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Euproctis chrysorrhoea Linnaeus, 1758 (Lepidoptera: Lymantriidae) biology and determination of damage Yedisu, Bingöl, Türkiye

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Abstract

In this study, the effect of *Euproctis chrysorrhoea* (Linnaeus, 1758) species, known as the Brown-tail moth in the determined locality, on many plant species was investigated and it was determined that caused significant damage to the related plant species. The brown-tailed moth gives offspring once a year. There are four biological life stages. These are eggs, larvae, pupae, and adults. Eggs are laid in July. The egg stage lasts for one month, the larval stage for nine months, the pupa for one month, and the next stage for one month as an adult. It has been determined that *E. chrysorrhoea* Linnaeus, 1758 species, has been found in a cyclical manner for 4-6 years, and in the region for the last four years in a row, mainly in pine tree species and in some fruit trees and products grown in gardens, causing a high level of damage. It is seen that especially abiotic factors cause very important effects on the increase in the population number of the living thing, and the effect of increasing climatic changes in recent years is great. Biological control methods can be effective against this harmful species; it is suggested to be used as an important control method to balance the pest population by ensuring the release of bird species (stork, starling, finch, etc.) and some parasitoids belonging to the region. It has been determined that the chemical control methods used extensively by the agricultural producers in the region make the pest more resistant in the following years, cause the death of many living species (mass bee and bird deaths, etc.), and cause loss of quality of other cultivated plants together with commercial beekeeping activities.

Keywords

Euproctis chrysorrhoea, Biology, Damage, Biological control, Bingöl

Introduction

E. chrysorrhoea causes great damage to fruit trees by making a population explosion at intervals of 8-10 years in the Anatolian Region (Bulut, 1991). It is necessary to understand the biology of *E. chrysorrhoea* very well in order to develop control methods against *E. chrysorrhoea*, which causes damage by consuming the leaves of various tree species in many agricultural and forest areas in the world and as a result threatens agriculture and forest production to a great extent (Bilgener, 2009). Many insect species are known that are harmful to forests and can disrupt the forest ecosystem. One of these species is *E. chrysorrhoea* L. (Golden butterfly) (Kansu, 1955; King, 1998; Sekendiz, 1984; Pilarska et al., 2001). This species, known in our country as the "golden-ass butterfly, golden butterfly or golden *feather butterfly*" is also an important agricultural pest (Çanakçıoğlu, 1983). It is known as one of the important pests of broad-leaved forest trees, especially fruit trees such as apple, pear, apricot, sour cherry, cherry, and hawthorn (Kansu, 1955; Gürses, 1975; İren, 1977). *E. chrysorrhoea* is common throughout Europe and North Africa, from southern Sweden and southeastern England to southern Russia. From there it went to North America. In our country, it is possible to see this pest almost everywhere. *E. chrysorrhoea* preferred host plants of the polyphagous in its natural range are oak, fruit trees, crataegus, and rose. But it also damages poplar, willow, elm, maple, plane tree, linden, Hippophae, and *Arbutus unedo*. The host plant species and the quality determine the pupa weight of the pest and the size of the egg clusters (Frago et al., 2011). The brown-tailed moth gives offspring once a year. There are four biological life stages. These are eggs, larvae, pupae, and adults. Eggs are laid in July. The egg stage lasts for one month, the larval stage for nine months, the pupa for one month, and the

