

Harmful and Beneficial Insects Species Determined in Sugar Beet Areas in Çayırılı District of Erzincan Province and Short Biology of *Spodoptera exigua* (Hbn.) (Lepidoptera: Noctuidae)

Erzincan İli Çayırılı İlçesi'nde Şeker Pancarı Alanlarında Tespit Edilen Zararlı ve Faydalı Böcek Türleri ve *Spodoptera exigua* (Hbn.) (Lepidoptera: Noctuidae)'nın Kısa Biyolojisi


Ekin TEYMUROĞLU¹, Saliha ÇORUH^{2*}

Abstract

This study was conducted between 2019-2020 in Erzincan Province Çayırılı District to reveal beneficial and harmful species and the biology of *Spodoptera exigua* (Hbn.) (Lepidoptera: Noctuidae), which is an important pest in sugar beet cultivation area. The study area designated as "Erzincan Çayırılı Beet Production Area" (EÇPÜA) has many beet cultivation areas. The beet production obtained from these beet fields changes according to the years, but is also noteworthy for both the region and our country. This area, sugar beet does not only bind the farmers to their field and their villages, provide work and employment opportunities to all family members, but it also is an important plant with its by-products all of which are processable. At the end of the study, five different harmful insect species belonging to the orders Orthoptera, Hemiptera, Coleoptera, Lepidoptera and 22 species [*Coccinella septempunctata* Linnaeus, *Hippodamia variegata* (Goeze), *Psyllobora vigintiduopunctata* (Linnaeus), *Syrphus* sp., *Sphaerophoria scripta* (Linnaeus), *Sphaerophoria turkmenica* Bankowska, *Eristalinus aeneus* (Scopoli), *Tipula* sp., *Cotesia glomerata* (Linnaeus), *Exeristes roborator* (Fabricius), *Endromopoda phragmitidis* (Perkins), *Enicospilus merdarius* (Gravenhorst), *Exetastes laevigator* (Villers), *Itopectis viduata* (Gravenhorst), *Exetastes laevigator* (Villers), *Itopectis viduata* (Gravenhorst), *Lissonota (Loxonota) histrio* (Fabricius), *Lissonota (Loxonota) flavovariegata* Lucas, *Ophion pteridis* Kriechbaumer, *Pimpla spuria* (Gravenhorst), *Scambus nigricans* (Thomson), *Scambus brevicornis* (Gravenhorst), *Sinophorus nitidus* (Brischke) and *Chrysoperla carnea* (Stephens)] belonging to the orders Neuroptera, Coleoptera, Diptera and Hymenoptera were determined on the sugar beet plant. Among the pest species, the biology of the *Spodoptera exigua* (Hbn.), known as "caradrina" has been observed and the biological stages of the *Agrotis segetum* (Schiff.) which is in the secondary pest status have been followed. Damage patterns and densities of other pests (*Cassida nebulosa* Linnaeus, *Aphis fabae* (Scopoli), and *Gryllotalpa gryllotalpa* Linnaeus) were also tried to be revealed. *Sinophorus nitidus* (Brischke) collected in the study area which belonging to the family Ichneumonidae is determined as our new record for East Anatolia.

Keywords: Sugar beet, *Spodoptera exigua* (Hbn.), Biology, Erzincan, Çayırılı

¹ Ekin TEYMUROĞLU, Erzurum Sukkar Sugar Factory, Erzurum, TURKEY. E-mail: ekin4310@gmail.com  OrcID: 0000-0002-0360-0218.

^{2*} Sorumlu Yazar/Corresponding Author: Saliha ÇORUH, Department of Plant Protection, Faculty of Agriculture, Atatürk University, Erzurum, TURKEY. E-mail: spekel@atauni.edu.tr  OrcID: 0000-0002-6822-6677.

Atıf/Citation: Teymuroğlu, E., Çoruh S. Harmful and Beneficial Insects Species Determined in Sugar Beet Areas in Çayırılı District of Erzincan Province and Short Biology of *Spodoptera exigua* (Hbn.) (Lepidoptera:Noctuidae). *Tekirdağ Ziraat Fakültesi Dergisi*, 19 (3), 483-495.

