



Research Article

Determination of Beneficial Insect Species in Thyme Fields of Manisa and Denizli Provinces

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Abstract

This study was conducted with the purpose of determining the beneficial insect species in thyme fields in Salihli district of Manisa province and in Central, Güney, Çal, Buldan and Bekilli districts of Denizli province between 2013 and 2014. Insect samples were collected by visual control, sweeping nets, sampling frames and culturing methods. Common species from the study in Coleoptera order were determined as *Coccinella septempunctata* (Coleoptera: Coccinellidae), *Hippodamia variegata* (Coleoptera: Coccinellidae), *Coccinula quatuordecimpustulata* (Coleoptera: Coccinellidae), *Stethorus gilvifrons* (Coleoptera: Coccinellidae), while *Aphidius* sp. (Hymenoptera: Braconidae), *Temelucha* sp. (Hymenoptera: Ichneumonidae), *Apanteles* sp. (Hymenoptera: Braconidae), *Trichogramma* sp. (Hymenoptera: Trichogrammatidae) were determined in Hymenoptera order. The most common species *C. septempunctata* was found as 47 individuals in Manisa, while it was 45 in Denizli in 2013. The same species was found to have 74 individuals in Manisa and 12 individuals in Denizli in 2014. This situation is thought to be related to the number of samplings.

Keywords: Thyme, Beneficial insect, Sampling, *Coccinella septempunctata*.

Denizli ve Manisa İllerindeki Kekik Tarlalarında Faydalı Böcek Türlerinin Belirlenmesi

Öz

Bu çalışma kekik alanlarında bulunan yararlı böcek türlerinin belirlenmesi amacıyla, Manisa ili Salihli ilçesi ve Denizli ili Merkez, Güney, Çal, Buldan ve Bekilli ilçelerinde 2013- 2014 yıllarında yürütülmüştür. Böcek örnekleri gözle kontrol, atrap ve çerçeve yöntemleri ile toplanmıştır. Çalışmalar süresince yaygın olarak tespit edilen Coleoptera takımına bağlı türler *Coccinella septempunctata* (Coleoptera: Coccinellidae), *Hippodamia variegata* (Coleoptera: Coccinellidae), *Coccinula quatuordecimpustulata* (Coleoptera: Coccinellidae), *Stethorus gilvifrons* (Coleoptera: Coccinellidae) ile Hymenoptera takımına bağlı *Aphidius* sp. (Hymenoptera: Braconidae), *Temelucha* sp. (Hymenoptera: Ichneumonidae), *Apanteles* sp. (Hymenoptera: Braconidae), *Trichogramma* sp. (Hymenoptera: Trichogrammatidae) olarak belirlenmiştir. En yaygın tür olan *C. Septempunctata*, 2013 yılında Manisa'da 47 adet, Denizli'de ise 45 adet olarak bulunmuştur. 2014 yılında ise aynı tür Manisa'da 74 adetken Denizli'de 12 adet olarak belirlenmiştir. Bu durumun örnekleme sayıları ile ilgili olduğu düşünülmektedir.

Anahtar Kelimeler: Kekik, Faydalı böcek, Örnekleme, *Coccinella septempunctata*

Introduction

Thyme (*Origanum* spp.), which is a plant in Lamiaceae family of medicinal and aromatic plants, is used as a spice, beverage, paint and perfume since ancient times, in addition to its usage as a cure for some diseases. Because of the side effects of synthetic and chemical drugs, the usage of medicinal and aromatic plants has become widespread (Bayramoğlu et al., 2009; Bozdemir, 2019).

Thyme is one of the most important export products for Turkey. Turkey has the 40% of the thyme export in the world and its export quantity has reached to 59 million dollars in 2019 (Acun, 2020). Thyme, which is produced in high volumes in Denizli and Manisa provinces in recent years, is an important addition to the country's economy as an export product.

