PRELIMINARY DATA ON THE BEETLE (COLEOPTERA) FAUNA OF TUROPOLJSKI LUG FOREST

PRELIMINARNI PODACI O FAUNI KORNJAŠA (Coleoptera) TUROPOLJSKOG LUGA

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SUMMARY

Wetlands provide many important ecosystem services, e.g. serving as natural retention areas to prevent flooding and they can be recreational areas for the general public. They also represent vital habitats for many animal species and many are protected nature areas. In spite of this, the fauna of many wetlands in Croatia is still mostly unknown, especially when it comes to beetles. Not knowing the fauna of a particular habitat hinders management efforts. One such location is Turopoljski Lug forest, south-east from the capital Zagreb. The fieldwork was done from March till September 2017, utilising four methods: sweep netting, baited traps on tree trunks, light trapping with UV light traps at night, and collecting by hand. Additionally, several records from earlier visits are included. The total number of currently known species for the forest is raised from 51 to 133. A total of nine species are near threatened (NT), seven of which are saproxylic. Three species listed in Annexes II and IV of the Habitats Directive occur in the area, of which only Cerambyx cerdo had been recorded. Additionally, a neglected literature record of a fourth, Phryganophilus ruficollis, has been discovered. Current management practices for the forest should be re-evaluated and modified if necessary. Future research targeting specific beetle groups should yield further increases in the number of species known for the area, while a targeted mapping of the distribution of species listed on the Annexes should yield much-needed conservation information.

KEY WORDS: flooded forest, Natura 2000 Ecological Network, Cerambyx cerdo, Phryganophilus ruficollis, Trox perrisii, nature protection areas

INTRODUCTION

UVOD

Wetlands represent important habitats for many animal species, as a suitable home for them and as a source of food and water (Junk et al., 2013). Many are globally protected through the Ramsar Convention (Anonymous, 2008) and through local/national legislation, e.g. as national and nature parks and through ecological networks such as Natura 2000 (Anonymous, 1979, 1992). Examples of such wetlands in Croatia are the Kopački Rit and Lonjsko Polje Nature Parks and Natura 2000 sites, and Turopoljski Lug in Turopolje.

Turopolje is a region located between the right bank of the Sava River to the north-east and the Vukomeričke Gorice to the south-west, south-east of Zagreb and Velika Gorica, north-west of Sisak (Lazowski, 1910). One of its defining features is the Turopoljski Lug forest, covering an area of 33.44 km². The area changed a lot in the last 200-odd years,
mainly due to the shift from an acorn-harvesting to a lumber-harvesting attitude by the people from the area and the expansion of the villages (Tvrtković, 1997a). This is evident in the reduction of the Turopoljski Lug forest’s surface area, as is evident comparing the First Military Survey maps created during the Habsburg Monarchy (Biszak et al., 2014) with modern sources (e.g. Google Earth). While the reduction in the number of bogs and other wetlands was evident by the beginning of the 20th century (Lazowski, 1910), one of the major changes when it comes to the water regime and wetland habitats was when the Sava-Odra canal was dug in 1965, to divert excess water from the Sava River away from Zagreb, as a flood prevention measure (Tvrtković, 1997a). This, and other flood prevention measures implemented throughout the years, caused a shift in the groundwater levels (Tvrtković, 1997a). Additionally, the wet grassland habitats are either drying out, or disappearing due to overgrowing. Despite this, Turopoljski Lug is still considered to be one of the most important wetland habitats in Croatia, and as such is covered by the Natura 2000 site Odransko Polje (Anonymous, 2015), and the Significant Landscapes Turopoljski Lug and Odransko Polje (Anonymous, 2003).

