

New bryophyte records from Kazakhstan

ZBYNĚK HRADÍLEK¹, JIŘÍ CHLACHULA^{2,3} & SVETLANA GEORGIEVNA NESTEROVA⁴

¹ Department of Botany, Faculty of Science, Palacký University, Šlechtitelů 11, Olomouc-Holice, CZ-783 71, Czech Republic; zbynek.hradilek@upol.cz

² Laboratory for Palaeoecology, T. Baťa University in Zlín, nám. T.G.M. 5555, 760 01 Zlín, Czech Republic; Altay@seznam.cz

³ Institute of Geoecology and Geoinformation, Faculty of Geology and Geography, Adam Mickiewicz University, Dziegielowa 27, 61-680 Poznań, Poland

⁴ Department of Ecology and Botany, Faculty of Biology, Al-Farabi Kazakh National University, Al-Farabi avenue 71, 050040 Almaty, Kazakhstan; Svetlana.Nesterova@kaznu.kz

Hradílek Z., Chlachula J. & Nesterova S.G. (2011): New bryophyte records from Kazakhstan. – Thaiszia – J. Bot. 21: 29-36. – ISSN 1210-0420.

Abstract: Eighteen bryophyte taxa have been recently recorded in Kazakhstan for the first time – *Aloina rigida*, *Andreaea rupestris*, *Bryum cryophilum*, *B. weigeli*, *Campylidium sommerfeltii*, *Conocephalum salebrosum*, *Dicranella crispa*, *Dicranum acutifolium*, *D. angustum*, *D. undulatum*, *Fissidens bryoides* var. *gymnandrus*, *Orthotrichum vladikavkanum*, *Pogonatum dentatum*, *Pohlia prolifera*, *Rhabdoweisia crispata*, *Sciuro-hypnum curtum*, *Struckia enervis*, and *Trachycystis ussuriensis*. Details of the study sites, including the bryophyte species distribution and population abundance are provided.

Keywords: bryophytes, new records, Altai, Kazakhstan, Asia.

Introduction

During systematic field investigations carried out in East Kazakhstan as part of recent complex biodiversity mapping and environmental management studies we found 17 bryophyte species and one variety which had not previously been recorded from Kazakhstan. The bryophytes were collected in the southern part of the Altai Mts., principally in the Katon-Karagay National Park and the Markakol Nature Reserve (Fig. 1), in June-July 2007. The Altai area as a whole is rather

unique with respect to the high diversity of plants including endemic species. Systematic research of bryophytes of Kazakhstan started by the end of the 19th century. The first collections from Kazakhstan were probably made by O. A. Fedchenko, B. A. Fedchenko, V. F. Brotherus, R. E. Regel, V. P. Drobov, A. Y. Gordyagin, etc. Their material was published by BROTHERUS (1914, 1918, 1931). Northern Tian-Shan attracted the greatest attention. This mountain range is perhaps the best explored area of Kazakhstan (BROTHERUS 1914, 1918, 1931, LISOWSKI 1964, EREMINA 1965, 1966, EREMINA et al. 1970, NESTEROVA 2006, etc.). Also a rather large number of bryophyte data are from the Kazakh part of the Altai Mts. (GODVINSKIJ 1966, SAKAUOVA 1991a,b, 1992, 2006, BAITULIN et al. 1995, NESTEROVA 2008). In spite of this Kazakhstan belongs to one of rather poorly explored areas of Middle Asia as to bryophytes. The most recent overview of bryophytes (mosses and liverworts) of Kazakhstan was provided by MAMATKULOV et al. (1998). A recent list of mosses of East Europe and North Asia (including Kazakhstan) was compiled by IGNATOV et al. (2006). A total of 390 moss and 38 liverwort species have been listed for Kazakhstan to date.



Fig. 1. Study area and localities.

