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An analysis of travel reports of the Finnish botanical expeditions to Russian Lapland (Murmansk Region and northern Karelia) in 1861 and 1863

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- 1 An analysis of travel reports of the Finnish botanical expeditions to Russian Lapland (Murmansk Region and northern
- 2 Karelia) in 1861 and 1863

3 (Abstract)

4 Finnish botanical expeditions, which were made to Russian Lapland (present-day Murmansk Region and northern  
5 Karelia, Russia) in 1861 and 1863, published travel reports with preliminary information, which contained numerous  
6 floristic novelties and phytogeographical observations but have been overlooked in present-day studies. Two reports  
7 appeared in print, by Gustav Selin on the expedition made in 1861, and by Nils Isak Fellman on the expedition made in  
8 1863. We analysed mentions of vascular plant species published in these travel reports in order to trace and evaluate first  
9 records and localities of rare and legally protected species on the basis of herbarium vouchers kept at H. In spite of high  
10 self-claims, Selin actually reported 9 species new to present-day Murmansk Region and 1 species new to Republic of  
11 Karelia, and 4 species of vascular plants that are currently under legal protection in Murmansk Region, whereas Fellman  
12 reported 11 species new to Murmansk Region and 5 species new to Karelia, with 34 species under legal protection in  
13 Murmansk Region. First records of alien plants were 7 species from Selin and 4 species from Fellman. These numbers  
14 brought the contemporary floristic knowledge in Russian Lapland to 504 species of native plants (50% of the current  
15 total) and 54 species of alien plants (11% of the current total). Fellman's report included the first phytogeographical  
16 observations from the Kola Peninsula, with the first botanical limits observed, and the first descriptions of key botanical  
17 territories which are currently under strict protection. This study contributes to botanical history, plant protection and  
18 management of plant invasions in Murmansk Region.

19

## 20 Introduction

21

22 Lapland is a historical territory in Fennoscandia lying largely north of the Arctic Circle. This territory received its  
23 name from the Sámi people, a Fenno-Ugric nation called Lapps in previous times, who are indigenous to the area. It has  
24 never been officially defined, and its limits varied with changes in scientific concepts and delimitation of northern  
25 administrative territories (present-day or historical) of the Nordic countries (Finnmark in Norway, Lapland in Sweden,  
26 Lappi in Finland). Whereas the western part of Lapland (Sweden and Norway before 1809) had received much attention  
27 of botanists already in the 18<sup>th</sup> and early 19<sup>th</sup> centuries (Linnaeus 1737, Wahlenberg 1812), the western part (Russia) was  
28 a true *terra incognita* with no features of flora and vegetation known (Sennikov and Kozhin 2018).

29 The first checklist of vascular plants of Russian Lapland (present-day Murmansk Region and the northern part of  
30 Karelia, Russia) was compiled by Jacob Fellman, who was a priest at Utsjoki, northern Finland (Väre 2011). The  
31 checklist (Fellman 1831) was based on Fellman's own herbarium collections, which eventually were acquired to H but  
32 not before 1920 (Väre 2011).

33 Fellman's checklist remained the only source of information on the flora of Russian Lapland in the first part of  
34 the 19<sup>th</sup> century, in spite of the efforts of some scientists employed by the Russian Academy of Sciences; the results of  
35 those travels and collecting activities remained unpublished and inaccessible except for a few brief reports in academic  
36 periodicals (Sennikov and Kozhin 2018).

37 When the *Societas pro Fauna et Flora Fennica* (further referred to as the Society) published its first checklist  
38 (Nylander and Sælan 1859) of the flora of East Fennoscandia (Finland and neighbouring Russia), which was strictly  
39 based on the herbarium collections accumulated by the Society, the shortage or even lack of collections from Russian  
40 Lapland became apparent. This was especially true when the new checklist and analysis of the flora of Western Lapland  
41 was published (Andersson 1846). In late 1850s and early 1860s, the Society became a very strong scientific  
42 organization, leading the studies of natural history in Finland; with its own funds and the availability of financial support  
43 from the University of Helsinki and associated foundations, the Society decided to organise expeditions to little known  
44 areas of Finnish interest in order to fill the gaps in knowledge and collections (Wallgren 1996).

45 Two big expeditions to the north-east, which aimed to collect insects, plants, lichens and fungi of the Kola  
46 Peninsula, were organised and took place in 1861 and 1863 (Sennikov and Kozhin 2018). These expeditions are linked  
47 with the name of Nils Isak Fellman (1841–1919), then a 20-years-old student of the University of Helsinki. In 1861, two  
48 groups were directed to explore various parts of the Peninsula. The first group (N.I.Fellman, P.A.Karsten) covered the

49 western part, whereas the second group (G.Selin, K.E.Inberg) was supposed to travel along the coasts of the White Sea  
50 and then the Barents Sea westwards to the main road from Kola but cancelled the original plan and explored only the  
51 western part of the Peninsula. In 1863, a single team (N.I.Fellman, who became the leader because of his experience and  
52 age, M.M.W.Brenner, N.J.Laurin) travelled extensively around the whole Kola Peninsula and returned back along the  
53 main road (Kola – Kandalaksha).

54 The expeditions intended to cover gaps in the knowledge of various groups of vascular plants and cryptogams in  
55 Russian Lapland. The other purpose was to collect herbarium specimens for the Museum of Natural History, University  
56 of Helsinki, which was de facto managed by the Society (Wallgren 1996); the curatorial idea was to have a complete  
57 representation of the flora in collections, with at least one specimen per species from each biogeographic province  
58 (Nylander and Sælan 1859). The materials collected by these expeditions were abundant and brought a wealth of  
59 scientific information, published as regional monographs on lichens (Nylander 1866), fungi (Karsten 1866), and  
60 vascular plants (Fellman 1869).

61 Since at that time the Kola Peninsula was among the least known territories in Europe, the results of this  
62 expedition were much appreciated and laudably accepted in Europe. Prior to their full-size publication, selected  
63 discoveries in vascular plants and general features of the vegetation were described in a letter sent by Fellman in  
64 September 1863 on the way back from Kola to Helsinki to the president of the Society, William Nylander, who at that  
65 time resided in Paris. Nylander read Fellman's travel report on 27 November 1863 at the meeting of the French  
66 Botanical Society, which was published in French in the journal of that society (Fellman 1864a) and quickly translated  
67 into German (Fellman 1864b) and English (Fellman 1865). The Russian translation was published recently (Sennikov  
68 and Kozhin 2018).

