

First insight into host ant use of the scarce large blue *Phengaris teleius* (Lepidoptera: Lycaenidae) in Ljubljansko barje (Central Slovenia)

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Abstract. First data on the host ant use of the scarce large blue *Phengaris teleius* in Ljubljansko barje are presented herewith. A survey was carried out in 2021 in the vicinity of the Bevke village. Altogether, 59 *Myrmica* ant nests were surveyed for the presence of scarce large blue caterpillars, 58 of *M. scabrinodis* and one of *M. rubra*. We found four caterpillars of the scarce large blue in three *M. scabrinodis* ant nests. Our results indicate that *M. scabrinodis* is probably the main host of *Phengaris teleius* in Ljubljansko barje, the same as in other regions of Europe.

Key words: scarce large blue, *Phengaris teleius*, *Maculinea teleius*, Slovenia, host ants, *Myrmica*, Ljubljansko barje

Izvleček. Prvi podatki o gostiteljskih vrstah mravelj strašničinega mravljiščarja *Phengaris teleius* na Ljubljanskem barju (osrednja Slovenija) – V prispevku predstavljamo prve podatke o gostiteljskih vrstah mravelj strašničinega mravljiščarja *Phengaris teleius* na Ljubljanskem barju. Pregled mravljišč za prisotnost gosenic strašničinega mravljiščarja je potekal v letu 2021 na območju Bevk. Skupno smo pregledali 59 mravljišč, 58 mravljišč vrste *Myrmica scabrinodis* in eno mravljišče *Myrmica rubra*. Našli smo štiri gosenice strašničinega mravljiščarja v treh mravljiščih barjanske rdečke *Myrmica scabrinodis*, ki je tudi v drugih predelih Evrope pomembna gostiteljska vrsta strašničinega mravljiščarja.

Ključne besede: strašničin mravljiščar, *Phengaris teleius*, *Maculinea teleius*, Slovenija, gostiteljske mravlje, *Myrmica*, Ljubljansko barje

Introduction

The scarce large blue *Phengaris teleius* is an endangered butterfly species due to its highly specialized myrmecophilous life, its high sensitivity to habitat changes and risk of extinction (Settele et al. 2005). On the European Red List of butterflies (van Swaay et al. 2010), the species

is listed as vulnerable and is protected by the Habitats' Directive Annex II and IV (Ur. l. EU 1992).

In Slovenia, the scarce large blue occurs locally throughout the country from early July to early September (Verovnik et al. 2012). Females lay their eggs on the larval host plant great burnet *Sanguisorba officinalis* and after this the first instar caterpillars need to be adopted by *Myrmica* ants to continue their life cycle in ant nests as social parasites (Thomas et al. 1989, Elmes et al. 1998). The strength of specificity in relationship between *Myrmica* ants and *Phengaris* butterflies is variable between different *Phengaris* species and the scarce large blue is considered as the least host-specific throughout Europe (Tartally et al. 2019).

The scarce large blue can successfully develop and survive in nests of several *Myrmica* species occurring at the same site, although *M. scabrinodis* is the most commonly used host ant species (Stankiewicz & Sielezniew 2002, Tartally & Varga 2008, Witek et al. 2008). The only study in Slovenia was conducted in its north-easternmost part (Goričko region) where the caterpillars of the scarce large blue were found in ant nests of the three *Myrmica* species: *M. scabrinodis*, *M. rubra*, and *M. gallienii* (Zakšek et al. 2021). The total number of ant nests hosting the scarce large blue caterpillar was the highest in *M. scabrinodis*, while the total number of caterpillars was the highest in *M. rubra* nests (Zakšek et al. 2021).

In Ljubljansko barje, two species from the genus *Phengaris* occur, the scarce large blue and the alcon large blue *P. alcon* (Verovnik et al. 2012). The area is part of the Natura 2000 network (SI5000014) and was also designated to protect the scarce large blue. The species inhabits mainly mesotrophic humid meadows with the great burnet. In Ljubljansko barje, the species occurs very locally in two smaller areas, one in the western part of the area close to the Bevke village and the other in the eastern part along the Iščica stream.

