

A PRELIMINARY CHECK-LIST OF THE HEPATICS OF
КАМЧАТКА PENINSULA (RUSSIAN FAR EAST)
ПРЕДВАРИТЕЛЬНЫЙ СПИСОК ПЕЧЕНОЧНИКОВ ПОЛУОСТРОВА
КАМЧАТКА (РОССИЙСКИЙ ДАЛЬНИЙ ВОСТОК)

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Abstract

A check-list of the liverworts of Kamchatka Peninsula (Russian Far East) has been compiled for the first time. It contains 158 species, including 78 new records for the peninsula. One species is recorded for the first time in Russia (*Nardia unispiralis* Amakawa), two species are new for Asia, and 4 are new for East Asia. There are also some rare Asian species. *Lophozia latifolia* R. M. Schust. is synonymized with *L. propagulifera* (Gottsche) Steph.

Резюме

Впервые составлен список печеночников Камчатки. Он включает 158 видов, 78 из которых приводится для флоры полуострова впервые. Среди найденных один вид впервые выявлен во флоре России (*Nardia unispiralis* Amakawa); ранее он считался Японским эндемом. Еще два вида являются новыми для Азии и еще четыре – новыми для Восточной Азии. Показано, что *Lophozia latifolia* R. M. Schust. является синонимом *L. propagulifera* (Gottsche) Steph.

HISTORICAL REVIEW

The study of the liverworts of the Kamchatka Peninsula started with G. Wahlenberg's (1811) paper, where he recorded 8 species for the peninsula, but without citing any collection localities. Apparently these collection were made by H. Tilesius near Avacha Bay (localities 15 or 16 in Fig. 1.). The best finding was *Asterella saccata*, new to science. In 1927 H. W. Arnell published an account of the hepatics collected by E. Hulten during the expedition on the steamship "Commander Bering" (1920-1922). Arnell enumerated 28 species, including *Nardia kamtschatica* Arnell new to science (in 1976 it was synonymised with *N. assamica* by J. Váňa). In 1970 H. Persson published results of a study of the collection of Kamchatian bryophytes made by Hulten and R. Malaise (these specimens were collected in 1920-1926 and by 1970 were still unidentified). Up to 1970 about 50 species were known from Kamchatka. Persson (l. c.: 209) estimated that the number of "known bryophytes from Kamchatka will increase by some 30-40%". However, current research has shown that this is an underestimate, and the hepatic flora of Kamchatka is considerably richer.

The next publication on Kamchatian hepatics was in 2001 (Blagodatskich & Duda, 2001) with a list of the species collected by L. S. Blagodatskich in 1985. Blagodatskich had collected about 50 specimens in Kronotsky State Reserve and near the Avacha volcano. The authors listed 22 species, including *Jungermannia fusiformis* new to Russia. In 1990 I. V. Chernyadjeva collected bryophytes in the South Kamchatian Reserve. The hepatics were identified by A. D. Potemkin and published by Chernyadjeva & Potemkin (2003), who enumerated 38 species of hepatics. In addition, Potemkin, during his study of other Kamchatian collections, found *Kurzia sylvatica* (Konstantinova & al., 1992) a new species for the Russian flora.

The author of this current paper collected liverworts in Kamchatka in 2001 and 2002. Two species from these collections were published as *exsiccata* in 2003 (Bakalin & Konstantinova, 2003). The identification of more than 600 specimens from these collections forms the background for this paper.

Prior to the present research only 80 species of liverworts were known from Kamchatka. The current study has increased this to 158 species.

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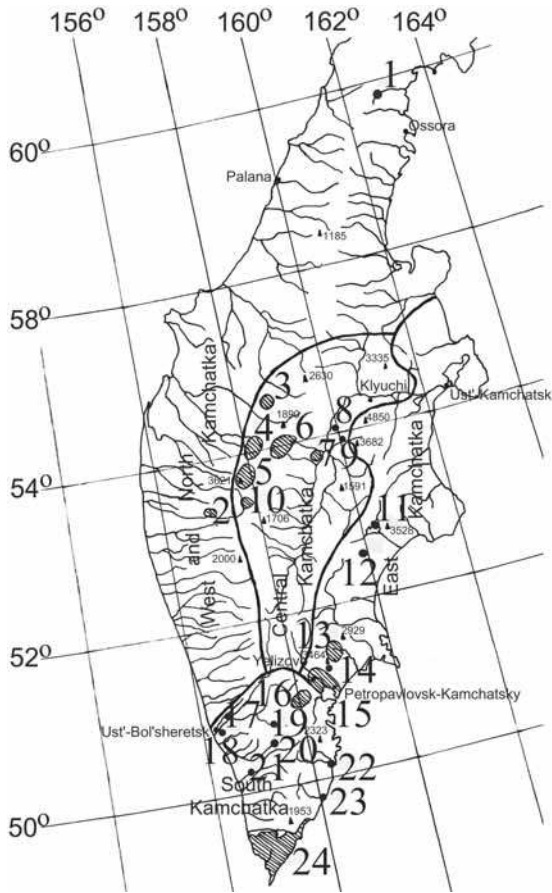


Fig. 1. Collecting localities in Kamchatka:

West and North Kamchatka

1. Middle course of Kichiga River: Smetanin, 2002.
2. Middle course of the Icha River : Bakalin, coll. 2001.

Central Kamchatka

3. Oxinsky Hot Springs: Bakalin, coll. 2002.
4. Demshikan Pass: Bakalin, coll. 2002.
5. Okura Pass: Bakalin, coll. 2001, 2002.
6. Neighboring of Esso Settl., Anavgaj Settl, Anauna River, Anauna Mts.: Persson, 1970: Bakalin, coll. 2001, 2002.
7. Lokhmatka (The Middle of Kamchatka River): Bakalin, coll. 2001.
8. Kozyrevsk: Persson, 1970.
9. Tolbachik: Persson, 1970.
10. Shanuch (The Upper Icha River): Bakalin, coll. 2002.

East Kamchatka

11. Kronotskoye Lake: Persson, 1970.
12. Gejzernaja River and Uzon Caldera: Blagodatskikh, Duda, 2001.
13. Pinochevo and Nalychevo valleys: Blagodatskikh, Duda, 2001; Bakalin, coll. 2001.
14. Avacha vlc.: Blagodatskikh, Duda, 2001.
15. Neighboring of Petropavlovsk-Kamchatsky and Yelizovo Towns (including Mokhovaya, Zavojko): Arnell, 1927; Persson, 1970; Bakalin, coll. 2001.