69 Another letter was sent to Nylander on 5 August 1862 by Gustav Selin, reporting the summary of his main  
70 botanical discoveries in 1861. In Autumn of 1862, after Selin's death, this report was approved for publication by the  
71 Society but was not published in time because of the lack of means of rapid publication in Finland; ultimately, it was  
72 published as Selin (1869), and its Russian and English translations appeared in Sennikov and Kozhin (2018).

73 Despite the considerable fame achieved by the Finnish expeditions to Russian Lapland in 1861 and 1863, there is  
74 a certain level of obscurity which hindered details of their travels and collecting activities. The brevity or absence of  
75 precise data (or erroneously stated data) on distributed specimens and in original publications resulted in a common  
76 confusion between the two expeditions, and in a mess with their collecting localities and their locations. These technical

77 particulars were clarified in Sennikov and Kozhin (2018) but an analysis of botanical activities of the expeditions  
78 remains to be produced and published.

79 The publications of these expeditions were much appreciated and laudably reviewed, and had a great impact on  
80 further botanical studies in Russian Lapland. However, they have not been evaluated for the level of novelty and  
81 accuracy in their floristic inventory, and the value of preprinted information (travel accounts) has been forgotten.

82 This contribution is part of a larger study dedicated to the botanical legacy of Nils Isak Fellman (Sennikov and  
83 Kozhin 2018). The early botanical outputs of Finnish botanical expeditions to Russian Lapland are the subject of the  
84 present contribution, with the aims to analyse all mentions of vascular plants which were published in Fellman's and  
85 Selin's travel reports and represent the first records of rare and protected species of vascular plants in Murmansk  
86 Region. These records have been very incompletely taken into account in the Russian literature (Gorodkov 1953–1954,  
87 Pojarkova 1956–1966), and their background documentation has never been analysed and verified. We also place the  
88 expeditions in the context of botanical studies in Russian Lapland in the 19<sup>th</sup> century.

89

## 90 **Materials and methods**

91

### 92 *Published sources*

93

94 Two published sources, travel reports of Fellman (1864a) and Selin (1869), were screened and analysed for  
95 records of vascular plant species from Murmansk Region and neighbouring Karelia, which were the first reports of  
96 scientific results of the Finnish botanical expeditions to Russian Lapland in 1861 and 1863 (Sennikov and Kozhin 2018).  
97 Among the four versions of Fellman's report (Fellman 1864a, 1864b, 1865, Sennikov and Kozhin 2018), the original  
98 (French) version was used.

99 The obtained records were checked for floristic novelties against contemporary checklists and accounts (Fellman  
100 1831, Ledebour 1841–1853, Nylander 1843, 1844, 1846, Nylander and Sælan 1859).

101

### 102 *Study area*

103

104 Since 1850s, the studies of natural history in East Fennoscandia were based on the scheme of biogeographic  
105 provinces produced by members of the Society (Wallgren 1996). The Finnish botanical expeditions studied the

106 biogeographic province *Laponia rossica* (Russian Lapland), which at the time was defined to include territories north  
107 of the Kem River and Lakes Kuittijärvet (now in Karelian Republic, Russia) until the Barents Sea shore, i.e. the whole  
108 of Murmansk Region of Russia (Nylander and Sælan 1859). The southern border of Russian Lapland was the northern  
109 limit of *Karelia rossica* (Russian Karelia). Later (Sælan et al. 1889) the biogeographic border between Lapland and  
110 Karelia was redefined and moved northwards to the Kanda River (now in Murmansk Region); the southern part of the  
111 former *Laponia rossica* became part of the biogeographic Karelia as *Karelia keretina*.

112 In the present contribution, we are focusing on localities visited and sampled by the expeditions strictly within  
113 *Laponia rossica* as defined in Nylander and Sælan (1859). Most of this territory falls into present-day Murmansk  
114 Region of Russia but a minor part belongs to the Republic of Karelia of Russia (Fig. 1). Published records and  
115 herbarium specimens from other territories, referable to *Karelia rossica* as defined in Nylander and Sælan (1859), are  
116 not included in the present study.

117

#### 118 *Herbarium materials and species records*

119

120 The herbarium collections of vascular plants, obtained in the course of the expeditions, had been completely  
121 deposited in the Botanical Museum (now Finnish Museum of Natural History), University of Helsinki (H). These  
122 collections were traced, recorded and submitted to the Finnish Biodiversity Information Facility (<https://laji.fi/>), the  
123 online database accumulating floristic records of the University of Helsinki, and to the database of the project ‘Flora of  
124 Russian Lapland’ ([www.laplandflora.ru](http://www.laplandflora.ru), now at test stage) which is maintained at the Moscow State University.  
125 Localities and dates given on labels of herbarium specimens were checked and complemented using the routes of the  
126 expeditions (Sennikov and Kozhin 2018). Taxonomic literature and floristic treatments were used to clarify the  
127 taxonomy and identity of herbarium specimens. Identifications in herbarium collections were checked, updated and  
128 corrected, and used in verification of the background of the published records. In our identifications, all recent  
129 taxonomic treatments were critically assessed and taken into account by the authors. Species distributions in Murmansk  
130 Region were verified using standard reference books (Gorodkov 1953–1954, Pojarkova 1956–1966, Hultén 1971,  
131 Ramenskaya and Andreeva 1982, Konstantinova et al. 2014).

132 Plant records traced from Fellman (1864a) and Selin (1869) are collected in Appendices 1 and 2, in which the  
133 data on nomenclature, current taxonomy, background information (herbarium vouchers), and accepted taxonomic  
134 identity are provided for each record. The status of each record was assessed and is indicated as follows: novelty to the

135 province *Lapponia rossica* according to *Herbarium Musei Fennici* (Nylander and Sælan 1859), that means presence or  
136 absence of relevant specimens in the collections of the Society; novelty to *Lapponia rossica* according to the published  
137 information (Fellman 1831, Ledebour 1841–1853, Nylander 1843, 1844, 1846, Nylander and Sælan 1859), that means  
138 the first published record from the territory; novelty to Murmansk Region and Karelia (present-day administrative  
139 territories of Russia), that means our assessment of the background material (taxonomic acceptance and territorial  
140 assignment).

