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**Research Article/Araştırma Makalesi**

# A STUDY ON THE GENUS *Sphaeridium* FABRICUS, 1775 (COLEOPTERA: HYDROPHILIDAE) IN KÜTAHYA PROVINCE, WESTERN TURKEY

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**Abstract:** Coprophilous Hydrophilidae were sampled from June 2010 to May 2011 using baited pitfall traps in 14 localities at different altitudes (469m-1810m) in Kütahya, western Turkey. As a result of the study, a total of 668 samples belonging to 5 species were identified. The identified specimens are *Sphaeridium bipustulatum* Fabricius, 1781, *S. lunatum* Fabricius, 1792, *S. marginatum* Fabricius, 1787, *S. scarabaeoides* (Linnaeus, 1758) and *S. substriatum* Faldermann, 1838, among which *S. lunatum* is recorded from Turkey for the first time. *S. bipustulatum* and *S. marginatum*, which made up 80.69% of all collected beetles determined as eudominante. The highest number of specimens was obtained from December to April meaning that the *Sphaeridium* community in the study area reached its highest number in winter and spring.

***Key words:*** Coleoptera, Hydrophilidae, *Sphaeridium*, coprophilous, new records, seasonal dynamics.

## Türkiye'nin Batısında, Kütahya İlinde *Sphaeridium* Fabricus, 1775 (Coleoptera: Hydrophilidae) Cinsi Üzerine Bir Çalışma

**Özet:** Türkiye batısında Kütahya'da, Haziran 2010'dan Mayıs 2011'e kadar, 14 lokalitede ve farklı yüksekliklerde (469m-1810m) yemli çukur tuzaklar kullanılarak koprofil Hydrophilidae örnekleri toplanmıştır. Çalışma sonucunda toplam 5 türe ait 668 örnek tespit edilmiştir. Toplanan örneklerin *Sphaeridium bipustulatum* Fabricius, 1781, *S. lunatum* Fabricius, 1792, *S. marginatum* Fabricius, 1787, *S. scarabaeoides* (Linnaeus, 1758) ve *S. substriatum* Faldermann, 1838 türlerine ait oldukları belirlenmiştir. *S. lunatum* Türkiye'den ilk kez kayıt edilmiştir. Toplanan böceklerin %80,69'unu oluşturan *S. bipustulatum* ve *S. marginatum* en baskın türler olarak belirlenmiştir. Aralık ayından Nisan ayına kadar yoğun örnek elde edilmiş olması, çalışma alanı içerisindeki *Sphaeridium* popülasyonlarının kış ve ilkbahar döneminde en yüksek birey sayılarına ulaştığını göstermektedir.

***Anahtar kelimeler:*** Coleoptera, Hydrophilidae, *Sphaeridium*, koprofil, yeni kayıtlar, mevsimsel aktivite.

## Introduction

Members of the family Hydrophilidae are mostly represented with an aquatic lifestyle but a third of all known species of the family are terrestrial scavengers. The colonization of terrestrial habitats occurred secondarily multiple times and terrestrial taxa are therefore found in five of six existing subfamilies although the vast majority of terrestrial taxa belong to a single subfamily Sphaeridiinae (Short & Fikáček 2013) which currently contains nearly 1,000 described species (Hansen 1999, Short & Hebauer 2006, Short & Fikáček 2011). Sphaeridiinae members are terrestrial organisms living in various kinds of decaying organic matter. In northern temperate zones, most of the species within this subfamily are coprophagous and colonize animal droppings in early stages of decomposition (Fikáček 2010). Unlike most aquatic hydrophilids whose life cycles are known, several terrestrial species apparently have two generations per year (Hansen 1987).

The community structures and seasonal dynamics of coprophagous hydrophilid beetles have been reported so far for beetles from various regions of the world (Hanski 1980a, Koskela & Hanski 1977, Przewoźny & Bajerlein 2010, Šlachta *et al.* 2010, Šlachta 2013, Mroczyński & Radoslav 2014, Wassmer 2014) but studies in Turkey on the same subject was performed only in western parts of the country (Anlaş *et al.* 2008, Anlaş 2011).