Some essential oils in medicinal and aromatic plants are used in management of agricultural pests, because of their repellent and toxic effects on these insect species (Kumar et al., 2011; Zoubiri

& Baaliouamer, 2014). However, these plants also have pest species that damage them and cause losses in quantity and quality of the harvested product. There is a limited amount of studies in literature about the pests and diseases on thyme, which is an important medicinal and aromatic plant. The pest species found on thyme are thyme aphid; *Aphis serpylli* Koch (Hemiptera: Aphididae), Miner beetle; *Apteropeda* sp. (Coleoptera: Chrysomelidae), *Thrips tabaci* Lindeman (Thysanoptera: Thripidae), *Tetranychus urticae* C.L. Koch (Arachnida: Tetranychidae), *Dasytiscus* spp. (Coleoptera: Dasytidae), *Asphondylia* sp. (Diptera: Cecidomyiidae) and *Haplothrips reuteri* Karny (Thysanoptera: Phlaeothripidae) (Rajabi Mazhar et al., 2011; Hashemi Khabir, 2012; Haghghian & Sadeghi, 2015).

Pests can cause between 4-9% yield losses in thyme if left uncontrolled (Nekrosiene, 2009). Control of pest species on medicinal and aromatic plants, like thyme, is difficult due to the side effects of synthetic pesticides both on human health and environment. Therefore, biological control of pests on medicinal and aromatic plants is crucial. The numbers of studies about the beneficial insects on thyme are also limited (Tezcan et al., 2003; Tezcan et al., 2006 and Wert, 2020). Thus, the aim of this study was to determine the beneficial insect species in thyme fields of Manisa and Denizli provinces in 2013 and 2014.

Materials and Methods

The main materials of the study were the beneficial insect species that collected on thyme fields of Denizli (Çal, Central, Güney, Akköy, Bekilli and Buldan districts) and Manisa (Salihli district) and cultivated thyme plants (*Origanum* spp. L.). Surveys were conducted with the method of Bora and Karaca (1970) in biweekly periods between May and August, in thyme production season of 2013 and 2014.

Insect samples were collected by checking 50 plants visually in each field, by 100 sweeping net sweeps and by throwing a 50x50 frame randomly in the field. Insects on plants were collected with the help of aspirators. Adult insects with soft bodies were placed in 70% alcohol and adult insects with rigid bodies were killed in killing jars, and then transferred to the laboratory in ice boxes. Preadult insects were transferred to the laboratory alive and cultured to get adult insects. All insect samples were prepared for identification in the laboratory and sent to the specialists.

Samplings were conducted in a total of 29 thyme fields in Poyrazdamları and Yeşilova villages of Manisa province and Gözler village of Central district, Adıgüzeller, Gündoğdu, Eziler villages of Güney district, Çamköy village of Buldan district, Kabalar village of Çal district and Bekilli district of Denizli Province.

Data evaluation

Data was evaluated by calculating the total number of beneficial insects in different locations for every beneficial insect species for each year. The graphics were constructed with this data set.

Results and Discussion

Beneficial Insect Species and Numbers in 2013

Beneficial insect species determined in thyme fields in 2013 are shown in Table 1. Most common species in Poyrazdamları and Yeşilova villages of Manisa were *Coccinella septempunctata* L. (Coleoptera: Coccinellidae), *Coccinula quatuordecimpunctata* L. (Coleoptera: Coccinellidae), *Hippodamia variegata* Goeze (Coleoptera: Coccinellidae), *Stethorus gilvifrons* Mulsant (Coleoptera: Coccinellidae), *Scymnus* sp. (Coleoptera: Coccinellidae) and *Cotesia* sp. (Hymenoptera: Braconidae).

Coccinella septempunctata and *Aphidius* sp. were determined in all thyme fields of Denizli province. Also, these species were the only ones determined in Çal and Bekilli districts. *Temelucha* sp. and *Apanteles* sp. were only determined in Salihli district of Manisa and Güney district (Eziler village) of Denizli in 2013. Most common species was *C. septempunctata* in both provinces in 2013, which was followed by *Apanteles* sp. and *H. variegata* (Figure 1). Other species were only found in small numbers in both locations in the first year of the study.