141 Native and non-native plants are analysed separately because of their contrast history in the local flora. A species  
142 is considered native if arrived to the territory in pre-historical times, presumably without human assistance. Non-native  
143 plants include both neophytes (arrived after 1492) and archeophytes (arrived before 1492); species included in these  
144 categories appeared in the territory with direct or indirect assistance of humans, irrespective of their times of arrival and  
145 their level of naturalisation.

146

## 147 **Results**

148

149 The Finnish botanical expeditions to Russian Lapland in 1861 and 1863 had two goals, to collect specimens for  
150 the *Herbarium Musei fennicae*, and to improve the botanical knowledge and produce a new checklist of the regional  
151 flora. The checklist *Herbarium Musei fennicae* (Nylander and Sælan 1859) was strictly based on the herbarium  
152 collections at H; more correctly, it was not a floristic checklist but a curatorial herbarium inventory that served as a  
153 checklist and at the same time as a *desideratum* calling for further collecting activities. This checklist omitted published  
154 information if the specimens were not deposited at H; for this reason, about 40% of records published in Fellman (1831)  
155 and Ledebour (1841–1853) were not included in Nylander and Sælan (1859) because the relevant specimens were kept  
156 in the private collections of these authors or at LE (Fig. 2). As a result, the novelties reported by the Finnish expeditions  
157 were rather novelties to the Finnish collections than to the available knowledge, and should be evaluated as such.

158 To show the rapid progress and the success of the expeditions, Fellman, Karsten and Selin reported the number of  
159 new species to the Society, based on specimens collected in 1861. Regarding vascular plants, with *Herbarium Musei*  
160 *fennicae* as a guide, Selin reportedly collected 237 species new to *Karelia rossica* and 125 species new to *Lapponia*  
161 *rossica*, of which two species were new to East Fennoscandia (Helsingfors Dagblad, № 285, p. 1, 8 December 1862),  
162 whereas Fellman reported 155 species new to *Lapponia rossica*, of which one species (*Sparganium hyperboreum* Laest.  
163 ex Beurl.) was new to East Fennoscandia (Helsingfors Dagblad, № 54, p. 1, 6 March 1863). Since these impressive



164 numbers denoted novelties to the collections, the actual increase of floristic knowledge cannot be inferred from this  
165 information.

166

167 **Travel report of Gustav Selin, dated 1862, published in 1869**

168

169 Floristic novelties

170

171 The travel report of Gustav Selin (1869) was based on his expedition to the Kola Peninsula made in 1861. For  
172 technical reasons, on the way to Lapland Selin spent extra time in Russian Karelia, and his collections from the target  
173 area were not as rich as expected (Sennikov and Kozhin 2018). Nevertheless, he claimed to have collected 125 species  
174 of vascular plants new to *Lapponia rossica*, including two species new to East Fennoscandia, of which one species  
175 (*Potentilla nivea* L.; correct identification: *Potentilla chamissonis* Hultén) was collected in the Khibiny Mts. in  
176 Russian Lapland.

177 In the report Selin explained that he assumed his major task as filling the gaps in the collections; for this reason,  
178 he collected and reported many rather trivial plants typical of forests, meadows and paludified areas, which were  
179 formally missing in the collections from his study area. For this reason he recorded only 4 species of vascular plants that  
180 are currently under legal protection in Murmansk Region (Konstantinova et al. 2014).

181 Among the vascular plants collected and mentioned by Selin (1869), we verified on the basis of Selin's  
182 specimens and contemporary literature that 10 species had never been reported from *Lapponia rossica* in published  
183 sources, including 9 species new to present-day Murmansk Region and 1 species new to Karelia. Among the species  
184 previously reported as presumably present in Russian Lapland, *Sagina nodosa* (L.) Fenzl was actually reported first by  
185 Selin because Fellman (1831) included this species in his list of Kola plants on the basis of material collected in  
186 Varanger Fjord (now part of Norway), and Ledebour (1842) mentioned 'Kola' on the basis of Fellman's record only.

187

188 Non-native species

189

190 Selin made no significant phytogeographical observations in his travel report. This may be another reason why  
191 his expedition was not considered successful (Sennikov and Kozhin 2018). However, Selin collected the species which  
192 had not been appreciated in his times but are in focus of active studies nowadays, i.e. non-native plants.

193 In his report, Selin included 7 alien plants new to present-day Murmansk Region. Those plants were collected in  
194 Russian fishermen's villages along the Kandalaksha and Tersky coasts of the White Sea. Notably, he collected *Galium*  
195 *mollugo* L., *Pimpinella saxifraga* L., '*Hypericum quadrangulum* L.' (= *H. maculatum* Crantz), and *Linaria vulgaris*  
196 Mill. in Umba Village; these plants still occur on anthropogenic (managed for hay-making) meadows in the old part of  
197 the village (Kozhin, pers. obs. 2010–2019).

198 Along the Kandalaksha Bay, Selin observed *Urtica urens* L., which was known from 5 localities in the beginning  
199 of the 19<sup>th</sup> century (Fellman 1831) and from 11 localities in the end of the 19<sup>th</sup> century (Hjelt 1902). To the present day,  
200 the number of localities and abundance of this species have considerably decreased.

201 Altogether, Selin's work had increased the knowledge of the alien plant diversity in Russian Lapland by 15%.

202

### 203 Unreliable record

204

205 Among other records, Selin (1869) reported *Hieracium saxifragum* Fr. from the Kildin Island. No relevant  
206 specimen has been traced in the collections. So far, this record is considered doubtful because the only species of  
207 *Hieracium* sect. *Oreadea* Fr. in the Russian north is known from Liinahamari at the border with Norway, far from Kildin  
208 (Schljakov 1966).

209

### 210 **Travel report of Nils Isak Fellman, dated 1863, published in 1864**

211

### 212 Floristic novelties

213

214 The travel report of Fellman (1864a) mentions a number of remarkable and characteristic plant species of Russian  
215 Lapland, based on the results of the expeditions in 1861 and 1863. After 1861, Fellman's expedition reported that 155  
216 species were collected as new to *Laponia rossica*; in 1863, Fellman was more concentrated on rare species and features  
217 of plant geography.

