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Article

Entomofauna of urbanized areas of South-Eastern Crimea during abnormal winter warming

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Abstract. Additional information is provided on the insect species collected in parks and garden squares in the southeast of the Crimean Peninsula during the anomalous winter warming of 2024–2025. Average temperatures in January 2025 in southeastern Crimea exceeded those recorded during the entire period of instrumental meteorological observations at the Karadag Scientific Station, and this influenced the activity of adults of many insect species. A total of 117 species belonging to 94 genera, 42 families, and 8 orders were identified. Pest species were found, in particular, Orthoptera: *Anacridium aegyptium*; Hemiptera (Homoptera): *Philaenus spumarius*; Hemiptera (Heteroptera): *Halyomorpha halys*, *Monosteira unicostata*, *Nezara viridula*; Coleoptera: *Phyllotreta atra*, *Phyllotreta nigripes*, *Xanthogaleruca luteola*; Hymenoptera: *Neuroterus quercusbaccarum*; Lepidoptera: *Agrotis segetum*, *Autographa gamma*, *Pieris brassicae*, *Pieris rapae*, as well as protected Hymenoptera species – *Xylocopa valga* and *X. violacea*. Phytophagous beetles (Chrysomelidae) dominate the collections. *Phyllotreta nigripes* is the species with the largest number of individuals in the collections. The number of adults of the invasive species *Anacridium aegyptium*, *Halyomorpha halys*, and *Harmonia axyridis* was insignificant during the winter months in urbanized areas of the peninsula.

Keywords: insects, parks, climate, Orthoptera, Hemiptera, Coleoptera, Neuroptera, Hymenoptera, Lepidoptera, Diptera

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Научная статья

Энтомофауна урбанизированных территорий Юго-Восточного Крыма в условиях аномального зимнего потепления

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Аннотация. Приведены дополнительные сведения о видах насекомых, собранных в парках и скверах юго-востока Крымского полуострова во время аномального зимнего потепления 2024–2025 гг. Средние температуры января 2025 г. в юго-восточном Крыму превышали таковые за все время инструментальных метеонаблюдений на Карадагской научной станции, что обусловило активность имаго многих видов насекомых. Выявлено 117 видов, относящихся к 94 родам, 42 семействам и 8 отрядам. Были обнаружены виды-вредители, в частности, Orthoptera: *Anacridium aegyptium*; Hemiptera (Homoptera): *Philaenus spumarius*; Hemiptera (Heteroptera): *Halyomorpha halys*, *Monosteira unicostata*, *Nezara viridula*; Coleoptera: *Phyllotreta atra*, *Phyllotreta nigripes*, *Xanthogaleruca luteola*; Hymenoptera: *Neuroterus quercusbaccarum*; Lepidoptera: *Agrotis segetum*, *Autographa gamma*, *Pieris brassicae*, *Pieris rapae*, а также охраняемые виды перепончатокрылых – *Xylocopa valga* и *X. violacea*. В сборах доминируют растительноядные жуки (Chrysomelidae). Наибольшим числом особей в сборах представлен вид *Phyllotreta nigripes*. Численность имаго инвазивных видов *Anacridium aegyptium*, *Halyomorpha halys* и *Harmonia axyridis* в зимние месяцы в урбанизированных районах полуострова была незначительной.

Ключевые слова: насекомые, парки, климат, Orthoptera, Hemiptera, Coleoptera, Neuroptera, Hymenoptera, Lepidoptera, Diptera

Финансирование. Работа выполнена по теме «Изучение биотических и абиотических компонентов наземных экосистем, особенности их структурно-временной организации в различных климатических условиях среды» № 124030100098-0. Работа А.С. Сажнева выполнена в рамках государственного задания Министерства науки и высшего образования РФ № 124032500016-4.

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Introduction

Studying the influence of climate on the composition and structure of entomofauna is a relevant and important task of modern entomology (Koval and Guseva, 2008; Musolin, 2007; Rubtsov and Utkina, 2019; etc.). Climate changes in Crimea are systemic in nature (Degterev, 2020; Drygval et al., 2024; Gorbunov et al., 2021; etc.). Climate changes result in shifts in the phenology of insect species and repeated disruptive events altering the ecosystem structure (Babkina et al., 2024; Musolin and Saulich, 2014; Rubtsov and Utkina, 2019; etc.). The consequences of climate fluctuations for Crimea's entomofauna generally depend on the nature and duration of exposure to climatic factors (temperature, humidity, insolation, etc.) on the peninsula, as well as on the complex responses of insects caused by their natural adaptive mechanisms (increasing or decreasing the duration of activity, changing ranges, number of generations, etc.). The study of insect phenology in urbanized areas is critical for assessing and predicting environmental impediments to revegetation (Dremova, 2005) and to increase understanding of the increasing role of cities as environmental filters and drivers of adaptation for these arthropods.

The purpose of this study is to identify the species composition of insects in urbanized areas and their phenological responses to climate change in Crimea.

Material and methods

The material was collected in January, February, and December 2024, and in January, February, and early March 2025 during the daytime in garden squares and parks of the Feodosia Municipal District, located in the southeastern part of Crimea (the city of Feodosia, the park of the biological station of the Karadag Nature Reserve (village of Kurortnoye), and village of Krasnokamenka) (Fig. 1). Insects were primarily collected by hand (from the walls of houses, on asphalt, under stones and fallen leaves, on tree bark), as well as using Mörike traps (yellow pan traps). Insects were fixed in a 70% ethyl alcohol solution and the collected material was processed in the laboratory. The material was mounted using standard entomological methods (Golub et al., 2021). Species were identified using reference collections, identification guides, and revisions (Benkovsky, 1999; 2020; Opredelitel..., 1965, 1969, 1970, 1978; Seifert et al., 2024; Steiner et al., 2018), including the online resource Die Käfer Europas1. The taxonomic position of species is given in accordance with foreign and national entomological online catalogs Fauna Europaea2 and Insecta.pro3.

