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Original Scientific Paper

European endemic *Ptychostomum minii* (Bryaceae, Bryophyta) - new to Turkey and its significant range extention to SW Asia

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ABSTRACT:
In this study, *Ptychostomum minii*, a European endemic species is recorded for the first time in Turkey and Southwest Asia. The species was found in the Bolkar Mountains in Turkey. Insights into recent discoveries, along with accompanying photographs, ecology, and location specifics in Turkey are presented.

Keywords:
Bolkar Mountains, Bryophytes, endemic, mosses, new record, Turkey.

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INTRODUCTION

The acrocarpous moss family Bryaceae has a wide distribution worldwide and is an important component among bryophytes (Spence 2020). However, the understanding of the evolutionary pattern of Bryaceae, one of the large families of mosses, has changed drastically in the last two decades as a result of molecular studies (Cox *et al.* 2000; Pedersen & Hedenäs 2003; Pedersen *et al.* 2003). In this context, it has become evident that the conventional genus classification rooted in morpho-taxonomy is insufficient, particularly within intricate families such as Bryaceae (Holyoak 2021).

According to the latest European checklist, Bryaceae is acknowledged as comprising six genera, namely *Anomobryum* Schimp., *Brachymenium* Schwägr., *Bryum* Hedw., *Imbribryum* Pedersen, *Ptychostomum* Hornsch. and *Rhodobryum* (Schimp.) Limpr., and the genera *Gemmabryum* J.R. Spence & H.P. Ramsay, *Osculatia* De Not., *Plagiobryoides* J.R. Spence, *Plagiobryum* Lindb. ex Sakurai and *Rosulabryum* J.R.Spence, are accepted as synonyms (Holyoak 2021). One of its members, the polyphyletic genus *Bryum sensu lato*, a taxonomically complex group of mosses, encompasses approximately 450 taxa worldwide and is further subdivided into several subgenera (Spence & Shevock 2012). More recently, the genus *Ptychostomum* emerged from *Bryum sensu lato*. Mostly distributed in the northern hemisphere, the members of the genus *Ptychostomum* grow in boreal-temperate, arctic and alpine environments. The genus was lectotyped by Spence (2005, 2020).

Ptychostomum minii (Podp. ex Guim.) D.Bell & Holyoak was initially documented in Portugal by Machado (1916) as *Bryum marginatum* Bruch & Schimp. and this name was validly published by Machado (1930). Later, the same materials described by Machado were studied by Podpěra under the new name *B. minii* var. *latifrons* (Podpěra 1954). However, Cezón *et al.* (2010) studied some of the original material used for the description and found that *B. minii* var. *latifrons* did not differ from the type variety and proposed the synonymisation of the names as a single taxon with the name *B. mini*. Original-

