

Distribution of the endangered aquatic plant *Nuphar lutea* and some notes on its ecology in Bulgaria

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Abstract. Yellow Water-Lily (*Nuphar lutea*) is a well-known aquatic plant for the flora of Bulgaria. However, presently it has very limited distribution. Many former localities have disappeared during the last century. This paper provides current data on some important populations of the species in Northwest Bulgaria, the municipalities of Byala Slatina and Boychinovtsi, and presents information on its distribution and syntaxonomy in the country.

Key words: Yellow Water-Lily, rivers Skat and Ribine

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Introduction

Nuphar lutea (L.) Sm. is a perennial aquatic herb with creeping rhizome, two types of leaves (floating – big and ovate, and submerged – with thin transparent lamina) and yellow single flowers. The species inhabits slow waters, bogs and lakes. Due to the long-time drainage of swamps and wetlands, most localities reported in literature have been destroyed (Jordanov 1970). Yellow Water-Lily is included in the *Red Data Book of the People's Republic of Bulgaria* (Vassilev 1984) and in the *Red Data Book of Bulgaria* (Peev & Tsoneva 2015) as an endangered species.

According to Petkov (1911), at the turn of the 20th century *N. lutea* was widespread in the marshes of Archar, Kozloduy, Karaboaz, and Svishtov-Belene (Danubian Plain). Jordanov (1970) had summarized information on the following localities of the species: Black Sea Coast – in the lower reaches and at the mouth of river Kamchia; Thracian Lowland – in the overflows of river Maritsa, near the villages of Popovitsa and Sadovo. The same source indicated that the species was known also for river Ropotamo, Arkutino Marsh, lakes Shabla and Devnya, marshes of Aydemir, Ostrov and Belene, lake Rabisha, and the regions of Byala Slatina, Knezha and Shumen towns.

Kochev & Jordanov (1981) had summarized the existing localities of *N. lutea* in Bulgaria based on personal observations in the 1970's. Those localities were along Danube River – near Selanovtsi village (Vratsa district,) Kaykusha Marsh near Oresh village (Veliko Tarnovo district), Batin Fishpond (Ruse district). The already known localities from the Black Sea Coast were lake Shabla (Dobrich district), lake Beloslav (Varna district), Arkutino Marsh and the mouth of river Ropotamo (Burgas district). Martvoto Blato Marsh on Belene Island (Pleven district) could be also added (Kochev & Tzolova 1984) to those existing in that period.

Peev and Tsoneva (2015) have summarized information on the distribution of *N. lutea* in Bulgaria. They indicated the localities along the Black Sea Coast (lake Shabla, the mouths of rivers Kamchia and Veleka, Velyov Vir Reserve), Northeast Bulgaria (Kalimok-Brashlen Marsh), and Danubian Plain (drainage canals around Kozloduy town and Orsoya village). They have concluded that due to drainage of swamps and wetlands, most localities reported in literature are extinct.

A summary of the information published in the last 50 years indicates that a rapid decline of the localities and populations of *N. lutea* in Bulgaria has started since the middle of the 20th century.

In 2022, a new locality of the Yellow Water-Lily was recorded by Irina Mateeva in the application SmartBirds Pro (Popgeorgiev & al. 2015) for the Sredna Gora (*West*) floristic region.

In 2021 and 2022, two localities of the species in the Danubian Plain have been purposefully investigated by the authors: along river Skat, close to Byala Slatina town (Vratsa district), mentioned in the publication of Velenovsky (1898), and in river Ribine, near village Beli Brod (Montana district). The described populations are important at national level. *N. lutea* is a dominant in macrophytic communities in those localities. The localities have been mapped and several phytocenological relevés have been prepared to classify those communities at association level.

The known localities in lakes Shabla and Ezerets, in Velyov Vir Reserve, and in river Veleka have also been studied to determine the phytocenological

position of *N. lutea* communities in Bulgaria. That study was carried out in 2022, during the species monitoring as part of the National System for Monitoring the Status of Biological Diversity. In the course of the same monitoring, the presence of the species was confirmed in river Ropotamo, at coordinates 42.3002°N, 27.697895°E and 42.301333°N, 27.704345°E.

Material and methods

The research was based on own collections and field studies in six localities of *N. lutea* (river Skat, river Ribine, river Veleka, Velyov Vir Reserve, lake Shabla, lake Ezerets). The phytocoenological research was conducted in 2021-2022 with the classical Braun-Blanquet's methodology (Braun-Blanquet 1964). The localities were presented on a UTM grid map (10×10 km) of Bulgaria, following the recommendations of Kožuharov & al. (1983). Nomenclature of the vascular plants followed Euro+Med PlantBase (Euro+Med 2022). The syntaxonomic scheme followed the fullest checklist of European syntaxa (Mucina & al. 2016).

