

LIVERWORTS OF THE RITSA NATIONAL PARK (ABKHAZIA, CAUCASUS) ПЕЧЕНОЧНИКИ НАЦИОНАЛЬНОГО ПАРКА РИЦА (АБХАЗИЯ, КАВКАЗ)

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Abstract

The annotated list of liverworts collected by the authors over three days in the Ritsa National Park contains 42 species, including *Cephaloziella baumgartneri* and *Mannia triandra* new for the Caucasus and 12 species recorded as new for Abkhazia. Distribution and occurrence of some sporadic and rare species in the Caucasus are discussed. Taking into account the data obtained, the list of liverworts known for Abkhazia counts 91 species, which most likely does not make up even a half of the species occurring in its territory. The subalpine and alpine zones remain completely unexplored in both the Ritsa Park and Abkhazia, and the epiphytic flora and flora of the Colchis limestones are also understudied.

Резюме

Впервые составленный на основе трехдневного изучения аннотированный список печеночников национального парка Рица включает 42 вида, в том числе 12 видов новых для Абхазии, среди которых *Cephaloziella baumgartneri* и *Mannia triandra* – новые для Кавказа. Обсуждается распространение вновь найденных, а также редких и спорадически встречаемых на Кавказе видов. Учитывая новые находки, список печеночников Абхазии насчитывает 91 вид, что, скорее всего, не составляет и половины видов, встречающихся в Абхазии. Совершенно не обследованными как в парке Рица, так и в Абхазии остаются субальпийский и альпийский пояса, недоизучены также эпифитная флора и флора Колхидских известняков.

KEYWORDS: biodiversity, Colchis, rare species, species new for Caucasus

INTRODUCTION

The first data on Caucasian liverworts were published in the second half of the 19th century (Brotherus, 1892). Currently, bibliographies on Caucasian liverworts comprise several dozen titles, including publications that provide brief overviews of studies of Caucasian liverworts in general (Chikovani, 1978), in specific regions (Abramova & Abramov, 1953; Chikovani, 1986; Konstantinova, 2011; Ignatova *et al.*, 2008; Konstantinova *et al.*, 2009; Konstantinova & Savchenko, 2011, 2012, 2021; Bakalin *et al.*, 2016, *etc.*), numerous papers with additions to the flora of liverworts of the Caucasus or its specific regions (e.g., Ladyzhenskaya, 1951; Ladyzhenskaya, 1861; Konstantinova & Savchenko, 2008; Potemkin & Doroshina, 2009, *etc.*) or description of species new for science (Váňa, 1970; Konstantinova & Vilnet, 2011, 2016). However, despite the relatively long history of studying the Caucasus, the distribution of species and even species composition in this region has been insufficiently studied. Abkhazia is no exception. Until now, 76 species were known for Abkhazia (Bakalin *et al.*, 2016). It is obvious that, given the area of the republic (ca. 8700 sq. km), its location, mountainous terrain with an altitude difference from 0 to 3256 m above sea level on mount

Agepsta in Ritsa National park, the number of species in this territory should be greater. Not only the species composition, but also the distribution and ecology of liverworts in the republic have not been studied sufficiently. As far as we know, liverworts have never been specifically studied in the Ritsa National Park, so when we were offered to organize a short field trip to the park, we were very pleased. Thanks to the good organization and support of our work by the park administration and, in particular, the Deputy Director for Research, I.V. Taniya, who provided us with guest rooms near the park and a car for our trips, we were able to work quite effectively for three days. As a result, a list of liverworts found in the park was compiled for the first time, and new species were recorded for Abkhazia and Caucasus, including rare and endangered species in Europe. Therefore, we consider it useful to publish the results of our three-day work in the Ritsa National Park.

STUDY AREA

Ritsa National Park is situated on southern slope of Great Caucasus Ridge (Fig. 1A) and occupies 390 sq. km in four climatic zones, from moderately humid and warm to highland with cold summers (Shirokikh *et al.*, 2017). The underlying rocks in this area are very vari-

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Fig. 1. Abkhazia (A) and collecting localities in the valleys of Ritsa and Malaya Ritsa Lakes (B) and the valley of Gega River (C). Red line – western border of Ritsa National Park (based on <https://ritsa-park.ru/index.php/about-us/team/geograficheskoe-polozhenie>).

Collecting localities (Figs. 1B, C, 2, 3).

