Трансформация экосистем
Ecosystem Transformation

ISSN 2619-0931 Online
www.ecosysttrans.com

DOI 10.23859/estr-220604
EDN PPIATD
UDC 595.77+591.9

Article

Species composition and seasonal dynamics of brachyceran flies (Diptera, Brachycera) in specially protected natural areas of South-Eastern Crimea

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Abstract. This article presents new data on the fauna of brachyceran flies (Diptera, Brachycera) collected in 2019–2020 in specially protected natural areas of South-Eastern Crimea: in the Karadag Nature Reserve and "Tepe-Oba Mountain Range" regional conservation park (66 species of 21 families were identified). The following species are recorded for the first time for Crimea: *Ceroxys urticae* (Linnaeus, 1758) (Ulidiidae), *Eudorylas fusculus* (Zetterstedt, 1844) (Pipunculidae), *E. ruralis* (Meigen, 1824), *Graphomya maculata* (Scopoli, 1763) (Muscidae), *Lomatia polyzona* Loew, 1869 (Bombyliidae), *Oedalea tibialis* Macquart, 1827 (Hybotidae), *Suillia affinis* (Meigen, 1830) (Heleomyzidae), *Symphoromyia immaculata* (Meigen, 1844) (Rhagionidae), *Thereva aurata* Loew, 1854 and *T. plebeja* (Linnaeus, 1758) (Therevidae). In specially protected natural areas of South-Eastern Crimea, a protected species of Diptera *Merodon nigritarsis* Rondani, 1845 (Syrphidae) has been recorded.

Keywords: Karadag Nature Reserve, "Tepe-Oba Mountain Range" regional conservation park, fauna

Funding. The work was carried out within the framework of the State Assignment of the Ministry of Education and Science No. 121032300023-7 at the Karadag State Nature Reserve.

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To cite this article: Shorenko, K.I., Berezhnova, O.N., 2023. Species composition and seasonal dynamics of brachyceran flies (Diptera, Brachycera) in specially protected natural areas of South-Eastern Crimea. *Ecosystem Transformation* **6** (5), 107–117. https://doi.org/10.23859/estr-220604

Received: 04.06.2022
Accepted: 26.08.2022
Published online: 08.12.2023

DOI 10.23859/estr-220604
EDN PPIATD
УДК 595.77+591.9

Научная статья

Видовой состав и сезонная динамика численности короткоусых двукрылых (Diptera, Brachycera) на особо охраняемых природных территориях Юго-Восточного Крыма

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Аннотация. В статье приведены новые данные по фауне короткоусых двукрылых насекомых (Diptera, Brachycera), собранных в 2019–2020 гг. на особо охраняемых природных территориях Юго-Восточного Крыма: в Карадагском природном заповеднике и региональном природном заказнике «Горный массив Тепе-Оба». Выявлено 66 видов из 21 семейства. Виды *Ceroxys urticae* (Linnaeus, 1758) (Ulidiidae), *Eudorylas fusculus* (Zetterstedt, 1844) (Pipunculidae), *E. ruralis* (Meigen, 1824), *Graphomya maculata* (Scopoli, 1763) (Muscidae), *Lomatia polyzona* Loew, 1869 (Bombyliidae), *Oedalea tibialis* Macquart, 1827 (Hybotidae), *Suillia affinis* (Meigen, 1830) (Heleomyzidae), *Symphoromyia immaculata* (Meigen, 1844) (Rhagionidae), *Thereva aurata* Loew, 1854 (Therevidae), *T. plebeja* (Linnaeus, 1758) впервые приведены для фауны Крыма. На особо охраняемых природных территориях Юго-Восточного Крыма отмечен охраняемый вид двукрылых *Merodon nigritarsis* Rondani, 1845 (Syrphidae).

Ключевые слова: Карадагский природный заповедник, заказник «Горный массив Тепе-Оба», фауна, мухи

Финансирование. Работа выполнена в рамках Государственного задания Минобрнауки № 121032300023-7 на УНУ ГПЗ «Карадагский».