There are only four literature sources covering the beetle fauna of Turopoljski Lug, listing a total of 51 species (Anonymous, 2015; Mikšić, 1963; Schlosser, 1878; Vujčić-Karlo and Klipa, 1998). Of those, 44 are of the Carabidae family – a result of the only as of yet systematic beetle inventory work carried out there (Vujčić-Karlo and Klipa, 1998). Based on this, it can be said that the beetle fauna of Turopolje is very poorly known. Since conservation and management should be evidence-based (Sutherland et al., 2004), and since beetles are an important component of many habitat communities as herbivores, predators and decomposers (Cálix et al., 2018; Petersen and Luxton, 1982), this lack of basic data of an important lowland forest represents a critical gap in the foundation for future actions.

To partly fill this gap and provide additional information useful for conservation and management actions in the future, we present an overview of the currently known beetle species for Turopoljski Lug, based on literature and newly collected field data.

**MATERIALS AND METHODS**

To perform a broad screening of the beetle fauna of Turopoljski lug, 15 locations were visited from March till September 2017 (Figures 1 & 2, Table 1). Baited traps were made from plastic 1.5 l bottles by cutting off the top part of the bottles, inverting it and inserting them back into the

![Figure 1. – Map of Turopoljski Lug showing the research locations. Location numbers correspond to those in Table 1. The border of the northwestern part of the Natura 2000 site Odransko Polje is also shown.](image-url)
body of the bottles. This was secured using small pieces of metal wire. A mixture of white and red wine (1 : 1), with a few pieces of banana, was poured inside as bait. The traps were setup in three sets of five. The first two sets were set up on 13 June 2017 at locations 5 and 7, while the third set was set up on 13 July at location 4, to provide additional screening during the peak of the activity of some saproxylic species. All three were removed on 28 September. They were emptied once a month. In order to survey nocturnal beetles, four to eight UV light traps were used three times to collect beetles at location 11, in May, July and September. Sweep netting was performed by sweeping herbaceous and low woody vegetation on all locations, on 9 April, 14 & 29 May, 13 June, and 13 July 2017 to find beetles hiding and/or feeding within that vegetation layer, especially on flowers. Collecting by hand was carried out on all locations and represents random non-specific collecting.

Additionally, several beetle records from UV light trapping in April and September 2015 from locations 3 and 5, with some random sampling methods from March 2015 on location 4, are also included in the results.

Specimens of species which could be reliably identified in the field were examined macroscopically and/or by using handheld magnifiers (10× magnification). Those that could not were collected using ethyl acetate and brought back to the lab, examined under a 1MISTBMS143T stereo microscope and their genitalia were isolated when needed for identification purposes. The usual keys were used for identification, both in the field, and in the lab (Ballerio et al., 2010; Bense, 1995; Bordy et al., 2012; Curletti et al., 2003; Freude, 1971; Laibner, 2000; Lompe, 2009; Mikšić, 1965, 1958; Nedvěd, 2015; Novák, 2014; Sama, 2002; Sustek, 1981; Trautner and Geigenmüller, 1987; Turin et al., 2003; War- cholowski, 2010, 2003). All collected specimens are deposited in the Coleoptera collection of Association Hyla. The identification of members of the Elateridae family was additionally checked by Tamás Németh from the Hungarian Natural History Museum (NHMUS). The nomenclature follows Fauna Europaea (de Jong et al., 2014).

RESULTS

During the field work, and including the authors’ personal records from 2015, a total of 89 beetle species were recorded, seven of which are already known from the literature. Thus, the total number of beetle species currently known for Turopoljski Lug is raised to 133 (Appendix 1). Only one of those is listed in Annexes II and IV of the Habitats Di-
Appendix 1. – List of beetle species currently known for Turopoljski Lug. Location numbers correspond to those in Table 1. IUCN statuses according to Vujčić-Karlo et al. (2007) for Carabidae, and Nieto & Alexander (2010) for the rest. LC – Least Concern, NT – Near Threatened. * – saproxylic species.