Table 1. Occurrence of beneficial insects in thyme fields of Manisa and Denizli provinces in 2013

Order	Family	Species	Manisa			Denizli		
			Salihli	Merkez	Çal	Güney	Buldan	Bekilli
Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i> L.	+	+	+	+	+	+
		<i>Hippodamia variegata</i> Goeze	+	+	-	+	+	-
		<i>Propylea quatuordecimpunctata</i> L.	+	-	-	-	-	-
		<i>Stethorus gilvifrons</i> Mulsant	+	-	-	-	-	-
		<i>Scymnus</i> sp.	+	-	-	-	-	-
Hymenoptera	Ichneumonidae	<i>Temelucha</i> sp.	+	-	-	+	-	-
	Braconidae	<i>Cotesia</i> sp.	+	-	-	-	-	-
		<i>Apanteles</i> sp.	+	-	-	+	-	-
	Aphidiidae	<i>Aphidius</i> sp.	-	+	+	+	+	+

+ Fields with beneficial insects
- Fields without beneficial insects

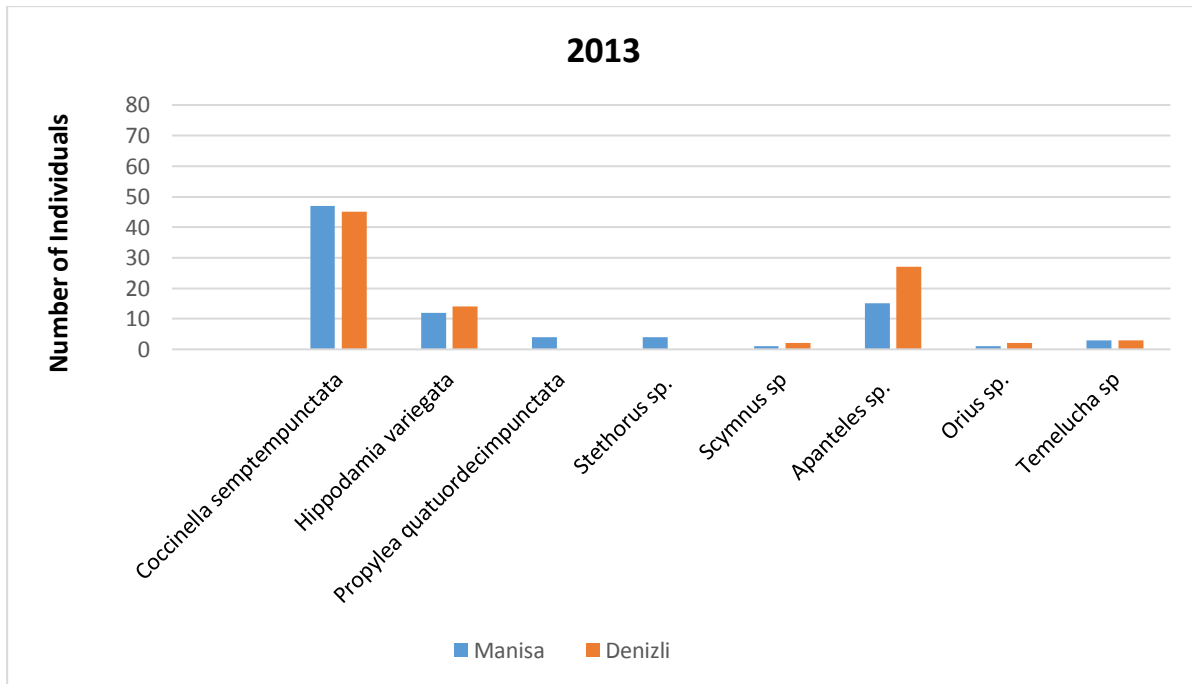


Figure 1. Total number of beneficial insects in Manisa and Denizli in 2013

Generally, beneficial insects have started to appear in the fields end of March and their numbers have tended to increase in parallel with the rising temperatures (Table 2). This was especially apparent with *C. septempunctata*, which first individuals were sampled at the end of March and the numbers of this species have increased until mid-June, when it started to decrease. This decrease was thought to be caused by the aestivation behavior of *C. septempunctata* adults in higher elevations in summer months (Özpınar et al., 2018).