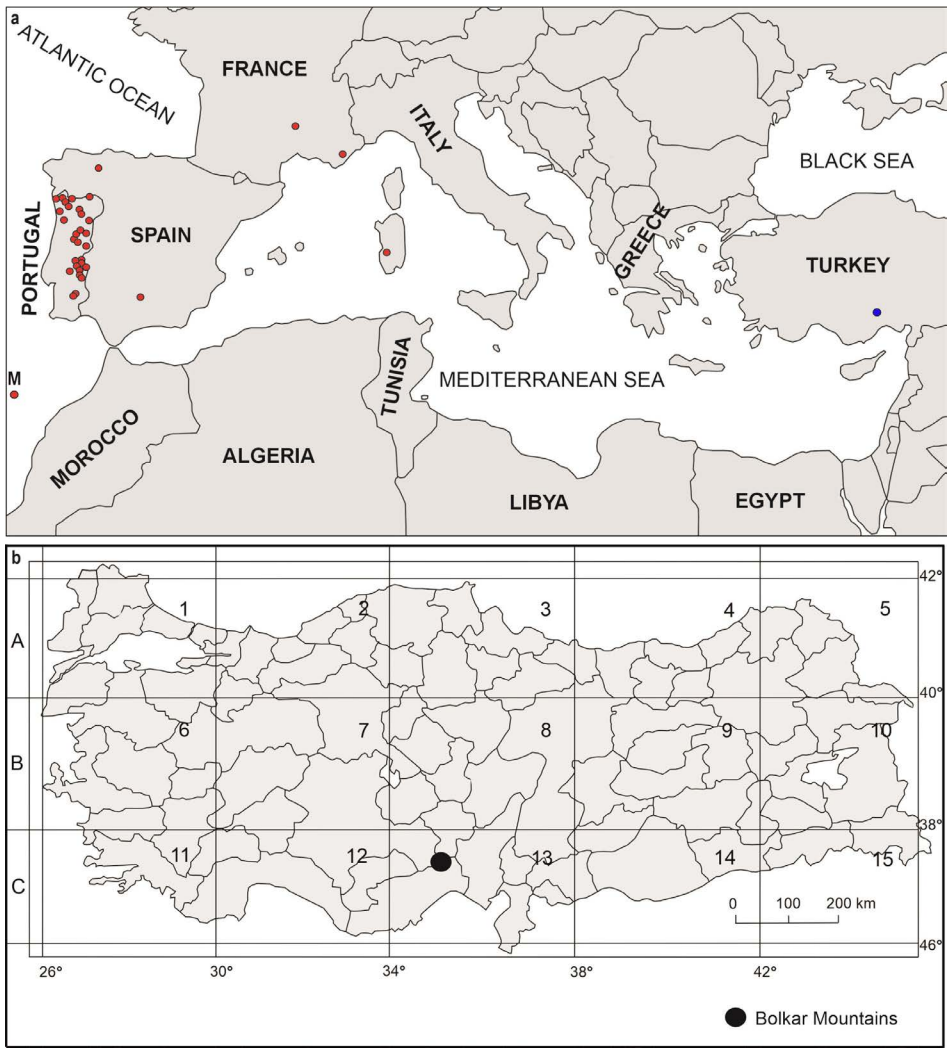

Fig 1. a. The general distribution of *Ptychostomum minii*; M. Madeira Island, the red dot corresponds to the European localities and the blue dot to the new locality in Turkey, b. Henderson (1961)'s grid system for Turkish bryophytes and the location of the Bolkar Mountains.

ly considered a rare species, *P. minii* was later recorded from several localities in Portugal, Madeira Island, and also from Italy (Sardinia), Spain and France (Skrzypczak 1998; Sérgio *et al*. 1999, 2013a; Cezón *et al*. 2010; Ros *et al*. 2013; Ellis *et al*. 2018, 2021; Holyoak 2021).

MATERIAL AND METHODS

Study area. The Bolkar Mountains, spanning an area of approximately 1290 km^2, constitute the eastern part of the Central Taurus Mountains and are located at the intersection of the Mediterranean and Irano-Turanian phytogeographic regions. Also, according to the grid system prepared by Henderson for Turkish bryophytes, it is located in the C13 grid-square (Henderson 1961) (Fig. 1).

The Bolkar Mountains, whose highest point is Medetsiz Hill at 3524 meters a.s.l., encompass a wide variety of natural habitats including both Mediterranean and steppe vascular flora elements. Some of these habitats comprise particularly mixed and pure forests of *Pinus brutia* Ten., *P. nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Quercus coccifera* L., *Abies cilicica* (Antoine & Kotschy) Carrière, *Juniperus excelsa* M.Bieb. and *Cedrus libani* A.Rich. in the southern parts, with steppes dominated by *Acantholimon ulicinum* Boiss., *Astragalus angustifolius* Lam., *A. plumosus* Willd. and *Onobrychis cornuta* (L.) Desv. in the northern parts, as well as many small glacial cirque lakes and small streams. Accordingly, the microhabitats in the alpine zone of the Bolkar Mountains also exhibit great diversity due to the specific humidity, temperature, and bedrock characteristics. In addition, the drying effects of intensive solar radiation and strong winds have played an important role in shaping the microhabitats of the Bolkar Mountains and the alpine vegetation, including bryophyte communities (Kürschner 1984; Atay *et al*. 2009).