next stage for one month (adult). The egg stage is passed in various fruit trees, especially in the oak forests in and around Bingöl. Pre-diapause larvae emerge after 3 weeks by August. Diapause larvae form common winter nests in the fall. They spend the winter in their burrows. In the post-diapause period, swarms of larvae emerge in late spring and summer. In larvae that disperse after diapause, the nests are disintegrated and the larvae begin to feed independently. From the larval stage to 6-8 instars, it turns into pupa as of June. The emergence of the adults with the winged sexual form occurs approximately one month after the adults with the form called imago (İren, 1977). The stretched wingspan of adults is 30-35 mm. The fore and hind wings are white. At the end of the body is a tuft of golden yellow hairs. Males often have blackish spots on the inside angle of the front wings. Antennae are unilateral in females and bilaterally combed in males. It coincides with the months of June and July. The female adult lays her brown eggs in piles (200-300 pieces) in rows on the underside of the leaves and covers them with yellow scales at the end of the body. The caterpillars, which emerge 2-3 weeks after the egg, eat the leaves around them and eventually weave them together to prepare a fist-sized wintering nest. After spending the winter in the nest as caterpillars, they come out in the spring when the trees turn green. The caterpillars live in groups at first and always return to their nests after feeding. Later, they scatter around, prepare a translucent cocoon between leaves or in the soil, and turn into pupae in it in late May and June. It has a simple generation (Southwood & Henderson, 2000). The factors that influence the distribution and abundance of insect herbivores are a fundamental issue in the ecology of insects the species involved may cause economic losses. Assessing the factors incurring mortality to a species, as well as those affecting reproductive potential, maybe a first step in understanding insect outbreaks, and developing sustainable control methods. Life table analysis has been an essential tool for the comprehension of herbivore population dynamics because they account for both survival and reproductive potential (Baş and Selmi, 1990).

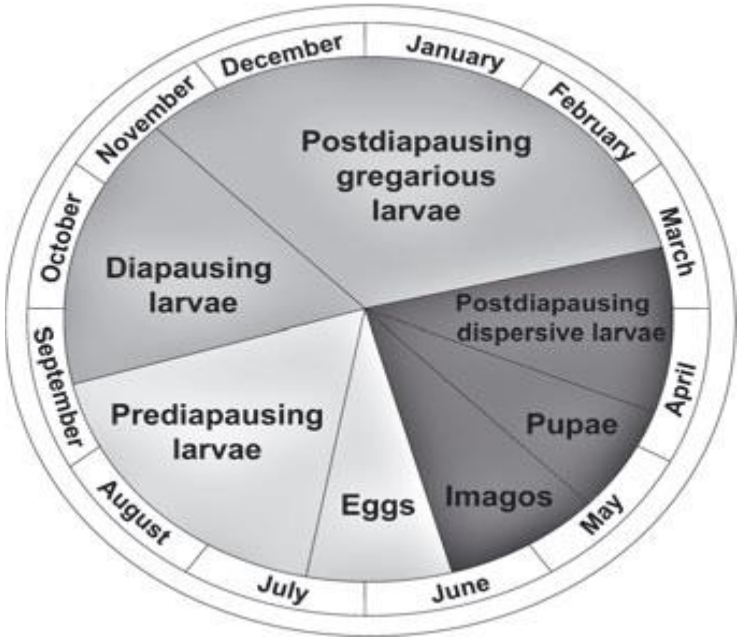

Figure 1. Phenology of the different stages of *Euproctis chrysorrhoea* feeding on Arbutus unedo in the studied populations, grouped in summer (light grey), winter (medium grey), and spring (dark grey) stages. Modified from (Frago et al., 2011).

According to Figure 1., the phenology of the *E. chrysorrhoea* species is shown in its different stages. Especially in the light gray area, the developmental stages in the summer months are egg and prediapause. Although it corresponds to the winter months in the middle gray area, the developmental stages occur as diapause larva and post diapause gregarious larva, and the development stages to the first spring months in the dark gray area post dispersive larvae, pupae, and imagos (Frago et al., 2011).

The sacs on trees and shrubs in small areas such as orchards, parks, and roadsides are cut with branch shears during the winter and the larvae in them are killed. In this type of mechanical warfare carried out in large areas, sacs are placed in pits dug in the soil and the edges of the pit are treated with insecticides to prevent the larvae from dispersing into the environment.

Biological control

In this way, biological warfare can be helped by ensuring that both the larvae die and the parasites emerge. As a result of the studies carried out to date, 92 parasitic species of *E. chrysorrhoea* have been identified in Europe. The most effective *Bacillus thuringiensis* preparations in field and laboratory conditions, *Bt. subsp. gallarie* and *Bt. subsp. dendrolimus*. But they are effective when the air temperature exceeds 16°C. In semi-natural conditions, Bt. subsp. in the course immediately stops the larvae from getting food. But the death that occurs in this way is slower than that of insecticides. In the chemical warfare against this pest, pyretroids such as Trichlorphon, Carbaryl, and recently Deltamethrin and Diflubcnzuron, a chitin inhibitor, have been used successfully (Baş and Selmi, 1990).

