

## Study of leafy moss diversity of Samur-Yalama National Park: new species for Azerbaijan brioflora

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**Abstract:** Samur-Yalama National Park in Azerbaijan is a region of biodiversity characterized by forests rich in various species of flora, including bryophytes. This article studies the diversity of leafy mosses common in the study area. More than 100 collected herbarium materials along different route lines were identified using hand magnifiers, Motic Digital Microscope and identification key. Of the collected species, *Bryum algovicum* Sendtn. ex Müll. Hal. were identified as new species for Azerbaijan. In addition, the species *Bryum pallens* Sw., *Brachythecium mildeanum* (Schimp.) Schimp., *Plagiothecium laetum* Schimp. and *Taxiphyllum wissgrillii* (Garov.) Wijk et Marg. were identified for the first time for Samur-Davachi lowland botanical-geographic region. In addition, it was determined that 70 species were included IUCN Red List as Least Threatened (LC) category. Three species - *Palamocladium euchloron* (Bruch ex Muell. Hal.) was included as Endangered (EN), *Dicranum muehlenbeckii* Bruch & Schimp as Vulnerable (VU) and *Leucodon pendulus* Lindb. as Not Evaluated (NE) category.

**Keywords:** moss diversity, new record, protected area, rare, red list

### INTRODUCTION

Forests are complex ecosystems that harbour a wide range of plant species, including bryophytes, which play crucial roles in ecosystem processes [Crouzeilles et al., 2017; Glime, 2024; Pakeman et al., 2019; Rehm, 2019]. Among epiphytic plants in temperate climates mosses are small, non-vascular plants that often overlooked but essential components of forest ecosystem [Bates et al., 2004; Ezer et al., 2022; Zotz, Bader, 2009]. Within forest plant communities, trees are fundamental elements, with epiphytic bryophytes heavily reliant

on them as substrates, significantly contributing to forest species diversity [Ellison et al., 2005].

They promote nutrient cycling by absorbing and holding water and nutrients, which are then released back into the soil as they decompose. Bryophytes also provide habitat and food for a variety of small animals and insects, making them important components of forest food webs. In addition to their ecological significance, bryophytes also have cultural and medicinal importance [Mammadova, Abiyev, 2023; Weiskopf et al., 2020]. Their susceptibility to variations in air humidity, water availability, and drought frequencies due to physiological dependencies makes them particularly vulnerable to climate change [Wierzcholska et al., 2020].

Biodiversity indicators play a pivotal role in informing policy decisions and conveying ecosystem health to the public. The Caucasian ecoregion rich in biodiversity, harboring species distribution of which in ecosystems remains largely undiscovered. Based on the updated checklist of the mosses distributed in Azerbaijan comprises 504 taxa across 57 families and 152 genera [Mammadova, 2022]. The Samur-Davachi lowland, an ecologically diverse area influenced by both Caspian Sea and Caucasus mountain. Despite the protected status, information about the species diversity of mosses in this region remains scarce, so the study of species diversity and ecological and biological characteristics of mosses as integral components of plant formations becomes relevant.

This paper focuses on the diversity of bryophytes within the Samur-Davachi lowland based on collected samples, with new findings for Azerbaijan and the study area, including their role in the ecosystem. Through field research and a comprehensive review of existing literature, the paper sheds light on the importance of bryophytes in maintaining biodiversity and ecosystem health in forested areas.

### MATERIAL AND METHODS

*Study area.* SYNPA in Azerbaijan is one such area that boasts a rich diversity of bryophytes. Located in the northeastern part of the country, near the border with

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Russia, the park encompasses a variety of ecosystems, including temperate deciduous forests, mixed forests, and wetlands [Abiyev et al., 2020a]. These diverse habitats provide ideal conditions for a wide range of bryophyte species to thrive. The climate of the SYN region has dry, warm summers and mild winters. The area is characterized by a temperate-warm climate of the semi-deserts and dry steppes and influence of weak continental climate. The average annual temperature is between 12.0-12.2°C. The max. monthly temperature was 25-35°C. The min. average monthly temperature was 1.0-1.2°C. The absolute max. temperature was 42°C, the absolute min. temperature was -19°C. Often from the second decade of May till the end of October the characteristic temperature ranges 17-22°C. The average annual precipitation in the area is low (300-400 mm) [Abiyev et al., 2020b].

The dominant tree species in the forests are the following: pedunculated oak (*Quercus robur* subsp. *pedunculiflora* (K. Koch) Menitsky), common hornbeam (*Carpinus betulus* L.) and hybrid poplar (*Populus hybrida* M. Bieb.). In addition to these tree species, which form characteristic local forest stands, ordinary ash

(*Fraxinus excelsior* L.), common alder (*Alnus glutinosa* subsp. *barbata* (C.A. Mey.) Yalt.) and field maple (*Acer campestre* L.) are also common, and in some areas of the forest these mixed tree species predominate.

