Arctoa (1995): 4: *65-104*

THE FAMILIES CRYPHAEACEAE, LEUCODONTACEAE AND LEPTODONTACEAE (MUSCI) IN RUSSIA

СЕМЕЙСТВА CRYPHAEACEAE, LEUCODONTACEAE И LEPTODONTACEAE (MUSCI) В РОССИИ

MICHAEL S. IGNATOV[1] & VALENTINA YA. CZERDANTSEVA[2]

МИХАИЛ СТАНИСЛАВОВИЧ ИГНАТОВ[1] и ВАЛЕНТИНА ЯКОВЛЕВНА ЧЕРДАНЦЕВА[2]

Abstract

Three families of the Russian moss flora are described and illustrated. Leptodontaceae includes *Leptodon smithii* and 5 species of *Forsstroemia* (*F. japonica, F. cryphaeoides, F. stricta, F. trichomitra* and *F. noguchi*). *F. stricta* Lazarenko is considered as an endemic of Russian Far East; this species is very close to pan-subtropical *F. producta*. Endotome segments are found in *F. japonica*. Cryphaeaceae includes 2 species of *Cryphaea*, both known in Russia by the single collection – *C. heteromalla* is known from Northern Caucasus, *C. amurensis* Ignatov sp. nov. is described from Khabarovsk Territory, Far East. Leucodontaceae includes *Dozya japonica*, *Antitrichia curtipendula* and 5 species of *Leucodon* (*L. sciuroides, L. immersus, L. coreense, L. pendulus* and *L. flagellare*). Sporophytes of *L. flagellare* are described for the first time.

Резюме

Рассмотрены три семейства бриофлоры России. Leptodontaceae включает *Leptodon smithii* и 5 видов *Forsstroemia* (*F. japonica, F. cryphaeoides, F. stricta, F. trichomitra* и *F. noguchi*). Признается видовой статус *F. stricta* Lazarenko, эндемика российского Дальнего Востока; этот вид очень близок к широко распространенной в тропиках и субтропиках *F. producta*. У *F. japonica* обнаружен б. м. развитый эндостом со свободными отростками. Семейство Cryphaeaceae представлено 2 видами *Cryphaea*, которые известны в России лишь по единичным сборам – *C. heteromalla* известна с Северного Кавказа, *C. amurensis* Ignatov sp. nov. описана из Хабаровского края. Leucodontaceae включает *Dozya japonica*, *Antitrichia curtipendula* и 5 видов *Leucodon* (*L. sciuroides, L. immersus, L. coreense, L. pendulus* и *L. flagellare*). Спорогоны *L. flagellare* описаны впервые.

INTRODUCTION

A group of principally xerophytic families of the order Leucodontales (Isobryales) including about 40 genera has been classified into 6 families: Hedwigiaceae, Leucodontaceae, Cryphaeaceae, Leptodontaceae, Anomodontaceae and Cyrtopodaceae (Buck & Vitt, 1986). Among these Hedwigiaceae are rather distinct in the papillose leaf cells and the absence of peristome (or its strong reduction in the monotypic East Asian *Cleistoma*). Cyrtopodaceae, a principally southern hemispheran family, are rather peculiar in having subulate leaves from a sheathing base. Anomodontaceae have cells with well developed papillae above the lumina.

The other three families comprise a puzzling complex that remains a source of disagreements for taxonomists. The complex contains about 25 genera, mostly mono- or oligotypic, with two rather big genera, *Leucodon* (20-30 species) and *Cryphaea* (30-50 species). The latter genera are clearly contrasting. *Leucodon* has longly acuminate leaves without costa and often plicate, plants are invariably dioicous, and capsules are mostly exserted. In *Cryphaea* leaves are acute to acuminate from an ovate base, the costa typically is strong and exceeds the midleaf, all the species are autoicous, and the seta is usually much shorter than urn. The other smaller genera of this complex were linked ei-

[1] – Main Botanical Garden of Russian Academy of Sciences, Botanicheskaya 4, Moscow 127276 Russia – Россия 127276 Москва, Ботаническая 4, Главный ботанический сад РАН.

[2] – Institute of Biology and Pedology, Stoletiya av., 159, Vladivostok 690022 Russia – Россия 690022 Владивосток, просп. Столетия 159, Биолого-Почвенный Институт.

ther to *Cryphaea*, or to *Leucodon*, segregating thus in Cryphaeaceae or Leucodontaceae (Brotherus, 1905). However the characters useful for delimitation of *Cryphaea* and *Leucodon* are sometimes combined in uncomfortable way within other genera. For this reason, the position of practically all the genera of Leucodontaceae and of many genera in Cryphaeaceae caused disagreements. To reflect the absence of obvious affinities of the genera, many of them were maintained in their own subfamilies. The most serious problem for familial classification is caused by *Forsstroemia*, a medium-size genus of 11 species, which includes both dioicous and autoicous species, with capsules immersed to exserted, the costa weak to strong, leaves shortly ovate to acuminate, and lamina cells isodiametric to elongate. Thus *Forsstroemia* was several times removed from Leucodontaceae to Cryphaeaceae and back (cf. Brotherus, 1905, 1925; Manuel, 1974, 1994; Noguchi, 1989; Crum & Anderson, 1981). Recently Buck (1980) suggested removing *Forsstroemia* from both these families and placing it in Leptodontaceae, though again in a separate subfamily (with *Pseudocryphaea*). His opinion was supported also by Stark (1987). The characteristic features of *Leptodon* and *Forsstroemia* include the hairy calyptra, bipinnate branching pattern (in *Leptodon* and most species of *Forsstroemia*), presence of paraphyses elongating much after fertilization, and strongly reduced endostome (in most species). However, there is no one character common to *Forsstroemia* and *Leptodon*, that is unknown in the other genera of Cryphaeaceae and Leucodontaceae.

