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The Macroheterocera Fauna of the Sündiken Mountains (Türkiye: Eskişehir)

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Araştırma Makalesi

Abstract − The moths of the Sündiken Mountains are still not comprehensively known. We aimed to study the distribution of Lepidoptera in more detail, particular for some rare species with limited records. We sum up the results of the expeditions to the Sündiken Mountains in the period between 2019 and 2022. The moths were recorded from 49 stations. 113 species belonging to a total of 9 families along with four new families (Drepanidae, Lasiocampidae, Nolidae, Sphingidae) from the Sündiken Mountains were identified. All the given 113 species are recorded for the first time from moth fauna of the Sündiken Mountains and likewise, 106 species are recorded for the first time from the moth fauna of Eskişehir province. Eight species are new records for the Central Anatolia Region: *Amphipoea oculea* (Linn.,1761), *Mythimna (Anapoma) riparia* (Ram.,1829), *Noctua (Paranoctua) interposita* (Hb.,1790), *Ascotis selenaria* ([Den. & Sch.],1775), *Chloroclysta siterata* (Huf., 1767), *Pachypasa otus* (Dr., [1773]), *Menophra berenicidaria* (Tr., 1924), *Aedia leucomelas* (Linn., 1758). With this study, the number of Eskişehir lepidopters increaseasd from 160 to 266 species. The identified species were assessed in terms of agricultural and forest entomology and the indicator species were discussed.

Keywords − *Lepidoptera, moths, fauna, Sündiken Mountains, Eskişehir*

Sündiken Dağlarının Macroheterocera Faunası (Türkiye: Eskişehir)

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Araştırma Makalesi

Öz − Sündiken Dağları'nın güveleri henüz tam olarak bilinmemektedir. Çalışmada Lepidoptera'nın yayılışını, özellikle sınırlı kayıtlara sahip bazı nadir türler için daha ayrıntılı şekilde incelemeyi amaçladık. Makalede 2019-2022 yıllarında Sündiken Dağları'na yapılan arazi çalışmalarının sonuçları özetlenmiştir. Örnekler 49 istasyondan toplanmıştır. Çalışma sonucunda Sündiken Dağları'ndan dört yeni familya (Drepanidae, Lasiocampidae, Nolidae, Sphingidae) ile birlikte toplam 9 familyaya ait 113 tür tespit edilmiştir. Söz konusu 113 türün tamamı Sündiken Dağları güve faunası için, ve aynı şekilde 106 tür Eskişehir ili güve faunası için yenidir. Sekiz tür İç Anadolu Bölgesi için yeni kayıttır: Amphipoea oculea (Linn.,1761), Mythimna (Anapoma) riparia (Ram.,1829), Noctua (Paranoctua) interposita (Hb.,1790), Ascotis selenaria ([Den. & Sch.],1775), Chloroclysta siterata (Huf., 1767), Pachypasa otus (Dr., [1773]), Menophra berenicidaria (Tr., 1924), Aedia leucomelas (Linn., 1758). Bu çalışma ile Eskişehir ili Lepidoptera tür sayısı 160'tan 266 türe çıkmıştır. Tespit edilen türler tarım ve orman entomolojisi açısından değerlendirilmiş ve gösterge türler tartışılmıştır.

Anahtar Kelimeler − *Lepidoptera, güveler, fauna, Sündiken Dağları, Eskişehir*

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1. Introduction

The Sündiken Mountains are in the province Eskişehir, which is in the Central Anatolian region of Turkey between the districts of Alpu and Mihalıççık. When examined in an east-west direction, respectively, Hamam Mountain (1540 m), Kartal Hill (1754 m), Kızıl Hill (1818 m), Karameşecik Hill (1605 m) and Bozdağ (1423 m) are located. The area consist of oak, black pine, scotch pine and red pine forests, Juniper communities, steppe and high mountain meadows and agricultural areas. While the southern slopes of the Sündiken Mountains facing the plains have a steppe character, the northern slopes extend along the Sakarya Valley, which shows the typical Mediterranean climate (Ekim, 1991). The area is included in Important Plant Areas (IPA). The IPA flora of the area includes 40% Mediterranean, 32% Euro-Siberian and 28% Iranian-Turanian elements as far as can be determined (Özhatay et al., 2005).

The Lepidoptera of Turkey have a rich biodiversity with 5577 species (Koçak & Kemal, 2018). The oldest popular uses are Rhopalocera and Heterocera. Although the heterocera group is classified differently in various sources, they are traditionally classified as macro- and microheterocera. The macro-moths comprise the majority of the presently named Lepidoptera species (Kristensen et al., 2007). The most crowded families among these group are Noctuidae and Geometridae families. There are over 900 species known in Europe (Hausmann, 2001) and 702 species in Turkey for Geometridae (Koçak & Kemal, 2018, Özdemir 2019, Seven 2019, Seven et al. 2019, 2021, Kemal et al. 2020; Wanke et al., 2020, Aykal & Seven, 2022). In Europea approximate 1400 species are known, representig 14 subfamilies (Fibiger, 1990). In Turkey 1241 species are also known for Noctuidae (Koçak and Kemal 2018).

Classification studies on lepidopters, which are still used today, date back to the 18th century (Scopoli, 1763, Hübner, 1790, 1796-[1838], Herrich-Schaeffer, 1843-[1856], Eversmann, 1844, Zeller, 1847, Mann, 1861). The first studies on Anatolian fauna were made by Staudinger (1878-1879). Some other important publications on the Macroheterocera fauna were published in the following years: Rebel, 1905, 1913, Boursin, 1940, 1941, 1962, Wiltshire, 1976, Varga, 1979, De Freine & Hacker, 1985, Hacker et al., 1986, Hacker, 1986b, 1987, Riemis, 1992, 1994, 1998, Wherlii, 1932). Numerous studies have been conducted on the macromoths of the Central Anatolian Region, and most of them are in Ankara and places near it (Schwingenschus, 1938-1939, Witt, 1981, Hacker, 1986a, Rebel, 1933, Ronkay, 1989, Koçak, 1990, 1991, Koçak & Seven [Çalışkan], 1994a, 1994b, 1996, Seven [Çalışkan], 1996, 2000, Seven [Çalışkan] & Bakowski, 1996, Seven [Çalışkan] et al., 2000, Çalışkan Seven, 2014a, 2014b, Torun & Çalışkan, 2016). Only a few publications on Eskişehir Lepidoptera have been published (Rebel, 1905, Kansu, 1961a, 1961b, 1963, Nizamoğlu, 1962, Çanakçıoğlu, 1963, İren,1972, İren & Bulut, 1981, Kornoşor, 1992, Çalışkan Seven, 2014b).