I. Yupshan Canyon near the southern border of Ritsa National Park, 09.05.2019. – 5: Waterfall Men's Tears; 43.4334° N, 40.523° E, 379 m alt. **II.** Northern shore of Lake Ritsa, 09.05.2019. – 10: right bank of Lashipse River, 43.481855° N, 40.562505° E, 900 m alt.; 11: the alley near Stalin's dacha, 43.484935° N, 40.538307° E, 910 m alt.; 12: the left bank of the stream flowing into the lake, *Taxus baccata*–*Carpinus*–*Acer*–*Alnus* forest, 43.486057° N, 40.548273° E, 977 m alt. **III.** East side of Ritsa Lake, 09.05.2019. – 6: slope to the road, 43.474031° N, 40.531223° E, 811 m alt.; 7: *Carpinus*–*Tilia*–*Abies* forest 43.474979° N, 40.529955° E, 876 m alt.; **8:** *Carpinus*–*Tilia*–*Abies* shrub forest, 43.474616° N, 40.529448° E, 915 m alt.; 9: *ibid.*, 43.474449° N, 40.530083° E, 926 m alt.; **IV.** Watershed between Ritsa and Malaya Ritsa Lakes, forests along the trail, 11.05.2019. – 22: *Pinus*–*Picea* with admixture of broad-leaved trees and *Hedera colchica* forest 43.472528° N, 40.528631° E, 998 m alt.; 23: *Picea*–*Abies* with broad-leaved trees forest with numerous logs, 43.472544° N, 40.528038° E, 1008 m alt.; 24: coniferous forest with numerous mossy boulders, 43.472758° N, 40.527568° E, 1019 m alt.; 25: *Picea*–*Abies* with single *Fagus orientalis* forest, 43.472575° N, 40.527017° E, 1038 m alt.; 26: coniferous forest, 43.472604° N, 40.526806° E, 1052 m alt.; 28: *Picea*–*Abies* forest with *Ilex*, 43.473129° N, 40.524502° E, 1124 m alt.; 29: coniferous forest dominated by *Abies*, 43.473370° N, 40.524000° E, 1129 m alt.; 30: bank of small lake in *Picea* dominated forest 43.474173° N, 40.519648° E, 1134 m alt.; 31: *Pi-*

cea–*Abies* forest, 43.474281° N, 40.517389° E, 1161 m alt.; 32: bank of small lake in *Picea* dominated forest with the Colchian undergrowth, 43.474292° N, 40.515033° E, 1179 m alt.; 33: bank of small lake in *Picea* dominated forest with the Colchian undergrowth 43.474693° N, 40.514324° E, 1226 m alt.; **V.** Valley of Malaya Ritsa Lake, 11.V.2019; – 34: *Picea*–*Abies* dominated forest with the Colchian undergrowth 43.474122° N, 40.505866° E, 1244 m alt.; 35: *Picea*–*Abies* dominated forest with the Colchian undergrowth near trail, 43.474122° N, 40.505866° E, 1244 m alt.; 36: trail in *Picea*–*Abies* dominated forest with the Colchian undergrowth, 43.473924° N, 40.508000° E, 1281 m alt.

VI: Lower Gega River, 10.05.2019. 14: slope to the road with *Sedum acre* 43.410130° N, 40.453401° E, 478 m alt.; 20: south facing slope in canyon on right bank of Gega River, on steep side to the road to gorge, 43.411784° N, 40.459193° E, 417 m alt.; **VII:** Middle Gega River near waterfall and upstream 10.05.2019 – 15: right bank of Gega River, *Abies nordmaniana* dominated forest, 43.438266° N, 40.443255° E, 583 m alt.; 16: north facing limestone cliffs on right bank of Gega River, 43.439081° N, 40.445491° E, 449 m alt.; 17: north facing slope in canyon on right bank Gega River, boulder field, 43.443069° N, 40.446158° E, 577 m alt.; 18: north facing steep side of road to gorge in canyon on right bank of Gega River, 43.440220° N, 40.444685° E, 641 m alt.; **19:** right bank of Gega waterfall, in large cave with small rivulets between rocks 43.434282° N, 40.442200° E, 417 m alt.