Table 2. Occurrence of beneficial insects in thyme fields of Manisa and Denizli provinces in 2013

	<i>Coccinella septempunctata</i>		<i>Hippodamia variegata</i>		<i>Propylea quatuordecimpunctata</i>		<i>Stethorus</i> sp.		<i>Scymnus</i> sp.		<i>Apanteles</i> sp.		<i>Orius</i> sp.		<i>Temelucha</i> sp.	
	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli
15.03.2013	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
06.04.2013	7	2	0	1	0	0	0	0	0	0	2	0	0	0	0	0
19.04.2013	9	6	2	0	0	0	1	0	0	1	2	4	1	0	1	0
05.05.2013	13	5	0	3	0	0	1	0	0	0	2	3	0	0	0	1
18.06.2013	8	11	3	2	1	0	0	0	0	0	1	1	0	0	0	1
01.07.2013	3	5	1	4	0	0	0	0	1	1	4	3	0	0	0	0
22.07.2013	1	6	1	1	2	0	1	0	0	0	2	5	0	0	2	0
03.08.2013	1	7	4	1	1	0	0	0	0	0	1	4	0	0	0	0
14.08.2013	3	3	1	1	0	0	1	0	0	0	3	5	0	0	0	0
Total	47	45	12	14	4	0	4	0	1	2	15	27	1	2	3	3

Beneficial Insect Species and Numbers in 2014

Beneficial insects found in thyme fields in 2014 are shown in Table 3. Common species found in Salihli district (Poyrazdamları and Yeşilova villages) of Manisa were *C. septempunctata*, *H. variegata*, *P. quatuordecimpunctata*, *S. gilvifrons*, *Orius* sp., *Nabis* sp. and *Trichogramma* sp.

In Denizli, the most common predator species was *C. septempunctata*. Other beneficial insect species in Denizli were *S. gilvifrons*, *Coccinula quatuordecimpustulata* L., *Nephus nigricans* Weise and *Orius* sp. (Figure 2). In all thyme fields in Manisa and Denizli provinces, *C. septempunctata* was the most common beneficial insect species in both years (Figure 2). Also, aphids, mites, leafhoppers and *Helicoverpa* sp. were found during sampling, which are prey to the determined predator insects.

Table 3. Occurrence of beneficial insects in thyme fields of Manisa and Denizli provinces in 2014

Order	Family	Species	Manisa			Denizli		
			Salihli	Merkez	Çal	Güney	Buldan	Bekilli
Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i> L.	+	+	+	+	+	+
		<i>Hippodamia variegata</i>	+	-	-	-	+	-
		<i>Propylea quatuordecimpunctata</i> L.	+	-	-	-	-	-
		<i>Stethorus gilvifrons</i> Mulsant	+	+	-	-	-	-
		<i>Coccinula quatuordecimpustulata</i> L.	-	+	-	-	+	-
		<i>Nephus nigricans</i>	-	+	-	-	-	-
Hemiptera	Nabidae	<i>Orius</i> sp.	+	+	-	-	-	-
	Anthocoridae	<i>Nabis</i> sp.	+	-	-	-	-	-
Hymenoptera	Trichogrammatidae	<i>Trichogramma</i> sp.	+	-	-	+	+	-