This study is the first comprehensive study on the moth fauna of the Sündiken Mountains. In this paper, a total of 113 species under 10 families are listed. All the species were identified for the first time in the study area. With this study, the number of known Lepidoptera in Eskişehir rose to 278. In addition, the study makes important contributions to filling the gaps in the distribution areas of moths distributed in Turkey.

2. Material Method

The specimens collected from 49 different stations from the Sündiken Mountains between April-September during the years 2018-2022 were investigated. Collection areas (Table 1) are shown in map 1 (Figure 1). The Robinson light trap was used to collect samples. 8V UV light was used in the light trap. A total of 1235 samples were examined. Collected samples were rehydrated in special containers in the laboratory and mounted on placement boards according to university museum procedure. The dried samples were labeled and placed in the collection boxes in the Gazi University Faculty of Science Zoology Museum collection. External morphological characters and male genital structures were considered for diagnosis. Identification of the samples was made by comparing them with the relevant literature (Fibiger, 1990, 1993, 1997, Fibiger, et al., 2007, 2009, 2010, 2011, Hacker et al., 2002, Hausmann, 2001, 2004, Hausmann and Viidalepp, 2012,

Mironov, 2003, Müller et al., 2019, Ronkay et al., 2001, Skou and Sihvonen, 2015, Zilli, 2005). The specimens are preserved in the Gazi University Zoology Museum. Photographs of some species identified from the study area are given in Fig.2. The distribution of species is given according to Koçak & Kemal (2018) in Table 3. Turkey province plate codes were used for the distribution (Table 2). QGIS 3.2 Mapping program was used in the preparation of the map. This work emerged from the first author's doctoral study.

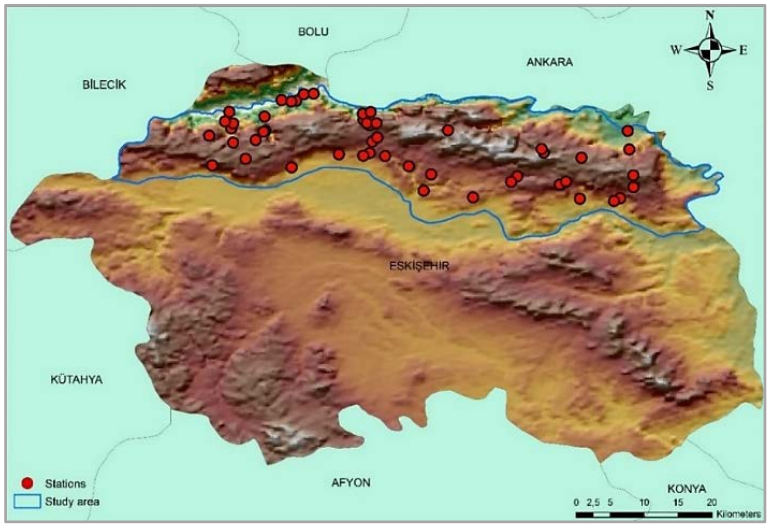

Figure 1. Physical map of Sündiken Mountains and study areas and collecting stations

Figure 2. **a**. Adult of *Amphipoea oculea* (Linn., 1761), **b**. Adult of *Narraga cappadocica* Herbulot, 1943, **c**. Adult of *Noctua interposita* (Hb., 1790), **d**. Adult of *Ascotis selenaria* ([Den. & Sch.], 1775), **e**. Adult of *Chloroclysta siterata* (Huf., 1767), **f**. Adult of *Pachypasa otus* (Dr., [1773]), **g**. Adult of *Menophra berenicidaria* (Tr., 1924), **h**. Adult of *Thalerastria diaphora* (Staudinger, 1879), **ı**. Adult of *Laothoe*

populi (Linnaeus, 1758), **i**. Adult of *Biston stratarius* (Hufnagel, 1767), **j**. Adult of *Dysauxes ancilla* (Linnaeus, 1767), **k**. Adult of *Lygephila amasina* (Staudinger,1879), **l**. Adult of *Ligdia adustata* ([Denis & Schiffermüller], 1775), **m**. Adult of *Hydria cervinalis* (Scopoli, 1763), **n**. Adult of *Cidaria fulvata* (Forster, 1771), **o**. Adult of *Thalpophila matura* (Hufnagel, 1766) , **ö**. Adult of *Camptogramma bilineata* (Linnaeus, 1758), **p**. Adult of *Eumera rejina* Staudinger, 1892, **r**. Adult of *Chiasmia aestimaria* (Hübner, [1809]), **s**. Adult of *Neognopharmia stevenaria* (Boisduval, 1840)

