

## NEW DATA ON INSECTA FROM THE OLD ORHEI, REPUBLIC OF MOLDOVA

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**Abstract.** The paper includes first data about the species diversity of insects (Coleoptera and Odonata) from Old Orhei, Republic of Moldova. A total number of 46 insect species were revealed, of which 16 Odonata and 30 Coleoptera. The research carried out in alfalfa allowed highlighting a wide spectrum of coleoptera with different trophic preferences, with the predominance of phytophagous and zoophagous species.

**Keywords:** dragonfly, coleoptera, new record, protected area, Republic of Moldova.

**Rezumat. Date noi despre insectele din Orheiul Vechi, Republica Moldova.** Lucrarea include date noi privind diversitatea speciilor de insecte (Coleoptera și Odonata) din Orheiul Vechi, Republica Moldova. În total au fost colectate 46 de specii de insecte, dintre care 16 specii de Odonata și 30 de specii de Coleoptera. Cercetările efectuate în lucernă au permis evidențierea unui spectru larg de coleoptere cu diferite preferințe trofice, cu predominarea speciilor fitofage și zoofage.

**Cuvinte cheie:** libelule, gândaci, date noi, arie protejată, Republica Moldova.

### INTRODUCTION

The Orheiul Vechi Cultural-Natural Reserve (known as “Old Orhei”) developed as a result of a harmonious collaboration between man and nature from prehistoric times to the present day, with archeological findings as early as the Late Paleolithic era (ca 30.000-20.000 BC). Due to its strategic position close to the Dniester River, a major trading route connecting the Carpathians and the Black Sea Basin, and its geology forming a natural fortification, it has been inhabited almost continuously for thousands of years across the different civilizations and cultures who have called this place home. In order to protect and enhance the cultural heritage of the area, the Old Orhei was declared a reserve on March 15, 1968 (\*\*\*) <https://orheiulvechi.com/en/the-reserve/>.

On July 12, 2013, a decision was taken "Regarding the foundation of the Orhei National Park", including four districts: Orhei, Strășeni, Călărași and Criuleni and 18 localities. Several protected areas were included in the newly created park, including the Old Orhei located on the eastern edge of the Orhei National Park. Unfortunately, the diversity of invertebrate species in this area is insufficiently studied (Fig. 1).



Figure 1. View towards the Old Orhei and River Răut (original photos Bușmachiu G.).

During the 60s of the 20<sup>th</sup> century, entomologists started to collect and study insect species in the localities Ivancea, Vatici, Trebujeni and Butuceni from the Old Orhei. Today, these insects are part of the collection housed in the Entomology Museum of the Institute of Zoology, USM. The inventory of species from the museum collection revealed three species from the Diptera order, Tachinidae family: *Carcelia iliaca* (Ratzeburg, 1840), *Compsilura concinnata* (Meigen, 1824), *Pales pavida* (Meigen, 1824) and two species from the Tabanidae family: *Hybomitra ukrainica* (Olsufjev, 1952), *Tabanus autumnalis* (Linnaeus, 1761) collected in Old Orhei (CEBOTARI & BUȘMACHIU, 2020, 2021). Likewise, 13 species of ladybugs collected in Ivancea were published by BUȘMACHIU et al. (2022); BACAL et al. (2021). Only a small part of insect species collected in Old Orhei and housed in the Museum of Entomology, Institute of Zoology has been published to date.

The entomological research continued in the 21<sup>st</sup> century. An inventory of edaphic and saproxylic coleoptera species collected from the forest ecosystems of Old Orhei between 2007-2020 and 2023 years were published by BUȘMACHIU & BACAL, 2016; BACAL et al., 2023. The paper includes 131 coleopteran species collected in the Old Orhei and selected from previously published sources. Between them 18 species were cited for the first time.

Only three species of dragonflies *Aeshna affinis* Vander Linden, 1820 (Brauner, 1910), *Calopteryx splendens* Harris, 1780, *Platycnemis pennipes* Harris, 1780 have been cited from the territory of Old Orhei by DYATLOVA (2010).

## MATERIALS AND METHODS

**Site description.** The Orhei National Park has an area of 33,792.09 ha and is located on the Codrii Plateau (90.7%), in a forest-steppe region (9.3%) with calcareous canyons on the banks of the Răut and Dniester rivers. The slopes of the Codrii heights are characterized by a sandy relief, represented by narrow ridges, deep valleys and hills (Fig. 1). Agricultural fields, including alfalfa, are located on the studied territory.