*This study is some part of Master Science ythesis of first author, accepted at 04.02.2021in Atatürk University, Graduate School of Natural and Applied Sciences ©Bu çalışma Tekirdağ Namık Kemal Üniversitesi tarafından Creative Commons Lisansı (<https://creativecommons.org/licenses/by-nc/4.0/>) kapsamında yayınlanmıştır. Tekirdağ 2022

Öz

Bu çalışma 2019-2020 yılları arasında Erzincan İli Çayırılı İlçesi şeker pancarı ekim alanlarında faydalı ve zararlı böcek türleri ile önemli bir zararlı olan *Spodoptera exigua* (Hbn.) (Lepidoptera: Noctuidae)'nın kısa biyolojisini ortaya koymak için yapılmıştır. “Erzincan Çayırılı Pancar Üretim Alanı” (EÇPÜA), olarak belirlenen çalışma bölgesi pek çok pancar ekim alanına sahiptir. Bu pancar alanlarından yıllara göre değişmekle birlikte elde edilen pancar üretimi de hem bölge hem de ülkemiz için kayda değer durumdadır. Bu bölgede şeker pancarı, çiftçileri tarlalarına ve köylerine bağlamakla kalmayıp, tüm aile bireylerine iş ve istihdam olanağı sağlayan, aynı zamanda tamamı işlenebilir yan ürünleriyle de değerli bir bitki durumundadır. Çalışma sonucunda, pancar bitkisinde Orthoptera, Hemiptera, Coleoptera ve Lepidoptera takımlarına ait beş zararlı, Neuroptera, Coleoptera, Diptera ve Hymenoptera takımlarına ait 22 yararlı tür [*Coccinella septempunctata* Linnaeus, *Hippodamia variegata* (Goeze), *Psyllobora vigintiduopunctata* (Linnaeus), *Srypus* sp., *Sphaerophoria scripta* (Linnaeus), *Sphaerophoria turkmenica* Bankowska, *Eristalinus aeneus* (Scopoli), *Tipula* sp., *Cotesia glomerata* (Linnaeus), *Exeristes roborator* (Fabricius), *Endromopoda phragmitidis* (Perkins), *Enicospilus merdarius* (Gravenhorst), *Exetastes laevigator* (Villers), *Itopectis viduata* (Gravenhorst), *Exetastes laevigator* (Villers), *Itopectis viduata* (Gravenhorst), *Lissonota (Loxonota) histrio* (Fabricius), *Lissonota (Loxonota) flavovariegata* Lucas, *Ophion pteridis* Kriechbaumer, *Pimpla spuria* (Gravenhorst), *Scambus nigricans* (Thomson), *Scambus brevicornis* (Gravenhorst), *Sinophorus nitidus* (Brischke) and *Chrysoperla carnea* (Stephens)] tespit edilmiştir. Zararlı türlerin arasında halk arasında “karadrina” olarak bilinen *Spodoptera exigua* (Hbn.)'nın bölgedeki biyoloji ile ilgili gözlemler yapılmış, sekonder zararlı durumunda olan *Agrotis segetum* (Schiff.)'un biyolojik dönemleri takip edilmiştir. Tespit edilen diğer zararlıların (*Cassida nebulosa* Linnaeus, *Aphis fabae* (Scopoli) ve *Gryllotalpa gryllotalpa* (Linnaeus) da zarar şekilleri ve yoğunlukları belirlenmeye çalışılmıştır. Çalışma alanından atrapla toplanan yararlı türlerden Ichneumonidae familyasına ait *Sinophorus nitidus* (Brischke) türü çalışma bölgesi için yeni kayıttır.

Anahtar kelimeler: Şekerpancarı, *Spodoptera exigua* (Hbn.), Biyoloji, Erzincan, Çayırılı

1. Introduction

“Sugar beet” from which sugar is extracted has a strategic importance throughout the world within the scope of agriculture. In addition to being an essential nutrient, sugar has also become a preserved product due to its contribution to agricultural production and employment as well as its by-products (Akbay, 2003; Erdinç, 2017; Eştürk, 2018; Konyalı, 2019).

Approximately 28% of sugar production in the world is derived from sugar beets and 72% is extracted from sugarcanes. There are differences between the sugar extracted from sugar beet and sugarcane in terms of quality. However, the sugarcane that can only be grown in the tropical and sub-tropical regions can be produced at a low cost when compared with sugar beets, and they also have a low processing cost. Due to such reasons, sugar extracted from sugar canes has a low cost production (Kaya, 2015).

It is assumed that Turkey, Syria, Palestine and Egypt are the centres of origin of this plant, and then it has spread on to other countries. Its tuberous root is very delicious and extremely good for health, and it’s a root vegetable that grows under soil (Anonymous, 2020).

