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THE SOUTHERN SWALLOWTAIL, *Papilio alexanor* Esper, 1800 (Lepidoptera: Papilionidae) – NEW BUTTERFLY SPECIES FOR THE FAUNA OF SERBIA

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ABSTRACT. This article reports the first finding of the Southern Swallowtail, *Papilio alexanor* Esper, 1800 (Lepidoptera: Papilionidae) in Serbia. The butterfly fauna of Serbia now comprises 202 species. A single male specimen was collected on May 9th, 2025, on a warm, dry serpentinite slope in southwestern Serbia, in the Zlatibor Nature Park, Čajetina municipality, Stublo village, in the lower part of the Uvac canyon, near the Uvac monastery. This species inhabits dry and warm shrublands and grasslands. Its distribution area is highly fragmented and extends from northern Spain, south-eastern France to the north-west and southernmost parts of Italy, the southern Balkans, Türkiye, the Caucasus, the Middle East and Central Asia. It is listed in Annex IV of the Habitats Directive (92/43/CEE), in Appendix II of the Bern Convention and is classified as near threatened (NT) in Europe according to the IUCN. A proposal for the Serbian name is "sokolov repak".

Keywords: Alexanor, Baluchi Yellow Swallowtail, Papilionoidea, Zlatibor, Balkans, EU Habitats Directive.

INTRODUCTION

With 201 recorded butterfly (Lepidoptera: Papilionoidea) species (POPOVIĆ and VEROVNIK, 2018; MILOJKOVIĆ *et al*., 2021; TOT *et al*., 2021), Serbia is one of the most diverse countries in the Balkans and Europe (VAN SWAAY *et al*., 2010). The most recent revised checklist of the butterflies of Serbia was presented in 2018 by POPOVIĆ and VEROVNIK (2018), who reported a total of 199 species present. However, they note that the list is probably not complete, as some regions in Serbia require systematic surveys and

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mention some species that also may occur in Serbia, such as *Erebia triaria* (de Prunner, 1798), *Erynnis marloyi* (Boisduval, 1834), *Tarucus balkanicus* (Freyer, 1844), *Pieris krueperi* Staudinger, 1860, *Gonepteryx farinosa* (Zeller, 1847), *Hipparchia senthes* (Fruhstorfer, 1908), *Pseudochazara amalthea* (Frivaldszky, 1845), *Muschampia tessellum* (Hübner, 1803) and *Melitaea britomartis* Assman, 1847.

Two years later, in 2020, a single specimen of a new butterfly species for Serbia was discovered in the city of Niš (southern Serbia) - the Geranium Bronze *Cacyreus marshalli* Butler, 1897 (MILOJKOVIĆ *et al*., 2021). The presence of this species was expected, as it is an invasive species from southern Africa that has already been detected in the neighboring Balkan countries. Its host plant is *Pelargonium* spp., a commonly cultivated ornamental plant in Serbia (MILOJKOVIĆ *et al*., 2021). Since then, this species has not been detected anywhere or at any time in Serbia. In 2021, a 201st butterfly species was finally confirmed for Serbia, when TOT *et al*. (2021) reported the occurrence of six specimens of the Little Tiger Blue, *Tarucus balkanicus*, from the hemlet of Čivčije, Bujanovac Municipality, the southernmost part of the Pčinja Valley, near the border with the Republic of North Macedonia. In 2022, its occurrence was confirmed at the same locality (MILJEVIĆ *et al*., 2014-2025). Since then, this species has not been recorded anywhere else in Serbia.

The abovementioned list of nine species that could be found in Serbia omitted one of the largest and the most iconic species in Europe – The Southern Swallowtail, *Papilio alexanor* Esper, 1800 (Lepidoptera: Papilionidae). This species has a highly fragmented geographical range (Fig. 1) extending from northern Spain, south-eastern France to the north-west and southernmost parts of Italy, the southern Balkans, Türkiye, the Caucasus, the Middle East and Central Asia (GBIF SECRETARIAT, 2023). In Europe, the most abundant populations are recorded in south-eastern France and Greece (BOLLINO and SALA, 2004; ANSELMO, 2021; GBIF SECRETARIAT, 2023). BOLLINO and SALA (2004) mentioned that *P. alexanor* is a typical Ponto-Mediterranean species with a dispersal center in central and southern Anatolia. *Papilio alexanor* is listed in Annex IV of the Habitats Directive (92/43/CEE) (THE COUNCIL OF THE EUROPEAN COMMUNITIES, 1992), in Appendix II of Convention on the conservation of European wildlife and natural habitats, signed in Berne on 19.IX 1979 and is classified as near threatened (NT) in Europe (VAN SWAAY *et al*., 2025).

