

Additions and amendments to the list of Estonian bryophytes

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Abstract: Three new species have been added to the Estonian bryoflora within last two years, one of which – *Fontinalis dichelymoides* was identified for us from earlier herbaria materials during European research of the genus *Fontinalis*. Two species – *Bryum violaceum* and *Rhynchostegiella tenella* – were found during recent bryological inventories. In addition, voucher data for two new taxonomical combinations and four species estimated to be extinct according to the IUNC evaluations in 2018, are presented and discussed here. Our results show that the total number of bryophyte species in Estonia is currently 621. For all new taxa IUCN categories are given.

Keywords: bryophytes, IUCN category, Estonia

INTRODUCTION

Regional and local lists of species are important bases for getting overview of the local flora, for better understanding of the local nature conditions, and for preparing conservation plans. One of the most important goals for amending regional lists is also to update taxon names according to the valid synonyms, while this gives assurance for researchers that they report the same taxa in studies when using databases from different regions. Updating enables also to compare the presence of the same taxa in the neighbouring countries or regions, for example by list of European bryophytes (Hodgetts & Lockhart, 2020) and that of Nordic countries (Lönnell et al., 2025).

The first list of bryophytes from Estonian territory was published already in 1860 by Girgensohn, including 301 species names, first contemporary list was published in 1994 (Ingerpuu et al., 1994). Since then, several supplementations and corrections have been inserted to the list. For all bryophyte species and varieties recorded from Estonia a voucher has been selected among checked herbaria specimens since 2015 (Vellak et al., 2015). The voucher allows taxon identification verifications also later. The most recent list of Estonian bryophytes (Vellak et al., 2023) is available only electronically. In 2024 first updates on this list were made

(Kupper et al., 2024). Several taxonomical rearrangements have been published recently that include taxa known also from Estonia (e.g., Hassel et al., 2025; Wolski & Polus, 2024). New taxa can appear in the local floras also as result of inventory works and re-assessments of earlier material kept at herbaria.

The aim of this study is 1) to check herbarium specimens for possible new taxa or synonyms for Estonian bryoflora; 2) present locality data for the new taxa, and evaluate them against IUCN threat categories; 3) to comment or represent re-evaluated threat categories of those species that were evaluated as extinct in Estonia in 2018, but have got recent new records.

MATERIAL AND METHODS

New species for Estonian flora were identified from recent collections and were verified by all authors of this study. For new species and taxonomical combinations identified for Estonia by other scientists, we inspected all Estonian bryological collections of TAA, TALL; TAM and TU for clarifying their present distribution and for evaluating against IUCN criteria. For all species listed in this study the voucher specimens were selected and IUCN threat categories are given. Species' names in Estonian, given in parentheses, were approved by the Estonian Committee of Botanical Terminology. We

have followed taxonomical approach of species presented in the list of European bryophytes (Hodgetts et al., 2020) and Latin names are checked according to GBIF.

RESULTS AND DISCUSSION

Three new species and two new taxonomical combinations are added to the Estonian bryoflora, which rises the total number of bryophyte species in Estonia to 621.

Confusion with old specimens labelled as *Anthoceros punctatus* was resolved. In Europe two species of genus *Anthoceros* are accepted – *A. punctatus* L. and *A. agrestis* Paton (Hodgetts & Lockhart, 2020). *A. agrestis* has been treated also as a synonym or a variety or a subspecies of the *A. punctatus* (Damsholt, 2002). In Estonia all recent specimens are identified as *A. agrestis*, but three historical specimens carried the name of *A. punctatus*. Thus, we checked these samples in herbaria and found that only *A. agrestis* occurs in Estonia. Both species are short-lived summer-annuals, but *A. punctatus* has more Mediterranean-Atlantic distribution in Europe compared to *A. agrestis*. *Anthoceros agrestis* is evaluated as near threatened (NT) in Europe (Hodgetts & Lockhart, 2020). It has several localities mainly in South and Central Estonia and was evaluated here as LC in 2018.