Results

The current spatial data for the studied populations of *N. lutea* in the Danubian Plain are presented here: in the stream of river Skat and in some fishponds and artificial reservoirs close to the river (near Popitsa village [Fig. 1 and Fig. 2], Byala Slatina municipality, Vratsa district), 128 m, 43.43277°N, 23.96358°E, GP31, 03.09.2021; in the stream of river Ribine (near Beli Brod village – Boychinovtsi municipality, Montana district), 67 m, 43.53590°N, 23.56707°E, GP02, 26.07.2022; observed by V. Georgiev, S. Tsoneva, R. Tzonev, Ch. Gushev. The described populations of *N. lutea* are located in river Skat, between Byala Slatina town and Barkachevo village (in a stretch of about 17 km), but mostly in the surroundings of Popitsa village (Fig. 3), and in river Ribine (Fig. 4), up to 2 km upstream from its confluence with river Ogosta.



Fig. 1. Community of *Nuphar lutea* in river Skat.



Fig. 2. Population of *Nuphar lutea* in an artificial reservoir between Byala Slatina town and Popitsa village.



Fig. 3. Population of *Nuphar lutea* in river Skat close to Popitsa village.



Fig. 4. Population of *Nuphar lutea* in river Ribine.

The population near Byala Slatina town and Popitsa village inhabited mainly the slow-flowing stream of river Skat with fragments of varied sizes. Yellow Water-Lily plants growing with high density in old river beds and artificial reservoirs along the river (Fig. 2) were also found. The approximate area occupied by the plants is about 2.87 ha, calculated on the base of free satellite images and field observations. The population in river Ribine was not so numerous and inhabited small stretches of slow current, which alternated with fast and shallow stretches of the river current unsuitable for the species. The approximate area occupied by the plants is about 0.08 ha, calculated on the base of free satellite images and field observations. An indicative map of the populations of *N. lutea* in the rivers Skat and Ribine is shown in Fig. 5.

The communities (Table 1) in river Skat during the time of investigation were located mostly in the riverbed at a depth of about 1–1.30 m. The river water was slow-flowing, muddy, with a muddy river bottom. Such communities were found also in artificial reservoirs (Fig. 2) located very close to the river, where the plants were growing in shallower water, e.g. at about 0.50–0.80 m. Due to the narrow riverbed and relatively large catchment area of river Skat, significant torrential floods have been registered in it (Kiradzhiev 2013). However, the population of *N. lutea* seemed to have adapted to these drastic fluctuations in the wa-

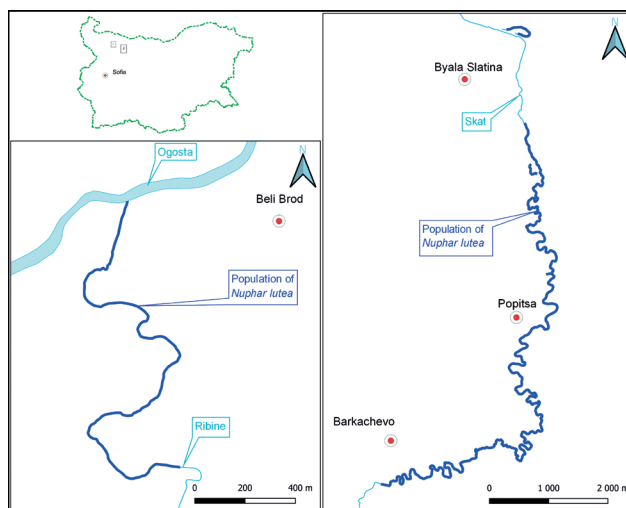


Fig. 5. Indicative map of the populations of *Nuphar lutea* in the rivers Skat and Ribine.

ter level. The population in river Ribine was not large, although its ecological peculiarities have been similar to those in river Skat. The floristic composition of those communities included some most widespread aquatic plants in Bulgaria: *Lemna minor*, *Myriophyllum spicatum*, *Persicaria amphibia*, *Ceratophyllum demersum*, *Berula erecta*, *Najas minor*, *Sparganium erectum*, etc.

The studied communities in other localities (Velyov Vir Reserve, mouth of river Veleka and lakes Shabla and Ezerets) grew under very similar ecological conditions: water depth, bottom ground, species

composition, etc. Only one *relevé* in river Veleka was in a deeper water layer: near 2 m.