Results and discussion

As a result of the survey of urbanized areas of Crimea, we collected 869 specimens of insects belonging to 8 orders, 42 families, 94 genera and 117 species.

List of insect species collected in South-Eastern Crimea in the winter-spring period 2024–2025

Legend and abbreviations: (1) Feodosia, embankment, (2) Karadag Nature Reserve, biostation park, (3) Feodosia District, Krasnokamenka, territory of St. Stephen of Sourozh Monastery; ♀ – female, ind. – specimen, * – species listed in the Red Data Book of the Republic of Crimea (Krasnaya Kniga..., 2025), (Mk) – Mörike trap.

Order Orthoptera
Suborder Caelifera
Family Acrididae

1. *Anacridium aegyptium* Linnaeus, 1764

Material. (2), 1.01.25, 1 ind., 14.01.25, 2 ind.

[1] Die Käfer Europas. Web page. URL: https://coleonet.de/coleo/index.htm (accessed: 01.05.2025).

[2] Fauna Europaea. Web page. URL: https://fauna-eu.org (accessed: 12.05.2025).

[3] Insecta.pro. Web page. URL: https://insecta.pro (accessed: 15.05.2025).

Suborder Ensifera
Family Gryllidae
2. *Acheta domesticus* (Linnaeus, 1758)
Material. (1), 9–10.01.25, 1 ind.
Order Hemiptera
Suborder Homoptera
Family Aphrophoridae
3. Philaenus spumarius (Linnaeus, 1758)
Material. (1), 10.12.24, 2 ind.
Suborder Heteroptera
Family Anthocoridae
4. *Anthocoris minutus* (Bergroth, 1895)
Material. (1), 10.12.2024, 1 ind.
Family Cydnidae
5. *Tritomegas bicolor* (Linnaeus, 1758)
Material. (1), 1–3.02.2025, 1 ind.
Family Lygaeidae
6. *Arocatus melanocephalus* (Fabricius, 1798)
Material. (1), 1–3.02.2025, 7 ind.
7. *Lygaeus simulans* Deckert, 1985
Material. (1), 10.12.2024, 2 ind., 01–03.02.2025, 1 ind., 17–18.12.2024, 3 ind.
8. *Spilostethus pandurus* (Scopoli, 1763)
Material. (1), 01–03.02.2025, 1 ind., 21–22.12.2024, 2 ind.
Family Oxycarenidae
9. *Oxycarenus hyalinipennis* (Costa, 1847)
Material. (1), 16–17.02.2025, 1 ind., 10.12.2024, 3 ind., 17–18.12.2024, 2 ind.
Family Pentatomidae
10. *Halyomorpha halys* (Stål, 1855)
Material. (1), 16.12.2024, 1 ind., 17–18.12.2024, 4 ind., 21–22.12.2024, 2 ind., 29.01.2024, 1 ind., 13.02.2025, 1 ind., 16–17.02.2025, 2 ind.
11. *Nezara viridula* (Linnaeus, 1758)
Material. (1), 16–17.12.2024, 1 ind., 25.01.2025, 1 ind., 16–17.02.2025, 1 ind.
Family Pyrrhocoridae
12. *Pyrrhocoris apterus* (Linnaeus, 1758)
Material. (1), 21–22.12.2024, 1 ind., 25.01.2025, 2 ind., 1–3.02.2025, 1 ind.
Family Rhyparochromidae
13. *Lamproplax picea* (Flor, 1860)
Material. (1), 1–3.02.2025, 1 ind.
14. *Plinthisus brevipennis* (Latreille, 1807)
Material. (1), 1–3.02.2025, 1 ind.
15. *Rhyparochromus vulgaris* (Schilling, 1829)
Material. (1), 1–3.02.2025, 1 ind.
Family Tingidae
16. *Monosteira unicostata* (Mulsant & Rey, 1852)
Material. (1), 10.12.2024, 24 ind., 19–20.01.2025, 8 ind.
Order Coleoptera
Suborder Adephaga
Family Carabidae
17. *Harpalus distinguendus* (Duftschmid, 1812)
Material. (2), 28–30.01.2025, 1 ind.
18. *Lebia cyanocephala* (Linnaeus, 1758)
Material. (1), 10.12.2024, 1 ind., 21–22.12.2024, 1 ind.
19. *Lebia trimaculata* (Villers, 1789)
Material. (1), 1–3.02.2025, 2 ind.