New taxa for Estonian bryoflora

BRYUM VIOLACEUM Crundw. & Nyholm
[pöld-pungsammal]

Voucher specimen: TU155885.a. Tartu Co., Tartu Comm., Kāmara village, in a corn field (58.4519° N; 26.5171° E), leg. A. Helm, T. Reitalu, 25 July 2025, det. T. Kupper 14 Dec 2025, ver. N. Ingerpuu, K. Vellak, 27 Jan 2026.

Bryum violaceum is a common species in Europe but probably overlooked because it is difficult to identify in field (Holyoak, 2021). This species grows on disturbed and temporary open habitats like arable fields, roadsides or waste ground. The finding from Estonia is also from an arable field. It is evaluated as least concern in Europe (Hodgetts & Lockhart, 2020), and could also be out of threats in Estonia, but due to lack of data on threats, it is evaluated as DD at present.

FONTINALIS DICHELYMOIDES Lindb. [kūüs-vesi-sammal]

Voucher specimen: TAA5026796. Võru Co., Võru Comm., Kirikumäe village, west bank of the lake Kirikumäe, near lake shore in water (57.6845° N; 27.2437° E), leg. H. Mäemets, 30 Aug 2024, det. M. Leis, 12 Jan 2025.

This species was identified for Estonia from earlier herbaria specimens from three different localities (Wolski & Polus, 2024). On the basis of Estonian herbaria, it has been found again only from Kirikumäe lake after its first record in 1986. The species inhabits stagnant water lakes at the basin of the Baltic Sea and could be more common as expected for now, since it has been treated as synonym of *F. dalecarlica* for a long time (Wolski & Polus, 2024). All Estonian findings are from semi-dystrophic small lakes, two of them are located in South-Estonia and one in East-Estonia. This species is evaluated as vulnerable (VU) in Estonia according to D2 criterion, in Europe it is near threatened (NT; Hodgetts & Lockhart, 2020).

RHYNCHOSTEGIELLA TENELLA (Dicks.) Limpr. [örn nokksamblake]

Voucher specimen: TU155652, Pärnu Co., Häädemeeste Comm., Napste, on a stone at the bank of rivulet Arakaoja (58.0777° N; 24.6274° E), leg. T. Kupper, 07 Oct 2024, det. T. Kupper, 11 Nov 2024, ver. N. Ingerpuu, K. Vellak, 18 Nov 2024.

Rhynchostegiella tenella is distributed all over Europe and is evaluated here as least concern (LC; Hodgetts & Lockhart, 2020). This species is known also in Scandinavia but is not recorded from Latvia and Lithuania. It prefers shaded basic habitats, growing on rocks and walls (Hedenäs et al., 2014). The second locality was found in summer 2026 from Maarjamäe (Tallinn, Harju County). Nevertheless, due to lack of data for its real distribution in Estonia and on threats this species belongs to DD at present.

New taxonomical combinations

Members of the subgenus *Subsecunda* of *Sphagnum* have been treated differently, including also *Sphagnum* literature in Estonian. Laasimer et al. (1954) considered *Sphagnum inundatum* Russ. and *S. gravetii* Russ. as separate species, but later they were treated as

synonyms of *S. denticulatum* Brid. (Ingerpuu et al., 1994). In the last book of Estonian peat-mosses (Vellak et al., 2024), *S. gravetii* was set as the synonym of *S. auriculatum* Schimp. Recent morphological and molecular analyses clarified species delimitations between these four taxa (Hassel et al., 2025; Meleshko et al., 2025). *Sphagnum gravetii* was proved to be a variety of *S. inundatum*, and *S. auriculatum* as a synonym of *S. denticulatum*.

