In 1995 a botanical survey led by Dr. Yuichi Kadota of National Science Museum, Tokyo, was carried out in the western part of the Tien Shan Mountains in collaboration with the Central Siberian Botanical Garden, Novosibirsk (cf. Kadota 1995). In July–August 1995 I collected bryophyte specimens as a member of the survey. Recently Ignatov et al. (2006) compiled the checklist of the mosses of East Europe and North Asia. The moss flora of Central Asia is insufficiently known.

Study area

The Tien Shan Mountains are a big mountain system in Central Asia and are situated along the border area between the former USSR countries and China. The botanical survey was made in the Dzhungarsky Alatau, the Zailisky Alatau, the Tereskey Alatau, the Central Tien Shan, the Kirghisky, the Alaisky and the Za Alaisky Range (Fig. 1), and locations are described below. The specimens examined are kept in the herbarium of the Department of Botany, National Museum of Nature and Science (TNS), and the duplicates in the herbarium of the Central Siberian Botanical Garden (NS).

Kazakhstan

Dzhungarsky Alatau (45°13’N, 80°20’E)
Zailisky Alatau (43°02’N, 77°00’E)

Kyrgyzstan

Tereskey Alatau (42°15’N, 78°30’E)
Kirghisky (42°34’N, 73°36’E)
Alaisky (39°35’N, 71°58’E)
Za Alaisky Range (39°25’N, 72°08’E)

This paper deals with taxa of the families Hypnaceae and Hylocomiaceae occurring in the Tien Shan Mountains based on the collections made by Higuchi in 1995. By the examination of the specimens, eleven species in three genera and four species in four genera were recognized in Hypnaceae and Hylocomiaceae, respectively. Hypnum callichroum and H. subimponens subsp. subimponens are new records for the moss flora of Kazakhstan, and Hypnum cupressiforme var. subjulaceum and H. recurvatum are new to Kyrgyzstan. A key for the Hypnum species in Kazakhstan and Kyrgyzstan is shown.

Key words: Hypnaceae, Hylocomiaceae, mosses, Tien Shan Mountains, Russia, Kazakhstan, Kyrgyzstan

Hypnaceae

Although the recent molecular phylogenetic analyses indicate that the Hypnaceae as well as its type genus Hypnum itself were polyphyletic
(e.g., Tsubota et al. 2002), the delimitation of the family is still controversial. Here I follow the system of Hypnaceae by Goffinet and Buck (2004) with some changes and Hypnum by a series of study by Ando respectively.


   Specimen examined. Kazakhstan, Mts. Dzhungarsky Alatau, Maly Baskan, 2480 m, July 21, 1995 (Higuchi 27952).

   Distribution. Europe, Caucasus, Pakistan, N. and C. Asia, China, Korea, Japan and N. America.

Specimens examined. Russia, Novosibirsk, Central Siberian Botanical Garden, 150 m, July 12, 1995 (*Higuchi 27723, 27725, 27728, 27730*); July 14, 1995 (*27736, 27743, 27752*).


Nine species and one subspecies of *Hypnum* including *H. callichroum*, *H. cupressiforme* var. *subjulaceum* and *H. subimponens* subsp. *subimponens* newly added here are known from Kazakhstan and/or Kyrgyzstan. The following key is revised from Ando (1973, 1976, 1993, 1994). The species with asterisk (*) are not present in this collection.