Sugar beet is a biennial crop that comes from the Amaranthaceae family and sugar is extracted from its fleshy root. The first year is the vegetative growth and the second year is the generative growth of its organs. Its seeds are found in compound form. Its top flowers grow together in bunches and they are green. A small part of their roots are visible from outside. It starts in the form of a cylindrical body with yellowish-white colour on the outside and white inside, and then it takes a conical form (Anonymous, 2008a,b).

There are important economic pests of sugar beet plants. Among them *Spodoptera exigua* (Hbn.) (Lepidoptera: Noctuidae), is a very common species due to damage and host partnership in the world (Hassanein et al., 1972; Aarvik, 1981; Stewart et al., 1996). It is known as “sugar beet leaf worm”, “beet armyworm”. In the study area it is names is “caradrina”. Especially sugar beet, sunflower potato, cotton, beans, clover, melon, watermelon, is among the preferences of the pest (Kıray, 1964; İyriboz, 1971; Yıldırım et al., 1998; Atlıhan and Özgökçe, 2003; Atlıhan et al., 2003).

Unfortunately is that, the fight against the pests in the sugar beet fields is mainly carried out by using chemicals. The irreparable problems brought about due to use of such methods are affecting the diversity in the eco-system and they result in the disturbance of natural balance.

Based on such importance, “Erzincan Çayırılı Sugar Beet Production Areas”, plots of land never been studied upon before, have been chosen as the study area of this research and It has been tried to put forth new findings in this study.

Some observations have been carried out in the region in relation to the biology of *Spodoptera exigua* (Hbn.), a major insect pest that threatens the beet crops and the biological phases of *Agrotis segetum* (Schiff.) which is a secondary harmful insect. In the meantime, it has also been tried to determine some beneficial species that visit the beet crops.

2. Materials and Methods

2.1. Material

This study has been carried out in the province of Erzincan (*Figure 1*), district of Çayırılı and is based on the sugar beet production areas located within the mentioned district. The harmful and beneficial insect species that have been determined constitute the materials of this study.

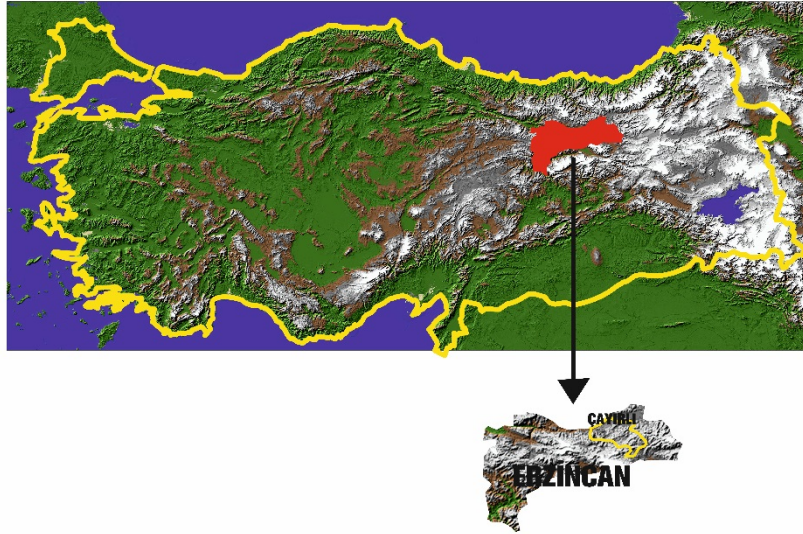


Figure 1. Map showing the location of Erzincan province

2.2. Method

2.2.1. Field study

This study continued between 2019-2020, and the materials of this study are the samples that have been collected from the different fields (420) in the region known as “Erzincan Çayırılı Beet Production Area” (EÇPÜA) between April and September (*Figure 2*).



Figure 2. Some views from the study areas

The province of Erzincan, located in the Yukarı Fırat Part of the Eastern Anatolia Region, is surrounded by the province of Erzurum in the east, Bingöl in the south-east, Bayburt and Gümüşhane in the north, Giresun in the northwest, Sivas in the west, Tunceli in the south and Elazığ and Malatya districts in the southwest. It measures 11903 m².