able and are represented, among others, by coarsely folded Upper Jurassic and Cretaceous limestones. It is one of the best-preserved areas of the refugium of the Tertiary-relict biota of the limestone part of Colchis (Shirokikh *et al.*, 2017). On the first day of collecting, May 9, we surveyed the valley of Lake Ritsa (Fig. 1B). The lake is located at an altitude of ca. 900 m above sea level in the Bzyb River basin and is surrounded by mountains of 2000–3000 m height (Fig. 1B, 2A). Mainly mixed fir (*Abies nordmaniana*) & beech (*Fagus orientalis*) forests with evergreen undergrowth (e.g. *Hedera colchica*, *Ilex*, etc.) occur around the lake. In these forests we collected species common in the mid-mountain forest belt of the Caucasus. There are mainly widespread liverworts of rotten

wood (e.g. *Cephalozia bicuspidata*, *Fuscocephaloziopsis lunulifolia*, *Lophocolea heterophylla*, *Lejeunea cavifolia*, *Nowellia curvifolia*, *Blepharostoma trichophyllum*), epiphytes (e.g. *Metzgeria furcata*, *Radula complanata*) or species occurring mostly on rocks (e.g. *Metzgeria conjugata*) or soil (*Plagiochila porelloides*). Only here on a log of *Abies nordmaniana* on the bank of Lashipse River, a rather rare in the Caucasus *Anastrophyllum michauxii* was collected.

On the second day, collecting took place in a valley of Gega River (Fig. 1C) at altitude 417–577 m in the low forest zone. Here, we were able to study the greatest diversity of habitats (Fig. 2). On dry cliffs covered with steppe communities with *Sedum*, etc. grew *Mannia* and



Fig. 2. Ritsa Lake and collecting localities in the Gega River Gorge: A – Lake Ritsa; B – Gega River Gorge; C – Cliffs in the Gega River Gorge; D – Gega River Gorge upstream of waterfall; E – Slopes to the road in Gega River Gorge; F – Habitat of *Mannia triandra* on slopes to the road in Gega River Gorge (the arrows show clusters of *Mannia triandra* receptacles); G – *Mannia triandra* with numerous receptacles; H – *Mannia triandra* thallus under receptacles.