Material and Methods

The documented records of bryophytes were geographically localized with GPS (WGS-84). The herbarium voucher specimens are currently stored in the first author's private herbarium. The used nomenclature follows IGNATOV et al. (2006) for mosses and VÁŇA & IGNATOV (1995) for liverworts, excluding *Sciurohypnum curtum* (Lindb.) Ignatov and *Conocephalum salebrosum* Szweyk., Buczkowska & Odrzykoski.

Results and discussion

Aloina rigida (Hedw.) Limpr.

Altai Mts.: Uryl district, road between Zhambul and Berel on the right bank of the Bukhtarma River, c. 6 km N of the village of Zhambul, loess wall, N 49° 17' 30" E 86° 19' 21", 1100 m a.s.l., 9 July 2007.

It is surprising that *A. rigida* had not yet been recorded from Kazakhstan, as it grows in almost all neighbouring countries (cf. MAMATKULOV et al. 1998, IGNATOV et al. 2006). The moss was collected in its typical habitat: on a loess wall in a steppe together with another interesting moss, *Hilpertia velenovskyi* (Schiffn.) R. H. Zander (BLOCKEEL et al. 2008).

Andreaea rupestris Hedw.

Altai Mts.: Katon-Karagay National Park, NE shore of lake "Bukhtarminskoye ozero" near the village of Ust-Chindagatuy, stony debris, N 49° 17' 51" E 86° 55' 41", 2085 m a.s.l., 23 June 2007.

A. rupestris is very common in the Russian Altai (IGNATOV 1994), but rather scarce in the Kazakh part of the Altai Mts.

Bryum cryophilum Mårtensson

Altai Mts.: Katon-Karagay National Park, Uryl, Tarbagatay Range, Bakanas Saddle, N 49° 12' 05" E 86° 21' 57", 2284 m a.s.l., 7 July 2007.

This species is widely distributed in Siberia and the Far East (cf. IGNATOV et al. 2006), Mongolia (TSEGMED 2001), and in the Himalayas. It is reported here for the first time from the mountains of Central Asia and Kazakhstan (cf. MAMATKULOV et al. 1998, IGNATOV et al. 2006). The reported moss was collected in a cold spring setting in association with *Warnstorfia sarmentosa* (Wahlenb.) Hedenäs, *Straminergon stramineum* (Dicks. ex Brid.) Hedenäs, and *Philonotis fontana* (Hedw.) Brid. There are some other species of *Bryum* known from this region which have not yet been subjected to a critical revision.

Bryum weigeliai Spreng.

Altai Mts.: Katon-Karagay National Park, village of Arshaty, forest on the left bank of the Bukhtarma River, N 49° 18' 03" E 86° 32' 48", 1234 m a.s.l., 4 July 2007.

B. weigeli is infrequent in the Altai Mts. Its occurrence in Central Asia was previously documented only in the Tian-Shan Mountains (MAMATKULOV et al. 1998).

Campylidium sommerfeltii (Myrin) Ochyra

Altai Mts.: Katon-Karagay National Park, village of Berel, valley of the Belaya Berel River, at bridge over the river c. 1 km E of the village of Yazovka, on the right river bank, N 49° 26' 34" E 86° 22' 01", 1194 m a.s.l., 27 June 2007. – Markakol Nature Reserve, village of Urunkhayka, on the bank of a creek on the eastern shore of lake Markakol 2 km N of the village, N 48° 48' 24" E 86° 02' 00", 1465 m a.s.l., 13 July 2007.

The plants mentioned by GODVINSKIJ (1966) from the vicinity of lake "Rakhmaninovskoye ozero" in the Kazakh Altai under the name *Campylium hispidulum* (Brid.) Mitt. might belong to this species.

Conocephalum salebrosum Szweyk., Buczkowska & Odrzykoski

Altai Mts.: Katon-Karagay National Park, village of Berel, settlement of Yazovka, valley of the Belaya Berel River, "zimovka Ser-Sembai", N 49° 37' 59" E 86° 28' 29", 1585 m a.s.l., 28 June 2007. – Katon-Karagay National Park, village of Arshaty, forest on the left bank of the Bukhtarma River, N 49° 18' 03" E 86° 32' 48", 1230 m a.s.l., 4 July 2007.