The landforms of Erzincan province consists of the mountain ranges lined up in the north and south, and Karasu valley and Tercan and Erzincan plains lie along this valley. The heights of the mountainside partly exceed 3000

m, and the mountains occupy 60% of the territories of the province. In the north are the Otlukbeli, Esence and Çimen mountains, the extensions of the Kop Mountains are lined up from east to west. The summits of the Otlukbeli Mountains also form the waterline which separates Yeşilirmak and Fırat basins from each other. The highest point of such mountainous area reaches 3549 in Keşiş Mountain. The Munzur chain extended in the southern part of the province forms the boundaries of Tunceli and Erzincan. The Ergani Mountain (3256 m), Akbaba mount (3463 m), Bakıl mountain (2826) and Hel mountain (3196 m) are some of the important elevations (Karadeniz, 2016).

Çayırılı is located in the northeast of Erzincan province (Figure 2). It measures 1480 km² with an altitude of 1520 meter. Tercan and Aşkale districts are located in the east, and the central district of Erzincan is located in the west. It neighbours Bayburt province, Otlukbeli district in the north, and central district of Erzincan and Tercan districts in the south. Its landform is fragmental, rough and bare. It is surrounded by Keşiş, (Esence), Spikkor and Coşan mountains. Balıklı Dorum and Mans streams flow into Karasu River that lines the boundaries of the district. Irrigated farming is practised in the district, though not much. There are plains, huge meadows and plateaus. Winters are very cold and long, summer seasons are short in the district (Anonymous, 2019).

The harmful species that give harm to beet fields have been determined and of such species, the biology of *Spodoptera exigua* in public has been observed in the region. *Agrotis segetum* (Denis & Schifferrmüller) (Lepidoptera: Noctuidae), has also been scrutinized as a secondary pest in the region. Time of the day between 11⁰⁰ and 16⁰⁰ has been preferred for collecting the beneficial species and sweep netting has been used for collecting such species. The samples were preserved in alcohol in boxes and brought to the laboratories. Ekin Teymuroglu collected all the samples and took their photographs.

Biological observations have been carried out in 20 fields varying from 5 dacare minimum and 50 dacare maximum in size within the study area. For the purpose of designation of the rate of spread in the fields, 10 fields, each approximately measuring 5 dacare, have been picked randomly, and by avoiding the edges of the fields that are not used in cultivation, from 200 sugar beets lined up diagonally in every 50 metres, 20 control beets have been spotted as control plants. Encountering 5-10 harmful eggs or larvae in each of these 20 plants has been considered “high density”, the spread in half of those 20 plants has been considered “average density” and observation of such pests in 4 of those 20 plants has been considered “low density”.

2.2.2. Laboratory studies

Of the samples taken from the harmful species (*Spodoptera exigua* (Hbn.), *Agrotis segetum* (Schiff.), *Cassida nebulosa* L., *Aphis fabae* (Scopoli) and *Gryllotalpa gryllotalpa* (L.) and all parasitoids and predator species in the laboratories, the harmful ones have been cultivated, and the beneficial samples have been assessed according to their distinctive taxonomic characters and they were segregated under sub-families and then stored.

Various sources and experts were used in the identification of the samples.

3. Results and Discussion

In this study, we here report five different insect pests belonging to Lepidoptera, Coleoptera, Hemiptera and Orthoptera orders, and 22 different beneficial species belonging to Hymenoptera, Diptera, Neuroptera and Coleoptera orders were found in the beet crops.

One of the beneficial insect species, *Sinophorus nitidus* (Brischke, 1880) from Ichneumonidae family, collected in the study area by sweep netting, has been noted as a new record for the Erzincan. Harmful species are shown in Table 1.

Spodoptera exigua (Hübner) (Beet Armyworm (Caradrina))

In the summer of 2019, caradrina caused epidemic in the study field and its harm exceeded 100%. In the same year, the biology of the pest has been observed and some data has been obtained.






Morphology of Caradrina:

Egg:

Female moths have left their eggs in the form of packages. Eggs are 0.3-0.4 mm in diameter. When looked from above, they are circular or compressed, slightly pointed towards the edges. Their colour is whitish or greenish.

Its top is covered with a blurry or waxy material (*Figure 3a*).

Table 1. Harmful insect species identified in Çayırılı District of Erzincan Province

	Species	Spread
	<i>Spodoptera exigua</i> (Hbn.) Sugar beet Leafminer (Caradrina)	High Density
	<i>Agrotis segetum</i> (Schiff.) (Turnip Moth)	High Density
	<i>Cassida nebulosa</i> L. Tortoise Beetle	Average Density
	<i>Aphis fabae</i> (Scopoli) Black Bean Aphid	Low Density
	<i>Gryllotalpa gryllotalpa</i> L. Mole Cricket	Low Density

Larvae:

The newly hatched larvae look naked and transparent, and they are light green with a slightly big head that is rather dark green. A very light strip in its body colour starts forming in the larvae that grow with the third stage. As the larvae grow, this strip gets darker and becomes distinct. Larvae are naked and when touched, they coil up with a sudden reflex and sometimes they throw themselves. While the height of newly hatched larvae is (over 10 samples) close to 1 mm, they reach approximately 2.2 in the second stage; 8, 3 in the third stage (*Figure 3b-e*); 13 mm in the fourth stage and up to 22 mm in the final stage (*Figure 3b-e*).

