

## Bioecological peculiarity of the Privet hawk moth (*Sphinx ligustri*, Linnaeus, 1758)

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### Abstract

This scientific article presents information on how *Sphinx ligustri* (Linnaeus, 1758) shows different sizes at different stages of development in relation to feed.

Plant species with the highest nutritional value have been identified for *Sphinx ligustri* (Linnaeus, 1758).

When feeding with various feeds (within 21-23 days), the highest rate was in the larvae of the *Sphinx ligustri*, which were fed with the *Syringa* plant. The larvae that fed on this plant increased very quickly.

The duration of diapause was also shorter than in larvae feeding on other plants.

**Keywords:** Privet hawk moth-*Sphinx ligustri* (Linnaeus, 1758), eggs, larva, pupa, imago, feeder, diapause, ecosystem, Protected species

### Introduction

*Sphinx ligustri* (Linnaeus, 1758) is a species belonging to the phylum Arthropoda, class Insecta, order Lepidoptera, family Sphingidae, genus *Sphinx* (Pilipenko VN, Lozovskaya MV, et.al., 2014) <sup>[1, 2]</sup>. *Sphinx ligustri* (Linnaeus, 1758) is a large butterfly, with a wingspan of 90-120 mm. Unlike other hawk moths, the *Sphinx ligustri* folds its front wings against its body when it calms. The forewings are brown-gray, with several black lines. The base of the hind wing is pink with two browns. The paunch of the butterfly is pink and has several black rings. A light brown thick border runs along the shoulder of the body (Derjaves YA.,1984) <sup>[3, 5, 6]</sup>. Spread in gardens and parks and there are many trees. The *Sphinx ligustri* produces two generations in one season. The first generation emerge in April-May, the second generation - in July-August (Pittaway, A. R.,1996) <sup>[12]</sup>. Flying in the air is very intense (Tixonov VT.,2007) <sup>[7]</sup>. The proboscis is well formed, adapted to feeding on flower nectar. The length of the proboscis is equal to the size of the butterfly's body, sometimes longer. Hanging in the air, it feeds by pointing its proboscis at nectar.

Mainly active at night. At night the sensitivity to light is high and the light attracts the butterfly (Raximov MSh., 1997) <sup>[9]</sup>. The female *Sphinx ligustri* lays up to 200 eggs (Koshkin E., 2016) <sup>[8]</sup>. They lay their eggs singly or two or three together under the leaves of the food plant. The larvae hatch from the eggs in 10-20 days depending on the temperature. After the fourth diapause, the length of the larvae is 90-110 mm.

The color of the larvae is green, with a diagonal white-brown line along the body.

In some cases, the larvae may be purple in color (Abduraxmanov AG.,1998) <sup>[6]</sup>. The larvae feed on *Syringa*, *Ligustrum*, *Fraxinus*, *Spiraea*, *Viburnum*, *Lonicera*, *Ribes*, *Malus*, *Filipendula*, *Pyrus*, *Prunus avium*, *Sambucus*, *Rubus idaeus*, *Jasminum*, *Sorbus*, *Aruncus dioicus*, *Symphoricarpos*, *Berberis* (S. Bricteux-Gregoire, W. G. Verly & M. Florkin.,1957). The pupa is large, 50-55 mm long. Unlike other hawk moths, *Sphinx ligustri* has a clearly visible of the proboscis in the pupa. In the pupal stage, it

hibernates in humus-porous soil layers up to 10 cm deep (Akkuzu, E., Ayberk, H., Inac, S. 2007) <sup>[19]</sup>. Characteristic of the polyarctic region, it can be found almost everywhere on earth, including all European countries, Mongolia, Northern China, Japan, the CIS countries and the Far East (Poulton, E.B.1885) <sup>[20]</sup>.

In recent years, the *sphinx ligustri* has been under protection in many countries due to its rare occurrence in nature (Kitching, I. J.,2019) <sup>[4]</sup>.

### Materials and methods

The research was carried out in 2022 from May to September in the areas of Ishtikhan (39°57'54.78"N 66°29'02.47"E), Kattakurgan (39°54'41.28"N 66°16'00.99"E), Narpay (39° 53'50.4"N 65° 56'10.65"E), Urgut (39°28'02.08"N, 67°02'49.67"E), Jambay (39°41'40.54"N, 67°06'04.3"E), Tailak (39°30'39.54"N 67°12'01.23"E) and Bulungur (39 °38'33.03"N 67°21'16.95"E). Materials for research were collected from gardens, shrubs and trees located in the above areas. Imago gathered in the dark time. The material was collected by placing a 500 W lamp against a white cloth screen and the light attracts butterflies. Butterflies in the rays of light lose their balance and fall on the fabric spread on the ground under the screen. Butterflies falling on the fabric are collected in a special container (morelka) filled with pieces of cotton wool moistened with a 70% chloroform solution and filter paper folded in a zigzag pattern, the lid of the container is tightly closed. In this case, the butterflies are soaked in a container and rendered unconscious by the chloroform. The purpose of placing the filter paper in the container is to absorb the moisture in the container and prevent damage to the butterfly wings. Anesthetized butterflies are placed in envelopes with their wings raised up and labeled (information about the material is recorded). Envelopeted materials are delivered to the laboratory and softened in a desiccator for two days. Soft-bodied butterflies are straightened with a special spreader. In this case, the

