

First record of *Phengaris (Maculinea) teleius* in Săcădat (Bihor County, Romania)

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Abstract. The Scarce Large Blue (*Phengaris teleius*) is a threatened butterfly throughout Europe due to its special life cycle and habitat loss. *P. teleius* butterflies tend to be very sedentary and move only a few hundred meters a day and rarely leave their home patches. In this paper, details are presented regarding the first mention of *P. teleius* in the region of Săcădat locality, Bihor County, Romania. This location meets all the environmental requirements of *P. teleius* (host plants for larvae and ants of the genus *Myrmica*). The area researched was about 3.16 ha, with about 25000 individuals of *Sanguisorba officinalis* L. flowers, on which we found an approximate number of 94 *P. teleius* butterflies. We hope that our initial study of *P. teleius* could have a positive impact on the conservation of this species in this new location.

Keywords: Lepidoptera, *Sanguisorba officinalis*, endangered butterflies, habitat management.

The decline of some populations of *Phengaris* has occurred locally in many countries and was mainly induced by intensive agriculture or land abandonment, which resulted in the deterioration of their biotopes (Mouquet et al. 2005, Gao et al. 2016, Costache et al. 2021). This decline led to the fact that nowadays, *Phengaris (Maculinea)* butterflies are one of the most endangered groups of butterflies in the Palearctic (Nowicki et al. 2005, Gao et al. 2016, Thomas & Schönrogge 2019, Dziekańska et al. 2020). There are reports of declining *Phengaris* populations in Romania and the Carpathian basin as well (Rákósy 2013, Timus et al. 2017). Due to the dramatic current state of human disturbance and destruction, suitable patches may become diminished and isolated as the inter-patch distances increase (Wynhoff 1998, Gao et al. 2016). In order to survive, blue butterflies of the genus *Phengaris* require a particular combination of ecological factors and a specialized life cycle (Wynhoff 1998). *Phengaris* has, fortunately, been the subject of many conservation projects and management activities in recent decades as a result of the severe threats facing it (Filz et al. 2013, Gao et al. 2016). *Phengaris* butterflies have subsequently been successfully conserved and are regarded as a paradigm of insect conservation (Thomas & Settele 2004, Gao et al. 2016). Even Europe's 'flagship' butterfly species belong to the genus *Phengaris* (Thomas & Settele 2004, Nowicki et al. 2005).

Phengaris (Maculinea) teleius is a butterfly protected by the legislation of the European Union and Romania, at the European level being considered a vulnerable taxon. *P. teleius* also appears in Appendix II. of the "Bern Convention" (van Langevelde & Wynhoff 2009, European Commission. Directorate-General for the Environment et al. 2010). In Romania, this species belongs to the category of vulnerable taxa as well (Rákósy & Vodă 2008, Rákósy et al. 2021). In Romania, in Cluj county, some localities represent the safest site in Europe, where all four species of the genus *Phengaris (Maculinea)* (*nausithous*, *teleius*, *arion* and *alcon*) coexist and are protected by the Habitats Directive in a unique taxonomic combination (Rákósy 2013, Rákósy et al. 2021, Pachetul 6 pajiști importante pentru fluturi (Maculinea sp)).

The distribution of *P. teleius* strictly coincides with the distribution of its food plant *Sanguisorba officinalis* L. (Sevilleja et al. 2022). *S. officinalis* is a long-lived perennial herb that is distributed throughout the Palearctic region (Tartally 2008, Gao et al. 2016, Thomas & Schönrogge 2019). It grows in colder regions of Europe, Asia, as well as northern regions of North America (Batáry et al. 2007, Timus et al. 2017, Tocai et al. 2021, Zhou et al. 2021). *S. officinalis* can be found in many wet grassland habitats throughout central Europe (Musche et al. 2008, Gao et al. 2016, Zhou et al. 2021). Also, in Romania, *S. officinalis* can be found on wet piedmont meadows (Ardelean & Mohan 2008, Tocai et al. 2021). Among the main pollinators of *S. officinalis* are syrphid flies, muscid flies, bees, and butterflies (Musche et al. 2008). An abundant assemblage of short-tongued insects visit *S. officinalis* flowers, attracted to pollen and nectar, though visitation frequency and assemblage composition vary widely (Musche et al. 2008, 2010, Jang et al. 2018). The inflorescences of *S. officinalis* are arranged hierarchically and contain up to 100 flowers per inflorescence, each developing into a single seed (Musche et al. 2008, Bunse et al. 2021). Flowering begins from early July to August (Jang et al. 2018, Bunse et al. 2021, Zhou et al. 2021). Self-pollination may occur spontaneously in the absence of cross-pollination (Musche et al. 2008, Zhao et al. 2017, Zhou et al. 2021). *S. officinalis* is an indispensable resource for two butterflies *P. nausithous* and *P. teleius*, because it represents their only food plant (Thomas et al. 1989, Popović et al. 2022, Sevilleja et al. 2022). The caterpillars of the genus *Phengaris* feed on plant inflorescences until they reach the fourth instar. This is the stage at which they abandon the plant to be taken over by specific *Myrmica* host ants (Thomas & Settele 2004, Batáry et al. 2007, Tartally 2008, Casacci et al. 2019). In Venjakob's opinion, *P. teleius* typically visits flowers of *S. officinalis*, perhaps because of the amino acid content of its nectar (Venjakob et al. 2022). There is no evidence that frequent cutting of meadows negatively affects *S. officinalis*, but it may prevent butterfly populations from establishing by killing the caterpillars and by lowering habitat quality for *Myrmica*