Dodatak 1. – Popis trenutačno poznatih vrsta komaja za Turopoljski lug. Brojevi lokacija odgovaraju onima u Tablici 1. IUCN statusi dani su prema Vujčić-Karlo i sur. (2007) za porodicu Carabidae te Nieto i Alexander (2010) za preostale. LC – najmanje zabrinjavajuća vrsta, NT – gotovo ugrožena vrsta. * – saproksilna vrsta.

| No. Br. | Species | Literature | This research | IUCN status |
|---------|---------|------------|---------------|-------------|
|         |         | Vrsta | Literatura | Ovo istraživanje |             |
| Buprestidae |         |         |             |             |             |
| 1.  | Anthaxia fulgurans (Schrank, 1789) * | | | 13 |
| 2.  | Anthaxia nitidula (Linnaeus, 1758) * | | | 1, 13 |
| 3.  | Anthaxia salicis (Fabricius, 1776) * | | | 1, 8 |
| Carabidae |         |         |             |             |             |
| 4.  | Abax carinatus (Duftschmid, 1812) | Vujčić-Karlo & Klipa (1998) | | | |
| 5.  | Abax parallelus (Duftschmid, 1812) | Vujčić-Karlo & Klipa (1998) | | | |
| 6.  | Abax parallelepipedus (Piller & Mitterpacher, 1783) | Vujčić-Karlo & Klipa (1998) | | | |
| 7.  | Agonum viduum (Panzer, 1796) | Vujčić-Karlo & Klipa (1998) | | | |
| 8.  | Amara sp. | Vujčić-Karlo & Klipa (1998) | | | |
| 9.  | Anchomenus dorsalis (Pontoppidan, 1873) | Vujčić-Karlo & Klipa (1998) | | | |
| 10. | Badister dilatatus Chaudoir, 1837 | Vujčić-Karlo & Klipa (1998) | | | |
| 11. | Badister dorsiger (Duftschmid, 1812) | Vujčić-Karlo & Klipa (1998) | | | |
| 12. | Brachinus creptans (Linne, 1758) | Vujčić-Karlo & Klipa (1998) | | | |
| 13. | Calosoma inquisitor (Linne, 1758) | Vujčić-Karlo & Klipa (1998) | | | |
| 14. | Carabus nemoralis O.F. Muller, 1764 | Vujčić-Karlo & Klipa (1998) | | | |
| 15. | Carabus granulatus Linne, 1758 | Vujčić-Karlo & Klipa (1998) | | | |
| 16. | Carabus ullrichii Germar, 1824 | Vujčić-Karlo & Klipa (1998) | | | |
| 17. | Carabus violaceus Linne, 1758 | Vujčić-Karlo & Klipa (1998) | | | |
| 18. | Carabus coniaceus Linne, 1758 | Vujčić-Karlo & Klipa (1998) | | | |
| 19. | Carabus cancellatus Illiger, 1798 | Vujčić-Karlo & Klipa (1998) | | | |
| 20. | Cryptophonus tenebrosus (Dejean, 1829) | Vujčić-Karlo & Klipa (1998) | | | |
| 21. | Diachromus germanus (Linnaeus, 1758) | Vujčić-Karlo & Klipa (1998) | | | |
| 22. | Dyschirius digitatus (Dejean, 1825) | Vujčić-Karlo & Klipa (1998) | | | |
| 23. | Elaphrus cupreus Duftschmid, 1812 | Vujčić-Karlo & Klipa (1998) | | | |
| 24. | Harpalus distinguendus (Duftschmid, 1812) | Vujčić-Karlo & Klipa (1998) | | | |
| 25. | Harpalus latus (Linne, 1758) | Vujčić-Karlo & Klipa (1998) | | | |
| 26. | Leistus piceus Frölich, 1799 | Vujčić-Karlo & Klipa (1998) | | | |
| 27. | Limodromus assimilis (Paykull, 1790) | Vujčić-Karlo & Klipa (1998) | | | |
| 28. | Limodromus longiventris (Mannerheim, 1825) | Vujčić-Karlo & Klipa (1998) | | | |
| 29. | Loricera picipennis (Fabricius, 1775) | Vujčić-Karlo & Klipa (1998) | | | |
| 30. | Metallina lampos (Herbst, 1784) | Vujčić-Karlo & Klipa (1998) | | | |
| 31. | Metallina properans (Stephens, 1828) | Vujčić-Karlo & Klipa (1998) | | | |
| 32. | Nebria brevicollis (Fabricius, 1792) | Vujčić-Karlo & Klipa (1998) | | | |
| 33. | Panagaeus cruxmajor (Linne, 1758) | Vujčić-Karlo & Klipa (1998) | | | |
| 34. | Pangus scalaris (Sturm, 1818) | Vujčić-Karlo & Klipa (1998) | | | |
| 35. | Patrobus sp. | Vujčić-Karlo & Klipa (1998) | | | |
| 36. | Philochthus biguttatus (Fabricius, 1779) | Vujčić-Karlo & Klipa (1998) | | | |
| 37. | Platynus livens (Gyllenhal, 1810) | Vujčić-Karlo & Klipa (1998) | | | |
| 38. | Poecilus cupreus (Linne, 1758) | Vujčić-Karlo & Klipa (1998) | | | |
| 39. | Pseudophonus griseus (Panzer, 1796) | | | 11 |
| 40. | Pseudophonus rufipes (De Geer, 1774) | Vujčić-Karlo & Klipa (1998) | | | |
| 41. | Pterostichus pumilio (Dejean, 1828) | Vujčić-Karlo & Klipa (1998) | | | |
| 42. | Pterostichus ovoides (Sturm, 1824) | Vujčić-Karlo & Klipa (1998) | | | |
| 43. | Pterostichus strenuus (Panzer, 1796) | Vujčić-Karlo & Klipa (1998) | | | |
| 44. | Pterostichus nigrita (Paykull, 1790) | Vujčić-Karlo & Klipa (1998) | | | |
| 45. | Stomis pumicatus (Panzer, 1796) | Vujčić-Karlo & Klipa (1998) | | | |
| 46. | | | | | LC |
| No. | Species | Literature | This research | IUCN status |
|-----|---------|------------|---------------|-------------|
| 47  | Syntomus obscuroguttatus (Duftschmid, 1812) | Vujčić-Karlo & Klipa (1998) | 47 |  |
| 48  | Thalassophilus longicornis (Sturm, 1825) | Vujčić-Karlo & Klipa (1998) | 48 |  |
| 49  | Trechus sp. | Vujčić-Karlo & Klipa (1998) | 49 |  |