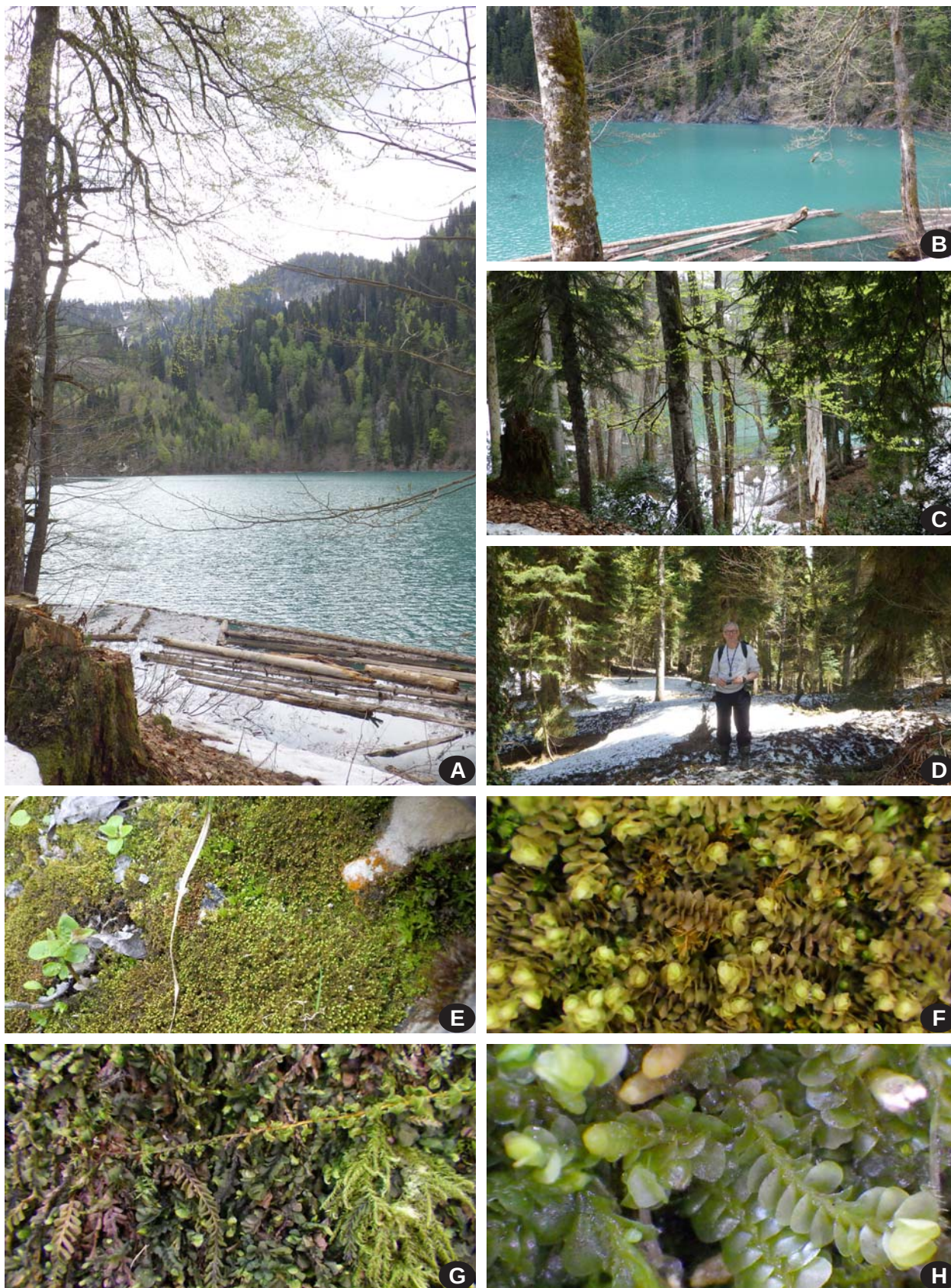


Fig. 3. Collecting localities in watershed of Ritsa and Malaya Ritsa Lakes and in valley of Malaya Ritsa Lake: A – Malaya Ritsa Lake; B – Forest on steep slopes to Malaya Ritsa Lake; C – Beech-fir forest in Malaya Ritsa Lake valley; D – *Abies nordmaniana* forest; E – Mats of *Scapania aequiloba* on rocky slopes to the road; F – *Scapania aequiloba*; G – Mats of *Pedinophyllum interruptum* with single shoots of *Plagiochila porelloides*; H – *Pedinophyllum interruptum*.

Riccia species (Fig. 2C, F, G, H). Near the waterfall, several liverworts, common in such places, were found: *Conocephalum conicum*, *Apopellia endiviifolia*, *Jungermannia atrovirens*, *Pedinophyllum interruptum*, etc. Upstream from the waterfall, large mats of *Mesoptychia collaris* were found on wet sides of the road. Large mats of *Scapania aequiloba* were found on the rock-field on the wet right side of the road. On the final day, May 11, we collected bryophytes along the trail from the Lake Ritsa to the Lake Malaya Ritsa (Figs. 1B, 3). Despite having to partially walk through snowfields (Fig. 3A, C, D), we were able to find many interesting species, particularly those living on rotting wood in varying states of decomposition. Fallen fir and beech trunks are abundant along the road, and we discovered many liverworts characteristic for decaying wood of coniferous and mixed broadleaved-coniferous forest on them. It was in such habitats that a number of species new to Abkhazia were found, e.g. *Geocalyx graveolens*, *Crossocalyx hellerianus*, and others.

MATERIAL AND METHODS

A total of 80 specimens were collected in 36 localities. The collecting localities are shown on the map as seven groups, I–VII (Fig. 1) and are described in the figure caption. The numbering in the descriptions corresponds to the numbers of points on the maps (Fig. 1). For each locality, a brief description of the collecting site, geographical coordinates and elevation or their range are provided. Locations numbered 1–4 and 13 are situated outside the park, so they are not shown on the maps or given in the descriptions. Point 21 was set at the turn into the Gega River valley and no gatherings were carried out there.