+ Fields with beneficial insects

- Fields without beneficial insects

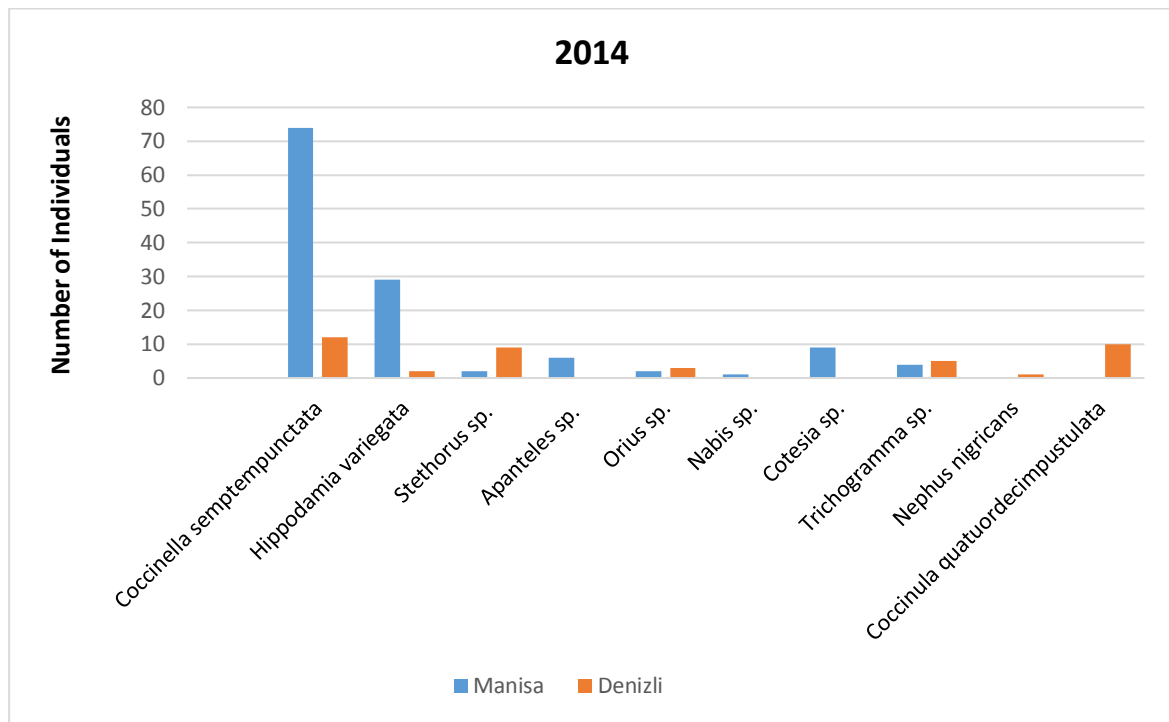


Figure 2. Number of beneficial insects in Manisa and Denizli in 2014

Contrary to the previous year, the number of *C. septempunctata* individuals was significantly higher in Manisa than Denizli in 2014. However, the fluctuations of the numbers in samplings were similar to 2013. Number of insects has increased with the passing of the seasons in parallel to the increase in temperatures. This change was evident with *C. septempunctata*, again. Like the previous year, it is thought to be the result of migration to aestivation sites.

Table 4. Number of beneficial species on sampling dates in Manisa and Denizli provinces in 2014

	<i>Coccinella septempunctata</i>		<i>Hippodamia variegata</i>		<i>Stethorus sp.</i>		<i>Apanteles sp.</i>		<i>Orius sp.</i>		<i>Nabis sp.</i>		<i>Cotesia sp.</i>		<i>Trichogramma sp.</i>		<i>Nephus nigricans</i>		<i>Coccinula quatuordecimpustulata</i>	
	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli	Manisa	Denizli
27.03.2014	7	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03.04.2014	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.04.2014	15	3	4	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
02.05.2014	21	2	11	0	0	1	0	0	0	1	0	0	2	0	0	0	0	0	0	0
12.06.2014	9	0	3	0	1	0	0	0	1	1	0	0	4	0	0	2	0	0	0	3
19.06.2014	4	4	0	0	0	3	3	0	1	0	0	0	0	0	2	0	0	0	0	0
25.06.2014	5	2	1	0	0	4	1	0	0	1	1	0	1	0	0	0	0	1	0	1
03.07.2014	3	0	2	1	1	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0
09.07.2014	1	1	3	0	0	1	2	0	0	0	0	0	2	0	0	0	0	0	0	4
Total	74	12	29	2	2	9	6	0	2	3	1	0	9	0	4	5	0	1	0	10

Tezcan et al. (2003), have found nine species of beneficial insects, which were *Scymnus frontalis* Fabricius (Coleoptera: Coccinellidae), *Scymnus nderihensis* Mulsant (Coleoptera: Coccinellidae), *Scymnus quadriguttatus* Fürsch et Kreissl (Coleoptera: Coccinellidae), *Scymnus rubromaculatus* Goeze (Coleoptera: Coccinellidae), *N. nigricans* (Coleoptera: Coccinellidae), *Exochomus nigromaculatus* Goeze (Coleoptera: Coccinellidae), *H. variegata* Goeze, *C. quatuordecimpustulata* and *C. septempunctata* in thyme fields of Salihli and Turgutlu districts of Manisa province. According Tezcan et al. (2006) *Agathis malvacearum* Latreille and *Chelonus longivertis* Tobias from Braconidae family of Hymenoptera were collected from Turgutlu and Salihli districts of Manisa. Also, Van Wert (2020) has reported insects from Syrphidae and Apidae families on the flowers of English Thyme plants. Atakan & Pehlivan (2018) have found six predatory insect species that *Orius niger* (Wolff) was the most common one on various medicinal and aromatic plants in Adana. Also, Ayten et al. (2020) have found that *Heliothis peltigera* (Denis & Schiffermüller) (Lepidoptera: Noctuidae), which is a pest of thyme, is parasitized by *Aleiodes miniatus* (Herrich-Schäffer) (Hymenoptera: Braconidae).