As the larvae grow bigger, they have lost their mobility, but on the contrary their feeding capability has increased. Devouring caradrinas continued their feeding from one plant to another.

Pupae:

Larva transforms into pupa under soil. Pupae have a mummy-like form, they are dark brown, 18-20 mm long and have two sharp barbs on the edge (*Figure 3f,g*).

Adult:

They are grey-brown or darker. They have spots and zig-zag strips on their front wings. Again, they have a kidney-shaped spot and a circular spot on the front wing which spots are darker than the wing itself. Their wingspan is 25-30 mm; they're 20-25 mm in length. Rear wings are light grey or light brown with dark coloured line formed on their edges.

Biology of Caradrina:

Spodoptera exigua have spent the winter in soil in pupation in the study field, and the adults have appeared as the weather got warmer and they have mated and laid their eggs. The first appearance of took place on 3rd May 2019. The larvae acted and fed themselves collectively until the third stage, and after the third stage, they continued feeding separately. It has been noted that during the fourth and the fifth stages whereby they fed separately, they have become most harmful.

By the end of the fifth larvae stage, we have noted that their feeding activities have stopped and larvae went 10 cm down in the soil and started pupation in a chamber they made. Starting from 3rd May, the larvae stage was completed by 18th May, lasting 15 days. As of 18th May, pupation stage started and continued until 8th June, taking 21 days (*Table 2*).



Figure 3. *Spodoptera exigua* (Hbn.): a) eggs, b-e) larvae, f,g) pupae, h,i) adults

The adult stage observed on 8th June continued until 1st July. The reason the life cycle of an insect lasts a short time is the suitable climate for the pest and the freshness of the host plant on which the *S. exigua* feeds itself. In other words, the pest keeps its life cycle short, striving to breed more.

In conclusion, it has completed two generations in the study area.

Table 2. Life cycle of *Spodoptera exigua* (Hbn.) in Çayırlı District

Stage	Between
Larvae Stage	03.05.2019 18.05.2019
Pupae Stage	18.05.2019 08.06.2019
Adult Stage	08.06.2019 09.06.2019
Egg Stage	10.06.2019 01.07.2019

Humidity and temperature ratings of the *S. exigua* within their life time have also been given (Figure 4).