218 We have evaluated the records published in Fellman (1864a) for taxonomic accuracy and floristic novelty. The  
219 resulting statistics are summarised in Table 1, counting novelties according to historical biogeographic provinces and  
220 present-day administrative territories, separately for each expedition and each team on the basis of the background  
221 herbarium data.

222 The report mentions 65 species of vascular plants, which were new to *Lapponia rossica* in *Herbarium Musei*  
223 *Fennici* (Nylander and Sælan 1859), of which some may be considered rare (*Poa caesia* Sm., *Eriophorum callitrix*  
224 Cham. ex C.A.Mey. (correct identification: *E. brachyantherum* Trautv. & C.A.Mey.), *Luzula hyperborea* R.Br. (= *L.*  
225 *confusa* Lindeb.), *Gentiana tenella* Rottb. (= *Comastoma tenellum* (Rottb.) Toyok.), *Astragalus oroboides* Hornem. (= *A.*  
226 *norvegicus* Weber), *Paeonia anomala* L., *Cochlearia officinalis* L., *Gypsophila fastigiata* L.) but the others are  
227 common north boreal plants that had not been represented in regional collections (*Arctostaphylos uva-ursi* (L.) Spreng.,  
228 *Calluna vulgaris* (L.) Hull, *Atriplex nudicaulis* Boguslaw, *Betula pubescens* Ehrh. s.l., *Eriophorum vaginatum* L.,  
229 *Ligusticum scothicum* L., *Juncus trifidus* L.).

230 The actual value of these novelties was uncovered when herbarium specimens were checked against the  
231 contemporary literature (Fellman 1831, Nylander 1843, 1844, 1846, Ledebour 1841–1853). Only 15 species were new  
232 to *Lapponia rossica*, of which 11 species were new to Murmansk Region and 5 species were new to Republic of Karelia.  
233 For example, although Fellman (1864a) specifically reported *Subularia aquatica* L. as a novelty to Russian Lapland, it  
234 was actually published earlier, both from Murmansk Region (Fellman 1831, Ledebour 1842) and Republic of Karelia  
235 (Nylander 1852, Nylander and Sælan 1859).

236 Fellman's expedition of 1863 concentrated on the least studied territories of the eastern part of the Tersky Coast  
237 of the White Sea and the East Murman Coast of the Barents Sea. In 1863, 52 species were collected as new to Russian  
238 Lapland in *Herbarium Musei Fennici*, of which 18 species were recollected after 1861. Newly recorded from Russian  
239 Lapland were 29 species, of which 7 species were also collected in 1861. New to Murmansk Region were 25 species, of  
240 which only 4 species were recollected. This higher level of novelty may be explained by the formerly poor knowledge  
241 and unique features of the flora of the eastern part of the Kola Peninsula, which was intensely sampled by Fellman.  
242 Among 8 species new to East Fennoscandia, which were previously absent in *Herbarium Musei Fennici*, 6 species were  
243 collected in the east, in the area of the Ponoï River.

244 It is worth noting that Fellman (1864a), as compared with the latest Red Data Book of Murmansk Region  
245 (Konstantinova et al. 2014), reported 34 species of vascular plants that are under legal protection in Murmansk Region.  
246 So high level of botanical information relevant for plant protection was possible only because Fellman was concentrated  
247 on rare plants in his study.

248 Altogether, based on the work of his teams in 1861 and 1863, Fellman (1864a) reported 37 species as new to  
249 Russian Lapland, which constituted an addition of 8% to the previously known plant diversity of this territory.  
250 Summarizing the data from all published sources including Fellman (1864a), now we know that there were 504 species

251 of vascular plants recorded by 1864 in the flora of Russian Lapland, with 450 native species which make 50% of the  
252 currently known native flora of Murmansk Region (Kozhin and Sennikov 2019).

253

254 Phytogeographical limits

255

256 Besides reporting the most important (rare or otherwise special) plants, Fellman (1864a) mentioned a number of  
257 more common plants characteristic of certain territories and landscapes. This was done in a phytogeographical context:  
258 Fellman attempted to give a botanical description of major biomes in the Kola Peninsula and to trace the patterns of their  
259 distribution and their limits.

260 The territory best studied by Fellman was the southern and eastern coasts of the Kola Peninsula, i.e. the coasts of  
261 the White Sea. He noticed two limits connected with major changes in landscapes and plant communities. The first limit  
262 he has drawn at the Turii Mys cape; the coast is rocky and composed of granite outcrops west of this point, whereas it  
263 turns low and sandy east of this point. The second limit Fellman had found in the vicinities of Pyalitsa Village; east of  
264 this point he observed more raised coasts with rocky and clayey places.

265 To characterise the territories delimited by these points, Fellman used the data on the coastal relief, bedrocks and  
266 soils, and also the limits of forest and particular trees. Along the southern coast of the Peninsula he observed spruce,  
267 birch and pine as main forest trees. He demonstrated a regular decrease in forestation and abundance of all particular tree  
268 species in the west-east direction. The most drastic decrease he noticed in pine, which retreats towards inland in the  
269 eastern part of the Peninsula. As described by Fellman, the western part of the White Sea Coast is completely forested,  
270 whereas in the east, starting from Pyalitsa, the coast is devoid of trees and only in a few kilometres inland one can find  
271 sparse forests of mountain birch with contorted trunks. Nevertheless, Fellman concluded that trees can be found in  
272 depressions of any territories in Russian Lapland, from the Rybachii Peninsula in the extreme west to the Ponoï River in  
273 the extreme east.

