

New records of the rare liverwort *Mannia triandra* (Scop.) Grolle in Croatia

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About

Mannia triandra (Scop.) Grolle is a rare thalloid liverwort species, known from a few, mostly sporadic, historical records in Croatia. In the recent years, two findings have been recorded on Mt Žumberačka Gora and one from Plitvice Lakes, and subsequently published. During 2022, two adjacent populations close to these previously known localities were found, but also a first locality in Gorski Kotar region (in the canyon of the River Kamačnik) was recorded. In addition, an old literature record from the area of Dubrovnik city from the beginning of the 20th century was found while browsing literature for this paper. Thanks to these new findings, we are now closer to a better understanding of the species ecology and habitat preferences in Croatia.

Keywords: liverwort, Mt Žumberačka Gora, Plitvice Lakes, River Kamačnik, SE Europe

Bučar, M., Šegota, V., Alegro, A. (2023): Novi nalazi rijetke jetrenjarke *Mannia triandra* (Scop.) Grolle u Hrvatskoj. Glas. Hrvat. bot. druš. 11(1): 64-70.

Sažetak

Mannia triandra (Scop.) Grolle je rijetka talozna jetrenjarka. U Hrvatskoj je donedavno bila poznata samo iz povijesnih sporadičnih nalaza. U proteklih nekoliko godina objavljena su dva nalaza sa Žumberačke gore i jedan s Plitvičkih jezera. Tijekom 2022., zabilježene su dvije populacije blizu tih ranije poznatih nalazišta, ali i prvi nalaz u Gorskom kotaru, u kanjonu rijeke Kamačnik. Tijekom pisanja ovog priloga pronađen je i stari literaturni nalaz ove vrste s početka 20. stoljeća iz okolice grada Dubrovnika. Zahvaljujući recentnim nalazima, na korak smo boljem razumijevanju ekologije i potencijalnim staništima ove vrste u Hrvatskoj.

Ključne riječi: jetrenjarka, Žumberačka gora, Plitvička jezera, rijeka Kamačnik, jugoistočna Europa

Introduction

Mannia triandra, a circumboreal species, is a short-lived perennial of subcontinental-subalpine chorological element (Hatchel et al. 2003). It is widely distributed in Central and Southern Europe with a centre of its distribution in the Alps. There, it reaches altitudes up to 2600 m a.s.l. and prefers bare soil in the crevices of calcareous cliffs. In Southeastern Europe it is found in Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Montenegro, North Macedonia, Romania and Slovenia (Hodgetts & Lockhart 2020) where it also prefers shaded and relatively mesic sites, often in the forms of crevices of calcareous and dolomite cliffs (Frey et al. 2006, Németh & Papp 2011). The preferred crevices are usually closer to the ground level where *M. triandra* is often surrounded by forest vegetation. It also grows on freshly eroded sites as a pioneer species. In the last decade, the neighbouring Balkan countries have also advanced in their knowledge of this species' distribution in their respective territories. In 2017, *Mannia triandra* was finally confirmed in Slovenia, the country of its *locus classicus*, after 100 years (Strgulc Krajšek & Martinčič 2017). In Montenegro, more than 10 new localities were found throughout 2019 and 2020, about 50 years after previously known records (Dragičević & Berg 2022). A new checklist of hornworts and liverworts of Serbia (Pantović et al. 2020) revealed that *Mannia triandra* is still insufficiently known there as it was erroneously cited in Sabovljević et al. (2004). Alongside the failure by the Czech bryologists to find *M. triandra* during their long-term monitoring of Natura 2000 species (Vicherová 2022), we can argue that *M. triandra* is a rare and habitat-specific species. It is included in the EC Habitat Directives (Anonymus 1992). According to European Red List of Mosses, Liverworts and Hornworts (Hodgetts et al. 2019) it is vulnerable in Europe. In Bulgaria and Hungary it is considered endangered and in Romania vulnerable, whereas in Croatia no threat status has been given so far (Hodgetts & Lockhart 2020). In Croatia, it is a strictly protected species (Anonymus 2016).