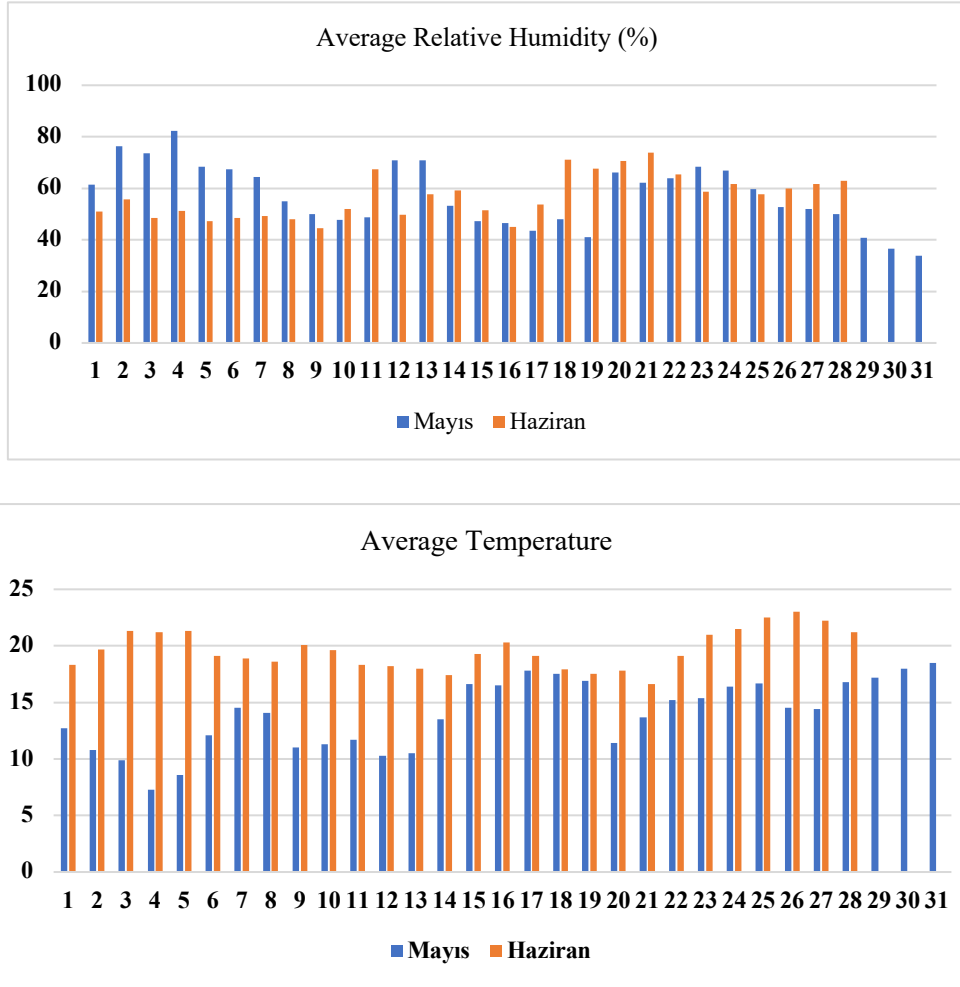


Figure 4. Average temperature and humidity rates in Erzincan Çayırılı

Harms of *Caradrina*:

The *S. exigua* intensely fed itself during the five stages it has gone through. As the larvae grew bigger, their feeding rate has increased (Figure 5).



Figure 5. *Spodoptera exigua* (Hbn.) disinfection

***Agrotis segetum* (Schiff.) (Turnip Moth)**

A. segetum observed almost everywhere in our study area, started giving harm to the beet crops biting their root crown when the beet had 2-4 leaves. By cutting it from the bottom of its leafstalk and pulling it inside the soil, the pest leaves the crop naked (*Figure 6*). They have also eaten the leaves of other crops either entirely or leaving the median vein only. By also giving harm to the parts of the plants under soil, they have caused impaired the productivity and quality.



Figure 6. Larvae of *Agrotis segetum* (Schiff.)

It is among our determinations that the pest is only active during the night time. A very high damage has been observed in the study area. Some short observations have also been conducted in relation to *A. segetum* biology (*Table 3*).

Table 3. *Agrotis segetum* (Schiff.) life time

Stage	Between
Larvae Stage	04.05.2019 21.05.2019
Pupa Stage	21.05.2019 12.06.2019
Adult Stage	12.06.2019 25.06.2019
Egg Stage	26.06.2019 15.07.2019

***Cassida nebulosa* Linnaeus, 1758 (Tortoise Beetle)**

It has been observed that the adults opened up holes in the seedlings and on the leaves of young beet crops, eating the lower epidermis and epithelium of the leaf, leaving it full of holes like lace. The “average” rate of spread has been observed in the study area.

***Aphis fabae* (Scopoli, 1763) (Black Bean Aphid)**

Black bean aphid was observed while feeding on the beet leaves, however it has been observed that its rate of spread was “under the average” (*Figure 7*).



Figure 7. *Aphis fabae* (Scopoli)

***Gryllotalpa gryllotalpa* Linnaeus, 1758 (Orthoptera: Gryllotalpidae)**

It has been observed that pests opened up passages under soil, and gave harm to sugar beet by cutting its roots. A “low-density” spread rate has been noticed in the study area.

Beneficial Species Detected on Beet Crops in Erzincan Çayırılı:

Such identification has been carried out in the beet fields that form the study area, between April and September in 2019 and 2020 by using sweep net sampling (*Table 4, Figure 8*).

Of the identified species, *Sinophorus nitidus* (Brischke, 1880) is a new record for the Ichneumonidae family in East Anatolia. With this new record, the number of Ichneumonidae species in Turkey has reached 1439 (Doğru, 2022).

