

Studies on the Bryophyte Flora of the Tien Shan Mountains. 2.* Encalyptaceae and Splachnaceae (Bryophyta)

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Abstract Five species in one genus in Encalyptaceae and two species in one genus in Splachnaceae are reported based on the collections made in the Tien Shan Mountains in 1995. *Encalypta intermedia* is a new record for the moss flora of Kazakhstan, and *Tayloria froelichiana* and *T. hornschurchii* are new to Kyrgyzstan. Keys for the *Encalypta* and *Tayloria* species in Kazakhstan and Kyrgyzstan are shown.

Key words : Encalyptaceae, Kazakhstan, Kyrgyzstan, mosses, Splachnaceae, Tien Shan Mountains.

This paper deals with the Encalyptaceae and Splachnaceae (Bryophyta) occurring in Kazakhstan and Kyrgyzstan, based on the collections made by the author in 1995 (cf. Higuchi, 2007). By the examination of the specimens, five species in one genus and two species in one genus were recognized in Encalyptaceae and Splachnaceae, respectively. According to Ignatov *et al.* (2006), *Encalypta intermedia* is a new record for the moss flora of Kazakhstan, and *Tayloria froelichiana* and *T. hornschurchii* are new to Kyrgyzstan. 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 Sibe-

rian Botanical Garden (NS).

Encalyptaceae

The family Encalyptaceae include two genera; *Bryobrittonia* and *Encalypta* (cf. Goffinet and Buck, 2004). Although one species of *Bryobrittonia* and nine species of *Encalypta* are known from Kazakhstan and/or Kyrgyzstan (Ignatov *et al.*, 2006), five species of *Encalypta* were recognized in the collection. The following key is revised from Nyholm (1998) and Horton (1983). The species with asterisk (***) are not present in this collection.

Key to the species of *Encalypta* in Kazakhstan and Kyrgyzstan

1. Spores isopolar or paraisopolar; peristome when present double, outer and inner±fused; vaginula in upper part with cup-shaped fragile remnant of base of calyptra..... 2
1. Spores heteropolar; peristome absent or present, when present single; vaginula in upper part with remnant of calyptra either cup-shaped or umbrella-like..... 4
2. Capsule with large revoluble annulus cells; calyptra lacerate at base; filiform gemmae mostly present in upper part of sterile stems. *E. streptocarpa****

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2. Capsule without large revoluble annulus cells; calyptra lobed at base; gemmae not observed. 3
3. Peristome present, double, outer and inner fused. *E. longicolla***
3. Peristome absent. *E. alpina*
 4. Seta yellow; vaginula±elongate, in upper part with cup-shaped remnant of base of calyptra; base of loosened calyptra lobed. *E. ciliata*
 4. Seta red; vaginula short, in upper part with remnant of base of calyptra umbrella-like; base of loosened calyptra erose. 5
5. Peristome present, yellow or reddish-brown. 6
5. Peristome absent. 7
 6. Peristome without preperistome, yellow, irregularly developed, fragile, sometimes seemingly absent; capsule with±weakly yellow striae. *E. trachymitra***
 6. Peristome well developed, red-brown, usually with short or elongate preperistome; capsule with prominent yellow or red-brown striae, when dry and empty deeply longitudinally furrowed. *E. rhapsocarpa*
7. Upper leaves with±elongate hair point. *E. spatulata***
7. Leaves without hair point. 8
 8. Capsule±furrowed; seta 1–4mm long; leaves inconspicuously keeled in upper part on abaxial surface. *E. intermedia*
 8. Capsule±smooth; seta 4–8mm long; leaves prominently keeled in upper part on abaxial surface. *E. vulgaris*

1. ***Encalypta alpina*** Sm., Engl. Bot. 20: 1419 (1805). this area.