Figure 1. Map of the currently known distribution of *Papilio alexanor*.
Yellow and orange dots represent records of *P. alexanor*. (GBIF SECRETARIAT, 2023).

Although *P. alexanor* was considered extinct in former Yugoslavia (COLLINS and MORRIS, 1985), there are many recent records proving its occurrence in the neighboring

Balkan countries, Croatia, Bosnia and Herzegovina, Montenegro, North Macedonia, Albania and Greece (BOLLINO and SALA, 2004; MELOVSKI and BOZHINOVSKA, 2014; ŠVARA *et al.,* 2015; VEROVNIK and ŠVARA, 2016; KOREN and MARTINOVIĆ, 2019; KOREN *et al.,* 2019, 2020; GBIF SECRETARIAT, 2023). The nearest record is from Orljak hill, 5 km SW of Raduša, Skopje, North Macedonia (MELOVSKI and BOZHINOVSKA, 2014), which is just 8 km from the Serbian-North Macedonian border, so the occurrence of *P. alexanor* was expected in Serbia, in the southern parts of the Autonomous Province of Kosovo and Metohija, or the Preševo and Pčinja valleys in south Serbia. To the west, the nearest record was from the Nevidio canyon, Šavnik, Montenegro (GBIF SECRETARIAT, 2023), around 50 km from the Serbian-Montenegrin border, so the occurrence of *P. alexanor* could have been expected in canyons of south-western Serbia. Based on these assumptions, this article aims to report the first record of *P. alexanor* in Serbia.

MATERIALS AND METHODS

The butterfly field research was carried out on May 9th, 2025, in the territory of the Zlatibor Nature Park, Čajetina Municipality, village of Stublo, in the south-exposed, warm, dry serpentinite slope of the lower part of the Uvac Gorge (Fig. 2). The butterfly survey was carried out in a 4.0 km transect, starting at Kolijevka viewpoint (43.629173N, 19.600394E) at an elevation of 1060 m a.s.l. and ending in the vicinity of the Uvac Monastery (43.613104N, 19.590850E) at 550 m a.s.l. (Fig. 3).

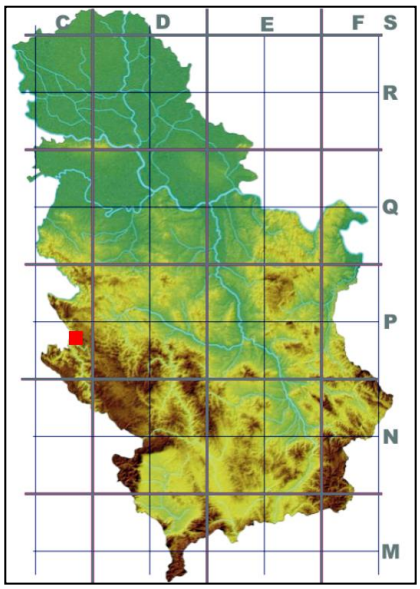

Figure 2. Map of the location of the record (red point) of *Papilio alexanor* in Serbia.

The first part of the transect (around 1 km) was carried out in an open road through the serpentinite Scotch (*Pinus sylvestris* L.) and Austrian pine (*Pinus nigra* J.F.Arnold) forest. The second and the longest part of the transect (around 2.5 km) was carried out in an open road through the warm, dry and sunny serpentinite shrublands (Fig. 3), dominating by *Carpinus orientalis* Mill., *Quercus* sp., *P. nigra*, *Fraxinus ornus* L., *Cotinus coggygria* Scop., *Isatis tinctoria* L., *Euphorbia glabriflora* Vis., *Genista* sp., *Stipa* spp., etc. The last part of the transect (around 500 m) was carried out in an open road through the shrubland and forest dominated by *Quercus* sp.

