

**TRITHEMIS ANNULATA (PALISOT DE BEAUVOIS, 1807)  
AND SELYSIOTHEMIS NIGRA (VANDER LINDEN, 1825)  
(ODONATA: LIBELLULIDAE): NEW MEMBERS OF  
THE DRAGONFLY FAUNA OF SERBIA**

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## Abstract

Field investigations along the South Morava River near Niš have led to the discovery of two new dragonfly species for Serbia: *Trithemis annulata* (Palisot de Beauvois, 1807) and *Selysiothemis nigra* (Vander Linden, 1825), both belonging to the family Libellulidae. *S. nigra* was found in large numbers and with confirmed reproduction at several sites, indicating well-established populations. In contrast, *Trithemis annulata* was recorded at only two locations, with sightings limited to male individuals patrolling or resting in the typical "obelisk" posture. These findings increase the total number of dragonfly species known in Serbia to 69, enriching our understanding of the region's biodiversity and providing a foundation for further ecological and conservation research.

KEY WORDS: Violet Dropwing, Black Pennants, new findings, Anisoptera, range expansion, Niš, gravel pit

## Introduction

In Serbia, there is a relatively long history of odonatological research, which began as early as the 19th century (Frivaldszky, 1877; Petrović *et al.*, 1981; Kohaut, 1896). The region of Serbia north of the Sava and Danube

rivers has been extensively studied through various academic efforts by students at the universities in Novi Sad and Belgrade (master's and undergraduate studies) (Vijatov, 2000; Đurđev, 2002; Santovac, 2007; Arandelović, 2012; Rajkov, 2014), as well as through systematic research of specific areas (Adamović, 1956; Adamović & Andus, 1983; Santovac & Andus, 1995-98; Adamović & Vijatov, 1996; Rajkov & Šćiban, 2012; Santovac, 2013; Rajkov *et al.*, 2015; Šćiban, 2017). This level of detailed research is not the case for other parts of the country, where such research has been conducted to a lesser extent (e.g., Petrović, 2005; Đurđević, 2013; Rajkov, 2016; Đukić *et al.*, 2019).

In the vicinity of the city of Niš, dragonfly imagoes have been more intensively researched over the past decade, and the results have been presented at scientific symposia within the country (Đurđević *et al.*, 2017; Đurđević *et al.*, 2019; Nikolić *et al.*, 2019). Before this period, there was only one publication that documented findings of Odonata species near Niš (Adamović, 1948).

*Trithemis annulata* (Palisot de Beauvois, 1807) is an Afrotropical element of fauna with a broad distribution in Africa, the Arabian Peninsula, Anatolia, and Iran, which has recently been rapidly colonizing the Mediterranean Basin, especially southern and southwestern Europe (Kalkman *et al.*, 2015). Aided by climate change, it is expanding its range in Europe, particularly by shifting its northern boundary (Smallshire & Swash, 2020), as evidenced by recent initial findings of the species in neighboring countries: Montenegro, Hungary, Bulgaria, Slovenia, and Croatia (Gligorović *et al.*, 2010; Farkas, 2017; Stefanov & Vasilev, 2021; Vinko & Šalamun, 2021; Koren *et al.*, 2022).

*Selysiothemis nigra* (Vander Linden, 1825) is a species belonging to a monotypic genus within the Libellulidae family. It is widespread in the arid parts of Central Asia, and Northern Africa, and is also intermittently found in the Mediterranean area (Smallshire & Swash, 2020; Dijkstra *et al.*, 2020). At the beginning of the 21st century, this species expanded its range, and its presence has been confirmed in surrounding countries such as Bosnia and Herzegovina, Bulgaria, Hungary, North Macedonia, Romania and Slovenia (Marinov, 2000; Gashtarov & Beshkov, 2010; Koren *et al.*, 2012; Šalamun, 2012; Benstead, 2013; Skolka, 2014; Vinko *et al.*, 2017; Vinko, 2019; Mészáros, 2020)

In this publication, we will present the first findings of *T. annulata* (without confirmed reproduction at the sites) and *S. nigra* (with confirmed reproduction at the sites) in Serbia. These findings increase the total number of species recorded in the country from 67 (Đurđević *et al.*, 2020) to 69 Odonata species.