More than 100 specimens were collected by route and stationary methods. Collected specimens were determined using hand magnifiers, Motic Digital Mikroskop and identification key [Ignatov, Ignatova, 2003], according to the systems of F.V. Brotherus, L.E. Anderson and M.I. Ignatov. Specimens were placed to Herbarium collection of the Institute of Botany (BAK). Names of species were checked against the database of Tropicos. In addition, literature data and herbarium fund data were checked.

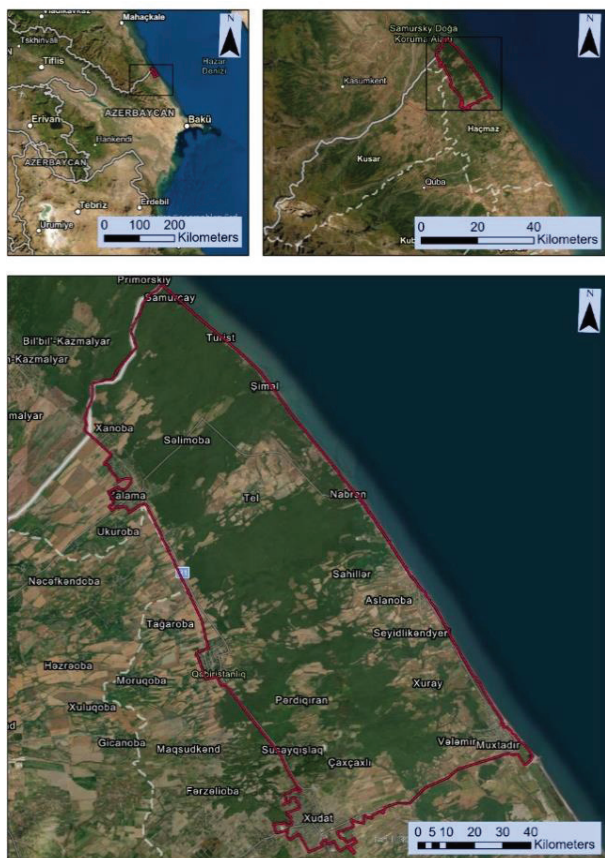
## RESULTS

Identified specimens were resulted in 36 species (2 variations) belonging to 23 genera and 17 families. One species represents first record for Azerbaijan bryoflora. Four species were recorded for the first time in the studied botanical-geographical region. From the ecological point of view, these species were classified as hygromesophytes with 2 species, hygrophytes with 4 species, xeromesophytes with 9 species, xerophytes with 12 species, mesohygrophytes with 8 species, mesoxerophytes with 29 species and mesophytes with 50 species. 73 species are listed in the IUCN Red List. *Palamocladium euchloron* (Bruch ex Muell. Hal.) evaluated as Endangered (B2ab(iii);D); *Dicranum muehlenbeckii* Bruch & Schimp as VU C2a(i); *Leucodon pendulus* Lindb. as Not Assessed; and the remaining 70 species as of Least Concern (Table 1).

The genus *Bryum* Hedw. is known for its robust and densely tufted growth habit. There are 24 species of *Bryum* in Azerbaijan, three of which are distributed in the SYN. In this study two species of the genus – *Bryum algovicum* Sendtn. ex Müll. Hal. and *B. pallens* Sw. were identified of which *B. algovicum* represents a new record for Azerbaijan (Fig. 2a, b, c).

### *Bryum algovicum*

Species is a small moss characterized by its distinctive morphology: typically, 1-3 cm tall, with erect stems that bear spirally arranged leaves 0.9-2.4 mm long, which are ovate-lanceolate in shape, gradually tapering to a swollen, acute tip, with margins folded. The leaf cells are smooth and rectangular, with thick walls and a well-developed midrib. One of the key distinguishing features of this species is the presence of gemmae, which are small, multicellular bodies that are produced asexually and can give rise to new plants.