Based on data from eleven phytocoenological *relevés* (Table 1), it is concluded that the communities of the studied populations belong to the association *Nymphaeo albae-Nupharetum luteae*, reported for the first time for Bulgaria.

The association *Nymphaeo albae-Nupharetum luteae* is represented by communities dominated by *Nuphar lutea*, which usually has large leaves floating on the water surface. It occurs in mesotrophic to eutrophic waters of different natural wetlands, but also in channels and lentic sections of streams. Most often, it is found at water depth of 0.50–1.50 m, although it

tolerates even strong fluctuations of the water level. It is widespread in most European countries but mainly in the lowlands and plains in the temperate regions of Europe (Šumberová 2011). The association is included in the following syntaxonomic scheme:

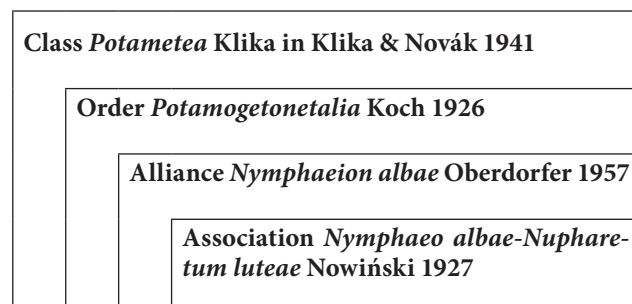


Table 1. Diagnostic table of the association *Nymphaeo albae-Nupharetum luteae* Nowiński 1927 from Bulgaria

Relevé number	1	2	3	4	5	6	7	8	9	10	11
Locality	River Skat, near Popitsa village	River Skat, near Popitsa village	River Skat, near Popitsa village	River Skat, near Popitsa village	River Ribine, near Beli Brod village	Lake Shabla	Lake Ezerets	River Veleka	River Veleka	Velyov Vir Reserve	Velyov Vir Reserve
Date	3.9. 2021	3.9. 2021	3.9. 2021	3.9. 2021	26.7. 2022	10.9. 2022	9.9. 2022	29.9. 2022	29.9. 2022	1.8. 2022	1.8. 2022
Latitude	43. 43354	43. 43277	43. 44115	43. 42563	43. 53590	43. 56808	43. 58918	42. 06361	42. 06101	42. 30061	42. 29983
Longitude	23. 96272	23. 96358	23. 96110	23. 95838	23. 56707	28. 56050	28. 55226	27. 9545	27. 93933	27. 70932	27. 71072
Total cover	80	90	70	60	70	60	90	80	70	90	75
Water depth (m)	1	1.2	1.2	1.2	1.5	1.5	1.5	2.0	1.5	1.5	1.0
Sample area (square meters)	50	50	50	50	25	50	50	50	50	50	50
Diagnostic species for the association											
<i>Nuphar lutea</i> (L.) Sm.	4	5	4	4	4	4	5	5	4	5	4
Diagnostic species for <i>Potametea</i>, <i>Potamogetonetalia</i> and <i>Nymphaeion albae</i>											
<i>Myriophyllum spicatum</i> L.	+		+	2	+	+	1	1	+		
<i>Persicaria amphibia</i> (L.) Delarbre		+									
<i>Ceratophyllum demersum</i> L.			3			1	1	+	+	+	1
<i>Hydrocharis morsus-ranae</i> L.						1	+				
<i>Potamogeton nodosus</i> Poir.					+			+	1		

Discussion

The studied populations in rivers Skat and Ribine are highly representative, but do not provide a reason for changing the conservation status of *N. lutea* at national level.

A locality near river Skat was reported as early as the end of the 19th century: the stagnant waters near Byala Slatina, along with the mouth of river Kamchia were the first published localities of this species in Bulgaria (Velenovsky 1898), based on materials collected by H. Škorpil. That locality has not been confirmed ever since in any scientific publication or herbarium collection. Musliyska (1984) and Borisov (1988) had published some interesting reports in the popular science magazines presenting in a suitable form for a wide range of readers data and facts about *N. lutea* in that area: topographical allocation in stagnant waters and in the bed of river Skat, size of the site, spatial setting, attempts at biotechnical measures, threatening factors and suggestions for protection, and declaration of a protected area.

A summary of the information about the localities of the species in Bulgaria is given below by floristic regions.

► Black Sea Coast

There are viable populations in the following localities along the Black Sea Coast: lakes Shabla and Ezerets (PJ22), rivers Ropotamo (including Velyov Vir Reserve) (NG58) and Veleka (NG75, NG85). The remaining known localities from the past, such as lake Devnya (or lake Beloslav) (NH58) and the mouth of river Kamchia (NH76), have not been confirmed for many decades.