From a lithological point of view, most of the Bolkar Mountains consist of permo-carboniferous limestones and are mostly covered with steppe and rock vegetation types (Ünaldi & Kömüşcü 2007). While the southern parts of the area, which fall into the Mediterranean phytogeographic region, are covered with maquis shrub-

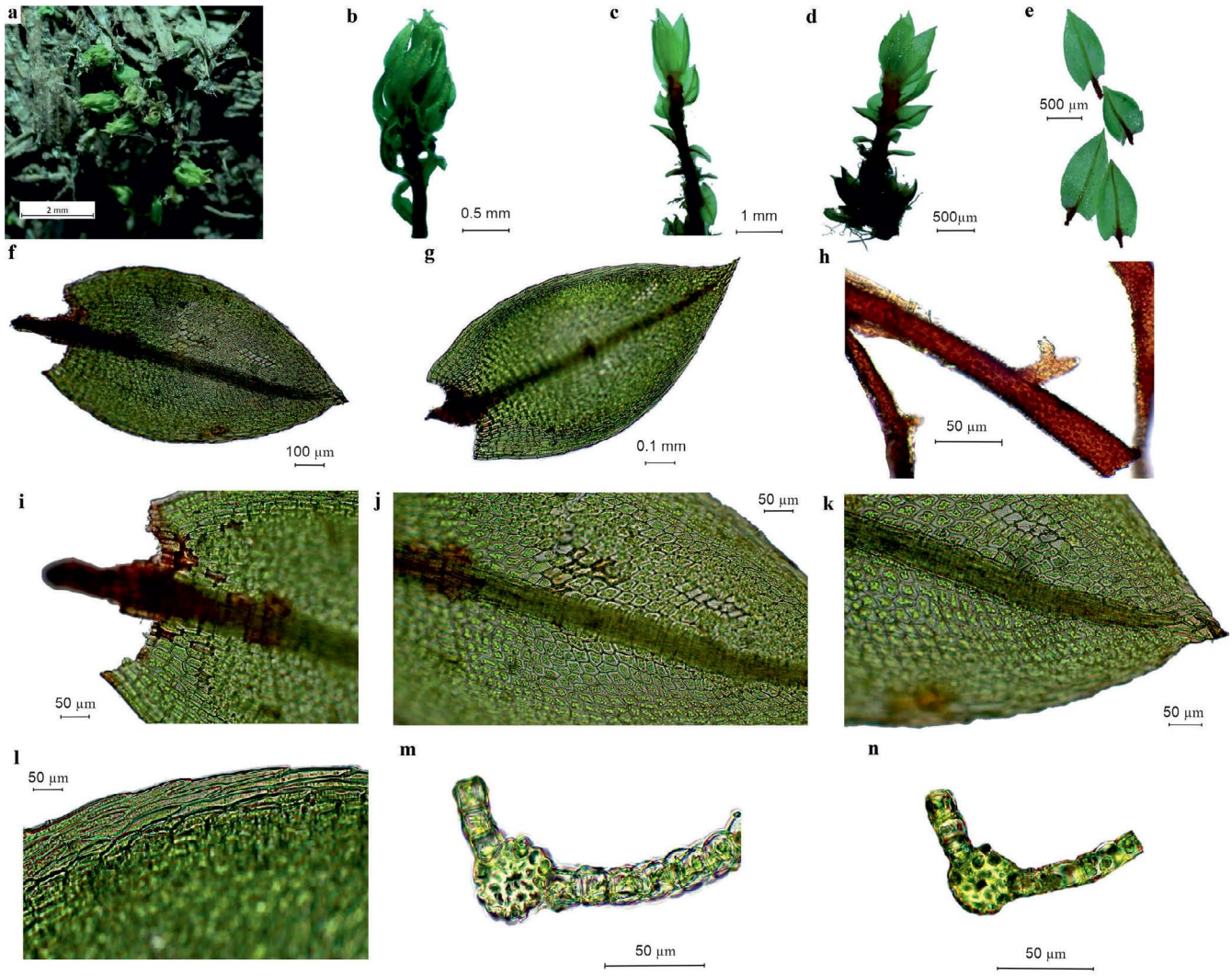

Fig. 2. The gametophytic characteristics of the Turkish material; *Ptychostomum minii* (Ezer 2480). a. Habitus, b. Dry plants with spirally twisted leaves, c-d. Hydrated plants, e-g. Leaves, h. Rhizoid, i. Basal leaf cells, j. Median leaf cells, k. Leaf apex, l. Leaf margin, m-n. Cross-sections of the leaves.

lands and coniferous forests, the northern parts, which fall into the Irano-Turanian phytogeographic region, are covered with steppe vegetation (Kürschner 1984).