Table 4. Beneficial insect species identified in sugar beet fields in Çayırılı district

Species	Family	Order
<i>Coccinella septempunctata</i> Linnaeus, 1758	Coccinellidae	COLEOPTERA
<i>Hippodamia variegata</i> (Goeze, 1777)	Coccinellidae	Coleoptera
<i>Psyllobora vigintiduopunctata</i> (Linnaeus, 1758)	Coccinellidae	Coleoptera
<i>Srypus</i> sp.	Syrphidae	DIPTERA
<i>Sphaerophoria scripta</i> (L., 1758)	Syrphidae	Diptera
<i>Sphaerophoria turkmenica</i> Bankowska, 1964	Syrphidae	Diptera
<i>Eristalinus aeneus</i> (Scopoli, 1763)	Syrphidae.	Diptera
<i>Tipula</i> sp.	Tipulidae	Diptera
<i>Cotesia glomerata</i> (Linnaeus, 1758)	Braconidae	HYMENOPTERA
<i>Exeristes roborator</i> (Fabricius, 1793)	Ichneumonidae	Hymenoptera
<i>Endromopoda phragmitidis</i> (Perkins, 1957)	Ichneumonidae	Hymenoptera
<i>Enicospilus merdarius</i> (Gravenhorst, 1829)	Ichneumonidae	Hymenoptera
<i>Exetastes laevigator</i> (Villers, 1789)	Ichneumonidae	Hymenoptera
<i>Itopectis viduata</i> (Gravenhorst, 1829)	Ichneumonidae	Hymenoptera
<i>Lissonota (Loxonota) histrio</i> (Fabricius, 1798)	Ichneumonidae	Hymenoptera
<i>Lissonota (Loxonota) flavovariegata</i> Lucas, 1849	Ichneumonidae	Hymenoptera
<i>Ophion pteridis</i> Kriechbaumer, 1879	Ichneumonidae	Hymenoptera
<i>Pimpla spuria</i> (Gravenhorst, 1829)	Ichneumonidae	Hymenoptera
<i>Scambus nigricans</i> (Thomson, 1877)	Ichneumonidae	Hymenoptera
<i>Scambus brevicornis</i> (Gravenhorst, 1829)	Ichneumonidae	Hymenoptera
*<i>Sinophorus nitidus</i> (Brischke, 1880)	Ichneumonidae	Hymenoptera
<i>Chrysoperla carnea</i> (Stephens, 1836)	Chrysopidae	NEUROPTERA

* New record for the Turkish fauna

4. Conclusions

“Sugar” is an important nutrient in Europe and is extracted from sugarcane (72%) and sugar beet (28%) (Özgür, 2015). Sugar beet (*Beta vulgaris* L.) from which sugar is extracted is a biennial industrial plant, the origin of which is Central Europe (Sunulu et al., 2020).

While 301 million tons of sugar beet is produced on a 4.8 million hectare of land worldwide, the production in our country is 20,8 million tons on a land of 338.826 hectare (Anonymous 2020). Both in the world and in our country, biotic and abiotic factors, climate change play role in the occurrence of various pests in the production of sugar beet and thus in loss of products (Çetin et al., 2020; Sunulu et al., 2020).

By the end of this study, sugar beet pests, particularly *Spodoptera exigua* (Hbn.) which we know as “caradrina”, and other pests, namely *Agrotis segetum* (Schiff.), *Cassida nebulosa* L., *Aphis fabae* (Scopoli) ve *Gryllotalpa gryllotalpa* L. have been observed in Erzincan Çayırılı Beet Production Areas which have been chosen as the field of study, during 2019-2020. Also, 22 beneficial species from Neuroptera, Coleoptera, Diptera and Hymenoptera orders which are shown in *Table 4* have been identified.

Biological observations have been carried out on *Spodoptera exigua* and *Agrotis segetum* which were recorded as harmful pests. Their rate of spread has been determined and it has been concluded that caradrina caused harm on an epidemic level within 2019.

Besides, the spread rate of *Cassida nebulosa* encountered in the field of study has been considered medium, and this rate in *Aphis fabae* and *Gryllotalpa gryllotalpa* has been considered low in density.

Many studies have been and are still being carried out on sugar beet pests both in our country and in the world. There are many pests that are considered sugar beet pests and listed as pests that have economic importance.

Özgür (2015) have listed such pests as beet cyst nemotade, leaf worms, soil worms, beet bugs, wireworms, curculio, tortoise beetle, alder blight, and red spider mite and beet moth.

Among these pests, the most significant one that sometimes causes economic losses is *Spodoptera exigua* which is also known as “Caradrina”. It’s a tropical crop pest originating from South Eastern Asia (Capinera 2008). Caradrina is a polyphagous pest that has effect on more than 170 plant species from 135 families including cotton, corn, sugar beet and sunflower (Zheng et al., 2011).



