

INSECT FAUNA FOUND ON VINE PLANT IN VINEYARDS OF CAPPADOCIA REGION

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ABSTRACT

This study was carry out to determine insect fauna and their distributions in vineyards in Cappadocia (Kayseri and Nevşehir provinces) in Turkey during the years 2012-2013. Surveys were made at least one time in a week and in irregular form between May and October which of vegetation time for grapes. At the end of study, 127 insect species belonging to 37 families from 6 ordo were determined. In addition, 14 insects could be identified at genus level and 1 insect at subfamily level. It was determined that 80 species were phytophagous and 35 species were entomophagous of these insects. Also, 12 ant species were found in the study. In the literature, no information has been found on the fact that most phytophagous species obtained are grape pests. However, the species belong to Aphididae, Cicadellidae and Tortricidae families are important pests of grapes. Especially, *Lobesia botrana* (Denis schiffermüller, 1775) (Lepidoptera: Tortricidae) and some Cicadellidae species such as *Arboridia adanae* (Dlabola, 1957) (Hemiptera: Cicadellidae) are key pests of vineyards in the region.

KEYWORDS:

Ant, cappadocia, fauna, natural enemy, pest, vineyard

INTRODUCTION

The grape (*Vitis vinifera* L., Vitaceae) is one of the oldest and most important cultivated plants in the world. It is know that growing of grape started as cultivated plant between the years 5000-6000 B.C. According to 2017 data, Turkey has 5th largest vineyard area with aproximately 417.000 ha after Spain, China, France and Italy and 6th the most grape producing country with 4.200.000 tonne after China, Italy, U.S.A., France and Spain in the World [1]. Kayseri and Nevşehir provinces are located in Central Anatolian Region in Turkey. These two cities located in historical Cappadocia region where the history of a viticulture based on many years since Hittites and earlier [2]. According to 2017 data, while 32.798 tonnes grapes was produced in 7.942 ha vineyard area in Kayseri, 113.606 tonnes grapes was produced in 18.499 ha vineyard area in

Nevşehir [3].

Many insect species live in the vineyard ecosystem and it is known that some of these insect species are pest of grapes, some are natural enemies and some are neutral species. Öztürk et al. [4], reported that 267 pest species belonging to 63 families and 13 ordo (Insecta= 9, Gastropoda, Arachnida, Aves and Mammalia) were determined in vineyards in different geographical region of Turkey. However, studies to determine of grape pests are very limited in Kayseri and Nevşehir provinces. Untill now, the most important study to determine of grape pests was conducted by İren [5] in Kayseri and Nevşehir provinces. In this study, she identified pests in vineyards in Central Anatolian region including Kayseri and Nevşehir provinces. As in other cultivated plants, effective pests on grape may vary according to factors such as the climate and geographical conditions of the region, vine variety, breeding technique. Additionally, time is another important factor and it may change over time the key pest on any cultivated plant.

Similarly, it is know that many natural enemy belong to different ordo and families is found on pests in vineyards. Öztürk et al. [4] reported that 9 ordo (Insecta= 7 ve Arachnida= 2) and 41 family belong to 115 natural enemies were determined in vineyards in Turkey. However, it is not carry out any remarkable study in vineyards of these provinces till now. In this study, it was aimed to determine the pest, natural enemy and neutral insect species on grape, their distributions in vineyards of Cappadocia region (Kayseri and Nevşehir provinces).

MATERIALS AND METHODS

The study was conducted between the years 2012-2013 in vineyards of Cappadocia region (Kayseri and Nevşehir Provinces and Ihlara Valley in Güzelyurt district of Aksaray Province) (Fig. 1.). Surveys were made at least one time in a week and in irregular form between May and October which of vegetation time for grapes. First year, north-south and east-west line directions were determined in both provinces and all districts of both provinces