RESULTS

The annotated list of liverworts counts 42 species. The nomenclature follows Hodgetts *et al.* (2020). Annotation of each species includes some synonyms used in some previous publications (in square brackets) followed by data on presence of gynoecia (gyn.), perianthia (per.), androecia (and.), sporophytes or spores (spor.), female or male receptacle (fem. or male recep.). An asterisk (*) marks a species new for Abkhazia. Two asterisks (**) mark a species new for Caucasus. After the dash, the collection sites are given under the corresponding Roman numerals and the following Arabic numerals. These are followed by the substrate description and, in square brackets, one of the numbers indicating the most representative specimen of the species in the KPABG (Herbarium of Polar-Alpine Botanical Garden-Institute). All specimens are deposited in the Herbarium of Polar-Alpine Botanical Garden-Institute of the Kola Scientific Center, Russian Academy of Sciences – KPABG(H) and label information is available at <https://kpabg.ru>. For frequently occurring species, the most characteristic associated species are listed. For species found in one or two localities, all associated species are listed.

Anastrophyllum michauxii* (F. Weber) H. Buch, per., and. – **II: 10. On log [126486]. Dominates in mats with minor admixtures of *Nowellia curvifolia* and *Cephaloziella* sp. A species that is rather rare and sporadically found in the Caucasus. The species is assessed as NT in Europe (Hodgetts *et al.*, 2019).

Aneura pinguis (L.) Dumort. – **IV**: 17. Several specimens on soil covered rock between boulders in boulder field, dominated in mats with admixture of *Scapania aequiloba* and *Mesoptychia collaris* [126503]; 18. On sandy soil on steep bank on side of road to gorge, single shoots with *Mesoptychia collaris* and *Preissia quadrata* [126508].

Apopellia endiviifolia (Dicks.) Nebel & D. Quandt [*Pellia endiviifolia* (Dicks.) Dumort.] – **I**: 5. Rock on left bank, in crevice in pure mats [126464]; **VI**: 19. Dominated in mats on rock and fine earth, with admixture of *Jungermannia atrovirens* [126492].

Blepharostoma trichophyllum (L.) Dumort., per., spor. – **III**: 8, 9; **IV**: 22, 23, 24, 26, 28, 29, 36. In coniferous (*Picea* or *Picea-Abies* dominated), mixed *Pinus-Picea* with admixture of broad leaved trees and Colchian undergrowth and *Carpinus-Tilia-Abies* forests, on sides of decaying logs of *Picea* and *Abies*, on stumps, on rotten wood. In pure mats but often mixed with other liverworts (see below).

Calypogeia muelleriana (Schiffn.) Müll. Frib. – **IV**: 29. On decaying log in coniferous forest dominated by *Abies*. Dominated in mats with admixture of *Geocalyx graveolens* and *Syzygiella autumnalis* [126523].

C. suecica (Arnell & J.Perss.) Müll. Frib. – **IV**: 29, 30. On rotting logs in *Picea-Abies* forests. Scattered in mats dominated by *Syzygiella autumnalis* and *Lioclaena lanceolata* [126528], scattered in mats dominated by *Schistochilopsis incisa* [126560].

Cephaloziella bicuspidata (L.) Dumort., per., spor. – **IV**: Coniferous forest, on decaying logs of *Abies* and *Picea*, common: 22, 23, 24, 29 [126528].

Cephaloziella divaricata (Sm.) Schiffn., per., and., gemm. – **IV**: 22, 23, 24. Mixed coniferous-broad leaved forests, on decaying log, scattered or single shoots among other liverworts [126510].

***C. baumgartneri* Schiffn., gyn., young per. – **VI**: 15, 16. Crevices of limestone cliffs, pure mats, several specimens [126499] or mixed with *Southbya tophacea* [126498].

Conocephalum conicum (L.) Dumort. s. str. [*Fegatella conica* (L.) Corda] – **I**: Rock on left bank, in crevice [126463] in pure mats; **VII**: 19. In large cave with small rivulets on soil [126494].

Crossocalyx hellerianus* (Nees ex Lindenb.) Meyl., per., and., gemm. – **V: 22. *Pinus-Picea* with admixture of broad leaved trees and *Hedera colchica* forest, on the side of stump dominated in mats with admixture of *Nowellia curvifolia* [126509]; 29. Bank of small lake in *Picea* dominated forest with Colchian undergrowth on decaying log, dominated in mats with admixture of *Cephaloziella divaricata* [126510].

Frullania dilatata (L.) Dumort., per., and., spor. – **II**: 11. On *Abies* [126488] and on *Tilia cordata* [126487]; 12. On *Carpinus* [126491]. This species is not mentioned for Abkhazia in Bakalin *et al.* (2016), but it is characterized as common in Chikovani *et al.* (1986).