Climatically, the southern parts of the Bolkar Mountains are under the influence of the typical Mediterranean climate with little rainfall, while the northern parts are influenced by the semi-arid-cold Mediterranean climate (Akman 2011).

Data source. The present study is based on specimens collected from the Bolkar Mountains on 25 July 2023. These specimens were collected from a single population in the same habitat and were identified using the relevant literature (Sérgio *et al.* 1999; Cezón *et al.* 2010; Guerra *et al.* 2010; Holyoak 2021). The voucher specimen is stored in the Herbarium of Niğde Ömer Halisdemir University (the herbarium does not yet have an international index herbariorum code).

RESULTS AND DISCUSSIONS

***Ptychostomum minii* (Podp. ex Guim.) D.Bell & Holyoak.** Journal of Bryology 42(1): 6. 2020. (28 May 2020) (J. Bryol.).

Basionym: *Bryum minii* Podp. ex Guim.. Revue Bryologique Lichénologique 8: 112–114. 1935.

Ind. loc.: "…Famalicao, près de Oporto (Portugal)… Parêdes do Coura (Minho) et à Vendas de Galizes (Beira), au Nord du Portugal." TYPE: "E. Bauer, Musci Europaei Exsiccati. n° 1634. *Bryum marginatum*… PORTUGAL: Famalicão, Rorigo… Dez. 1922 legit *A. Machado*" (lectotype, here designated, PO!; syntype: "Vendas de Galizes, Aug. 1916, *A. Machado*" PO 3469B!).

Specimen examined: Turkey: Niğde Province, Bolkar Mountains, Geyikdede Hill, Alagöl: N 37° 22' 51", E 34° 30' 40", growing on limestone wet soil near Lake Alagöl,

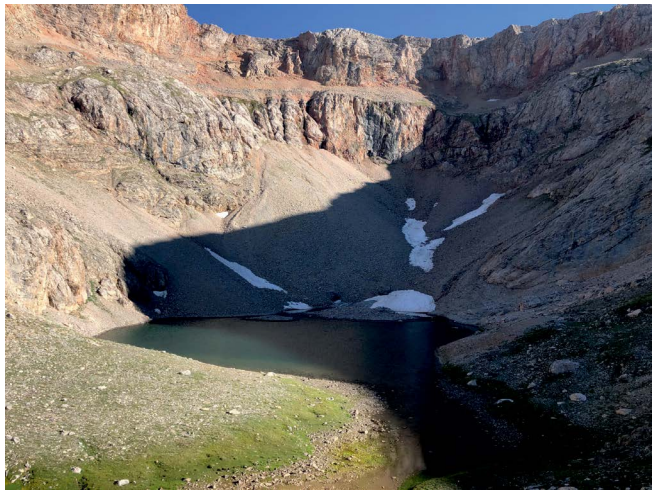

Fig. 3. The habitat of *Ptychostomum minii* in Turkey. Niğde Province, Bolkar Mountains, Geyikdede Hill, Alagöl, N 37° 22' 51", E 34° 30' 40", 2900 m a.s.l. (Photo T. Ezer)

2900 m a.s.l., 25 July 2023, *leg.* and *det.* T. Ezer, N. Batan *s.n.* Confirmation: C. Sérgio (Collector number: Ezer 2480, Herbarium number: NOHU4801).