Mannia triandra is a thalloid liverwort with a thin (2-3 mm), linear, dichotomously branched thallus. Characteristically, the dorsal, dying part of thallus of a mature plant is lacunose and looks reticular from above. Its air pores are simple with 1-4 rings of 4-9 guard cells. Antheridia are embedded in the thallus, while sphaerical or conical female receptacles are stalked and have 3-4 bell shaped involucre, each with 1 sporophyte (Frey et al. 2006, Schill 2007).

In Croatia, *Mannia triandra* was historically reported along the Eastern Adriatic coast: on Peninsula Pelješac, island of Brač (Bischler & Jovet-Ast 1973) and Mt Biokovo (Schiffner 1916) in the south and city of Opatija and Peninsula Istria (Matouschek 1905) in the north. In the past eight years, it was reported from three inland localities. First two were from Mt Žumberačka Gora (Alegro et al 2015): along the path from Stari grad village towards Stari grad Žumberak castle on thermophilous slopes, and next to Sopotski Slap waterfall near Sošice village, on shaded and moist limestone rocks in hop-hornbeam – beech forest. The third record was on shaded limestone and dolomite rocks at Lake Galovac in Plitvice Lakes National Park. This was erroneously reported as a locality from the Lake Gradinsko in Alegro et al. (2019).

Methods

Observations were made in 2022. Photo documentation was made and the specimens were collected for the herbarium collection Herbarium Croaticum (ZA) where the identification was confirmed using Frey et al. (2002). Accompanying bryophyte and vascular plant species were only recorded for one of the localities (above Sopotski slap waterfall).

Results and discussion

We report two new localities of *Mannia triandra* in Croatia, one from field observation, one from literature and confirm two recently recorded localities by specimens found in a close proximity.

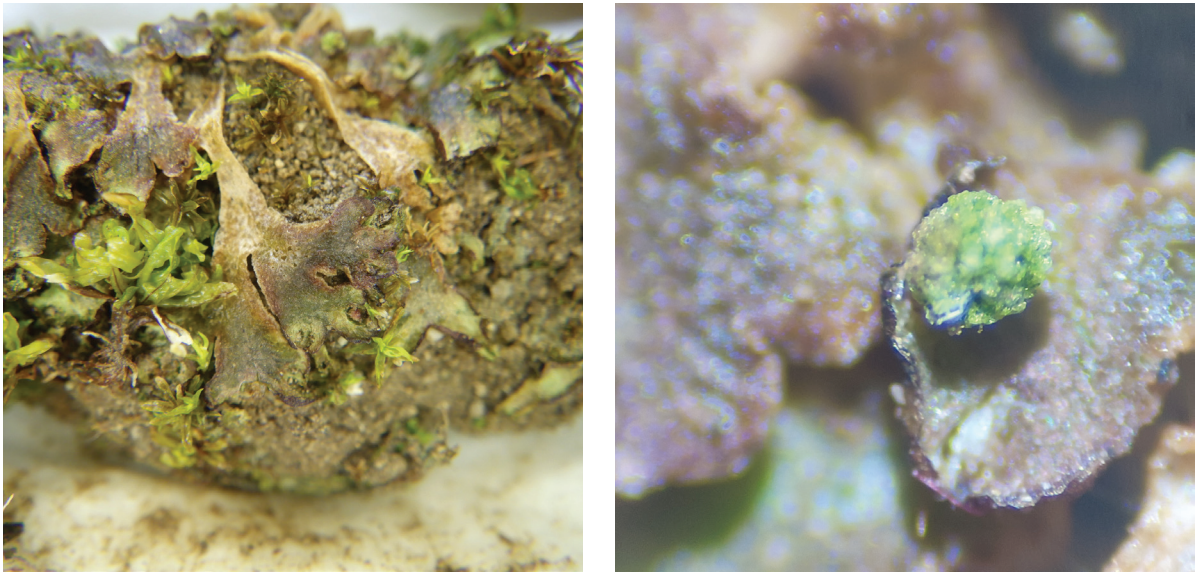


Figure 1. *Mannia triandra* specimen from canyon of River Kamačnik.