## Materials and Methods

Field research was carried out at active and abandoned gravel pits along the South Morava River in the Niš Valley to survey the Odonata fauna of the area.

Individuals were observed, photographed, and captured with an entomological net before being released back into the wild. A single male specimen from both species was collected and is now part of the private collection of the first author. Species identification was conducted using field guides (Smallshire & Swash, 2020; Dijkstra *et al.*, 2020).

All the studied sites consist of complexes of ponds formed in sand excavations (gravel pits) of varying ages and distributed across different locations. The area investigated on this occasion extends from the confluence of the Nišava into the South Morava River in the north (elevation of 175 m) to the village of Dobrotin near Leskovac in the south (elevation of 268 m). This area covers about 65 km along the course of the Južna Morava River, with the two surveyed points located 53 km apart as the crow flies (Fig. 1; Table I).

Table I: List of gravel pit complexes where the species *T. annulata* and *S. nigra* were recorded, listed from north to south.

No	Nearest settlement	Latitude	Longitude	Altitude (m.a.s.l)	<i>T. annulata</i>	<i>S. nigra</i>
1	Supovac	43,385411	21,771435	175		+
2	Sečanica	43,373130	21,771698	177		+
3	Lalinac	43,348322	21,777772	177	+	+
4	Krušće	43,334114	21,777441	178	+	+
5	Čokot	43,300164	21,803619	183		+
6	Lipovica	43,131937	21,917103	204		+
7	Dobročin	42,931219	22,026338	268		+

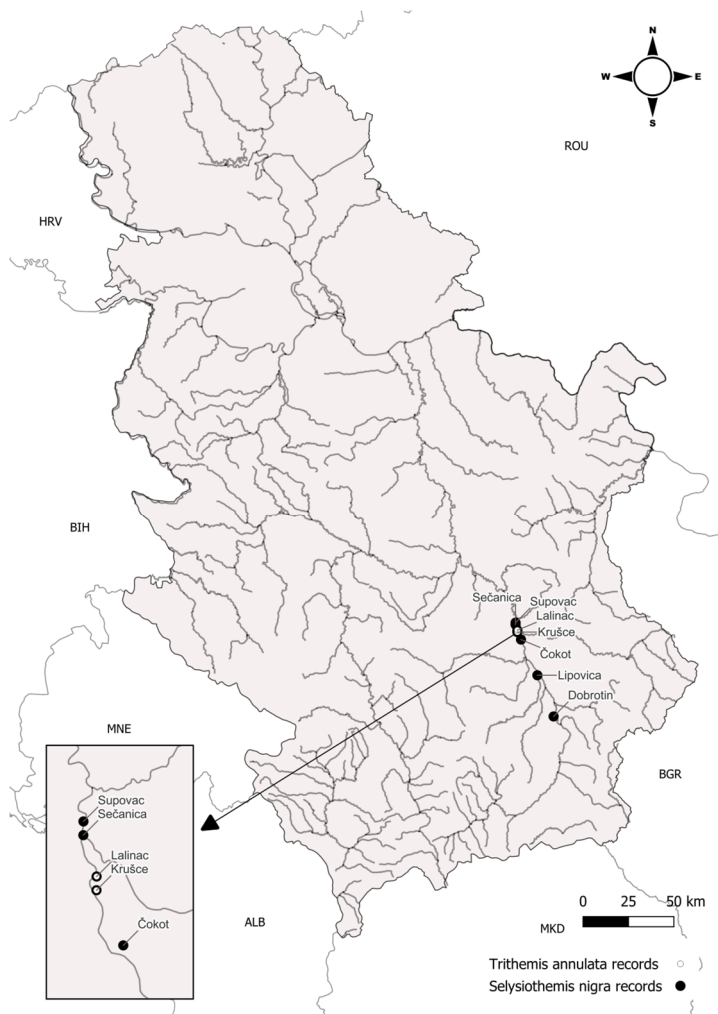


Figure 1. Cartographic representation of localities with findings of *T. annulata* and *S. nigra* along the course of the South Morava River.