lower part of the front wing should be in a position at an angle of 90 degrees to the body. After that, the rear wing is aligned close to the front wing. Butterflies are left in the spreader for 48 hours. After an appropriate period of time, butterflies are placed in entomological boxes and marked. Butterflies included in the collection, the species composition was determined using the determinant "Overview of the systems of hawk moths (Lepidoptera, Sphingidae) with a list of species of the fauna of the USSR" (Yu. A. Derzhavets 1984). The material of the larval stage was collected during the day and delivered to the laboratory along with food plants. The brought larvae were placed in a special device for storage and observation of insects (insectarium). For the study, 4 imago and 8 larvae were caught. In order to study the bioecological characteristics, the materials were delivered to the laboratory "Experimental Zoology" of the Department of Zoology of Uz MU.

**Results**

The larvae delivered to the laboratory were fed food plants under laboratory conditions. As a result, it was noticed that the development of larvae in relation to different foods shows different sizes. The larvae were fed leaves of Ribus (blackcurrant), Malus (apple), Pyrus (pear), Prunus avium (cherry), Rubus idaeus (raspberry). The Syringa plant was used as a control feed. According to the experiment, six larvae were fed the above plants in laboratory conditions until the pupa period. Of these, the leaf-feeding larvae of Ribus and Rubus idae develop somewhat faster than the leaf-feeding larvae of Malus, Pyrus and Prunus avium (Table 1). As can be seen from the table, Sphinx ligustri larvae feeding on Syringa showed the highest developmental status compared to larvae feeding on other plants. Larvae fed on Malus leaves were relatively small in developmental stages compared to other larvae. The duration of feeding of the larvae was 21-23 days.

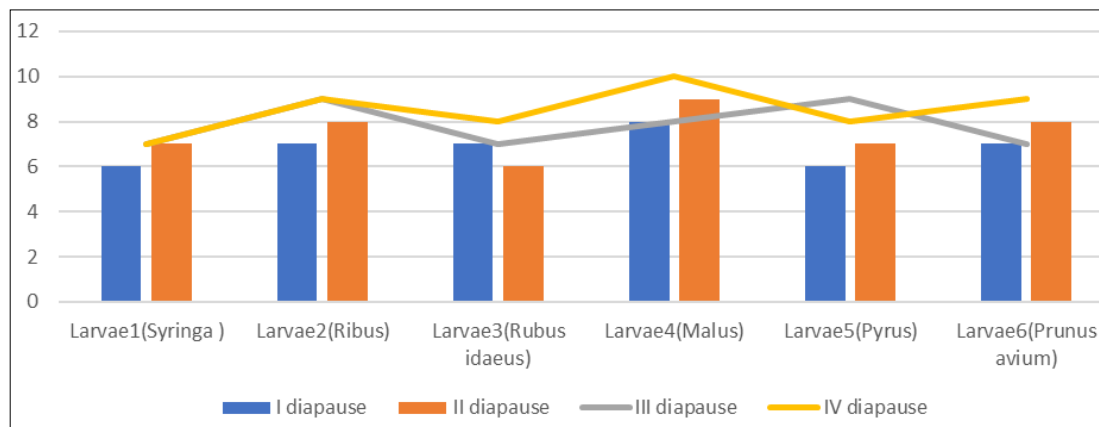
**Table 1:** Development of Sphinx ligustri in relation to food at the larval stage, mm.

Larvae	Larvae1 (control), mm	Larvae 2 mm	Larvae 3 mm	Larvae 4 mm	Larvae 5 mm	Larvae 6 mm
food plant	<i>Syringa</i>	<i>Ribus</i>	<i>Ribus idaeus</i>	<i>Malus</i>	<i>Pyrus</i>	<i>Prunus avium</i>
Stages of larval development (diapause)	I*	10-40	10-40	10-40	10-40	10-40
	II	60	57	51	46	48
	III	88	86	77	71	72
	IV	110	109	109	97	102

\*- period of grasping of larvae from nature

In addition, it was noted that when larvae were fed different food plants, the duration of diapause in their development was different. The duration of each diapause usually averages 6-9 days in the larvae of almost all species of hawk moths. The larvae of sphinx ligustri had different durations

of diapause in relation to food. The transition of larvae from one stage to another was observed (in 7-8 days), feeding on the leaves of Syringa (As a control plant). It is noted that larvae feeding on Malus leaves pass from one stage to the second in 9-11 days (diagram 1).