**Figure 1.** Sampling area in Samur-Yalama National Park.

**Table 1.** Species of Bryophytes collected from Samur-Yalama National Park.

Family	Scientific name	This study	IUCN	Eco-group
1	2	3	4	5
<i>Thuidiaceae</i> Schimp.	<i>Abietinella abietina</i> (Hedw.) Fleisch.	-	LC	Xeromesophyte
<i>Amblystegiaceae</i> Kindb.	<i>Amblystegium jurarzkanum</i> Schimp.	+	-	Mesophyte
<i>Amblystegiaceae</i> Kindb.	<i>Amblystegium serpens</i> (Hedw.) Schimp.	-	LC	Mesophyte
<i>Andreaeaceae</i> Dumort	<i>Andreaea rupestris</i> Hedw.	+	LC	Xerophyte
<i>Thuidiaceae</i> Schimp.	<i>Anomodon longifolius</i> (Schleich.ex Brid.)	+	-	Mesophyte
<i>Thuidiaceae</i> Schimp.	<i>Anomodon rugelii</i> (Muell. Hal.) Keissl.	-	-	Mesophyte
<i>Thuidiaceae</i> Schimp.	<i>Anomodon viticulosus</i> (Hedw.) Hook.et Tayl.	+	LC	Mesoxerophyte
<i>Pottiales</i> M.Fleisch.	<i>Barbula acuta</i> (Brid.) Brid.	-	-	Xerophyte
<i>Pottiales</i> M.Fleisch.	<i>Barbula muralis</i> (Hedw.) F.Weber.	-	-	Xerophyte
<i>Pottiales</i> M.Fleisch.	<i>Barbula muralis</i> (Hedw.) F.Weber. var. <i>aestiva</i> (Brid.ex Hedw.) Röhl.	-	-	Xerophyte
<i>Pottiales</i> M.Fleisch.	<i>Barbula reflexa</i> (Brid.) Brid.	-	-	Mesoxerophyte
<i>Pottiales</i> M.Fleisch.	<i>Barbula sinuosa</i> (Mitt.) Grav.	+	-	Xeromesophyte
<i>Pottiales</i> M.Fleisch.	<i>Barbula unguiculata</i> Hedw.	-	LC	Mesoxerophyte
<i>Bartramiaceae</i> Schwaegr.	<i>Bartramia halleriana</i> Hedw.	-	LC	Mesophyte
<i>Bartramiaceae</i> Schwaegr.	<i>Bartramia pomiformis</i> Hedw.	-	LC	Mesophyte
<i>Brachytheciaceae</i> Schimp.	<i>Brachytheciastrum velutinum</i> (Hedw.) Ignatov & Huttunen	-	LC	Mesophyte
<i>Brachytheciaceae</i> Schimp.	<i>Brachythecium albicans</i> (Hedw.) Schimp.	-	LC	Mesoxerophyte
<i>Brachytheciaceae</i> Schimp.	<i>Brachythecium campestre</i> (Muell.Hal.) Schimp.	-	LC	Mesoxerophyte
<i>Brachytheciaceae</i> Schimp.	<i>Brachythecium glareosum</i> (Bruch ex Spruce) Schimp.	-	LC	Mesophyte
<i>Brachytheciaceae</i> Schimp.	<i>Brachythecium mildeanum</i> (Schimp.) Schimp.	+	-	Mesohygrophyte
<i>Brachytheciaceae</i> Schimp.	<i>Brachythecium rivulare</i> Schimp.	+	LC	Mesohygrophyte
<i>Brachytheciaceae</i> Schimp.	<i>Brachythecium salebrosum</i> (Hoffm.ex Web.&Mohr) Schimp.	+	LC	Mesophyte
<i>Bryaceae</i> Rchb.	<i>Bryum algovicum</i> Schimp.	+	-	Xerophyte
<i>Bryaceae</i> Rchb.	<i>Bryum pallens</i> Sw. ex Anon.	+	-	Mesohygrophyte
<i>Bryaceae</i> Rchb.	<i>Bryum schleicheri</i> Schwaegr.	-	-	Hygrophyte
<i>Bryaceae</i> Rchb.	<i>Bryum torquescens</i> Bruch & Schimp.	+	-	Mesoxerophyte
<i>Bryaceae</i> Rchb.	<i>Bryum turbinatum</i> (Hedw.) Turn.	+	-	Mesohygrophyte
<i>Hypnaceae</i> Schimp.	<i>Calliergonella cuspidata</i> (Hedw.) Loeske.	-	LC	Hygrophyte
<i>Amblystegiaceae</i> Kindb.	<i>Campylium stellatum</i> (Hedw.) C.Jens.	+	LC	Mesohygrophyte
<i>Ditrichaceae</i> Limpr.	<i>Ceradotum purpurens</i> (Hedw.)Brid.	-	LC	Xeromesophyte
<i>Brachytheciaceae</i> Schimp.	<i>Cirriphyllum reichenbachianum</i> Broth.	-	-	Mesophyte
<i>Climaciaceae</i> Kindb.	<i>Climacium japonicum</i> Lindb.	+	-	Mesophyte
<i>Hylocomiaceae</i> Fleisch.	<i>Ctenidium molluscum</i> (Hedw.) Mitt.	-	-	Xeromesophyte
<i>Hylocomiaceae</i> Fleisch.	<i>Ctenidium molluscum</i> (Hedw.) Mitt.	-	-	Mesoxerophyte