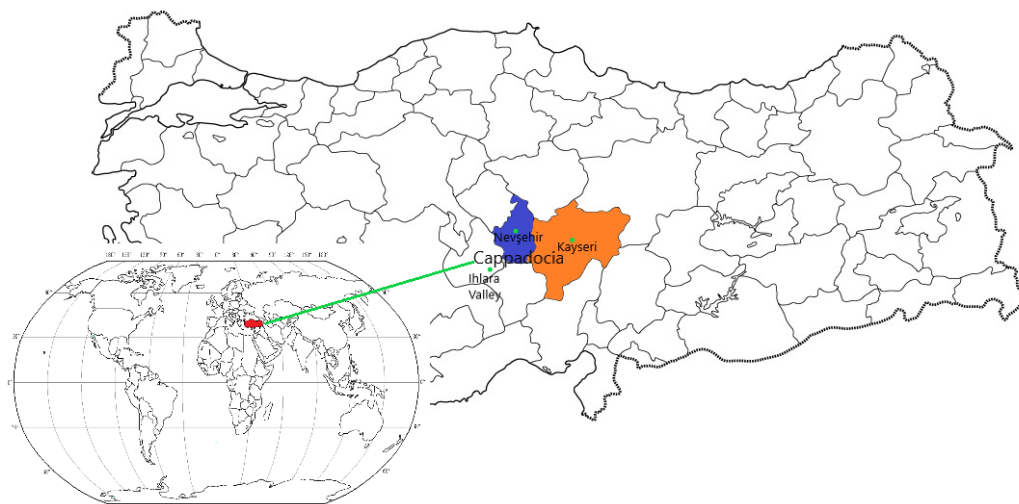


FIGURE 1

Cappadocia region (Kayseri, Nevşehir and Ihlara Valley) in Central Anatolia, Turkey

were surveyed. Second year, because of did not find enough vineyard in some districts of both provinces, the study was mainly focused in İncesu district of Kayseri and Ürgüp, Gülşehir, Avanos, Acıgöl and central districts of Nevşehir where vineyards are very common. In addition, surveys was made in Ihlara valley which found in rocky Cappadocia region in Güzelyurt district of Aksaray province too.

The Methods Used for Collecting Insects.

The samples were collected from vineyards accordingly different size of the field by using Lazarov and Grigorov [6] method was used (Table 1).

TABLE 1

The number of sampled vine plants according to the number of vine plants available for sampling area, based on sampling progression described by Lazarov and Grigorov [6].

Numbers of total vines in vineyard	The number of sampled vines
1-20	All vines
21-70	10-30
71-150	31-40
151-500	41-80
501-1000	15% of all vines
More than 1000	5% of all vines

For sampling, it was entered from a corner of the vineyard and sampled in enough number of grape plants which were chosen randomly till to the other cross corner. Three different method were used for collecting insect.

i) Beating: a kind of steiner funnel was kept at beneath of branch of the vine plant and using a stick three times were beaten to each of the five branches found in different directions and center of plant. In this way, insects were dropped into the plastic jar. Some insect which stayed on the net were collected with an aspirator.

ii) Visual inspection: Examining the leaves, branches, sprouts, bunches, bark of vine, some pest species were taken into petri plates using a fine brush.

iii) Sticky and pheremone traps: Traps were placed to catch the various pests in two vineyards where made the pest control in one and do not in one in each of İncesu, Avanos and Ürgüp districts. Pheromone traps for *Lobesia botrana* and yellow sticky traps for many species were used.

The pests and their natural enemies collected using above methods were brought to laboratory within plastic bags, jars and petri plates. Insects were killed by using insect killing jar and pure ethyl alcohol. Some samples which collected in pre-adult stage were fed with a suitable nutrient and they were provided to reach to adult stage. They were identified at family level, labelled and sent to their specialist for identification. Collected samples were identified by Dr. Ionel Andriescu (Alexandru Ioan Cuza University, Iași, Romania) (Chalcididae), Dr. Meral Fent (Trakya University, Edirne, Turkey) (Heteroptera), Dr. Ali Gök (Süleyman Demirel University, Isparta, Turkey) (Chrysomelidae), Dr. M. Bora Kaydan (Çukurova University, Adana, Turkey) (Coccidae), Dr. Kadri Kıran (Trakya University, Edirne, Turkey) (Formicidae), Dr. Petr Kocarek (University of Ostrava, Ostrava, Czech Republic) (Dermaptera), Dr. Sándor Koczor (Plant Protection Institute, Budapest, Hungary) (Auchenorrhyncha except Cicadidae), Dr. Janko Kolarov (University of Plovdiv, Plovdiv, Bulgaria) (Ichneumonidae), Dr. Vladimír Novák (Czech University of Life Sciences Prague, Prague, Czech Republic) (Alleculidae), Dr. Işıl Özdemir 5 (Plant Protection Central Research Institute, Ankara, Turkey) (Aphididae), Dr. Mustafa Özdemir (Plant Protection Central Research Institute, Ankara, Turkey) (Lepidoptera), Dr. French Szentkiralyi (Plant Protection Institute, Budapest, Hungary) (Chrysopidae), Dr. Yakup Şenyüz (Dumlupınar Universi-