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Для цитирования: Шоренко, К.И., Бережнова, О.Н., 2023. Видовой состав и сезонная динамика численности короткоусых двукрылых (Diptera, Brachycera) на особо охраняемых природных территориях Юго-Восточного Крыма. *Трансформация экосистем* **6** (5), 107–117. https://doi.org/10.23859/estr-220604

Поступила в редакцию: 04.06.2022
Принята к печати: 26.08.2022
Опубликована онлайн: 08.12.2023

Introduction

The fauna of Russia and neighboring countries includes 45 families of Diptera: Brachycera, with many species having transregional and polyregional ranges. The Diptera of the Karadag Nature Reserve and adjacent territories have been studied relatively poorly. To date, more than 300 species of the order Diptera, belonging to 32 families and 193 genera, are known from the territory of the reserve. The most studied are dipterans from the families Conopidae (Zimina, 1993), Syrphidae (Zimina, 1993; Popov, 2009) and Tachinidae (Richter, 1996).

There are published data on individual species from other families of Brachycera occurring in the reserve: Stratiomyidae (Krivosheina, 2004); Tabanidae (Olsufiev and Melnikova, 1962); Dolichopodidae (Grichanov et al., 2015), Muscidae (Vikhrev and Erofeeva, 2018); Chloropidae (Narchuk and Przhiboro, 2017), Ephydridae (Krivosheina, 2014), etc. In addition, among the brachyceran dipterans of the reserve there are rare species listed in the Red Book of the Republic of Crimea (Krasnaya kniga..., 2015): *Merodon nigritarsis* Rondani, 1845; *Pogonosoma maroccanum* (Fabricius, 1794); *Neorhynchocephalus tauscheri* (Fischer, 1812) (Zimina, 1993; Kostenko, 2016).

The purpose of this work was to identify the species composition and study the seasonal dynamics of the brachyceran flies in the Karadag Nature Reserve and adjacent territories.

Material and methods

The study area includes steppe and forest-steppe biotopes of two specially protected natural areas (SPNA) of South-Eastern Crimea: Karadag Nature Reserve (area 28.7 km^2, maximum height – Svyataya Mountain, 577 m above sea level), located between the villages of Shchebetovka, Kurortnoye and Koktebel, and the “Tepe-Oba Mountain Range” conservation park (area 1200 hectares, maximum height 302 m a.s.l.), located 15 km east of the reserve. The material was collected during the 2019–2020 growing seasons. Using a set of methods: entomological sweeping, Merike (‘yellow pan”) and Malaise traps. Insects were removed from Merike traps every 3 days, and from the Malaise trap every 8 days. The collected material was fixed with ethyl alcohol and part of it was mounted on entomological pins.

Identifications were made under a Micromed MS-2 Zoom binocular microscope using keys, including diagnostic tables for individual genera included in publications and monographs of some authors (Michelsen, 1980; Olsufiev, 1977; Opredelitel’ nasekomykh yevropeyskoy chasti SSSR, 1969, 1970; Shatalkin, 2000; Tschorsnig and Herting, 1994, etc.). To clarify the identification for some species, temporary preparations of male genitalia were made according to generally accepted methods.

Traps were installed at six localtions: N 44°56′23.79" E 35°14′11.11"; N 44°54′47.57" E 35°12′02.38"; N 44°54′46.70" E 35°11′59.42"; N 45°01′18.72" E 35°24′11.49"; N 45°00′29.02" E 35°22′56.63"; N 44°54′57.00" E 35°11′09.96". K.I. Shorenko collected the material and performed preliminary taxonomic sorting; O.N. Berezhnova identified material to species level. The relative abundance (p) of species was calculated using the formula:

$$P = n/N \times 100\%,$$

where n – number of individuals of an identified species, N – total number of individuals of all species collected. If the label data for collecting a species included the dates of two months, the number of individuals in the calculations (Fig.1) was taken into account twice – for each of the months indicated in the primary data.