The known members of terrestrial Hydrophilidae in Turkey belong to 19 species classified within four genera: *Cercyon* Leach (13 spp.), *Cryptopleurum* Mulsant (1 sp.), *Megasternum* Mulsant (1 sp.) and *Sphaeridium* Fabricius (4 spp.) (Darilmaz & İncekara 2011). Terrestrial species were generally not included in studies concerning Turkish Hydrophilidae since most of them focused mainly on aquatic hydrophilid beetles. The main purpose of this study is to analyse community structure and seasonal

dynamics of coprophagous hydrophilid beetles in Kütahya province.

## Materials and Methods

*Study Area*

Kütahya province is situated between 38º70'-39º80'N and 29º00'-30º30'E in the interior western Anatolian part of Aegean Region of Turkey. The geographical layout of the study area and the sampled localities are given in Fig.1.

Locality 1: The sampled area is located along a river, thus shows characteristics of a riparian habitat. The traps in this locality were set up in a plantation of *Pinus brutia* Ten, *Fraxinus* sp., *Onopordum* sp., *Verbascum* sp., *Mentha* sp., *Juncus* sp. and *Epilobium* sp.

Locality 2: *Alcea* sp., *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Paliurus spina-christi* P. Mill. and *Rubus* sp. The locality is characterized by a mix forest with a neighboring open area.

Locality 3: *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Rubus* sp. and *Salix* sp. Near the forest.

Locality 4: *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe and *Quercus* sp. Mix forest.

Locality 5: *Quercus* sp., Open area and grassland.

Locality 6, 7, 8, 9: *Juniperus* sp., *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Quercus* sp. Mix forest.

Locality 10: *Juniperus* sp., *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe. Mix forest.

Locality 11: *Cedrus libani* A. Rich., *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Quercus* sp., *Verbascum* sp. and *Rosa* sp. Mix forest.

Locality 12: *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Verbascum* sp., *Juniperus* sp. and *Astragalus* sp. Open area near a mix forest. Grassland.

Locality 13: *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Verbascum* sp., and *Populus* sp. Open area near a mix forest.

Locality 14: Near the military radar of Kütahya. *Acantholimon* sp., *Verbascum* sp., *Astragalus* sp. Grassland.

*Sampling Method*

Samplings were performed from June 2010 to May 2011 in 14 different localities within the study area with altitudes ranging from 469m to 1810m. Altitudes and geographic coordinates of the sampling localities are given in Table 1. A single sampling station was chosen for each locality and samplings were performed in a manner to keep an average of 100m altitude increase from one to another locality (Table 1). All specimens were collected by using baited pitfall traps with 1,000gr of fresh cow dung. The trap consisted of a plastic bucket (20cm in height and 25cm in diameter) buried in the soil with its rim at ground level. The upper part of the trap was filled with fresh dung placed on a wire mesh. Water, liquid detergent and 4% formaldehyde was used as the preserving fluid. Traps were placed in the field for 3 days (72 hours) each month from June 2010 to May 2011.


**Fig. 1.** The sampled localities in study area. Each number represents a single locality.

**Table 1.** Coordinates and altitudes of the localities.

| Loc. No | Localities | Latitude | Longitude | Altitude (m) |
|---|---|---|---|---|
| 1 | Kütahya-Tavşanlı-Balıköy | 39°29.572′ | 29°11.088′ | 469 |
| 2 | | 39°29.353′ | 29°13.939′ | 560 |
| 3 | | 39°30.472′ | 29°18.765′ | 666 |
| 4 | | 39°31.055′ | 29°20.836′ | 790 |
| 5 | Kütahya-Tavşanlı-Kayı Village | 39°31.794′ | 29°35.168′ | 893 |
| 6 | Kütahya-Siner Village | 39°23.032′ | 30°02.547′ | 988 |
| 7 | | 39°21.974′ | 30°02.164′ | 1090 |
| 8 | | 39°21.831′ | 30°01.308′ | 1190 |
| 9 | | 39°21.624′ | 30°00.567′ | 1290 |
| 10 | Kütahya-Aydoğdu Village | 39°24.946′ | 29°55.268′ | 1391 |
| 11 | | 39°24.838′ | 29°54.722′ | 1478 |
| 12 | | 39°24.592′ | 29°53.987′ | 1582 |
| 13 | | 39°24.334′ | 29°53.040′ | 1688 |
| 14 | | 39°24.348′ | 29°52.506′ | 1810 |