1	2	3	4	5
<i>Dicranaceae</i> Schimp	<i>Dicranoweisia cirrata</i> (Hedw.) Lindb.ex Milde	-	-	Mesophyte
<i>Dicranaceae</i> Schimp	<i>Dicranoweisia crispula</i> (Hedw.) Milde	-	-	Mesophyte
<i>Dicranaceae</i> Schimp	<i>Dicranum bonjeanii</i> De Not.	-	LC	Mesophyte
<i>Dicranaceae</i> Schimp	<i>Dicranum fuscencens</i> Turn.	-	LC	Mesophyte
<i>Dicranaceae</i> Schimp	<i>Dicranum majus</i> Turn.	-	LC	Mesophyte
<i>Dicranaceae</i> Schimp	<i>Dicranum muehlenbeckii</i> Bruch & Schimp	-	VU C2a(i)	Mesophyte
<i>Dicranaceae</i> Schimp	<i>Dicranum polysetum</i> Sw.	-	LC	Mesoxerophyte
<i>Dicranaceae</i> Schimp	<i>Dicranum scoparium</i> Hedw.	-	LC	Mesophyte
<i>Dicranaceae</i> Schimp	<i>Dicranum spadiceum</i> Zett.	-	LC	Mesophyte
<i>Pottiales</i> M.Fleisch.	<i>Didymodon fallax</i> (Hedw.) Zander.	-	LC	Xeromesophyte
<i>Pottiales</i> M.Fleisch.	<i>Didymodon vinealis</i> (Brid.) Zander.	-	LC	Xerophyte
<i>Ditrichaceae</i> Limpr.	<i>Distichium capillaceum</i> (Hedw.)Bruch.	-	LC	Xeromesophyte
<i>Amblystegiaceae</i> Kindb.	<i>Drepanocladus aduncus</i> (Hedw.) Warnst.	-	LC	Hygrophyte
<i>Amblystegiaceae</i> Kindb.	<i>Drepanocladus uncinatus</i> (Hedw.) Warnst.	+	-	Mesophyte
<i>Encalyptaceae</i> Schimp	<i>Encalypta procera</i> Bruch	-	LC	Mesophyte
<i>Entodontaceae</i> Kindb.	<i>Entodon concinnus</i> (De Not) Par.	-	LC	Mesoxerophyte
<i>Brachytheciaceae</i> Schimp.	<i>Eurhynchium hians</i> (Hedw.) Sande Lac.	+	-	Mesohygrophyte
<i>Brachytheciaceae</i> Schimp.	<i>Eurhynchium hians</i> (Hedw.) Sande Lac. var <i>atrovirens</i> (Swartz.) Moenk.	-	-	Mesohygrophyte
<i>Brachytheciaceae</i> Schimp.	<i>Eurhynchium pulchellum</i> (Hedw.) Jenn.	-	LC	Mesophyte
<i>Brachytheciaceae</i> Schimp.	<i>Eurhynchium striatum</i> (Schreb.ex Hedw.) Schimp.	-	LC	Mesophyte
<i>Fissidentaceae</i> Schimp.	<i>Fissidens bryoides</i> Hedw.	-	LC	Mesophyte
<i>Fissidentaceae</i> Schimp.	<i>Fissidens crassipes</i> Wils.ex Bruch & Schimp.	+	LC	Mesophyte
<i>Fissidentaceae</i> Schimp.	<i>Fissidens viridulus</i> (Sw.) Wahlenb	-	LC	Mesophyte
<i>Funariaceae</i> Schwaegr	<i>Funaria hygrometrica</i> Hedw.	+	-	Mesophyte
<i>Grimmiaceae</i> Arnott.	<i>Grimmia elatior</i> Bruch ex Bals.	-	LC	Xerophyte
<i>Grimmiaceae</i> Arnott.	<i>Grimmia ovalis</i> (Hedw.) Lindb.	-	LC	Xerophyte
<i>Grimmiaceae</i> Arnott.	<i>Grimmia pulvinata</i> (Hedw.) Sm.	-	LC	Xerophyte
<i>Hedwigiaceae</i> Schimp.	<i>Hedwigia ciliata</i> Hedw. P. Beauv.	-	LC	Xerophyte
<i>Brachytheciaceae</i> Schimp.	<i>Homalothecium lutescens</i> (Hedw.) Robins.	+	LC	Xeromesophyte
<i>Brachytheciaceae</i> Schimp.	<i>Homalothecium philippeanum</i> (Spruce) Schimp.	+	LC	Mesophyte
<i>Brachytheciaceae</i> Schimp.	<i>Homalothecium sericeum</i> (Hedw.) Schimp.	+	LC	Mesophyte
<i>Hypnaceae</i> Schimp.	<i>Homomallium incurvatum</i> (Schrad. Ex. Brid.)	-	LC	Mesoxerophyte
<i>Amblystegiaceae</i> Kindb.	<i>Hygroamblystegium varium</i> (Hedw.) Moenk	-	LC	Mesophyte
<i>Hypnaceae</i> Schimp.	<i>Hypnum cupressiforme</i> Hedw.	+	LC	Mesoxerophyte
<i>Hypnaceae</i> Schimp.	<i>Hypnum cupressiforme</i> Hedw. var <i>lacukossum</i>	+	-	Mesoxerophyte
<i>Hypnaceae</i> Schimp.	<i>Hypnum cupressiforme</i> Hedw. var <i>mammillatum</i> Brid.	+	-	Mesophyte