Specimens examined. **Kazakhstan**, Mts. Dzhungarsky Alatau, Maly Baskan, 2500m, July 21, 1995 (*Higuchi 27902*); 2550m (*Higuchi 27909, 27911, 27912, 27933, 27938*); Mts. Zailisky Alatau, north of Almaty, 2600m (*Higuchi 28286*); 2850m (*Higuchi 28191*); 3100m (*Higuchi 28214*); 3210m (*Higuchi 28241*). **Kyrgyzstan**, Tien Shan, Mts. Tereskey Alatau, 2920m, August 1, 1995 (*Higuchi 28417*); 3640m, July 31, 1995 (*Higuchi 28390*); near glacier, 3600m, August 2, 1995 (*Higuchi 28485, 28490*); Mts. Kirgizskiy, 3550m, August 6, 1995 (*Higuchi 28571, 28572*).

Distribution. Europe, North Africa, Caucasus, Turkey, Himalayas, Central Asia, China, Japan, North America and Greenland (cf. Nyholm, 1998).

Notes. This species is the commonest species of the genus in the area investigated. *Encalypta alpina* is characterized by ovate-lanceolate leaves with gradually narrowed apices, calyptra reaching some distance below capsule and with fringed base and absence of peristome. This species sometime occurs with *Myurella julacea* in

2. ***Encalypta ciliata*** Hedw., Spec. Musc. 61 (1801).

Specimens examined. **Kazakhstan**, Sarkand, 900m, July 20, 1995 (*Higuchi 27807*); Mts. Dzhungarsky Alatau, Maly Baskan, 1900m, July 22, 1995 (*Higuchi 27992, 28076*); 2100m (*Higuchi 28024, 28025*); 2270m (*Higuchi 28011*); 2400m, July 21, 1995 (*Higuchi 27895*); 2500m (*Higuchi 27903*); Mts. Zailisky Alatau, north of Almaty, 1750m, July 25, 1995 (*Higuchi 28127*); 2600m, July 27, 1995 (*Higuchi 28276*); 2850m, July 26, 1995 (*Higuchi 28186*). **Kyrgyzstan**, Tien Shan, Mts. Tereskey Alatau, 2430m, July 30, 1995 (*Higuchi 28322, 28334*).

Distribution. Europe, North, Central and South Africa, Caucasus, Turkey, Israel, Kazakhstan, Kyrgyzstan, Siberia, Mongolia, China, Japan, North, Central and South America, New Guinea, Australia and New Zealand (cf. Nyholm, 1998; Ignatov *et al.*, 2006).

Notes. *Encalypta ciliata* is characterized by yellow seta, lobed calyptra with long rostrum and single peristome. This species has heteropolar

spores, that is, the ornamentation of proximal and distal surfaces of spores is markedly differentiated (cf. Horton, 1983).

3. **Encalypta intermedia** Jur., Verh. Zool. Bot. Ges. Wien 20: 595 (1870).

Specimens examined. **Kazakhstan**, Mts. Dzhungarsky Alatau, Maly Baskan, 1900 m, July 22, 1995 (*Higuchi 28090, 28107*); Mts. Zailisky Alatau, north of Almaty, 2850 m, July 26, 1995 (*Higuchi 28199, 28201*); 3100 m (*Higuchi 28210*).

Distribution. North Europe, Caucasus, Turkey, Iran, Kyrgyzstan and western North America (cf. Horton, 1983; Ignatov *et al.*, 2006).

Notes. *Encalypta intermedia* is a new record for the moss flora of Kazakhstan. This species is closely allied to *E. vulgaris*, and some authors considered that this species is one of variation in *E. vulgaris*. According to Horton (1983), this species is treated as distinct species with distinguishing characters, such as furrowed capsules and short setae. Ignatov *et al.* (2006) listed *E. intermedia* as different from *E. vulgaris*.

4. **Encalypta rhapsocarpa** Schwägr., Supp. Sp. Musc. 1(1): 56 (1811).

