MOSS FLORA OF TOKINSKY STANOVIK RANGE (AMUR PROVINCE AND SOUTHERN YAKUTIA; RUSSIA): AN ANNOTATED CHECKLIST

ФЛОРА МХОВ ТОКИНСКОГО СТАНОВИКА (АМУРСКАЯ ОБЛАСТЬ И ЮЖНАЯ ЯКУТИЯ): АННОТИРОВАННЫЙ СПИСОК

SERGEY V. DUDOVI1,2*, VLADIMIR E. FEDOSOVI1,3, ELENA A. IGNATOVI1 & OLGA I. RYABENKO1

Abstract

Data on the moss flora of Tokinsky Stanovik are presented. This is a hard-to-reach and little-studied mountainous area, including a territory of the recently organized Tokinsko-Stanovoy National Park. We collected mosses in 2018–2021. Original field materials supplemented by published data resulted in an annotated check-list of 338 species and one variety; collecting localities, altitudinal distribution and ecology are provided for each species. 145 species are newly recorded for Tokinsky Stanovik. Within the boundaries of the Tokinsko-Stanovoy National Park, 267 species of mosses were revealed. Thirteen species from our list are new for the southern part of the Russian Far East, two are new for Yakutia and 33 species are presented for the first time for the Amur Province.

KEYWORDS: mosses, Tokinsky Stanovik Range, altitude zonation, Far East, biodiversity conservation

INTRODUCTION

The severe nature of the eastern part of the Stanovoy Range – Tokinsky Stanovik Range – was described by soviet writer G.A. Fedoseev in the novels “Death Will Wait for Me” and “The Path of Trials” (Fedoseev, 1976). In the 30s – 50s of 20th century, the writer was the head of geodesic expeditions, during which the first topographic map of the area was created. In 21st century, this mountainous region on the Main Siberian watershed remained inaccessible and relatively untouched by human impact as it was described in the books by Fedoseev.

First collections of mosses were made in this area by O.I. Kuzeneva and N.I. Prokhorov in 1911. Their expedition crossed Stanovoy Range along the Okonon River to the Bolshoe Toko Lake (Fig. 2), describing for the first time the nature of the main watershed and differences in vegetation on its macroslopes (Prokhorov, 1912). Moss specimens collected during the expedition were identified by V.F. Brotherus and S.O. Lindberg; they are kept in LE. The published annotated list of mosses collected during Amur expeditions in 1908-1914 (Brotherus et al., 1916) includes 112 species for the Stanovoy Range and its foothills.

In 1986-1992 K.A. Volotovskij collected mosses on Tokinsky Stanovik. Based on his collections, the annotated check-list for this area was published (Stepanova et al., 1995), which, with later refinements (Ivanova & Ignatov, 1999), includes 112 species for the Stanovoy Range and its foothills.

In 1986-1992 K.A. Volotovskij collected mosses on Tokinsky Stanovik. Based on his collections, the annotated check-list for this area was published (Stepanova et al., 1995), which, with later refinements (Ivanova & Ignatov, 1999), includes 221 species and 8 varieties of mosses. Collections of K.A. Volotovskij comprised several species, such as Encalypta alpina, Hamatocaulis...
lapponicus, and Tetrodontium repandum, occurring there at the edge of their ranges. Ivanova (2010) mentioned that lower (forest and subalpine) belts were better sampled during these expeditions.

In 2018 SD collected mosses during the biodiversity survey specially organized in the course of a legally protected natural area establishment. A hiking route was passed with a reindeer caravan (Fig. 1) from the Ulak-Elga railway (the watershed of the Anachyan and Algoma rivers) along the Ulyagir and Tok Rivers, through the Okonom volcanic plateau, along the Malye and Bolshie Tuksani, Sivaktylyak 1st Rivers to the upper reaches of the Zeya River, then by rafting down the Zeya River (Fig. 2).

On December 20, 2019, a decree of the Government of the Russian Federation was issued on the creation of the Tokinsky Stanovoy National Park on the southern slopes of the Stanovoy Range with an area of 2530 sq. km. In 2020, a study of the biodiversity of the National Park was launched during the expeditions of the Zeya Reserve. In August of this year, OR collected mosses at the Zeya-Tuksani pass (points 32–39). In July 2021, SD visited the Tas-Balagan Pass (points 40–47), and OR studied mosses in August 2021 during rafting down the Zeya River from the mouth of the Sivaktylyak 1st River. In total, in 2018–2021 we collected ca. 1100 moss specimens, including about 500 ones collected above the timberline. Localities of herbarium collections are presented in the Table 1.

STUDY AREA
Tokinsky Stanovik is a highly elevated (up to 2100–2400 m a.s.l.), intensively developing neotectonic block of complex geological structure, it forms the highest part of the Stanovoy Range. The axial part of the range is composed mainly of Archean metamorphic rock: gneisses and schists with interbeds of marbles and calciphyres. The southern macroslope of the ridge is composed mainly of Proterozoic metamorphic rocks: crystalline schists and gneisses. Outcrops of anorthosites, basalts, and tuffs associated with Pleistocene volcanism are encountered (Mikailov et al., 1971). Early Cretaceous and Early Proterozoic granite and granodiorite intrusions are widespread. Modern tectonic movements are still going on with an average annual uplift up to 11 mm, and high seismic activity (Lebedeva et al., 2014).

An important feature of Tokinsky Stanovik is the glacial relief originated in the course of the Pleistocene mountain-valley glaciations (Kornilov, 1962). As a result of glacial activity and erosion, against the background of modern tectonic activity, the alpine-type relief of the ridge was developed. Narrow, ridge-like, often rocky watersheds, steep slopes with scree, an abundance of glacial cirques with lakes on the bottoms, “ram’s foreheads”, well-defined trough valleys and moraines are characteristic.

V.I. Gotvanskij (Schlothgauer et al., 1980) suggested distinguishing three landscape subregions on Tokinsky Stanovik according to the features of the topography and
landscape patterns. The Utuk region occupies the northern part of the ridge with a high-mountainous alpine-type relief with structures composed of gneisses and intrusions of acidic rocks. The relative height of the ridges reaches 1000 m, the absolute height exceeds 2000 m a.s.l. Steep slopes covered with scree, acute ridges of watersheds and glacial landforms are typical here. The Tok-Zeya region is stretched along the southern border of the ridge. The mid-mountain relief is developed here with heights up to 1700–1800 m a.s.l. The summits are mostly flattened. The slopes of the mountains and ridges are steep, but mostly covered by vegetation. The Tok-Tuktsani region is represented by a high volcanic plateau (1100–1400 m). The surface of the plateau is formed of basalts and tuffs, overlain by metamorphic rocks and granitoids. The area is characterized by a flat relief with depressions occupied by lakes.