**Cerambycidae**

| No. | Species | Literature | This research | IUCN status |
|-----|---------|------------|---------------|-------------|
| 50  | Aegomorphus clavipes (Schrank, 1781) * | Mikšić (1963) | 50 |  |
| 51  | Aegosoma scabricorne (Scopoli, 1763) * | 11 | LC |
| 52  | Agapanthia cardui (Linnaeus, 1767) * | 11 |  |
| 53  | Agapanthia villosoridescens (De Geer, 1775) * | 11 |  |
| 54  | Aromia moschata (Linnaeus, 1758) * | 4, 5 | LC |
| 55  | Calamobius filum (Rossi, 1790) * | 11 |  |
| 56  | Cerambyx cerdo Linnaeus, 1758 * | Anonymous (2015) | 4 | NT |
| 57  | Cerambyx scopolii Fuessly, 1775 * | 6, 7, 8, 13 | LC |
| 58  | Chlorophorus sartor (Muller, 1766) * | 13 | LC |
| 59  | Leptura quadrifasciata Linnaeus, 1758 * | 5 |  |
| 60  | Pseudovadonia livida (Fabricius, 1776) * | 7 |  |
| 61  | Rhagium mordax (De Geer 1775) * | 5 |  |
| 62  | Rhagium sycophanta (Schrank 1781) * | 5 |  |
| 63  | Rutpela maculata (Poda, 1761) * | 7 |  |
| 64  | Stenurella nigra (Linnaeus, 1758) * | Mikšić (1963) | 64 |  |