So far, a total of 40 ant species have been listed for Ljubljansko barje (Mori et al. 2020), with seven species of the genus *Myrmica* found in this area: *M. curvithorax*, *M. rubra*, *M. ruginodis*, *M. rugulosa*, *M. sabuleti*, *M. scabrinodis* and *M. schencki*.

The aim of our study was to fill the knowledge gap about local host ant specificity, which might be one of the limiting factors for species distribution in the area of Ljubljansko barje Nature Park. Knowledge of host ant specificity is crucial for an insight into local variability that could be integrated in the area specific habitat management and species conservation.

Study area and methods

Ljubljansko barje is the largest Slovenian and the southernmost European bog (Martinčič 1987). Currently, Ljubljansko barje is a very fragmented mosaic of fields, intensively managed meadows, pastures, late-mown wet meadows, rich fen and transition mire patches, forests, tree plantations and some shrub land areas (Trčak & Erjavec 2014).

In June 2021, we searched for *Myrmica* ant nests near Bevke in Ljubljansko barje (Fig. 1). We focused on microlocations with high densities of the scarce large blue butterflies in summer 2020 (Zakšek & Kogovšek 2020) to raise the probability to detect a scarce blue caterpillar. After checking for *Myrmica* nest in close proximity to the great burnet (circular less than 1.5 m), the nest was marked and carefully excavated. Each excavated ant nest was gently opened and precisely checked for *Phengaris* caterpillars. After inspection, the nest material was returned to the excavated site. Ten ant workers were collected from each nest and preserved in 70% ethanol for later identification. *Myrmica* species were identified according to Seifert (2018) and Radchenko & Elmes (2010). Field work was carried out with the licence (35601-56/2016-2) issued by the Slovenian Environment Agency of the Ministry of the Environment and Spatial Planning of the Republic of Slovenia to the Centre for Cartography of Fauna and Flora.