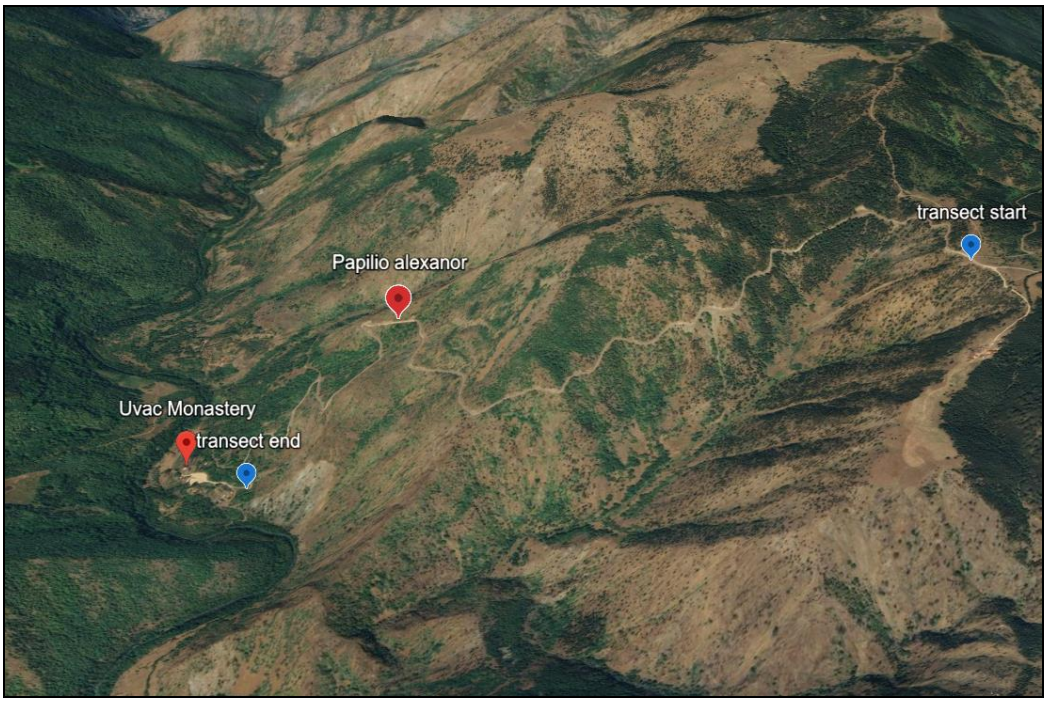

Figure 3. The satellite view of the butterfly survey transect on the southern-exposed slope of the lower part of the Uvac Gorge (photo from Google Earth Pro).

During the butterfly survey in the transect, all observed butterfly specimens were captured with an entomological net, photographed and identified on the site before being released. Specimens of certain species were collected and transported to the Laboratory of General and Applied Entomology at the Faculty of Science, University of Kragujevac, where they were prepared, sexed, and deposited in the butterfly collection of the first author. All photographed and collected butterfly specimens were identified using field guides (TOLMAN and LEWINGTON, 2008; POPOVIĆ and ĐURIĆ, 2011). All records were georeferenced and entered into the Alciphron database of insects of Serbia (MILJEVIĆ *et al*., 2014-2025). Taxonomic classification and nomenclature are compliant with WIEMERS *et al*. (2018).

The satellite showing the butterfly survey transect, the starting and ending point of the transect, and the exact location of *P. alexanor* collection in the researched areas were made using Google Earth Pro software.

RESULTS AND DISCUSSION

During the butterfly transect on May 9, 2025, in the territory of the Zlatibor Nature Park, Čajetina Municipality, village of Stublo, in the south-exposed, warm, dry serpentinite slope of the lower part of the Uvac Gorge, due to adverse weather conditions, just 24 butterfly species and one species complex were recorded (Tab.1).

