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ГЛАСНИК ОДЈЕЉЕЊА ПРИРОДНИХ НАУКА, 24, 2020.

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***MARSILEA QUADRIFOLIA* L. (MARSILEACEAE), A NEW REPORT FOR THE FLORA OF MONTENEGRO**

Abstract

A four-year field study on the species *Marsilea quadrifolia* L. was conducted in flooded regions of Skadar Lake and its tributaries to establish the distribution and conservation status of the species. The study confirmed the presence of a large population in the area of Žabljačke Livade, along the river Moračica. This location is a new record for the species *M. quadrifolia* in Montenegro.

Keywords: *Marsilea quadrifolia*, Montenegro, new record, Skadar Lake

INTRODUCTION

Marsilea quadrifolia L. is heterosporous, aquatic fern that survives summer drought in terrestrial form. Its leaves composed of two pairs of opposite leaflets resemble a four-leaf clover (Figs. 1–2). The species occupies stale, shallow marshlands on the banks of lakes, ponds, and river deltas. Due to the destruction of its natural habitats, it is rare and endangered in Europe (Near Threatened conservation status) [4]. It is protected by the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and listed on Annex IIb and IVb of the European Habitats Directive.

In Montenegro, the species was reported for the area of Skadar Lake, at Plavnica [7], [3], Gostilj, and Mataguži [3]; [5] and [1] cite this species for Skadar Lake based on older literature data. Until now, the species has been listed as Extinct (EX) or Critically Endangered (CR?) in the preliminary red list for

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the flora of Montenegro [6]. It is protected by national legislation („Službeni list RCG“ 76/60).

MATERIALS AND METHODS

The study on the distribution of *M. quadrifolia* started in 2013, as part of the project „Monitoring of the flora and fauna of Skadar Lake“. The field work had been conducted at locations cited for this species, before (Plavnica, Gostilj, Mataguži), as well as in other regions harboring its potential habitats: the Bay of Gušenica, Kamenik, river banks of the Karatuna and Crmnička Rijeka, a tributary of the river Morača, and in Žabljačke Livade. Although the presence of the species at these locations was not confirmed, the field studies did not support its extinction in the region of Skadar Lake, Montenegro, either and highlighted the need for further research [2].

Voucher specimens collected from the study site are deposited in the herbarium of the Natural History Museum of Montenegro.

RESULTS AND DISCUSSION

The field work on the same locations as well as in additional potential habitats for this species, which were continued as part of the planning strategy of the Public Company National Parks of Montenegro, confirmed the presence of *M. quadrifolia* along the banks of the Moračica River (Figs 3–4). At the time of field explorations (16 June 2017), the riverbed of Moračica was dry and overgrown with vegetation. Based on the GPS coordinates collected at the beginning and at the end of the discovered population of *M. quadrifolia*, the length of the area covered with the population was estimated to 270 m on the right bank, with an interruption of 50 m (Figure 5); on the left bank, the population

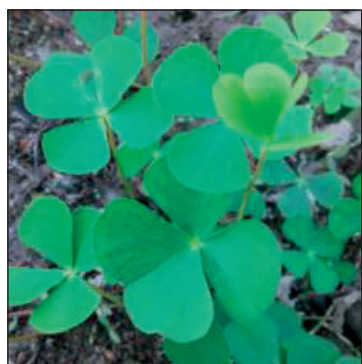


Fig. 1. Leaf of *Marsilea quadrifolia* consisting of two pairs of opposite leaflets

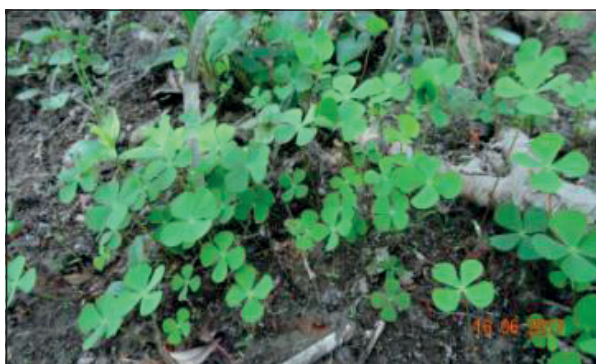


Fig. 2. *Marsilea quadrifolia* in a vegetative stage



Fig. 3. Dried-out riverbed of the Moračica River (habitat of *Marsilea quadrifolia*).