Materials and Methods

Camera (18-55 mm, 1920x1080, 24.1 MP), insect storage containers, and polyethylene and ice bags were used as materials in the research.

Euproctis chrysorrhoea Linnaeus, 1758, it has been determined that for the last four years between 2018 and 2021, it has caused high-level damage to many plant species, especially many pines, fruit trees, and cultivated plants in gardens, which spread on an area of approximately 5 thousand hectares in the Yedisu (Figure 2-3) district of Bingöl province. *Euproctis chrysorrhoea* L. species are seen areas where intensely; I took place in a total of 34 localities, namely Akımlı, Dinarbey, Elmalı, Eskibalta, Güzgülü, Kabaoluk, Kaşıklı, Şenköy, Yağmurpınar, in Yedisu district of Bingöl province. Within the framework of the research, in order to examine the silky structure and species samples of the related species, they were brought to the Entomology Laboratory of the Faculty of Agriculture and examined with an ocular microscope, and the species were identified by me.

Results and Discussion

Lepidoptera: Lymantriidae

Euproctis chrysorrhoea Linneaus, 1758

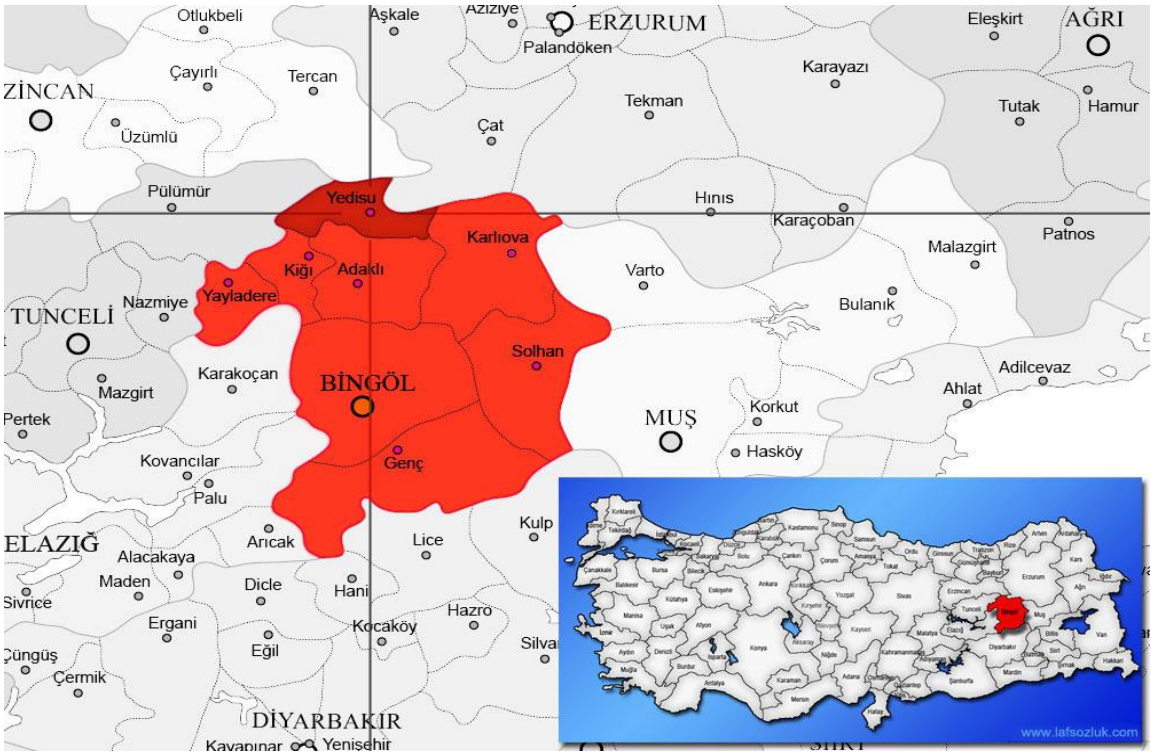

Figure 2. The research area Yedisu, Bingöl

According to (Figure 2) the region-area of the population of harmful species is shown on the map of Turkey. Especially *E. chrysorrhoea* L. species has had an intense effect in the part shown with the red area and in the rural areas district of Yedisu, province of Bingöl.