The climate of the study area is ultracontinental, excessively humid. According to the CHELSA climate model (Karger et al., 2017), the average annual temperature is from −6.5°C in the Zeya River valley at an absolute height of 850 m a.s.l. to −12.0°C at altitudes above 2000 m a.s.l. Average July temperature ranges from +20°C to +14°C. The annual precipitation is 500–750 mm. The area is characterized by the wide distribution of permafrost (Nekrasov & Klimovsky, 1978).
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<td>55°44′46″–55′45″</td>
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<td>55°49′37″–55′46″</td>
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<td>Anonymous stream valley (left tributary of Bolshie Tuksani River upstreams)</td>
<td>55°49′37″–55′46″</td>
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<td>833</td>
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<td>55°44'52&quot;–55°45'19&quot;</td>
<td>130°33'45&quot;–130°34'5&quot;</td>
<td>low shrub tundra, screes, tundra peat bogs</td>
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<td>130°34'9&quot;–130°34'25&quot;</td>
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<td>a saddle between two peaks</td>
<td>55°44'46&quot;–55°44'46&quot;</td>
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<td>130°33'24&quot;–130°33'44&quot;</td>
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<td>55°44'36&quot;</td>
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<td>Tas-Balagan mountain pass</td>
<td>55°44'30&quot;–55°44'4&quot;</td>
<td>130°46'1&quot;–130°46'33&quot;</td>
<td>dwarf-shrub tundra, rock outcrops, tundra peat bogs, snowbeds</td>
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<tr>
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</tbody>
</table>
The first data about the flora and vegetation of the Southwestern Okhotsk region was obtained during the expedition of A. F. Middendorf (Middendorf, 1867). The patterns of vegetation structure of Tokinsky Stanovik were first described by O.I. Kuzeneva and N.I. Prokhorov (Prokhorov, 1914). In the mid-1950s, L.N. Tyulina (1956) published a brief essay of the vegetation, indicated the patterns of altitudinal-belt arrangement, and noted the relationship between vegetation and the geomorphological structure of the territory. A significant contribution to the study of the flora and vegetation of Tokinsky Stanovik was made by S.D. Schlothgauer, who worked there in 1974, 1975, and 1978. Based on collected data, Schlothgauer et al. (1980) gave an overview of the vegetation of Tokinsky Stanovik; Schlothgauer also provided an information on the diversity and structure of plant communities of the Western Okhotsk region in general (Schlothgauer, 1990).

Altitudinal gradient is a primary driver of vegetation diversity in the study area (Schlothgauer, 1990; Isaev & Kuznetsova, 2010). The lower altitudinal belt is a mountain taiga, formed mainly by boreal coniferous forests. Above the treeline, two belts are formed: dwarf pine and dwarf alder thickets and mountain tundra. The latter is often called “golets” in the literature on the Siberian mountains. In view of bioclimatic definition of altitudinal belts of vegetation (Körner et al., 2011) hereafter we refer to these as taiga, subalpine and alpine belts.

**Taiga belt** occurs up to 1200–1300 m a.s.l. Widespread larch forests are formed by Larix gmelinii. Significant areas are occupied by open larch forests with dwarf birch (Betula divaricata). A dwarf-shrub-herb layer is largely composed by Ledum palustre, Vaccinium uliginosum, and V. vitis-idea. Moss cover is often well developed, composed mainly of Pleuroziunm schreberii, Hylcomium splendens, and Dicranum spp. Fruticose lichens (Cladonia spp., Cetraria islandica) are usually abundant. In the upper part of the mountain taiga belt, mainly in the Tok-Zeya landscape region, spruce forests (Picea ajanensis) occur. Herb layer is usually sparse in these forests and consists of Vaccinium vitis-idea, Carex pallica, Linnaea borealis, and Lycopodium annotinum. At the same time, cover of mosses (mostly Hylcomium splendens, Pleuroziunm schreberii and Dicranum spp.) reaches 90%. On rotten logs and trunk bases Iwatsukiella leucotricha, Dicranum montanum, D. fuscescens, Aquilumnium plicatulum, Plagiothecium svalbardense, Sanonia uncinita occur. On the ends of spruce branches Ulota rehmanni often grows.

River valleys are occupied by complexes of valley vegetation up to absolute heights of about 1000 m. On fresh pebble alluvium, pioneer species (Artemisia mongolica, A. borealis, Chamaenerion latifolium, seedlings of poplar and willows) occur. Mosses are represented there by Niphodrichyum panshii, Schistidium platyphillum, etc. At the later stage of succession, valley forests composed of Populus suaveolens and Chosenia arbutifolia form. These communities are the richest in diversity of eiphyte mosses, among which Pylaia polyana, P. condensata, Zygodon sibiricus, Lewinska elegans, and L. sordida are most common. The final stage of successions is represented by larch forests with spruce and birch (Betula platyphillum). Relatively large areas are occupied by auleus glades. Ice often remains there until mid-August. Two main types of vegetation communities occur in such conditions: sedge (Carex drymophilla, C. pallida, C. media) – horsetail (Equisetum variegatum) – moss (Sanonia uncinita) and low-shrub (Salix saxatilis, Vaccinium uliginosum) communities. Open, boggy larch forests are widely distributed on river terraces in conditions of close permafrost.

**Subalpine belt** occurs at altitudes 1200–1500 m a.s.l. Open larch woodlands and crooked birch forests of Betula lanata occur near the timberland. Large areas on slopes are occupied by siberian dwarf pine (Pinus pumi-la) and dwarf alder (Alnus alnobetula subsp. fruticosa) thicket. These communities do not form a continuous band, and vary in herb and moss layer composition. Shrub willow communities (Salix krylovi, S. hastata, S. divaricata) are formed in stream valleys. In the lower parts of the slopes, communities of dwarf birch often occur among dwarf pine thickets. These communities occupy especially large areas in the Tok-Tuksani geomorphological region. A characteristic feature of the belt is the presence of meadows dominated by Festuca altaica, Helictotrichon dahuricum, Geranium krylovii, Veratr um lobelianum, Dasiphora fruticosa, and Viola kusnezowiana; such subalpine meadows are widespread in the Tok-Tuksani geomorphological region neighboring with peculiar open larch woodlands with a diverse forb layer (Fig. 3B).

In **alpine belt** (1400–2200 m), mountain tundra communities dominate. Composition of these communities depends on the underlying rocks and the thickness of the snow cover. Dwarf-shrub tundra dominated by Dryas ajanensis, Rhododendron redowskianum, Salix berberifolia, S. phlebophylla, and Diasenps sobvata are widespread. Moss layer is represented by Hylcomium splendens, Abietinella abietina, Rhytidium rugosum, Dicranum bonjeanii, D. elongatum, Hylcomiastra pyrenaicum, Aulacomium turgidum, and Racotriticum lanuginosum.

In snowbeds, tundras composed of Phyllodode caerula, Rhododendron aureum, Salix turczaninovii, as well as nival meadows with Carex podocarpa, Gentiana algida, Callianthemum isopyroides, etc. occur. In such conditions, Dicranum bonjeanii, D. acutifolium, Sanonia uncinita, Flexitrichum flexicaule, Conostomum tetragonum, and Oligotrichum falcatum are often found.

On the summit surfaces, mainly on acidic rocks,

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1 Names of vascular plants follow The World Flora online database (http://www.worldfloraonline.org/)
Fig. 3. Main habitats of mosses on the Tokinsky Stanovik Range. A: dwarf-shrub tundra and rock outcrops on the watershed between the Bolshie Tukuksi and Sylaktyliak-1 Rivers; B: subalpine meadows on volcanic plateau in upper course of the Malyj Okonon River valley; C: wet outcrops in the Oyur River valley; D: scree in the Solokit River valley; E: spruce forest in the Sylaktyliak-1 River headwaters; F: larch forest with dwarf-shrubs and lichens in the Ulyagir River valley; G: base-rich outcrops in the Tok River valley; H: aufeus glades in Sylaktyliak-1 River floodplain. Photos: S.V. Dudov, 2018.
shrub-lichen tundras with *Rhododendron edgeworthianum*, *Salix phlebophylla*, *S. nasarovii*, *Alectoria ochroleuca*, *Cladonia stellaris* and *Equisetum variegatum* in the aufeis glade.

Anatomobryum concinnatum (Spruce) Lindb. – Stepanova et al., 1995; [740–980 (!1700) m] 5, 29, 30: in crevices of base-rich rock outcrops; on wet rock block in dwarf-shrub lichen tundra.