**Alfalfa.** Private agricultural fields were sown with alfalfa. To identify the insect complex associated with alfalfa, several collections were made from the same points located on the banks of the River Răut. The land surfaces varied between 700-1000 m<sup>2</sup>.

**Natural forest.** The forest from Old Orhei consists of several oak species (*Quercus petraea*, *Q. robur*) located on the slopes with northern exposure. Sessile oak trees mixed with hornbeam (*Carpinus betulus*) are found on the slopes with north-east and east exposure. The banks of Răut river, in the perimeters of Trebujeni and Butuceni, are covered with water protection strips, formed by willows, ash and palustral vegetation.

**Forest plantation.** At a lower altitude, oak forest in combination with hornbeam, sessile and pedunculate oaks are found. Willow forests (*Salix* sp.) were formed in the meadows of the medium-sized Răut river (MUNTEANU et al., 2011). In Old Orhei, there is also a *Pinus nigra* plantation, along the roads or the forest strips.

**Collection of materials.** Insects were collected from wood decompose of natural forests, under bark of the *Pinus nigra* plantation, pasture, palustral vegetation on the bank of the Răut river, in agricultural fields such as alfalfa, in different localities: Butuceni (47°30'N 28°96'E) (June 1, 2023, May 3 and 25, 2024), Trebujeni (47°32'N 28°95'E) (June 1, 2023, Mai 3 and 25, 2024, July 19 2024), Vatici (47°34'N 28°62'E) (April 12, 2024), Ivancea (46°28'N 28°87'E) (June 3 and 4, 2023).

**Species identification.** For the taxonomic identification of insect species, the morphological method was used, along with several determination keys (KRYZHANOVSKIY, 1965; \*\*\*. <http://coleonet.de/coleo/html/start.htm>; \*\*\*. <http://www.kaefer-der-world.de/>; BOUDOT & KALKMAN, 2015).

## RESULTS AND DISCUSSIONS

As a result of investigations in Old Orhei, a total number of 46 insect species belonging to 38 genera and 18 families from two orders – Odonata and Coleoptera – was revealed. Altogether, individuals of 16 Odonata species belonging to 11 genera and 6 families and 30 Coleoptera species from 27 genera and 12 families were observed in the studied habitats. The list of species and type of habitats are included in table 1. Most identified insect species are cited for the first time for Old Orhei and are marked with an asterisk (\*) in table 1.

Table 1. The species of Odonata and Coleoptera revealed in the Old Orhei.

| No.                           | Species   | Alfalfa | Banks of river/ | Forest/ forest plantation | Forest edge | Trophic group |
|-------------------------------|---|---------|-----------------|---------------------------|-------------|---------------|
| <b>Order Odonata</b>          |   |         |                 |                           |             |               |
| <b>Family Calopterygidae</b>  |   |         |                 |                           |             |               |
| 1.                            | <i>Calopteryx splendens</i> (Harris, 1780)              |         | +               | +                         | +           | Zoophagous    |
| <b>Family Platycnemididae</b> |   |         |                 |                           |             |               |
| 2.                            | <i>Platycnemis pennipes</i> (Harris, 1780)              | +       | +               | +                         | +           | Zoophagous    |
| <b>Family Coenagrionidae</b>  |   |         |                 |                           |             |               |
| 3.                            | * <i>Coenagrion puella</i> (Linnaeus, 1758)             |         | +               |                           |             | Zoophagous    |
| 4.                            | * <i>Erythromma viridulum</i> (Charpentier, 1840)       |         | +               |                           |             | Zoophagous    |
| 5.                            | * <i>Ischnura elegans</i> (Vander Linden, 1820)         | +       | +               | +                         | +           | Zoophagous    |
| 6.                            | * <i>Ischnura pumilio</i> (Charpentier, 1825)           |         | +               |                           |             | Zoophagous    |
| <b>Family Lestidae</b>        |   |         |                 |                           |             |               |
| 7.                            | * <i>Lestes barbarus</i> (Fabricius, 1798)              |         | +               |                           |             | Zoophagous    |
| <b>Family Aeshnidae</b>       |   |         |                 |                           |             |               |
| 8.                            | * <i>Anax imperator</i> (Leach, 1815)                   |         | +               |                           |             | Zoophagous    |
| 9.                            | * <i>Anax parthenope</i> (Selys 1839)                   |         | +               |                           |             | Zoophagous    |
| <b>Family Libellulidae</b>    |   |         |                 |                           |             |               |
| 10.                           | * <i>Crocothemis erytraea</i> (Brullé, 1832)            |         | +               |                           | +           | Zoophagous    |
| 11.                           | * <i>Libellula depressa</i> (Linnaeus, 1758)            |         | +               |                           |             | Zoophagous    |
| 12.                           | * <i>Orthetrum albistylum</i> (Selys, 1848)             |         | +               |                           |             | Zoophagous    |
| 13.                           | * <i>Orthetrum coerulescens</i> (Fabricius, 1798)       |         | +               |                           |             | Zoophagous    |
| 14.                           | * <i>Orthetrum cancellatum</i> (Linnaeus, 1758)         |         | +               |                           | +           | Zoophagous    |
| 15.                           | * <i>Sympetrum meridionale</i> (Selys, 1841)            |         | +               |                           | +           | Zoophagous    |
| 16.                           | * <i>Sympetrum sanguineum</i> (Müller, 1764)            |         | +               |                           | +           | Zoophagous    |
| <b>Order Coleoptera</b>       |   |         |                 |                           |             |               |
| <b>Family Coccinellidae</b>   |   |         |                 |                           |             |               |
| 17.                           | * <i>Coccinella 7-punctata</i> (Linnaeus, 1758)         | +       |                 | +                         | +           | Zoophagous    |
| 18.                           | <i>Coccinula quatuordecimpustulata</i> (Linnaeus, 1758) | +       |                 |                           |             | Micetophagous |