Specimens examined. **Kazakhstan**, Mts. Zailisky Alatau, north of Almaty, 2600 m, July 27, 1995 (*Higuchi 28269*); 3210 m, July 27, 1995 (*Higuchi 28218, 28221*). **Kyrgyzstan**, Tien Shan, Mts. Tereskey Alatau, 2920 m, July 31, 1995 (*Higuchi 28360*); 3370 m (*Higuchi 28403*); 3700 m (*Higuchi 28379*); near glacier, 3600 m, August 2, 1995 (*Higuchi 28457*); Mts. Kirghisky, near glacier, 3600 m, August 6, 1995 (*Higuchi 28591, 28593*); Mts. Alaisky, south of Gulcha, 3550 m, August 9, 1995 (*Higuchi 28664, 28669*,

28672).

Distribution. Europe, Caucasus, Kazakhstan, Kyrgyzstan, Mongolia, Siberia, Japan, Hawaii, North America and Greenland (cf. Nyholm, 1998; Ignatov *et al.*, 2006).

Notes. *Encalypta rhapsocarpa* is characterized by deeply furrowed capsules, peristome with preperistome and almost entire base of calyptra.

5. **Encalypta vulgaris** Hedw., Spec. Musc. 60 (1801).

Specimens examined. **Kyrgyzstan**, Tien Shan, Mts. Tereskey Alatau, 2900 m, July 31, 1995 (*Higuchi 28362, 28363*).

Distribution. Europe, North Africa, Caucasus, Kazakhstan, Kyrgyzstan, West Asia and North America (cf. Nyholm, 1998; Ignatov *et al.*, 2006).

Notes. *Encalypta vulgaris* is characterized by smooth capsules, long seta and prominently keeled leaves.

Splachnaceae

The family Splachnaceae include six genera, *Aplodon*, *Moseniella*, *Splachnum*, *Tayloria*, *Tetraplodon*, *Voitia* (cf. Goffinet and Buck, 2004). Although two species of *Splachnum*, five species of *Tayloria*, three species of *Tetraplodon* and one species of *Voitia* are known from Kazakhstan and/or Kyrgyzstan (Ignatov *et al.*, 2006), two species of *Tayloria* were recognized in the collection. The following key is revised from Marino (2014) and Nyholm (1989). The species with asterisk (**) are not present in this collection.

Key to the species of *Tayloria* in Kazakhstan and Kyrgyzstan

1. Leaves lingulate or rarely obovate to oblong; apices obtuse to rounded occasionally bluntly acute; margins entire or sometimes with blunt teeth..... 2
1. Leaves obovate, oblong, or ovate-lanceolate, rarely lingulate; apices acute or acuminate, not broadly rounded, sometimes obtuse; margins serrate distally..... 4
 2. Prostome present; seta slender, 1.5–4 cm..... *T. lingulata***
 2. Prostome absent; seta stout, to 1 cm..... 3

3. Leaves uniformly spaced along stem, slightly contorted when dry; columella included; hypophysis as long as urn; exostome teeth lanceolate, yellow to tan; operculum deciduous. *T. froelichiana*
3. Leaves crowded at stem and branch apices, stiffly erect-imbricate when dry; columella exserted; hypophysis longer than urn; exostome teeth truncate to obtuse, red to red-brown; operculum systylius. *T. hornschurchii*
4. Exostome teeth not split. 5
4. Exostome teeth split at base into linear-lanceolate filaments 6
5. Rhizoids red with gemmae *T. serrata***
5. Rhizoids brownish without gemmae. *T. tenuis***
6. Plants 1–3 cm; leaf apices blunt or apiculate; setae 1.5–3 cm; capsule urns 2–3.5 mm when moist; columella exserted when dry; operculum long-conic. *T. splachnoides***
6. Plants 0.5–1 cm; leaf apices long-acuminate; setae 0.6–1.5 cm; capsule urns 0.8–2 mm when moist; columella not or barely exserted when dry; operculum short-conic *T. acuminata***

6. **Tayloria froelichiana** (Hedw.) Mitt. ex Broth. in Engler & Prantl, Nat. Pfl. 1(3): 502 (1903).

Specimens examined. **Kazakhstan.** Mts. Dzhungarsky Alatau, Maly Baskan, 2400 m, July 21, 1995 (*Higuchi 27893*); 2550 m (*Higuchi 27926, 27929*); Mts. Zailisky Alatau, north of Almaty, 3210 m, July 26, 1995 (*Higuchi 28236*). **Kyrgyzstan.** Mts. Kirghisky, 3300 m, August 6, 1995 (*Higuchi 28625*); near glacier, 3600 m (*Higuchi 28588*).