*Aquilonium plicatum* (Lindb.) Hedenäs, Schlesak & D. Quandt – Stepanova et al., 1995; [680–1600 m] 12, 28, 49, 50: on fallen logs, trunks of spruce, larch, siberian dwarf pine and stone birch.


*A. fulvella* (Dicks.) Bruch, Schimp. & W. Gümbel – [1600 m] 27: on boulders of rock field with dwarf shrub tundra, on shaded rocks.


*A. rhizomatum* (Hedw.) Schwägr. – Stepanova et al., 1995; [1400–1500 m] 10, 26, 32: on soil in bogs, dwarf birch communities and subalpine meadows.

*A. rupestris* (Hedw.) Schwägr. – Stepanova et al., 1995; [1400–1800 m] 23, 24, 27: on rock outcrops, soil in dwarf-shrub and forb tundras, at tree bases in forests; widely distributed in the study area.

*A. salicetorum* (Hedw.) Schwägr. – Stepanova et al., 1995; [1400–1800 m] 23, 24, 27: on rock outcrops, soil in dwarf-shrub and forb tundras, at tree bases in forests; widely distributed in the study area.

*A. salicetorum* var. *rupestris* (Hedw.) Schwägr. – Stepanova et al., 1995; [1400–1800 m] 23, 24, 27: on rock outcrops, soil in dwarf-shrub and forb tundras, at tree bases in forests; widely distributed in the study area.


*A. obovata* Thed. – Brotherus et al., 1916: [1800 m] mountain pass from Bolschije Tuksani to Mulam.

*Anoectangium thomsonii* Mitt. – [800–1230 m] 25, 26, 28, 29: on walls and in crevices of rock outcrops (mainly base-rich), on soil in community with *Salix saxatilis* and *Equisetum variegatum* in the aufeis glade.


*A. obovata* Thed. – Brotherus et al., 1916: [1800 m] mountain pass from Bolschije Tuksani to Mulam.

*Anoectangium thomsonii* Mitt. – [800–1230 m] 25, 26, 28, 29: on walls and in crevices of rock outcrops (mainly base-rich), on soil in community with *Salix saxatilis* and *Equisetum variegatum* in the aufeis glade.


*Aquilonium plicatum* (Lindb.) Hedenäs, Schlesak & D. Quandt – Stepanova et al., 1995; [680–1600 m] 12, 28, 49, 50: on fallen logs, trunks of spruce, larch, siberian dwarf pine and stone birch.


*Aquilonium plicatum* (Lindb.) Hedenäs, Schlesak & D. Quandt – Stepanova et al., 1995; [680–1600 m] 12, 28, 49, 50: on fallen logs, trunks of spruce, larch, siberian dwarf pine and stone birch.


*Aquilonium plicatum* (Lindb.) Hedenäs, Schlesak & D. Quandt – Stepanova et al., 1995; [680–1600 m] 12, 28, 49, 50: on fallen logs, trunks of spruce, larch, siberian dwarf pine and stone birch.

B. mildeanum (Schimp.) Schimp. ex Milde – Stepanova et al., 1995: taiga belt: on soil in birch (Betula lanata) forest.
B. rotaecum De Not. – [619 m] 51: on trunk bases in spruce forest.

**B. turgidum** (Hartm.) Kindb. – Stepanova et al., 1995: [1621 m] 43: on rock outcrops in crevices, on poplar.
**Cinclidium arcticum** (Bruch, Schimp. & W. Gümbl) Schimp. – (SASY) [1469 m] 40: on moist sedge-willow tundra.

**C. stygium** Sw. – Stepanova et al., 1995; [970–1707 m] 30, 41: in stream bed in the Syvaktliak River valley, on moist soil near ground water discharge in tundra belt, on rock outcrops and mossy larch forests.

**C. subrotundum** Lindb. – [1330 m] 40: in moist sedge-willow tundra.


*Conostomum tetragonum* (Hedw.) Lindb. – Stepanova et al., 1995; [1300–1600 m] 17, 20, 22, 27, 40: on fine soil, wet rocks and boulders near watercourses and in snowbeds in taiga, subalpine and alpine belts.


*C. subrotundum* Lindb. – Stepanova et al., 1995; taiga belt: on base-rich rock outcrops.

*B. rotaecum* (Hartm.) Kindb. – Stepanova et al., 1995; [800–1707 m] 32, 41: on base-rich rock outcrops, on soils in the aufeis glade community, on pebble alluvium.

*C. hymenophyllum* (Schimp.) Kindb. – Stepanova et al., 1995; [1000–1763 m] 5, 23, 27, 29, 30, 40, 42: on fine soil banks near watercourses, on boulders and rocks in all altitude belts.

*C.itenella* (Schimp.) Limpr. – Stepanova et al., 1995; [1000–1300 m] 7, 20: on boulder, in crevices of acidic rock outcrops in all altitude belts.

*C. subrotundum* Lindb. – Stepanova et al., 1995; [800–1707 m] 32, 41: on base-rich rock outcrops, on moist soil near ground water discharge in tundra belt.

*C. hymenophyllum* (Bruch & Schimp.) Holmen – [960–1200 m] 15: on soil, fallen logs, rocks, burnt wood, and cliffs of various composition.


*C. stellatum* (Hedw.) Schimp. – (SASY) [1469 m] 40: on moist sedge-willow tundra.

*C. stellatum* (Hedw.) Schimp. – (SASY) [1469–1525 m] 40: on minerotrophic tundra peatbogs.

Ceratodon purpureus (Hedw.) Brid. – Stepanova et al., 1995; [1330 m] 15: on soil, fallen logs, rocks, burnt wood, and cliffs of various composition.
D. angustum Lindb. – Stepanova et al., 1995; [1400 m] 10: on soil in the dwarf birch community in the Inarogda River upstreams, in low shrub tundra.

D. bardunovii Tubanova & Ignatova – [800–1500 m] 11, 30, 40, 48: among boulders in rock fields, on soil and on trunk bases in open larch forests, on soil in forb meadow in subalpine belt.

D. bigenicans De Not. – [1450–2030 m] 10, 22, 27, 32, 40, 45, 46, 47: on soil in various tundra communities, in forb communities in snowbeds and rock fields in alpine belt, on trunk bases of larches in subalpine belt.

D. elongatum Schleich. ex Schwägr. – Stepanova et al., 1995; [1000–1600 m] 1, 2, 3, 8, 9, 11, 12, 20, 21, 27, 31, 40, 43: on soil, on rotten wood and trunk bases of larches in larch woodlands, on soil in tundra and dwarf pine thickets, among boulders of rock fields, in crevices of rock outcrops.

D. flexicaule Hedw. – [1100 m] 8: on boulder in rock field.


D. flagellare Brid. – Stepanova et al., 1995; [700–1400 m] 9, 10, 30, 49, 50: on rotten wood and on trunk bases of conifers.

D. fuscescens Turn. – Stepanova et al., 1995; [680–1500 m] 1, 9, 10, 12, 26, 30, 32, 40, 49, 50: on soil, fallen logs, tree trunk bases in forests of different types, in rock fields and outcrops, in sedge-willow tundra.


D. leioneuron Kindb. – Stepanova et al., 1995; [1470–1550 m] 40, 44: in moist sedge-willow tundra on base-rich soil.

D. majus var. orthophyllum A. Braun ex Milde – [1600 m] 22: subalpine meadow with shrubs on cirque floor, on soil.

D. montanum Hedw. – [680–1500 m] 12, 48, 50: on trunk bases of conifers, on rotten log.

D. pacificum Ignatova & Fedosov – [1500 m] 10, 12: on trunk bases of conifers and rotten logs in open larch and larch-spruce forests in the Inarogda River upstreams.