Table 1
Collected station

No	Stations	No	Stations
1	Eskişehir, Alpu, Büğdüz 26.07.2019 1527 m 39˚ 51’ 20” N 31˚ 7’ 39” E	25	Eskişehir, Mihalıççık, Sazak 7.06.2021 833 m 39˚ 47’ 4” N 31˚ 36’ 57” E
2	Eskişehir, Alpu, Ağaçhisar 26.07.2019 1412 m 39˚ 58’ 24” N 31˚ 10’ 22	26	Eskişehir, Mihalıççık, Diközü 7.06.2021 854 m 39˚ 47’ 26” N 31˚ 31’ 29” E
3	Eskişehir, Tepebaşı, Koyunlar 31.08.2019 1161 m 39˚ 52’ 46” N 30˚ 32’ 36” E	27	Eskişehir, Mihalıççık, Güce 8.06.2021 980 m 39˚ 50’ 7” N 31˚ 20’ 28” E
4	Eskişehir, Tepebaşı, Bozdağ 31.08.2019 1110 m 39˚ 56’ 26” N 30˚ 35’ 55” E	28	Eskişehir, Mihalıççık, Belen 7.06.2021 1234 m 39˚ 53’ 59” N 31˚ 31’ 44” E
5	Eskişehir, Mihalgazi, Sakarıılıca 1.09.2019 523 m 39˚ 58’ 41” N 30˚ 35’ 39” E	29	Eskişehir, Mihalıççık, Bahtiyar 7.06.2021 805 m 39˚ 55’ 19” N 31˚ 39’ 25” E
6	Eskişehir, Tepebaşı, Atalantekke 1.09.2019 636 m 39˚ 58’ 89” N 30˚ 35’ 57” E	30	Eskişehir, Mihalıççık, Koyunağılı 7.06.2021 558 m 39˚ 58’ 18” N 31˚ 39’ 8” E
7	Eskişehir, Tepebaşı, 22.07.2020 1181 m 39˚ 53’ 49” N 30˚ 37’ 56” E	31	Eskişehir, Alpu, Başören 28.08.2021 1081 m 39˚ 56’ 34” N 30˚ 58’ 13” E
8	Eskişehir, Tepebaşı, Atalantekke 22.07.2020 1121 m 39˚ 57’ 32” N 30˚ 31’ 66” E	32	Eskişehir, Alpu, Başören 28.08.2021 1076m 39˚ 59’ 12” N 30˚ 57’ 45” E
9	Tepebaşı, Yakakayı 22.07.2020 1244 m 39˚ 56’ 50” N 30˚ 39’ 33” E	33	Eskişehir, Alpu, Sakarıkaracaören 29.08.2021 797 m 40˚ 1’ 1” N 30˚ 56’ 43” E
10	Eskişehir, Mihalıççık, Diközü, Sivrihisar 17.07.2020 1172 m 39˚ 49’ 42” N 31˚ 28’ 15” E	34	Eskişehir, Alpu, Gökçekaya 29.08.2021 585 m 40˚ 1’ 18” N 30˚ 57’ 58” E
11	Eskişehir, Mihalıççık, Camikebir,Diközü Yolu 17.07.2020 1215 m 39˚ 50’ 11” N 31˚ 29’ 15” E	35	Eskişehir, Laçin, Sarıcakaya 9.07.2021 300 m 40˚ 2’ 60” N 30˚ 45’ 15” E
12	Eskişehir, Mihalıççık, Sorkun 18.07.2020 1546 m 39˚ 54’ 49” N 31˚ 25’ 42” E	36	Eskişehir, Laçin, Sarıcakaya 10.07.2021 288 m 40˚ 4’ 9” N 30˚ 47’ 15” E
13	Eskişehir, Mihalıççık, Sorkun 18.07.2020 1364 m 39˚ 55’ 22” N 31˚ 25’ 22” E	37	Eskişehir, Sarıcakaya, Düzköy 10.07.2021 244 m 5 40˚ 4’ 15” N 30˚ 48’ 50” E
14	Eskişehir, Mihalgazi, Bozaniç 21.08.2020 257 m 40˚ 2’ 35” N 30˚ 35’ 13” E.	38	Eskişehir, Tepebaşı, Kozlubel 21.08.2021 897 m 39˚ 54’ 33” N 30˚ 52’ 52” E
15	Eskişehir, Mihalgazi, Bozaniç 21.08.2020 233 m 40˚ 2’ 121” N 30˚ 35’ 33” E	39	Eskişehir, Alpu, Büğdüz 23.04.2022 906 m 39˚ 52’ 37” N 31˚ 4’ 4” E
16	Eskişehir, Mihalgazi, Sakarıılıca 22.08.2020 425 m 39˚ 59’ 141” N 30˚ 35’ 20” E	40	Eskişehir, Alpu, Özdenk 23.04.2022 1002 m 39˚ 54’ 16” N 31˚ 0’ 17” E
17	Eskişehir, Mihalgazi, Sakarıılıca 22.08.2020 330 m 39˚ 59’ 49” N 30˚ 34’ 37” E	41	Eskişehir, Alpu, Özdenk 30.04.2022 1004 m 39˚ 54’ 16” N 31˚ 0’ 16” E
18	Eskişehir, Sarıcakaya, Mayıslar 18.09.2020 384 m 40˚ 0’ 35” N 30˚ 40’ 59” E	42	Eskişehir, Alpu, Başören 30.04.2022 1084 m 39˚ 57’ 14” N 30˚ 59’ 1” E
19	Eskişehir, Sarıcakaya, Dağküplü 18.09.2020 827 m 39˚ 58’ 17” N 30˚ 41’ 5” E	43	Eskişehir, Alpu, Belkese 30.04.2022 1006 m 39˚ 59’ 32” N 30˚ 57’ 23” E
20	Eskişehir, Sarıcakaya, Dağküplü 19.09.2020 945 m 39˚ 58’ 10” N 30˚ 40’ 49” E;	44	Eskişehir, Alpu, Belkese 30.04.2022 1213 m 39˚ 59’ 31” N 30˚ 58’ 53” E
21	Eskişehir, Mihalıççık, Ahurözü 28.06.2021 1100 m 39˚ 47’ 39” N 31˚ 14’ 22” E	45	Eskişehir, Mihalıççık, Korucu 26.05.2022 1067 m 39˚ 49’ 56” N 31˚ 21’ 14” E

Table 1
Collected station (continues)

No	Stations	No	Stations
22	Eskişehir, Mihalıççık, Hamidiye 28.06.2021 1406 m 39˚ 51’ 11” N 31˚ 40’ 3” E	46	Eskişehir, Mihalıççık, Diközü, Sivrihisar 26.05.2022 1031 m 39˚ 48’ 33” N 31˚ 28’ 38” E
23	Eskişehir, Mihalıççık, Üçbaşlı 28.06.2021 1164 m 39˚ 49’ 17” N 31˚ 40’ 4” E	47	Eskişehir,Alpu, Büğdüz 26.05.2022 933 m 39˚ 52’ 37” N 31˚ 4’ 29” E
24	Eskişehir, Mihalıççık, Üçbaşlı 7.06.2021 910 m 39˚ 47’ 31” N 31˚ 37’ 57” E	48	Eskişehir,Alpu, Bozan 26.05.2022 840 m 39˚ 48’ 19” N 31˚ 6’ 7” E
		49	Eskişehir, Beylikova, Süleymaniye 23.04.2022 753 m 39˚ 41’ 3” N 31˚ 20’ 58” E