The most important finding is the discovery of the Southern Swallowtail, *Papilio alexanor* (Fig. 4), which represents the first finding of this species in Serbia. With this species, the number of butterfly species recorded in Serbia increased to 202 (POPOVIĆ and VEROVNIK, 2018; MILOJKOVIĆ *et al*., 2021; TOT *et al*., 2021).

Material examined: Zlatibor District, Zlatibor Nature Park, Čajetina Municipality, village of Stublo, the lower part of the Uvac canyon 45.810661N, 20.145515E, 748 m a.s.l., May 9th, 2025, 1♂ specimen collected (Fig. 4), leg. F. Vukajlović, det. F. Vukajlović. A single collected male specimen was prepared, sexed, and deposited in the butterfly collection of the first author, at the University of Kragujevac, Faculty of Science.

Table 1. Butterfly species (Lepidoptera: Papilionoidea) recorded in the transect in the territory of the Zlatibor Nature Park, Čajetina Municipality, village of Stublo.

List of species	ERL[1]	Serbia[2]	HD[3]
Family Hesperiidae Latreille, 1809			
Subfamily Pyrginae Burmeister, 1878			
1 *Pyrgus malvae* (Linnaeus, 1758)	LC		
2 *Spialia orbifer* (Hübner, 1823)	LC		
Family Papilionidae Latreille, 1802			
Subfamily Papilioninae Latreille, 1802			
3 *Iphiclides podalirius* (Linnaeus, 1758)	LC		
4 *Papilio alexanor* Esper, 1800	NT		Annex II
Family Pieridae Swainson, 1820			
Subfamily Dismorphiinae Schatz , 1887			
5 *Leptidea sinapis/juvernica*	LC		
Subfamily Pierinae Swainson, 1820			
6 *Pieris rapae* (Linnaeus, 1758)	LC		
7 *Pieris ergane (Geyer, 1828)*	LC		
8 *Pieris napi* (Linnaeus, 1758)	LC		
9 *Anthocharis damone* Boisduval, 1836	LC		
Subfamily Coliadinae Swainson, 1827			
10 *Colias croceus* (Geoffroy, 1785)	LC		
11 *Colias hyale/alfacariensis*	LC		
Family Lycaenidae (Leach, 1815)			
Subfamily Lycaeninae Leach, 1815			
12 *Lycaena phlaeas* (Linnaeus, 1760)	LC		
13 *Lycaena tityrus* (Poda, 1761)	LC		
Subfamily Polyommatinae Swainson, 1827			
14 *Glaucopsyche alexis* (Poda, 1761)	LC		
15 *Scolitantides orion* (Pallas, 1771)	LC		
16 *Pseudophilotes vicrama* (Moore, 1865)	NT	Annex I	
17 *Polyommatus icarus* (Rottemburg, 1775)	LC		
18 *Lysandra bellargus* (Rottemburg, 1775)	LC		
Family Nymphalidae Rafinesque, 1815			
Subfamily Satyrinae Boisduval, 1833			
19 *Lasiommata megera* (Linnaeus, 1767)	LC		
20 *Lasiommata petropolitana* Fabricius, 1787	LC		
21 *Coenonympha pamphilus* (Linnaeus, 1758)	LC		
22 *Erebia medusa* (Denis & Schiffermüller, 1775)	LC		
Subfamily Nymphalinae Swainson, 1827			
23 *Vanessa atalanta* (Linnaeus, 1758)	LC		
24 *Vanessa cardui* (Linnaeus, 1758)	LC		
25 *Aglais urticae* (Linnaeus, 1758)	LC		

ERL[1] – European Red List of Butterflies, based on VAN SWAAY *et al*. (2010): LC – least concern; NT – near threatened.
Serbia[2] – According to the Rulebook on the declaration and protection of strictly protected and protected wild species of plants, animals and mushrooms (ANONYMOUS, 2016).
HD[3] – Habitats Directive by THE COUNCIL OF THE EUROPEAN COMMUNITIES (1992).

Figure 4. Collected specimen of *Papilio alexanor* from Zlatibor Nature Park (photos by M. Miljević).