ty, Turkey) (Scarabaeidae), Dr. Dmitry Telnov (Natural History Museum, London, United Kingdom) (Anthicidae), Dr. Göksel Tozlu (Atatürk University, Erzurum, Turkey) (Buprestidae), Dr. Nedim Uygun (Çukurova University, Adana, Turkey, retired) (Coccinellidae), Dr. Ünal Zeybekoğlu (On dokuz Mayıs University, Samsun, Turkey) (Cicadidae). The identified samples were preserved in collections of their specialists who identified the samples except Coccinellids. Coccinellids have been preserved in Erciyes University, Department of Plant Protection.

RESULTS AND DISCUSSION

In the study, 108 insect species including 32 species belonging to Coleoptera, 48 species belonging to Hemiptera, 14 species belonging to Hymenoptera, 7 species belonging to Lepidoptera, 6 species belonging to Neuroptera and 1 species belonging to Dermaptera were determined. Many of these insect species are phytophagous which are shown in table 2. Also, some of these phytophagous insects are neutral species while some species are grape pests.

TABLE 2
Phytophagous insect species found in Kayseri and Nevşehir provinces and their distributions by districts

Species	Surveyed districts *									
	1	2	3	4	5	6	7	8	9	10
COLEOPTERA										
ALLECULIDAE										
<i>Omophlus flavipennis</i> Küster										+
<i>Omophlus syriacus</i> Mulstant									+	
ANTHICIDAE										
<i>Notoxus trifasciatus</i> Rossi		+				+				+
BUPRESTIDAE										
<i>Agrilus roscidus</i> Kiesenwetter,									+	+
CHRYSOMELIDAE										
<i>Anoxia orientalis</i> (Krynicky)									+	
<i>Clytra novempunctata</i> Olivier **								+		+
<i>Oulema melanopus</i> (Linnaeus)								+		+
SCARABAEIDAE										
<i>Blitopertha nigripennis</i> Reitter		+								
<i>Omaloplia</i> sp. Schönherr									+	
HEMIPTERA (SUBORDO HETEROPTERA)										
ALYDIDAE										
<i>Alydus calcaratus</i> (Linnaeus)										+
<i>Camptopus lateralis</i> (Germar) **						+				+
COREIDAE										
<i>Arenocoris fallenii</i> (Schilling)								+		
<i>Syromastus rhombeus</i> (Linnaeus)										+
CYDNIDAE										
<i>Canthophorus melanopterus</i> (Herrich-Schaeffer)									+	
HETEROGASTERIDAE										
<i>Heterogaster affinis</i> Herrich-Schaeffer									+	
<i>Phytocoris</i> sp.		+							+	+
LYGAEIDAE										
<i>Brachyplax tenuis</i> (Mulsant & Rey)										+
<i>Emblethis</i> sp.								+		
<i>Lygaeus equestris</i> (Linnaeus) **										+
<i>Microplax interrupta</i> (Fieber)									+	+
<i>Nysius</i> sp.									+	+
<i>Spilostethus saxatilis</i> (Scopoli)										+
<i>Tropidothorax leucopterus</i> (Goeze)		+								
OXYCARENIDAE										
<i>Metaplox origani</i> (Kolenati) **						+			+	+
PENTATOMIDAE										
<i>Ancyrosoma leucogrammes</i> (Gmelin) **										+
<i>Anthemina lunuata</i> (Goeze)								+	+	
<i>Anthemina pusio</i> (Kolenati)										+
<i>Brachynema germarii</i> (Kolenati)									+	
<i>Carpocoris fuscispinus</i> Boheman									+	+
<i>Carpocoris pudicus</i> (Poda)									+	
<i>Carpocoris purpureipennis</i> (De Geer) **										+
<i>Codophila varia</i> (Fabricius)									+	+
<i>Dolycoris baccarum</i> (Linnaeus) **		+		+		+			+	+
<i>Eurydema ornata</i> (Linnaeus) **		+				+		+	+	+
<i>Holcostethus stictus</i> (Fabricius)		+	+		+	+		+	+	+
<i>Rhaphigaster nebulosa</i> (Poda) **									+	
PIESMIDAE										
<i>Parapiesma</i> sp.		+								