Table 2
City plate codes

Province	Cod	Province	Cod	Province	Cod	Province	Cod	Province	Cod
Adana	1	Çankırı	18	İzmir	35	Ordu	52	Bayburt	69
Adıyaman	2	Çorum	19	Kars	36	Rize	53	Karaman	70
Afyon	3	Denizli	20	Kastamonu	37	Sakarya	54	Kırıkkale	71
Ağrı	4	Diyarbakır	21	Kayseri	38	Samsun	55	Batman	72
Amasya	5	Edirne	22	Kırklareli	39	Siirt	56	Şırnak	73
Ankara	6	Elazığ	23	Kırşehir	40	Sinop	57	Bartın	74
Antalya	7	Erzincan	24	Kocaeli	41	Sivas	58	Ardahan	75
Artvin	8	Erzurum	25	Konya	42	Tekirdağ	59	Iğdır	76
Aydın	9	Eskişehir	26	Kütahya	43	Tokat	60	Yalova	77
Balıkesir	10	Gaziantep	27	Malatya	44	Trabzon	61	Karabük	78
Bilecik	11	Giresun	28	Manisa	45	Tunceli	62	Kilis	79
Bingöl	12	Gümüşhane	29	Kahramanmaraş	46	Şanlıurfa	63	Osmaniye	80
Bitlis	13	Hakkari	30	Mardin	47	Uşak	64	Düzce	81
Bolu	14	Hatay	31	Muğla	48	Van	65		
Burdur	15	Isparta	32	Muş	49	Yozgat	66		
Bursa	16	İçel	33	Nevşehir	50	Zonguldak	67		
Çanakkale	17	İstanbul	34	Niğde	51	Aksaray	68		

3. Result and Discussion

In this research, a total 113 species are listed alphabetically under the related families with number species and distribution in Turkey (Table 3). 106 species are recorded for the first time from moth fauna of Eskişehir province. Eight species are recorded for the first time from of the Central Anatolia Region: *Amphipoea oculea* (Linn.,1761), *Mythimna* (*Anapoma*) *riparia* (Ram.,1829), *Noctua* (*Paranoctua*) *interposita* (Hb.,1790), *Ascotis selenaria* ([Den. & Sch.],1775), *Chloroclysta siterata* (Huf., 1767), *Pachypasa otus* (Dr., [1773]), *Menophra berenicidaria* (Tr., 1924), *Aedia leucomelas* (Linn., 1758). *Dysauxes ancilla* (Linnaeus, 1767) was known only from Ankara and Isparta provinces in Turkey (Koçak & Kemal, 2018). Eskişehir record is the westernmost distribution record of this species.

Table 3
The collecting stations of the macrolepidoptera species from Sündiken Mountains and their distributions in Turkey (continues)

Family	**Species**	**Distribution**	**Station Number**	**Specimens Number**
Erebidae	*Arctia festiva* (Hufnagel, 1766)	05 06 12 13 14 16 17 21 24 25 27 32 36 38 40 42 44 47 49 56 58 60 63 64 65 71 75	49	1
	Arctia villica (Linnaeus, 1758)	01 03 04 05 06 07 10 13 14 15 16 17 19 21 22 23 26 27 29 31 32 33 34 36 37 39 42 44 46 48 55 56 60 61 62 64 66 71 75 80	22,2	2
	Catocala hymenaea ([Denis & Schiffermüller], 1775)	05 06 07 09 13 16 30 33 34 35 42 50 56 60 65	32,37	3
	Catocala nupta (Linnaeus, 1767)	12 13 16 21 30 33 38 39 46 48 51 56 59 62 65 73	20,4	2
	Drasteria cailino (Lefèbvre, 1827)	01 02 03 04 05 06 08 13 14 18 21 24 25 29 30 33 42 44 45 46 47 50 51 56 58 60 62 65 66 69 73	22	1
	Dysauxes ancilla (Linnaeus, 1767)	06 32	13	1
	Dysauxes famula (Freyer, 1836)	01 04 06 07 08 10 11 12 13 14 16 17 21 23 25 30 31 33 34 36 38 42 44 45 46 50 56 59 60 65 71 73 76	1,14,16,21,24, 28,35	25
	Dysgonia algira (Linnaeus, 1767)	01 05 07 08 10 13 16 17 18 21 22 27 28 30 31 33 34 35 39 40 42 44 45 48 50 52 56 61 62 63 65 73	18,30,34,35	11
	Eublemma purpurinum ([Denis & Schiffermüller], 1775)	03 05 10 14 18 24 34 36 42 44 50 56 60 62 65	6	1
	Euplagia quadripunctaria (Poda, 1761)	01 05 06 07 08 09 13 14 16 21 25 29 31 33 34 35 36 41 45 46 48 51 52 53 56 58 60 62 65 75 78	33	4
	Euproctis chrysorrhoea (Linnaeus, 1758)	04 05 06 08 12 13 14 16 19 24 25 36 38 42 46 49 50 55 56 58 60 65 66 71 75 76	7,8,9,10,11	10
	Grammodes stolida (Fabricius, 1775)	01 05 06 07 08 09 16 18 31 33 35 36 39 44 56 62 63 65 73 76	5,24,28,30,37	13
	Lygephila amasina (Staudinger, 1879)	01 03 04 05 06 07 08 11 13 18 24 25 32 33 36 42 49 50 51 56 58 62 65 66 70	5,6,10,11,14,2 0,21,23,28,33, 34	45
	Lygephila craccae (Fabricius, 1787)	01 05 06 07 08 12 13 14 16 17 18 22 23 24 25 29 30 31 33 36 42 44 48 49 50 56 58 60 62 63 65 75 76	5,6,10,16,18,2 0,21,22,23,30, 31,33,34,35,37	42
	Lymantria dispar (Linnaeus, 1758)	06 07 10 11 12 13 17 19 23 25 30 31 33 36 46 48 49 50 56 62 65 71 76	31,32,34	3
	Manulea costalis (Zeller, 1847)	01 06 07 08 10 16 25 33 34 36 42 45 46 48 51 53 56 75	4,6,8,12,16,19	16
	Pericyma albidentaria (Freyer, [1841])	06 09 19 23 33 35 36 42 44 46 47 50 51 56 58 66 70 76	24,25,28,30,37	19
	Phragmatobia placida (Frivaldsky, 1835)	04 05 06 10 13 21 23 30 31 32 33 36 42 43 46 50 51 55 56 58 60 65 73	29	1
	Phytometra viridaria (Clerck, 1759)	04 05 07 08 11 14 16 22 25 32 33 39 42 50 54 58 59 60 65	8,10,12,13	11
	Tyria jacobaeae (Linnaeus, 1758)	04 05 06 07 13 16 19 23 25 29 30 34 36 48 60 65 71	37	2

Table 3
The collecting stations of the macrolepidoptera species from Sündiken Mountains and their distributions in Turkey (continues)