F. tamarisci (L.) Dumort. – **I**: 5. On trunk of *Staphylea colchica* [126468] and on trunk of a hazel tree (*Corylus* sp.) ca. 15 cm in diameter [126471]; **IV**: 25. On *Fagus orientalis* ca. 50 cm diameter [126520]. Dominated in mats with admixture of *Radula complanata*, *Metzgeria furcata*.

- **Fuscocephaloziopsis catenulata* (Huebener) Váňa & L. Söderstr. (per.) – **IV**: 30. On decaying log of *Picea* [127818], dominated in mats with admixture of *Fuscocephaloziopsis lunulifolia*, *Calypogeia suecica*, *Blepharostoma trichophyllum*, *Syzygiella autumnalis*, *Lophocolea heterophylla* and other species of decaying wood.
- F. lunulifolia* (Dumort.) Váňa & L. Söderstr. (per., and., spor.) – **II**: 7; **IV**: 30; **V**: 34. On side of decaying logs and stumps of *Picea* or *Abies* in *Picea-Abies* and *Carpinus-Tilia-Abies* dominated forests with the Colchian undergrowth, dominated in mats [126560, 126475] or mixed with other liverworts of decaying wood, e.g. *Calypogeia suecica*, *Blepharostoma trichophyllum*, *Lophocolea heterophylla*, *Nowellia curvifolia* [126537].
- **Geocalyx graveolens* (Schr.) Nees, per. – **IV**: 26. On log, mixed with *Blepharostoma trichophyllum* [126521]; 29. On rotting wood, mixed with *Syzygiella autumnalis*, *Liochlaena lanceolata* [126524, 126526].
- Jungermannia atrovirens* Dumort., per., and., dioicous – **I**: 5. Rock on left bank, in crevice [126462]; **II**: Large cave with small rivulets, in crevices of rocks [126493].
- Lejeunea cavifolia* (Ehrh.) Lindb. – **I**: 5. On trunk of a hazel tree (*Corylus* sp.), ca. 6 cm in diameter; on dead trunk of *Taxus baccatus*; on trunk *Staphylea colchica*. Dominated in mats [126469] or mixed with other corticolous liverworts: *Frullania tamarisci*, *Metzgeria furcata*, *Radula complanata* and others.
- Lepidozia reptans* (L.) Dumort. – **III**: 9. On side of stump [126482]; **IV**: 32. Decaying log [126536]; **V**: 35. At base of boulder near trail. Mostly mixed with other liverworts: *Blepharostoma trichophyllum*, *Crossocalyx hellerianus*, *Tritomaria exsecta*, etc.
- Liochlaena lanceolata* Nees [= *Jungermannia lanceolata* sensu Schrad.], per., and. – **IV**: 29, 31. Several specimens on rotting logs in *Picea-Abies* forests [126535], mostly in pure mats with admixture of *Syzygiella autumnalis*, *Blepharostoma trichophyllum*.
- Lophocolea heterophylla* (Schr.) Dumort., per., and. spor. – **III**: 6, 9; **IV**: 22, 23, 24, 28, 30, **V**: 34, 36. Common on rotten wood, decaying logs, decomposed stumps in coniferous *Picea* and *Picea-Abies* dominated forest with broadleaved trees and Colchian undergrowth, with numerous logs, and in *Carpinus-Tilia-Abies* forests with Colchian undergrowth [126478], both in almost pure mats but often mixed with other liverworts characteristic for rotten wood.
- **Lophozia guttulata* (Lindb. & Arnell) A. Evans – **V**: 36. *Picea-Abies* with broadleaved trees and Colchian undergrowth forest, on log [127817]. Scattered in mats dominated by *Lophocolea heterophylla* and *Blepharostoma trichophyllum*.
- L. ventricosa* (Dicks.) Dumort. var. *ventricosa*, per. – **IV**: 29. On decaying logs, several specimens, dominated in mats [126530], mixed with other species of decaying wood.
- ***Mannia triandra* (Scop.) Grolle, fem. recept. – **VII**: 14. Steep side to the road in gorge, sandy soil [126552]. This species is assessed as vulnerable in Europe (Hodgetts *et al.*, 2019). *Mannia androgyna* and *M. fragrans* were known earlier for Abkhazia (Bakalin *et al.*, 2016).
- Marchantia quadrata* Scop. [*Preissia quadrata* (Scop.) Nees] – **IV**: 20. Sandy soil, mixed with *Aneura pinguis* and *Mesoptychia collaris* [126507].