The material is housed in the collection of the Department of Zoology and Parasitology, Faculty of Medical Biology, Voronezh State University.

Results and discussion

As a result of the ecological and faunal study, 501 individuals of brachyceran flies belonging to 66 species, 48 genera, and 21 families were collected.

The greatest abundance of Diptera was recorded in June (Fig. 1): 52 species of 18 families. The lowest abundance was reported in April and October – 2 species each from 2 families. The most numerous species in the collections were: *Eristalinus sepulchralis* (21%), *Chloromyia speciosa* (14%) and *Helina sexmaculata* (9%). The species *Tachina fera* is bivoltine. The abundance of syrphid flies in June is associated with the massive flowering of food plants in the study area and the characteristics of the life cycles of the species.

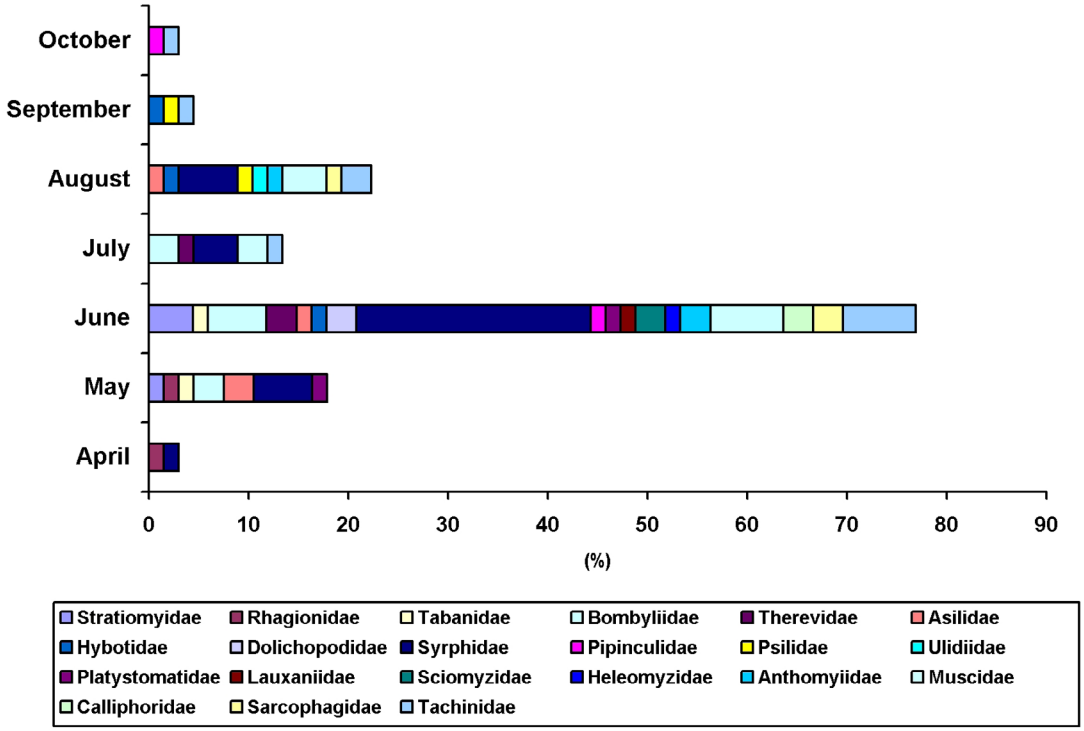

Fig. 1. Seasonal dynamics of the relative abundance of brachyceran flies (Diptera, Brachycera) in South-Eastern Crimea.

List of species of brachyceran Diptera on SPNAs of South-Eastern Crimea

Species names are given in accordance with the "Fauna Europaea database"[1] (http://www.fauna-eu.org/). Species that are first records for the territory of the Karadag Nature Reserve are marked with one asterisk (*), for the territory of Crimea with two (**). All species of flies identified in the Tepe-Oba Mountain Range Conservation Park are listed for this territory for the first time. The studied protected areas are designated by numbers: (1) state reserve of regional significance "Tepe-Oba Mountain Range"; (2) Karadag State Reserve.

