

Moss Flora of Altaisky Territory, Central Russia

Masanobu Higuchi

Department of Botany, National Museum of Nature and Science,
Amakubo 4–1–1, Tsukuba, Ibaraki 305–0005, Japan
E-mail: higuchi@kahaku.go.jp

(Received 11 December 2017; accepted 20 December 2017)

Abstract The moss flora of Altaisky Territory of Central Russia, including three areas, was investigated in 2016. The mosses recognized comprise 24 families, 48 genera and 64 species. The moss flora recognized from each areas have different species compositions. It is thought to be due to the difference of geology. Among the species recognized in this study, such calcicole mosses as those species of *Encalypta*, *Homomallium*, *Timmia* and of the family Pottiaceae are only found in limestone area, but such calcifuge ones as those species of *Hedwigia*, *Racomitrium* and of the family Polytrichaceae are not found there. For each species, locality, substrate and specimen number were given.

Key words: Altaisky Territory, bryophytes, Central Russia, flora, mosses.

This study deals with the moss flora of Altaisky Territory, Central Russia. Although the outline of the moss flora in Russia is becoming clear (cf. Ignatov *et al.*, 2006), there has never been enough knowledge on the local flora. In 2016 I made a field research and collected bryophytes mainly from three areas, two in Cherginsky range and one in Tigireksky range, in Altaisky Territory. One of the areas in Cherginsky range is a *Pinus sylvestris* forest with granite boulders and the other is a place of a waste dump of old tungsten mine. The area in Tigireksky range is a forest-steppe with outcrops of limestone.

Materials and Methods

Field study was carried out in 2016, and a total of ca.130 bryophyte specimens were collected. The complete set of the specimens are preserved in the herbarium of the Department of Botany, National Museum of Nature and Science (TNS). The main sites investigated are as follows.

A. Cherginsky range, at 17 km SE of Belokuriha

City, headwaters of Osinovka River, waste dump of old (1939–1953) tungsten mine, 51°52'57"N, 84°48'48"E, ca. 680 m elev., July 10, 2016 (Figs. 1, 2).

B. Cherginsky range, at 13 km SE of Belokuriha City, headwaters of Chernovaya River, granite boulders in the *Pinus sylvestris* forest, 51°54'45"N, 84°50'48"E, ca. 810 m elev., July 12, 2016 (Figs. 5, 6).

C. Tigireksky range, at 3.4 km NW from the community of Tigirek, forest-steppe, limestone steep rock, 51°10'00"N, 82°59'39"E, ca. 690 m elev., July 13, 2016 (Figs. 9, 10).

Results and Discussion

1. *Comparison of the moss flora among the site A, B and C*

The species recognized from the areas investigated comprise 24 families, 48 genera and 64 species. In the number of species, the site A, including 30 spp., is richer than those of the sites B and C. The species composition of each sites is rather different. For example, *Hypnum*



Figs. 1–4. Site A. 1, 2. Place of waste dump of old (1939–1953) tungsten mine at 17 km SE of Belokuriha City, headwaters of Osinovka River. 3. *Dicranum nipponense* growing on base of tree-trunk. 4. *Racomitrium canescens* growing on sunny boulder. 5–8. Site B. 5, 6. *Pinus sylvestris* forest with granite boulders at 13 km SE of Belokuriha City, headwaters of Chernovaya River. 7. *Leskeella nervosa* growing on root and having many bud-like gemmae at shoot tips. 8. *Syntrichia ruralis* growing on granite rock covered with humus.



Figs. 9–16. Site C. 9, 10. Forest-steppe with outcrops of limestone at 3.4 km NW from the community of Tigirek. 11. *Encalypta raptocarpa* growing on crevice of rock. 12. *Encalypta streptocarpa* growing on crevice of rock. 13. *Mniun lycopodioides* growing on crevice of rock in cave. 14. *Orthotrichum anomalum* growing on sunny rock-cliff. 15. *Tortella tortuosa* growing on crevice of rock. 16. *Abietinella abietina* growing on rock-cliff.

cuessiforme which is known as a cosmopolitan is only the species occurring on the three sites. Twenty five species are only found in the site A, twenty two species in the site C and seven species in the site B. Many bryophytes are faithful indicators for particular sets of substratum-related conditions. Especially the distinction between calcicole (“calcium-loving”) and calcifuge (“calcium-hating”) species can be the principal dichotomy in a regional bryophyte flora (Bates, 2009). There are many limestone outcrops in the site C. The calcicole species recognized in this study are as follows, showing occurring sites in the parentheses.