- Mesoptychia collaris* (Nees) L. Söderstr. & Váňa, per., and. (dioicous) – **VI**: 20; **VII**: 17. Moist soil and fine earth covered rock between boulders. Dominated in mats [126504] with admixture of *Scapania aequiloba* or mixed with *Aneura pinguis*.
- Metzgeria conjugata* Lindb., per., and. (autoicous) – **III**: 7. On side of boulder [126474]; **IV**: 24. On side of mossy boulder [126518]. In pure mats or mixed with *Plagiochila porelloides*.
- M. furcata* (L.) Dumort., gemm. – **I**: 5. On trunk of *Carpinus* [126481], *Staphylea colchica*, hazel tree (*Corylus* sp.), on a dead *Taxus baccatus*, mixed with *Radula complanata*, *Porella platyphylla*, *Frullania tamarisci*, *Lejeunea cavifolia*; **III**: 9. On trunk of *Carpinus* [126481].
- Nowellia curvifolia* (Dicks.) Mitt., per. – **II**: 10; **III**: 9; **IV**: 22, 23, 24, 28, 30; **V**: 36. Decaying wood including sides of decaying and rotten logs and stumps in coniferous and mixed broad-leaved & coniferous forests often with Colchian undergrowth (e.g. *Hedera colchica*, *Buxus colchica*, etc.) [126477]. In pure mats or mixed with other species of decaying wood.
- Pedinophyllum interruptum* (Nees) Kaal., per. – **V**: 35. At base of boulder. **VII**: 19. At base of rock. In pure mats [126495].
- **Pellia neesiana* (Gottsche) Limpr. – Right bank of Gega waterfall, in large cave with small rivulets, in crevices of rocks.
- Plagiochila porelloides* (Torr. ex Nees) Lindenb., per. – **II**: 12; **III**: 9; **IV**: 24. Mossy boulders in coniferous forest, rocks near water, soil covered rotting wood [126517]. Mostly in pure mats.
- Radula complanata* (L.) Dumort., gemm., per., spor. – **I**: 5; **II**: 12; **III**: 9; **IV**: 22; **V**: 35. At base of boulders, on decaying wood in coniferous and mixed forests, on trunks of trees in *Picea-Abies* dominated forest with the Colchian undergrowth, in pure mats [126540] or mixed with *Metzgeria furcata*, *Frullania tamarisci*, *Lejeunea cavifolia*.
- R. lindenbergiana* Gottsche ex C. Hartm., per., and., spor. (dioicous) – **VII**: 19. On bark of *Abies nordmanniana* [127816].
- Reboulia hemisphaerica* (L.) Raddi – **VI**: 14. On peaty soil. [126554].
- **Riccardia palmata* (Hedw.) Carruth. – **IV**: 30. On decaying log of *Picea* [126534]. Mixed with *Calypogeia suecica*, *Fuscocephaloziopsis lunulifolia*, *F. catenulata*.
- **Riccia sorocarpa* Bisch., spor. – **VII**: 14. On sandy soil [126555].
- **Scapania apiculata* Spruce., gemm. – **IV**: 30. On decaying log of *Picea* [127819], some shoots in mats dominated by *Fuscocephaloziopsis catenulata*, *F. lunulifolia*, *Calypogeia suecica* and admixture of *Nowellia curvifolia*. This species is assessed as near threatened in Europe (Hodgetts *et al.*, 2019).
- **Scapania aequiloba* (Schwägr.) Dumort., gemm. – **VI**: 17. On fine earth between rocks and on rocky slopes to the road [126500], mixed with *Mesoptychia collaris*, *Aneura pinguis*.
- Schistochilopsis incisa* (Schr.) Konstant. – **IV**: 29. Decaying log in coniferous forest. Mixed with *Syzygiella autumnalis*, *Blepharostoma trichophyllum*, *Tritomaria exsecta*, *Lophozia ventricosa*, *Calypogeia suecica* [126533].
- Southbya tophacea* (Spruce) Spruce – **VI**: 16. Crevices of limestone cliffs [126498], mixed with *Cephaloziella baumgartneri*.
- Syzygiella autumnalis* (DC.) K. Feldberg, Váňa, Hentschel & Heinrichs [= *Jamesoniella autumnalis* (DC.) Steph., *Jungermannia autumnalis* DC.], per., and. – **IV**: 23, 29. Decaying logs in coniferous and mixed forests [126525]. Dominated in mats, mixed with *Blepharostoma trichophyllum*, *Tritomaria exsecta*, *Lophozia ventricosa*, *Calypogeia suecica*.
- Tritomaria exsecta* (Schmidel) Schiffn. ex Loeske, gemm., per.,