274 Besides describing changes in tree species, Fellman gave a brief characteristic of plant communities and their  
275 distribution. He termed the plant cover of the eastern coast of the Kola Peninsula (between Pyalitsa Village and Ponoï  
276 River) as “tundra” and subdivided it further into “dry tundra” and “moist tundra”. Based on Fellman’s descriptions and  
277 mentions of characteristic plant species, we interpret this terminology in the following way. “Dry tundra” is tundra in  
278 present-day meaning of this term; Fellman characterised it by *Cladonia* sp., *Stereocaulon* sp., *Platysma nivale* (L.) Frege  
279 (= *Flavocetraria nivalis* (L.) Kärnefelt & A.Thell), *Empetrum nigrum* L. s.l., *Arctostaphylos alpina* (L.) Spreng. (=

280 *Arctous alpina* (L.) Nied.), *Calamagrostis neglecta* Gaertn., B.Mey. & Scherb. (= *C. stricta* (Timm) Koeler), *Festuca* sp.  
281 etc. His “moist tundra” seems to correspond to mires with the following characteristic species: ‘*Carex ampullacea*  
282 Gooden.’ (= *C. rostrata* Stokes), *Eriophorum angustifolium* Honck., *E. vaginatum* L., ‘*E. alpinum* L.’ (= *Trichophorum*  
283 *alpinum* (L.) Pers.) etc.

284 In spite of the brief format of scientific communication, Fellman (1864a) provided the first scientific data on the  
285 plant geography of the Kola Peninsula. These observations, further elaborated in Fellman (1869), became the basis for  
286 the more detailed biogeographic division of Russian Lapland (Hjelt 1888, Sælan et al. 1889, Bomansson and Brotherus  
287 1894, Anonymous 1938). The biogeographic limits drawn by Fellman correspond to the borders between *Lapponia*  
288 *Imandrae* and *Lapponia Varsugae* (Turii Mys), and between *Lapponia Varsugae* and *Lapponia ponojensis* (Pyalitsa  
289 Village) (Fig. 3).

290

291 *Distribution patterns of tree species*

292

293 Fellman (1864a) paid particular attention to the diversity and distribution of forest trees in the Kola Peninsula.  
294 Among the most important timber trees of the region, he detailed the taxonomy of spruce, formerly passed under the  
295 collective name *Pinus abies* L. and absent from the Finnish collections of the region (Nylander and Sælan 1859).  
296 Fellman reported the occurrence of three distinct taxa of spruce in Russian Lapland, with different geographical  
297 distributions. He observed the typical ‘*Pinus Abies*’ (= *Picea abies* (L.) H.Karst. subsp. *abies*; current taxonomy of  
298 spruce after Kurtto et al. (2019)) only west of Kandalaksha, whereas ‘*Pinus abies* var. *medioxima*’ (*Picea abies* subsp.  
299 ×*fennica* (Regel) Parfenov) and ‘*Pinus obovata*’ (= *Picea abies* subsp. *obovata* (Ledeb.) Domin) were found as common  
300 in East Lapland.

301 Birch is as important as spruce in forests of Russian Lapland. Fellman (1864a) specified that ‘*Betula alba*’ is a  
302 common tree in the inner part of the Kola Peninsula; at present, these plants have been referred to *B. pubescens* Ehrh.  
303 subsp. *pubescens* in the south-western part of Russian Lapland and to *B. pubescens* subsp. *subarctica* (N.I.Orlova)  
304 Á.Löve & D.Löve in its central and eastern parts. He mentioned the occurrence of another taxon, ‘*B. tortuosa*’ in the  
305 coastal area of the Peninsula, which is a mixture of *B. pubescens* subsp. *czerepanovii* (N.I.Orlova) Hämet-Ahti and *B.*  
306 ×*alpestris* Fr. (Hämet-Ahti 1987, Tzvelev 2004).

307 Fellman (1864a) was also first to demonstrate the differences between the alder of the Kola Peninsula, which he  
308 referred to ‘*Alnus pubescens*’, and the common alder *A. incana* (L.) Moench. The Kola alder has rather obtuse green

309 leaves (vs. acute to subacute grey leaves) and has been recently described as *A. kolaënsis* N.I.Orlova (= *A. incana* subsp.  
310 *kolaënsis* (N.I.Orlova) Á.Löve & D.Löve); it is highly similar to the recent hybrid between *A. glutinosa* (L.) Gaertn. and  
311 *A. incana* and may have originated as a stabilised hybridogenous taxon of the same origin (Tzvelev 2004). Fellman  
312 (1864a) observed that alder is widespread in Russian Lapland but disappears north of the Ponoï River.

313         Among the other arboreous species, Fellman (1864a) reported *Sorbus aucuparia* as widespread in the Kola  
314 Peninsula, going as far north as to Kildin Island. He also observed *Cotoneaster integerrimus* Medikus s.l. (as ‘*C.*  
315 *vulgaris*’) along the White Sea coast up to the Ponoï River. Both observations are still in match with the modern data  
316 (Kurtto et al. 2013).

317

### 318         Comparisons of the flora of coastal areas

319

320         Since the expeditions in 1861 and 1863 largely followed the sea coasts, Fellman (1864a) observed and described  
321 peculiarities of the flora of the White Sea and the Barents Sea coasts.

322         Fellman provided rather extensive lists of characteristic plants of the sea shores. Along the Barents Sea, he  
323 observed a number of plants typical of tundra, namely *Poa pratensis* var. *alpigena* Fr. ex Blytt (= *Poa pratensis* subsp.  
324 *alpigena* (Fr. ex Blytt) Hiitonen), *Catabrosa latifolia* (R.Br.) Fr. (= *Arctagrostis latifolia* (R.Br.) Griseb.), *Carex rigida*  
325 Good. (= *C. bigelowii* Torr. ex Schwein.), *Hieracium alpinum* L., *Luzula hyperborea* (= *L. confusa*), *Silene acaulis* L.,  
326 *Ranunculus pygmaeus* Wahlenb., *Diapensia lapponica* L. Along the White Sea, many boreal species were observed,  
327 namely *Luzula pilosa* (L.) Willd., *Maianthemum bifolium* (L.) F.W.Schmidt, *Lonicera coerulea* L., *Orobus vernus* L.  
328 (*Lathyrus vernus* (L.) Bernh.), ‘*Actaea spicata* [f.] *erythrocarpa* Turcz.’ (= *A. erythrocarpa* (Fisch. & C.A.Mey.) Mørch)  
329 etc. Present-day knowledge classifies these coasts in different ecosystems: the Barents Sea coast was referred to south  
330 tundra (Alexandrova 1977), forest tundra (Safronova et al. 1999) or northern boreal zone (Ahti et al. 1968), whereas the  
331 White Sea coast was referred to northern boreal zone (Ahti et al. 1968), corresponding to northern taiga of Russian  
332 authors (Safronova et al. 1999).