**Fig 1:** Periods of development of Sphinx ligustri larvae in relation to food. diagram 1

**Discussion**

Sphinx ligustri is an agricultural pest. It damages many trees, including fruit trees important for ornamental trees and horticulture, during the growing season and negatively affects plant productivity and growth. To date, sufficient measures have been taken to combat this pest butterfly. Even as a result of overexposure to countermeasures, this hawk moths is rarely found in nature. In this regard, in a certain sense, there is a need to develop measures to protect the Sphinx ligustri. Today this species is protected in many countries.

**Conclusion**

As a result of the study, the following conclusions were made. When the ghost butterfly Sphinx ligustri was fed Ribus (currant), Malus (apple), Pyrus (pear), Prunus avium (cherry), Rubus idaeus (raspberry) plants in the laboratory, their developmental stages were similar to the larvae fed by Syringa on the control plant, in comparison with it, its dimensions were somewhat smaller. When feeding the above plants, the periods of their development also manifested themselves in different periods. It was shown that the larvae of butterflies that were fed with the Syringa plant passed to the next stages of development in the

shortest possible time, and the larvae that were fed with an *Malus* required a relatively long period of time to move to the next stages of development. Respectively, *Syringa* is marked as the most optimal fodder plant for the development of *Sphinx ligustri* in the larval period.

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### References

- Pilipenko VN, Lozovskaya MV, et.al., Red Book of the Astrakhan Region, 2014, 211-212.
- Lampert K. Atlas of butterflies and larvae of Europe, Russia and Asia, 1913, 135.
- Derjaves YA. List of species of hawk moths of the fauna of the USSR (Lepidoptera, Sphingidae), 1984:3:604-620.
- Eitschberger U, Mey W. Sphingidae (Lepidoptera: Bombycoidea), Sphingidae Taxonomic Inventory, 2007, 195-203.
- Poltavskiy AN. Hawk moths of the Rostov region and the southern regions of Russia (Lepidoptera, Sphingidae), 2004, 13-15.
- Abduraxmanov AG. Species composition and bioecological characteristics of hawk moths (Sphingidae, Lepidoptera) of the Republic of Dagestan. Dagestan ecological journal, 1998:1:137-141.
- Tixonov VT. Moth hawks (Sphingidae) of the "Sarykum dunes" section of the "Dagestan" reserve. Bulletin of the Dagestan State Pedagogical University. Natural Sciences, 2007:1:121-128.
- Koshkin E. Hawk moths (Sphingidae). Journal of "Amur Star", 2016:2:29-31.
- Raximov MSh. Fauna, biology and ecology of night butterflies (Noctuidae) of anthropogenic landscapes of the Khorezm oasis. Avtoreferat, 1997, 2.
- Malikjon Shermatov and others. Distribution of butterflies of the family Sphingidae (Insecta, Lepidoptera) in the Ferghana Valley. International Journal of Virology and Molecular Biology, 2021:10(2):27-33. DOI: 10.5923/j.ijvmb.20211002.01
- Omonov ShN. On The Study of Hawk Moths in Uzbekistan. European Multidisciplinary Journal of Modern Science, 2022:4:884-885.
- Pittaway AR. Observations on the host plant preferences of *Laothoe populi* (Linnaeus, 1758) (Lepidoptera: Sphingidae). Journal Entomologist, 1996:115(2):124-128.
- Lucy Pearson. "The corpora pedunculata of *Sphinx Ligustri* L. and other Lepidoptera: an anatomical study". Philosophical transactions of the royal society of London, 1971:259(833):477-516.
- Nokkala S. Cytological characteristics of chromosome behaviour during female meiosis in *Sphinx ligustri* L. (Sphingidae, Lepidoptera). Hereditas, 1987:106(2):169-179.
- Lutz Thilo Wasserthal, Wiltrud Wasserthal. Innervation of heart and alary muscles in *Sphinx ligustri* L. (Lepidoptera). Cell and Tissue Research, 1997:184:467-486.
- Bricteux-Gregoire, Verly WG & Florkin M. Protein Synthesis in *Sphinx ligustri* Pupae. Nature, 1957:179:678-679.
- George N. On the nervous system of the *Sphinx ligustri*, Linn., and on the changes which it undergoes during a part of the metamorphoses of the insect. Philosophical Transactions is the world's first and longest-running scientific journal, 1832:122:383-398. <https://doi.org/10.1098/rstl.1832.0019>
- Statna AP, Cherevatov OV, Volkov RA. *Sphinx Ligustrinae* 5S ribosoma DNKsining molekulyar tuzilishi va evolyutsiyasi. Visnik ukrains' kogo tovaristva, 2013:11(2):276-282.
- Akkuzi E, Ayberk H, Inac S. Hawk moths (Lepidoptera: Sphingidae) of Turkey and their zoogeographical distribution. Journal of Environmental Biology, 2007:28(4):723-730.
- Poulton EB. Further notes upon the markings and attitudes of lepidopterous larvæ, together with a complete account of the life-history of *Sphinx ligustri* and *Selenia illunaria*. Transactions of the Royal Entomological Society of London, 1885:33(2):281-329.