Only recently recognised liverwort has been separated of *Conocephalum conicum* by SZWEYKOWSKI et al. (2005). It seems to be a widespread holarctic species. The species grows on stones along creeks in a wet taiga forest zone. Older published data of *Conocephalum conicum* (e.g. SAKAUOVA 1991a, 2006) in Kazakhstan probably belong to this newly separated species. *C. salebrosum* can be distinguished from *C. conicum* by the combination of the following features: (1) Conspicuous borders between air chambers, (2) 1-2 rows of hyaline cells at margin of the thallus versus 3-4 in *C. salebrosum*, (3) 4-5 air chambers between costa and margin versus 6-7 in *C. salebrosum*. Both species were recognised in the Russian Altai (BOROVICHEV et al. 2009).

Dicranella crispa (Hedw.) Schimp.

Altai Mts.: Katon-Karagay National Park, village of Arshaty, forest on the left bank of the Bukhtarma River, N 49° 18' 03" E 86° 32' 48", 1230 m a.s.l., 4 July 2007.

The species was recorded at this single locality on bare soil in a roadside at a spruce forest margin together with *Pohlia prolifera* (Kindb.) Lindb. ex Broth. and *Blasia pusilla* L.

Dicranum acutifolium (Lindb. & Arnell) C.E.O.Jensen

Altai Mts. Katon-Karagay National Park, east shore of lake "Bukhtarminskoye ozero" near the settlement of Ust-Chindagatuy, forest along a small creek, N 49° 16' 49" E 86° 58' 32", 2087 m a.s.l., 23 June 2007.

The species was collected on top of brunisolic soil in shrubs along a small creek in the upper forest zone.

Dicranum angustum Lindb.

Altai Mts.: Katon-Karagay National Park, Uryl district, mountain ridge above the Bukhtarma River between Arshaty and Ust-Chindagatuy, peat bog on SW bank of a mountain lake c. 10 km W of the settlement of Ust-Chindagatuy, N 49° 15' 07" E 86° 51' 14", 2315 m a.s.l., 22 June 2007.

This moss was found in a peat bog in the subalpine zone. The species has recently also reported from some localities in the Russian Gorno Altai (IGNATOV 1994).

Dicranum undulatum Schrad. ex Brid.

Altai Mts.: Katon-Karagay National Park, Uryl district, mountain ridge above the Bukhtarma River between Arshaty and Ust-Chindagatuy, peat bog on SW bank of a mountain lake c. 10 km W of the settlement of Ust-Chindagatuy, N 49° 15' 07" E 86° 51' 14", 2315 m a.s.l., 22 June 2007.

The collected species from peat bog in the alpine region was found in association with *Sphagnum capillifolium* (Ehrh.) Hedw., *Climacium dendroides* (Hedw.) F. Weber & D. Mohr, *Aulacomnium palustre* (Hedw.) Schwägr., *Polytrichum commune* Hedw., and *P. strictum* Brid.

Fissidens bryoides Hedw. var. ***gymnandrus*** (Büse) R.Ruthe

Altai Mts.: Katon-Karagay National Park, village of Berel, valley of the Belaya Berel River, on the right river bank at bridge c. 1 km E of the settlement of Yazovka, N 49° 26' 34" E 86° 22' 01", 1194 m a.s.l., 27 June 2007.

The only small population of sterile plants was recorded on humus in a wet rock crevice on the right bank of the Belaya Berel River. Nevertheless, the characteristic shape of leaves and leaf tips suggests that our plants belong to this variety. Some authors distinguish this taxon at the species level (e.g. HILL et al. 2006).

Orthotrichum vladikavkanum Venturi

Altai Mts.: Markakol Nature Reserve, village of Urunkhayka, eastern bank of Lake Markakol, on *Salix* sp., N 48° 47' 16" E 86° 01' 24", 1451 m a.s.l., 14 July 2007.