333         Fellman listed rather many sea shore species which are obligate or facultative halophytes. Quite a number of such  
334 species he mentioned from the Barents Sea coast, although these species also occur along the White Sea coast:  
335 *Matricaria inodora* var. *phaeocephala* Rupr. (*Tripleurospermum maritimum* subsp. *subpolare* (Pobed.) Hämet-Ahti,  
336 *Calamagrostis stricta*, *Elymus arenarius* L. (= *Leymus arenarius* (L.) Hochst.), *Rhodiola rosea* L., *Lathyrus maritimus*  
337 (L.) Bigelow, *Stellaria crassifolia* Ehrh., *S. humifusa* Rottb., ‘*Selinum tataricum* (Fisch.)’ (= *Conioselinum tataricum*

338 Hoffm.), *Haloscias scoticum* (L.) Fr. (= *Ligusticum scoticum* L.). As a species peculiar to the White Sea coast Fellman  
339 reported *Ranunculus polyanthemus* L. as well as *Zostera marina* L.; the latter was characterised as common along the  
340 western coast of the White Sea. Fellman noted large heaps of *Zostera* thrown on shore by the sea; this fact was not  
341 known to Vekhov (1992) who studied mass death of *Zostera* as a new phenomenon in the 20<sup>th</sup> century.

342

343 Botanically important territories and new records

344

345 The Finnish botanical expeditions in 1861 and 1863 had visited some botanically important places of Russian  
346 Lapland. The most important territory highlighted by Fellman (1864a) was the lower course of the Ponoï River, which  
347 he praised as the territory ‘from which our best collections had originated’. Fellman gave a brief characteristic of the  
348 vegetation of this river valley. He mentioned *Androsace septentrionalis* L., *Asplenium crenatum* Fr. (= *Diplazium*  
349 *sibiricum* (Turcz. ex Kunze) Sa.Kurata), *Armeria arctica* (Cham.) Wallr. (= *A. maritima* subsp. *sibirica* (Turcz. ex  
350 Boiss.) Nyman), ‘*Eriophorum callitrix*’ (correct identification: *E. brachyantherum*), *Eutrema edwardsii* R.Br., *Gentiana*  
351 *tenella* (= *Comastoma tenellum*), *Paeonia anomala*, *Ligularia sibirica* (L.) Cass., *Hedysarum arcticum* B.Fedtsch. (= *H.*  
352 *obscurum* L.), *Gentiana nivalis* L., ‘*Aconitum lycoctonum*’ (correct identification: *A. septentrionale* Koelle); the data on  
353 legally protected species from this list have been lately taken into account in the Red Data Book of Murmansk Region  
354 (Konstantinova et al. 2014). Some rare species found by Fellman (‘*Poa sudetica* var. *remota* (Forselles) Fr.’ = *P. remota*  
355 Forselles, *Pedicularis sudetica* Willd.) are known only in the south-eastern part of the Kola Peninsula.

356 In the latest decades many other rare species have been found in the Ponoï area. For this reason, G.N. Andreev,  
357 M.L. Ranemskaya and R.N. Schljakov in 1972 elaborated a proposal to establish a new protected area named “Rare  
358 plant species in the lower course of the Ponoï River” (Kryuchkov et al. 1988), but this idea has never been implemented.  
359 In 2002, river sides in the lower course of the Ponoï River were included in the Ponoï Fish Sanctuary, which aims at  
360 preservation of natural landscapes for sustainable use of natural resources. In 2018, on the basis of new field data, we  
361 proposed to establish a new botanical protected area (sanctuary) at the regional level of protection (Belkina et al. 2018,  
362 Kozhin et al. 2018).

363 The expeditions have also visited and specially noted the Turii Mys cape, which is one of the most famous  
364 protected areas in the Kola Peninsula. In this place they have found *Androsace septentrionalis*, ‘*Hedysarum obscurum*’  
365 (correct identification: *H. alpinum* L.), *Helianthemum vulgare* Gaertn. (= *H. nummularium* (L.) Mill.). The record of  
366 *Helianthemum* was most remarkable at that time because the nearest localities of that species are situated about 1000 km

367 southwards (Tzvelev 1996). Based on Fellman's collections, this population was described as a local endemic, *H.*  
368 *arcticum* (Grosser) Janch. (Grosser 1903, Janchen 1909, Tzvelev 1996), which has been legally protected at the national  
369 level (Filippova 1988, Kostina 2008) as endangered. Lately the taxonomical status of *H. arcticum* was reconsidered; on  
370 the basis of phylogeographic analysis, Volkova et al. (2016) concluded that this taxon represents an outlying peripheral  
371 population of *H. nummularium* which was preserved since the last postglacial major range expansion of this species, and  
372 bears the same plastid haplotype as the bulk of east and north European populations.

373         After Fellman, in the 19<sup>th</sup> and 20<sup>th</sup> centuries Turii Mys was frequently visited by botanists who discovered  
374 numerous populations of rare plants and spruce forest of the middle taiga type which is not typical of Murmansk Region  
375 (Andreev 1975). An issue of conservation concern was raised when apatites had been discovered in the Turii Mys; ore  
376 mining would have completely destroyed this unique nature monument (Andreev 1975, Andreev et al. 1978). Luckily,  
377 this territory was promptly incorporated into the Kandalaksha Strict Nature Reserve in 1977 (Kryuchkov et al. 1988). To  
378 date, the Turii Mys is known to accommodate 26 species of vascular plants legally protected at the regional level and 6  
379 species of vascular plants legally protected at the national level (Bardunov et al. 2008, Konstantinova et al. 2014).

380         Fellman's expeditions also visited the Lumbovka Bay on the north-eastern coast of the Kola Peninsula, where  
381 they discovered several rare plants. This territory was designated on herbarium labels and in publications as  
382 'Sapadnivolok' or 'Sapadnij volok' and was referred to the Svyatoy Nos Cape because of the territorial proximity.  
383 However, in the travel diaries of Magnus Brenner (kept in the archive of the Society), who participated in the  
384 expeditions in 1863, this locality was noted as 'utskjutande udde vid Lumbofskij' (a prominent cape near Lumbovsky).  
385 Its correct Russian name was apparently 'Zapadnyi Navolok'; we traced it precisely at the mouth of the Zapadnaya  
386 River on the northwestern side of the Lumbovka Bay (Sennikov and Kozhin 2018).