## Results

On July 17, 2023, the Krušće locality was visited (Fig. 1; Table II), where two male specimens of *S. nigra* were observed for the first time, captured, photographed, and one specimen was collected. Two days later, on July 19, 2023, research was conducted again at the Krušće and Lalinac localities (Fig. 1; Table II), with Lalinac located slightly to the north. At the Lalinac site, a large number *S. nigra* adults were recorded, and exuviae were found, confirming the species' reproduction at this location. Additionally, during this visit, the presence of the species *T. annulata* was also recorded at the Lalinac site (Fig. 2), marking another discovery of a species previously unrecorded in the country. A subsequent visit to the Krušće locality also confirmed the presence of *T. annulata*.

Table II: Findings of *T. annulata* and *S. nigra* with observed behavior at the localities.

Species	Supovac	Sečanica	Lalinac	Krušće	Čokot	Lipovica	Dobrotin
<i>T. annulata</i>			19 Jul 2023. (♂)	19. Jul 2023. (♂)			
			19 July 2023 (♂, ♀, exuviae)	17 July 2023 (♂)			
<i>S. nigra</i>	25 July 2023 (♂, ♀)	25 July 2023 (♂, ♀)	25 July 2023 (♂, ♀, exuviae) 29 July 2023 (♂, ♀, tandem, egg laying)	19 July 2023 (♂) 25 July 2023 (♂, ♀)	25 July 2023 (♂, ♀)	28 July 2023 (♂, ♀)	28 July 2023 (♂, ♀, copula, tandem, egg laying)



Figure 2. Male *T. annulata* in the characteristic "obelisk" position, photographed on July 19, 2023, at Lalinac locality (Photo: I. Medenica).

Following the initial findings of *T. annulata* and *S. nigra*, similar sites were investigated to the south and north along the South Morava River: Čokot, Dobrotin, Lipovica, Sečanica, and Supovac (Table I). Research continued from July 25 to July 29, 2023, during which the presence of *S. nigra* was recorded (Fig. 3) at all the mentioned sites, with egg-laying documented at the Dobrotin site (Table II), further confirming the species' reproduction. *T. annulata* was not found at any of the subsequently visited localities.



Figure 3. Male (A) with exuvia and female (B) photographed on July 25, 2023, at Krušce locality (Photo: M. Nikolić).

## Discussion

*Trithemis annulata* typically inhabits various types of open standing and slow-flowing waters and is also a pioneer species in newly formed waterbodies such as canals, reservoirs, gravel pits, accumulation lakes, and similar aquatic habitats created by human activity (Kalkman *et al.*, 2015; Wildermuth & Martens, 2019; Dijkstra *et al.*, 2020). It is considered a good flyer, capable of traveling long distances, although it is not considered a migratory species in the traditional sense (Wildermuth & Martens, 2019). Furthermore, due to the rapid development of its larvae, which lasts 7-8 weeks (Boudot *et al.*, 2017), it demonstrates the ability to colonize even ephemeral waterbodies (Wildermuth & Martens, 2019). The larvae can develop in waters with low oxygen concentrations, as well as in waters that are slightly acidic (Bonet Betoret, 2000). Due to all these factors, adults in the Mediterranean basin are active from February to November (Kalkman *et al.*, 2015; Chiari *et al.*, 2020) and can appear in two generations per year (Boudot *et al.*, 2017). This species was found at both sites in young ponds that were sparsely vegetated with submerged and shore plants and featured gravelly, open shores (Fig. 4). Based on the information previously mentioned, these characteristics can be considered typical habitats for this species.



Figure 4. A – gravel pit at the locality of Lalinac – site of the first finding of *T. annulata*; B – locality of Krušće – site of the first finding of *S. nigra* (Photo: A. Đurđević).