Family Anthomyiidae
1. **Anthomyia pluvialis* (Linnaeus, 1758)
Material. (2), 7.06–14.06.2019, 1 specimen; 14.08–20.08.2019, 1 specimen
2. **Eustalomyia festiva* (Zetterstedt, 1845)
Material. (2), 11.06–12.06.2020, 1 specimen
Family Asilidae
3. **Dioctria humeralis* Zeller, 1840
Material. (2), 20.05–31.05.2019, 2 specimens; 31.05–7.06.2019, 1 specimen
4. **Leptogaster cylindrica* (De Geer, 1776)
Material. (2), 20.05–31.05.2019, 1 specimen; 31.05–7.06.2019, 2 specimens
5. **Stenopogon sabaudus* (Fabricius, 1794)
Material. (1), 14.08–17.08, 2020, 1 specimen
Family Bombyliidae
Subfamily Lomatiinae
6. ***Lomatia polyzona* Loew, 1869
Material. (1), 19.06–20.06.2020, 14 specimens; (2), 31.05–7.06.2019, 5 specimens; 7.06–14.06.2019, 4 specimens; 14.06–21.06.2020, 1 specimens; 1.06–4.06.2020, 1 specimen; 17.06–19.06, 3 specimens; 25.06–27.06.2020, 1 specimen

[1] Fauna Europaea. Web page. URL: https://fauna-eu.org/ (accessed: 01.06.2022).

Distribution. Southern Europe, Caucasus, Asia Minor and South-West Asia (Evenhuis and Greathead, 2003; Hakimian et al., 2013; Koçak and Kemal, 2014; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

Subfamily Cythereinae

7. **Cytherea obscura* Fabricius, 1794

Material. (2), 17.06–19.06.2019, 2 specimens; 4.07–7.07.2020, 1 specimen; 8.07–9.07.2020, 1 specimen

Subfamily Anthracinae

8. **Petrorossia hespera* (Rossi, 1790)

Material. (2), 31.05–7.06.2019, 1 specimen

9. **Hemipenthes velutina* (Meigen, 1820)

Material. (1), 8.07–9.07.2020, 1 specimen; (2), 4.07–7.07.2020, 1 specimen; 10.07–11.07.2020, 1 specimen

Family Calliphoridae

10. **Calliphora vicina* Robineau-Desvoidy, 1830

Material. (2), 17.06–19.06.2019, 1 specimen

11. *Lucilia silvarum* (Meigen, 1826)

Material. (1), 19.06–20.06.2020, 1 specimen

Family Dolichopodidae

Subfamily Dolichopodinae

12. *Dolichopus calinotus* Loew, 1871

Material. (1), 19.06–20.06.2020, 1 specimen; (2), 14.06–21.06.2019, 1 specimen; 25.06–27.06.2020, 1 specimen; 28.08–4.09.2019, 1 specimen

13. **Dolichopus excisus* Loew, 1859

Material. (1), 19.06–20.06.2020, 1 specimen; (2), 14.06–21.06.2019, 1 specimen

Family Heleomyzidae

Subfamily Suilliinae

14. ***Suillia affinis* (Meigen, 1830)

Material. (2), 1.06–4.06.2020, 1 specimen; 4.06–6.06.2020, 1 specimen

Distribution. Western Palaearctic species (Koçak and Kemal, 2014; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

Family Hybotidae

Subfamily Oedaleinae

15. ***Oedalea tibialis* Macquart, 1827

Material. (2), 7.06–14.06.2019, 1 specimen

Distribution. North and center of Western Europe, north-west and center of European Russia (https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

Family Lauxaniidae

16. **Sapromyza intonsa* Loew, 1847

Material. (2), 7.06–14.06.2019, 2 specimens; 25.06–28.06.2019, 1 specimen

Family Muscidae

Subfamily Mydaeinae

17. ***Graphomya maculata* (Scopoli, 1763)