As it can be seen in the results, the number of beneficial insects was generally higher in Manisa than Denizli. This finding is thought to be the result of the higher sampling numbers in Manisa. Because of the geographical distance of Denizli being longer than Manisa, it was possible to do more samplings in Manisa. This situation has reflected to the results as a higher total number of beneficial insects.

Conclusions

As the result of the study, it is concluded that beneficial species found in thyme fields have a high potential to use in the biological control of thyme pests, also data from this study would be a reference for further studies on the biological control programs in thyme and other medicinal and aromatic plants.

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Conflicts of Interest Statement

The author have no conflicts of interest to declare.

References

- Acun, A., 2020. Türkiye dünya kekik ticaretinin yüzde 40'ına sahip. Türk Tarım Orman Dergisi. 74-77.
- Atakan, E., Pehlivan, S., 2018. Bazı tıbbi ve aromatik bitkilerde thripslerle (Thysanoptera) birlikte saptanan avcı böcek türleri. Derim. 35(1): 37-44.
- Bayramoğlu, M.M., Toksoy, D., Şen, G., 2009. Türkiye’de tıbbi bitki ticareti. II. Ormancılıkta Sosyo-Ekonomik Sorunlar Kongresi. Bildiriler, 89-98. 19-21 Şubat, Isparta.
- Bora, T., Karaca, İ., 1970. Kültür bitkilerinde hastalığın ve zararın ölçülmesi. Ege Üniversitesi Matbaası, Bornova.
- Bozdemir, Ç., 2019. Türkiye’de yetişen kekik türleri, ekonomik önemi ve kullanım alanları. Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi. 29(3): 583-594.
- Haghighian, F., Sadeghi, E., 2015. Pests, diseases and weeds associated with thyme species in Chaharmahal & Bakhtiary province. Iranian Journal of Forest and Range Protection Research. 12(2): 130-136.
- Hashemi Khabir, Z., 2012. Studying pests and diseases of different thyme species (*Thymus* spp.) in Iran. Forest and Range Protection Research. 9(1): 26-36.
- Kumar, P., Mishra, S., Malik, A., Satya, S., 2011. Insecticidal properties of Mentha species: A review. Indian Crop Production. 34(1): 802-817.
- Nekrosiene, R., 2009. Cultivation possibilities for thyme, an important medicinal plant, in Western Lithuania. Agronomy Research. 7(1): 430-435.
- Özpinar, A., Şahin, A.K., Polat, B., 2018. Population dynamics of *Coccinella septempunctata* (Coleoptera: Coccinellidae) in the region of Edremit Gulf in West Anatolia (Mount Ida). European Journal of Entomology. 115: 418-423.

- Rajabi Mazhar, N.R., Sadeghi, S.E., Adel, F., 2012. Pests and diseases associated with thymus species in Hamadan province. *Semi-annually Forest and Range Protection Research*. 9(1): 26-36.
- Tezcan, S., Beyaz, G., Uygun, N., 2003. Manisa ilinde yetiştirilen kültür kekiği (*Origanum* spp.) (Lamiaceae)'ndeki Coccinellidae (Coleoptera) türlerinin belirlenmesi üzerinde çalışmalar. *Alatırım*. 2(2): 30-33.
- Tezcan, S., Yildirim, E., Anlaş, S., Beyaz, G., 2006. Manisa ilinde kekik türlerinde (Lamiaceae) saptanan Hymenoptera türleri, *Ege Üniversitesi Ziraat Fakültesi Dergisi*. 43(1): 55-62.
- Van Wert, K.K., 2020. Attractiveness of English thyme (*Thymus vulgaris* L.) to arthropod natural enemies and its suitability as a dual use resource. Faculty of California Polytechnic State University, Master of Science Thesis. 187 s.
- Zoubiri, S., Baaliouamer, A., 2014. Potentiality of plants as source of insecticide principles. *Journal of Saudi Chemistry Society*. 18(6): 925-938.