1	2	3	4	5
<i>Hypnaceae</i> Schimp.	<i>Hypnum revolutum</i> (Mitt.) Lindb.	-	-	Mesoxerophyte
<i>Dicranaceae</i> Schimp	<i>Kiaeria falcata</i> (Hedw.) Hag.	-	-	Hygromesophyte
<i>Dicranaceae</i> Schimp	<i>Kiaeria starkei</i> (Web.et Mohr) I.Hag.	-	-	Xerophyte
<i>Amblystegiaceae</i> Kindb.	<i>Leptodictyum riparium</i> (Hedw.) Warnst.	+	LC	Mesohygrophyte
<i>Leucodontaceae</i> Schimp.	<i>Leucodon immersus</i> Lindb.	+	-	Mesoxerophyte
<i>Leucodontaceae</i> Schimp.	<i>Leucodon pendulus</i> Lindb.	-	NA	Mesoxerophyte
<i>Leucodontaceae</i> Schimp.	<i>Leucodon sciuroides</i> (Hedw.) Schwaegr.	+	LC	Mesoxerophyte
<i>Mniaceae</i> Schwaegr.	<i>Mnium spinosum</i> (Voit.) Schwaegr.	-	LC	Mesophyte
<i>Mniaceae</i> Schwaegr.	<i>Mnium stellari</i> Hedw.	-	LC	Mesophyte
<i>Neckeraceae</i> Schimp.	<i>Neckera besseri</i> (Lob.) Jur.	+	-	Mesoxerophyte
<i>Neckeraceae</i> Schimp.	<i>Neckera complanata</i> (Hedw.) Hueb.	+	-	Mesoxerophyte
<i>Dicranaceae</i> Schimp	<i>Oncophorus virens</i> (Hedw.) Brid.	-	-	Hygromesophyte
<i>Orthotrichaceae</i> Arn.	<i>Orthotrichum affine</i> Brid.	-	-	Mesophyte
<i>Orthotrichaceae</i> Arn.	<i>Orthotrichum anomalum</i> Hedw.	-	LC	Xerophyte
<i>Orthotrichaceae</i> Arn.	<i>Orthotrichum speciosum</i> Nees.	-	-	Mesoxerophyte
<i>Orthotrichaceae</i> Arn.	<i>Orthotrichum stramineum</i> Hornsch.ex Brid.	-	LC EN	Mesophyte
<i>Brachytheciaceae</i> Schimp.	<i>Palamocladium euchloron</i> (Bruch ex Muell. Hal.)	+	(B2ab(ii i); D), CR D	Mesoxerophyte
<i>Dicranaceae</i> Schimp	<i>Paraleucobryum enerve</i> (Thed.) Loeske.	-	LC	Xerophyte
<i>Dicranaceae</i> Schimp	<i>Paraleucobryum longifolium</i> (Hedw.) Loeske.	-	LC	Mesophyte
<i>Bartramiaceae</i> Schwaegr.	<i>Philonotis fontana</i> Hedw.	-	LC	Hygrophyte
<i>Mniaceae</i> Schwaegr.	<i>Plagiomnium cuspidatum</i> (Hedw.) T.Kop.	-	LC	Mesophyte
<i>Mniaceae</i> Schwaegr.	<i>Plagiomnium undulatum</i> (Hedw.) T.Kop.	-	LC	Mesophyte
<i>Plagiotheciaceae</i>	<i>Plagiothecium lateum</i> Schimp.	+	LC	Mesophyte
<i>Entodontaceae</i> Kindb.	<i>Platygyrium repens</i> (Brid.) Schimp.	+	-	Mesophyte
<i>Ditrichaceae</i> Limpr.	<i>Pleuridium subulatum</i> (Hedw.) Rabenh.	-	LC	Xeromesophyte
<i>Pottiales</i> M.Fleisch.	<i>Pleurochaete squarrosa</i> (Brid.) Lindb.	-	-	Mesoxerophyte
<i>Polytrichaceae</i> Schwaegr	<i>Polytrichum juniperinum</i> Hedw.	-	LC	Mesoxerophyte
<i>Neckeraceae</i> Schimp.	<i>Pseudanomodon attenuatus</i> (Hedw.) Ignatov & Fedosov	-	-	Mesoxerophyte
<i>Pterigynandraceae</i> Schimp.	<i>Pterigynandrum filiforme</i> Hedw.	-	LC	Mesophyte
<i>Hypnaceae</i> Schimp.	<i>Pylasia polyantha</i> (Hedw.) Schimp.	+	LC	Mesophyte
<i>Grimmiaceae</i> Arnott.	<i>Racomitrium canescens</i> Brid.	-	LC	Xerophyte
<i>Mniaceae</i> Schwaegr.	<i>Rhizomnium punctatum</i> (Hedw.) T.Kop.	-	LC	Mesophyte
<i>Grimmiaceae</i> Arnott.	<i>Schistidium apocarpum</i> (Hedw.) Bruch & Schimp.	+	LC	Xerophyte
<i>Grimmiaceae</i> Arnott.	<i>Schistidium strictum</i> (Turner) Loeske ex Martensson.	-	LC	Mesoxerophyte
<i>Brachytheciaceae</i> Schimp.	<i>Sciuro-hypnum populeum</i> (Hedw.) Ignatov & Huttunen	-	LC	Mesophyte