Barbulla unguiculata (C)
Bryoerythrophyllum recurvirostrum (A)
Didymodon rigidulus (C)
Encalypta raptocarpa (C) (Fig. 11)
Encalypta streptocarpa (C) (Fig. 12)
Gymnostomum calcareum (C)
Homomallium incurvatum (C)
Schistidium apocarpum (C)
Syntrichia ruralis (B, C) (Fig. 8)
Timmia bavarica (C)
Tortella tortuosa (C) (Fig. 15)

On the other hands, the calcifuge species found in this study are as follows.

Atrichum undulatum var. *gracilisetum* (A)
Hedwigia ciliata (A)
Racomitrium canescens (A) (Fig. 4)
Polytrichum juniperinum (A)

The geology is one of the main reasons of the different species compositions among the three sites, although the geological detail is not well-known.

2. Noteworthy species

Dicranum nipponense Besch. (Fig. 3) is one of East Asian elements and this species is mainly reported from Japan, Korea and China. In Russia it has been only reported from Primorskiy Territory, the southern part of Far East Russia (“S-FE” in Ignatov *et al.*, 2006). The range of the species extends disjunctly northwestward to Altaisky Territory.

3. Enumeration of species

The species recognized in this study comprise 24 families, 48 genera and 64 species, and they are listed below. The scientific names follow Frey *et al.* (2006) and Goffinet *et al.* (2009). The families, genera and species are arranged alphabetically. Each species is referred by collecting sites (A–C), substrates and collector’s numbers of the author.

Amblystegiaceae

Sanionia uncinata (Hedw.) Loeske
 A: on decaying log, mh-54553, 54554.

Brachytheciaceae

Brachythecium glareosum (Bruch ex Spruce) Schimp. B: on boulder, mh-54672.
Cirriphyllum cirrosus (Schwägr.) Grout C: on crevice of rock, mh-54709 (+ *Lescuraea mutabilis*); on rock-cliff, mh-54713, 54720, 54722, 54726.
Eurhynchium angustirete (Broth.) T.J.Kop. A: on soil, mh-54600.
Eurhynchium hians (Hedw.) Sande Lac. A: on soil at rock-cliff, mh-54599.

Bryaceae

Bryum caespiticium Hedw. C: on soil at rock-cliff, mh-54702; on crevice of rock, mh-54716.
Leptobryum pyriforme (Hedw.) Wils. C: on soil in cave, mh-54738.

Dicranaceae

Dicranella heteromalla (Hedw.) Schimp. C: on rock-cliff, mh-54723 (+ *Abietinella abietina*).
Dicranum fulvum Hook. B: on base of tree-trunk, mh-54674.
Dicranum fuscescens Turn. A: on decaying log, mh-54581, 54602.
Dicranum nipponense Besch. (Fig. 3) A: on rock-cliff, mh-54560; on base of tree-trunk,

mh-54583.

Ditrichaceae

Distichium capillaceum (Hedw.) Bruch & Schimp.
C: on crevice of rock, mh-54725 (+ *Didymodon rigidulus*)

Encalyptaceae

Encalypta rhamnoides Schwägr. (Fig. 11) C:
on crevice of rock, mh-54700, 54703, 54717,
54724, 54730.

Encalypta streptocarpa Schwägr. (Fig. 12) C:
on crevice of rock, mh-54705, 54714; on soil
at crevice of rock, mh-54718 (+ *Mnium stel-
lare*)

Fissidentaceae

Fissidens bryoides Hedw. A: on soil,
mh-54598.