Suborder Polyphaga
Family Brentidae
20. *Aspidapion aeneum* (Fabricius, 1775)
Material. (1), 7–8.02.24, 1 ind.
21. *Ceratapion basicorne* (Illiger, 1807)
Material. (1), 17–18.12.2024, 1 ind.
22. *Diplapion confluens* (Kirby, 1808)
Material. (1), 1–5.01.24, 1 ind.
23. *Diplapion stolidum* (Germar, 1817)
Material. (1), 10.12.2024, 1 ind.
Family Cerambycidae
24. *Pogonocherus perroudi* Mulsant, 1839
Material. (1), 1–9.01.2025, 1 ind.
Family Chrysomelidae
25. *Aphthona abdominalis* (Duftschmid, 1825)
Material. (2), 12.02.24, 1 ind.
26. *Aphthona nonstriata* (Goeze, 1777)
Material. (1), 19–20.01.2025, 1 ind.
27. *Aphthona semicyanea* Allard, 1859
Material. (1), 7–8.02.24, 1 ind.
28. *Chrysolina oricalcia* (O.F. Müller, 1776)
Material. (1), 5.02.2025, 1 ind.
29. *Lochmaea machulkai* Roubal, 1926
Material. (1), 7–8.02.24, 2 ind.
30. *Longitarsus albineus* (Foudras, 1860)
Material. (1), 10.12.2024, 1 ind.
31. *Longitarsus echii* (Koch, 1803)
Material. (1), 1–5.01.24, 3 ind., 7–8.02.24, 1 ind., 10–13.02.24, 1 ind.
32. *Longitarsus fallax* Weise, 1888
Material. (1), 17–18.12.2024, 1 ind.
33. *Longitarsus fuscoaeneus* Redtenbacher, 1849
Material. (1), 1–5.01.24, 3 ind.
34. *Longitarsus ochroleucus* (Marsham, 1802)
Material. (1), 17–18.12.2024, 1 ind.
35. *Longitarsus rectilineatus* (Foudras, 1860)
Material. (1), 10.12.2024, 3 ind., 1–3.02.2025, 1 ind.
36. *Longitarsus* cf. *violentus* Weise, 1893
Material. (1), 10.12.2024, 1 ind., 17–18.12.2024, 1 ind.
37. *Oulema duftschmidi* (L. Redtenbacher, 1874)
Material. (1), 10–13.02.24, 1 ind.
38. *Phyllotreta atra* (Fabricius, 1775)
Material. (1), 10.12.2024, 1 ind.
39. *Phyllotreta nigripes* (Fabricius, 1775)
Material. (1), 10.12.2024, 12 ind., 17–18.12.2024, 3 ind., 21–22.12.2024, 1 ind., 1–5.01.24, 68 ind., 7–8.02.24, 109 ind., 10–13.02.24, 32 ind., 1–9.01.2025, 9 ind., 9–10.01.2025, 4 ind., 19–20.01.2025, 1 ind., 25.01.2025, 1 ind., 29.01.2025, 2 ind., 1–3.02.2025, 14 ind.; (2), 12.02.24, 4 ind.
40. *Phyllotreta procera* (Redtenbacher, 1849)
Material. (1), 10.12.2024, 2 ind., 17–18.12.2024, 1 ind., 21–22.12.2024, 1 ind., 1–5.01.24, 3 ind., 10–13.02.24, 1 ind.
41. *Psylliodes circumdatus* (Redtenbacher, 1842)
Material. (1), 9–10.01.2025, 1 ind.
42. *Psylliodes cupreus* (Koch, 1803)
Material. (1), 10.12.2024, 3 ind., 1–5.01.24, 5 ind., 7–8.02.24, 3 ind., 10–13.02.24, 2 ind.
43. *Psylliodes tricolor* Weise, 1888
Material. (1), 1–5.01.24, 1 ind., 7–8.02.24, 1 ind., (2), 12.02.24, 1 ind.

44. *Xanthogaleruca luteola* (O.F. Müller, 1776)
Material. (1), 10.12.2024, 1 ind., 21–22.12.2024, 2 ind., 1–3.02.2025, 1 ind., 16–17.02.2025, 1 ind.
Family Coccinellidae
45. *Adalia bipunctata* (Linnaeus, 1758)
Material. (1), 10.12.2024, 1 ind.
46. *Coccinella septempunctata* Linnaeus, 1758
Material. (1), 10.12.2024, 3 ind., 21–22.12.2024, 2 ind., 1–9.01.2025, 3 ind., 9–10.01.2025, 1 ind., 29.01.25, 2 ind., 31.01.25, 15 ind., 1–3.02.2025, 3 ind., 14.02.25, 2 ind.; (2), 30.01.25, 3 ind., (3), 1.02.25, 3 ind.
47. *Harmonia axyridis* (Pallas, 1773)
Material. (2), 19.12.2024, 1 ind.
48. *Hippodamia variegata* (Goeze, 1777)
Material. (1), 10.12.2024, 1 ind., 1–3.02.2025, 1 ind.
49. *Vibidia duodecimguttata* (Poda, 1761)
Material. (1), 10.12.2024, 1 ind.
Family Cryptophagidae
50. *Atomaria* sp.
Material. (1), 1–3.02.2025, 1 ind.
51. *Cryptophagus* cf. *setulosus* Sturm, 1845
Material. (1), 10.12.2024, 5 ind., 19–20.01.2025, 2 ind., 1–3.02.2025, 1 ind.
Family Curculionidae
52. *Aulacobaris coerulescens* (Scopoli, 1763)
Material. (1), 1–3.02.2025, 1 ind.
53. *Ceutorhynchus chalybaeus* Germar, 1823
Material. (1), 1–5.01.24, 2 ind.
54. *Ceutorhynchus contractus* (Marsham, 1802)
Material. (1), 10.12.2024, 2 ind.
55. *Ceutorhynchus erysimi* (Fabricius, 1787)
Material. (1), 7–8.02.24, 1 ind.
56. *Ceutorhynchus pallidactylus* (Marsham, 1802)
Material. (1), 7–8.02.24, 4 ind.
57. *Coeliastes lamii* (Fabricius, 1792)
Material. (1), 10–13.02.24, 2 ind.
58. *Ethelcus denticulatus* (Schrank, 1781)
Material. (1), 10.12.2024, 23 ind., 1–5.01.24, 8 ind., 7–8.02.24, 14 ind., 10–13.02.24, 4 ind., 1–9.01.2025, 4 ind., 1–3.02.2025, 5 ind.
59. *Hypera melancholica* (Fabricius, 1792)
Material. (1), 10.12.2024, 1 ind.
60. *Hypera postica* (Gyllenhal, 1813)
Material. (1), 1–5.01.24, 1 ind., 7–8.02.24, 2 ind., 10–13.02.24, 2 ind.
61. *Mogulones cynoglossi* (Frauenfeld, 1866)
Material. (1), 1–3.02.2025, 1 ind.
62. *Sitona macularius* (Marsham, 1802)
Material. (1), 1–5.01.24, 1 ind., 10–13.02.24, 1 ind., 1–3.02.2025, 1 ind.
63. *Stenocarus ruficornis* (Stephens, 1831)
Material. (1), 10.12.2024, 2 ind., 1–5.01.24, 10 ind., 7–8.02.24, 4 ind., 10–13.02.24, 2 ind.
Family Mordellidae
64. *Mordellistena pumila* (Gyllenhal, 1810)
Material. (2), 19.12.2024, 1 ind.
Family Ptinidae
65. *Ptinus variegatus* Rossi, 1792
Material. (1), 1–3.02.2025, 4 ind.
Family Staphylinidae
66. *Atheta* sp.
Material. (1), 1–3.02.2025, 1 ind.