Distribution. North and Central Europe, Caucasus, Central Asia, Siberia, Himalayas, Mongolia, western North America and Greenland (cf. Nyholm, 1998; Ignatov *et al.*, 2006).

Notes. *Tayloria froelichiana* is a new record for the moss flora of Kyrgyzstan. This species was growing on crevice of rock-cliff or soils by stream near glacier and was sometimes mixed with *Encalypta* spp. or *Blepharostoma trichophila*. *Tayloria froelichiana* is easily distinguished from *T. hornschurchii* by several sporophytic characters described in the key. In addition, the seta is longer (1 cm) and twisted when dry in this species, while that of *T. hornschurchii* is shorter (less than 1 cm) and not twisted when dry (Marino, 2014). The sexual condition also differs in the both species, that is, cladautoicous or synoicous in *T. froelichiana* and dioicous in *T. hornschurchii*.

7. **Tayloria hornschurchii** (Grev. & Arnott)

Broth. in Engler & Prantl, Nat. Pfl. 1(3): 502 (1903).

Specimens examined. **Kyrgyzstan,** Tien Shan, Mts. Tereskey Alatau, 2900 m, July 31, 1995 (*Higuchi 28365, 28368, 28370*); 3640 m (*Higuchi 28388*); 2920 m, August 1, 1995 (*Higuchi 28416*); near glacier, 3600 m, August 2, 1995 (*Higuchi 28486*).

Distribution. North and Central Europe, Kazakhstan, Nepal, China, Japan and North America (cf. Marino, 2014; Ignatov *et al.*, 2006).

Notes. *Tayloria hornschurchii* is new to Kyrgyzstan. This species was growing on almost the same habitat with *T. froelichiana*. Lafarge-England and Vitt (1985) studied *Tayloria hornschurchii* and *T. froelichiana* in North America with special reference to the gametophytic characters. They found that *T. hornschurchii* differs from *T. froelichiana* by having axillary propagule. This difference was observed in the specimens of the both species examined from this collection.

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References

- Goffinet, B. and Buck, W. R. 2004. Systematics of the Bryophyta (mosses): from molecules to a revised classification. In: Goffinet, B., Hollowell, V. and Magill, R. (eds.), Molecular Systematics of Bryophytes. Monographs in Systematic Botany from the Missouri Botanical Garden 98: 205–239.
- Higuchi, M. 2007. Studies on the bryophyte flora of the Tien Shan Mountains. 1. Hypnaceae and Hylocomiaceae (Musci). Bulletin of the National Museum of Nature and Science, Series B 33: 115–121.
- Horton, D. G. 1983. A revision of the Encalyptaceae (Musci), with particular reference to the North American taxa. Part II. Journal of the Hattori Botanical Laboratory 54: 353–532.
- 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.
- Lafarge-England, C. and Vitt, D. H. 1985. A taxonomic study of *Tayloria hornschurchii* and *T. froelichiana* in North America. Bryologist 88: 82–93.
- Marino, P. C. 2014. Splachnaceae. In: Flora of North America Editorial Committee (ed.), Flora of North America North of Mexico. Vol. 28, Bryophyta, part 2, pp. 14–29. Oxford University Press, New York.
- Nyholm, E. 1989. Illustrated Flora of Nordic Mosses. Fasc. 2. Pottiaceae–Splachnaceae–Schistostegaceae, pp. 75–141. Nordic Bryological Society, Copenhagen.
- Nyholm, E. 1998. Illustrated Flora of Nordic Mosses. Fasc. 4. Aulacomniaceae–Meesiaceae–Catoscopiaceae–Bartramiaceae–Timmiaceae–Encalyptaceae–Grimmiaceae–Ptychomitraceae–Hedwigiaceae–Orthotrichaceae, pp. 249–405. Nordic Bryological Society, Copenhagen.