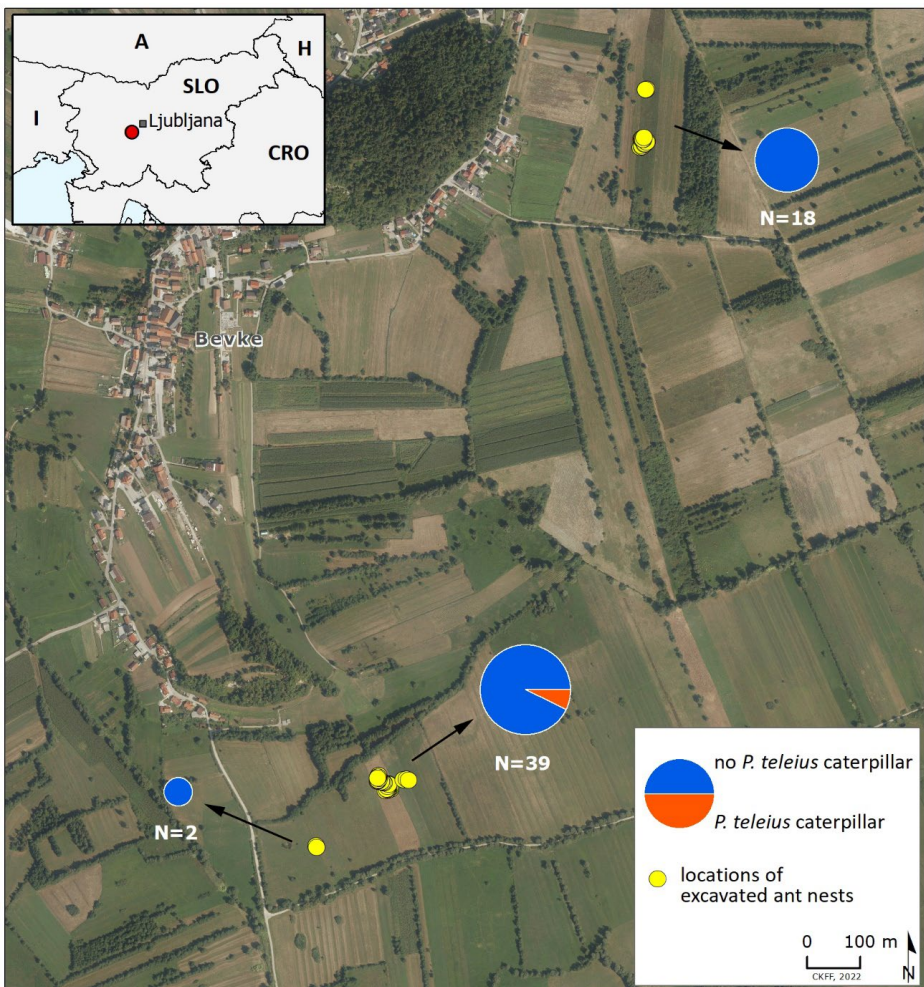


Figure 1. Locations of excavated ant nests and presence of the scarce large blue *Phengaris teleius* caterpillars.
Slika 1. Lokacije pregledanih mravljišč in najdbe gosenic strašničnega mravljiščarja *Phengaris teleius*.

Results and discussion

Altogether, 59 ant nests were excavated, 58 *M. scabrinodis* and one *M. rubra*. We found three ant nests, all of *M. scabrinodis*, that were hosting *Phengaris* caterpillars, i.e. in 5% of the examined *M. scabrinodis* nests. One nest contained two caterpillars and two nests a single caterpillar. All three occupied nests were located in a single meadow (coordinates: N 45.973978° E 14.359716°) (Fig. 1). The maximum distance between occupied nests was 30 metres.

Myrmica scabrinodis and *Myrmica rubra* nests were also dominant species close to the larval host plants in Goričko (Zakšek et al. 2021). Here, almost 2.5× more ant nests were examined and excavated; and the scarce large blue caterpillars were found in 15% of *M. scabrinodis* ant nests, which is slightly higher compared to the results in this study (5%).

The results of our study suggest that in the studied area of Ljubljansko barje *M. scabrinodis*, a very common species here, is probably the main host species for *Phengaris teleius*.



Figure 2. The scarce large blue *Phengaris teleius* caterpillar in *Myrmica scabrinodis* ant nest in Ljubljansko barje (photo: B. Zakšek).

Slika 2. Gosenica strašničinega mravljiščarja *Phengaris teleius* v mravljišču mravlje *Myrmica scabrinodis* na Ljubljanskem barju (foto: B. Zakšek).