Hansen (1987) was used to identify the species. The taxonomic characters including size of the beetle, posterior margin of pronotum, apical elytral spots, subhumeral spots, colour of the pronotum and meso- and metafemora were used to identify the species. Aedeagus were dissected out under a stereo microscope (Zeiss Stemi 2000) and kept in 10% KOH solution for 1-2h. Voucher specimens are deposited in entomology museum of the Biology Department at Dumlupınar University.

The following equation (1) was used as a measure of dominance (D) which, according to Tischler (1977), describes the relative abundance of a species within a community.

$$D = \frac{b}{a * 100} \quad (1)$$

where "b" represents number of individuals of a particular species and "a" represents number of total individuals.

The Dominance scale (given below) according to Engelmann (1978) was used.

| | |
|---|---|
| 6 (eudominant) | $> 32.0 \leq 100\%$ |
| 5 (dominant) | $> 10.0 \leq 32.0\%$ |
| 4 (subdominant) | $> 3.2 \leq 10.0\%$ |
| 3 (recedent) | $> 1.0 \leq 3.2\%$ |
| 2 (subrecedent) | $>0.32 \leq 1.0\%$ |
| 1 (sporadic) | $\leq 0.32\%$ |
| 0 (missing) | $= 0\%$ |

**Results**

The evaluation of the collected material showed that a total of 668 specimens belonging to five species were sampled. The species were identified as *Sphaeridium bipustulatum*, *S. lunatum*, *S. marginatum*, *S. scarabaeoides* and *S. substriatum*. Among them which *S. lunatum* (Fig. 2) is recorded from Turkey for the first time.

The details of the material collected were given below. Each species determined during the study was given with the sampled localities and sampling numbers. The distributional ranges of each species in the Palaearctic Region were also given in addition to their Turkey distributions.

Family HYDROPHILIDAE Latreille

Subfamily Sphaeridiinae Latreille

Tribus Sphaeridiini Latreille

Genus *Sphaeridium* Fabricus

*Sphaeridium bipustulatum* Fabricius, 1781

**Material examined: 1:** 15-18.VI.2010, 4 exs.; 15-18.VII.2010, 12 exs.; 15-18.VIII.2010, 27 exs.; 15-18.IX.2010, 9 exs.; 16-19.X.2010, 1 ex.; 18-21.V.2011, 10 exs.; **2:** 15-18.VI.2010, 13 exs.; 15-18.VII.2010, 5 exs.; 15-18.IX.2010, 6 exs.; 18-21.V.2011, 18 exs.; **3:** 15-18.VIII.2010, 1 ex.; 15-18.IX.2010, 30 exs.; 16-19.X.2010, 1 ex.; 15-18.XI.2010, 1 ex.; 18-21.V.2011, 9 exs.; **4**: 15-18.VI.2010, 2 exs.; 15-18.VII.2010, 1 ex.; 15-18.VIII.2010, 29 exs.; 15-18.IX.2010, 6 exs.; 16-19.X.2010, 6 exs.; 15-18.XI.2010, 6 exs.; 18-21.V.2011, 9 exs.; **5:** 15-18.VII.2010, 6 exs.; 15-18.VIII.2010, 2 exs.; 15-18.IX.2010, 5 exs.; 16-19.X.2010, 1 ex.; 18-21.V.2011, 4 exs.; **6:** 15-18.VIII.2010, 1 ex.; 15-18.IX.2010, 2 exs.; 18-21.V.2011, 3 exs.; **7:** 15-18.VII.2010, 2 exs.; 15-18.IX.2010, 1 ex.; 18-21.V.2011, 1 ex.; **8:** 15-18.IX.2010, 1 ex.; **9:** 15-18.VII.2010, 3 exs.; 15-18.VIII.2010, 2 exs.; 15-18.IX.2010, 1 ex.; 18-21.V.2011, 1 ex.; **10:** 15-18.VII.2010, 7 exs.; 15-18.VIII.2010, 4 exs.; 15-18.IX.2010, 1 ex.; **11:** 15-18.VI.2010, 1 ex.; 15-18.VIII.2010, 1 ex.; **13:** 15-18.VIII.2010, 2 exs.; 18-21.V.2011, 3 exs.; **14:** 15-18.VIII.2010, 4 exs.; 18-21.V.2011, 1 ex.; leg. and det. Şenyüz Y.