These gemmae are found in the leaf axils and are an important means of reproduction for this species. The capsule is reddish-brown, 2.5 mm long, elliptical, with a 2 cm long seta.

This species is identified by its pear-shaped capsule and outer peristome with vertical or slanting lines connecting horizontal joints. The spore size varies from 28 to 34  $\mu\text{m}$ . *B. algovicum* is distinguished from its similar species *B. uliginosum* based on the color of its basal laminal cells [Kürschner and Frey, 2011, [Shirzadian et al., 2014]. The moss species is yellow-green to brownish-green in color, densely branched, and possess 0.5 cm tall, orange-brown to reddish-brown rhizoids, and 2-4 subapical branches.

Moist, shady habitats, damp soil or rocks near streams or rivers are typical habitats for the species. It is commonly associated with forested areas, where it can form dense mats or tufts on the forest floor. The presence of *B. algovicum* is indicative of a healthy ecosystem, as it plays a role in nutrient cycling and provides habitat for a variety of microorganisms and invertebrates. It has been documented in Afghanistan, Turkey, Iran, Russia (Dagestan), Georgia (Osetia), Syria and other countries [Ignatov et al., 2010; Kürschner and Frey 2011; Shirzadian et al, 2014; Doroshina, 2015], where it thrives on sand dunes and rock crevices.

*Specimen examined:* Azerbaijan, Khachmaz district, Khuray village, Samur-Yalama National Park, sand-rock. 41.682228° 48.744249°, -8 m, 06.02.2022, Y.Abiyev. The specimen is kept at the BAK.

New records include five following species.

*Bryum pallens* Sw. (Fig. 2d, e, f).

Moss species with reddish-brown, 1.5-2.5 cm long rusty-brown or brownish-red rhizoids. Leaves are morphologically ovate or ovate-lanceolate in the lower part, with an acute apex from the middle part, slightly concave, and toothed margins. Leaves measure 0.9-4.6 mm. It produces yellow-green spores.

Species is a typical mesohygrophyte, found in moist and muddy soil near rivers, streams, and damp rocks. It is distributed in Shamakhi, Gadabey, Lankaran districts and Nakhchivan Autonomous Republic.

*Specimen examined:* Khachmaz district, Susaygishlag village, Samur-Yalama National Park, rock, 41.661202° 48.654080°, 46 m, 06.02.2022, Y.Abiyev.

*Brachythecium mildeanum* (Schimp.) Schimp. (Fig.

2g, h, i)

Green or yellow-green, densely branched, large-sized, irregularly branched leafy moss species, reaching 8 cm in length. Branches are 6 mm long. Leaves are ovate-lanceolate in morphological structure, with an acute apex and toothed margins. Leaf cells are 1.6-3 mm in size.

Species is mesohygrophyte and grows epiphytic on tree trunks in forests.

It is distributed in Guba district, Garayazi State Nature Reserve, Goygol National Park, Nakhchivan Autonomous Republic.

*Specimen examined:* Khachmaz district, Yalama village, Samur-Yalama National Park, seaside, 41.761142° 48.586122°, 53 m, 08.02.2022, Y.Abiyev.

*Plagiothecium laetum* Schimp. (Fig. 2j, k, l)

The moss species is yellowish-green or greenish-white, 2 cm long, leafy. Its leaves are 2.5 mm long, asymmetric, elongate-ovate, ovate-lanceolate in shape, with an acute apex. Spores are yellow, yellowish-green, or brownish-green. Species is mesophyte, found on decaying wood. It is known from only Lankaran district.