Grimmiaceae

Coscinodon cribrus (Hedw.) Spruce C: on
rock-cliff, mh-54728.

Grimmia fuscolutea Hook. B: on boulder,
mh-54670.

Racomitrium canescens (Hedw.) Brid. (Fig. 4)
A: on boulder, mh-54571.

Schistidium apocarpum (Hedw.) Bruch & Schimp.
C: on boulder, mh-54733.

Schistidium papillosum Culm. A: on boulder,
mh-54580.

Hedwigiaceae

Hedwigia ciliata (Hedw.) P.Beauv. A: on boul-
der, mh-54579. B: on boulder, mh-54671.

Hylocomiaceae

Hylocomium splendens (Hedw.) Schimp. A:
on humus, mh-54565. B: on boulder covered
with humus, mh-54684.

Pleurozium schreberi (Brid.) Mitt. A: on
rock-cliff, mh-54564; on boulder, mh-54569.

Rhytidiadelphus triquetrus (Hedw.) Warnst.
A: on boulder covered with humus, mh-54563;
on humus, mh-54604.

Hypnaceae

Callicladium haldanianum (Grev.) H.A.Crum
A: on decaying log, mh- mh-54601.

Homomallium incurvatum (Brid.) Loeske C:
on rock-cliff, mh-54701; on boulder,
mh-54731.

Hypnum cupressiforme Hedw. A: on base of
tree-trunk, mh-54555. B: on rock-cliff,
mh-54685. C: on boulder, mh-54695, 54735;
on rock-cliff, mh-54721.

Hypnum pallescens (Hedw.) P.Beauv. A: on
decaying log, mh-54556, 54557. B: on base of
tree-trunk, mh-54673.

Pylaisia polyantha (Hedw.) Schimp. A: on
rock-cliff, mh-54576; on tree-trunk,
mh-54582.

Pylaisia selwynii Kindb. A: on decaying log,
mh-54559; on tree-trunk, mh-54567, 54590,
54592; on fallen tree, mh-54587.

Taxiphyllum wissgrillii (Garov.) Wijk & Margad.
C: on crevice of rock in cave, mh-54742,
54744.

Leskeaceae

Lescuraea mutabilis (Brid.) Lindb. C: on
crevice of rock, mh-54709 (+ *Cirriphyllum
cirrosom*).

Leskeella nervosa (Brid.) Loeske (Fig. 7) B:
on base of tree-trunk, mh-54676; on root,
mh-54677. C: on boulder, mh-54697; on rock-
cliff, mh-54708, 54727, 54747.

Leucodontaceae

Leucodon sciuroides (Hedw.) Schwägr. B: on
rock-cliff, mh-54688.

Mniaceae

- Mnium lycopodioides** (Hook.) Schwägr. (Fig. 13) B: on rock-cliff, mh-54686. C: on crevice of rock in cave, mh-54749.
- Mnium stellare** Hedw. C: on soil at crevice of rock, mh-54706, 54718 (+ *Encalypta streptocarpa*), 54736; on rock-cliff, mh-54719.
- Plagiomnium cuspidatum** (Hedw.) T.J.Kop. A: on humus, mh-54562; on base of tree-trunk, mh-54584.
- Plagiomnium medium** (Bruch & Schimp.) T.J.Kop. B: on boulder covered with humus, mh-54683.
- Pohlia wahlenbergii** (F.Weber & D.Mohr) A.L.Andrews C: on rock-cliff in cave, mh-54745.

Neckeraceae

- Homalia trichomanoides** (Hedw.) Schimp. A: on rock-cliff, mh-54566, 54578.
- Neckera pennata** Hedw. B: on rock-cliff, mh-54689, 54690.

Orthotrichaceae

- Orthotrichum anomalum** Hedw. (Fig. 14) B: on rock-cliff, mh-54669. C: on rock-cliff, mh-54699, 54729; on boulder, mh-54732.
- Orthotrichum pallens** Bruch ex Brid. A: on rock-cliff, mh-54596.
- Orthotrichum rupestre** Schleich. ex Schwägr. B: on rock-cliff, mh-54691.
- Orthotrichum speciosum** Nees A: on tree-trunk, mh-54558.
- Orthotrichum striatum** Hedw. A: on fallen tree, mh-54588; on tree-trunk, mh-54589; 54591. B: on tree-trunk, mh-54675.