Figure 3. Yedisu rural area

Figure 4. The nest knits in the plant

Figure 5. Collective species and their nests

Figure 6. Types of damage

Figure 7. Types of damage

Figure 8. Types of damage

Figure 9. Collective species and their nests

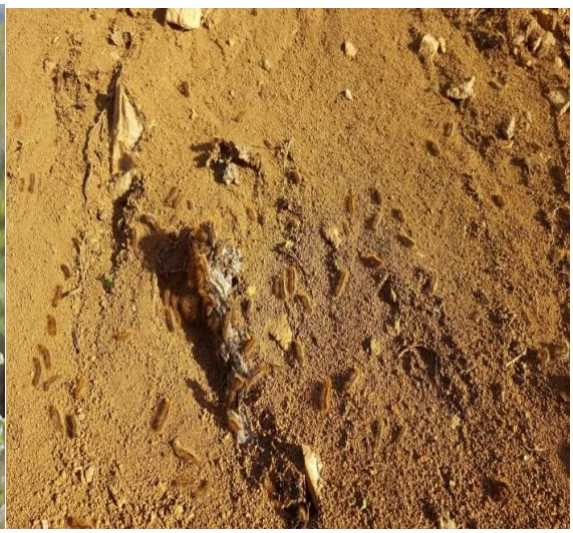

Figure 10. Behavior and habitat of the species

According to (Figure 3). an image related to the habitat and geography of the relevant pest species and the vegetation it has damaged is given. In Figure 4., the damage caused by the harmful species on plant products and the area where it spreads is observed. According to (Figures 5-10), various forms of harm and behavior patterns of the pest are seen in the study.

Conclusion

Euproctis chrysorrhoea Linnaeus, 1758 species, known as the "Golden butterfly caterpillar" is an important plant pest that has been cyclically repeated in the last four years (2018-2021) the city with the most forest assets in the area of Yedisu district of Bingöl. *E. chrysorrhoea* L. species, has four biological life stages with one offspring per year. Eggs are laid in July. The egg stage lasts for one month, the larval stage for nine months, the pupa for one month, and the next stage for a month as an adult. After spending the winter in the nest as caterpillars, they come out in the spring when the trees turn green. The caterpillars live in groups for the first time and always return to their

nests after feeding. Many insect species are known that are harmful to forests and can disrupt the forest ecosystem. It is known as one of the important pests of broad-leaved forest trees, especially with fruit trees such as apple, pear, apricot, sour cherry, cherry, and hawthorn. It was determined that the producers caused high damage to the cultivated plants they planted, especially the pine trees growing in the related harmful forest (Figure 4-10). It is known that the life cycle of the pest is determined and the conditions under which it grows and develops. The species, which is known to form silky sacs in flocks in trees and can reproduce very quickly, which can cause damage to many plant species with this feature, adversely affects the natural balance when the population number exceeds a certain rate. In this context, in order to minimize the damage, knowing the biology and climate demands of the creature and determining the conditions in which it lives, and ensuring the effective use of plant protection methods against this will reveal important results. It is expected that especially, raising the awareness of the producers about pest control, the implementation of protective and cultural control methods, followed by the implementation of biological control practices, will provide significant gains and a significant reduction in the population of the pest. Ensuring the effective use of biological control agents; some predatory insects (*Calosoma sycophanta*) seem to play an important role in balancing the pest and reducing its number. In addition, eggs, larvae (*Trichogramma turkeiensis* and *Telenomus* sp.), chrysalis and adult parasitoids, and disease-causing bacteria species (*Bacillus thurigiensis*) are highly effective organisms against *E. chrysorrhoea* species. Although the first method that herbal producers commonly apply against pests is chemical control, this method makes the pest more resistant in the process, chemical ingredients create residue problems in herbal products, endanger human health and the lives of other living things, and many organisms (bees, birds, etc.) was determined to cause death. In addition, the deterioration of the ecological balance in this direction by causing air, water, and soil pollution requires very limited and controlled use of chemical control methods.

Compliance with Ethical Standards

Conflict of interest

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author contribution

The author read and approved the final manuscript. The author verifies that the Text, Figures, and Tables are original and that they have not been published before.

Ethical approval

Not applicable.

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Data availability

Not applicable.

Consent for publication

Not applicable.

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