D. polysetum Sw. – [620–1500 m] 12, 50, 51: on soil in larch and spruce forests, in siberian dwarf pine thickets.

D. schlitjakovi Ignatova & Tubanova – [1000–1600 m] 1, 4, 11, 19, 27: on trunk bases of conifers, on boulders in rock fields, on fine soil in tundra, on rock outcrops and pillars throughout the altitudinal range.

D. scoparium Hedw. – Stepanova et al., 1995; [1400 m] 27: on birch trunk bases in crooked Betula lanata forest.

D. spadicum J.E. Zetterst. – Stepanova et al., 1995; [800–1500 m] 11, 16, 16, 20, 27, 28, 32, 40, 47: among boulders in rock fields, on rock outcrops, on soil in tundra and on trunk bases in spruce forests.

D. undulatum Schrad. ex Brid. – Stepanova et al., 1995; [700–1300 m] 1, 3, 9, 48, 49, 50: on soil, trunk bases and rotten wood in larch forests.


D. inclinatum (Hedw.) Bruch & Schimp. – Stepanova et al., 1995; taiga belt: wet rock crevices, wet marble rock outcrops.

D. inclinatum (Hedw.) Bruch & Schimp. – Stepanova et al., 1995; [1400 m] 17: among boulders in rock fields.


D. linearis Hedw. – Stepanova et al., 1995; [800–1400 m] 14, 29: on rock outcrops and on sandy alluvium.


the revision of the genus, additional herbarium material are required to confirm the presence on this species
Funaria hygrometrica Hedw. – Stepanova et al., 1995; [1000–1800 m] 1, 36; on fine soil near small pond near the “Ulak–Elga” railroad and on natural salt lick in tundra belt.
*Grimmia donniana* (Müll. Hal.) Ando – [1490 m] 40: on boulders in rock fields, on rock outcrops. The most frequent species of the genus in our territory.
G. fusilis (Schwägr.) Bruch, Schimp. & W. Gümbl – [800–1900 m] 29, 47; on base-rich rock outcrops in Zeya River valley, on stones in alpine belt.
G. incurvatum Schwägr. – [1600 m] 27: on rock outcrops in watershed between Bolsheie Tuksenki and Sylaktyliakh river basins.
G. longirostris Hook. – [1000–1600 m] 4, 7, 14, 16, 19, 25, 27, 40, 45, 49; on boulders and rock outcrops. Widely distributed in the study area.
G. reflexidens Müll. Hal. – [1800 m] 23, 42; on boulders in dwarf shrub tundra.
G. torquata Drumm. – [1600 m] 27: on rock outcrops in the watershed area among the Bolsheie Tuksenki and Sylaktyliakh river basins.
G. unicolor Hook. – [1850 m] 45: on rock outcrops in alpine belt.
Gymnostomum aeruginosum Sm. – [800–1000 m] 5, 29: in crevices of base-rich rock outcrops in Tok and Zeya river valleys.
Habitaculatus lapponicus (Norrl.) Hedenäs – Stepanova et al., 1995; taiga and subalpine belts: on boulders in dwarf-shrub moss tundra.
H. vernicosus (Mitt.) Hedenäs – Stepanova et al., 1995; [1000–1470 m] 40: in minerotrophic tundra bog; on soil in larch forest and on base-rich outcrops.
Haplomhenium triste (Ces.) Kindb. – [800 m] 29: on base-rich boulder in Zeya River valley.
Homalia trichomanoides (Hedw.) Brand. – Stepanova et al., 1995; [800–1000 m] 4, 29: in shaded niches of cliffs and rock outcrops.
Homomallium connexum (Cardot) Broth. – [1000 m] 4; in crevices of rock outcrops in Tok River valley.
H. incurvatum (Schrad. ex Brand.) Loeske – Stepanova et al., 1995; [800 m] 31: on base-rich cliffs in Zeya River valley.
Hygrohypnella ochracea (Turner ex Wilson) Ignatov & Ignatova – Stepanova et al., 1995; [950–1700 m] 28: on temporary stream alluvium in the Sylaktyliakh–1 River valley; on wet outcrops, on boulders in water.
H. polaris (Lindb.) Ignatov & Ignatova – Stepanova et al., 1995; [750–1500 m] 7, 12, 13, 14, 21, 31, 32, 38: on rocks along river banks and in river brook beds.
Hygrohypnum laridum (Hedw.) Jenn. – Stepanova et al., 1995; [750–1700 m] 33; on pebbly alluvium of Zeya River; also on wet calcareous outcrops, on boulders in stream.
Hylocomiadelphus triquetrus (Hedw.) Ochyra & Stebel – Stepanova et al., 1995; [800–1660 m] 28, 43, 48; on rotten log in poplar-birch–larch forest, on soil in forb dwarf-shrub tundra.
Hylomicrostoma pyrenaicum (Spruce) M. Fleisch. – Stepanova et al., 1995; [1500–1800 m] 22, 23, 43, 48; on outcrops in subalpine meadow with shrubs on cirque floor, in dwarf-shrub tundra.
Hymelomena splendens (Hedw.) Schimp. – Stepanova et al., 1995; [1420 m] 10: on soil, tree trunks and fallen logs in forests, dwarf pine thickets and erimk communities, on soil in tundra. Forms extensive moss cover in taiga forests.
Hymenostylium recurvirostrum (Hedw.) Dixon – [980–1515 m] 5, 48; on base-rich rock outcrops.
Hypnum cupressiforme Hedw. – Stepanova et al., 1995; [500–1800 m] 4, 5, 12, 20, 27, 29, 30, 40, 41, 43, 48; on rock pillars, rock outcrops, on trunk bases of larches, on soil in dwarf-shrub tundra. Three specimens we determined as Hypnum cupressiforme var. subjulacea Molo (27, 29, 30).
H. saitoi Ando – Ivanova & Ignatov, 1999; [1400–1720 m] 11, 17, 27, 40; on boulders in tundra and in siberian dwarf pine thickets.
Isopterygiella alpicola (Lindb. & Arnell) Ignatov & Ignatova – Stepanova et al., 1995; [1400 m] 14: in cliff crevices in the valley of tributary of Malyi Okonon River.
Isopterygiopsis catagonioides (Broth.) Ignatov & Ignatova – Ivanova & Ignatov, 1999 (as I. muelleriana); [1000–1800 m] 4, 7, 16, 20, 21, 27, 28, 31, 32, 36: on soil in dwarf-shrub tundra, on boulders, rock outcrops and cliffs throughout altitudinal range.
Iwatsukiella leucotricha (Mitt.) W.R. Buck & H.A. Crum – Ivanova & Ignatov, 1999; [800–1300 m] 20, 25, 27, 28, 32, 48: on tree branches and trunks, more frequently on spruce, on rock walls and boulders.
Jochenia pallescens (Hedw.) Hedenäs, Schlesak & D. Quandt – Stepanova et al., 1995; [800 m] 48: on boulder in larch forest; on tree bases.
Leptobryum pyriforme (Hedw.) Wilson – Stepanova et al., 1995; [800 m] 48: on trunk base of larch, also is specified to base-rich rock outcrops and burnout.
Leptodictyum riparium (Hedw.) Warnst. – Stepanova et al., 1995; taiga belt: birch (Betula lanata) forest, willow thickets.
Leskea polycarpa Hedw. – Stepanova et al., 1995; [1400–1720 m] 10, 17, 44, 48: on tussock near lake shore, in mossy open...
Oncophorus vivens (Hedw.) Brid. – Stepanova et al., 1995; [1469 m] 40: in sedge–willow tundra.