O. vladikavkanum is a rather rare moss growing amongst the other *Orthotrichum* spp. on bark of old trees.

Pogonatum dentatum (Brid.) Brid.

Altai Mts.: Katon-Karagay National Park, E shore of lake "Bukhtarminskoye ozero" near the settlement of Ust-Chindagatuy, N 49° 16' 25" E 86° 58' 37", 2080 m a.s.l., 23 June 2007.

The moss was collected on bare regosolic soil in a small creek in the upper forest zone.

Pohlia proligera (Kindb.) Lindb. ex Broth.

Altai Mts.: Katon-Karagay National Park, village of Berel, valley of the Belaya Berel River, at bridge over the river c. 1 km E of the settlement of Yazovka, on

the right river bank, N 49° 26' 34" E 86° 22' 01", 1194 m a.s.l., 27 June 2007. – Village of Arshaty, forest on left bank of the Bukhtarma River, N 49° 18' 03" E 86° 32' 48", 1215 m a.s.l., 4 July 2007.

This gemmiferous species grows on bare soils on river banks and in roadsides. It can be partly overlooked in the study area.

Rhabdoweisia crispata (Dicks. ex With.) Lindb.

Altai Mts.: Katon-Karagay National Park, Uryl district, rocks in steppe above the village of Zhambul on the SW slopes of the Southern Altai Range, N 49° 14' 42" E 86° 17' 59", 1041 m a.s.l., 5 July 2007. – Village of Uryl, Tarbagatay Range, Bakanas Saddle, N 49° 12' 05" E 86° 21' 57", 2284 m a.s.l., 7 July 2007.

R. crispata is a wide-spread holarctic species. It is probably a rare moss growing in shaded humid crevices of granite rocks on the SW slopes of the Southern Altai mountain system.

Sciuro-hypnum curtum (Lindb.) Ignatov

Altai Mts.: Katon-Karagay National Park, village of Berel, settlement of Yazovka, valley of the Belaya Berel River, "Nizhnyy Lager" – the lower camp site under Mount Belukha, N 49° 43' 06" E 86° 40' 04", 1958 m a.s.l., 29 June 2007.

Recently, on the basis of molecular data, IGNATOV & MILYUTINA (2007a,b) have suggested that *S. curtum* and *S. oedipodium* are different taxa on the species level. According to these results, so far only *S. curtum* is known in the Altai and the rest of Central Asia. Our plants correspond to the description of *S. curtum*.

Struckia enervis (Broth.) Ignatov, T.J.Kop. & D.G.Long

Altai Mts.: Uryl district, road between Zhambul and Berel on the right bank of the Bukhtarma River, c. 6 km N of the village of Zhambul, stony debris, N 49° 17' 27" E 86° 19' 18", 1100 m a.s.l., 9 July 2007.

According to IGNATOV (1994), this species is rather frequent in the Russian Gorno Altai. In the present study area of East Kazakhstan, the recorded species grows on shaded humus-covered granite rocks in association with *Trachycystis ussuriensis* (Maack & Regel) T.J.Kop., *Hedwigia ciliata* (Hedw.) P.Beauv., *Plagiomnium cuspidatum* (Hedw.) T.J.Kop., *Porella platyphylla* (L.) Pfeiff., and *Neckera pennata* s.l.

Trachycystis ussuriensis (Maack & Regel) T.J.Kop.

Altai Mts.: Uryl, road between Zhambul and Berel on the right bank of the Bukhtarma River, c. 6 km N of Zhambul, stone debris, N 49° 17' 27" E 86° 19' 18", 1100 m a.s.l., 9 July 2007.

The species was collected together with the bryophytes mentioned at the previous species.

Acknowledgement

The authors thank Professor R. Ochyra (Krakow) for confirmation of our identification of *Dicranum acutifolium* and *D. angustum*. The project was supported by the Czech Ministry of Environment (Development Programme, Project Altai, no. RP/6/2005).