Material. (2), 4.07–7.07.2020, 1 specimen

Distribution. Palaearctic, Oriental and Australian regions (Sorokina, 2012; Koçak and Kemal, 2014; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

Subfamily Phaoniinae

18. *Phaonia pallida* (Fabricius, 1787)

Material. (2), 11.06–12.06.2020, 1 specimen; 14.06–21.06.2019, 1 specimen; 21.06–25.06.2019, 1 specimen

19. **Phaonia rufipalpis* (Macquart, 1835)

Material. (1), 19.06–20.06.2020, 4 specimen; (2), 17.06–19.06.2019, 8 specimen; 11.08–12.08.2020, 1 specimen; 17.06–19.06.2020, 2 specimens

20. **Phaonia subventa* (Harris, 1780)

Material. (2), 17.06–19.06.2019, 1 specimen

21. **Phaonia valida* (Harris, 1780)

Material. (2), 14.06–21.06.2019, 3 specimens; 21.08–28.08.2019, 1 specimen; 17.06–19.06.2019, 1 specimen

22. **Helina sexmaculata* (Preyssler, 1791)

Material. (1), 25.06–27.06.2020, 1 specimen; (2), 4.07–7.07.2020, 3 specimens; 5.08–14.08.2019, 1 specimen; 11.08–12.08.2020, 41 specimens

Family Pipunculidae

Subfamily Pipunculinae

23. ***Eudorylas fusculus* (Zetterstedt, 1844)

Material. (2), 15.10–21.10.2019, 1 specimen

Distribution. Northern and central Europe, Eastern Palearctic (De Meyer et al., 1989; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

24. ***Eudorylas ruralis* (Meigen, 1824)

Material. (1), 19.06–20.06.2020, 2 specimens

Distribution. Europe, except the northern part, Eastern Palearctic, North Africa (De Meyer, 1995; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

Family Platystomatidae

Subfamily Platystomatinae

25. *Platystoma seminationis* (Fabricius, 1775)

Material. (2), 20.05–31.05.2020, 1 specimen; 4.06–12.06.2020, 1 specimen

Family Psilidae

26. **Chamaepsila rosae* (Fabricius, 1794)

Material. (2), 28.08–4.09.2019, 9 specimens; 11.09–18.09.2019, 10 specimens

Family Rhagionidae

27. ***Symphoromyia immaculata* (Meigen, 1804)

Material. (2), 24.04–1.05.2019, 1 specimen

Distribution: Western and Central Europe, northwestern Russia (Romiti et al., 2021; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

Family Sarcophagidae

28. *Sarcophaga* (*Liosarcophaga*) *jacobsoni* (Rohdendorf, 1937)

Material. (1), 18.08–20.08.2020, 4 specimens; 20.07–22.08.2020, 1 specimen

29. **Sarcophaga* (*Heteronychia*) *haemorrhoa* Meigen, 1826

Material. (1), 19.06–20.06.2020, 1 specimen; (2), 14.08–20.08.2019, 3 specimens

30. **Sarcophaga* (*Heteronychia*) *vagans* Meigen, 1826

Material. (2), 7.06–14.06.2019, 2 specimens; 25.06–27.06.2020, 1 specimen

Family Stratiomyidae

31. *Chloromyia formosa* (Scopoli, 1763)

Material. (1), 17.06–18.06.2020, 3 specimens; 19.06–20.06.2020, 2 specimens

32. **Chloromyia speciosa* (Macquart, s1834)

Material. (1), 17.06–18.06.2020, 10 specimens; 19.06–20.06.2020, 26 specimens; (2) 31.05–7.06.2019, 1 specimen; 7.06–14.06.2019, 25 specimens; 7.06–9.06.2020, 3 specimens; 11.06–12.06.2020, 7 specimens

33. **Oxycera trilineata* (Linnaeus, 1767)