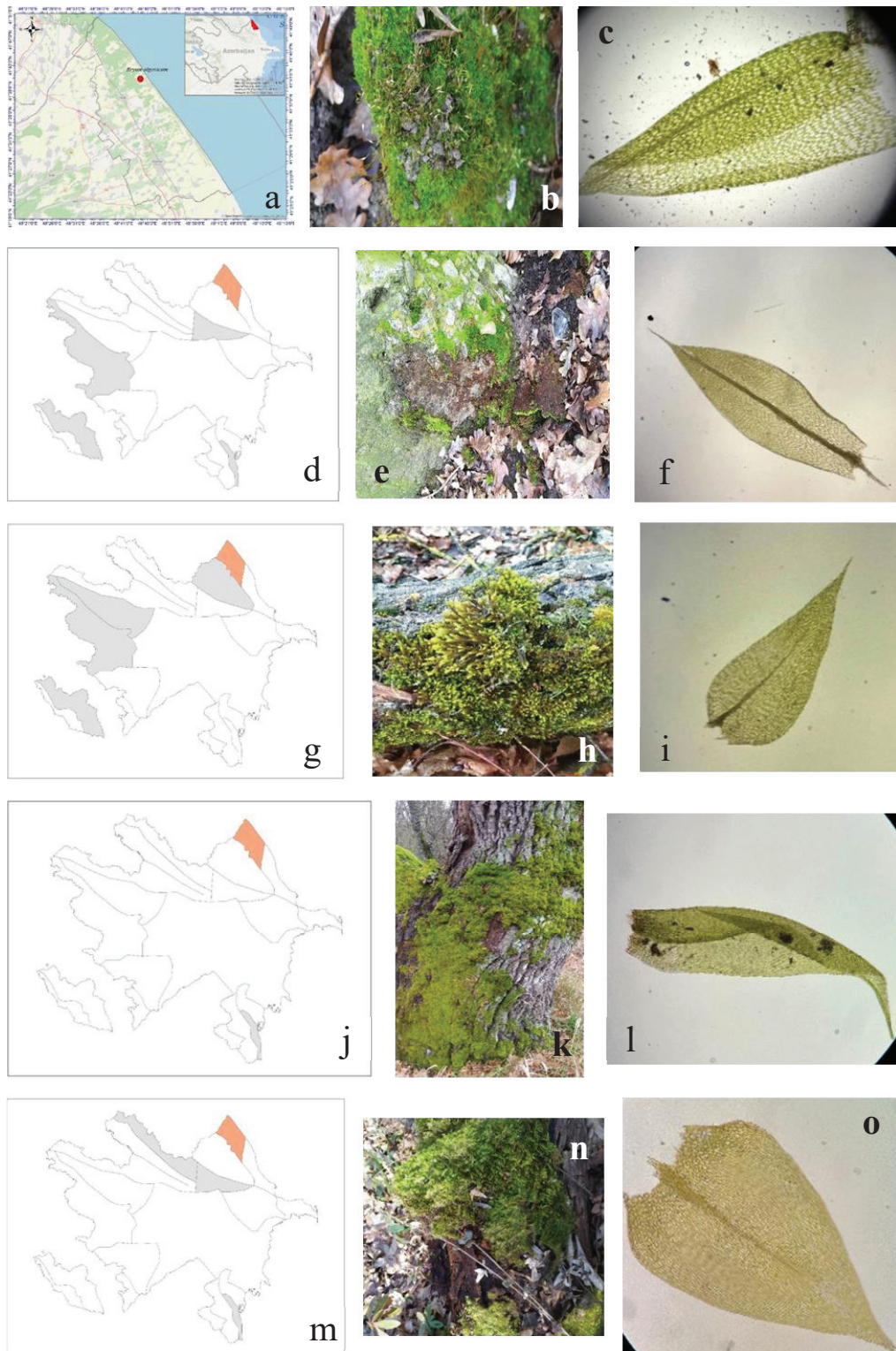
*Location:* Khachmaz district, Susaygishlag village, Samur-Yalama National Park, tree. 41.669611° 48.647755°, 51 m, 05.02.2022, Y.Abiyev.

*Taxiphyllum wissgrillii* (Garov.) Wijk et Marg. (Fig. 2m, n, o)

The moss species is green, yellowish-green, densely branched, and 1-1.5 cm long. Its leaves are elongate-ovate in shape, with an acute apex, bluntly toothed margins, and a silvery sheen. Species is mesophyte, found on tree trunks and in shady, moist places on rocks. It is distributed in Balakan, Shamakhi and Lankaran district.

*Location:* Khachmaz region, Tel village, Samur-Yalama National Park, dry tree. 41.778317° 48.630112°, 23 m, 05.02.2022, Y.Abiyev.