**Records in Turkey:** Afyon, İçel and İzmir (Darilmaz & İncekara 2011).

**Distribution in World: Europe:** Armenia, Austria, Azores, Belgium, Bosnia Herzegovina, Bulgaria, Belarus,

Croatia, Russia, *Central European Territory*, Czech Republic, Denmark, Estonia, Finland, France (incl. Corsica, Monaco), Great Britain (incl. Channel Islands), Germany, Hungary, Italy (incl. Sardinia, Sicily, San Marino), Latvia, Lithuania, Macedonia, Moldavia, The Netherlands, Norway, Russia, *North European Territory*, Poland, Portugal, Slovakia, Slovenia, Spain (incl. Gibraltar), Russia, *South European Territory*, Sweden, Switzerland, Ukraine, Serbia and Montenegro, **North Africa:** Algeria, Canary Islands, Egypt, Tunisia, **Asia:** Afghanistan, Russia: East Siberia, Israel, Kazakhstan, Mongolia, Tajikistan, Turkey, Russia: West Siberia, **America;** North of Mexico (Fikáček *et al.* 2015).


**Fig. 2.** Dorsal habitus of *S. lunatum.*

*Sphaeridium lunatum* Fabricius, 1792

**Material examined: 1:** 15-18.VI.2010, 1 ex.; 15-18.VII.2010, 1 ex.; 18-21.V.2011, 3 exs.; **2:** 15-18.VI.2010, 1 ex.; 18-21.V.2011, 3 exs.; **3:** 18-21.V.2011, 1 ex.; **4:** 15-18.VIII.2010, 2 exs.; 18-21.V.2011, 2 exs.; **9:** 15-18.VII.2010, 1 ex.; **10:** 15-18.VI.2010, 1 ex.; **11:** 15-18.VII.2010, 4 exs.; 15-18.IX.2010, 2 exs.; 18-21.V.2011, 1 ex.; **12:** 15-18.VI.2010, 1 ex.; leg. and det. Şenyüz Y.

**Records in Turkey:** This species was recorded for the first time for Turkish fauna.

**Distribituon in World: Europe:** Armenia, Austria, Belgium, Bulgaria, Belarus, Croatia, Russia, *Central European Territory*, Czech Republic, Denmark, Estonia, Finland, France (incl. Corsica, Monaco), Great Britain (incl. Channel Islands), Germany, Ireland, Italy (incl. Sardinia, Sicily, San Marino), Latvia, Lithuania, Norway, Russia, *North European Territory*, Poland, Slovakia, Slovenia, Spain (incl. Gibraltar), Sweden, Switzerland, Ukraine, Serbia and Montenegro, **North Africa:** Algeria, **Asia:** Russia: Far East, Israel, Jordan, Kazakhstan, Mongolia, China: Northwest Territory, Syria, Tajikistan, Russia: West Siberia, **America:** North of Mexico (Fikáček *et al.* 2015)**.**