South Kamchatka

16. Paratunka Area (including Nachiki Lake): Arnell, 1927; Persson, 1970; Bakalin, coll. 2001.
17. Agashka (Amigacha) River : Persson, 1970.
18. Bol'shaja River and Bol'sheretsk Area: Arnell, 1927; Persson, 1970.
19. Bannaja River : Arnell, 1927; Persson, 1970.
20. Opala vlc.: Arnell, 1927; Persson, 1970.
21. Opala River : Persson, 1970.
22. Asacha Bay: Arnell, 1927.
23. Khodutka Area: Arnell, 1927.
24. South Kamchatian Reserve (including Toporkov Isl.): Persson, 1970; Czernyadjeva & Potemkin, 2003.

Only a few previously recorded taxa were not re-found and 78 species are new records for the Kamchatka Peninsula. One species is newly recorded for Russia (the first locality outside Japan), two species are new for Asia, 4 are new for East Asia, and two species are recorded for only the second time in Asia. These records are discussed in detail in the checklist.

There is a very complex question: how many species can be added by future studies? As shown in the map (Fig. 1.), collections from Kamchatka are very patchy. Thus, only about 20 species are known from West and North Kamchatka, and of these, two species, (*Pleurocladula albescens* and *Marchantia polymorpha*) are only known from locality 1. In locality 2 hepatic collection was restricted to 1.5-2 hours so the intensity of study does not allow us to say that the liverwort flora is completely known.

The author expects that species could also be found in Kamchatka that at present are only known from the Koryak Uplands, whose mountain system extends to the north of the Kamchatka Peninsula. However, it is doubtful if many more temperate species will ever be found in Kamchatka because the severe tundra of the Koryak Uplands impedes migration. Comparison of the floras of the Koryak Uplands (Afonina & Duda, 1989; Konstantinova & Kuzmina, 2001) and the Kamchatka Peninsula revealed that the following 18 taxa known from Koryak were not found in Kamchatka: *Barbilophozia rubescens* (R. M. Schust. et Damsh.) Kartt. et L. Soderstr., *Calypogeia neesiana* (C. Mass. et Carest.) Müll. Frieb., *Cephalozia ambigua* C. Mass., *Cephalozia arctica* Bryhn. et Douin, *Eremonotus myriocarpus* (Carr.) Lindb. & Kaal., *Lophozia polaris* (R. M. Schust.) R. M. Schust., *Marsupella commutata*

(Limpr.) H. Bernet, *Mesoptychia sahlbergii* (Lindb. et Arnell) Evans, *Odontoschisma demudatum* (Nees) Dumort., *Prasanthus suecicus* (Gottsche) Lindb., *Protolophozia elongata* (Steph.) Schljakov, *Radula prolifera* Arnell, *Riccia bifurca* Hoffm., *R. cavernosa* Hoffm., *Saccobasis polymorpha* (R. M. Schust.) Schljakov, *Sauteria alpina* (Nees) Nees, *Scapania tundrae* (Arnell.) H. Buch, *S. zemljae* S. W. Arnell and *Tritomaria scitula* (Tayl.) Jörg.

In addition, some Arctic (*Marsupella arctica* (Berggr.) Bryhn et Kaal., *Scapania simmonsii* Bryhn et Kaal., etc) and Arctomontane species (*Marsupella sprucei* (Limpr.) H. Bern., *Scapania brevicaulis* Tayl., *Athalamia hyalina* (Sommerf.) Hatt., etc.) could possibly be found on Kamchatka. Some species with amphioceanic and Pacific affinities may be also found (*Scapania obscura* (Arnell et C. E. O. Jensen) Schiffn., *Macrodiplophyllum imbricatum* (M.A. Howe) Perss., *Solenostoma rubrum* (Gottsche ex Underw.) R. M. Schust., etc.). Additional records of some disjunct species are also possible.

In conclusion it is estimated that the number of hepatics known from Kamchatka could increase by 35-40 taxa (about 20%).

COLLECTING LOCALITIES USED IN CHECK-LIST

Treatment of the floristic districts follows Persson (1970). Comparison of modern geographic names with those used in older literature revealed many discrepancies between old and modern names. Most of these discrepancies arise from differences in transliteration systems (Shadutka is undoubtedly Khodutka, Savoiko – Zavojko, etc.). Some differences result from historic changes of names (Maschuna became Mokhovaya, Agashka – Amigacha, etc.). One site, Akhomten Bay, is probably the modern Asacha Bay. Some sites, such as Sahach vlc. and Berenzojarr, have not been located on recent maps, but both are within South Kamchatka (Persson, 1970). Collecting localities are shown in Fig. 1.

CHECK-LIST

Nomenclature follows N. A. Konstantinova & al. (1992), with some recent alterations: Konstantinova & A. N. Vasiljev (1994), Bakalin (2001), Bakalin & al. (2001). New taxa for Kamchatka are marked by asterisk. Authors of names are cited as proposed by R. K. Brummit & Powell C. E. (1992). The synonyms used by R. Grolle & D. G. Long (2000) are added where

concept of genera is different (e. g. *Jungermannia* s. l. and *Lophozia* s. l.).

Additional information is provided on reproductive structures and collecting localities:

ant. – antheridia
arch. – archegonia
per. – perianthia
spor. – sporogonia
gemm. – gemmae.

W&NK – West and North Kamchatka

CK – Central Kamchatka

EK – East Kamchatka

SK – South Kamchatka.

**Anastrophyllum sphenoloboides* R. M. Schust. – per. – CK: 6! – One of the most southern localities (56°N). Previously in East Asia was only found in Chukotka (Afonina & Duda, 1993).

**Aneura pinguis* (L.) Dumort. – EK: 13!; CK: 3!, 4!
Anthelia julacea (L.) Dumort. – SK: 22! (Arnell, 1927), 24! (Persson, 1970; Czernyadjeva & Potemkin, 2003).

A. juratzkana (Limpr.) Trevis. – per., ant., spor. – CK: 5!, 6!, 10!; EK: 13!; SK: 16!, 19 (Persson, 1970), 24 (Czernyadjeva & Potemkin, 2003).

**Apometzgeria pubescens* (Schrank) Kuwah. – CK: 5!, 6!; EK: 15!

Asterella saccata (Wahlenb.) A. Evans. – Without locality (Wahlenberg, 1811).