67. *Hypopycna rufula* (Erichson, 1840)
Material. (1), 10.12.2024, 1 ind.
68. *Quedius boops* (Gravenhorst, 1802)
Material. (1), 10.12.2024, 1 ind.
69. *Quedius ochripennis* (Ménétriés, 1832)
Material. (1), 21–22.12.2024, 2 ind.
70. *Tachyporus hypnorum* (Fabricius, 1775)
Material. (1), 1–3.02.2025, 3 ind.
71. *Tachyporus pusillus* Gravenhorst, 1806
Material. (1), 10.12.2024, 1 ind., 1–3.02.2025, 2 ind.
Order Neuroptera
Suborder Hemerobiiformia
Family Chrysopidae
72. *Apertochrysa prasina* (Burmeister, 1839)
Material. (1), 19.12.24, 1 ind.; (2), 1–3.02.25, 1 ind.
Order Hymenoptera
Suborder Apocrita
Family Apidae
73. *Andrena thoracica* (Fabricius, 1775)
Material. (2), 1–3.02.25, 2 ind (Mk)
74. *Apis mellifera* Linnaeus, 1758
Material. (1), 1–9.01.25, 2 ind., 10.01.25, 1 ind., 29.01.25, 2 ind.
75. *Halictus* sp.
Material. (1), 1–3.02.25, 1 ind (Mk)
76. Xylocopa violacea Linnaeus, 1758*
Material. (2), 28–30.01.25, 1 ind. (Mk), 1–3.02.25, 3 ind. (Mk)
*77. Xylocopa valga Gerstaecker, 1872**
Material. (1), 10.01.25, 1 ind (Mk)
Family Cynipidae
78. Neuroterus quercusbaccarum Linnaeus, 1758
Material. (2), 1–9.01.25, 1 ind. (Mk)
Family Formicidae
79. *Crematogaster schmidti* (Mayr, 1853)
Material. (1), 1–3.02.2025, 1 ♀
80. *Dolichoderus quadripunctatus* (Linnaeus, 1771)
Material. (1), 10.12.2024, 1 ♀
81. *Formica gagates* Latreille, 1798
Material. (2), 28–30.01.2025, 1 раб. (Mk); (3), 2.02.2025, 2 раб.
82. *Lasius neglectus* Van Loon, Boomsma et Andrasfalvy, 1990
Material. (1), 9–10.01.2025, 1 раб.
83. *Messor ponticus* Steiner et al., 2018
Material. (2), 19.12.2024, 2 раб.
84. *Tapinoma glabrellum* (Nylander, 1849)
Material. (2), 1–3.02.2025, 1 раб.
85. *Tetramorium immigrans* Santschi, 1927
Material. (1), 5.02.2025, 1 раб., 1–3.02.2025, 1 ♀
Family Vespidae
86. *Polistes dominula* (Christ, 1791)
Material. (1), 8.03.25, 1 ind.
87. *Vespula germanica* (Fabricius, 1793)
Material. (1), 11.03.25, 1 ind.
Family Ichneumonidae
88. *Anomalon* sp.
Material. (2), 1–3.02.25, 2 ind.
89. Ophion luteus Linnaeus, 1758
Material. (2), 19.12.24, 1 ind.