Family	**Species**	**Distribution**	**Station Number**	**Specimens Number**
Erebidae	*Zekelita antiqualis* (Hübner, [1809])	01 03 05 06 07 08 12 13 16 17 18 24 30 32 33 35 36 37 42 44 45 46 47 48 50 51 56 58 62 65 67 70 73	10,13,22,23,28, 35,36,37	51
	Zekelita ravalis (Herrich-Schäffer, [1852])	01 05 06 07 08 13 18 24 25 27 30 31 33 35 42 44 46 47 50 56 58 62 65 69 70 76	10,17,24,25,26, 28	17
	Zethes insularis Rambur, 1833	02 05 07 10 14 16 21 22 31 33 35 42 45 48 56 63	28	2
Cossidae	*Cossus cossus* (Linnaeus, 1758)	01 05 06 12 13 14 16 17 19 23 25 30 36 42 46 49 53 55 56 58 60 61 62 65 70 73 76	24	1
Drepanidae	*Cilix asiatica* A. Bang-Haas, 1907	05 06 07 10 12 13 17 21 30 31 33 36 42 44 45 46 47 49 50 56 58 60 65 71 73	5,12,35	3
	Watsonalla binaria (Hufnagel, 1767)	02 05 06 08 10 12 13 14 16 21 30 31 42 46 49 50 53 56 62 65 71 73 75	1,5,6	9
Geometridae	*Ascotis selenaria* ([Denis & Schiffermüller], 1775)	01 05 10 14 16 17 21 22 31 33 34 45 46 52 56 57 61 65 81	8,9,12,13,23,29 ,34	12
	Biston stratarius (Hufnagel, 1767)	01 05 13 33 34 42	44	1
	Camptogramma bilineata (Linnaeus, 1758)	01 02 05 06 10 13 14 16 17 18 21 22 23 28 30 33 34 35 36 38 39 42 44 45 46 48 52 56 57 59 60 65 73 80	4,16	2
	Chiasmia aestimaria (Hübner, [1809])	08 16 30 42 46 48 56 65	35	8
	Chiasmia clathrata (Linnaeus, 1758)	02 05 06 10 13 14 16 18 21 22 30 31 33 34 36 42 46 49 50 56 65 71 75 80 81	29	1
	Chloroclysta siterata (Hufnagel, 1767)	14 33 46 56 65 75	42,43	3
	Cidaria fulvata (Forster, 1771)	06 13 14 24 29 42 58 61 65 69 75 76	2,12,13	6
	Comibaena bajularia ([Denis & Schiffermüller], 1775)	07 13 14 31 32 37 39 42 52 57 60 61	22	3
	Crocallis inexpectata Warnecke, 1940	05 08 18 25 33 42 50 51 52 56 58 62 65 66	20,32,34	11
	Dyscia innocentaria (Christoph, 1885)	01 05 06 07 13 14 16 17 18 20 21 25 27 30 34 35 36 38 42 44 45 46 47 50 56 65 71	19,20,24,30	14
	Eilicrinia cordiaria (Hübner, 1790)	01 02 05 06 09 13 14 16 18 22 24 30 36 38 42 44 45 46 51 56 58 59 61 65 71 73	37	21
	Eumera regina Staudinger, 1892	05 14 33 42 58	6,12	2
	Heliomata glarearia (Brahm, 1791)	01 05 06 13 14 16 29 30 36 37 39 43 49 56 60 65 71 75 76	29	1
	Hydria cervinalis (Scopoli, 1763)	05 06 17 24 29 51 58	42	2
	Idaea ostrinaria (Hübner, [1813])	01 07 16 17 31 33 42 44 46 59 60 71 80	23	5
	Ligdia adustata ([Denis & Schiffermüller], 1775)	05 14 16 18 22 33 39 53 61 81	43	5
	Menophra berenicidaria (Turati, 1924)	07 81	35	3

Table 3
The collecting stations of the macrolepidoptera species from Sündiken Mountains and their distributions in Turkey (continues)

Family	**Species**	**Distribution**	**Station Number**	**Specimens Number**
Geometridae	*Narraga cappadocica* Herbulot, 1943	06 18 38 58 71	26	8
	Neognopharmia stevenaria (Boisduval, 1840)	01 02 05 06 08 13 14 16 17 21 22 25 27 30 31 36 42 44 46 56 61 65	12,23	7
	Orthostixis cribraria (Hübner, [1799])	01 05 06 12 13 14 16 17 29 31 33 42 46 56 65 72 75 80	16	1
	Rhodostrophia auctata (Staudinger, 1879)	01 05 06 12 13 24 25 29 38 42 43 44 46 49 50 51 56 57 58 61 62 65 69 70 71 76	29	1
	Rhodostrophia vibicaria (Clerck, 1759)	05 13 14 22 25 29 34 38 39 42 52 57 59 60 61 65 69 75 76 81	2,7,8,9,12,13,20,22,29	33
	Thetidia smaragdaria (Fabricius, 1787)	05 06 16 36 42 65 71	25,30	14
Lasiocampidae	*Dendrolimus pini* (Linnaeus, 1758)	03 05 06 08 11 14 17 19 24 25 36 37 42 46 53 60 61 62 70 75	1,2,5,6,8,9,12,13,18,23,32,33,34	63
	Malacosoma castrensis (Linnaeus, 1758)	02 04 05 06 12 13 14 16 23 24 25 30 33 35 36 38 42 44 53 56 58 60 65 71 76	26,30	4
	Malacosoma neustria (Linnaeus, 1758)	05 06 08 12 13 14 17 19 22 23 25 30 32 33 35 36 37 42 46 49 53 55 58 60 61 62 65 71	23,26	6
	Pachypasa otus (Drury, [1773])	05 13 16 21 30 31 33 35 56 62 65 73	1,33,34	7
	Phyllodesma tremulifolium (Hübner, [1810])	01 05 06 07 10 12 13 24 25 30 31 32 33 36 42 46 49 56 58 60 62 64 65 71	27	1
Noctuidae	*Abrostola triplasia* (Linnaeus, 1758)	04 05 08 13 16 18 25 28 31 36 37 38 39 41 53 65 75	28	1
	Acontia lucida (Hufnagel, 1766)	01 05 06 13 16 18 23 24 30 31 32 33 34 35 41 42 46 50 51 58 65 71 73 76	27	1
	Acontia trabealis (Scopoli, 1763)	01 04 05 06 07 08 11 13 16 18 30 32 33 36 38 41 42 46 50 55 56 58 59 60 65 66 71 75 76	1,5,21,23,25,26,27,28,30	27
	Acronicta aceris (Linnaeus, 1758)	01 02 05 06 07 13 16 17 24 25 30 31 33 35 36 37 39 42 46 47 50 56 58 62 65 73 76	8	1
	Acronicta aceris (Linnaeus, 1758)	01 02 05 06 07 13 16 17 24 25 30 31 33 35 36 37 39 42 46 47 50 56 58 62 65 73 76	8	1
	Aedia leucomelas (Linnaeus, 1758)	01 05 07 11 16 28 30 34 52 55 59	37	1
	Aedophron rhodites (Eversmann, 1851)	01 05 07 11 16 28 30 34 52 55 59	24	1
	Agrotis bigramma (Esper, [1790])	01 03 05 06 07 08 13 14 18 21 25 33 36 42 46 50 56 58 59 61 62 63 65 70 73 75	32,34	2
	Agrotis exclamationis (Linnaeus, 1758)	01 03 04 05 06 07 08 12 13 14 18 24 25 28 30 33 34 36 37 39 36 42 44 45 46 50 51 55 58 60 65 71	27,29,33	18
	Agrotis ipsilon (Hufnagel, 1766)	01 03 05 06 07 08 11 13 14 15 16 18 20 21 25 27 29 30 31 32 33 35 36 37 42 44 46 47 48 49 50 51 56 57 58 62 63 65 67 69 71 73 80	32	1