Species	Surveyed districts *									
	1	2	3	4	5	6	7	8	9	10
RHOPALIDAE										
<i>Brachycarenum tigrinus</i> Schilling						+				
<i>Corizus hyascyami</i> hyascyami (Linnaeus)						+		+	+	
<i>Liorhysus hyalinus</i> (Fabricius)								+		
<i>Maccevethus corsicus</i> Signoret						+			+	
<i>Maccevethus errans errans</i> (Fabricius)									+	
<i>Rhopalus parampunctatus</i> Schilling		+				+	+	+	+	
SCUTELLERIDAE										
<i>Eurygaster austriaca</i> (Schrank)								+		
TINGIDAE										
<i>Catoplatus anticus</i> (Reuter)					+		+			
<i>Dictyla echii</i> (Schrank)						+		+		
<i>Elasmotropis testacea</i> (Herrich-Schäffer)							+			
<i>Physatocheila municeps</i> Horváth										+
<i>Tingis</i> sp.		+				+	+	+	+	
<i>Tingis (Tingis) grisea</i> Germar					+			+		
HEMIPTERA (SUBORDO HOMOPTERA)										
APHIDIDAE										
<i>Aulacorthum solani</i> (Kaltenbach)								+	+	
<i>Aphis gossypii</i> Glover **		+				+		+	+	
<i>Aphis illinoisensis</i> Shimer **						+		+	+	
CERCOPIDAE										
<i>Cercopis intermedia</i> Kirschbaum		+				+				
CICADELLIDAE										
<i>Arboridia adanae</i> (Dlabola) **	+	+				+	+	+	+	
<i>Arboridia</i> sp.	+	+						+	+	
<i>Empoasca decipiens</i> Paoli **										+
<i>Empoasca</i> sp.							+		+	
<i>Eohardya fraudulenta</i> (Horváth)										+
<i>Euscelis alsius</i> Ribaut						+				
<i>Euscelis</i> sp.						+			+	
<i>Fruticidia bisignata</i> (Mulsant & Rey)										+
<i>Neoaliturus fenestratus</i> (Herrich-Schäffer) **						+				
<i>Platymetopius rostratus</i> (Herrich-Schäffer)						+				
<i>Platymetopius</i> sp.										+
<i>Selenocephalus pallidus</i> Kirschbaum	+					+	+	+		
<i>Selenocephalus</i> sp.	+	+				+	+		+	
CICADIDAE										
<i>Cicadatra adanai</i> Kartal						+				
CIXIIDAE										
<i>Cixius</i> sp.										+
COCCIDAE										
<i>Parthenolecanium corni</i> (Bouché) **						+		+		+
DELPHACIDAE										
<i>Delphacinae</i> sp.								+		
ISSIDAE										
<i>Agalmatium bilobum</i> **								+		
<i>Agalmatium</i> sp.								+	+	
TETTIGOMETRIDAE										
<i>Tettigometra costulata</i> Fieber										+
<i>Tettigometra sulphurea</i> Mulsant & Rey										+
LEPIDOPTERA										
NOCTUIDAE										
<i>Agrotis segetum</i> Denis & Schiffmüller **		+								
<i>Calamia staudingeri</i> Warnecke								+		
<i>Euxoa</i> sp.										+
PLUTELLIDAE										
<i>Plutella xylostella</i> (Linnaeus)								+	+	
PYRALIDAE										
<i>Phycitodes lacteella</i> (Rothschild)			+							
TORTRICIDAE										
<i>Lobesia botrana</i> (Denis & Schiffmüller) **		+		+	+	+	+	+	+	
<i>Sparganothis pillariana</i> (Denis & Schiff.) **								+	+	