Fig. 4. Part of the population of *Marsilea quadrifolia* at the study site along the Moračica River

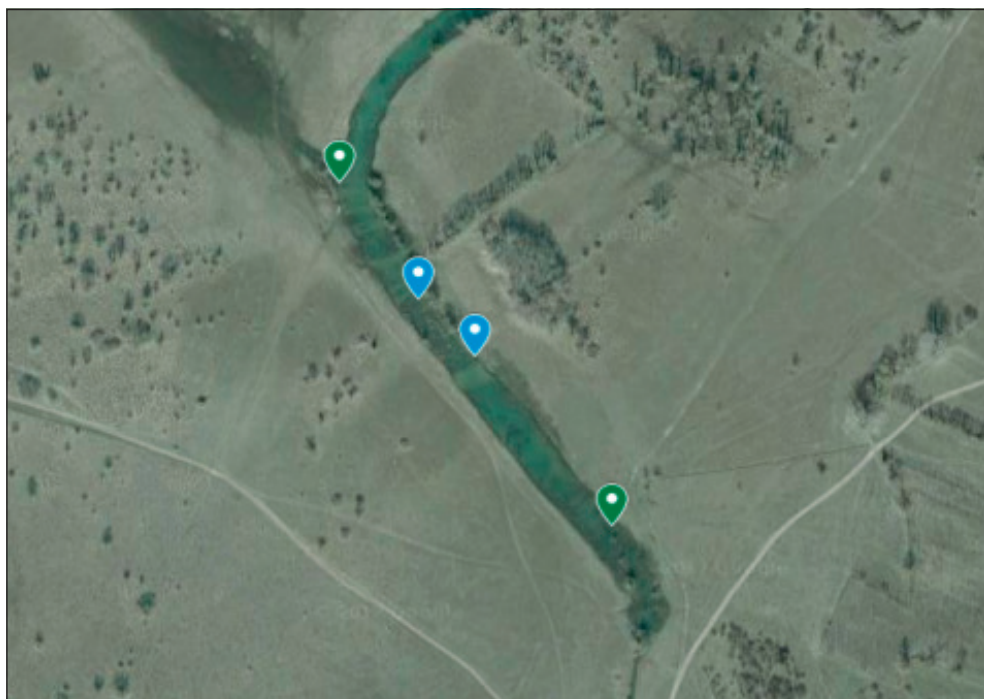


Fig. 5. Aerial photo of the study site. Green inverted droplets mark the length of the population of *Marsilea quadrifolia* on the right bank of the river Moračica, which has been estimated to 270 m. Blue inverted droplets indicate the interruption of 50 m in the population observed on the right river bank.

was extended over an area 135 m long. The width of the area was 2–3 m on both banks; these banks are waterlogged during the river flow. Based on visual assessment, the population was large and dense, growing on a wet, muddy substrate, and mixed with sporadic individuals of *Nymphoides peltata* (S. G. Gmelin) O. Kuntze.

The earlier records of the species in Plavnica, Gostilj and Mataguži were not confirmed in the present study probably due to habitat destruction caused by extensive urbanization and vegetation overgrowth on the banks of the Plavnica and Gostiljska Rijeka, particularly by the overgrowth of shallow and quiet inlets, which provide suitable environments for growth of this species.

CONCLUSION

Our investigation confirmed the presence of a large population of *Marsilea quadrifolia* in the area of Žabljačke Livade, along the river Moračica. This location is a new record for this species in Montenegro. Future research will be carried out to collect detailed data about the population of *Marsilea quadrifolia* on the banks of Moračica, as well as at other possible locations along its river banks.

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***Marsilea quadrifolia* L. (Marsileaceae), novi nalaz u flori Crne Gore**

Sažetak

Kao rezultat četvorogodišnjeg istraživanja vrste *Marsilea quadrifolia* L., na plavnim terenima Skadarskog jezera i njegovih pritoka, sa ciljem da se utvrdi distribucija i konzervacijski status vrste, pronađena je brojna populacija na području Žabljačkih livada, na rijeci Moračici. Ovaj lokalitet je novi nalaz za vrstu *Marsilea quadrifolia* L. za područje Crne Gore.

Ključne riječi: *Marsilea quadrifolia*, Crna Gora, novo nalazište, Skadarsko jezero