The previous research conducted in the study area, especially in Khachmaz district by L.B. Lyubarskya in [1978], E.A. Baryanika [2002] and A.V. Mammadova from [2017; 2018a; 2018b; 2020], serves as a foundation for further investigation. As a result of these studies, 114 species belonging to 64 genera in 24 families were collected from the SYN and the surrounding ecosystem and preserved in the BAK (Tab. 1).



**Figure 2.** *Bryum algovicum*: a) Distribution of the species in Azerbaijan, b) habitat of species, c) microscopic image; *Bryum pallens*: d) Distribution of the species in Azerbaijan, e) habitat of species, f) microscopic image; *Brachythecium mildeanum*: g) Distribution of the species in Azerbaijan, h) habitat of species, i) microscopic image; *Plagiothecium laetum*: j) Distribution of the species in Azerbaijan, k) habitat of species, l) microscopic image; *Taxiphyllum wissgrillii*: m) Distribution of the species in Azerbaijan, n) habitat of species, o) microscopic image.

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### Samur-Yalama Milli Parkının yarpaqgövdəli mamır müxtəlifliyinin öyrənilməsi: Azərbaycan brioflorası üçün yeni növ

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Azərbaycanda Samur-Yalama Milli Parkı müxtəlif flora növləri, o cümlədən briofitlərlə zəngin meşələrlə səciyyələnən biomüxtəliflik regionudur. Bu məqalədə Samur-Dəvəçi ovalığında yayılmış yarpaqgövdəli mamırların müxtəlifliyi araşdırılır. Müxtəlif marşrut xətləri boyunca 100-dən çox toplanmış herbarium materialları əl böyüdücüləri, Motic Digital Mikroskop və identifikasiya açarı vasitəsilə müəyyən edilmişdir. Toplanmış növlərdən *Bryum algovicum* Sendtn. ex Müll. Hal. Azərbaycan üçün yeni növ kimi müəyyən edilmişdir. Bundan əlavə, *Bryum pallens* Sw., *Brachythecium mildeanum* (Schimp.) Schimp., *Plagiothecium laetum* Schimp. və *Taxiphyllum wissgrillii* (Garov.) Wijk et Marg. növləri Samur-Dəvəçi ovalığı botaniki-coğrafi rayonu üçün ilk dəfə müəyyən edilmişdir. Bundan əlavə, 70 növün BTMİ-nin Qırmızı Siyahısına daha az təhlükəyə məruz qalan (LC) kateqoriyası üzrə daxil edildiyi müəyyən edilmişdir. Üç növ – *Palamocladium euchloron* (Bruch ex Muell. Hal.) “nəslə kəsilmək təhlükəsi altında olan” (EN), *Dicranum muehlenbeckii* Bruch & Schimp “həssas” (VU) kateqoriyası, *Leucodon pendulus* Lindb. “təhlükəyə yaxın” (NE) kateqoriyası ilə qiymətləndirilmişdir.

**Açar sözlər:** mamır müxtəlifliyi, yeni növ, qorunan ərazi, qırmızı siyahı

### Изучение разнообразия листостебельных мхов Самур-Яламинского Национального парка: новый вид для бриофлоры Азербайджана

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Самур-Яламинского Национального парк Азербайджана является одним из регионов с

высоким разнообразием экосистем, включая леса, богатые бриофитами (мхами). Мохообразные, являются маленькими, несудистыми растениями, играющими важную роль в различных экосистемах. В статье приведены результаты исследования разнообразия стеблелистных мхов листостебельных мхов, распространенных в лесных экосистемах Самур-Дивичинской низменности, в которых они играют особую роль в поддержании биоразнообразия. В различных типах растительности по намеченным маршрутам было собрано более 100 образцов. Собранный гербарный материал был определен с помощью лупы, цифрового микроскопа Motis и ключа для определения. Из всех собранных видов *Bryum algovicum* Sendtn. ex Müll. Hal. был

определен как новый вид для Азербайджана. Было выявлено, что несколько видов мхов таких как *Bryum pallens* Sw., *Brachythecium mildeanum* (Schimp.) Schimp., *Plagiothecium laetum* Schimp. и *Taxiphyllum wissgrillii* (Garov.) Wijk et Marg. являются новыми для Самур-Дивичинской низменности. Также 70 видов были включены в Красный список как «вызывающие наименьшие опасения» (LC). Три вида – *Palatocladium euchromon* (Bruch ex Muell. Hal.) оценен как «находящиеся под угрозой исчезновения» (EN), *Dicranum muehlenbeckii* Bruch & Schimp как «уязвимый» (VU), *Leucodon pendulus* Lindb. как «близкий к угрожаемому» (NE).

**Ключевые слова:** разнообразие мхов, новая запись, заповедная территория, красный список