Key to the speices of *Hypnum* in Kazakhstan and Kyrgyzstan

1. Perichaetial leaves not plicate; seta twisted to the right throughout the whole length when dry, rarely only slightly turned to the left below the capsule; spores maturing in fall to winter ....... 2
2. Leaves oblong-lanceolate; alar parts remarkably excavated and usually brown-colored; median cells (50–60–70(–80)/H11003 3–4(–5) μm ........................................ 5. *H. cupressiforme* var. *subjulaceum*
3. Epidermal cells of stem always much larger than the associated inner cortical cells, hyaline with thin outer walls (hyalodermous); sometimes phyllodioicous ........................................ 4
4. Plants medium- to large-sized; leaves usually broadly acuminate; growing in moist habitats ......................................................... 7. *H. lindbergii*
5. Stem leaves weakly narrowed and not or only slightly rounded to the insertion; margins usually recurved below, sometimes so upwards; alar cells only slightly differentiated ............. 6
6. Plants small-sized, procumbent or erect to ascending in dense tufts; stem leaves ovate-lanceolate, 1.3–1.5/H11003 0.4–0.5 mm; laminal cells 40–60(–70)/H11003 3–4 μm in lumina ....... *H. hamulosum* *
7. Alar parts of leaves consisting of heterogeneous cells, with enlarged, thin-walled, hyaline cells at the outer angle .......................................................... 10. *H. subimponens* subsp. *subimponens*
8. Alar parts of leaf strongly excavate, composed of porose cells that are thick-walled ........ 3. *H. bambergeri*
9. Plants large-sized; leaves more markedly dimorphic in stem- and branch leaves; stem leaves cordate-auriculate at base ........................................ 12. *H. procerrimum*

Specimens examined. Kazakhstan, Mts. Dzhungarsky Alatau, Maly Baskan, 2000 m, July 21, 1995 (Higuchi 27957); 2100 m, July 22, 1995 (Higuchi 28023).

Distribution. Spitsbergen, Iceland, Europe, Russia, Canada, Alaska and Greenland (Ando 1996).

Notes. This species is characterized by having falcate, smooth leaves with entire channelled acumen, incrassate, porose laminal cells and brown-colored alar parts of leaves. According to Ando (1996), the distribution of the species in Asia is limited to Siberia north of about 60°N and the Altai Mountains. Ignatov et al. (2006) reported this species from Kazakhstan and Kyrgyzstan as *Stereodon bambergeri* (Schimp.) Lindb.


Specimens examined. Kazakhstan, North of Semipalatinsk, 340 m, July 17, 1995 (Higuchi 27762).

Distribution. Europe, Siberia and northern N. America (Ando 1997, as *H. callichroum* subsp. *callichroum*). New to Kazakhstan.

Notes. This species is characterized by the hyalodermatous stems and inflated hyalinealar cells of leaves. Ando (1997) described a new subspecies of the species, *H. callichroum* subsp. *japonicum*, from alpine region of Japan, which is distinguished from subs. *callichroum* by the smaller-sized plants usually showing more close branching and foliation, and the somewhat shorter laminal cells and setae.


Specimens examined. Kazakhstan, Sarkand, 900 m, July 20, 1995 (Higuchi 27814/H11001); Mts. Dzhungarsky Alatau, Maly Baskan, 1900 m, July 22, 1995 (Higuchi 28083, 28098, 28100). Kyrgyzstan, Tien Shan, Mts. Tereskey Alatau, 2800 m, Aug. 1, 1995 (Higuchi 28411); 2900 m, July 31, 1995 (Higuchi 28355); 2920 m, Aug. 1, 1995 (Higuchi 28428).

Distribution. Widely distributed in the world.


Specimens examined. Kazakhstan, Sarkand, 900 m, July 20, 1995 (Higuchi 27785); Mts. Dzhungarsky Alatau, Maly Baskan, 1900 m, July 22, 1995 (Higuchi 28083, 28098, 28100). Kyr-
gystan, Tien Shan, Mts. Tereskey Alatau, 3600
m, July 31, 1995 (*Higuchi 28375*); near glacier,
3600 m, Aug. 2, 1995 (*Higuchi 28459, 28466*);
Mts. Alaisky, south of Gulcha, 2000 m, Aug. 9,
1995 (*Higuchi 28643, 28652, 28663, 28668*).

Distribution. Widely distributed in the
Northern Hemisphere and New Zealand. New to
Kyrgyzstan.