**Chrysomelidae**

| No. | Species | Literature | This research | IUCN status |
|-----|---------|------------|---------------|-------------|
| 65  | Aphthona nonstriata Goeze, 1777 | 10 |  |
| 66  | Cassida murraea Linnaeus, 1767 | 10, 13 |  |
| 67  | Chrysochus asclepiadeus (Pallas, 1773) | 13 |  |
| 68  | Chrysolina fastuosa (Scopoli, 1763) | 1, 4, 7 |  |
| 69  | Chrysomela populi Linnaeus, 1758 | 2 |  |
| 70  | Crepidodera aurata (Marsham, 1802) | 8, 11 |  |
| 71  | Crepidodera plata (Latreille, 1804) | 8 |  |
| 72  | Cryptopephalus antiquus Suffrian, 1848 | 13 |  |
| 73  | Diabrotica virgifera LeConte, 1858 | 11 |  |
| 74  | Donacia bicolora Zschach, 1788 | 1, 8 |  |
| 75  | Donacia dentata Hoppe, 1795 | 10 |  |
| 76  | Donacia simplex Fabricius, 1775 | 1 |  |
| 77  | Gastrophysa viridula (De Geer, 1775) | 8 |  |
| 78  | Phaedon cochlæarum (Fabricius, 1792) | 10 |  |
| 79  | Smaragdina salicina (Scopoli, 1763) | 10 |  |

**Coccinellidae**

| No. | Species | Literature | This research | IUCN status |
|-----|---------|------------|---------------|-------------|
| 80  | Calvia decemguttata (Linnaeus, 1758) | 11 |  |
| 81  | Calvia quatuordecimguttata Linnaeus, 1758 | 8 |  |
| 82  | Calvia quindecimguttata (Fabricius, 1777) | 11 |  |
| 83  | Coccinella septempunctata Linnaeus, 1758 | 8, 10, 11, 14, 15 |  |
| 84  | Harmonia axyridis Pallas, 1773 | 5, 8, 11, 13, 15 |  |
| 85  | Hippodamia tredecimpunctata Linnaeus, 1758 | 15 |  |
| 86  | Hippodamia variegata Goeze, 1777 | 15 |  |
| 87  | Propylea quatuordecimguttata (Linnaeus, 1758) | 10, 13 |  |
| 88  | Psylo borea vigintiduopunctata (Linnaeus, 1758) | 8, 11 |  |
| 89  | Subcoccinella vigintiquatuorpunctata Linnaeus, 1758 | 10 |  |
| 90  | Vibia duodecimguttata (Poda, 1761) | 11 |  |

**Cantharidae**

| No. | Species | Literature | This research | IUCN status |
|-----|---------|------------|---------------|-------------|
| 91  | Rhagonycha fulva (Scopoli, 1763) | 11 |  |

**Elateridae**

| No. | Species | Literature | This research | IUCN status |
|-----|---------|------------|---------------|-------------|
| 92  | Agriotes sputator (Linnaeus, 1758) * | 11 |  |
| No. | Species | Literature | This research | IUCN status |
|-----|---------|------------|---------------|-------------|
| 93. | *Ampedus glycerus* (Herbst, 1784) | 9 | NT |
| 94. | *Ampedus sanguinolentus* (Schrank, 1776) | 8, 9 | LC |
| 95. | *Athonius haemorrhoidalis* (Fabricius, 1801) | 8, 9, 11 | NT |
| 96. | *Calambus bipustulatus* (Linnaeus, 1767) | 5 | LC |
| 97. | *Cidnopus pilosus* (Leske, 1785) | 11, 14 | LC |
| 98. | *Elatbus impressifrons* (Hampe, 1866) | Schloesser (1878) | 11 |
| 99. | *Melanotus crassicollis* (Erichson, 1841) | 8, 9, 11 | LC |
| 100. | *Synaptus filiformis* (Fabricius, 1781) | 8, 11 | LC |