New localities

A newly found locality of *M. triandra* is in the canyon of the River Kamačnik, a significant landscape in the Gorski Kotar region, next to the town of Vrbovsko. The specimen (Fig. 1) was found on the 18th of April 2022, in shade on bare soil in the crevice of calcereous rock, approximately 1.5 meters above the walking path (45.3625N°, 15.06722E°). It was found solitary and surrounded by bare soil, exposed to the east at approximately 400 m a.s.l. It does not seem that this habitat is degraded or threatened by the human activity.

Interestingly, while writing this paper, we stumbled upon additional locality cited in doctoral thesis on taxonomy and phylogeny of the genus *Mannia* (Schill 2007). Schill used about 280 specimens of different *Mannia* species to study the spores with the scanning electron microscope. Two of those specimens of *Mannia triandra*, loaned to her by the Swedish Museum of Natural History (S), were from Croatia and both were collected in the city of Dubrovnik area (Tab. 1).

Table 1. Croatian localities of *Mannia triandra* from Schill 2007. (original text from the label and translation in square brackets)

		Locality	Date of collection	Collector
Dalmatien [Dalmatia]	Ragusa [Dubrovnik]	-	V 1911 [May of 1911]	Bäumler
Dalmatien [Dalmatia]	Ragusa [Dubrovnik]	an der Eisenbahn S.Stefano-Čajković, c. 40 m [on the railway from settlements Sustjepan to Čajković; cca. 40 m a.s.l.]	23 IV 1912 [23 of April 1912]	Latzel



Figure 2. *Mannia triandra* specimen in the forest above Sopotski Slap waterfall.

The historical railway stretching from Čapljina in Bosnia and Herzegovina (Bosnia and Herzegovina) to Zelinika in Montenegro, branched through Uskoplje in Bosnia and Herzegovina reaching port Gruž in the city of Dubrovnik area (Croatia). In this portion of the railway to Dubrovnik, on the southern margin of Dubrovačka Reka bay are settlements Sustjepan and Čajković. The coordinates of the locality are at approximated 42.67169°N, 18.10639°E in between those two settlements. In the year 1976, the last train left from Dubrovnik and the railway was dismantled in the following months. Whether or not these findings of *M. triandra* were published in literature is unknown to us, so these herbarium specimens (presumably still held at S) represent important information on the distribution of *Mannia triandra* in Croatia, as we never knew it was recorded around Dubrovnik.

Confirmed localities

Another specimen of *M. triandra* (Fig. 2) was found on the 24th of April 2022 during a fieldwork which was targeting this species as a part of monitoring of

rare species in the EC Habitat Directives. Sopotski Slap waterfall was visited in order to confirm the previously known locality (Alegro et al. 2015), however, it was not confirmed. However, following a trail ascending from the waterfall and taking the trail upstream, within 150 meters, a new locality was found (45.76492°N, 15.39602°E), beneath the last years fallen leaves, on hummus between roots of a beech (*Fagus sylvatica* L.) at the margins of a forest in the form of a small landslide once caused by trucks, that can be considered as a part of the same previously known population. Further listed species were found close by: *Encalypta streptocarpa* Hedw., *Reboulia hemisphaerica* (L.) Raddi, *Ctenidium molluscum* (Hedw.) Mitt., *Exsertotheca crispa* (Hedw.) S. Olsson, Enroth et D. Quandt, *Asplenium trichomanes* L., *Polystichum aculeatum* (L.) Roth, *Potentilla carniolica* A. Kern., *Erica herbacea* L., *Asplenium scolopendrium* L. and *Helleborus niger* L.

About 350 m areal distance from the previously known locality of *M. triandra* on the western bank of the Lake Galovac in Plitvice Lakes National Park, a new specimen (Fig. 3) was observed on



Figure 3. *Mannia triandra* specimen from Plitvice Lakes.

the 27th of May 2022 on the eastern bank of the same lake, next to a visitors' path along the lake bank on bare soil in a shady and moist microhabitat on the edge of thermophilous forest vegetation (44.87528°N, 15.60806°E), being the part of the previously known population (Alegro et al. 2019).