References

- BAITULIN I. O., SAKAUOVA G. B. & NESTEROVA S. G. (1995): Listostebelnye mkhi Kazakhstanskogo Altaya. Mkhi Kazakhstana. [Mosses of the Kazakh Altai. Mosses of the Kazakhstan.], Almaty, 9-15p.
- BLOCKEEL T. L., ABAY G., BAKALIN V. A., BEDNAREK-OCHYRA H., OCHYRA R., ÇETIN B., CYKOWSKA B., FUERTES E., HESPANHOL H., HOLYOAK D. T., HRADÍLEK Z., KEÇELI T., KÜRSCHNER H., LARRAÍN J., LONG D. G., PAROLLY G., PIĄTEK M., PIĄTEK J., RAMS S., ROS R. M., SÉNECA A., SÉRGIO C., SOLDÁN Z., ŞTEFĂNUŢ S., UYAR G., VÁÑA J. & ÖZLEM TONGUÇ YAYINTAŞ (2008): New national and regional bryophyte records, 19. – *Journal of Bryology* **30**: 231-237.
- BOROVICHEV E. A., KALINAUSKAITĖ N. & KONSTANTINOVA N. A. (2009): On the distribution of *Conocephalum conicum* and *C. salebrosum* (Marchantiophyta) in Russia. – *Arctoa* **18**: 115-120.
- BROTHERUS V. F. (1914): Mkhi (Andreaeales; Bryales, I.) [Mosses (Andreaeales; Bryales, I.)] – In: FEDCHENKO B. A. [ed.], *Flora Aziatskoj Rossii*, Pt. 4., p. 1-78. – Petrograd.
- BROTHERUS V. F. (1918): Mkhi (Bryales, II.). [Mosses (Bryales, II.)] – In: FEDCHENKO B. A. [ed.], *Flora Aziatskoj Rossii*, Pt. 13., p. 78-182. – Petrograd.
- BROTHERUS V. F. (1931): Mkhi Aziatskoj Rossii (Bryales, III.). [Mosses of Asian Russia (Bryales, III.)] – *Trudy Bot. Sada Akad. Nauk SSSR* **42** (2): 141-180.
- EREMINA N. KH. (1965): Materialy k flore akrokarpnykh mkhov Zailijskogo Alatau. [Materials on flora of acrocarpous mosses of Zailiisky Alatau.] – *Bot. Mat. Gerb. Inst. Bot. Akad. Nauk Kazakhskoy SSR* **3**: 115-125.
- EREMINA N. KH. (1966): Pojasnoe raspredelenie nekotorykh vidov mkhov v Zailijskom Alatau. [Altitudinal distribution of some moss species in Zailiisky Alatau.] – *Bot. Mat. Gerb. Inst. Bot. Akad. Nauk Kazakhskoy SSR* **4**: 155-161.
- EREMINA N. KH., SUYUNSHALIEVA U. KH. & PRUS L. N. (1970): K brioflore Alma-Atinskogo zapovednika. [On bryoflora of Alma-Atinsky State Reserve.] – *Trudy Alma-Atinskogo Gos. Zapov.* **9**: 46-50.
- GODVINSKIY M. I. (1966): Listostebelnye mkhi pribrezhiy Rakhmaninovskogo ozera. [Mosses on banks of the Rakhmaninovskoe ozero lake.] – *Bot. Mat. Gerb. Inst. Bot. Akad. Nauk Kazakhskoy SSR* **4**: 140-154.
- HILL M. O., BELL N., BRUGGEMAN-NANNENGA M. A., BRUGUÉS M., CANO M. J., ENROTH J., FLATBERG K. I., FRAHM J.-P., GALLEGO M. T., GARILLETI R., GUERRA J., HEDENÄS L., HOLYOAK D. T., HYVÖNEN J., IGNATOV M. S., LARA F., MAZIMPAKA V., MUÑOZ J. & SÖDERSTRÖM L. (2006): An annotated checklist of the mosses of Europe and Macaronesia. – *Journal of Bryology* **28**: 198-267.
- IGNATOV M. S. (1994): Bryophytes of Altai Mountains. I. – *Arctoa* **3**: 13-27.
- IGNATOV M. S., AFONINA O. M. & IGNATOVA E. A. [eds.] (2006): Check-list of mosses of East Europe and North Asia. – *Arctoa* **15**: 1-130.
- IGNATOV M. S. & MILYUTINA I. A. (2007a): On *Sciuro-hypnum oedipodium* and *S. curtum* (Brachytheciaceae, Bryophyta). – *Arctoa* **16**: 47-61.
- IGNATOV M. S. & MILYUTINA I. A. (2007b): A revision of the genus *Sciuro-hypnum* (Brachytheciaceae, Bryophyta) in Russia. – *Arctoa* **16**: 63-86.
- LISOWSKI S. (1964): Sur la flore bryologique du Tian-Chan septentrional. – *Bulletin de la Société des Amis des Sciences et des Lettres de Poznań*, ser. D **5**: 83-101.
- MAMATKULOV U. K., BAITULIN I. O. & NESTEROVA S. G. (1998): Mokhoobraznye Sredney Azii i Kazakhstana. [Bryophytes of the Middle Asia and Kazakhstan.] Almaty, 232 pp.
- NESTEROVA S. G. (2006): Flora mkhov Kazakhstanskogo Ketmentau. [Moss flora of Kazakh Ketmentau.] *General Botany Questions: Tradition and Perspectives*.