Barbilophozia barbata (Schmidel ex Schreb.) Loeske – CK: 4!, 5!, 6!, 10!; EK: 15! (Persson, 1970), SK: 24 (Czernyadjeva & Potemkin, 2003).

B. hatcheri (A. Evans) Loeske – ant., gemm. – CK: 4!, 5!, 6!; EK: 15!; SK: 24 (Czernyadjeva & Potemkin, 2003).

B. lycopodioides (Wallr.) Loeske – CK: 3!, 5!; EK: 12 (Blagodatskich & Duda, 2001), 15!; SK: 16!, 20 (Arnell, 1927), EK:

**Bazzania bidentula* (Steph.) Steph. – CK: 10!

**B. ovifolia* (Steph.) Hattori – CK: 10! – The most northern locality in Eurasia.

**B. tricrenata* (Wahlenb.) Lindb. – CK: 10!

Blasia pusilla L. – gemm. – CK: 3!, 6!; EK: 15! (Arnell, 1927).

Blepharostoma trichophyllum (L.) Dumort. – per., spor., gemm. – CK: 4!, 5!, 6!; EK: 15!; SK: 24 (Czernyadjeva & Potemkin, 2003); without locality (Wahlenberg, 1811).

Calycularia laxa Lindb. et Arnell – EK: 12 (Blagodatskich & Duda, 2001), SK: 16!, 24 (Czernyadjeva & Potemkin, 2003).

Calypogeia azurea Stotler et Crotz – Only literature data: SK: 21 (Persson, 1970; Wahlenberg, 1811), 24 (Czernyadjeva & Potemkin, 2003).

**C. integrispula* Steph. – gemm. – CK: 5!, 6!

C. muelleriana (Schiffn.) Mull. Frib. – W&NK: 2!; CK: 4!, 5!, 6!, 10!; EK: 13!; SK: 18 (Persson, 1970),

- 24 (Czernyadjeva & Potemkin, 2003).
- **C. sphagnicola* (Arnell et J. Perss.) Warnst. et Loeske – CK: 5!
- Cephalozia bicuspidata* (L.) Dumort. – per., ant., spor., gemm. – CK: 5!, 6!, 10!; EK: 12 (Blagodatskich & Duda, 2001), 13!, 15!; SK: 18 (Arnell, 1927), 24 (Czernyadjeva & Potemkin, 2003).
- **C. connivens* (Dicks.) Lindb. – ant., arch. – W&NK: 2!
- C. leucantha* Spruce – Only literature data: SK: 18 (Arnell, 1927).
- C. lunulifolia* (Dumort.) Dumort. – per. – CK: 5!, 6!, 10!; EK: 15!; SK: 18 (Arnell, 1927).
- **C. pachycaulis* R. M. Schust. – per. – CK: 5!; EK: 15!; SK: 16! – This poorly known species was gathered in a few localities in Kamchatka Peninsula. It grows on soil along paths in birch grass forest, on fine-grained soil in spots of cryogenic origin, in moss-lichens tundra and on rocky banks of streams in brushwood of *Pinus pumila* Pall. In Eurasia this species is also known from Khamar-Daban Range (South Siberia, Konstantinova & al. 2004). Mixed with *Cephalozia bicuspidata*, *Diplophyllum taxifolium*, *Marsupella emarginata*, *Tetralophozia setiformis*, *Pellia neesiana*, *Nardia japonica*, *Plectocolea subelliptica*, *Blepharostoma trichophyllum*.
- C. pleniceps* (Austin) Lindb. – per. – CK: 5!; EK: 11 (Persson, 1970).
- **Cephalozia arctogena* (R. M. Schust.) Konstantinova – ant., arch., per., gemm. – W&NK: 2; CK: 5!, 6!, 7!; EK: 15!; – The most southern locality in the world (see Konstantinova, 2000).
- **C. divaricata* (Sm.) Schiffn. – ant., arch., per. – CK: 5!, 6!; EK: 15!
- C. rubella* (Nees) Warnst. – ant., arch., per., spor., gemm. – CK: 5!, 6!, 7!, 8 (Persson, 1970); EK: 13!, 15!; SK: 24 (Czernyadjeva & Potemkin, 2003).
- **C. springera* (Lindb.) Warnst. – ant., per., spor. – W&NK: 2!; CK: 6!
- **C. uncinata* R. M. Schust. – per., ant. – CK: 6!; EK: 15! – The most southern locality and the first for East Asia.
- Chiloscyphus fragilis* (A. Roth) Schiffn. [*C. pallescens* (Ehrh. ex Hoffm.) Dumort.] – EK: 12 (Blagodatskich & Duda, 2001).
- C. pallescens* (Ehrh. ex Hoffm.) Dumort. – EK: 15 (Persson, 1970).
- C. polyanthos* (L.) Corda – ant., arch. – CK: 6!, 10!; EK: 13!, 15!; SK: 16!, 24 (Czernyadjeva & Potemkin, 2003).
- C. rivularis* (Schrad.) Hazsl. [*C. polyanthos* (L.) Corda] – EK: 15 (Arnell, 1927).
- Cladopodiella fluitans* (Nees) H. Buch – EK: 15!; SK: 18! (Arnell, 1927).
- Conocephalum conicum* (L.) Dumort. – CK: 3!, 5!, 10!; EK: 13!, 15! (Arnell, 1927); SK: 16!
- C. japonicum* (Thunb.) Grolle – EK: 12 (Blagodatskich & Duda, 2001); 15!; SK: 22!, 23 (Arnell, 1927).
- Crossogyna autumnalis* (DC) Scaljakov [*Jamesoniella autumnalis* (DC) Steph.] – without locality (Persson, 1970)
- Diplophyllum albicans* (L.) Dumort. – CK: 5!; SK: 24 (Czernyadjeva & Potemkin, 2003)
- **D. obtusatum* (R. M. Schust.) R. M. Schust. – per., ant. – CK: 10 – This taxon was described by Schuster (1974) from Minnesota, and occurred only in few localities in North America. This species was recorded for the first time in Eurasia from the Sayan Mts. (South Siberia, Konstantinova & Vasiljev, 1994). Subsequently it was found in Upper of Bureja River (Konstantinova et al., 2002) and published as exsiccate from Stanovoye Uplands East Siberia (Bakalin & Konstantinova, 2003). The autoecious inflorescences was described as the main distinguishing feature (Schuster, 1974; Konstantinova & Vasiljev, 1994). However, in a large collection from East Siberia (used as material for exsiccate) among the majority of autoecious plants some paroecious and dioecious specimens were found, although these plants did not differ from the autoecious ones in any other characters. So, it is possible *D. obtusatum* is only an autoecious race of *D. obtusifolium*.
- D. taxifolium* (Wahlenb.) Dumort. – per., ant., gemm. – CK: 4!, 5!, 6!, 10!; EK: 13!, 14 (Blagodatskich & Duda, 2001), 15!; SK: 16!, 22 (Arnell, 1927), 24 (Czernyadjeva & Potemkin, 2003).
- Fossombronina* Raddi sp. – Only literature data: SK: 16 (Arnell, 1927).
- **Frullania bolanderi* Austin – W&NK: 2!; CK: 6!, 7!, 10!; EK: 13!, 15!;
- **F. dilatata* (L.) Dumort. – CK: 6!
- Gymnocolea inflata* (Huds.) Dumort. – per., ant. – CK: 5!, 10!; EK: 12 (Blagodatskich & Duda, 2001); SK: 16 (Persson, 1970), 24 (Czernyadjeva & Potemkin, 2003).
- **Gymnomitrium apiculatum* (Schiffn.) Müll. Frib. – CK: 5!, 6!
- **G. concinnatum* (Lightf.) Corda – ant., spor. – CK: 5!, 10!
- **G. corallioides* Nees – spor. – CK: 5!
- **Harpanthus flotovianus* (Nees) Nees – CK: 5, 6; EK: 13!
- **Hygrobiella laxifolia* (Hook.) Spruce – per., ant. – CK: 6!, 10!; EK: 13!
- **Isopaches bicrenatus* (Schmidel ex Hoffm.) H. Buch [*Lophozia bicrenata* (Schmidel ex Hoffm.) Dumort.] – per., ant., spor., gemm. – CK: 5!, 6!; EK: 13!, 15!
- **Jungermannia atrovirens* Dumort. – EK: 13!
- **J. borealis* Damsh. et Váňa – CK: 6!
- **J. eucordifolia* Schljakov [*Jungermannia exertifolia* subsp. *cordifolia* (Dumort.) Váňa] – ant. – CK: 5!, 10!; EK: 13!