* Surveyed districts: 1. Develi, 2. İncesu, 3. Sarioğlan, 4. Yahyalı, 5. Acıgöl, 6. Avanos, 7. Gülşehir, 8. The central district of Nevşehir, 9. Ürgüp, 10. Ihlara Valley.

** Previously determined species on grapes in Turkey.

Result of the surveys carried out in vineyards of Kayseri and Nevşehir provinces 67 phytophagous insect species belonging to different ordo and families were determined. Additionally, 15 speci-

mens could identified at genus level and one specimen at subfamily level. At the same time, *Eriophyes vitis* (Pgst.) (Acarina: Eriophyidae) was obtained from most vineyards in the region, but informations

related this pest are not covered in this article.

The European Grapevine Moth *Lobesia botrana* was determined as the most common vine pest species. This species was found in many vineyards in seven districts of Kayseri and Nevşehir provinces. In the interviews with the producers during the field surveys, they stated that *L. botrana* was the key pest of vineyard in the region. The results obtained from this study confirm the producers. *L.*

botrana were found in almost all vineyards in districts where viticulture very common. Especially, numerous *L. botrana* adults were caught with pheromone traps. Also, *L. botrana* were reported as key pest of vineyards in the other studies were conducted in different regions of Turkey [7, 8, 9, 10]. Other common vine pest species were Cicadellids. Different

TABLE 3
Entomophagous insect species found in Kayseri and Nevşehir provinces and their distributions by districts

Species	Surveyed Districts *									
	1	2	3	4	5	6	7	8	9	10
COLEOPTERA										
COCCINELLIDAE										
• <i>Adalia (Adalia) bipunctata</i> (Linnaeus)						+				
<i>Coccinella (Coccinella) septempunctata</i> Linnaeus **		+			+	+	+	+	+	+
• <i>Coccinella (Spilota) undecimpunctata</i> Linnaeus		+								
• <i>Coccinula quatuordecimpustulata</i> (Linnaeus) **								+	+	+
• <i>Coccinula sinuatmarginata</i> (Faldermann)		+						+	+	
• <i>Exochomus (Exochomus) quadripustulatus</i> Linnaeus **								+	+	
<i>Exochomus undulatus</i> Weise									+	
• <i>Harmonia axyridis</i> Pallas										+
• <i>Hippodamia (Hippodamia) variegata</i> Goeze **		+			+	+	+	+	+	
• <i>Myrrha (Myrrha) octodecimguttata</i> (Linnaeus)								+		
• <i>Nephus (Bipunctatus) nigricans</i> Weise								+		
<i>Oenopia conglobata</i> (Linnaeus) **								+	+	
• <i>Platynaspis luteorubra</i> (Goeze)										+
• <i>Propylea quatuordecimpunctata</i> (Linnaeus) **								+		
• <i>Psyllobora vigintiduopunctata</i> (Linnaeus) **					+	+			+	+
• <i>Scymnus (Scymnus) apetzii</i> Mulsant, 1846 **		+				+	+	+	+	+
• <i>Scymnus (Scymnus) bivulnerus</i> Baudi		+				+	+	+	+	
• <i>Scymnus (Mimopullus) flagellisiphonatus</i> (Fursch) **						+		+		
• <i>Scymnus (Scymnus) interruptus</i> (Goeze)										+
<i>Scymnus (Scymnus) quadriguttatus</i> Fursch et Kreissl **						+	+	+		
<i>Scymnus (Pullus) subvillosus</i> (Goeze) **							+			
• <i>Scymnus</i> sp.		+					+			
• <i>Stethorus gilvifrons</i> (Mulsant) **									+	
• <i>Subcoccinella vigintiquatuorpunctata</i> Linnaeus								+		
DERMAPTERA										
FORFICULIDAE										
<i>Forficula auricularia</i> Linnaeus		+				+	+	+	+	
HEMIPTERA										
MIRIDAE										
• <i>Deraeocoris (Camptobrochis) serenus</i> (Douglas & Scott)						+		+	+	
NABIDAE										
• <i>Nabis (Nabis) punctatus</i> A. Costa **		+			+	+	+	+	+	
HYMENOPTERA										
CHALCIDIDAE										
• <i>Brachymeria tibialis</i> (Walker)									+	
ICHNEUMONIDAE										
• <i>Pristomerus vulnerator</i> (Panzer) **						+				
NEUROPTERA										
CHRYSOPIDAE										
• <i>Pseudomallada prasinus</i> (Burmeister)						+			+	
• <i>Chrysoperla pallida</i> Henry, Brooks, Duelli & Johnson **								+	+	
• <i>Chrysoperla carnea</i> (Stephens) **						+	+	+	+	
• <i>Chrysoperla lucasina</i> (Lacroix)		+				+	+		+	
• <i>Pseudomallada flavifrons</i> (Brauer)						+				
<i>Dichochrysa prasina</i> (Burmeister) **									+	