Table 3
The collecting stations of the macrolepidoptera species from Sündiken Mountains and their distributions in Turkey (continues)

Family	**Species**	**Distribution**	**Station Number**	**Specimens Number**
Noctuidae	*Amphipyra pyramidea* (Linnaeus, 1758)	01 05 06 08 14 16 30 31 33 43 56 59	4	1
	Amphipyra stix Herrich-Schäffer, [1850]	01 05 06 08 13 15 25 30 32 36 41 42 50 56 62 65 73	1,32	3
	Autographa gamma (Linnaeus, 1758)	01 03 04 05 06 07 08 10 13 14 16 17 18 19 21 24 25 26 28 30 31 32 33 35 37 38 39 42 43 44 48 49 50 51 52 56 58 61 62 63 65 66 73 75 76 80	28,32	2
	Calamia staudingeri Warnecke, 1941	01 04 13 25 30 36 38 42 51 58 65 76	24	3
	Chersotis fimbriola (Esper, [1803])	01 03 04 05 06 08 12 13 18 19 23 24 25 29 30 36 38 42 44 46 49 50 51 56 58 60 65 66 69 70 73 76	12,24	4
	Dicycla oo (Linnaeus, 1758)	01 02 05 06 07 08 11 17 18 21 22 28 30 33 38 39 42 46 47 56 65	21,23	9
	Epilecta linogrisea ([Denis & Schiffermüller], 1775)	01 03 05 06 08 16 17 31 33 42 46 50 56 62 65	4,20,31,32,33,34,37	18
	Episema tersa ([Denis & Schiffermüller], 1775)	06 07 13 14 18 21 25 42 46 49 50 51 56 58 62 65	20	1
	Hadena compta ([Denis & Schiffermüller], 1775)	03 04 05 06 08 13 16 18 24 25 29 30 32 33 36 42 46 49 50 51 56 58 60 62 63 65 66 76	7,11,13	3
	Anarta mendax (Staudinger, 1879)	01 02 05 06 07 13 16 18 20 24 25 27 29 30 31 33 36 37 38 42 46 49 50 51 56 58 60 65 66 70	37	2
	Haemerosia renalis (Hübner, [1813])	05 06 09 12 13 15 16 25 30 32 33 36 40 42 46 47 50 56 62 65 66 73	5,7,8,10,11,12,17	11
	Helicoverpa armigera (Hübner, [1808])	01 04 05 06 08 13 14 16 20 25 26 28 30 31 33 36 37 44 46 47 49 50 51 53 56 57 58 61 63 65 71 75	14	1
	Heliothis peltigera ([Denis & Schiffermüller], 1775)	01 05 06 07 08 09 13 16 18 20 21 24 25 27 30 31 33 35 36 38 42 44 45 46 50 51 56 58 63 65 66 73 75 80	1	1
	Lacanobia w-latinum (Hufnagel, 1766)	04 05 06 11 13 18 21 24 25 28 30 33 34 36 37 39 42 49 50 58 60 61 65	28,29	2
	Mesogona acetosellae (Goeze, 1781)	05 06 14 18 24 25 30 36 38 56 58 65	20	9
	Mythimna l-album (Linnaeus, 1767)	05 06 07 08 10 12 13 16 17 18 21 25 30 31 32 33 34 36 38 39 42 44 45 46 49 50 51 56 58 61 62 63 65 69 80	1,18,23,30	9
	Mythimna riparia (Rambur, 1829)	10 22 48 60 63	28	1
	Mythimna vitellina (Hübner, [1808])	01 02 03 05 06 07 08 09 13 16 17 18 21 22 23 24 25 27 28 29 30 31 33 34 35 36 37 39 42 44 45 46 48 49 50 51 52 56 58 62 63 65 73 75 76 80	3,4,5,15,16,17,18,19,20,24,25,26,27,28,31,32,33,34,35	158
	Noctua fimbriata (Schreber, 1759)	03 05 06 07 08 12 13 14 16 18 25 29 30 39 42 43 46 49 51 56 59 60 62 65 73 80	2,3,12,19,20,32,33,34,37	17
	Noctua haywardi (Tams, 1926)	01 05 06 07 09 11 14 17 18 22 33 42 43 51 65 66	3,6,8,9,12,13,15,16,18,32,33,37	57

Table 3
The collecting stations of the macrolepidoptera species from Sündiken Mountains and their distributions in Turkey (continues)