Similarly to the new locality in the canyon of River Kamačnik, these two confirmed localities also do not show any signs of degradation even though they are in close proximity to forest road and walking trail, respectively.

Mannia triandra is an annual species which reproduces with its large spores. Having no asexual reproductive structures, this means that its dispersal is somewhat limited and its ability to compete with other species decreased (Glime 2021). Being a specialist which prefers specific microhabitats makes it a rare species in Croatia, but based on the fact that two of the new localities are in relatively close proximity to the older ones, we can assume that it doesn't seem to have a problem with finding those adjacent microhabitats when reproducing. Given that it occurs ephemerally and seemingly develops new individuals in new microhabitats according to seasonal changes in environmental conditions, we can conclude that its populations

are stable in confirmed localities. Thus, in order to monitor the population, perhaps we should look for individuals in the preferred microhabitats nearby, rather than focus on precise, previously known locality. Further possible habitats for this species in Croatia should be investigated.

Sufficient information is lacking to make a sound, direct or indirect status assessment of its risk of extinction based on its distribution and population status in Croatia. This uncertainty makes Data Deficient the most appropriate category. More information through future research is required for appropriate assessment (IUCN Standards and Petitions Subcommittee 2017, Hallingbäck et al. 2009).

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References

- Alegro, A., Šegota, V., Papp, B. (2015): Contribution to the bryophyte flora of Croatia IV. Žumberačka gora Mt. *Studia botanica hungarica* 46(1): 1-20.
- Alegro, A., Šegota, V., Rimac, A., Kiebacher, T., Prlić, D., Sedlar, Z., Vuković, N., Papp, B. (2019): New and noteworthy bryophyte records from Croatia. *Cryptogamie, Bryologie* 40(2): 5-13.
- Anonymus (2016): Pravilnik o izmjenama i dopunama Pravilnika o strogo zaštićenim vrstama. Official Gazette of the Republic of Croatia „Narodne novine“ 73/16.
- Anonymus (1992): Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (eur-lex.europa.eu).
- Bischler, H., Jovet-Ast, S. (1973): Un mission hépatilologique d'automne sur la côte yougoslave. *Revue Cryptogamie, Bryologie et Lichénologie* 39: 554-629.
- Dragičević, S., Berg, C. (2022): Contribution to the knowledge of *Mannia triandra* (Aytoniaceae, Marchantiophyta) in Montenegro: In: Alegro, A., Rimac, A. (eds.): Book of Abstracts of the 10th Conference of European Committee for Conservation of Bryophytes, Croatian Botanical Society, Zagreb: 19.
- Frey, W., Frahm, J.-P., Fischer, E., Lobin, W. (2006): The liverworts, Mosses and ferns of Europe. Apollo Books, Colchester.
- Glime, J. M. (2021): Aquatic and Wet Marchantiophyta, Class Marchantiopsida: Aytoniaceae. Chapt. 1-19. In: Glime, J. M. (ed.): *Bryophyte Ecology. Volume 4. Habitat and Role*. Michigan Technological University & International Association of Bryologists (e-book).
- Hachtel, M., Ludwig, G., Weddeling, K. (2003): *Mannia triandra* (Scop.) Grolle. In: Petersen, B., Ellwanger, G., Biewald, G., Hauke, U., Ludwig, G., Pretscher, P., Schröder, E. & Ssymank, A. (eds.): Das europäische Schutzgebietssystem Natura 2000. Ökologie und Verbreitung von Arten der FFH-Richtlinie in Deutschland. Band 1: Pflanzen und Wirbellose. Schriftenreihe für Landschaftspflege und Naturschutz 69/1: 274-280.
- Hallingback, T., Hodgetts, N., Urmi, E. (1996): How to use the new IUCN Red List categories on bryophytes. Guidelines proposed by the IUCN SSC Bryophyte Specialist Group. *Anales del Instituto de biología de la Universidad nacional autónoma de México. Serie Botánica* 67(1): 147-157.
- Hodgetts, N. G., Lockhart, N. (2020): Checklist and country status of European bryophytes - update 2020. Irish Wildlife Manuals, No. 123. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland.
- Hodgetts, N., Cáliz M., Englefield, E., Fettes, N., García Criado, M., Patin, L., Nieto, A., Bergamini, A., Bisang, I., Baisheva, E., Campisi, P., Cogoni, A., Hallingbäck, T., Konstantinova, N., Lockhart, N., Sabovljević, M., Schnyder, N., Schröck, C., Sérgio, C., Sim Sim, M., Vrba, J., Ferreira, C. C., Afonina, O., Blockeel, T., Blom, H., Caspari, S., Gabriel, R., Garcia, C., Garilleti, R., González Mancebo, J., Goldberg, I., Hedenäs, L., Holyoak, D., Hugonnot, V., Huttunen, S., Ignatov, M., Ignatova, E., Infante, M., Juutinen, R., Kiebacher, T., Köckinger, H., Kučera, J., Lönnell, N., Lüth, M., Martins, A., Maslovsky, O., Papp, B., Porley, R., Rothero, G., Söderström, L., Ștefănuț, S., Syrjänen, K., Untereiner, A., Váňa, J., Vanderpoorten, A., Vellak, K., Aleffi, M., Bates, J., Bell, N., Brugués, M., Cronberg, N., Denyer, J., Duckett, J., During, H. J., Enroth, J., Fedosov, V., Flatberg, K.-I., Ganeva, A., Gorski, P., Gunnarsson, U., Hassel, K., Hespanhol, H., Hill, M., Hodd, R., Hylander, K., Ingerpuu, N., Laaka-Lindberg, S., Lara, F., Mazimpaka, V., Mežaka, A., Müller, F., Orgaz, J. D., Patiño, J., Pilkington, S., Puche, F., Ros, R. M., Rumsey, F., Segarra-Moragues, J. G., Seneca, A., Stebel, A., Virtanen, R., Weibull, H., Wilbraham, J., Żarnowiec, J. (2019): A miniature world in decline: European Red List of Mosses, Liverworts and Hornworts. IUCN, Brussels.