Material. (2), 25.06–27.06.2020, 1 specimen

Family Sciomyzidae

34. **Coremacera marginata* subsp. *pontica* Elberg, 1968

Material. (2), 11.06–12.06.2020, 1 specimen

35. *Trypetoptera punctulata* (Scopoli, 1763)

Material. (1), 19.06–20.06.2020, 1 specimen

Family Syrphidae

Subfamily Syrphinae

36. *Chrysotoxum intermedium* Meigen, 1822

Material. (1), 19.06–20.06, 1 specimen; (2), 10.05–20.05.2019, 2 specimens; 24.05–1.05.2019, 2 specimens; 20.05–31.05.2019, 1 specimen

37. *Eupeodes corollae* (Fabricius, 1794)

Material. (1), 25.06–27.06.2020, 11 specimens; (2), 1.05–10.05.2019, 5 specimens; 10.05–

20.05.2019, 3 specimens; 20.05–31.05.2019, 1 specimen; (2), 25.06–27.06.2020, 1 specimen; 25.06–26.06.2020, 1 specimen

38. *Sphaerophoria rueppelli* (Wiedemann, 1830)

Material. (1), 19.06–20.06.2020, 1 specimen; (2), 24.04–1.05.2019, 2 specimens; 1.05–10.05.2019, 2 specimens; 7.06–14.06.2019, 1 specimen

39. *Sphaerophoria scripta* (Linnaeus, 1758)

Material. (2), 07.06–14.06.2019, 8 specimens; 14.06–21.06.2019, 1 specimen; 21.06–26.06.2019, 2 specimens; 25.06–27.06.2020, 1 specimen; 25.06–28.06.2019, 1 specimen

40. *Paragus bicolor* (Fabricius, 1794)

Material. (2), 31.05–7.06.2019, 1 specimen

Subfamily Pipizinae

41. *Pipizella maculipennis* (Meigen, 1822)

Material. (2), 26.06–26.06.2020, 1 specimen

Subfamily Eristalinae

42. *Eristalinus aeneus* (Scopoli, 1763)

Material. (1), 18.07–20.07.2020, 1 specimen

43. *Eristalinus sepulchralis* (Linnaeus, 1758)

Material. (1), 19.06–20.06.2020, 43 specimens; 25.06–27.06.2020, 1 specimen; 8.07–9.07.2020, 4 specimens; 20.08–22.08.2020, 5 specimens; (2), 25.06–27.06.2020, 52 specimens

44. *Eristalis arbustorum* (Linnaeus,1758)

Material. (1), 19.06–20.06.2020, 4 specimens; 25.06–27.06.2020, 1 specimen; 8.07–9.07.2020, 1 specimen; (2), 25.06–27.06.2020, 2 specimens

45. *Eristalis tenax* (Linnaeus, 1758)

Material. (1), 19.06–20.06.2020, 1 specimen; 8.08–9.08.2020, 1 specimen

46. *Eumerus basalis* Loew, 1848

Material. (2), 25.06–26.06.2020, 1 specimen

47. *Eumerus clavatus* Becker, 1921

Material. (2), 14.08–20.08.2019, 1 specimen

48. *Helophilus trivittatus* (Fabricius, 1805)

Material. (1), 11.08–13.08.2020, 1 specimen

49. *Merodon avidus* (Rossi, 1790)

Material. (2), 19.06–20.06, 2020, 2 specimen; 25.06–27.06.2020, 1 specimen

50. *Merodon crymensis* Paramonov, 1925

Material. (2), 1.06–4.06.2020, 2 specimens

51. **Merodon equestris* (Fabricius, 1794)

Material. (2), 7.06–9.06.2020, 1 specimen

52. *Merodon femoratoides* Paramonov, 1925

Material. (1), 19.06–20.06.2020, 1 specimen; 8.07–9.07.2020, 1 specimen; (2), 25.06–27.06, 2020, 1 specimen

53. *Merodon nigritarsis* Rondani, 1845

Material. (1), 17.06–18.06.2020, 1 specimen; 19.06–20.06.2020, 1 specimen; 25.06–27.06.2020, 1 specimen; (2), 25.06–27.06.2020, 1 specimen