387         The most remarkable finding at Lumbovka, new to Russian Lapland, was *Astragalus oroboides* (= *A.*  
388 *norvegicus*). Its nearest locality was known at the Varanger Fjord (Fellman 1831, Ledebour 1842) in Norway. In the  
389 same locality Fellman's expedition found *Pleurogyne rotata* (L.) Griseb. (= *Lomatogonium rotatum* (L.) Fr. ex Nyman)  
390 and '*Castilleja pallida* (L.) Spreng.' (now *C. lapponica* Gand. ex Rebrist.). Both records were subsequently misplaced to  
391 the Svyatoy Nos (Hultén 1971, Konstantinova et al. 2014) and have not been recollected to date.

392         The Lumbovka Bay belongs to the least studied territories of Murmansk Region. Lately it has been visited by an  
393 expedition of the Polar-Alpine Botanical Garden-Institute, which discovered a number of rare plants and species-rich  
394 plant communities; on the basis of these discoveries, they proposed to protect the sea shore west of the Lumbovka Bay



395 at the regional level. So far this proposal has not been implemented but the territory was listed among the Emerald  
396 Network Areas of Special Conservation Interest in Russia (Sobolev and Belonovskaya 2011–2013).

397

398 Non-native species

399

400 Fellman (1864a) had no focus on alien plants at all, and the information on such species in his publication is very  
401 limited. He mentioned alien plants only in the context of new records, rather than in connection with their non-native  
402 status. This publication reported four species that are currently treated as alien, i.e. *Brassica campestris* L., *Polygala*  
403 *amarella* Crantz, *Vicia sepium* L. and *Veronica chamaedrys* L.

404 The knowledge on non-native alien plants in the Kola Peninsula progressed very slowly in the 19<sup>th</sup> century. In the  
405 first checklist, Fellman (1831) listed 41 species on the basis of his own collections and observations; based on the  
406 collections of A. Schrenk, Ledebour (1841–1853) reported 2 more species. With the addition of 4 species in Fellman  
407 (1864a) and 7 species in Selin (1869), the flora of Russian Lapland included 54 non-native species of vascular plants in  
408 the beginning of the 1860s, which makes ca 11% of the current total in Murmansk Region (Kozhin and Sennikov 2019).

409

410 Confirmation of important previous records

411

412 On the basis of travel reports (Fellman 1864a, Selin 1869) and their background data (herbarium specimens at H)  
413 it was possible to confirm historical records of some rare species in Russian Lapland which had previously been lacking  
414 any documentation.

415 In Russian Lapland, *Asplenium crenatum* (= *Diplazium sibiricum*) was reported for the first time from  
416 Kandalaksha (Nylander 1844, Ruprecht 1845) but the relevant herbarium collections have been unknown. Fellman's  
417 expedition has found this species in the vicinities of Ponoï Village and Soukelo, which currently belong to Murmansk  
418 Region and Karelian Republic, respectively.

419 Another remarkable species, *Botrychium matricarioides* Willd. (= *Sceptridium multifidum* (S.G.Gmel.)  
420 M.Nishida, syn. *B. multifidum* (S.G. Gmel.) Rupr.) was collected by Fellman at Kola. This species had been previously  
421 reported from the Kola Peninsula (at Kandalaksha) on the basis of material collected by F. Nylander (Ruprecht 1845),  
422 but no such specimens can be found at H or LE.

423 *Gentiana tenella* (= *Comastoma tenellum*) was first reported by Fellman (1831) from the Kola Bay but without  
424 herbarium specimens; so far, this record has received doubtful confirmation by specimens collected by V. Krohn in 1911  
425 (at H). The first documented record of the species from the Kola Peninsula (Ponoi) was published by Fellman (1864a).

426 *Melandrium apetalum* (L.) Fenzl (= *Silene uralensis* (Ruprecht) Bocquet) was first reported from  
427 ‘Karelsгамmen’, an isthmus between the Vayda Bay and the Kiiskii Cape on the Rybachii Peninsula (Fellman 1831).  
428 Fellman (1864a) found it at the Kachkovka Bay. Neither record was supported by herbarium specimens.

429

#### 430 Completely erroneous records

431

432 Fellman (1864a) reported three species as new to Russian Lapland, i.e. *Littorella lacustris* L. (= *Littorella*  
433 *uniflora* (L.) Asch.), *Raphanus raphanistrum* L., *Veronica officinalis* L., which had not been confirmed by herbarium  
434 specimens. Fellman (1869a: 58) explained that the records of *Raphanus raphanistrum* and *Veronica officinalis* appeared  
435 because of an ‘unexplainable’ technical error and must therefore be rejected. Similarly, the record of *Littorella uniflora*  
436 was rejected, too (Hjelt 1923: 158). Such corrections are difficult to trace; this literature has been neglected in  
437 subsequent Russian works on the flora of Murmansk Region.

438

#### 439 **Discussion**

440

441 The information obtained by the Finnish botanical expeditions in 1861 was important to plan further trips to the  
442 Kola Peninsula, which were realised shortly thereafter in 1863. It was also important to obtain funding to continue the  
443 exploration.

444 The route of the expedition in 1863 skipped the western parts of the White Sea Coast (from Umba to Varzuga)  
445 because that territory had been well explored by Selin in 1861 (Selin 1869). The exclusion of this territory allowed  
446 Fellman to rapidly continue eastwards and get concentrated on the Ponoi area, where he made many important botanical  
447 discoveries.

448 The main results of the expedition 1863 had been drafted by Fellman immediately on the way from the Kola  
449 Peninsula (Sennikov and Kozhin 2018). Those results, pre-published in Fellman (1864a), not only increased the  
450 knowledge on the flora of that territory and demonstrated its speciality within East Fennoscandia but also shaped the  
451 future plant geography of the Kola Peninsula.