Family	**Species**	**Distribution**	**Station Number**	**Specimens Number**
Noctuidae	*Noctua interposita* (Hübner, 1790)	65	7,8,9,20,21,22,28,29,32,37	22
	Noctua orbona (Hufnagel, 1766)	01 03 04 05 06 07 08 13 14 16 17 18 21 23 25 27 28 30 31 36 38 39 42 43 46 47 50 51 56 58 59 60 62 63 65 66 70	1,3,4,5,12,16,18,20,21,22,23,26,28,29,32,33,35	68
	Noctua pronuba (Linnaeus, 1758)	01 04 05 06 07 08 13 14 16 17 18 21 24 27 28 31 33 34 35 36 39 42 43 44 45 46 50 51 56 58 59 60 61 62 63 65 71 73	1,3,9,12,23,25,26,28,31,32,34	27
	Olivenebula subsericata (Herrich-Schäffer, 1861)	03 05 08 13 16 17 18 30 33 34 35 42 46 50 58	3,33,34	8
	Panolis flammea ([Denis & Schiffermüller], 1775)	06 16 42 43	42	1
	Periphanes delphinii (Linnaeus, 1758)	01 04 05 06 07 18 22 23 24 25 32 36 42 44 46 50 51 58 60 65 66 76	25,26	2
	Scotochrosta pulla ([Denis & Schiffermüller], 1775)	06 13 24 25 30 42 56 62	19,20	6
	Teinoptera oliva (Staudinger, [1895])	01 18 24 25 32 37 42 44 50 51 58 60 70	9,24,25,26,28,35,37	42
	Thalerastria diaphora (Staudinger, 1879)	05 06 08 09 13 18 24 25 30 33 36 42 44 47 50 51 58 65 69 70 73 76 0	25,38,45,46,47,48	28
	Thalpophila matura (Hufnagel, 1766)	17 37 40 57 61	1,3,5,20	9
	Tyta luctuosa ([Denis & Schiffermüller], 1775)	01 02 04 05 06 07 08 11 13 14 16 17 18 22 23 25 30 31 32 33 34 35 36 38 42 44 46 50 51 56 58 60 61 62 63 65 66 67 69 70 71 75 76	1,7,10,12,23,28,34	10
	Valeria oleagina (Esper, [1786])	04 06 09 13 15 21 30 42 43 46 47 56 58 65 73	39,40,42,43,44	12
	Xestia c-nigrum (Linnaeus, 1758)	05 13 28 34 33 36 50 51 56 58 60 61 65 75	20	1
	Xylena exsoleta (Linnaeus, 1758)	01 05 06 09 13 15 25 26 33 36 45 46 50 65 66	42	1
Nolidae	*Bena bicolorana* (Fuessly, 1775)	01 02 05 06 11 13 17 18 21 33 39 42 46 48 56 62 73	6,33	2
Notodontidae	*Harpyia milhauseri* (Fabricius, 1775)	05 06 07 10 12 13 14 21 24 30 31 33 37 42 46 48 49 53 56 60 62 64 65 66 71 73	43	2
	Phalera bucephala (Linnaeus, 1758)	05 12 13 14 16 17 24 25 32 36 42 49 53 56 58 60 61 65	8	1
	Phalera bucephaloides (Ochsenheimer, 1810)	06 07 12 13 14 21 24 30 31 37 42 56 62	11,20	2
	Pterostoma palpinum (Clerck, 1759)	06 12 13 14 16 19 24 25 30 32 36 37 42 46 49 50 56 60 62 65 71	27	1
	Spatalia argentina ([Denis & Schiffermüller], 1775)	01 02 05 06 07 08 10 12 13 14 16 17 18 19 20 21 24 30 31 32 33 35 42 46 49 56 61 62 64 65 66 71 73 80	16,23	2
	Thaumetopoea pityocampa ([Denis & Schiffermüller], 1775)	01 05 07 09 10 16 19 31 33 34 42 46 48 55 59 60 70	14,15,33	14
Sphingidae	*Deilephila porcellus* (Linnaeus, 1758)	05 06 13 16 33 35 45 58 60 71	29	1
	Deilephila suellus Staudinger, 1878	01 04 05 06 07 12 13 19 25 30 32 42 49 50 58 60 61 65 66 70 71	27,29	2

Table 3
The collecting stations of the macrolepidoptera species from Sündiken Mountains and their distributions in Turkey (continues)

Family	Species	Distribution	Station Number	Specimens Number
Sphingidae	*Hyles euphorbiae* (Linnaeus, 1758)	01 05 06 07 09 10 13 14 15 16 17 20 21 24 25 30 32 33 35 36 42 45 44 46 47 48 50 51 56 58 60 63 65 70 73 76	28	1
	Laothoe populi (Linnaeus, 1758)	02 05 06 12 13 25 30 32 36 42 44 46 48 53 56 60 65 71 75	14	11
	Marumba quercuss ([Denis & Schiffermüller], 1775)	01 02 05 06 07 10 12 13 19 21 30 31 33 42 46 47 48 49 56 62 65 73	21,28	6
	Rethera komarovi (Christoph, 1885)	02 05 06 13 23 30 36 42 44 46 56 60 65 66 70 71	30,25	2
	Sphinx pinastri Linnaeus, 1758	05 06 08 09 10 15 17 19 31 32 33 36 42 46 60	1,2,5,8,12,18, 31,32,34	30

Table 4
Comparison of the macroheterocera species identified in the study area and the groups they belong with the existing literature.

Distribution of Types in the Study Area		
Family	**Number of species identified**	**Number of species in literature**
Erebidae Leach, [1815]	23	5
Cossidae Leach, [1815]	1	2
Drepanidae Boisduval, 1828	2	-
Geometridae Leach, 1815	23	5
Lasiocampidae Hanis,1841	5	-
Nolidae Bruand,1847	1	-
Noctuidae Latreille,1809	45	17
Notodontidae Stephens,1828	6	2
Sphingidae Latreille, [1802]	7	-
Saturniidae	-	2
Hepialidae	-	2
Total	**113**	**34**

22 species identified from the study area are included in the list of agricultural and forest damage. *Arctia villica* (Linnaeus, 1758), *Euplagia quadripunctaria* (Poda, 1761), *Cossus cossus* (Linnaeus, 1758), *Dendrolimus pini* (Linnaeus, 1758), *Malacosoma neustria* (Linnaeus, 1758), *Pachypasa otus* (Drury, [1773]), *Euproctis chrysorrhoea* (Linnaeus, 1758), *Lymantria dispar* (Linnaeus, 1758), *Thaumetapoea pityocampa* ([Denis & Schiffermüller], 1775), *Amphipyra pyramidea* (Linnaeus, 1758), *Bena bicolorana* (Fuessly, 1775), *Phalera bucephala* (Linnaeus, 1758), *Acronicta aceris* (Linnaeus, 1758), known as a forest pests (Karl, 1871, Bodenheimer, 1941, Keyder, 1961). *Cossus cossus* (Linnaeus, 1758), *Agrotis ipsilon* (Hufnagel, 1766), *Agrotis exclamationis* (Linnaeus, 1758), *Helicoverpa armigera* (Hübner, [1808]), *Heliothis peltigera* ([Denis & Schiffermüller], 1775) are known as agricultural pests (Anonymous, 2008a, 2008b, Keyder, 1961).