54. *Syritta pipiens* (Linnaeus, 1758)

Material. (1), 19.06–20.06.2020, 3 specimens

Family Tabanidae

55. **Tabanus bifarius* Loew, 1858

Material. (2), 31.05–7.06.2019, 8 specimens; 7.06–14.06.2019, 12 specimens; 14.06–21.06.2019, 5 specimens

Family Tachinidae

Subfamily Exoristinae

56. *Pales pavida* (Meigen, 1824)

Material. (1), 17.06–18.06.2020, 10 specimens; 19.06–20.06.2020, 4 specimens; (2), 17.06–19.06.2019, 3 specimens; 25.06–27.06.2020, 2 specimens; 17.06–19.06.2020, 1 specimen

57. *Exorista rustica* (Fallén, 1810)

Material. (2), 17.06–19.06.2019, 1 specimen

Subfamily Tachininae

58. **Mintho rufiventris* (Fallén, 1817)

Material. (2), 2.07–9.07.2019, 1 specimen; 4.07–7.07.2020, 1 specimen; 5.08–14.08.2019, 1 specimen

59. *Tachina fera* (Linnaeus, 1761)

Material. (2), 11.06–12.06.2019, 1 specimen; 15.10–23.10.2019, 1 specimen

Subfamily Phasiinae

60. *Cylindromyia bicolor* (Olivier, 1812)

Material. (2), 14.08–20.08.2019, 1 specimen

61. *Cylindromyia brassicaria* (Fabricius, 1775)

Material. (2), 14.06–21.06.2019, 1 specimen

62. *Cylindromyia intermedia* Meigen, 1824

Material. (2), 28.08–4.09.2019, 1 specimen

63. **Ectophasia oblonga* (Robineau-Desvoidy, 1830)

Material. (2), 25.06–26.06.2020, 1 specimen

Family Therevidae

Subfamily Therevinae

64. ***Thereva aurata* Loew, 1854

Material. (2), 25.06–27.06.2020, 1 specimen

Distribution. Southern European species, known from the Middle East (Koçak and Kemal, 2014; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

65. ***Thereva plebeja* (Linnaeus, 1758)

Material. (1), 19.06–20.06.2020, 3 specimens; (2), 7.06–9.06.2020, 1 specimen; 11.06–12.06.2020, 9 specimens; 17.06–19.06.2019, 2 specimens; 4.07–7.07.2020, 1 specimen

Distribution. Palaearctic species (Koçak and Kemal, 2014; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

Family Ulidiidae

Subfamily Otitinae

66. ***Ceroxys urticae* (Linnaeus, 1758)

Material. (2), 21.08–28.08.2019, 1 specimen

Distribution. Southern and Central Europe, the European part of Russia (Volgograd and Astrakhan regions); Kazakhstan, Turkmenistan, China; Egypt (Kameneva, 2008; Koçak and Kemal, 2014; https://fauna-eu.org/). Recorded for the first time for the territory of Crimea.

Conclusions

As a result of this study, 66 species of brachyceran dipterans belonging to 48 genera and 21 families were identified. The greatest species diversity is characteristic of the family of hoverflies (Syrphidae) (19 species; 183 specimens), in which the species *Eristalinus sepulchralis* was numerous in the collections. One species was identified in each of the families Rhagionidae, Hybotidae and Ulidiidae. 34 species of dipterans were listed for the first time for the fauna of the Karadag Reserve, and 28 species for the regional reserve “Tepe-Oba Mountain Range”. The species *Ceroxys urticae*, *Eudorylas fusculus*, *E. ruralis*, *Graphomya maculata*, *Lomatia polyzona*, *Oedalea tibialis*, *Suillia affinis*, *Symphoromyia immaculata*, *Thereva aurata*, and *T. plebeja* are recorded for the first time for Crimea. One species listed in the Red Book of the Republic of Crimea was noted, *Merodon nigritarsis*.

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