► Northeast Bulgaria

The locality of Kalimok-Brashlen protected area (MJ57) has not been confirmed in the last 20 years. The Aydemir Marshes (NJ18) (Georgiev 1906) were completely drained in the 1930s.

► Danubian Plain

The localities of the former wetlands of Kozloduy (GP24), Ostrov (KJ63, KJ64), Karaboaz (LJ04, LJ14), Svishtov-Belene (LJ53), and Batin Fishpond (LJ83, LJ93) do not exist after the drainage of the wetlands there. The localities on Belene Island (Martvoto Blato Marsh) (LJ53), as well as in the Kaykusha protected area (LJ52)

have also been destroyed and the species is extinct there. The locality in a drainage canal westwards from Belene town (Shovene area) (LJ43), documented firstly by Todorov (1984) and confirmed by Tzonev (2006), has not been reaffirmed since 2004, in spite of purposeful searches. There are data on former localities in the drainage canals near the now nonexistent fishponds in Orsoya (Vidin district) (FP64, FP65) (Dimitrov 1999) and in Ostrov Lowland, Selanovtsi village (Kalugerski Gred-Topolite and Gola Bara protected areas) (KJ63, KJ64) (Vratsa district) (Nedyalkov & al. 1983). The species had been also found in lake Rabisha (FP24) (Jordanov 1931), now transformed into a water reservoir, and thus its habitat was destroyed. There has been no recent information on the locality in a canal of the Kozloduy Nuclear Power Plant (2010 Tsoneva & Georgiev, pers. observation) (GP24). Therefore, recent information is lacking on any existing locality in the Danubian Plain, except for the populations described in this paper (GP02, GP30, GP31). Information in literature (Urumov 1935, Jordanov 1970) on the locality near Knezha town has not been confirmed.

► Balkan Range (Eastern)

Information in literature (Jordanov 1970) on the locality near Shumen town has never been confirmed. Davidov (1915) published the locality from Shumen region in the standing waters near Cherkez Kyoy village, presently Aleksandrovo (Smyadovo Municipality). It was located in the now nonexistent small marsh (Bataka) between Alexandrovo and Veselinovo villages (MH95) in the Balkan Range (East).

► Sredna Gora (Western)

In 2022, a new locality of the Yellow Water-Lily was recorded with four flowers in river Mativir by Irina Mateeva, with the application SmartBirds Pro (Popgeorgiev & al. 2015), at coordinates 42.42085°N, 23.9°E (GN30). That locality was confirmed by the authors on 4th August 2023.

► Thracian Lowland

Information on localities along river Maritsa near Popovitsa village and Sadovo town (LG26, LG36) was very old (from the turn of the 20th century – coll. V. Stříbrný) and these localities did not exist anymore.

After summarizing and analyzing the available data on the species in Bulgaria, a map was prepared

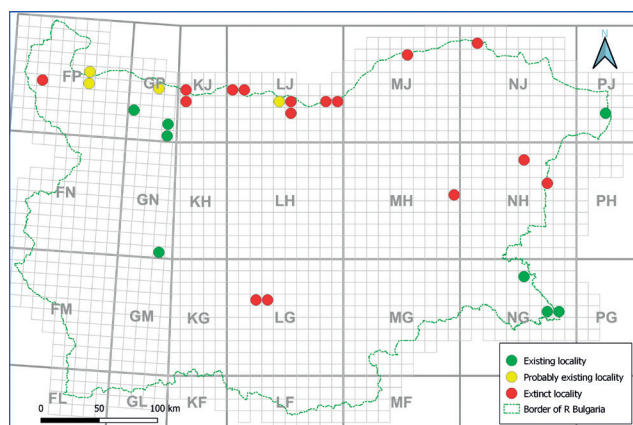


Fig. 6. The past and present distribution of *Nuphar lutea* in Bulgaria, presented on a UTM grid (10×10 km).

on a 10×10 km UTM grid (Fig. 6) featuring the existing, probably existing and extinct localities.

Actual extinction of *N. lutea* in most localities in the country increases the importance of the populations near Popitsa and Beli Brod villages for the protection of this species at population, coenotic and habitat levels. In order to ensure a more effective conservation of the species in Bulgaria, it is necessary to include those populations in the protected zones of Natura 2000 under the Biological Diversity Act, as protected areas under the Protected Areas Act, as well as as monitoring places within the National Biodiversity Monitoring System.

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