Figure 8. Hymenoptera species identified in this study

This pest has reached epidemic proportions in Central Anatolia Region in 2014, and fight against this pest had to be undertaken on land of 757.906 hectare (Anonymous, 2014).

Atlıhan et al. (2003), established in their studies that the pests caused epidemic in 1998, and reached their highest population within the season by the end of June in Erciş district and in the beginning of July in Muradiye district, and their population rate in 1999 was quite low. The year of epidemic and the stagnancy in the following year have parallels in that study.

When compared with the studies held both in our country and the in the world, It has also been noted in our study that caradrina that threatens sugar beet, is a major pest, and it caused pandemic in 2019.

It has been observed that Caradrina that has more than 170 species of hosts in a total of 152 countries located in Africa, Asia, Euro, North America and in the Oceans has produced two generations in one year in our region. However, it has been notified that the number of generations has gone up to 5 in warmer areas (Capinera, 2008). Under the circumstances of Central Anatolia such as in Konya, 3 generations of pests have been observed (Kaya, 2019).

It has been noticed that in 2020 during which the pest has not caused epidemic, there was no need for the use of chemical pesticides, and this fact has also been backed up by other studies (Sunulu et al., 2020). While the pest completed its life time in 21 days, in this study it has been found that it has completed one stage in 57 days.

In addition to all these, it has been tried to identify the types of insects collected in beet fields for two years by means of sweep net sampling, and beneficial species that have been identified, have also been included in this study.

Such beneficial species fall under four different insect orders. *Chrysoperla carnea*; Coleoptera order, *Coccinella septempunctata*, *Hippodamia variegata*, *Psyllobora vigintiduopunctata* are noted under Neuroptera order ; *Srypus* sp., *Sphaerophoria scripta*, *S. turkmenica*, *Eristalinus aeneus* ve *Tipula* sp are noted under Diptera order; *Cotesia glomerata*, *Exeristes roborator*, *Endromopoda phragmitidis*, *Enicospilus merdarius*, *Exetastes laevigator*, *Itopectis viduata*, *Ophion pteridis*, *Pimpla spuria*, *Scambus nigricans*, *S. brevicornis* and *Sinophorus nitidus* are noted under Hymenoptera order.

Among such species, Hymenoptera ranks the first in terms of density by 61%, and it is followed by Diptera species by 22%, Coleoptera by 13 % and Neuroptera by 4%. Within Hymenoptera, Ichneumonidae family is one identified with the highest number of species (Figure 9). *Chrysoperla carnea*, *Coccinella septempunctata*, *Cotesia glomerata*, *Exeristes roborator* ve *Pimpla spuria* are the most encountered species.

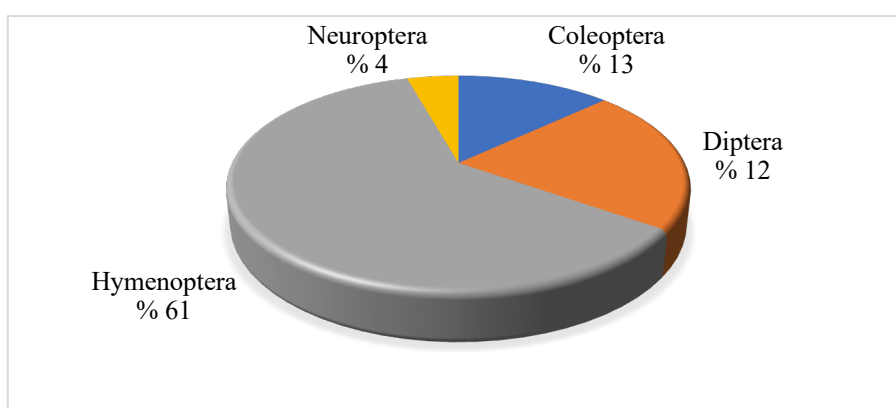


Figure 9. Rates of beneficial insects identified in this study

Of the Ichneumonidae species, while *Endromopoda phragmitidis*, *Enicospilus merdarius*, *Exetastes laevigator*, *Itopectis viduata*, *Lissonota (Loxonota) histrio* and *Scambus brevicornis* and *Sinophorus nitidus* (Brischke, 1880) have been new records for the province of Erzincan.

Studies on the determination of harms of caradrina on sugar beet in our country are quite limited. There has been no such extensive study held in this region before.

This study will shed light on and provide fundamental data for the studies that will be undertaken in relation to sugar beet and integrated pest management.

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