Notes. This variety is characterized by hav-
ing subjulaceous branches and the not or weakly
falcate leaves with excavated and usually brown-
colored alar areas. Although Ignatov
falcate leaves with excavated and usually brown-
ing subjulaceous branches and the not or weakly
Kyrgyzstan.

Northern Hemisphere and New Zealand. New to
Kyrgyzstan.

Notes. This variety is characterized by hav-
ing subjulaceous branches and the not or weakly
falcate leaves with excavated and usually brown-
colored alar areas. Although Ignatov *et al.* (2006)
doesn’t list the variety from Kazakhstan, Ando
(1990) cited the specimen of the variety from
“Kasachstania, Montes Kunjej-Alatau, 2000 m,
Lisowski (NICH 208140).”

(1864).

Specimen examined. Kazakhstan, Mts. Dzun-
garsky Alatau, Maly Baskan, 2400 m, July 21,
1995 (*Higuchi 27890*).

Distribution. Widely distributed in the
Northern Hemisphere and Brasil.

Notes. Hedenäs (1990) transferred this
species to the genus *Calliergonella* based on
some characteristics, such as appendiculate cilia
and large groups of strongly inflated alar cells of
stem leaves.

8. Hypnum recurvatum (Lindb. & Arn.)

Specimens examined. Kazakhstan, Sarkand,
900 m, July 20, 1995 (*Higuchi 27789*); Mts.
Zailisky Alatau, north of Almaty, 1750 m, July
25, 1995 (*Higuchi 28126*). Kyrgyzstan, Tien
Shan, Mts. Tereskey Alatau, 2500 m, Aug. 2,
1995 (*Higuchi 28302, 28503*); 2920 m, Aug. 1,
1995 (*Higuchi 28432, 28434*).

Distribution. Ural, Fennoscandia, Tatra,
Carpathians, Alps, Jura, Pyrenees, Caucasus,
Siberia, Mongolia, Canada, Montana and Green-

Notes. This species is closely related to *Hyp-
num revolutum*, but is distinguished from it
by having narrow-lanceolate to filamentous
pseudoparaphyllia (ovate to lanceolate in *H. rev-
olutum*), leaves with margins plane or recurved
below (usually margins revolute from the base up
to near the apex in *H. revolutum*) and sub-
quadrate alar cells 4–10 in the marginal row
(8–15 in the marginal row in *H. revolutum*).

9. Hypnum revolutum (Mitt.) Lindb., Oefv. K.

Specimens examined. Kazakhstan, Sarkand,
900 m, July 20, 1995 (*Higuchi 27814+Hypnum
cupressiforme var. cupressiforme*); Mts. Dzun-
garsky Alatau, Maly Baskan, 900 m, July 21,
1995 (*Higuchi 27820, 27825*); 1900 m, July 22,
1995 (*Higuchi 27979, 27980, 27984, 28001,
28067, 28073, 28079*); 2100 m, July 22, 1995
(*Higuchi 27834*); 2270 m (*Higuchi 28019*);
2400 m, July 21, 1995 (*Higuchi 27851, 27856,
27868, 27881, 27899*); 2550 m (*Higuchi 27907,
27931, 27939*); Mts. Zailisky Alatau, north of Almaty,
1750 m, July 25, 1995 (*Higuchi 28136, 28139*);
near reservoir, 2500 m (*Higuchi 28142, 28153,
28159*); 2560 m, July 27, 1995 (*Higuchi 28259,
28265*); 2600 m (*Higuchi 28287*); 2680 m, July
26, 1995 (*Higuchi 28254*); 2800 m (*Higuchi
28177*); 2850 m (*Higuchi 28182, 28183*); 3100 m
(*Higuchi 28205, 28208*); 3210 m (*Higuchi
28219, 28233, 28243, 28246*). Kyrgyzstan, Tien
Shan, Mts. Tereskey Alatau, 2480 m, July 30,
1995 (*Higuchi 28317*); 2700 m (*Higuchi 28339*);
2920 m, Aug. 1, 1995 (*Higuchi 28427*); 3370 m,
July 31, 1995 (*Higuchi 28398*); 3600 m, Aug. 2,
1995 (*Higuchi 28454, 28468, 28469, 28479*);
3640 m (*Higuchi 28386*); 3950 m, (*Higuchi
28381*); Mts. Kirghisky, 3400 m, Aug. 6, 1995
(*Higuchi 28637*); 3550 m (*Higuchi 28561,
28563, 28575, 28576*); near glacier, 3600 m
(*Higuchi 28583, 28586, 28604, 28606, 28608*);
Mts. Alaisky, south of Gulcha, 3550 m, Aug. 9,
1995 (*Higuchi 28658*); 3600 m (*Higuchi 28649*);
Mts. Za Alaisky, 2700 m, Aug. 11, 1995 (*Higuchi
28694, 28698*).