and. – IV: 23, 29, 32. Decaying logs in coniferous and mixed forests. Mostly mixed with other species of decaying wood, e.g. *Syzygiella autumnalis*, *Blepharostoma trichophyllum* [126513].

DISCUSSION

A total of 42 species were recorded based on identification of ca. 80 specimens collected over three days. This is slightly fewer than those found over a slightly longer period (four days of collection) within the Colchis temperate-subtropical rain forest zone in the nearby south Adjara (Bakalin *et al.*, 2016).

Liverworts new to the Caucasus

Of greatest interest are the findings of two species (*Cephaloziella baumgartneri* and *Mannia triandra*) not previously reported for the Caucasus. Both species are calciphytes and were collected in the valley of Gega River which is located in a strip of coarsely folded Upper Jurassic and Cretaceous limestones. One of them, *Cephaloziella baumgartneri*, is a worldwide rather rare Mediterranean-Atlantic species occurring mainly in the Mediterranean with the northernmost localities in the British Isles, the Netherlands, and Belgium (Paton, 1999). The plants were assigned to *Cephaloziella baumgartneri* based on characteristic appearance, particularly pure green color, distinctly squarrose, fairly large leaves with narrow at base, (5–7) cells wide, triangular lobes often ending in two superposed cells, large cells (14)16–20 µm wide at base of lobes and 25–30 µm long in lobes. The habitat in which this species was found is also very characteristic: a calcareous rock. It is also quite characteristic that in one of the mats this species was found mixed with another Mediterranean-Atlantic species *Southbya tophacea*. The second species new for Caucasus is *Mannia triandra*. It is rather sporadic disjunct circumpolar species assessed as vulnerable in Europe (Sabovljevic *et al.*, 2019).

Carbonates are extremely specific habitats and are widely represented in the area known as Colchis. Potentially, more species new to the Caucasus could be discovered in such habitats.

Liverworts new to Abkhazia

In addition to liverworts new to the Caucasus, 10 species new to Abkhazia were found in the study area. Most of them are species of rotting wood. These species were found in coniferous-broadleaf forests with Colchis undergrowth in Colchis temperate-subtropical forest zone. This group includes *Anastrophyllum michauxii*, *Fuscocephaloziopsis catenulata*, *Riccardia palmata*, *Crosso-calyx hellerianus*, *Geocalyx graveolens*, *Scapania apiculata*, and *Lophozia guttulata*. With the exception of *Lophozia guttulata*, all of these species are quite rare or sporadically occurring in the Caucasus, being known from few localities. *Lophozia guttulata* is probably not an uncommon species of coniferous and coniferous-broadleaf forests and is recorded for various regions of the Caucasus (Bakalin, 2005; Bakalin *et al.*, 2016; Konstantinova *et al.*, 2009, etc.). Interpretations of species in the genus *Lophozia* are extremely controversial. It is quite possible

that *Lophozia guttulata* was previously considered within another species of the genus, e.g. *Lophozia ventricosa* which is recorded for Abkhazia.

Scapania aequiloba seems to be not rare in the Caucasus, occurring in subalpine and alpine meadows, on banks of streams in subalpine and forest zone. The discovery of this species was entirely expected and the previous lack of species records for Abkhazia is explained solely by the insufficient study of the region. The very poor study of the liverwort flora of Abkhazia also explains why *Riccia sorocarpa* has not previously been reported for its territory. Species of this genus are typically seasonal and are most visible in early spring or late autumn. In this regard, the timing of our field trip was suitable, since the slopes were still quite well-watered and the *Riccia* thalli were clearly visible. Very few species of this genus are known to have been found in the Caucasus. *Riccia sorocarpa* is a worldwide widespread species but by now in Caucasus it is known from very few localities, provided by, e.g., Brotherus (1882) (Kobi ad fl. Terek), Chikovani (1986), Bakalin *et al.* (2016) (several provinces in Georgia), etc.

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