Papilio alexanor was collected in the warm, dry and sunny serpentinite shrubland (Fig. 5), dominating by *Carpinus orientalis* Mill., *Quercus* sp., *P. nigra*, *Fraxinus ornus* L., *Cotinus coggygria* Scop., *Isatis tinctoria* L., *Euphorbia glabriflora* Vis., *Genista* sp., *Stipa* spp., etc. The collected male specimen was active during the short period of sunny weather, around 2 PM. Based on the BOLLINO and SALA (2004), *P. alexanor* host plants in Europe are umbelliferous plant species, especially *Trinia* sp., *Ptychotis* sp. and *Opopanax* sp. Further botanical research of the area of Zlatibor mountain will probably give us the answer of the presence of its host plant in Serbia.

The discovery of *P. alexanor* in Serbia is another possible evidence of insects' expansion from the warmer area of the Mediterranean. In recent years, since 2015, *P. alexanor* has been rediscovered in the neighboring Balkan countries after more than 50 years (ŠVARA *et al.,* 2015; VEROVNIK and ŠVARA, 2016; KOREN and MARTINOVIĆ, 2019; GBIF SECRETARIAT, 2023). Based on BOLLINO and SALA (2004), *P. alexanor* is a typical Ponto-Mediterranean species, with a dispersal center in central and southern Anatolia. From here, during the Tertiary, it expanded its area to the east, west and south. Once it arrived at the continental Balkans, it expanded its areal to the west, through a trans-adriatic or trans-ionian way, and to the north, along the Balkan coastal massifs (BOLLINO and SALA, 2004). This is also supported by other butterfly species present in the area, *A. damone* and *P. ergane*. These species are also Ponto-Mediterranean and probably followed most of the same route (BOLLINO and SALA, 2004). It is important to emphasize that this is the second recorded locality of *A. damone* in Serbia, besides Trijebine, near the town of Sjenica (DRNDIĆ *et al*., 2017).

Despite decades of butterfly research in Serbia, especially in the recent 15 years in western and southern Serbia, *P. alexanor* remained unnoticed. This could be attributed to a lack of surveys in the region and especially scarcity of adults and extreme affiliation to their usually very localized larval habitat (VEROVNIK and ŠVARA, 2016). This type of distribution has already been mentioned for this species (BOLLINO and SALA, 2004), so it is not surprising that only a single specimen was collected. As we mentioned, the larval habitat is likely somewhere near, so further surveys of the area are required.

Six subspecies and three varieties of *P. alexanor* were reported (GBIF SECRETARIAT, 2023), while BOLLINO and SALA (2004) state that *P. alexanor graecus* Schmidt, 1989 (=*P. alexanor atticus* Verity, 1911) is present in most recorded areas in the Balkans. BOLLINO and SALA (2004) state that *P. alexanor* is typically a single-brooded species, with an emergence period ranging from late March, April or early May to late July, depending on local climatic conditions, while *P. alexanor graecus* usually flies in May, but early males can be seen in April. Our observation from the beginning of May supports this claim.

Figure 5. The habitat of *Papilio alexanor* in Zlatibor Nature Park in Serbia (photo by F. Vukajlović)

Papilio alexanor is listed in Annex II of the EU Habitat Directive, while *Pseudophilotes vicrama* (Moore, 1865), also recorded at the same locality, is a strictly protected species in Serbia (ANONYMOUS, 2016) (Tab. 1). These two species are considered near threatened (NT) in Europe (VAN SWAAY *et al*., 2010). The proposal for the Serbian name of the species is "sokolov repak", meaning falcon's tail. The name was inspired by the Serbian name for *Papilio machaon* Linnaeus, 1758 - "lastin repak", meaning swallow's tail. The tail of the peregrine falcon (*Falco peregrinus* Tunstall, 1771) has similar dark stripes as those on the wings of *P. alexanor*. We also propose that the Serbian term "repak", meaning "tail", should be used as a generic name for the genus *Papilio*.

In the future, detailed monitoring should be conducted in the wider area of Zlatibor Nature Park and further into west and southwest Serbia to find new localities, host plants and species status in Serbia.

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