Order Lepidoptera
Suborder Heterocera
Family Noctuidae
90. *Agrotis segetum* (Denis & Schiffermuller, 1775)
Material. (2), 12.12.24, 1 ind.
91. *Autographa gamma* (Linnaeus, 1758)
Material. (1), 9–10.01.25, 1 ind., (2), 1–3.02.25, 1 ind.
Family Pterophoridae
92. *Emmelina monodactyla* (Linnaeus, 1758)
Material. (1), 1–3.02.25, 2 ind.
Family Sphingidae
93. *Macroglossum stellatarum* (Linnaeus, 1758)
Material. (1), 10.01.25, 1 ind., 25.01.25, 2 ind., 16–17.02.25, 1 ind., (2), 19.12.24, 1 ind.
Suborder Rhopalocera
Family Nymphalidae
94. *Vanessa atalanta* (Linnaeus, 1758)
Material. (1), 2.01.2025, 1 ind.; (2), 9.01.2025, 6 ind.; (3), 1.02.25, 3 ind.
Family Pieridae
95. *Colias croceus* (Fourcroy, 1785)
Material. (2), 3.12.24, 1 ind.
96. *Pieris brassicae* (Linnaeus, 1758)
Material. (1), 21–22.12.24, 1 ind., 31.01.25, 1 ind.
97. *Pieris rapae* (Linnaeus, 1758)
Material. (1), 25.01.25, 1 ind.
Order Diptera
Suborder Nematocera
Family Culicidae
98. *Culex* cf. *pipiens* Linnaeus, 1758
Material. (1), 20–24.12.24, 5 ind.
Suborder Brachycera
Family Calliphoridae
99. *Calliphora vicina* Robineau-Desvoidy, 1830
Material. (1), 17–18.12.24, 1 ♀; (2), 19.12.24, 3 ♂, 2 ♀ (Mk), 20–24.12.24, 1 ♂, 1 ♀ (Mk), 9–10.01.25, 5 ♂, 5 ♀ (Mk), 15–20.01.25, 1 ♂ (Mk), 22–26.01.25, 5 ♀ (Mk), 22–26.01.25, 6 ♂ (Mk), 27.01.25, 1 ♂ (Mk), 28–30.01.25, 7 ♂, 2 ♀ (Mk), 1–3.02.25, 2 ♂ (Mk), 15–17.02.25, 1 ♂ (Mk), 27–28.02.25, 1 ♂ (Mk)
100. *Calliphora vomitoria* (Linnaeus, 1758)
Material. (2), 22–24.01.25, 2 ♂ (Mk), 28–30.01.25, 2 ♀ (Mk)
Family Drosophillidae
101. *Scaptomyza pallida* (Zetterstedt, 1847)
Material. (2), 15–17.01.25, 1 ♂, 2 ♀ (Mk), 1–3.02.25, 5 ♂, 5 ♀ (Mk)
Family Ephydridae
102. *Hecamebe albicans* (Meigen, 1830)
Material. (2), 9–10.01.25, 3 ♂, 3 ♀ (Mk)
103. *Parydra fossarum* (Haliday, 1833)
Material. (2), 1–3.02.25, 1 ♂ (Mk)
Family Heleomyzidae
104. *Suilla pallida* (Fallén, 1820)
Material. (2), 20–24.12.24, 1 ♂, 3 ♀ (Mk), 22–26.01.25, 4 ♂ (Mk)
105. *Suilla variegata* (Loew, 1862)
Material. (2), 22–26.01.25, 1 ♀ (Mk)
Family Lauxaniidae
106. *Calliopum aeneum* (Fallén, 1820)
Material. (1), 10.12.25, 1 ♂; (2), 20–24.12.24, 1 ♀ (Mk)

Family Muscidae
107. *Neomyia cornicina* (Fabricius, 1781)
Material. (2), 1–9.01.25, 1 ♀ (Mk), 9–10.01.25, 3 ♂, 2 ♀ (Mk), 22–26.01.25, 2 ♀ (Mk), 28–30.01.25, 6 ♂ (Mk), 1–3.02.25, 1 ♂ (Mk)
108. *Phaonia subventa* Harris, 1780
Material. (2), 20–24.12.24, 2 ♀ (Mk), 9–10.01.25, 1 ♀ (Mk), 22–26.01.25, 6 ♀ (Mk), 28–30.01.25, 6 ♀ (Mk)
109. *Polietes meridionalis* Peris & Llorente, 1963
Material. (2), 20–24.12.24, 2 ♀ (Mk), 9–10.01.25, 1 ♀ (Mk), 22–26.01.25, 2 ♀ (Mk), 28–30.01.25, 3 ♀ (Mk)
Family Sarcophagidae
110. *Sarcophaga carnaria* (Linnaeus, 1758)
Material. (2), 28–30.01.25, 1 ♂ (Mk)
Family Sepsidae
111. *Sepsis fulgens* Meigen, 1826
Material. (2), 22–26.01.25, 1 ♂, 1 ♀ (Mk)
Family Syrphidae
112. *Chrysotaxum intermedium* Meigen, 1822
Material. (2), 9–10.01.25, 1 ♀ (Mk)
113. *Episyrphus balteatus* (De Geer, 1776)
Material. (2), 1–9.01.25, 1 ♂ (Mk), 9–10.01.25, 2 ♀ (Mk), 22–26.01.25, 1 ♂, 1 ♀ (Mk), 1–3.02.25, 1 ♀ (Mk)
114. *Eristalis tenax* (Linnaeus, 1758)
Material. (1), 17–18.12.24, 1 ♀, 1–9.01.25, 1 ♀, 25.01.25, 1 ♀; (2), 20–24.12.24, 1 ♀ (Mk), 9–10.01.25, 8 ♀ (Mk), 15–20.01.25, 1 ♀ (Mk), 22–26.01.25, 2 ♀ (Mk), 28–30.01.25, 8 ♀ (Mk), 1–3.02.25, 20 ♀ (Mk), 15–17.02.25, 2 ♀ (Mk)
115. *Eupeodes corollae* (Fabricius, 1794)
Material. (1), 29.01.25, 1 ♂; (2), 20–24.12.24, 1 ♀ (Mk), 1–9.01.25, 1 ♂, 1 ♀ (Mk), 9–10.01.25, 22 ♂, 7 ♀ (Mk), 15-20.01.25, 11 ♂, 4 ♀ (Mk), 22–26.01.25, 6 ♂, 8 ♀ (Mk), 28–30.01.25, 2 ♂, 3 ♀ (Mk), 1–3.02.25, 4 ♂, 4 ♀ (Mk), 15–17.02.25, 3 ♂, 4 ♀ (Mk), 27–28.02.25, 1 ♀ (Mk)
116. *Scaeva pyrastri* (Linnaeus, 1758)
Material. (1), 9–10.01.25, 1 ♀, 25.01.25, 1 ♀, 29.01.25, 1 ♀, (2), 15–20.01.25, 1 ♀ (Mk)
117. *Syrphus vitripennis* Meigen, 1822
Material. (1), 19–20.01.25, 1 ♀; (2), 1–9.01.25, 1 ♀ (Mk)