* Surveyed districts: 1. Develi, 2. Incesu, 3. Sarioğlan, 4. Yahyalı, 5. Acıgöl, 6. Avanos, 7. Gülşehir, 8. The central district of Nevşehir, 9. Ürgüp, 10. Ihlara Valley.

** Previously determined species on grapes in Turkey.

Cicadellidae species obtained from many vineyards in different districts. Especially, *Arboridia adanae* the most encountered species of family Cicadellidae.

Sparganothis pilleriana, one of the important pests of vine, was found in central and ürgüp districts of Nevşehir. This pest especially was common in the town Uçhisar, Ürgüp. It was reported by İren [5] that *S. pilleriana* was present in the vineyards in Nevşehir province. Also, biology of this pest was studied by Ataç and Kansu [11] in Turkey.

Cutworm *A. segetum*, also known as a grape pest, was caught by pheromone traps hung for the Grapevine moth. This pest is only obtained from the traps in İncesu district in Kayseri province. İren [5] stated that this pest exists in the vineyard of Central Anatolia Region in Turkey and ate up the vine sprouts to the branch. Also, *Agrotis* spp. were emphasized by grape producers as one of the most important pests in vineyards of Erzincan province in East Anatolia Region [12].

Aphids are polyphagous pests fed on many plants. In the study, three aphid species were determined in vineyards in the region. From these species, *Aphis gossypii* was determined as the most common aphid species. *A. gossypii* was reported that as the vector of more than 50 persistent and non-persistent plant virus disease [13]. Also, the grapevine aphid *Aphis illinoisensis* was determined as the pest of grapes in the region. In Turkey, this pest firstly reported from Adana province located in the Mediterranean region in 2001 [9]. With this study, it was determined that vineyards in different districts of Nevşehir were infected by the grapevine aphid in a short time after this first report of the pest.

Another pest of vine *Parthenolecanium corni* was found under the trunk shells of the vine plant. Before, this pest was found at low population level in Kayseri and Nevşehir vineyards was reported [5]. Also, we found that this pest in limited number of vineyard in the region.

34 natural enemy insect species belonging to 5

ordo and 7 families were determined in vineyards of Kayseri and Nevşehir provinces (Table 3). Also, 1 *Scymnus* species could identified at genus level.

The majority of the natural enemy species obtained belong to the family Coccinellidae. Although Coccinellids have different feeding habits generally are predators of many pest species in larval and adult stages, especially aphids [14]. Also, the feeding habits of their larvae and adults are similar. In this study, 23 Coccinellid species was determined in vineyards of Kayseri and Nevşehir provinces. Also, 1 *Nephus* species could identified at genus level. *Coccinella septempunctata* and *Hippodamia variegata* were the most common coccinellid species. Whereas, *Harmonia axyridis* was found in Ürgüp district of Nevşehir. *H. axyridis* was first reported for Turkey and the Middle East in Göreme town of Ürgüp in 2015 [15]. After this date, this invasive species was reported different city and geographical region of Turkey.