*Sphaeridium marginatum* Fabricius, 1787

**Material examined: 1:** 15-18.VI.2010, 1 ex.; 15-18.VII.2010, 3 exs.; 15-18.IX.2010, 2 exs.; 18-21.V.2011, 2 exs.; **2:** 15-18.VI.2010, 7 exs.; 15-18.VII.2010, 1 ex.; 15-18.IX.2010, 3 exs.; 15-18.XI.2010, 2 exs.; 16-19.II.2011, 1 ex.; 16-19.III.2011, 1 ex.; 15-18.IV.2011, 1 ex.; 18-21.V.2011, 6 exs.; **3:** 15-18.VI.2010, 1 ex.; 15-18.VII.2010, 2 exs.; 15-18.IX.2010, 24 exs.; 16-19.X.2010, 8 exs.; 15-18.XI.2010, 12 exs.; 16-19.II.2011, 1 ex.; 16-19.III.2011, 1 ex.; **4:** 15-18.VI.2010, 1 ex.; 15-18.VII.2010, 3 exs.; 15-18.VII.2010, 28 exs.; 15-18.IX.2010, 8 exs.; 16-19.X.2010, 30 exs.; 16-19.III.2011, 1 ex.; 18-21.V.2011, 4 exs.; **5:** 15-18.VII.2010, 33 exs.; 15-18.VIII.2010, 5 exs.; c.; 16-19.X.2010, 15 exs.; 15-18.XI.2010, 1 ex.; 15-18.IV.2011, 2 exs.; 18-21.V.2011, 1 ex.; **6:** 15-18.VIII.2010, 1 ex.; 16-19.X.2010, 3 exs.; 18-21.V.2011, 6 exs.; **7:** 15-18.VII.2010, 2 exs.; 15-18.IX.2010, 1 ex.; 16-19.X.2010, 1 ex.; **8:** 15-18.VII.2010, 5 exs.; **10:** 15-18.VII.2010, 14 exs.; 15-18.VIII.2010, 2 exs.; **11:** 15-18.VI.2010, 1 ex.; 15-18.VII.2010, 2 exs.; 15-18.IX.2010, 2 exs.; 18-21.V.2011, 1 ex.; **12:** 15-18.VI.2010, 1 ex.; 15-18.IX.2010, 1 ex.; 16-19.X.2010, 1 ex.; **13:** 15-18.VI.2010, 1 ex.; 15-18.IX.2010, 2 exs.; 18-21.V.2011, 1 ex.; leg. and det. Şenyüz Y.

**Records in Turkey:** Manisa (Darilmaz & İncekara 2011).

**Distribution in World: Europe:** Bosnia Herzegovina, Bulgaria, Belarus, Croatia, Russia, *Central European Territory*, Czech Republic, Denmark, Finland, France (incl. Corsica, Monaco), Great Britain (incl. Channel Islands), Germany, Hungary, Ireland, Italy (incl. Sardinia, Sicily, San Marino), Macedonia, Poland, Romania, Slovakia, Slovenia, Spain (incl. Gibraltar), Russia, *South European Territory*, Switzerland, Turkey, Ukraine, **North Africa:** Algeria, Tunisia, **Asia:** Cyprus, Tajikistan, Turkey, Uzbekistan, Russia: West Siberia, Middle East, Near East, **America:** North of Mexico (Fikáček *et al.* 2015).

*Sphaeridium scarabaeoides* (Linnaeus, 1758)

**Material examined: 2:** 15-18.VIII.2010, 1 ex.; 16-19.III.2011, 1 ex.; **3:** 15-18.VII.2010, 1 ex.; 16-19.X.2010, 1 ex.; 18-21.V.2011, 2 exs.; **4:** 16-19.X.2010, 1 ex.; 18-21.V.2011, 2 exs.; **7:** 15-18.VII.2010, 1 ex.; **10:** 15-18.VI.2010, 1 ex.; 15-18.VII.2010, 5 exs.; **11:** 15-18.VI.2010, 2 exs.; 18-21.V.2011, 2 exs.; **13:** 15-

18.VI.2010, 2 exs.; 15-18.VII.2010, 1 ex.; 18-21.V.2011, 1 ex.; **14:** 15-18.VII.2010, 3 exs.; leg. and det. Şenyüz Y.