According to the European Atmosphere Monitoring Service Copernicus[4], mean temperature (°C) in Europe in January 2025 was 1.80 °C, which is 2.51 °C higher than the mean temperature for January 1991–2020 (Fig. 1). At the same time, in southeastern Crimea, a steady increase in average temperatures was recorded in January (Fig. 2) and February (Shorenko et al., 2025), and the mean long-term temperatures of weather anomalies over 104 years increased by 1 °C (Drygval et al., 2024). According to some estimates, the rate of climate change on the peninsula is 2–3 times greater than globally (Degterev, 2020). Overall, ecosystems in Crimea show a shift toward increasing average annual temperatures and precipitation (Gorbunov et al., 2021). Park areas of Crimea are traditionally located on the peninsula's coast. The winter temperature difference between the mountains and the parks of the coastal area can reach 10–15 °C. At altitudes of 400–500 meters a.s.l., typical of South-Eastern Crimea, temperatures often drop below freezing at night and remain slightly above freezing during the day. Meanwhile, coastal subtropical microclimates buffer thermal extremes, which limits insect hibernation and allows for extended periods of activity. Average air temperatures in December and January 2024–2025 for South-Eastern Crimea significantly exceeded long-term historical norms. At the end of January 2025, the temperature in Crimea exceeded the absolute maximum of 1936 by 0.2°C[5]. February 2025 was relatively cold, with

[4] Copernicus. Web page. URL: https://www.copernicus.eu/en (accessed: 01.05.2025).

[5] Federal State Budgetary Institution "Crimean Administration for Hydrometeorology and Environmental Monitoring." Web page. URL: https://www.meteo-crimea.ru (accessed: 05.02.2025).

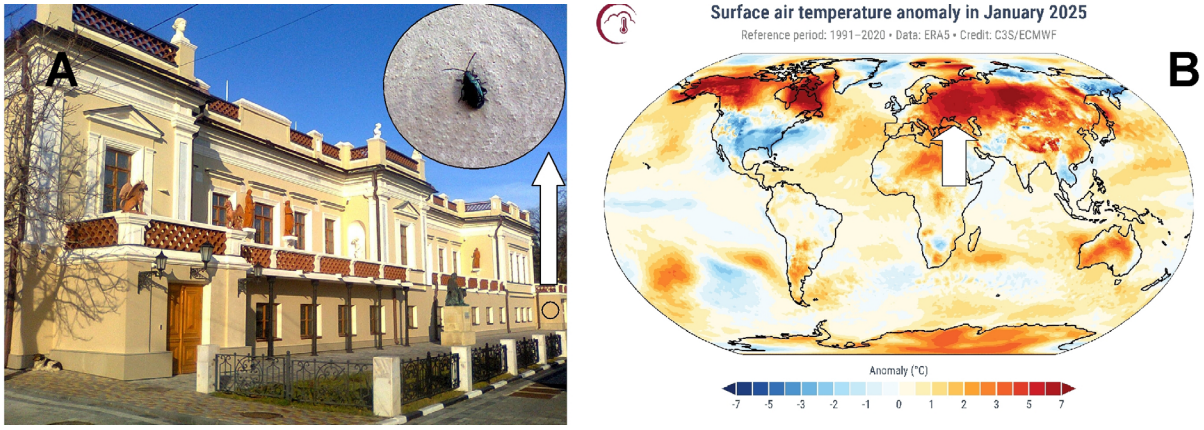


Fig. 1. Study area: **A** – Feodosia, facade of the I.K. Aivazovsky Art Gallery, showing location of anomalous mass accumulation of *Phyllotreta nigripes* (Fabricius, 1775) (February 2, 2025); **B** – insect collection location on the world map (marked with an arrow) and average monthly air temperature in January (according to https://www.copernicus.eu/en).

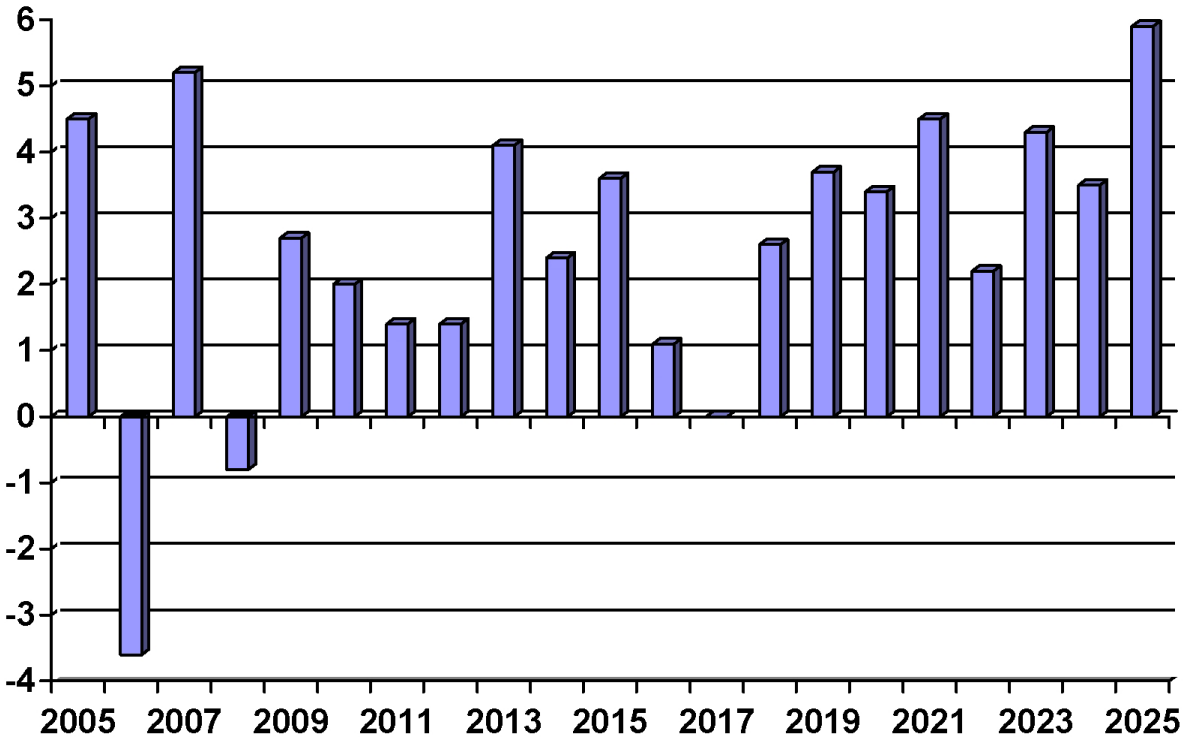


Fig. 2. Long-term data on mean air temperature (°C) in the south-east of Crimea in January 2005–2025 (according to the Karadag Scientific Station).