160 species are known in Eskişehir province (Nizamoğlu, 1962, 1963; Çanakçıoğlu, 1963; İren, 1972, İren and Bulut, 1981, Kornoşor, 1992, Seven [Çalışkan], 2014; Koçak & Kemal, 2018). Of these, 101 species belong to butterflies and 59 species belong to moths. Of the 59 moth records, only 34 belong to macrolepidoptera. In this study, 113 species belonging to 10 families were identified in the macroheterocera. 4 families (Drepanidae, Nolidae, Lasiocampidae, Sphingidae) were identified for the first time from Eskişehir. The number of identified species and the families they belong to were compared with the literature data (Table 4). With this study, the number of Lepidoptera species of Eskişehir increased from 160 to 266.

Distribution of species by families: Erebidae (23), Noctuidae (45), Geometridae (23), Sphingidae (7), Cossidae (1), Drepanidae (2), Lasiocampidae (5), Nolidae (1), Notodontidae (6). Noctuidae family is the most crowded family in the study area with 61 species. Cossidae and Nolidae family are represented by a single species in the region (Figure 3).

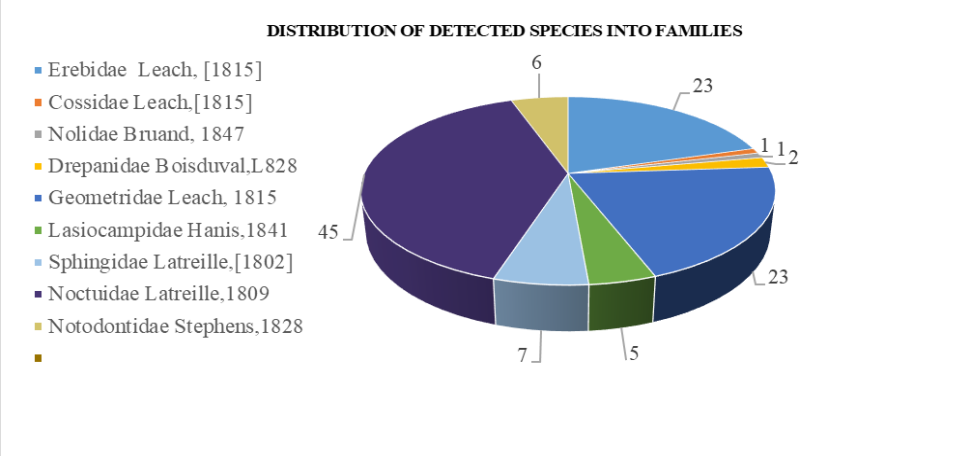

Figure 3. Distribution of identified species into families

4. Conclusion

The species of *Narraga* are indicators and are found only in the *Artemisia* steppe (Skou & Sihvonen, 2015). Three species of this genus are known in Turkey (*N. cappadocica, N. fasciolaria, N. tessularia*) (Koçak & Kemal, 2018). *Narraga* specimens identified from the research area show similarity with sp.*cappadocica* the most with their external morphology and male genitalia. This species has been defined as a subspecies of *nelvae* (*Narraga nelvae* ssp. *cappadocica* Herbulot, 1943 locus typicus [Türkei, Kappadokien, Kayseri]). The taxon with a 5% molecular difference was increased to the species (Skou & Sihvonen, 2015). The population of this endemic species in Turkey need to be investigated.

Laothoe populeti has been defined from Northern Iran by Bienert (1870). According to Danner et al. (1998), this species spreads in Turkey and western Iran. This species has been for a long time listed from Türkiye as *L. populi* (Mathew, 1881, Rebel, 1903, Acatay 1959, Kansu, 1963, de Freina, 1979, Kornosor & Sertkaya, 1996, Mol & Avcı, 1997, Kaygın et al., 2009) and quite recently this identification was changed to *L. populeti* Didmanidze et al. (2013) compared the molecular data of these two species and according to COI stated that they were genetically different. Zolotuhin (2018) revised the genus *Laothoe. L. populi* is common in Europe and *L. populeti* is widespread in Iran and Turkey. Danner et al. (1998) stated in their study that it is not yet known whether *L. populi* is on the European side of Turkey and therefore penetrates the Turkish peninsula. The specimens examined in this study were compared with the male genital structures of the sp. *populi* and sp. *populeti* (Zolutuhin, 2018). The spines in the vesica, which is especially emphasized in the species distinction, and the distribution of the spines are the same as in *L. populi*. This study confirmed the existence of *L. populi* in Turkey. The distribution areas of these two species should be identified with the samples to be taken from different regions of Turkey and the status of the species should be examined.

Lygephila lusoria is included in the Erebidae. Staudinger (1878) identified *L. lusoria var. amasina* from Turkey. In previous studies, samples from Turkey were reported as *L. lusoria*. In recent studies, it is given as *L. amasina* (Babics & L. Ronkay, 2009, Fibiger et al., 2010, Pekarsky, 2013, Koçak et al., 2021). This taxon has also been reported from Rhodes outside of Turkey (Fibiger et al., 2010). *Lygephila lusoria lusoria* is the largest representative of the species group. It differs from *Lygephila amasina* by a less contrasting wing pattern and sharp inner corner of the kidney-shaped stigmata. In Europe it extends from Spain to Bulgaria, from Ukraine to southern Russia and western Kazakhstan (Uralsk). The distribution of *L. amasina* is known as

Turkey, Lebanon and Israel (Pekarsky, 2013). The presence of *Lygephila lusoria*, which spreads in the Western Palearctic, in Turkey (especially in the Thrace region) should be investigated.

Considering the contribution of the number of Macroheterocera species detected in this study to Eskişehir province, it is expected that the number of Lepidoptera will increase significantly with new studies to be conducted in the field. The detailed data given with this study will make significant contributions to the future type protection activities.

Author Contributions

Author Nebahat Kocasaraç: Laboratory studies, collected data and wrote the article.

Author Selma Seven Çalışkan: Planned the study, checked species diagnoses, evaluated data and wrote the article

Author Mustafa Özdemir: Checked species diagnoses, evaluated data and wrote the article.

Conflict of Interest

Authors declared no conflict of interest.

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