**Histeridae**

| 102. | *Hololepta plana* (Sulzer, 1776) | 8 |

**Hydrophilidae**

| 103. | *Hydrophilus piceus* (Linnaeus, 1758) | 11 |

**Cetoniidae**

| 104. | *Cetonia aurata* (Linnaeus, 1761) | 4, 5, 8, 11, 13 |
| 105. | *Gnorimus nobilis* (Linnaeus, 1758) | 7, 8 | LC |
| 106. | *Gnorimus variabilis* (Linnaeus, 1758) | 4 | NT |
| 107. | *Oxythrea funesta* (Poda, 1761) | 8 |
| 108. | *Protaetia aeruginosa* (Linnaeus, 1767) | 7 | NT |
| 109. | *Protaetia fiebri* (Kraatz, 1880) | 5 | NT |
| 110. | *Tropinota hirta* (Poda, 1761) | 8 |
| 111. | *Valgus hemipterus* (Linnaeus, 1758) | 15 | LC |

**Lucanidae**

| 112. | *Dorcus parallelpipederus* (Linnaeus, 1785) | 5, 7 | LC |
| 113. | *Lucanus cervus* (Linnaeus, 1758) | Anonymous (2015) | NT |

**Melolonthidae**

| 114. | *Melolontha hippocastani* Fabricius, 1801 | 5 |
| 115. | *Melolontha melolontha* (Linnaeus, 1758) | 5 |
| 116. | *Serica bruna* (Linnaeus, 1758) | 11 |

**Trogidae**

| 117. | *Trax perrissi* Fairmaire, 1868 | 11 |
| 118. | *Trax scaber* (Linnaeus, 1767) | 11 |

**Silphidae**

| 119. | *Dendroxena quadrimaculata* (Scopoli, 1772) | 3 |
| 120. | *Necrodes litoralis* (Linnaeus, 1758) | 11 |
| 121. | *Nicrophorus vespillo* (Linnaeus, 1758) | 7, 11 |
| 122. | *Oiceoptoma thoracicum* (Linnaeus, 1758) | 7 |
| 123. | *Phosphuga atrata* (Linnaeus, 1758) | 3, 4, 11 |
| 124. | *Thanatophilus rufus* (Linnaeus, 1758) | 7 |

**Melandryidae**

| 125. | *Hypulus quercinus* (Quensel, 1790) | Schloesser (1878) |
| 126. | *Phryganophilus ruficollis* (Fabricius, 1798) | Schloesser (1878) | NT |

**Oedemeridae**

| 127. | *Oedemera femorata* (Scopoli, 1763) | 15 |

**Pyrochroidae**

| 128. | *Pyrochroa serraticornis* (Scopoli, 1763) | 5 |
| 129. | *Schizotus pectinicornis* (Linnaeus, 1758) | 12 |

**Tenebrionidae**

| 130. | *Allecula morio* (Fabricius, 1787) | 11 |
| 131. | *Diaperis boleti* (Linnaeus, 1758) | 3, 5 |
| 132. | *Enoplopus dentipes* (Rossi, 1790) | 3, 5 |

**Zopheridae**

| 133. | *Colydium elongatum* (Fabricius, 1787) | 8 |
DISCUSSION

RASPRAVA

With little-to-no data published for other wetlands in Croatia, it is almost impossible to put our results in any meaningful perspective. Tallósi (2008) lists 173 species of Carabidae along the Drava river and in Baranja, including a part of Kopački Rit. Kopački Rit by itself has a total of 275 beetle species, of which 155 are Carabidae (Krčmar, 2014; Kulundžić et al., 2014). Both areas are larger than Turopoljski Lug and contain more habitat types, and were researched more, so their larger number of species is not surprising. Nevertheless, future beetle research in Turopoljski Lug is expected to yield many more additions to the current species list.