frosts in the late first and middle of the second ten-day period (T avg. −1 °C), but the first ten-day period of February was anomalously warm (T max +11.4 °C). Thus, during the anomalous warming period of 2024–2025, we were able to collect entomological material in the parks of South-Eastern Crimea, which are not classified as subtropical. Records of numbers of identified taxa, including those obtained previously in February–March 2024 (Shorenko et al., 2025), are presented in Table 1.

The shift in climate boundaries due to the expansion of the subtropical Mediterranean zone from the southern coast of Crimea to the borders of southeastern Crimea leads to changes in the phenology of insect species, including in urbanized areas. During thaws, daily insect activity peaked at midday and ended after 4:00 PM as temperature dipped in the late afternoon. All species were found active in various park biotopes, including the moderately harmful invasive species *A. aegyptium* (Orthoptera).

The greatest species diversity in the parks and garden squares of Crimea is represented by the order Coleoptera, especially the families Staphylinidae and Chrysomelidae. Four species of beetles are recorded for the first time in Karadag (*A. abdominalis*, *H. distinguendus*, *M. pumila*, and *P. tricolor*). Adults of *C. septempunctata* were found throughout the park biotopes from December to March. Many individuals of this species were found on warm asphalt pavement and rocks, something we previously typically observed in autumn.

The elm leaf beetle *Xanthogaleruca luteola*, previously locally recorded by us in the first ten days of March in Yevpatoriya (Shorenko et al., 2025), was encountered sporadically in the southeast of the peninsula in the winter of 2024–2025. *X. luteola* normally appears in the European part of Russia in April–May (Kalyuzhnaya et al., 1995). This species is known to initiate mating 5–6 days after emerging from diapause, producing several generations per year and uncontrolled mass outbreaks (Kalyuzhnaya et al., 1995). We did not observe mating of *X. luteola* in winter.

The common flea beetle *Phyllotreta nigripes* (Alticini) was recorded locally in January and February 2024–2025, which was apparently related to winter improvement work in the park area (filling with large volumes of imported soil) and abnormal soil heating during this period (T min +0.8 °C, T max +10.4 °C according to the Karadag Scientific Station). In early March 2025, we recorded mating of *Ph. nigripes*; mating was previously recorded for *Coccinella septempunctata* (Shorenko et al., 2025). It is known that the flea beetles *Ph. nigripes* and *Ph. atra* are agricultural pests that overwinter in the soil at depths down to 5 cm. They typically emerge in early spring and develop on Brassicaceae plants (Tsurikov, 2013). In the southeast of the Crimean Peninsula, the species can reach high numbers in the summer (Dedyukhin and Shorenko, 2020). However, this is the first time *Ph. nigripes* has been collected in Crimea in winter in

Table 1. Insect records in coastal parks and garden squares of Crimea during the period of abnormal winter warming in 2024–2025.

Order	Families	Genera	Species	Specimens
Dermaptera	1	1	1	1
Orthoptera	2	2	2	5
Hemiptera	14	25	25	141
Coleoptera	13	51	75	712
Neuroptera	1	1	1	2
Hymenoptera	5	18	21	52
Lepidoptera	5	7	8	26
Diptera	10	19	21	273
Total	**51**	**124**	**154**	1214

such significant numbers (263 specimens). This species was concentrated primarily on building facades (Fig. 1), which we believe is due to their color and lighting.

In addition to *Ph. nigripes*, other Coleoptera species such as Staphylinidae (especially *T. hypnorum*) and Curculionidae, were also found on the facades. Hemiptera, including the invasive pest *Halyomorpha halys*, were also found there. According to our observations, *Pyrrhocoris apterus* is common in the Crimean park zone in winter. *Monosteira unicostata*, a pest, dominated among the Hemiptera collected. This species was recorded by us in small numbers in January and February 2024 (Shorenko et al., 2025). In the 2024–2025 collections, its abundance increased tenfold, which is explained by warmer conditions in December 2024 (T avg. +5.5 °C, according to data from the Karadag Scientific Station), when the largest number of *M. unicostata* (24 specimens) was collected. This species overwinters as an adult. Leafhoppers (Auchenorrhyncha) are represented in the collections by the meadow spittlebug *Philaenus spumarius,* a grape pest.

A significant number of true fly species (Diptera) present in the collections (twenty species) were collected using a Mörike trap. *Calliphora vicina*, *Eupeodes*, and *Eristalis tenax* can be considered background species in the collections. Ten dipteran species were noted in Karadag for the first time (*C. aeneum*, *C. vomitoria*, *N. cornicina*, *P. fossarum*, *P. meridionalis*, *S. carnaria*, *S. fulgens*, *S. pallida*, *Sc. pallida*, *S. variegata*), which is due to the incomplete faunistic study of this group on the peninsula. *E. tenax* produced the largest number of individuals in the collections from the park zone of southeastern Crimea during the thaw period; this species is common in autumn, but this is the first record in large numbers in winter.