Plagiotheciaceae

- Isopterygiopsis pulchella** (Hedw.) Z.Iwats. A: on soil at rock-cliff, mh-54573 (+ *Bryoerythrophyllum recurvirostrum*), 54605; on decaying log, mh-54606, 54607. B: on rock-cliff, mh-54681.

Polytrichaceae

- Atrichum undulatum** (Hedw.) P.Beauv. var. **gracilisetum** Besch. A: on soil, mh-54593.
- Notes. The plants (mh-54593) usually have two sporophytes per shoot and its sexuality is parocious.
- Polytrichum juniperinum** Willd. ex Hedw. A: on soil, mh-54568.

Pottiaceae

- Barbula convoluta** Hedw. C: on rock-cliff in cave, mh-54746.
- Barbula crocea** (Brid.) F.Weber & D.Mohr A: on soil at rock-cliff, mh-54575.
- Barbula indica** (Hook.) Spreng A: on soil at rock-cliff, mh-54595.
- Barbula unguiculata** Hedw. C: on rock-cliff in cave, mh-54740.
- Bryoerythrophyllum recurvirostrum** (Hedw.) P.C.Chen A: on soil at rock-cliff, mh-54572, 54574, 54577.
- Didymodon rigidulus** Hedw. C: on crevice of rock, mh-54707, 54725 (+ *Distichium capillaceum*); on boulder covered with thin layer of soil, mh-54743.
- Gymnostomum calcareum** Nees & Hornsch. C: on rock-cliff, mh-54737.
- Syntrichia ruralis** (Hedw.) F.Weber & D.Mohr (Fig. 8) B: on boulder covered with humus, mh-54682. C: on boulder, mh-54734.
- Tortella tortuosa** (Hedw.) Limpr. (Fig. 15) C: on rock-cliff, mh-54712; on crevice of rock, mh-54715; on boulder covered with soil, mh-54830.

Pterigynandraceae

- Pterigynandrum filiforme** Hedw. B: on boulder, mh-54680; on rock-cliff, mh-54693.

Pylaisiadelphaceae

- Platygyrium repens** (Brid.) Schimp. A: on tree-trunk, mh-54585, 54594.

Rhytidiaceae

Rhytidium rugosum (Ehrh. ex Hedw.) Kindb.
C: on rock-cliff, mh-54711.

Thuidiaceae

Abietinella abietina (Hedw.) M.Fleisch. (Fig. 16) C: on boulder, mh-54696; on rock-cliff, mh-54698, 54723 (+ *Dicranella heteromalla*).
Thuidium tamariscinum (Hedw.) Schimp. A: on rock-cliff, mh-54603.

Timmiaceae

Timmia bavarica Hessel. C: on soil at crevice of rock, mh-54741.

Acknowledgments

I wish to thank Dr. Evgeny Davydov, Altai

State University, and Dr. Yoshihito Ohmura, National Museum of Nature and Science, for their help in the field research.

References

- Bates, J. W. 2009. Mineral nutrition and substratum ecology. In: Goffinet, B. and Shaw, A. J. (eds.), *Bryophyte Biology*, second edition, pp. 299–356. Cambridge University Press, Cambridge.
- Frey, W., Frahm, J.-P., Fischer, E. and Lobin, W. 2006. *The Liverworts, Mosses and Ferns of Europe*. 512 pp. Harley Books, Colchester.
- Goffinet, B., Buck, W. R. and Shaw, A. J. 2009. Morphology, anatomy, and classification of the Bryophyta. In: Goffinet, B. and Shaw, A. J. (eds.), *Bryophyte Biology*, second edition, pp. 55–138. Cambridge University Press, Cambridge.
- Ignatov, M. S., Afonina, O. M. and Ignatova, E. A. 2006. Check-list of mosses of East Europe and North Asia. *Arctoa* 15: 1–130.