**Records in Turkey:** Adıyaman, Bilecik, Bolu, Isparta, İçel, İzmir, Manisa and Sakarya (Darilmaz & İncekara 2011, Yılmaz & Aslan 2014).

**Distribution in World: Europe:** Austria, Belgium, Bosnia Herzegovina, Bulgaria, Belarus, Croatia, Russia, *Central European Territory*, Czech Republic, Denmark, Estonia, Finland, France (incl. Corsica, Monaco), Great Britain (incl. Channel Islands), Germany, Georgia, Hungary, Ireland, Italy (incl. Sardinia, Sicily, San Marino), Latvia, Lithuania, Macedonia, The Netherlands, Norway, Russia, *North European Territory*, Poland, Portugal, Romania, Slovakia, Slovenia, Spain (incl. Gibraltar), Sweden, Switzerland, **North Africa:** Tunisia, **Asia:** Azerbaijan, Armenia, Israel, Japan, Kyrgyzstan, Kazakhstan, Nei Mongol (Inner Mongolia), Russia: East Siberia, West Siberia Far East, Heilongjiang (Heilungkiang), Tajikistan, Turkey, Uzbekistan, **Afrotropical:** South of the North African states included in the Palaearctic Region, **Australia:** South of The Lydekker Line, **America;** North of Mexico (Fikáček *et al.* 2015).

*Sphaeridium substriatum* Faldermann, 1838

Material examined: **1:** 15-18.VI.2010, 1 ex.; 16-19.III.2011, 1 ex.; 18-21.V.2011, 6 exs.; **2:** 15-18.VII.2010, 1 ex.; 18-21.V.2011, 4 exs.; **3:** 15-18.VI.2010, 3 exs.; 15-18.IX.2010, 1 ex.; 16-19.X.2010, 2 exs.; 18-21.V.2011, 3 exs.; **4:** 18-21.V.2011, 10 exs.; **5:** 15-18.VII.2010, 2 exs.; 16-19.X.2010, 1 ex.; 18-21.V.2011, 3 exs.; **6:** 15-18.VI.2010, 1 ex.; **9:** 15-18.VII.2010, 1 ex.; **10:** 15-18.VI.2010, 1 ex.; 15-18.IX.2010, 1 ex.; **11:** 15-18.VI.2010, 2 exs.; 15-18.IX.2010, 1 ex.; 18-21.V.2011, 9 exs.; **12:** 15-18.VI.2010, 1 ex.; **13:** 15-18.VI.2010, 2 exs.; 15-18.VII.2010, 7 exs.; 15-18.VI.2010, 1 ex.; **14:** 15-18.VI.2010, 1 ex.; 18-21.V.2011, 2 exs. leg. and det. Şenyüz Y.

**Records in Turkey:** Düzce, İzmir and Manisa (Darilmaz & İncekara 2011).

**Distribution in World: Europe:** Austria, Azores, Bosnia Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, France (incl. Corsica, Monaco), Germany, Greece (incl. Crete), Hungary, Italy (incl. Sardinia, Sicily, San Marino), Lithuania, Macedonia, Montenegro, Poland, Slovakia, Russia, *South European Territory*, Ukraine, **North Africa:** Algeria, Egypt, Tunisia, **Asia:** Azerbaijan, Armenia, Israel, India: Kashmir, Kazakhstan, Liaoning, Mongolia, China: Northeast Territory, Nei Mongol (Inner Mongolia), Shanxi (Shansi), Russia: Far East, East and West Siberia, Tajikistan, Turkmenistan, Turkey (Fikáček *et al.* 2015).