We have checked specimens labelled as *S. auriculatum* and *S. inundatum* from all Estonian herbaria (TU; TAA; TALL; TAM) for selecting appropriate voucher specimens for these taxa. According to our results *S. inundatum* var. *gravetii* has specimens from four localities up to now, and *S. denticulatum* from seven. Both species, *S. denticulatum* and *S. inundatum*, are rare in Estonia, and the last one is under state protection. *S. inundatum* is growing in wet fen meadows and has altogether 10 localities in Estonia, yet from some older localities, it has not been found later. *Sphagnum inundatum* var. *gravetii* is growing in even more wet places and is usually submerged, compared to *S. inundatum*. In island Hiiumaa both taxa were registered from the same overflowed fen. *Sphagnum denticulatum* is growing in lakes and wet fens, mostly in eastern part of Estonia, but one locality is on western island Hiiumaa. *S. denticulatum* was collected by E. Russow already in 1888 (TU168906), but this locality is vanished for now. According to our study there is no reason to change the threat categories of both species. We present voucher data for these three *Sphagnum* taxa below. The earlier voucher specimen (TU168074) of *S. inundatum* was re-identified as *S. subsecundum* in 2026, and thus a new voucher specimen has been selected also for *S. inundatum*. The voucher specimen selected for *S. denticulatum* in 2015, was the only recent sample of that species at that time, but included a mixture of different *Sphagnum* species. In course of inventory of the distribution of rare *Sphagnum* species in 2020 we visited also the voucher locality of *S. denticulatum* and found it there in a large quantity. Therefore, also updated voucher data for *S. denticulatum* are presented here.

SPHAGNUM DENTICULATUM Brid. [kõrv-turbasammal]
Voucher specimen: TU173705, Põlva Co., Räpina Comm., Meenikunno Landscape Reserve,

Lake Nohipalu Valgjärv, overflowed coastal zone of the lake (59.9420° N; 27.3482° E), leg. N. Ingerpuu, 05 May 2020, det. N. Ingerpuu, 05 May 2020.

SPHAGNUM INUNDATUM Russow

Voucher specimen: TU173692, I-Viru Co., Alutaguse Comm., Smolnitsa Landscape Reserve. Fen meadow, between sedge tussocks (59.0090° N; 27.6444° E), leg. K. Vellak 07 July 2020, det. K. Vellak 14 July 2020.

SPHAGNUM INUNDATUM VAR. GRAVETII (Russow) K. Hassel and Flatberg

Voucher specimen: TU180278, Lääne -Viru Co., Kadrina Comm., Viitna Nature Reserve, Lake Viitna Suurjärv, in water of the coastal zone of the lake (59.4442° N; 26.0091° E), leg. K. Vellak, 27 Apr 2020, det. N. Ingerpuu, K. Vellak, 22 Jan 2026.

New data for species evaluated previously as extinct in Estonia

Three bryophyte species that have been evaluated as regionally extinct (Ingerpuu et al., 2018), were recovered at new localities and thus needed to be re-evaluated against IUCN criteria. One species emerged from diaspore bank. Data for new voucher specimens is given below.

CLEVEA HYALINA (SOMMERF.) Lindb. [kahkjas kleevea]
Voucher specimen: TALL D028262, Harju Co., Tallinn, Haabersti district, Astangu, on klint outcrop (59.3996° N; 24.6148° E), leg. T. Kupper, 13 May 2024, det. T. Kupper 16 May 2024, ver. N. Ingerpuu, 17 May 2024.

Three new localities have been found for this species since the IUCN evaluations (Ingerpuu et al., 2018). All localities are on dry open calcareous outcrops. Both specimens were collected in spring. Also, the first historical specimen was collected in spring. Thus, this species needs to be searched for at early vegetation period due to its short life span, later in summer it could disappear. This species is not recorded from Latvia and Lithuania, in Finland it is evaluated as EN, in Europe as LC (Hodgetts et al., 2020). *Clevea hyalina* is evaluated in Estonia as VU, according to D2 criteria.