- J. exertifolia* Steph. –EK: 12 (Blagodatskich & Duda, 2001); SK: 24 (Czernyadjeva & Potemkin, 2003).
- **J. polaris* Lindb. – per., ant. – CK: 6!
- J. pumila* With. – per., ant., spor. – CK: 5!, 6!; EK: 12 (Blagodatskich & Duda, 2001), 13!
- Kurzia sylvatica* (A. Evans) Grolle – Without locality (Konstantinova et. al., 1992).
- **Leiocolea bantriensis* (Hook.) Jörg. – CK: 3!
- **L. gillmanii* (Austin) A. Evans – CK: 6!
- L. heterocolpos* (Thed. ex Hartm.) H. Buch – gemm. – CK: 5!, 6!, CK, without locality (Persson, 1970).
- L. ruthiana* (Limpr.) Müll. Frib. – CK: 6 (Persson, 1970).
- **Lepidozia reptans* (L.) Dumort. – CK: 4!
- Lophocolea heterophylla* (Schrad.) Dumort. – W&NK: 2; CK: 5!, 6!; EK: 13!, 15! (Persson, 1970).
- L. minor* Nees – gemm. – W&NK: 2!; CK: 3!, 4!, 5!, 6!; EK: 13!, 15! (Persson, 1970).
- **Lophozia excisa* (Dicks.) Dumort. – ant., arch., per., spor., gemm. – CK: 4!, 5!, 6!
- **L. heteromorpha* R. M. Schust. et Damsh. – ant., gemm. – CK: 6! – This extremely poorly known species was gathered in the sources of the Ubojnyj Creek on the bank of an almost dry brook, among mosses. The species is known from northernmost part North America (Schuster, 1969) and in Russia from Chukotka (Bakalin, unpublished). The so named specimens from Yamal Peninsula (Potemkin, 1993) should be referred to *L. ventricosa* sensu lat.
- L. lacerata* N. Kitagawa – SK: 24 (Czernyadjeva & Potemkin, 2003).
- L. longidens* (Lindb.) Macoun – per., ant., gemm. – W&NK: 2; CK: 5!, 6!, 10!; EK: 13!, 15!; SK: 16!, 22 (Persson, 1970).
- **L. propagulifera* (Gottsche) Steph. – per., ant., spor., gemm. – CK: 4, 5 – Study of the type specimen in JE revealed that it is identical with *L. latifolia* (as it is described by Schuster, 1969) in all essential characters: plants are dioecious (not monoecious, as was written by Schuster, 1969), cells and gemmae size, and shape of androecia, etc. are identical with those of *L. latifolia*. The synonymy of *L. latifolia* and *L. jurensis* was shown by Schljakov (1973). Unfortunately, the type specimens of *L. latifolia* was unavailable for me (as well as for Schljakov, 1973), so the both *L. latifolia* and *L. jurensis* are considered here as *provisional* synonyms of *L. propagulifera*. The nomenclature is as follows: ***Lophozia propagulifera*** (Gottsche) Steph. 1901. Exped. Antarct. Belge, Bot.: 3, 4 (Sept.) Bull. Herb. Boissler (ser. 2) 1:1145 (Oct.) Spec. Hep. 2:128, 139 - *Jungermannia propagulifera* Gottsche 1890. Neumayer, Int. Polarforsch., Deutsch. Exped. 2:451 (Type: South Georgia. Bachgrund oberhalb der Pinguinbay. 26 Jan. 1883, coll. Will, det. Gottsche; JE!). - *Lophozia jurensis* Meylan ex Müll. Frib. 1916. Rabenhorst Kryptogamenfl. Deutschland. (ed. 2) 6(2):767 (Type: Switzerland. "... Schweizer-Jura: ... Vuarnon bei St. Croix. 1903 coll. et det. Meylan) - *L. latifolia* R. M. Schust. 1953. Bryologist. 56:258 (Type: USA. "The Point, Grand Marias, Cook County, Minnesota" coll. et det. Schuster).
- L. savicziae* Schljakov – ant., gemm. – CK: 5!, 6!; EK: 13!; SK: 16!, 24 (Czernyadjeva & Potemkin, 2003) – This species is poorly known outside of Russia and seems to be an occasional component of the alpine coenosis in Kamchatka. It is characterized by numerous partly biconcentric oil-bodies, so its unambiguous identification is only possible when living cells are present for study. Treatment of the species was given by Bakalin (2000).
- L. schusteriana* Schljakov – ant., gemm. – SK: 16!, 22 (Persson, 1970).
- **L. silvicola* H. Buch – ant., arch., per., gemm. – W&NK: 2; CK: 4!, 5!, 6!, 10!; EK: 15!; SK: 16!
- **L. silvicoloides* N. Kitagawa – ant., per., gemm. – CK: 5!, 6! – This species is known in East Asia from Japan, Kolyma Uplands and South Primorje; in Europe from Murmansk Region (distribution map was published by Bakalin, 2001).
- L. sudetica* (Nees ex Huebener) Grolle – per., spor., gemm. – CK: 5!, 6!, 10!; EK: 12 (Blagodatskich & Duda, 2001), 13!, 14 (Blagodatskich & Duda, 2001), 15!, SK: 16!, 18 (Arnell, 1927), 24 (Czernyadjeva & Potemkin, 2003).
- L. ventricosa* (Dicks.) Dumort. sensu Grolle and Long, 2000, excluding *L. silvicola* – ant., per., gemm. – CK: 4!, 5!, 6!, 10!; EK: 13!, 15!; SK: 16!, 24 (Czernyadjeva & Potemkin, 2003).
- **L. wenzelii* (Nees) Steph. – gemm. – CK: 5!, 6!; EK: 13!
- **Macrodiplrophyllum microdontum* (Mitt.) H. Perss. – CK: 6!
- M. plicatum* (Lindb.) H. Perss. – gemm. – CK: 4!, 5!, 6!, 10!; SK: 16!, 22 (Persson, 1970).
- Mannia pilosa* (Horn) Frey et Clark - Without locality (Wahlenberg, 1811).
- Marchantia alpestris* (Nees) Burgeff [*Marchantia polymorpha* sensu lat.] – gemm. – CK: 3!, 5!, 6!, 10!; EK: 13!, 15!; SK: 17 (Persson, 1970).
- M. polymorpha* L. – ant., spor., gemm. – W&NK: 1 (Smetanin, 2002); CK: 5!, 6!; EK: 12 (Blagodatskich & Duda, 2001), 13!; SK: 18 (Arnell, 1927), 24 (Czernyadjeva & Potemkin, 2003).
- **Marsupella alpina* (Gottsche ex Husn.) H. Bernet – CK: 5!, 6! – The most northern locality in East Asia.
- **M. boeckii* (Austin) Kaal. – ant. – CK: 5!; SK: 16! – The most southern locality in East Asia and one of the most southern localities in the world.
- M. brevissima* (Dumort.) Grolle – CK: 6!; EK: 13!; SK: 22 (Persson, 1970).
- **M. emarginata* (Ehrh.) Dumort. – ant. – CK: 10!; SK: 16!
- **M. funckii* (F. Weber et D. Mohr) Dum. – CK: 5!
- M. sphacelata* (Gieske ex Lindenb.) Dumort. – SK:

- 24 (Czernyadjeva & Potemkin, 2003).
- **Metzgeria furcata* (L.) Dumort. – per., spor. – CK: 10!
- **Moerckia blyttii* (Moerch) Brockm. – ant. – SK: 16! – In East Asia this species was only known from Japan (see distribution map in Konstantinova, 2000), so this is the second locality in East Asia.
- Mylia anomala* (Hook.) Gray – gemm. – W&NK: 2!; CK: 5!, 6!, 10!; EK: 15!; SK: 18 (Arnell, 1927).
- Nardia assamica* (Mitt.) Amakawa – EK: 12 (Blagodatskich & Duda, 2001); SK: 19 (Arnell, 1927, as *N. kamschatica* Arnell), 24 (Czernyadjeva & Potemkin, 2003).
- N. breidlerii* (Limpr.) Lindb. – ant., arch., per., spor. – CK: 5!; EK: 13!, 15!; SK: 24 (Czernyadjeva & Potemkin, 2003).
- N. compressa* (Hook.) Gray – SK: 22 (Arnell, 1927).
- N. geoscyphus* (De Not.) Lindb. – per., ant. – CK: 4!, 5!, 6!, 10!; EK: 13!, 15!; SK: 24 (Czernyadjeva & Potemkin, 2003).
- **N. insecta* Lindb. – ant., arch., per. – CK: 4!, 5!, 6!
- N. japonica* Steph. – ant., arch. – CK: 5!; EK: 12 (Blagodatskich & Duda, 2001), 13!; SK: 16!; SK: 24 (Czernyadjeva & Potemkin, 2003).
- N. scalaris* Gray – SK: 24 (Czernyadjeva & Potemkin, 2003).
- **N. unispiralis* Amakawa – CK: 5! – This poorly known species was gathered on the East slope of the Ichinskaya Sopka volcano, in the upper Bol'shoj (Tunnel'nyj) Creek along a stream, with *Cephalozia bicuspidata*. According to J. Váňa (1976), *N. unispiralis* is synonymous with and has priority over *N. hiroshi* Amakawa. In Amakawa's treatment (1959) both species are characterized by dioicous inflorescences and leaves bilobed for $1/4-1/5$ the length. *N. unispiralis* differed from *N. hiroshi* in obsolete underleaves (versus rather small, but distinct) and in small cells in margin if the leaf 15-18 mm at apex (versus 22-30). Additionally, *N. unispiralis* has elaters with only one spiral, while sporophyte in *N. hiroshi* have not been found. Váňa (l. c.) did not explain his reasons for merging the two species. However, we do not have access to material to evaluate this synonymy and concur with Váňa's opinion. Sterile plants of this species (or both species) differ from other *Nardia* in the more or less lophozoid appearance, and are similar to *Protolophozia elongata*. From the latter *N. unispiralis* differs in generative structures (mainly in the characteristic perigynium) and fewer oil-bodies (up to 4 in leaf cells versus 15-30 in *Protolophozia*). This species appears close to *N. japonica*, but differs in small to obsolete underleaves, up to half the stem width, and $1/4$ of the leaf length, versus the rather large underleaves of *N. japonica*, almost as wide as the stem and $1/2$ to as long as the leaf. This locality is the first one outside Japan. Identification is based on sterile plants.
- **Obtusifolium obtusum* (Lindb.) S. W. Arnell [*Lophozia obtusa* (Lindb.) A. Evans] – CK: 5!
- Orthocaulis attenuatus* (Mart.) A. Evans [*Barbilophozia attenuata* (Mart.) Loeske] – gemm. – EK: 13!, 15!; SK: 16!, 22 (Persson, 1970).
- O. binsteadii* (Kaal.) H. Buch [*Barbilophozia binsteadii* (Kaal.) Loeske] – CK: 5!, 6!; EK: 15!; SK: 18 (Arnell, 1927, as *Jungermannia binsteadii*).
- O. kunzeanus* (Huebener) H. Buch [*Barbilophozia kunzeana* (Huebener) Müll. Frib. – gemm. – W&NK: 2!; CK: 4!, 5!, 6!, 9 (Persson, 1970), 10!
- Pellia endiviifolia* (Dicks.) Dumort. – ant. – CK: 6!, 10!; EK: 12 (Blagodatskich & Duda, 2001); SK: 24 (Czernyadjeva & Potemkin, 2003).
- P. epiphylla* (L.) Corda – EK: 15 (Arnell, 1927); without locality (Wahlenberg, 1811).
- P. neesiana* (Gottsche) Limpr. – ant. – CK: 3!, 4!, 5!, 6!; EK: 13! (Blagodatskich & Duda, 2001), 15 (Arnell, 1927); SK: 16!, 21 (Arnell, 1927), 24 (Czernyadjeva & Potemkin, 2003).
- **Peltolepis quadrata* (Saut.) Müll. Frib. – spor. – EK: 13!
- **Plagiochila porelloides* (Torrey ex Nees) Lindenb. – CK: 10!; EK: 15!
- Plectocolea hyalina* (Lyell) Mitt. [*Jungermannia hyalina* Lyell] – ant. – CK: 6!; EK: 15!; SK: 19 (Arnell, 1927).
- P. infusca* Mitt. (*Jungermannia infusca* (Mitt.) Steph. – SK: 24 (Czernyadjeva & Potemkin, 2003).
- P. obovata* (Nees) Lindb. [*Jungermannia obovata* Nees] – ant., arch. – CK: 10!; SK: 24 (Czernyadjeva & Potemkin, 2003).
- **P. subelliptica* (Lindb. ex Kaal.) A. Evans [*Jungermannia subelliptica* (Lindb. ex Kaal.) Levier] – ant., arch., per. – CK: 5!, 6!, 10!; EK: 13!; SK: 16! – Since Schljakov (1981) this species was included in *P. obovata* in the Russian literature and consequently its Russian distribution is poorly known.
- P. vulcanicola* Schiffn. [*Jungermannia vulcanicola* (Schiffn.) Steph.] – per. – CK: 5!; EK: 12 (Blagodatskich, Duda, 2001); SK: 24 (Czernyadjeva & Potemkin, 2003).
- Pleurocladula albescens* (Hook.) Grolle – per. – W&NK: 1 (Smetanin, 2002); CK: 4!, 5!, 6!; EK: 12 (Blagodatskich & Duda, 2001), 13!, 14 (Blagodatskich & Duda, 2001), 15!; SK: 16!, 22 (Arnell, 1927), 24 (Czernyadjeva & Potemkin, 2003).
- **Preissia quadrata* (Scop.) Nees – spor. – CK: 3!, 4!, 5!, 6!
- **Protolophozia debiliformis* (R. M. Schust.) Konstantinova [*Lophozia debiliformis* R. M. Schust.] – gemm. – CK: 13! – This is a new species for East Asia and the most southern locality in the world. The record of species for Kamchatka in Konstantinova (2000) is a mistake in compilation of the map (Konstantinova, pers. comm.).
- Ptilidium californicum* (Aust.) Pears. – per. – SK: 16!, 20 (Persson, 1970), 24 (Czernyadjeva &