452           Altogether, the preprinted reports from Finnish botanical expeditions to Russian Lapland in 1861–1863 (Fellman  
453 1864a, Selin 1869) contained important information on the flora of the Kola Peninsula. In terms of herbarium curation,  
454 the reports included records of 87 species of vascular plants new to *Laponia rossica* as defined in *Herbarium Musei*  
455 *Fennici* (Nylander and Sælan 1859), and 9 species were completely new to the Botanical Museum of the University of  
456 Helsinki. If all the published literature is taken into account, 43 species were actually new to Russian Lapland, which  
457 constituted an increase of ca. 9% of the known plant diversity. With the reports, 504 species of vascular plants were  
458 known from Russian Lapland by the first half of the 1860s, of which 54 species were non-native. These numbers include  
459 not only present-day Murmansk Region but also the northern parts of the Republic of Karelia (largely the vicinities of  
460 Keret Village); for this reason, it is currently impossible to estimate the exact impact of the expeditions on the  
461 knowledge of the flora of Murmansk Region in particular, although many species first known from Keret were  
462 subsequently found in the southern part of Murmansk Region.

463           Besides territorial novelties, Fellman (1864a) and Selin (1869) mentioned quite a number of more commonly  
464 distributed plants; these mentions were really important for the future synopsis of the flora of this poorly known  
465 territory. These persons, having travelled separately, differently understood the task of their studies. Fellman was more  
466 focused on native, rare and characteristic species, whereas Selin also included alien plants which he spotted in the  
467 nearest proximity of villages. The value of the latter information was not understood in Fellman's times and such reports  
468 were not appreciated by the Society (Sennikov and Kozhin 2018), but nowadays those early records of non-native plants  
469 have a special value in understanding times, pathways and dynamics of human-assisted plant immigration to the Kola  
470 Peninsula (Kozhin and Sennikov 2019).

471           For the first time in studies on the Kola Peninsula, Fellman (1864a) clearly held a synthetic view of the flora. He  
472 described a phytogeographical features of the territory and traced limits for floristic districts which have been  
473 established later largely on the basis of his results. He also described some botanically unusual territories which later  
474 became legally protected, and provided the first botanical data from those territories.

475           Further on, the floristic records published in Fellman (1864a) and Selin (1869) were taken into account in the  
476 synopsis of the flora of Russian Lapland (Fellman 1869) and subsequently included and assessed in the annotated  
477 synopsis of the flora of East Fennoscandia (Hjelt 1888, 1892, 1895, 1902, 1906, 1911, 1919, 1923, 1926). Although  
478 these works belong to major publications on the flora of East Fennoscandia and their copies have been widely and  
479 timely distributed (also to main Russian botanical libraries: e.g. Herder 1886), Fellman's and Selin's records were  
480 omitted from major Russian treatments of the flora of Murmansk Region (Gorodkov 1953–1954, Pojarkova 1956–1966,

481 Ramenskaya 1983). Only due to our inventories this information has been included into the latest version of the Red  
482 Data Book of Murmansk Region (Kostantinova et al. 2014).

483

#### 484 **Conclusions**

485

486 Express publications in small formats (letters, travel reports) that were common means of rapid communication  
487 of important information (most significant field records and new taxa) in the 19<sup>th</sup> century, may have been overlooked or  
488 mistreated as insignificant by botanists of the 20<sup>th</sup> century. To avoid losses of information in comprehensive databases of  
489 the 21<sup>th</sup> century, also minor publications should be screened and recorded.

490 The information delivered in field reports of the Finnish botanical expeditions to the Kola Peninsula (Fellman  
491 1864a, Selin 1869) included many first and early records of rare native plants, of which several are currently under legal  
492 protection (Konstantinova et al. 2014). Their records of alien plants help uncover time and pathways of introduction of  
493 the non-native flora in the Arctic and Subarctic territories, which is currently in focus of active exploration because of  
494 potential danger to the native flora and human economy and well-being (Wasowicz et al. 2019). For the first time in East  
495 Lapland, Fellman (1864a) presented a phytogeographical description of the territory and determined some key limits of  
496 plant distributions; this work laid foundation for the complete phytogeographical scheme (Fellman 1869) that became  
497 the basis for further studies on the flora and vegetation of the territory for the following 100 years (Ramenskaya 1983).  
498 Key areas visited and described as such by the expeditions have been subsequently protected (Borovichev et al. 2018).

499 The reports (Fellman 1864a, Selin 1869) not only have a high historical value as pioneer studies on the flora and  
500 vegetation of the Kola Peninsula but also remain a source of actual information on occurrences of legally protected  
501 plants because of the current lack of information on the population status of several species and little knowledge  
502 available on some remote and little-explored parts of the territory. Our critical examination of the reports contributes to  
503 the history of botanical exploration of the Kola Peninsula (Wallgren 1996, Sennikov and Kozhin 2018) and to the  
504 current botanical research, which aims to construct a comprehensive database in order to produce a precise  
505 phytogeography, to provide background for plant protection, and to develop informed decisions on plant invasions in  
506 Murmansk region of Russia.

507

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637 Figure 1. Collection locations of Finnish botanical expeditions to Russian Lapland in 1861 and 1863 (Murmansk Region  
638 and northern Karelia), showing localities that provide the background for Fellman (1864a) and Selin (1869). Adapted  
639 from Sennikov and Kozhin (2018). Phytogeographical limits follow Anonymous (1938).

640

641 Figure 2. Progress in floristic studies in Russian Lapland as traced from major early published sources (taxonomic  
642 richness recorded, including species and those varieties that were subsequently elevated to the species level).

643

644 Figure 3. Biogeographical provinces of Russian Lapland based on (left) Nylander and Sælan (1859) and (right)  
645 Anonymous (1938). Abbreviations: Kk — *Karelia keretina*, Ks — *Karelia kuusamoensis*, Kr — *Karelia rossica*, L —  
646 *Lapponia fennica*, Lim — *Lapponia Imandrae*, Lm — *Lapponia murmanica*, Lp — *Lapponia ponojensis*, Lps —  
647 *Lapponia petsamoensis*, Lr — *Lapponia rossica*, Lt — *Lapponia tulomensis*, Lv — *Lapponia Varsugae*, O —  
648 *Ostrobothnia borealis*; Poc — *Karelia pomorica occidentalis*, Por — *Karelia pomorica orientalis*.