DICRANELLA RUFESCENS (Dicks.) Schimp. [ruuge kaksikhambake]

Voucher specimen: TAA5012236, Harju Co., Rae Comm., Veneküla, Vão quarry (59.4269°

N; 24.9158° E), leg. E. Rajandu, 22 June 2017, det. E. Rajandu, M. Leis, 22 Oct 2021.

Two localities have been found for this species since the last evaluation, one from the natural habitat on Vormsi island, but another in a disturbed area in mainland. In Europe it is evaluated as least concern, and it could be also in Estonia more widely distributed as current data shows. This species can grow on different substrata. Since threats are not known yet, the species is evaluated as DD at present.

SOLENOSTOMA GRACILLIMUM (Sm.) R.M.Schust. [örn ümarlehik]

Voucher specimen: TU172608, Harju Co., Harku Comm., Tabasalu, Tiskre outcrop, on sandstone (59.4374° N; 24.5418° E), leg. N. Ingerpuu, 31 March 2025, det. N. Ingerpuu, 11 July 2025.

This species has one new locality, where the species has been recorded twice, in 2020 and in 2025. The single historical finding is on Saaremaa Island. This species is evaluated as critically endangered (CR) in Estonia according to D and B2a(iii) criteria, since it has less than 5 individuals at the only small location, it is not found from its historical locality, and the habitat is further threatened by the vicinity of an active hiking trail.

SPHAGNUM AONGSTROEMII C.Hartm. [Aongstroemi turbasammal]

S. aongstroemii had only one old record from North Estonia collected by Russow in 1893 (TU168768) until now, but surprisingly it germinated from the diaspore bank collected from South Estonia in 2019. We had an analogous case also earlier: *Meesia longiseta* known as regionally extinct, germinated from the diaspore bank in 2018 (Ingerpuu & Vellak, 2018). Consulting with IUCN authorities, *M. longiseta* was evaluated then as CR for Estonia.

Nevertheless, we do not consider species emerging from the diaspore bank as solid proof for species occurrence in local flora, since we have searched but not found neither species later from their historical localities. Although we consider *Sphagnum aongstroemii* still as regionally extinct in Estonia, we emphasize that bryophyte diaspore bank is important for conservation applications, and species may emerge from the diaspore bank also for many decades later

if climate and other environmental conditions are suitable (e.g., Callaghan et al., 2022). To accept them as members of current bryoflora, they have to appear naturally. *S. aongstroemii* is LC in Europe, and common in Scandinavia, but not recorded from Latvia and Lithuania.

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REFERENCES

- Callaghan, D. A., During, H., Medina, R., Yang, H. 2022. Long-term survival of bryophytes underground: an investigation of the diaspore bank of *Physcomitrium eurystomum* Sendtn. *Journal of Bryology* 44(3): 208–216. <https://doi.org/10.1080/03736687.2022.2151857>
- Damsholt, K. 2002. Illustrated Flora of Nordic Liverworts and Hornworts. Nordic Bryological Society, Lund.
- Hassel, K., Kyrkjeeide, M.O., Bengtson, F., Meleshko, O., Flatberg, K.I. 2025. Nomenclatural inconsistencies in European species of *Sphagnum* subgen. *Subsecunda* with typification of *Sphagnum denticulatum* Brid. and *S. inundatum* Russow. *Lindbergia* 2025(1). <https://doi.org/10.25227/linbg.027383>
- Hedenäs, L., Reisborg, C., Hallingbäck, T. 2014. Nationalnyckeln till Sveriges flora och fauna. Bladmossor: Skirmossor-baronmossor. Bryophyta: *Hookeria-Anomodon*. ArtDatabanken, SLU. Uppsala.
- Hodgetts, N. & Lockhart, N. 2020. Checklist and country status of European bryophytes – Update 2020. Irish Wildlife Manuals 123.
- Hodgetts, N.G., Söderström, L., Blockeel, T.L., Caspari, S., Ignatov, M.S., Konstantinova, N.A., Lockhart, N., Papp, B., Schröck, C., Sim-Sim, M., Bell, D., Bell, N.E., Blom, H.H., Bruggeman-Nannenga, M.A., Brugués, M., Enroth, J., Flatberg, K.I., Garilleti, R., Hedenäs, L., Holyoak, D.T., Hugonnot, V., Kariyawasam, I., Köckinger, H., Kučera, J., Lara, F. & Porley, R.D. 2020. An annotated checklist of bryophytes of Europe, Macaronesia and Cyprus. *Journal of Bryology* 42(1): 1–116. <https://doi.org/10.1080/03736687.2020.1812875>
- Holyoak, D.T. 2021. European Bryaceae. A guide to the species of the moss family *Bryaceae* in Western & Central Europe and Macaronesia. Pisces Publications.