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References

- Elmes G.W., Thomas J.A., Wardlaw J.C., Hochberg M.E., Clarke R.T., Simcox D.J. (1998): The ecology of *Myrmica* ants in relation to the conservation of *Maculinea* butterflies. *J. Insect Conserv.* 2: 67-78.
- Martinčič A. (1987): Fragmenti visokega barja na Ljubljanskem barju. High bog fragments on Ljubljansko barje (The Ljubljana Moor). *Scopolia* 14: 1-53.
- Mori N., Vrezec A., Tome D., Šalamun A., Ratajc U. 2020: Poročilo o Pilotni akciji »Revizija biodiverzitete v Krajinskem parku Ljubljansko barje« s priporočili za varstvo biodiverzitete kopenskih, negozdnih okolij Krajinskega parka Ljubljansko barje. Nacionalni inštitut za biologijo, Ljubljana, 107 pp.
- Radchenko A., Elmes G.W. (2010): *Myrmica* ants (Hymenoptera, Formicidae) of the Old World. *Natura Optima Deux*, Warsaw, 789 pp.
- Seifert B. (2018): The ants of Central and North Europe. Lutra Verlags- und Vertriebsgesellschaft, Tauer, 408 pp.
- Settele J., Kühn E., Thomas J. (Eds.) (2005): Studies on the ecology and conservation of butterflies in Europe: *Maculinea* butterflies as a model, Vol. 2, Pensoft, Sofia, Bulgaria, 289 pp.
- Stankiewicz A.M., Sielezniew M. (2002): Host specificity of *Maculinea teleius* Bgstr. and *M. nausithous* Bgstr. (Lepidoptera: Lycaenidae): the new insight. *Anna. Zool.* 52: 403-408.
- Tartally A., Thomas J.A., Anton C., Balletto E., Barbero F., Bonelli S., Bräu M., Casacci L.P., Csósz S., Czekes Z., Dolek M., Dziekańska I., Elmes G., Fürst M.A., Glinka U., Hochberg M.E., Höttinger H., Hula V., Maes D., Munguira M.L., Musche M., Nielsen P.S., Nowicki P., Oliveira P.S., Peregovits L., Ritter S., Schlick-Steiner B.C., Settele J., Sielezniew M., Simcox D.J., Stankiewicz A.M., Steiner F.M., Švitra G., Ugelvig L.V., van Dyck H., Varga Z., Witek M., Woyciechowski M., Wynhoff I., Nash D.R. (2019): Patterns of host use by brood parasitic *Maculinea* butterflies across Europe. *Phil. Trans. R. Soc. B* 374: 20180202.
- Tartally A., Varga Z. (2008): Host ant use of *Maculinea teleius* in the Carpathian Basin (Lepidoptera: Lycaenidae). *Acta Zool. Acad. Sci. H.* 54(3): 257-268.
- Thomas J.A., Elmes, G.W., Wardlaw J.C., Woyciechowski M. (1989): Host specificity among *Maculinea* butterflies in *Myrmica* ant nests. *Oecologia* 79: 425-457.
- Trčak B., Erjavec D. (2014): Kartiranje in naravovarstveno vrednotenje habitatnih tipov v Krajinskem parku Ljubljansko barje – izbrana območja. Center za kartografijo favne in flore, Miklavž na Dravskem polju, 21 pp.

- Ur. l. EU (1992): Direktiva Sveta 92/43/EGS z dne 21. maja 1992 o ohranjanju naravnih habitatov ter prostoživečih živalskih in rastlinskih vrst. Uradni list Evropske unije 206, 15/2: 102-145.
- Van Swaay C., Cuttelod A., Collins S., Maes D., Munguira M.L., Šašić M., Settele J., Verovnik R., Verstrael T., Warren M., Wiemers M., Wynhoff I. (2010): European red list of butterflies. Publications Office of the European Union, Luxembourg, 47 pp.
- Verovnik R., Rebeušek F., Jež M. (2012): Atlas dnevnih metuljev (Lepidoptera: Rhopalocera) Slovenije, Atlas of butterflies (Lepidoptera: Rhopalocera) of Slovenia. Atlas faunae et florae Sloveniae 3. Center za kartografijo favne in flore, Miklavž na Dravskem polju, 456 pp.
- Witek M., Śliwińska E.B., Skórka P., Nowicki P., Wantuch M., Vrabec V., Settele J., Woyciechowski M. (2008): Host ant specificity of large blue butterflies *Phengaris (Maculinea)* (Lepidoptera: Lycaenidae) inhabiting humid grasslands in East-central Europe. Eur. J. Entomol. 105: 871-877.
- Zakšek B., Kogovšek N. (2020): Končna ocena stanja populacije strašničinega mravljiščarja (*Phengaris teleius*) na projektnem območju projekta PoLJUBA na Ljubljanskem barju v letu 2020. Center za kartografijo favne in flore, Miklavž na Dravskem polju, 20 pp.
- Zakšek V., Zakšek B., Bračko G., Govedič M., Verovnik R. (2021): Local host ant usage of scarce large blue *Phengaris teleius* and dusky large blue *P. nausithous* (Lepidoptera: Lycaenidae) at Goričko Nature Park (NE Slovenia). Nat. Slov. 23(1): 21-33.