Distribution. Widely distributed in the
Northern Hemisphere and Antarctic Peninsula
(Ando 1973).

Notes. This species is the commonest
species of the genus in the area investigated. *Hypnum revolutum* is variable in size, but is most distinct in having more or less plicate leaves with strongly revolute margins and alar parts of leaves consisting of homogeneous subquadrate cells.


Specimens examined. Kazakhstan, Sarkand, 900 m, July 20, 1995 (*Higuchi 27790, 27809*).


Notes. This subspecies differs from *H. subimponens* subsp. *ulophyllum* (Müll.Hal.) Ando distributed in Himalayas, China, Taiwan, Korea and Japan by its larger plants, shorter costae of leaves and longer, arched capsules.


Specimen examined. Kazakhstan, Mts. Dzhungarsky Alatau, Maly Baskan, 1900 m, July 21, 1995 (*Higuchi 28101*).

Distribution. Widely distributed in the Northern Hemisphere.


Distribution. Widely distributed in the Northern Hemisphere.


Specimens examined. Russia, Novosibirsk, Central Siberian botanical Garden, 150 m, July 14, 1995 (*Higuchi 27747*). Kazakhstan, Mts. Dzhungarsky Alatau, Maly Baskan, 1900 m, July 22, 1995 (*Higuchi 27993*); 2100 m, July 21, 1995 (*Higuchi 27836, 27837*); 2500 m (*Higuchi 27901*). Kyrgyzstan, Tien Shan, Mts. Tereskey Alatau, 2430 m, July 30, 1995 (*Higuchi 28331, 28336*).

Distribution. Widely distributed in the Northern Hemisphere.


Specimens examined. Kyrgyzstan, Tien Shan, Mts. Tereskey Alatau, 2920 m, Aug. 1, 1995 (*Higuchi 28426*); 3640 m, July 31, 1995 (*Higuchi 28389*). Kyrgyzstan, Tien Shan, Mts. Tereskey Alatau, 2430 m, July 30, 1995 (*Higuchi 28331, 28332*).

Distribution. Widely distributed in the Northern Hemisphere.


Specimens examined. Kyrgyzstan, Tien Shan, Mts. Tereskey Alatau, 2430 m, July 30, 1995 (*Higuchi 28318, 28320, 28326*). Kyrgyzstan, Tien Shan, Mts. Tereskey Alatau, 2430 m, Aug. 1, 1995 (*Higuchi 28413*).

Distribution. Widely distributed in the Northern Hemisphere.


Specimens examined. Kazakhstan, Mts. Dzhungarsky Alatau, Maly Baskan, 2400 m, July 21, 1995 (*Higuchi 27891*); 2480 m (*Higuchi 27953*); Zailisky Alatau, north of Almaty, 3000 m, July 26, 1995 (*Higuchi 28202*). Kyrgyzstan, Tien Shan, Mts. Tereskey Alatau, 2920 m, Aug. 1, 1995 (*Higuchi 28413*).

Distribution. Morocco, Europe, Caucasus, Himalayas, N. and C. Asia, China, Japan, N. America, Mexico, Guatemala and Greenland.
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