In the study, six species were determined from Chrysopidae which another important predator insect family. The most common Chrysopid species was *Chrysoperla carnea* found in four districts. While adults of Chrysopidae family fed nectar and pollen, larval stages are predator of some phytophagous insects as aphids, thrips and little caterpillars was reported [16, 17]. It was reported in previous studies that another predator insect *Nabis (Nabis) punctatus* is one of the predator species found in the vineyards [12, 18]. Two parasitoid species were determined in this study. *Pristomerus vulnerator* obtained from *L. botrana* while *Brachymeria tibialis* emerged from *S. pilleriana* larvae. Actually, many parasitoids and hyperparasitoids species was collected during the study, but hosts of these parasitoids could not determined and therefore their identifications could not be made.

In the study, total 12 ant species (Hymenoptera: Formicidae) were found in vineyards of the region (Table 4). 11 species belonging to the Formicinae subfamily were found in Kayseri and

TABLE 4

Ant species found in Kayseri and Nevşehir provinces and their distributions by districts

Species	Surveyed District									
	1	2	3	4	5	6	7	8	9	10
<i>Camponotus aethiops</i> (Latreille)								+		
<i>Camponotus atricolor</i> (Nylander)		+		+				+	+	
<i>Camponotus baldaccii</i> Emery							+			
<i>Camponotus piceus</i> (Leach)		+					+	+		
<i>Cataglyphis aenescens</i> (Nylander)		+			+	+	+	+	+	
<i>Cataglyphis albicans</i> (Roger)		+								
<i>Formica cunicularia</i> Latreille									+	+
<i>Lasius turcicus</i> Santschi									+	
<i>Plagiolepis pygmaea</i> (Latreille)								+	+	
<i>Proformica kobachidzei</i> Arnol'di		+								
<i>Proformica striaticeps</i> (Forel)				+					+	
<i>Temnothorax dassyi</i> (Menozi)										+

* Surveyed districts: 1. Develi, 2. İncesu, 3. Sarioğlan, 4. Yahyalı, 5. Acıgöl, 6. Avanos, 7. Gülşehir, 8. The central district of Nevşehir, 9. Ürgüp, 10. İhlara Valley.

Nevşehir vineyards, and two ant species, one belong to Formicinae subfamily (*F. cunicularia*) and the other Myrmicinae (*Temnothorax dassyi*) were found on grapes in Ihlara Valley. *Cataglyphis aenescens* was the most common ant species. This species was collected from vineyards in incesu district of Kayseri and five districts of Nevşehir. All obtained ant species are first records for their collected provinces.

Ants are known ecosystem engineers due to their role in the regulation of their habitat. They have important positive ecological functions, such as improvement of the physical-chemical properties of the soil, dispersion and pollination of plants and predatory habit of many pest species [19, 20, 21, 22]. However, they might be play indirect negative role especially in agroecosystems. This kind trophobiotic relationships are seen between many ants species with hemipteran pests, such as aphids, mealybugs and coccids in different ecosystems [19, 23, 24, 25]. In this relationship, ants protect these hemipterans against their predators and parasitoids for they feed with the honeydew excreted by hemipterans [23, 26, 27].

Limited number studies related determination of ant species in vineyards were conducted. In these studies many ant species determined in vineyards found in different zoogeographical regions of the World [28, 29, 30, 31, 32, 33]. However, there is not any study about determination of ant species in vineyards in Turkey. Therefore, there are need more studies about ant species and their ecology in vineyards of Turkey.

CONCLUSION

As a result of the study, it was found that there are many insect species belonging to different ordo and families in the vineyards of Kayseri and Nevşehir provinces. Some of these species do not related with grape. They are most probably stray insect species. However, some species are grape pest. Especially, *L. botrana* and majority of cicadellid species were determined as main pests of vineyards in both cities. In addition, many natural enemies species connected with grape pests were found in same areas. According to these data obtained, IPM programs which more effective, more economical, environmentally friendly and protecting natural enemies, ants and neutral species should be developed against these pest species in Kayseri and Nevşehir vineyards.

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