- Ingerpuu, N., Kalda, A., Kannukene, L., Krall, H., Leis, M., Vellak, K. 1994. Eesti sammalde nimestik. List of the Estonian bryophytes. *Abiks Loodusevaatlejale* 94: 1–175.
- Ingerpuu, N., Vellak, K. 2018. Are viable diaspores valid members of the local bryophyte flora? *Journal of Bryology* 40(2): 193–195. <https://doi.org/10.1080/03736687.2018.1446772>
- Ingerpuu, N., Vellak, K., Ehrlich, L. 2018. Revised red data list of Estonian bryophytes. *Folia Cryptogamica Estonica* 55: 97–104. DOI: <https://doi.org/10.12697/fce.2018.55.10>
- Kupper, T., Vellak, K., Ehrlich, L., Kannukene, L., Leis, M., Ingerpuu, N. 2024. Updates to the species list of Estonian bryophytes. *Folia Cryptogamica Estonica* 61: 35–39. DOI: <https://doi.org/10.12697/fce.2024.61.04>
- Laasimer, L., Talts, S., Varep, E. 1954. Eesti NSV turbasamblad. Tallinn, Eesti Riiklik Kirjastus.
- Lönnell, N., Hassel, K., Goldberg, I., Huttunen, S., Bjarnason, Á. H., Blom, H.H., Hallingbäck, T., Hedenäs, L., Høitomt, T., Pihlaja, K., Prestø, T., Syrjänen, K., Söderström, L., Ulvinen, T., Weibull, H. 2025. An annotated checklist of bryophytes of the Nordic countries. *Lindbergia* 2025(1) <https://doi.org/10.25227/linbg.025337>
- Meleshko, O., Kyrkjeeide, M.O., Petlund, H.T., Flatberg, K.I., Eriksen, L.B., Martin, S.L.F., Hassel, K. 2025. Molecular species delimitation of *Sphagnum* subgenus Subsecunda in Europe. *Botanical Journal of the Linnean Society*: boaf077, <https://doi.org/10.1093/botlinnean/boaf077>
- Vellak, K., Ingerpuu, N., Leis, M., Ehrlich, L. 2015. Annotated checklist of Estonian bryophytes. *Folia Cryptogamica Estonica* 52: 109–127. <https://doi.org/10.12697/fce.2015.52.14>
- Vellak, K., Ingerpuu, N., Karofeld, E. 2024. Eesti turbasamblad. The *Sphagnum* mosses of Estonia. Tartu Ülikooli Kirjastus.
- Vellak, K., Ingerpuu, N., Kupper, T., Ehrlich, L., Leis, M., Kannukene, L. 2023. Checklist of Estonian bryophytes. Eesti sammaltaimede nimestik. https://sisu.ut.ee/wp-content/uploads/sites/207/estonian_bryophytes_list_2023.pdf [Accessed: 20.06.2026].
- Wolski, J.G., Polus, K. 2024. Is the endemic species *Fontinalis dichelymoides* Lindb. not as rare as previously thought in Europe? *Herzogia* 37(2): 169–175. <https://doi.org/10.13158/heia.37.2.2024.169>