Orthothecium retroflexum Ignatova & Ignatov – Stepanova et al., 1995; [1469–1900 m] 40, 41, 43, 46: in dwarf-shrub tundra on base-rich soil, on wet rock outcrops.

O. strictum Lorentz – Stepanova et al., 1995; taiga and alpine belts: base-rich outcrops, willow–moss community in snowbed.

Paludella squarrosa (Hedw.) Brid. – Stepanova et al., 1995; [970–1530 m] 30, 40: in temporary stream in boggy larch forest, in tundra peat bog.

P. fontana (Hedw.) Brid. – Stepanova et al., 1995; [1050–1700 m] 1: on shore of the pool near “Ulak–Elga” railroad, also collected by K.A. Volotovskij on shaded wet outcrops, on wet sandy alluvium and in dwarf-shrub tundra.

P. tomentella Molendo – Brothers et al., 1916; [1000–1700 m] 29, 41: on soil in community with Salix saxatilis and Equisetum variegatum on the afeide glacier, on soil kept moist by base-rich seepage water in alpine belt.

Plagiomnium acutum (Lindb.) T.J. Kop. – [1400 m] 25: at the base of poplar in the Bolshtye Tsukanski River floodplain.

P. confertidens (Lindb. & Arnell) T.J. Kop. – [1050–1400 m] 24, 27: at base of alder, on rotten stumps and logs in river floodplains.

P. curvatum (Lindb.) Schljakov – [800 m] 48: on soil in floodplain forest.

P. cuspidatum (Hedw.) T.J. Kop. – [800 m] 29: on rock near river bank.

P. ellipticum (Brid.) T.J. Kop. – Stepanova et al., 1995; [600–740 m] 50, 51: on soil in larch and spruce floodplain forests, crooked birch forests, dwarf-shrub moss tundra.

P. medium (Bruch & Schimp.) T.J. Kop. – Stepanova et al., 1995; taiga belt: birch (Betula lanata) forests, base-rich rock outcrops.


Plagiothecium cymbiforme (Lindb.) Z. Iwats. et al. – [800–1700 m] 4, 32, 50: on boulders on rock field.

P. denticulatum (Hedw.) Schimp. – Stepanova et al., 1995; [1200–1500 m] 12, 16, 20, 39: on wet dead wood in stream, on fine soil among boulders on rock field, in shaded cliff niche.

P. svalbardense (Brid.) Frisvoll – Stepanova et al., 1995 (as P. lae- etum); [680–1500 m] 4, 8, 12, 20, 28, 32, 48–50: on shaded niches on outcrops, among boulders on rock field, on fallen roots.

Platydictya jungermannioides (Br.) H.A. Crum – Stepanova et al., 1995; taiga belt: on rotten logs in spruce forest, on base-rich outcrops, on wet rocks in canyon.

Platygyrium repens (Brid.) H.A. Crum – [740–1000 m] 4, 32, 50: on rock outcrops, boulders, rarer on fallen logs and trunk bases.

Platyphyllum norvegicum (Schimp.) Ochyra – [530 m] 34: on rocky bank of Zeya River.

Pluviozium schreberi (Br.) Mitt. – Stepanova et al., 1995; [1500 m] 12: on soil in dwarf shrub tundra, in low shrub tundra, in siberian dwarf pine thikets and crooked birch forests, in coniferous and small-leaved forests.

Pogonatum dentatum (Brid.) Brid. – Stepanova et al., 1995; [1000–1500 m] 2, 11, 12, 17: on barren soil, cliffs covered...
by soil in river floodplains, among boulders on rock fields. *P. urnigerum* (Hedw.) P. Beauv. – Stepanova et al., 1995; [1050–1750 m] 6, 22, 27, 40, 43: on sandy alluvium in river floodplains, on sandy and gravel soil in tundra communities.


*P. atropurpurea* (Wahlenb. ex Fuernm.) Lindb. – Stepanova et al., 1995; alpine meadow in snowbed.


*P. camptotricha* (Renaudl & Cardot) Broth. – [1300 m] 16: among boulders in rock field.

*P. cruda* (Hedw.) Lindb. – Stepanova et al., 1995; [800–1850 m] 4, 25, 26, 31, 41, 48: in shaded wet niches of rock outcrops, on cliffs, in cryogenic crevices in tundra.

*P. crudioides* (Sull. & Lesq.) Broth. – Stepanova et al., 1995; [740–1600 m] 27, 33, 35: on shaded acidic rock outcrops, on pebble alluvium.


*P. elongata* Hedw. – [530–1000 m] 7, 34: in crevices of shaded rock outcrops.

*P. filum* (Schimp.) Märtensson – [740–1600 m] 1, 21, 33: on fine soil on river and stream banks, cliffs covered by fine soil.

*P. longicollis* (Hedw.) Lindb. – Stepanova et al., 1995; [850–1400 m] 5, 7, 21, 28, 31: on shaded rock outcrops.

*P. ludwigii* (Spreng. ex Schwägr.) Broth. – [1590 m] 32: on fine soil in dry stream bed.

*P. nutans* (Hedw.) Lindb. – Stepanova et al., 1995; [750–1600 m] 1, 12, 22, 35, 48, 49: on fallen logs, trunk bases, soil, and rocks in forests.

*P. tundrae* A.J. Shaw – [1000 m] 1: on fine soil on stream bank.

*Polytrichastrum alpinum* (Hedw.) G.L. Sm. – Stepanova et al., 1995; [1050–1600 m] 7, 11, 27, 32, 41: on wet shaded cliffs, among blocks on rock fields, on soil in tundra communities.

*Polytrichum commune* (Hedw.) Kindb. – Stepanova et al., 1995; [1300–1500 m] 1, 10, 26: on soil in subalpine meadows, ernik communities, bogs and forests, rarely on fallen logs and trunk bases of trees.


*P. jensenii* I. Hagen – Stepanova et al., 1995; [1000 m] 1: on soil in open larch forest in the Anachan River valley.

*P. juniperinum* Hedw. Stepanova et al., 1995; subalpine and alpine belts: snowbeds, subalpine meadows, dwarf-shrub and sedge–cottongrass tundras.

*P. piliferum* Hedw. – Stepanova et al., 1995; [1600–1700 m] 27, 32: on soil in dwarf shrub tundra and snowbed communities.

*P. strictum* Brid. – Stepanova et al., 1995; [800–1650 m] 1, 11, 48: on soil in mountain tundras, in dwarf pine thickets and ernik communities, open larch forests, among blocks in rock fields.

*P. svartzi* Hartm. – [1000–1350 m] 1, 13: on silt deposits of a temporary pool near the “Ulak–Elga” railroad and the Dugdii Lake, on soil in floodplain willow communities.

*Pseudobryum cinclidioides* (Huebener) T.J. Kop. – Brotherus et al., 1916; [11350 m] 13: on mossy shore of creek.

*Pseudophygrohypnum fauriei* (Cardot) Kučera & Ignatov – [1020–1320 m] 1, 16: on the ernik base in larch forest, on rock outcrops.

*P. subarcticum* Fedosov & Ignatova × *neglectum* Fedosov & Ignatova (see Fedosov et al., 2022) – [1150 m] 39: on rock outcrops.

*Pseudoleskea papillosa* (Lindb.) Kindb. – [1526 m] 34: on boulder in subalpine meadow.

*P. leucostictum* Fedosov & Ignatova – Stepanova et al., 1995; subalpine belt: snowbed community near stream.