- IUCN Standards and Petitions Subcommittee (2017): Guidelines for Using the IUCN Red List Categories and Criteria. Version 13. Prepared by the Standards and Petitions Subcommittee. (iucnredlist.org/documents/RedListGuidelines.pdf)
- Matouschek, F. (1905): Additamenta ad Floram bryologicam Istriae et Dalmatiae. Magyar botanikai lapok 4(1): 24-27.
- Nemeth, Cs., Papp B. (2011): *Mannia triandra* in the Transdanubian Range (Hungary). Studia Botanica Hungarica 42: 23-29.
- Pantović, J., Veljić, M., Grdović, S., Sabovljević, M. (2020): An Annotated List of Hornwort and Liverwort Species of Serbia. Cryptogamie Bryologie 41. 25-38.
- Sabovljević, M., Cvetić, T., Stevanović, V. (2004): Bryophyte red list of Serbia and Montenegro. Biodiversity and conservation 13(9): 1781-1789.
- Schiffner, V. (1916): Hepaticae Baumgartnerianae dalmaticae. I Serie. Österreichische Botanische Zeitschrift 66(1-2): 1-21.
- Schill, D. B. (2007): Taxonomy and phylogeny of the liverwort genus *Mannia* (Aytoniaceae, Marchantiales). Doctoral thesis. University of Edinburgh.
- Strgulc Krajšek, S., Martinčič, A. (2017): The confirmed presence of *Mannia triandra* (Aytoniaceae) liverwort in Slovenia. Hladnikia 40: 18-25.
- Vicherová, E. (2022): Bryophyte conservation and monitoring in the Czech Republic. In: Alegro, A., Rimac, A. (eds.): Book of Abstracts of the 10th Conference of European Committee for Conservation of Bryophytes, Croatian Botanical Society, Zagreb: 12.