Description of the Turkish specimen: Plants small, up to 7–10 mm, glossy, yellowish green upper and green to brown below. **Leaves** rosulate, spirally twisted when dry, lower leaves smaller than the upper leaves, oblong to oblong-ovate, 0.7–1.3 mm long and 0.5–0.9 mm wide, concave, shortly acuminate to slightly obtuse. Margins entire below and weakly denticulate above, with a border of linear cells 3–5 rows below and 1–3 rows above. **Costa** strong, wide at the leaf base, 50–100 µm, brown to reddish, ending below the apex. **Median leaf cells** hexagonal to rhomboidal, 35–60 × 8–15 µm, slightly thick-walled and slightly porose. **Basal leaf cells** rectangular or quadrate, 25–45 µm long, 14–20 µm wide, thick-walled. **Rhizoids** reddish-brown and papillose, without gemmae. Plants sterile, and sporophytes not seen in the Turkish material (Fig. 2).

Ecology and distribution in Turkey: The Turkish specimen was collected from the Bolkar Mountains, a tectonic mountain range located in the Eastern Mediterranean region and the Central Anatolian Plateau. *Ptychostomum minii* grows on limestone wet soils near Lake Alagöl, one of the cirque lakes in the alpine belt of the Bolkar Mountains (Fig. 3). The species grows with *Riccia glauca* L., *Marchantia quadrata* Scop., *Ptychostomum compactum* Hornsch., *P. pallecens* (Schleich. ex Schwägr.) J.R.Spence and *Bryum argenteum* Hedw.

In Europe, the species usually grows in open habitats between 250–1300 m a.s.l., in siliceous rock crevices and on the surface of stream banks (Cezón *et al.* 2010). In Turkey, the species was found on soil on limestone bedrock in the alpine zone of the Bolkar Mountains (2900 m a.s.l.). Due to the fact that the Bolkar Mountains are a tectonic mountain range, geologically, most of it consists of limestone bedrock, which is naturally alkaline and has a high pH level (Ünaldı & Kömüşcü 2007). The habitat characteristics of *P. minii* in the Bolkar Mountains indicates an expansion of our knowledge on the ecological characteristics of the species concurrent with the expansion of its geographical distribution on a global scale.

The species is endemic to Europe and has been recorded from several localities in NW Portugal, Madeira Island, Italy (Sardinia), Spain and France (Skrzypczak 1998; Sérgio *et al.* 1999, 2013a; Cezón *et al.* 2010; Ros *et al.* 2013; Ellis *et al.* 2018, 2021) (Fig. 1). This new record designates this species as subendemic to Europe.

Ptychostomum minii is categorised as Least Concern (LC) in the Portuguese Red Data Book and Vulnerable (VU) in Spain (Sérgio *et al.* 2013b; Brugués & González Mancebo 2014; Ellis *et al.* 2021). In Europe it is considered as Least Concern (LC) (Hodgetts *et al.* 2019; Sérgio *et al.* 2019).

The current paper marks a significant milestone by documenting the inaugural occurrence of *P. minii* in Turkey, thereby expanding its geographical distribution on a global scale. This novel finding also holds particular importance for the advancement of the Bryophyte Flora of Turkey.

Furthermore, the genus *Ptychostomum* Hornsch., formerly recognised as comprising 19 taxa within Turkey, as reported in previous studies (Kürschner & Frey 2020; Ellis *et al.* 2021; Erata *et al.* 2023), has now been enriched to encompass 20 taxa with the inclusion of this newly discovered species. This addition further contributes to our understanding of the diversity and taxonomy of the genus within the Turkish territory.

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REZIME

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Evropski endemit *Ptychostomum minii* (Bryaceae, Bryophyta) – nov za Tursku i njegovo značajno širenje areala ka JZ Aziji

Tülay Ezer, Ahmet Uygur, Ali Keskin, Harun Çulha, Nevzat Batan i Mevlüt Alataş

U ovoj studiji, *Ptychostomum minii*, evropska endemična vrsta zabeležena je prvi put u Turskoj i JZ Aziji. Vrsta je pronađena na Bolkar planini u Turskoj. Dat je uvid u skorašnja otkrića, zajedno sa pratećim fotografijama, ekologijom i specifičnostima lokaliteta u Turskoj.

Ključne reči: Bolkar planina, briofite, endemit, mahovine, novi nalaz, Turska.