*Selysiotthemis nigra* reproduces in well-vegetated, standing waters (ponds, small lakes, etc.), but can also be found in artificial, deep, standing waters (Uboni *et al.*, 2015; Smallshire & Swash, 2020). It tolerates brackish and saline waters, where it also reproduces (Kalkman & Bogdanović, 2015; Smallshire & Swash, 2020). Although the species is typical for coastal marine regions in the Mediterranean, its nomadic traits allow it to be found far from the coast (Boudot *et al.*, 2009). For these reasons, initial sightings of this species have been reported in surrounding countries, often without confirmed reproduction and, at times, far from waterbodies: in Bulgaria (Marinov, 2000; Gashtarov & Beshkov, 2010), Slovenia – at a waterbody with confirmed reproduction (Šalamun, 2012; Vinko, 2019), Bosnia and Herzegovina – at and near a waterbody with a large presence of both sexes (Koren *et al.*, 2012), Romania (Benstead, 2013; Skolka, 2014), North Macedonia – at a waterbody with confirmed reproduction (Vinko *et al.*, 2017), and Hungary – in a meadow without confirmed reproduction (Mészáros, 2020). Indeed, the species is expanding its range northward in Europe, as evidenced by sightings in northern Italy (Uboni *et al.*, 2015) and Ukraine (Tytar, 2007; Martynov, 2020).

Both species represent African and Mediterranean elements of the fauna (Smallshire & Swash, 2020; Dijkstra *et al.*, 2020; Kalkman *et al.*, 2015) that have recently been expanding their ranges northward, likely driven by the effects of climate change. The South Morava River valley serves as an important corridor connecting Serbia (including Niš) with these climatic zones. This could explain the presence and reproduction of the species in suitable habitats along the riverbed. This research provides a foundation for further studies on the biology and ecology of these species, as well as for assessing their distribution and the rate of colonization of new habitats in the country. Additionally, it can be assumed that both species have been present in Serbia for some time but had not been previously recorded. The discovery of *T. annulata* and *S. nigra* in neighboring Hungary (Farkas, 2017; Mészáros, 2020) suggests that the species have utilized existing river corridors through Serbia (South Morava – Great Morava – Danube – Tisa) to colonize new sites, indicating that these two species, or at least one of them, have likely been present in this area for several years. With the confirmation of the presence of these two species in the Republic of Serbia, the total number of Odonata species recorded in the country increases from 67 (Đurđević *et al.*, 2020) to 69. The findings presented in this paper significantly enrich our understanding of the distribution, newly identified habitats, and ecology of these two species. These insights are crucial for completing the ecological puzzle of how species adapt and shift in response to environmental changes, including climate change. The data not only fill critical gaps in our knowledge but also provide a solid foundation for future research into the biology and ecology of these species. Such studies are essential for evaluating the impact of various factors on the distribution of these species. The importance of this work lies in

its contribution to the broader field of biodiversity conservation and management, providing essential data that can inform conservation strategies and help mitigate the effects of climate change on these and other related species.

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TRITHEMIS ANNULATA (PALISOT DE BEAUVOIS, 1807)  
И SELYSIOTHEMIS NIGRA (VANDER LINDEN, 1825)  
(ODONATA: LIBELLULIDAE): НОВИ ЧЛАНОВИ ФАУНЕ  
ВИЛИНСКИХ КОЊИЦА СРБИЈЕ

АЦА ЂУРЂЕВИЋ, ИВАН МЕДЕНИЦА, АНА САМАРЦИЋ, МАРКО НИКОЛИЋ

Извод

Теренска истраживања дуж реке Јужне Мораве у близини Ниша довела су до открића две нове врсте вилинских коњица за Србију: *Trithemis annulata* (Palisot de Beauvois, 1807) и *Selysiotthemis nigra* (Vander Linden, 1825), обе из породице Libellulidae. *S. nigra* је пронађена у великом броју и са потврђеном репродукцијом на неколико локација, што указује на добро успостављене популације. Насупрот томе, *T. annulata* је забележена само на две локације, са посматрањима ограниченим на мужјаци који патролирају или одмарају у типичном „обелиск“ положају. Ова открића повећавају укупан број врста вилинских коњица забележених у Србији на 69, обогаћујући наше разумевање биодиверзитета региона и пружајући основу за даља еколошка и конзервациона истраживања.

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