| No. | Species   | Alfalfa | Banks of river/ | Forest/ forest plantation | Forest edge | Trophic group |
|-----|---|---------|-----------------|---------------------------|-------------|---------------|
| 19. | * <i>Harmonia axyridis</i> (Pallas, 1773)                       | +       |                 |                           |             | Polyphagous   |
| 20. | <i>Hippodamia variegata</i> (Goeze, 1777)                       | +       |                 |                           |             | Zoophagous    |
| 21. | <i>Propylaea quatuordecimpunctata</i> (Linnaeus, 1758)          | +       |                 | +                         | +           | Micotophagous |
| 22. | <i>Nephus redtenbacheri</i> (Mulsant, 1846)                     | +       |                 |                           |             | Zoophagous    |
| 23. | <i>Psyllobora vigintiduopunctata</i> (Linnaeus, 1758)           | +       |                 |                           | +           | Zoophagous    |
| 24. | * <i>Scymnus frontalis</i> (Fabricius, 1787)                    | +       |                 | +                         | +           | Zoophagous    |
| 25. | * <i>Scymnus nigrinus</i> (Kugelann, 1794)                      | +       |                 |                           |             | Zoophagous    |
| 26. | * <i>Subcoccinella vigintiquatuor punctata</i> (Linnaeus, 1758) | +       |                 |                           | +           | Zoophagous    |
| 27. | <i>Tytthaspis sedecimpunctata</i> (Linnaeus, 1758)              |         |                 | +                         | +           | Zoophagous    |
|     | <b>Family Phalacridae</b>                                       |         |                 |                           |             |               |
| 28. | * <i>Olibrus bicolor</i> (Fabricius, 1792)                      | +       |                 |                           |             | Oligophagous  |
|     | <b>Family Chrysomelidae</b>                                     |         |                 |                           |             |               |
| 29. | * <i>Cassida stigmatica</i> (Suffrian, 1844)                    | +       |                 |                           |             | Phytophagous  |
| 30. | * <i>Gonioctena fornicata</i> (Brüggemann, 1873)                | +       |                 |                           |             | Phytophagous  |
| 31. | * <i>Oreina alpestris</i> (Schummel, 1843)                      |         |                 |                           | +           | Phytophagous  |
| 32. | * <i>Phyllotreta nemorum</i> (Linnaeus, 1758)                   | +       |                 |                           | +           | Phytophagous  |
| 33. | * <i>Smaragdina affinis</i> (Illiger, 1794)                     | +       |                 |                           | +           | Phytophagous  |
|     | <b>Family Carabidae</b>   |         |                 |                           |             |               |
| 34. | * <i>Brachinus crepitans</i> (Linnaeus, 1758)                   | +       |                 |                           |             | Zoophagous    |
|     | <b>Family Cantharidae</b>                                       |         |                 |                           |             |               |
| 35. | * <i>Cantharis obscura</i> (Linnaeus, 1758)                     | +       |                 |                           |             | Zoophagous    |
| 36. | * <i>Cantharis rustica</i> (Fallén, 1807)                       | +       |                 |                           |             | Zoophagous    |
|     | <b>Family Cerambycidae</b>                                      |         |                 |                           |             |               |
| 37. | <i>Agapanthia violacea</i> (Fabricius, 1775)                    | +       |                 |                           |             | Phytophagous  |
|     | <b>Family Curculionidae</b>                                     |         |                 |                           |             |               |
| 38. | * <i>Hypera postica</i> (L.Gyllenhal, 1813)                     | +       |                 |                           |             | Phytophagous  |
| 39. | * <i>Polydrusus mollis</i> (Strøm, 1768)                        |         |                 |                           | +           | Phytophagous  |
| 39. | * <i>Sitona lineatus</i> (Linnaeus, 1758)                       | +       |                 |                           |             | Phytophagous  |
|     | <b>Family Melyridae</b>   |         |                 |                           |             |               |
| 41. | * <i>Malachius bipustulatus</i> (Linnaeus, 1758)                | +       |                 |                           |             | Polyphagous   |
|     | <b>Family Mordellidae</b>                                       |         |                 |                           |             |               |
| 42. | * <i>Mordellistena pumila</i> (Gyllenhal, 1810)                 | +       |                 |                           |             | Phytophagous  |
|     | <b>Family Attelabidae</b>                                       |         |                 |                           |             |               |
| 43. | * <i>Neocoenorhinius pauxillus</i> (Germar, 1824)               | +       |                 |                           | +           | Phytophagous  |
|     | <b>Family Elateridae</b>  |         |                 |                           |             |               |
| 44. | * <i>Athous subfuscus</i> (Müller, 1764)                        | +       |                 |                           |             | Phytophagous  |
| 45. | * <i>Athous hirtus</i> (Herbst, 1784)                           | +       |                 |                           |             | Phytophagous  |
|     | <b>Family Scarabaeidae</b>                                      |         |                 |                           |             |               |
| 46. | * <i>Tropinota hirta</i> (Poda, 1761)                           | +       | +               | +                         | +           | Phytophagous  |
|     | <b>Total</b>  | 28      | 14              | 7                         | 18          |               |