**Table 2.** The number of specimens (N) for each species sampled and their dominance status (D).

| Species | N | D (%) | Dominance Status |
|---|---|---|---|
| *S. bipustulatum* | 271 | 40,5688623 | Eudominant |
| *S. marginatum* | 268 | 40,1197605 | Eudominant |
| *S. substriatum* | 76 | 11,3772455 | Dominant |
| *S. scarabaeoides* | 27 | 4,04191617 | Subdominant |
| *S. lunatum* | 26 | 3,89221557 | Subdominant |
| **Total** | **668** | | |

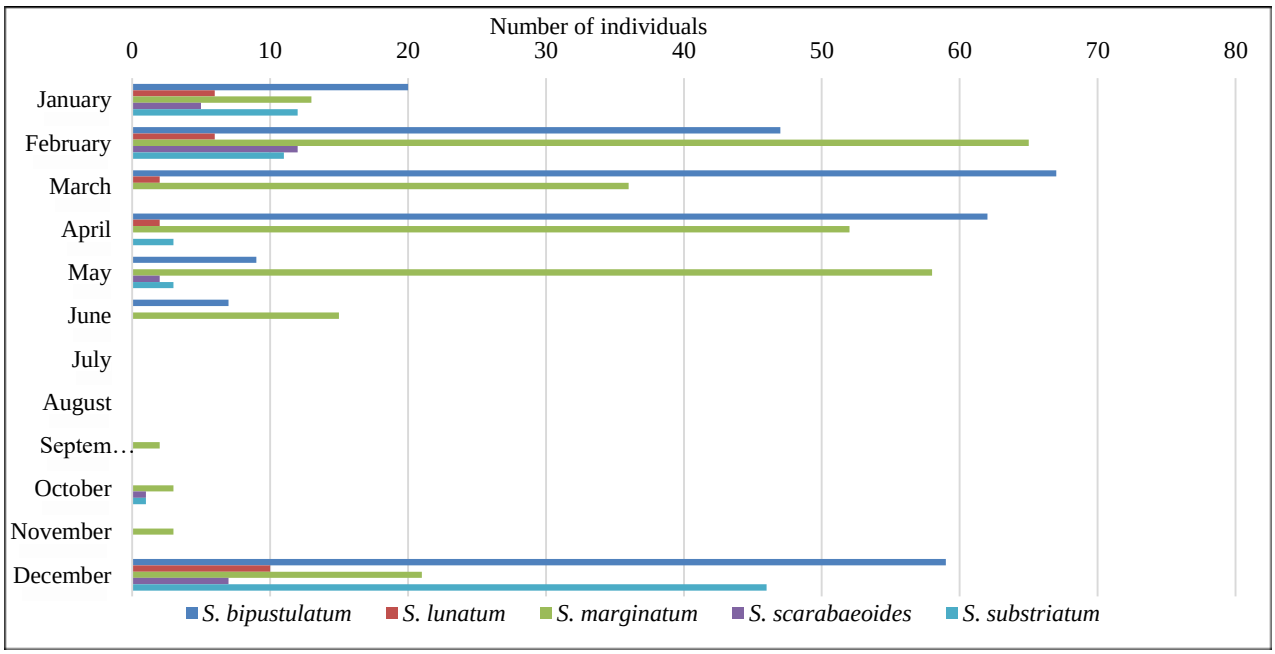


**Fig. 3.** Seasonal dynamics and number of specimens collected in each month during the study.

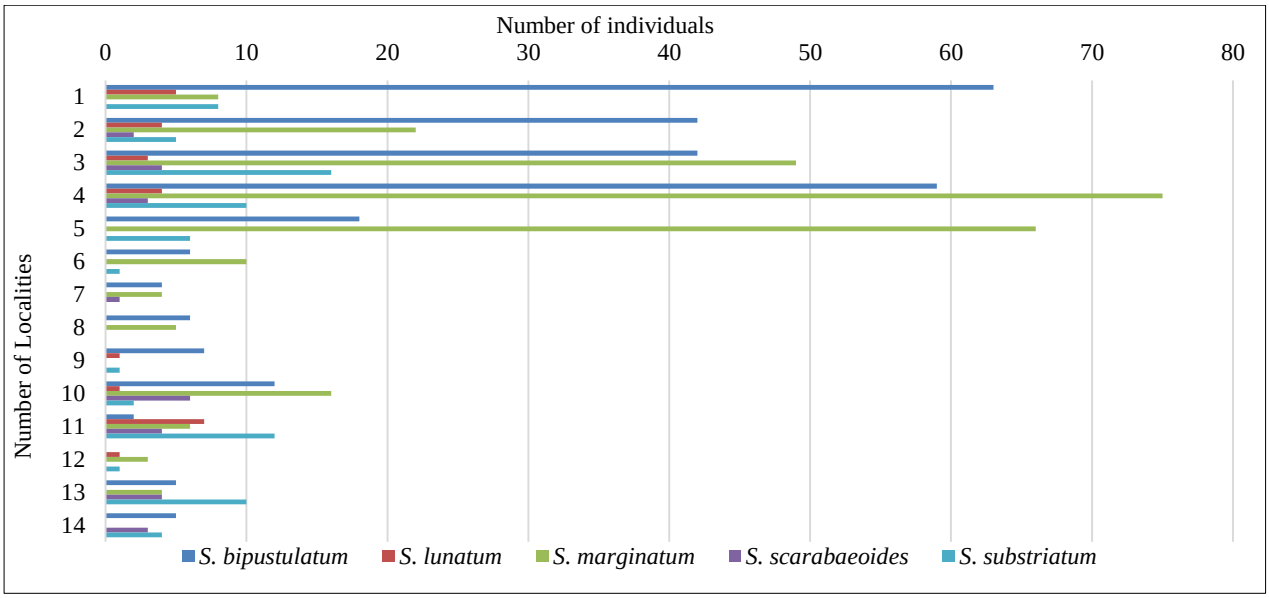


**Fig. 4.** Total number of specimens for each species collected in localities during the study.

## Discussion

The field investigation on *Sphaeridium* in Kütahya province was conducted for the first time and five species were recorded in the study area. All species are new records for fauna of Kütahya and *S. lunatum* is new record for Turkish fauna. Dominance status of each species was described on the basis of relative abundance following Engelmann's (1978) dominance scale (Table 2). According to the analysis, two species were referred as subdominant (*S. scarabaeoides*, *S. lunatum*), one species as dominant (*S. substriatum*) and two species as eudominant (*S. bipustulatum*, *S. marginatum*) status.

In Europe, while *S. bipustulatum* is the rarest species, *S. lunatum* and *S. scarabaeoides* are dominant species (Hanski 1980b). In this study, it was determined that *S. bipustulatum* species was eudominant (Table 2). In contrast to their status in Europe our results showed that *S. lunatum* and *S. scarabaeoides* species were found to be subdominant. According to Hanski (1980b), the spatial patterns shown by *S. lunatum* and *S. scarabaeoides* were the same. The researchers determined that the numbers of both species were positively correlated both between fields within a single locality and between different ages of the same dropping. Our results also showed the same positive correlation between these two species. Similarly, *S. bipustulatum* was eudominant in Spain according to Romero-Alkaraz *et al.* 1997, followed by *S. marginatum* and *S. scarabaeoides*. The order of dominance of these species is in a harmony with our study.

Seasonal changes in the community compositions were given by the differences in phenology of the species. The numbers of sampled beetles increased from the beginning of December until the end of April. The highest numbers of beetles were observed during winter and spring and a drastic decline was determined by July (Fig. 3). Hanski (1980b) determined that *S. scarabaeoides* was not trapped in June and August. When the recorded species were considered according to their highest sampling numbers with respect to sampling months, *S. bipustulatum* showed its peak in March, *S. marginatum* and *S. scarabaeoides* in February, *S. substriatum* and *S. lunatum* in December (Fig. 3). So, there is no activity in July and August. Alkaraz *et al.* 1997 determined that *S. scarabaeoides* did not show any activity from July to November, *S. bipustulatum* from November to May and *S. marginatum* in January in Spain. In the present study, localities numbered from 1 to 5 (up to about 900 meters) had the higher number of individuals in total (Fig. 4). Rahbek (1995) indicated that species richness declines at high altitudes because of temperature and productivity decrease along with increasing elevation.

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