- International Conference Materials – 200 years of the Kazan Botany School, Part 1, Kazan. 23-27 January, 2006. 249-251pp.
- NESTEROVA S. G. (2008): Flora listostebelnykh mkhov Yuzhnogo Altaya. [Moss flora of the southern Altai Mountains.] Biodiversity, ecological issues of Gornyi Altai and its neighbouring regions: present, past, and future. International Conference Materials, Part 1, Gorno-Altaysk. 22-26 September, 2008. 268-273pp.
- SAKAUOVA G. B. (1991a): Materialy k flore pechenochnykh mkhov Yuzhnogo Altaya. [Materials on flora of liverworts of South Altai.] – Dep. VINITI. M. No. 10. Mnscr. 7 pp.
- SAKAUOVA G. B. (1991b): Sphagnovye mkhi Yuzhnogo Altaya. [Sphagna of South Altai.] – Dep. VINITI. M. No. 10. Mnscr. 5 pp.
- SAKAUOVA G. B. (1992): Mokhoobraznye Yuzhnogo Altaya. [Bryophytes of South Altai.] Summary of Ph.D. Thesis, Dushambe, Akad. Nauk Resp. Tadjikistan, Inst. Bot., 22pp.
- SAKAUOVA G. B. (2006): Zakonomernosti raspredelenia mkhov Yuzhnogo Altaya po tipam rastitelnosti i vertikalnym pojasam. [Vegetation types and altitude as factors influencing distribution of mosses in the South Altai.] – In: KRYKVAEVA R. N. & CHELYSHEV A. N. [eds.], Trudy Katon-Karagayskogo Gos. Nacional. Parka. 1: 120-131. Ust-Kamenogorsk.
- SZWEYKOWSKI J., BUCZKOWSKA K. & ODRZYKOSKI I. J. (2005): *Conocephalum salebrosum* (Marchantiopsida, Conocephalaceae) – a new Holarctic liverwort species. – Pl. Syst. Evol. **253**: 133-158.
- TSEGMED T. (2001): Checklist and distribution of mosses in Mongolia. – Arctoa **10**: 1-18.
- VÁNA J. & IGNATOV M. S. (1995): Bryophytes of Altai Mountains V. Preliminary list of the altaian hepatics. – Arctoa **5**: 1-13.

Received: March 30th 2011

Revised: July 18th 2011

Accepted: July 18th 2011