host ants (Johst et al. 2006, Musche et al. 2008). We carried out studies on the species *S. officinalis* in the Săcădat region between 2020-2022 (Tocai (Moțoc) et al. 2022) and in the Poic Valley, Ciucea, Cluj County (Tocai et al. 2021), when we accidentally identified *P. teleius* butterflies in Săcădat area. Therefore, this paper presents a new distribution locality of *P. teleius* in Romania.

The observations were carried out in Săcădat locality, in northwestern Romania, an area situated on the borderland between plains and hills. The flora of Săcădat commune is characteristic of a steppe area with a moderate plain climate. In the area, research on some invertebrate fauna has also been carried out in the past (Hodișan & Cupșa 2007).

The studied area (47°03'23"N, 22°16'48"E) is located between Borșa and Săcădat localities, Bihor county, on a field surface of about 3.16 ha. The observations were made in August 2022, when *S. officinalis* flowers started to bloom.

The butterflies were observed and determined using different guides (Tolman & Lewington 2009, Rákósy 2013). Moreover, we relied on the distribution of *S. officinalis* in the researched region with the help of a drone, as the main habitat of *P. teleius*, was grasslands where the food plant *S. officinalis* (Figure 1) was dominant, and there were also shrubs and trees present. Plants that have also been observed in the field other than *S. officinalis* are *Gallium verum* and *Lotus corniculatus*, which are considered invasive plants because they can prevent the native plants from developing, which would have a negative impact on the native vegetation. These plants can represent a threat to the host plant of *P. teleius*.

The butterflies (Figure 2) were studied between 1-7

August 2022, when we observed an approximate number of 94 butterflies. The observations were made in the morning, between 08:00-12:00. There were estimated to be 25000 individuals of *S. officinalis*.



Figure 1. The study site of *Phengaris teleius* in Borșa, Săcădat (2022)



Figure 2. *Phengaris teleius* in different hypostases on *Sanguisorba officinalis* flower

It is known that *P. teleius* butterflies are extremely sedentary species, moving only several hundred meters a day and rarely leaving their colonies (Thomas et al. 1989, van Langevelde & Wynhoff 2009, Popović & Šašić 2016, Popović et al. 2017, 2022). Considering this fact, is important

to make conservation implications to maintain this species alive. *P. teleius* is rarer and has a greater decline compared to *P. nausithous*; the decline or the extinction of some populations of *P. teleius* was also influenced by the cessation of traditional agricultural practices (grazing and manual

mowing) and land abandonment (Rákósy et al. 2010, Vodă et al. 2010). For the conservation of endangered species, maintaining the quality of their habitats is essential, and the absence or fragmentation of habitats, pollution, intensive farming, deforestation, mechanical mowing, excessive grazing, and the production of fires can be some of the causes of population decline or even the disappearance of *P. teleius*. Thus, conservation efforts should be focused on conserving or even creating *S. officinalis* strips (Nowicki et al. 2005).

P. teleius is an indicator species for extensively used moist mesophile grasslands like litter meadows, tall herb communities, and wet meadows; therefore, Săcădat is a suitable site for maintaining these vulnerable butterflies. Nevertheless, more research on the adaptive potential of *P. teleius* to abiotic environments and its biological interactions under multiple selection pressures should be made (Timus et al. 2017, Casacci et al. 2019, Tartally et al. 2019, Thomas & Schönrogge 2019). The abundance of *P. teleius* in Săcădat locality is not completely known yet, but this location meets all the environmental requirements of the species (host plants for larvae and ants of the genus *Myrmica*).

In the future, we intend to study the number of individuals of this *P. teleius* population in that area, with the mark-release-recapture method (MRR) and monitoring the entire development process of these butterflies from July to August. According to the requirements of Measure 10 - Agroenvironment and Climate from the National Rural Development Program (PNDR) (2007-2013) to support *P. teleius* populations mowing (preferably with manual or light weight machinery) of the areas should be done only after August 25, the use of chemical fertilizers and pesticides should be prohibited.

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