- Potemkin, 2003).
- P. ciliare* (L.) Hampe – CK: 4!, 5!, 6!, 7!, 18 (Arnell, 1927), 24 (Czernyadjeva & Potemkin, 2003).
- P. pulcherrimum* (Weber) Vain. – per. – CK: 5!; EK: 12 (Blagodatskich & Duda, 2001), 13!, 15!
- **Radula complanata* (L.) Dumort. – gemm. – EK: 15!
- **Riccardia latifrons* (Lindb.) Lindb. – CK: 4, 5, 6
- **Riccia lamellosa* Raddi – CK: 6! – This mainly Mediterranean species is found in South Europe (Greece, Italy, France, Spain and Portugal) and in North Africa (Morocco, Algeria, Tunisia, Tripoli, Ethiopia). It is also known from Middle Asia, China and the New World: Argentina, USA and Mexico (Schuster, 1992; Ladyzhenskaya, 1962; Piippo, 1999). This is the most northern locality for this species.
- Riccocarpos natans* (L.) Corda – EK: 15 (Arnell, 1927).
- **Saccobasis polita* (Nees) H. Buch [*Tritomaria polita* (Nees) Jorg.] – ant. – EK: 13!
- **Scapania curta* (Mart.) Dumort. – ant., gemm. – CK: 6!; EK: 13!
- S. cuspiduligera* (Nees) Muell. Frib. – gemm. – CK: 6!; EK: 13!; SK: 22 (Persson, 1970).
- S. brevicaulis* Taylor – EK: 15 (Persson, 1970).
- **S. glaucocephala* (Taylor) Austin – gemm. – CK: 5!, 7! – This rare species is a newly recorded in East Asia.
- **S. hyperborea* Jorg. – gemm. – CK: 5!
- S. irrigua* (Nees) Nees – per., ant., gemm. – CK: 5!, 6!; EK: 13!; SK: 24 (Persson, 1970).
- **S. lingulata* H. Buch – gemm. – CK: 6!
- **S. mucronata* H. Buch – gemm. – CK: 5!, 6!; EK: 15!
- **S. obcordata* (Berggr.) S. W. Arnell – EK: 13! – This is the most southern record in the Northern Hemisphere.
- S. paludicola* Loeske et Müll. Frib. – gemm. – CK: 5!; EK: 13!, 15!, SK: Berenzojarr (Persson, 1970).
- S. paludosa* (Müll. Frib.) Müll. Frib. – ant. – CK: 4!, 5!, 10!; EK: 13!, EK: 15 (Persson, 1970).
- **S. parvifolia* Warnst. [*S. scandica*] – per., ant., gemm. – CK: 4!, 5!, 6!
- **S. scandica* (Arnell et H. Buch) Macvicar – per., ant. – EK: 15!
- S. subalpina* (Nees ex Lindenb.) Dumort. – ant., per., gemm. – CK: 5!, 6!, 10!; EK: 12 (Blagodatskich & Duda, 2001), 13!; SK: 22 (Arnell, 1927).
- S. uliginosa* (Lindenb.) Dumort. – CK: 5!; EK: 12 (Blagodatskich & Duda, 2001); SK: 24 (Czernyadjeva & Potemkin, 2003).
- **S. umbrosa* (Schrud.) Dumort. – per., spor. – CK: 5!
- S. undulata* (L.) Dumort. – gemm. – CK: 4!, 5!, 6!, 10!; EK: 13!; SK: 22 (Arnell, 1927).
- **Schistochilopsis grandiretis* (Lindb. ex Kaal.) Konstantinova [*Lophozia grandiretis* (Lindb. ex Kaal.) Schiffn. – gemm. – CK: 6!
- **S. hyperarctica* (R. M. Schust.) Konstantinova [*Lophozia hyperarctica* R. M. Schust.] – gemm. – CK: 4!, 6! – This poorly studied arctic species is known from Archangelsk Province (northern European Russia), Arctic Alaska, Canada and North Greenland (see distribution map in Konstantinova, 2000). Recently it was recorded also from Komi Republic (North-East Europe, Russia, see Dulin, et al., 2003). This find is the most southern in the world and a new record for Asia.
- S. incisa* (Schrud.) Konstantinova [*Lophozia incisa* (Schrud.) Dumort.] – ant., per., spor., gemm. – CK: 4!, 5!, 10!; EK: 13!, 15!; SK: 16!, 22 (Arnell, 1927), 24 (Czernyadjeva & Potemkin, 2003).
- S. opacifolia* (Culm. ex Meyl.) Konstantinova [*Lophozia opacifolia* Culm. ex Meyl.] – per., gemm. – CK: 5!; EK: 13!; SK: 16!, 24 (Czernyadjeva & Potemkin, 2003).
- **Solenostoma caespiticium* (Lindenb.) Steph. [*Jungermannia caespiticium* Lindenb.] – per., spor., gemm. – CK: 5!, 10! – It is the southernmost localities in Asia.
- S. confertissimum* (Nees) Schljakov [*Jungermannia confertissima* Nees] – CK: 5!; EK: 12 (Blagodatskich & Duda, 2001).
- S. fusiformis* (Steph.) R. M. Schust. (*J. fusiformis* Steph.) – EK: 12 (Blagodatskich & Duda, 2001).
- **S. gracillimum* (Sm.) R. M. Schust. [*Jungermannia gracillima* Sm.] – arch. – EK: 15! – Species is recorded for the first time in Asia.
- **S. jenseniana* (Grolle) Bakalin comb. nov. – *Jungermannia jenseniana* Grolle, Oesterr. Bot. Z. 111: 190. 1964.] – per. – CK: 5!
- **S. sphaerocarpum* (Hook.) Steph. [*Jungermannia sphaerocarpa* Hook.] – EK: 13!
- **Sphenobolus minutus* (Schreb.) Berggr. [*Anastrophyllum minutum* (Schreb.) R. M. Schust.] – ant., arch., per., gemm. – W&NK: 2!; CK: 4!, 5!, 6!, 10!; EK: 15!; SK: 16!; without locality (Wahlenberg, 1811).
- **S. saxicola* (Schrud.) Steph. [*Anastrophyllum saxicola* (Schrud.) R. M. Schust.] – CK: 6!
- Targionia hypophylla* L. – spor. – CK: 3!; without locality (Wahlenberg, 1811) – This is the northernmost locality in East Asia.
- **Tetralophozia setiformis* (Ehrh.) Schljakov – CK: 5!, 6!; SK: 16!
- **Tritomaria exsecta* (Schmidel) Loeske – gemm. – CK: 10!
- **T. exsectiformis* (Breidl.) Loeske – per., gemm. – CK: 6!
- **T. quinquentata* (Huds.) H. Buch – ant. – W&NK: 2!; CK: 4!, 5!, 6!, 10!

