrotis segetum*) were among the most destructive pests of early cabbage seedlings. These species mainly damaged the root collar and stem parts of seedlings during spring, causing plant wilting and death. Experiments conducted to determine the fecundity of *Plutella maculipennis*, *Pieris brassicae*, and *Mamestra brassicae* indicated that these species possessed high biotic potential. Female adults of *Pieris brassicae* laid an average of 260 eggs, while *Plutella maculipennis* and *Mamestra brassicae* laid approximately 215 and 180 eggs, respectively. The longevity of these pest species was recorded as 17.5, 11.6, and 13.8 days, respectively. The research results also demonstrated that climatic factors

directly affected the development and fecundity of Lepidoptera pest species. In particular, high oviposition activity of the second generation of *Mamestra brassicae* was observed under conditions of $+31.1 \pm 2^\circ\text{C}$ air temperature and 48.2% relative humidity. The mass flight period of adults occurred during the second ten-day period of June, when 3-4 adults per trap were recorded daily.

The distribution and dominance of Lepidoptera species in cabbage agrobiocenoses varied depending on crop species, climatic conditions, and agrotechnical practices. In early turnip agrobiocenoses, *Agrotis segetum*, *Mamestra brassicae*, *Pieris brassicae*, *Pieris rapae*, and *Plutella maculipennis* were identified as the most widespread species. Relatively less common species included *Autographa gamma*, *Agrotis exclamationis*, and *Synchlora daplidice*. Overall, the obtained results demonstrated that *Pieris brassicae*, *Plutella maculipennis*, *Mamestra brassicae*, and *Agrotis segetum* are the principal economically important dominant pest species in Brassicaceae agrobiocenoses. The study of their bioecological characteristics and population dynamics is of great significance for the development of Integrated Pest Management (IPM) systems against these pests.

Conclusions. The conducted studies revealed the species composition, bioecological characteristics, dominance, and population density of Lepidoptera pest species distributed in Brassicaceae agrobiocenoses of the Tashkent region. During the observations, a total of 14 major pest species belonging to the families Pieridae, Plutellidae, Pyralidae, and Noctuidae were recorded. According to the research results, *Pieris brassicae* L., *Plutella maculipennis* Curt., *Mamestra brassicae* L., and *Agrotis segetum* Den. et Schiff were identified as dominant pest species in cabbage agrobiocenoses. The occurrence rate of *Pieris brassicae* ranged from 43.4% to 61.6% in the Tashkent region and from 27.1% to 47.9% in the Syrdarya region. The population density of *Mamestra brassicae* accounted for 60.2-65.8%, while *Agrotis segetum* reached 34.6–36.8%. The diamondback moth (*Plutella maculipennis*), the large white butterfly (*Pieris brassicae*), and the cabbage armyworm (*Mamestra brassicae*) demonstrated high biotic potential. The fecundity of female adults averaged 215, 260, and 180 eggs, respectively. The longevity of these pest species ranged from 11.6 to 17.5 days. The large white butterfly (*Pieris brassicae*) was found to cause economic damage of up to 50.4% in cabbage crops.

The research demonstrated that climatic factors significantly influenced the development and distribution of pest species. In particular, changes in air temperature and relative humidity directly affected the population density, fecundity, and seasonal development dynamics of Lepidoptera species. Environmental conditions characterized by $+31.1 \pm 2^\circ\text{C}$ temperature and 48.2% relative humidity were identified as the most favorable for the second generation development of *Mamestra brassicae*. The distribution of dominant pest species in Brassicaceae agrobiocenoses exhibited distinct regional characteristics. A higher population density of *Pieris brassicae* was observed in the Tashkent region, whereas its occurrence rate decreased in the Syrdarya region due to lower relative humidity. At the same time, *Plutella maculipennis* and *Mamestra brassicae* demonstrated high adaptability to arid climatic conditions. The obtained results may serve as an important scientific basis for evaluating the bioecological characteristics of Lepidoptera pest species in Brassicaceae agrobiocenoses, forecasting their population dynamics, and improving

Integrated Pest Management (IPM) systems. Furthermore, the findings are of practical significance for the development of biological control methods, the effective use of parasitic and predatory entomophages, and the establishment of environmentally safe plant protection systems.

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