Three Natura 2000 species are listed for the site Odransko Polje: *Lucanus cervus* (Linnaeus, 1758), *Graphoderus bilineatus* (De Geer, 1774), and *Cerambyx cerdo* Linnaeus, 1758. Twenty-four species have an IUCN Red List status – 15 are Least Concern (LC), while nine are Near Threatened (NT). Of those two categories, ten and seven are saproxylic, respectively, i.e. in some way dependant and/or connected to the decay of wood at least during a part of their life cycle.

Three of the recorded species can be characterised as rare in Croatia: *Trox perrisi* Fairmaire, 1868, *Gnorimus variabilis* (Linnaeus, 1758), and *Elathous impressifrons* (Hampe, 1866). The first one has only recently been discovered for Croatia, on Ivanščica Mt. and on the Istria peninsula (Koren, 2015; Ziani et al., 2015). This is the third record for this species in Croatia. *G. variabilis* is rare in Europe and has a fragmented population throughout its range. Declines are reported from a number of states (Mannerkoski et al., 2010). Even though there are several literature records for Croatia (Koča, 1905; Mikšić, 1965; Müller, 1902; Novak, 1952; Schlosser, 1878), there were no recent records till 2015 (Šag, 2015). We found remains of an adult beetle while examining red rotten oak tree trunk in Turopoljski lug in March 2015.

*Elater impressifrons* is a poorly known beetle. It was described from the vicinity of Zagreb (Hampe, 1866). Schlosser (1878) mentions that the Croatian entomologist Julija Stiegler collected it in Turopoljski Lug forest in wood mould of oak tree hollows. This is so far the only precise known locality for this species. A female specimen of this species from Croatia, without any other collecting details, is deposited in the Coleoptera collection of the Hungarian Natural History Museum (Tamás Németh, personal communication). The species wasn’t recorded during this research, suggesting more focused surveys are required in the future.

Two of the recorded species are alien – *Harmonia axyridis* Pallas, 1773 and *Diabrotica virgifera* LeConte, 1858. The former, an invasive species that is now widespread in Europe, had first been recorded in Croatia in 2008 (Mičetić Stanković et al., 2010). It is known to have a negative influence on the native coccinellid fauna (Roy and Wajnberg, 2008). Since no previous published records exist for Coccinellidae of Turopoljski Lug, it will be impossible to know the changes in the fauna from before the arrival of *H. axyridis*. The current situation should be investigated in more...
detail to at least have a baseline to compare future changes, since the 11 coccinellid species recorded for Turopoljski Lug represent only 14% of the currently known Croatian ladybug fauna (Koren et al., 2012). The second alien species, D. virgifera, is a notable agricultural pest on maize crops. The first records of this species in Croatia were in 1995, near the border with Serbia (Igrc Barčić and Macelj-ski, 1997). Its expansion westwards was methodically tracked, and it reached the surroundings of Zagreb by 2003 (Igrc Barčić et al., 2003). Since corn is planted on some of the fields around Turopoljski Lug (the authors’ personal observation), its occurrence here is not surprising. However, it is unknown to us if it causes extensive damage to crops in the area.

To conserve the remaining wet grasslands within the study area, and all species depending on them, regular mowing and/or grazing should be re-established (Tvrtković, 1997b). This is needed to curb the advance of woody vegetation, especially the invasive Amorpha fruticosa L. However, this should be conducted in a manner that will not be so intense that it proves detrimental to the survival of herbaceous and flowering plants on which many beetle species depend. Additionally, it is possible that the water management measures implemented throughout the years could have, or have already had, a negative impact on aquatic beetles, especially G. bilineatus, due to the disappearance of suitable habitats (see Introduction and Lazowski, 1910). Further research should be conducted in this regard and, if necessary, modify and/or replace existing water management measures with more appropriate ones.