*Psilomelania cavifolia* (Wilson) I. Hagen – Stepanova et al., 1995; subalpine and alpine belts: on wet fine soil on stream banks and on rock terraces, on snowbeds.

*Ptilium crispa-castrensis* (Hedw.) De Not. – Stepanova et al., 1995; [900 m] 32: on soil under tree trunks and between rocks, in dwarf pine thickets and erniks, in cooked birch forests, in larch and spruce forests and in bogs.


*P. polyantha* (Hedw.) Bruch, Schimp. & W. Gämbel – Stepanova et al., 1995; [800–1400 m] 18, 25, 30, 32, 50: on trunks of birch, alder, and poplar in valley forests.

*Pyrusella tenuirostris* (Bruch & Schimp. ex Sull.) W.R. Buck – [900 m] 30: on trunks of birch, aspen, and larch, on fallen logs.

*Racemnium lanuginosum* (Hedw.) Brid. – Stepanova et al., 1995; [1100–2012 m] 10, 11, 16, 17, 19, 22, 27, 32, 40, 41, 45, 47: on sandy alluvium, on boulders in rock fields, on rock pillars, in dwarf shrub tundra and forb communities in snowbeds.

*Rhabdoweisia crispata* (Dicks. ex With.) Lindb. – [530–1600 m] 2, 4, 20, 26, 27, 32, 33: in cliff niches and crevices, on rocks.

*Rhizomnium pseudopunctatum* (Bruch & Schimp.) T.J. Kop. – Stepanova et al., 1995; [1400–1800 m] 17, 27, 43: on rock fields in forest and alpine belts, on gravel soil in dwarf-shrub tundra.

*Rhodobryum ontoriense* (Kindb.) Kindb. – [1400 m] 28: on rotten stub in spruce forest in the Syvaktylaik river upstreams.

*Rhytidium rugosum* (Hedw.) Lindb. – Stepanova et al., 1995; [1600 m] 27: on rocks, on soil in dwarf shrub tundra and communities of subalpine belt, often abundant, on tree trunk bases, rocky deposits, and cliffs.


*Saelania glaucescens* (Hedw.) Broth. – Stepanova et al., 1995; [1250–1600 m] 16, 20, 21, 27, 33: on side of hidlock in dwarf shrub tundra, on bare soil among boulders on rock fields, in shaded cliff niches.

*S. uncinata* (Hedw.) Loeske – Stepanova et al., 1995; [1330–1600 m] 12, 15, 27, 32, 34, 48: on soil in mountain tundra, forb communities in snowbeds, subalpine meadows, dwarf pine thickets; on fallen logs, trunk bases of trees, and rocks in forests of various types. Most frequent in floodplains.

*Samolus valeriu* (Hedw.) Lindb. – Stepanova et al., 1995; [1000–1500 m] 1, 2, 10, 13, 15: in temporary watercourses and hollows on bogs and boggy forests, on soil in shrub communities in floodplains.

*S. pseudosarmentosum* (Cardot & Thériot) Hedenäs – [800–1600 m] 27, 44: on ground water discharge place among rock outcrops, on wet depression in tundra peat-bog.
S. sarmentosum (Wahlenb.) Tuom. & T.J. Kop. – Stepanova et al., 1995; [1000–1780 m] 1, 7, 17, 29, 32, 34, 36: on gravel and rocks in rivers and brooks beds; wet boulders and in tundra sedge-moss bog.

S. trichophyllum (Warnst.) Hedenäs – [1590 m] 32: on rock on stream bed.

Schistidium agassizii Sull. & Lesq. – Stepanova et al., 1995; [1420–1590 m] 26, 32: on rock in the Bolshtye Tuksani River and its tributaries upstreams.


S. papillosum Culm. – [1100–1470 m] 14, 19, 40: in crevices of wet rock outcrops, on boulders in water of streams and wet tundra.

S. platyphyllum (Mitt.) Pers. – [730–976 m] 4, 30, 31: on rock outcrops near streams, on pebble alluvium.


S. rivulare (Brod.) Podp. – Stepanova et al., 1995; taiga belt: on wet boulders on a stream bed.


Sclerohypnum curtum (Lindb.) Ignatov – [680 m] 50: on birch in floodplain forest.

S. latifolium (Kindb.) Ignatov & Huttunen – Stepanova et al., 1995; taiga belt: spruce forest.

S. plumosum (Hedw.) Ignatov & Huttunen – [1150–1320 m] 16, 20, 29, 50: on soil and rocks in rock fields, on rock outcrops, on pebble alluvium.

S. reflexum (Starke) Ignatov & Huttunen – Stepanova et al., 1995; subalpine belt: subalpine forb meadow.

Scorpidium cossonii (Schimp.) Hedenäs – [1470 m] 40: in mere in mountain tundra.

S. revolvens (Sw. ex anon.) Rubers – Stepanova et al., 1995; [850–1500 m] 29, 40: in shallow water of lake with sedge–Sphagnum floating mat, in mere in mountain tundra, in forb community an anfeus glade.

S. scirpiodes (Hedw.) Limpr. – Stepanova et al., 1995; [850–1470 m] 29, 40: in shallow water of lake with sedge–Sphagnum floating mat, in mere in mountain tundra; in hollows in bog.

Scolotria pulcherrima Broth. – [1050 m] 6: on boulder in the Tok River bed.

Seligeria polaris Berggr. Stepanova et al., 1995; taiga belt: shaded wet rock outcrops.

S. tristichoides Kindb. – [800 m] 29: on base-rich cliff.


S. andersonianum R. E. Andrus – [1040–1600 m] 1, 27: on open boggy larch woodland, on ground water discharge place in mountain tundra.

S. angustifolium (C.E.O. Jensen ex Russow) C.E.O. Jensen – Stepanova et al., 1995; [750–1500 m] 1, 10, 12, 26, 48, 49: in boggy larch forests, subalpine meadows and ernik communities.

S. annulatum Warnst. – [1400 m] 9: on floating Sphagnum mat on a lake shore in the Inarogda River upstreams, with S. perlfoliatum.

S. aongstroemii Hartm. – Stepanova et al., 1995; [800–1720 m] 11, 17, 44, 48: on shore of pool in mountain tundra, on soil among boulders in rock field.


S. beringei A.J. Shaw, R.E. Andrus & B. Shaw – [1000–1500 m] 1, 10, 26: near lakes at water edge, in ernik and subalpine meadow communities.

S. capillifolium (Ehrh.) Hedw. – Brotherus et al., 1916; [1400–1530 m] 10, 12, 23, 40: in mossy tundra, ernik community, open larch forest.

S. compactum Lam. & DC. – Stepanova et al., 1995; [1400–1600 m] 10, 27, 44: in dwarf shrub tundra and ernik community.

S. divinum Flatberg & Hassel – Stepanova et al., 1995 (as S. magellanicum); [750–1000 m] 1, 32, 48: in peat bogs, in boggy larch forest.

S. fallax (Klinggr.) Klinggr. – Stepanova et al., 1995; [740 m] 50: in mossy larch forest.


S. flexuosus Dozy & Molk. – Stepanova et al., 1995; taiga belt, in spruce forest.

S. fuscom (Schimp.) H. Klinggr. – Stepanova et al., 1995; [800–1500 m] 1, 12, 32, 48: in bogs and boggy larch forests.

S. gergensohnii Russow – Stepanova et al., 1995; [800–1650 m] 1, 12, 16, 20, 22, 43, 48–51: in dwarf pine thickets and ernik communities, in bogs, spruce and larch forests.