The favourite habitat of Odonata is the wet one. All identified species were observed on the palustral vegetation. But there were specimens of two species seen on alfalfa - *Platycnemis pennipes* and *Ischnura elegans*, and other species used shrubs and trees at the edge of the forest for rest.

Most of the identified beetle species, 27 in total, were collected in alfalfa, 5 species - on the bank of the Răut river, 5 in forests or forest plantations and 12 were found on the herbaceous plants on the forest edge.

The trophic preferences of the detected species are also different. Odonata are fierce predators of other insects. They are successful hunters, relying on speed, agility, and stealth: they are apex predators of the insect world. All Odonata feed on living prey throughout their larval or adult life. They spend much of their time hunting, making short flights to capture prey and then perching to consume it. They eat what is available; they don't have a preferred target, but flies are a typical meal. Larger dragonflies may take prey as big as damselflies and butterflies, and sometimes smaller dragonflies too (\*\*<https://makeham.org/what-are-dragonflies-and-damselflies/feeding-and-predation>).



Figure 2. *Olibrus bicolor* (original photo Crețu I.)

The revealed coleopteran species have different trophic preferences, most of them being phytophagous (14), zoophagous (13), micetophagous (2), polyphagous (2) and oligophagous (1). Some species of beetles such as *Olibrus bicolor* (Fig. 2), *Tropinota hirta* prefer to consume flowers of Asteraceae, especially dandelion, which was abundant in the studied alfalfa crop. The presence of phytophagous species is typical for agricultural crops, especially alfalfa, preferred by many insect species, as well by many pests, including aphids, which favours the development of populations of aphid-eating coccinellids (Table 1).

Among the identified coleopteran species, several pests of agricultural crops can also be found, such as *Agapanthia violacea*, *Hypera postica*, *Polydrusus mollis*, *Tropinota hirta* and *Sitona lineatus*.

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#### CONCLUSIONS

Twenty-four species of Coleoptera and 14 of Odonata are cited for the first time for Old Orhei from the total number of 46 identified insect species. Altogether, individuals of 16 Odonata species belonging to 11 genera and 6 families and 30 Coleoptera species from 12 families and 27 genera were observed in the studied habitats. The study of coleoptera from the alfalfa crop in Orheiul Vechi allowed the identification of a whole series of coleoptera, including pest species. Among them, phytophagous and zoophagous species predominate, followed by species with other trophic preferences.

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