CONCLUSIONS

ZAKLJUČCI

With this the Natura 2000 site Odransko Polje, which covers Turopoljski Lug, became one of only several Croatian Natura 2000 sites with a list of known beetle species. Future research, targeting specific Coleoptera groups, should add many more species, especially those that are saproxylic, to the list. A systematic mapping of the Natura 2000 species known from the area would yield much needed conservation data. Current management practices and their effect on the biodiversity of Turopoljski Lug should be evaluated and steps taken to ensure its continued survival and vitality.

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Vlažna staništa pružaju mnoge usluge ekosustava, npr. služe kao prirodne retencije poplavnih voda, a mogu biti i područja za rekreaciju šire javnosti. Predstavljaju i životno važna staništa za brojne životinjske vrste, stoga su mnoga vlažna staništa pod nekim stupnjem zaštite. Unatoč tomu, fauna mnogih vlažnih staništa i dalje je većinom nepoznata, posebice po pitanju kornjaša. Nepoznavanje faune određenog područja otežava upravljanje istim. Jedna takva lokacija je šuma Turopoljski lug, smještena jugoistočno od glavnog grada Zagreba. Terensko istraživanje provedeno je od ožujka do rujna 2017. Koristile su se četiri metode: kečiranje, zamke s mamcima na stablima, svjetlosne zamke s UV žaruljama po noći i sakupljanje rukom. Rezultatima je pridodano i nekoliko nalaza od ranije. Ukućan broj poznatih vrsta kornjaša za Turopoljski lug podignut je s 51 na 133. Devet vrsta imaju gotovo ugrožen IUCN status ugroženosti, od kojih je sedam saproksilnog načina života. Iz područja su poznate tri vrste navedene u Dodacima II i IV Direktive o staništima, od kojih smo zabilježili samo Cerambyx cerdo. Također, pronađen je zanemaren nalaz iz literature za četvrtu – Phryganophilus ruficollis. Potrebno je preispitati i, po potrebi, izmijeniti dosadašnji način upravljanja šumom. Buduća usmjerenja istraživanja određenih skupina kornjaša trebala bi urodititi podatke za zaštitu prirode.

**SAŽETAK**

Vlažna staništa pružaju mnoge usluge ekosustava, npr. služe kao prirodne retencije poplavnih voda, a mogu biti i područja za rekreaciju šire javnosti. Predstavljaju i životno važna staništa za brojne životinjske vrste, stoga su mnoga vlažna staništa pod nekim stupnjem zaštite. Unatoč tomu, fauna mnogih vlažnih staništa i dalje je većinom nepoznata, posebice po pitanju kornjaša. Nepoznavanje faune određenog područja otežava upravljanje istim. Jedna takva lokacija je šuma Turopoljski lug, smještena jugoistočno od glavnog grada Zagreba. Terensko istraživanje provedeno je od ožujka do rujna 2017. Koristile su se četiri metode: kečiranje, zamke s mamcima na stablima, svjetlosne zamke s UV žaruljama po noći i sakupljanje rukom. Rezultatima je pridodano i nekoliko nalaza od ranije. Ukućan broj poznatih vrsta kornjaša za Turopoljski lug podignut je s 51 na 133. Devet vrsta imaju gotovo ugrožen IUCN status ugroženosti, od kojih je sedam saproksilnog načina života. Iz područja su poznate tri vrste navedene u Dodacima II i IV Direktive o staništima, od kojih smo zabilježili samo Cerambyx cerdo. Također, pronađen je zanemaren nalaz iz literature za četvrtu – Phryganophilus ruficollis. Potrebno je preispitati i, po potrebi, izmijeniti dosadašnji način upravljanja šumom. Buduća usmjerenja istraživanja određenih skupina kornjaša trebala bi urodititi dodatnim povećanjem broja vrsta poznatih za lug, dok bi ciljano kartiranje prisutnosti vrsta s Dodataka iznjedrilo prijeko potrebne podatke za zaštitu prirode.

**KLJUČNE RIJEČI:** poplavna šuma, Ekološka mreža Natura 2000, Cerambyx cerdo, Phryganophilus ruficollis, Trox perrisii, zaštićena područja