S. imbricatum Hornsch. ex Russow – [1000–1320 m] 1, 18: in willow and dwarf shrub community in anfeus glades in valleys.


S. lindbergii Schimp. – Stepanova et al., 1995; [800–1420 m] 1, 10, 48: in inundated lake shores, in waterlogged depression.

S. obtusum Warnst. – Stepanova et al., 1995; [1300 m] 15: in lake as floating mats.


S. platyphyllum (Lindb. ex Braithw.) Sull. ex Warnst. Stepanova et al., 1995; all belts: in rock crevices with seeping water.


S. riparium Ängstr. – Stepanova et al., 1995; [1000–1100 m] 1: in waterlogged depressions in bogs and boggy larch forests.


S. russowii Warnst. – Stepanova et al., 1995; [1500 m] 12: on a stream bank in open spruce–larch forest.

S. squarrosum Crome – Stepanova et al., 1995; [1500–1300 m] 1, 15: on wet banks of brooks, in lake floating mats.


S. subnitens Russow & Warnst. – (Brotherus et al., 1916) [1500 m] 43: on tundra peat bog.

S. teres (Schimp.) Ängstr. – Stepanova et al., 1995; [1000–1800 m] 1, 15, 22, 27, 40, 43, 44: in waterlogged depression in mountain tundra, on wet banks of brooks.


S. tundracea Flatberg – [1000–1600 m] 1, 2, 27, 30: in ground water discharge places under rock outcrops in alpine belt, on alluvium along brooks, on soil in poplar forest.
**Moss flora of Tokinsky Stanovik Range**

We do not include some species previously reported by Brothers et al. (1916), Stepanova et al. (1995) and Ivanova & Ignatov (1999) in the present check-list due to some moss genera were revised, resulting in considerably narrower species concepts, which made it impossible to interpret unconfirmed literature data. The list of erroneous or doubtful records thereby includes Brachythecium salebrosum (F. Weber & D. Mohr) Schimp., Campylium hispidulum (Br.) Mitt, Codriophorus acicularis (Hedw.) P. Beauv., Cynodontium polycarpum (Hedw.) Schimp., Dicranum brevifolium (Lindb.) Lindb., D. drummondii Müll. Hal., D. muehlenbeckii Bruch, Schimp. & W. Günbel, D. spurius Hedw., Didymodon rigidulus Hedw., D. vinealis var. flaccidus (Bruch, Schimp. & W. Günbel) R.H. Zander, Drepanocladius trifarius (F. Weber & D. Mohr) Broth. ex Paris, Grimmia ovalis (Hedw.) Lindb., Lewinska speciosa Nees, Philonotis caespitosa Jur., Pohlia obtusifolia (Br.) L. Koch., Schistidium apocarpum (Hedw.) Bruch, Schimp. & W. Günbel, S. strictum (Turn.) Loeske ex Müll., Stereodon callichrous (Br.) Lindb., Hedwigia ciliata (Hedw.) P. Beauv., Drepanocladius sendleri (Schimp. ex Müll. Hal.) Warnst. We also do not include in the list our specimens of Bryum which were identified only at the genus level (mainly without sporophytes). They were collected at altitudes from 800 to 1800 m in many localities (1, 2, 5, 11, 15, 17, 20, 23, 27, 29, 32, 39, 46), in various ecotopes: on fine soil, pebbly alluvium, boulders and rock outcrops. **NEW AND REMARKABLE MOSS RECORDS**

The check-list includes 338 species and one variety of mosses. 197 species from it were previously listed for Tokinsky Stanovik, and 145 species are recorded for the first time for the moss flora of Stanovoy Range. Within the boundaries of the Tokinsko-Stanovoy National Park, we noted 267 species of mosses.
Thirteen species in the check-list above are new for the southern part of Russian Far East as a whole; two species were first found in the Yakutia; 33 species are newly reported here for the Amur Province.

A remarkable contribution to the moss flora of the Amur Province and the southern part of Russian Far East represent arctic-alpine or northern, predominantly calci-/basi-phylous species which are found here on the southern extremity of their distribution; all species newly recorded for the southern part of Russian Far East belong to this group. Typically, these species are widely distributed northward of the studied area in the mountain ranges of Yakutia where calcareous rock outcrops occur, and also have scattered localities in the mountains of South Siberia. The area harbors an exceptional number of species from the genus *Cinclidiurn*, which usually grow in Arctic or montane rich fens. *Cinclidiurn stygium* is widely distributed in the Arctic and northern part of boreal zone, rapidly declining southwards (Fig. 5); this species is new for the southern part of Russian Far East and Amur Province. The closest localities are in the Udokan Range (Afonina et al., 2017) and in the Aldanskoe Upland (Gynym River valley, SASY cf. Ivanov et al., 2017). Likewise, *Cinclidiurn arcticum* is newly recorded for the southern part of Russian Far East and Amur Province. Beyond Arctic, it has scattered localities in the mountains of southern Siberia and Yakutia from Tyva Republic to Aldanskoe Upland (Fig. 5), this species was also collected by K.A. Volotovskij in the Ivak River upstreams in the Yakutian part of Tokinsky Stanovik Range (SASY cf. Ivanov et al., 2017).
Tortella spitzbergensis is rather widely, although spotty distributed in Arctic and permafrost regions of Siberia, mostly in the areas where calcareous rocks outcrop, reaching Ikatsky Range in the north Buriatia southwards (Werner et al., 2014); this species is also found in the vicinity of Ayan settlement in Khabarovsk Province. Thus, our record is the second one in the southern Russian Far East (Fig. 6). Aulacomnium acuminatum has similar distribution in North Asia being widespread in cryolithozone and having few distant localities in high mountains of South Siberia (Tyva Republic, East Sayan, Kodar Range). Closest previously known locality of this species originates from Khetomy River basin, vicinity of Neryungri settl. in Yakutia (Fig. 6). Brachythecium tur- gidum, Encalypta alpina and Timmia sibirica (Fig. 6) also have an arctoalpine distribution; these three species also were newly found in Stanovoy Range in the southern extent of their ranges.

Distribution of Didymodon subandreaeoides in Russia was revisited by Afonina et al. (2022); this species is known from southern Siberia (Altai, Buryaia, Zabaiakalsky Territory, Yakutia, and Chukotka. Our finding in Tokinsky-Stanovoy National Park is the first not only for Amur Province but for the southern part of Russian Far East. Tetraplodon pallidus is a predominantly arctic species with sporadic localities in permafrost area (Fig. 7), which thus was found remarkably southwards from their previously known distribution ranges. Throughout its range this species is associated with calcareous rocks. Likewise, the southernmost of the previously known loco- lities of Tetraplodon pallidus is situated in southern spurs of Verkhoyanskaya Mountain System. The newly revealed locality of this species might be caused by high altitudes and also by rather high abundance of wild reindeer in the area. Asian distribution of Tortella arctica largely resembles those of Tetraplodon pallidus; this Arctic species also has isolated occurrences on the Kodar Range (Afonina et al., 2017).