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- [AFONINA, O. M., J. DUDA] АФОНИНА, О. М., Й. ДУДА 1989. К флоре печеночников Северной Корякии. – [On the liverworts flora of North Koryakiya] *Новости сист. низш. раст.* [Novosti Sist. Nizsh. Rast] **26**: 147-149.
- [AFONINA, O. M., J. DUDA] АФОНИНА, О. М., Й. ДУДА 1993. Печеночники Чукотки. – [Liverworts of Chukotka] *Бот. журн.* [Bot. Zhurn.] **78**(3): 77-93.
- АМАКАВА, Т. 1959. Family Jungermanniaceae of Japan. I. – *J. Hattori Bot. Lab.* **21**: 248-291.
- ARNELL, N. W. 1927. Lebermoose aus Kamtschatka. – *Hedwigia* **67**: 110-112.
- BAKALIN, V. A. 2000. Notes on Lophozia I. What is Lophozia silvicola Buch var. grandiretis Buch et S. Arnell (Hepaticae: Lophoziaaceae). – *Arctoa* **9**: 111-114.
- BAKALIN, V. A. 2001. Notes on Lophozia III. Some taxonomic problems in Lophozia sect. Lophozia. – *Arctoa* **10**: 207-218.
- [BAKALIN, V. A., N. I. MOLOKOVA, T. N. OTNYUKOVA] БАКАЛИН, В. А., Н. И. МОЛОКОВА, Т. Н. ОТНЮКОВА 2001. К флоре печеночников Тоджинской котловины (Республика Тува, Южная Сибирь). – [On the liverworts flora of Todzha Valley (Tuva Republic, South Siberia)] *Arctoa* **10**: 19-26.
- BAKALIN, V. A., N. A. KONSTANTINOVA 2003. Hepaticae Rossica Exsiccata. Fasc. I. (N 1-25) – *Kirovsk, Polygraf*, 17.
- [BLAGODATSKIKH, L. S., J. DUDA] БЛАГОДАТСКИХ, Л. С., Й. ДУДА 2001. О флоре печеночников полуострова Камчатка. – [On hepatic flora of Kamchatka Peninsula] *Новости сист. низш. раст.* [Novosti Sist. Nizsh. Rast.] **34**: 218-220.
- BRUMMIT, R. K. & C. E. POWEL 1992. Authors of plant names. – *London, Royal Botanic Gardens, Kew*.
- [CZERNYADJEVA, I. V. & A. D. POTEKIN] ЧЕРНЯДЬЕВА, И. В., А. Д. ПОТЕМКИН 2003. Мохообразные Южно-Камчатского природного заказника – [The Bryophytes of South-Kamchatian Nature Reserve]. В кн.: *Флора и растительность Южной Камчатки* [In: Flora i Rastitel'nost' Yuzhnoj Kamchatki] *Петропавловск-Камчатский, Камчатский печатный двор* [Petropavlovsk-Kamchatsky, Kamchatsky Pechatny Dvor]: 73-98.
- [DULIN, M. V., KONSTANTINOVA, N. A., BAKALIN, V. A.] ДУЛИН, М. В., КОНСТАНТИНОВА, Н. А., БАКАЛИН В. А. 2003. К флоре печеночников республики Коми. – [To the liverwort flora of the Komi Republic] *Бот. журн.* [Bot. Zhurn.] **88**(3): 45-52.
- GROLLE, R., D. G. LONG. 2000. An annotated check-list of the Hepaticae and Anthocerotae of Europe and Macaronesia. – *J. Bryol.* **22**: 103-140.
- [KONSTANTINOVA, N. A.] КОНСТАНТИНОВА, Н. А. 2000. Анализ ареалов печеночников Севера Голарктики. – [Distribution patterns of the North Holarctic hepatics] *Arctoa* **9**: 29-94.
- KONSTANTINOVA, N. A., POTEKIN, A. D., SCHLJAKOV, R. N. 1992. Check-list of the Hepaticae and Anthocerotae of the former USSR. – *Arctoa* **1**: 87-127.
- KONSTANTINOVA, N. A. & A. N. VASILJEV 1994. On the hepatic flora of Sayan Mountains (South Siberia). – *Arctoa* **3**: 123-132.
- [KONSTANTINOVA, N. A. & E. Y. KUZMINA] КОНСТАНТИНОВА, Н. А., Е. Ю. КУЗЬМИНА 2001. К флоре печеночников Корякии (Северо-восток России). – [On the hepatic flora of Koryakiya (North East of Russia)] – *Arctoa* **10**: 103-114.