Hymenoptera are represented by a significant number of ants (Formicidae), all species previously recorded at Karadag (Yusupov and Shorenko, 2021). The material revealed two species of Vespidae wasps: *P. dominula* and *V. germanica*, five species of bees (Apidae), species of the family Ichneumonidae (*O. luteus* is recorded from Karadag for the first time), and the species *N. quercusbaccarum* of the family Cynipidae (the emergence of imagoes in winter was recorded for the first time). *N. quercusbaccarum* causes significant damage to young oak leaves, forming galls in the spring. It usually emerges from diapause in April; previously, abundant spring galls of *N. quercusbaccarum* were recorded in May 2023 in the Karadag Nature Reserve (Shorenko, 2023). Thus, pronounced phenological responses to climate warming in Crimea were observed among the Hymenoptera species recorded.

The emergence of *Andrena thoracica* in early February 2025 is not typical for this spring species. Single individuals were collected in February 2025, and a mass emergence was observed in March–April. Literature on the entomofauna of the Crimean Peninsula confirms that various Hymenoptera species temporarily emerge or forage during temporary winter thaws (Shorenko, 2017). Our observations show that, in the absence of abundantly flowering wild plants, most active anthophilous insects in Crimean parks and garden squares during winter warming feed on cultivated plants: honeysuckle (family Caprifoliaceae, *Lonicera* sp.) (Fig. 3), forsythia (family Oleaceae, *Forsythia* sp.), yucca (family Asparagaceae, *Yucca* sp.), and some others.

Lepidoptera are represented in the collections by eight species of two suborders (Table 1). The largest number of individuals in the urbanized landscapes of the peninsula are represented by the Holarctic species *V. atalanta*, which overwinters as an adult and normally emerges in April (Budashkin, 2006). In addition to the park zone, we recorded these Lepidoptera in the Crimean sparse forest at an altitude of about 500 m a.s.l. (Karadag, Mount Svyataya, Belogorsk District, Mount Kubalach). For the first time, active flight of imagoes of *P. brassicae* and *P. rapae*, pests of agricultural crops, was noted in the center of Feodosia (Bulvarnaya Gorka). In addition, on January 31, 2025, one live caterpillar of P. brassicae was found (Fig. 3). In eastern Crimea, these species typically begin their active flight in April–May and have three generations per year (Budashkin, 2006). Due to abnormally warm weather, we recorded *Colias croceus* in early December. This butterfly is normally found until the end of November (Budashkin, 2006); collection materials indicate that it was found in February 1902–1903 in Yalta (Budashkin et al., 2016). The suborder Heterocera is represented by the widespread species *E. monodactyla*, *M. stellatarum*, and the pests *A. segetum* and *A. gamma*, adults of which were found during the daytime under streetlights. Previously, these species were recorded year-round during the frost-free period when light trapping in Crimea (Budashkin, 2006).

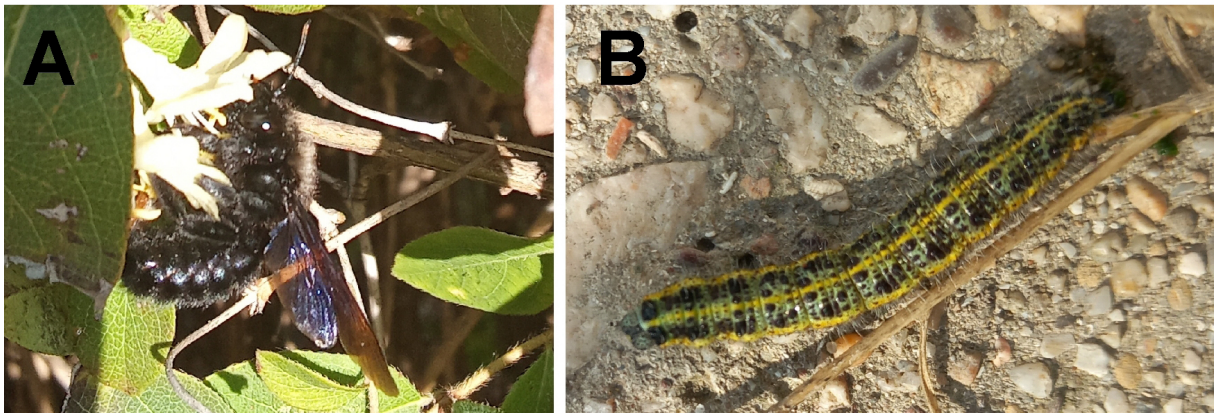


Fig. 3. Insects of coastal parks and garden squares in South-Eastern Crimea during abnormal winter climatic warming. **A** – *Xylocopa valga* emerging from diapause feeds on flowering honeysuckle (*Lonicera* sp.). Feodosia, embankment, January 10, 2025. B – Active caterpillar of *Pieris brassicae*. Feodosia, embankment, January 31, 2025.

Conclusions

As a result of a study conducted during the anomalous winter warming period of 2024–2025, we observed a significant number of insects typical of the spring season, emerging from diapause in Crimean parks and garden squares. In January, February, and December 2024 and January and February 2025, 1214 active insect specimens belonging to 154 species, 124 genera, 51families, and 8 orders were collected in Crimean parks and garden squares. Of these, 15 species (4 Coleoptera species, 1 Hymenoptera species, 10 Diptera species) were recorded for the first time in Karadag, which is included in the list of specially protected natural areas of federal significance. Thirteen pest species were recorded in the study area. Most of the species were represented by ruderal and synanthropic species overwintering as adults. Due to abnormal soil warming (Tmax +10.4 °C), coastal urbanized areas of Crimea (parks and garden squares) experienced increased activity, primarily among herpetobiontes. The primary phenological response to climatic anomalies during winter is early emergence from diapause; in a few cases, early mating (*C. septempunctata*, *Ph. nigripes*) and an increase in the potential number of generations per year (*P. brassicae*) have been observed.

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