Encalypta rhaphtocarpa, which was collected in calcareous rock outcrops in Zeya River valley, is first record- ed for the continental part of the Russian Far East. The closest localities are in the Aldanskoe Upland and Kodar Range (Ivanov et al., 2017), while the only known record from southern part of the Russian Far East originates from Vaida Mountain in Sakhalin Island (Fedosov, 2012). Similar distribution in the southern part of Russian Far East (Sakhalin and Stanovoy Range) have Catosciopum nigri- tum (Fig. 7), Meesia minor and Pseudostreodox pseudor- rimus. Encalypta brevicollis was previously known in the southern part of Russian Far East from a single locality on the Dusse-Alin’ Range; it also occurs on the Udokan Range (Filin et al., 2015), Dzugdzhur Range (Ignatova et al., 2021) and Kolyma Upland (cf. Ivanov et al., 2017). Campylium bambergeri also represents this “northern calciphilous group”; it was not previously reported for the Amur Province (Cherdantseva et al., 2018). The closest known localities of C. bambergeri are from the middle course of the Aldan River in Yakutia (MHA cf. Ivanov et al., 2017) and on Kodar Range (Afonina et al., 2017). In the southern part of Russian Far East this species was previously known from Sakhalin and lower Amur River area (Cher- dantseva et al., 2018).

In addition, among species first revealed in the southern part of Russian Far East, three newly described or recently resurrected species, Brideliella demetri, Ortho- thecium retroflexum and Tometypnum involutum apparently represent the “northern calciphilous group”, although their distributions remain underexplored. These species are largely associated with moist tundra communities and rich fens.

Sphagnum tescorum was revealed in Russia rather recently and its distribution remains insufficiently known since its differentiation from S. gigensohnii remains largely misunderstood. The newly revealed locality is the second known in the southern part of Russian Far East, where it was also found on Badzhal Range (Pisarenko et al., 2022).

Mielichoferia asiatica is an endemic of Russia, which occurs in southern part of the Russian Far East on the Sakhalin Island (Ignatov et al., 2018); our record is the first for the continental part of the Russian Far East. We collected this moss on the ferriferous rocks in the Tok River valley, along with another metallophilous species, Coscinodon hartzii. The latter occurs in the northern part of North America including Greenland (Hastings, 2007). In Russia it has wide distribution in Eastern Siberia (Ig- natov et al., 2017), and our record is the first for Amur Province and second for the southern part of Russian Far East, where it was also found in Badzhal Range (Pisarenko et al., 2021); other closest localities of this species are known from SE Yakutia, Irkutsk Province and the northern part of Transbaikalia.

One more representative of the genus, Coscinodon yukonensis was collected in the Bol’shiie Tuksani valley of the Lena River basin. This species is rather widespread in the humid areas of the Russian Far East from Kamchatka Peninsula to Primorsky Territory and south Kuril Islands and apparently also occurs in Japan (Ignatov et al., 2017); the closest localities are known in the upper Bureya River basin, Badzhal Range (Khabarovsk Terri- tory) and Vitimsky State Reserve, Stanovoe Upland (Irkutsk Province) (Ivanov et al., 2017), so our record is the first for Yakutia.

Dilutineuron fasciculare is here newly recorded for the moss flora of Yakutia. This species was collected in Stanovoy Range by Prokhorov and Kuzeneva in 1911. Its closest known localities are on the Dusse-Alyn’ Range, Badzhal Range and on North Sikhote-Alin’ (Ignatov et al., 2017; Pisarenko et al., 2022).

Four of seven Grimmia species revealed in the studied area (Grimmia donniana, G. incurva, G. funalis, G. torqua- ta) are newly reported for the Amur Province (Cherdantseva et al., 2018). Their closest localities are known on Kodar and Udokan Ranges of Stanovoe Upland and on
Fig. 5. Distribution of *Cinclidium arcticum* and *C. stygium* in Asian Russia based on herbarium specimens in the database of the moss flora of Russia (Ivanov et al., 2017). Red square: our records.

Fig. 6. Distribution of *Tortella spitsbergensis*, *Aulacomnium acuminatum*, *Brachythecium turgidum*, *Encalypta alpina* and *Timmia sibirica* in Asian Russia based on herbarium specimens in the database of the moss flora of Russia (Ivanov et al., 2017). Red square: our records.

Fig. 7. Distribution of *Tetraplodon pallidus* and *Catoscopium nigritum* in Asian Russia based on herbarium specimens in the database of the moss flora of Russia (Ivanov et al., 2017). Red square: our records.
Fig. 8. Distribution of Grimmia donniana, G. funalis, G. incurva, G. torquata in Asian Russia based on herbarium specimens in the database of the moss flora of Russia (Ivanov et al., 2017). Red square: our records.

Fig. 9. Distribution of Conostomum tetragonum, Lyellia aspera and Oligotrichum falcatum in Asian Russia based on herbarium specimens in the database of the moss flora of Russia (Ivanov et al., 2017). Red square: our records.

Fig. 10. Distribution of Strukia enervis in Asian Russia based on herbarium specimens in the database of the moss flora of Russia (Ivanov et al., 2017). Red square: our records.

1 Names of vascular plants follow The World Flora online database (http://www.worldfloraonline.org/)
Dusse-Alin’ and Badzhal Ranges of Bureinskoe Upland (Fig. 8). Similar distribution has one more montane species, newly found in Amur Province, Campylopus schimperi. Likewise, several species with arctic-montane or hypoarctic-montane distribution such as Lyellia aspera, Oligotrichum falcatum and Conostomum tetragonum are first reported for the Amur Province (Fig. 9); these species were collected from Stanovoy Range by K.A. Volotovskij (Stepanova et al., 1995, Ivanov et al., 2017).

Another species, which appeared rather common in the areas where acidic rocks outcrop is Bartramia deciduaefolia; it is remarkably different from the widespread B. tihyphylla even in the field due to leaving broken fragments of leaves in hands after collecting. This species is first reported here for the Amur Province; it occurs in the mountains of South Siberia and Yakutia with isolated localities in Khabarovsk (Dusse-Alin’ Range) and Primorsky Territories (Ignatov et al., 2018).

Among the other remarkable records, Struckia enervis was collected in Bol’shie Tuksani River basin (Yakutia). This species has largely Central Asian distribution with few Russian localities outside South Siberia (Fig. 10), on Sette Daban Range in Yakutia (Ignatov et al., 2018) and Badzhal Range in Khabarovsk Territory (Ellis et al., 2017; Pisarenko et al., 2022). Platyhypnum norvegicum also occurs in Zeya State Reserve (the specimen collected on wet cliffs in Zeya valley by D.A. Petelin and identified by I.V. Czernyadjeva in MW).

Ulota rehmannii, U. reptans, Didymodon zanderi, Timmia comata, Myurella sibirica, Dicranum pacificum, Pohlia tundrae and Schistidium subjulaceum were earlier first recorded here in Amur Province only from Zeysky Reserve (Dudov et al., 2018). Meesia triquetra was previously reported from Norsky State Reserve (Begzdov et al., 2013), where the southernmost locality of the species in the Russian Far East is situated. Newly revealed record of Anomodon thraustus in the Zeya River upper course apparently represents the northernmost locality of this predominantly East Asian species.

High mountains with diverse ecotopes in alpine belts are considered as refugia of arctic-alpine Bryophyte flora (Bakalin, 2015). In the southern part of Russian Far East quite a few of such refugia are known and among them Stanovoy Range may be considered as an exceptional case that captures the richest representation of them. Stanovoy Range may be considered as an exceptionally rich area for conservation of mosses with predominantly Arctic distribution, that underlines an importance of calcareous rocks for distribution and preservation of numerous northern bryophytes.

High moss species diversity on Tokinsky Stanovik corresponds to the presence of an apparent altitudinal zonation and numerous bedrock types. The peculiarity of the flora is determined both by the presence of the “northern calciphilous group” of species discussed above, and also East Asian elements. It highlights the conservation value of the area as a hotspot of the bryophyte diversity. This diversity is now protected within the new Tokinisko-Stanovoy national park in the Amur Province and a specially protected natural area of the regional level in Yakutian part of the study area.

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