- [KONSTANTINOVA, N. A., V. A. BAKALIN & A. D. POTEKIN] КОНСТАНТИНОВА Н. А., В. А. БАКАЛИН, А. Д. ПОТЕМКИН 2004. *Cephalozia pachycaulis* R. M. Schust. (Hepaticae, Cephaloziaaceae) – новый для России вид печеночника из Сибири и с Камчатки. – [Cephalozia pachycaulis R. M. Schust. (Hepaticae, Cephaloziaaceae) – a new for Russia liverwort from Siberia and Kamchatka] *Бот. журн.* [Bot. Zhurn.] **89** [in press].
- KONSTANTINOVA, N. A., V. A. BAKALIN, A. D. POTEKIN & M. S. IGNATOV 2002. Hepatic flora of the Upper Bureya River. – *Arctoa* **11**: 393-398.
- [LADYZHENSKAYA, K. I.] ЛАДЫЖЕНСКАЯ, К. И. 1962. Riccia lamellosa Raddi и R. papillosa Moris – новые виды для флоры СССР – [Riccia lamellosa Raddi and R. papillosa Moris – new species for the USSR flora] Труды отд. спор. раст. БИН АН СССР [Trudy Otd. Spor. Rast. Bot. Inst. Akad. nauk SSSR] **14**: 252-262.
- PERSSON, H. 1970. Contribution to the bryoflora of Kamchatka. – *Revue Bryologique et Lichenologique* **37**(2):209-221.
- PIIPPO, S. 1990. Annotated catalogue of Chinese Hepaticae and Anthocerotae. – *J. Hattori Bot. Lab.* **68**: 1-192.
- POTEKIN, A. D. 1993. The Hepaticae of the Yamal Peninsula, west Siberian Arctic. – *Arctoa* **2**: 57-101.
- [SCHLJAKOV, R.N.] ШЛЯКОВ, Р.Н. 1973. Систематические заметки по семейству Lophoziaaceae Cavers. – [Systematic notes on the Lophoziaaceae Cavers family] *Новости сист. низш. раст.* [Novosti Sist. Nizsh. Rast.] **10**: 287-302.
- [SCHLJAKOV, R. N.] ШЛЯКОВ, Р. Н. 1980. Печеночные мхи Севера СССР Том. 3. [Hepatics of the North of USSR. Vol. 3.] – *Л., Наука* [Leningrad, Nauka], 188.
- [SCHLJAKOV, R. N.] ШЛЯКОВ, Р. Н. 1981. Печеночные мхи Севера СССР Том. 4. [Hepatics of the North of USSR. Vol. 4.] – *Л., Наука* [Leningrad, Nauka], 212.
- SCHUSTER, R. M. 1969. The Hepaticae and Anthocerotae of North America East of the Hundredth Meridian. Vol. 2. – *New-York – London, Columbia University Press, XII+1062*.
- SCHUSTER, R. M. 1974. The Hepaticae and Anthocerotae of North America East of the Hundredth Meridian. Vol. 3. – *New York-London, Columbia University Press, 880*.
- SCHUSTER, R. M. 1992. The Hepaticae and Anthocerotae of North America East of the Hundredth Meridian. Vol. 6. – *Chicago, Field Museum of Natural History, 937*.
- SCHUSTER, R.M. & K. DAMSHOLT 1974. The Hepaticae of West Greenland. – *Meedelelser om Grönland* **199**(1): 1-373 + 80 maps.
- [SMETANIN, A. N.] СМЕТАНИН, А. Н. 2002. Экосистемы лососевой реки Кичиги (Северо-восточная Камчатка) [Ecosystems of the salmon's river Kichiga (North-East Kamchatka)] – *Петропавловск-Камчатский, КамчатГИТИ* [Petropavlovsk-Kamchatsky, KamchatGITI], 188.
- VÁŇA, J. 1976. Studien über die Jungermannioideae (Hepaticae) 10. Nardia. – *Folia Geobot. Phytotax.* **11**: 367-425.
- WAHLENBERG, G. 1811. Kamtschadalische Laub- und Lebermoose, gesammelt auf der russischen Entdeckungstreise von dem Herrn Hofrath Tilesius. – *Magazin für die neuesten Entdeckungen in der gesammten Naturkunde* **5**: 289-297.