The alternative approach combines all the genera of this complex in the single family Leucodontaceae (Nyholm, 1960; Crosby, 1980; Corley & al., 1981), retaining *Leptodon* in Neckeraceae.

Since the taxa of Cryphaeaceae/Leucodontaceae complex are poorly represented in Russia we are leaving familial classification without comments. The accepted generic placements are as follow:

Cryphaeaceae: *Cryphaea* – secondary stems rarely pinnately branching; central strand absent; leaves ovate to ovate-lanceolate, lamina cells mostly short; autoicous; perichaetial leaves sheathing, abruptly narrowed into long spinulose acumen; capsules deeply immersed; open capsules downward faced; annulus of 2-3 rows of big cells; calyptra mitrate, naked; endostome with well-developed segments.

Leucodontaceae: *Antitrichia, Dozya, Leucodon* – secondary stems unbranching or rarely pinnately branching; central strand present or absent; leaves ovate-lanceolate to linear lanceolate; lamina cells mostly elongate (ca. 4:1); dioicous; perichaetial leaves linear-lanceolate, acuminate, rare abruptly narrowed into short spinulose acumen; capsules exserted, rarer immersed; open capsules upward faced; annulus of 2-5 rows of big cells or absent; calyptra cucullate, naked; endostome without or with short fragile segments, represented mostly by basal membrane or totally absent.

Leptodontaceae: *Leptodon, Forsstroemia* – secondary stems densely pinnate or bipinnate; central strand absent; leaves ligulate, ovate or lanceolate; lamina cells shortly ovate to elongate; dioicous or autoicous; perichaetial leaves lanceolate, ± gradually acuminate; capsules shortly exserted, emergent or immersed; open capsules upward or downward fased; annulus absent or of 1-2 rows of small cells; calyptra hairy, cucullate; endostome represented by fragments adherent to exostome, rarer with basal membrane or with short fragile segments.

Characters common to these three families include medium to robust size of plants, stem differentiated into creeping primary stem with small often remote leaves and clusters of rhizoids, and ascending secondary stems with larger leaves and typically densely foliated. Lamina cells thick-walled, mostly ovate (1.5-2.5:1) near margin and longer in paracostal area; in lower half of leaf clear oblique row of cells observed. Perichaetial leaves after fertilization strongly enlarge, becoming up to 2-2.5 times longer than stem leaves and making the perichaetia well conspicuous. Capsules ± symmetric, immersed to exserted. Peristome teeth involute when dry, covering the urn mouth, and straight when wet. Fertilization typically takes place in summer and capsules become mature next winter, about 18 months after fertilization. Plants mostly corticolous (in less favourite conditions saxicolous), more common in temperate to subtropical zones.

The most ancient moss with the Cryphaeoid/ Leucodontoid habit and leaf areolation is *Muscites quescelinae* Townrow, described from the middle Triassic deposits of South Africa (Townrow, 1959), about 200 million years ago.

The great age of many genera of this complex is also obvious by the abundance of monotypic genera with rather local distribution (*Dendroalsia, Pseudocryphaea, Alsia, Dozya, Felipponea, Pilotrichopsis*) or widely disjunctive mono- or oligotypic genera (*Pterogonium, Antitrichia, Leucodontopsis*).

ARTIFICIAL KEY TO THE GENERA OF LEUCODONTACEAE, CRYPHAEACEAE AND LEPTODONTACEAE IN RUSSIA

1. Leaves broadly obtuse . . . . . *Leptodon*
1. Leaves acute to acuminate 2
   2. Costa absent . . . . . *Leucodon*
   2. Costa present 3
3. Costa in secondary stem leaves weak and short, ending at 0.3-0.5(0.6) of leaf length, often forking 4
3. Costa in secondary stem leaves strong, well-developed, ending mostly at 0.6-0.9 of leaf length 5
   4. Secondary stems strongly pinnately branching, capsules emergent to shortly exserted or plants sterile, endostome segments absent . . . . . *Forsstroemia (F. trichomitra, F. noguchii)*
   4. Secondary stems weakly branching, sporophytes frequent, capsules immersed, endostome segments present . . . *Cryphaea (C. amurensis)*
5. Leaves with sharp backward recurved teeth above . . . . . *Antitrichia*
5. Leaves entire to serrulate 6
   6. Plants rigid, glossy; secondary stems rarely branching, arcuate, densely foliated; leaves longly acuminate; alar cells deeply colored; saxicolous, rarer corticolous . . . . . *Dozya*
   6. Plants obscure; secondary stems regularly branching, leaves shortly acute or acuminate from ovate base; alar cells not differentiated from the other basal cells; corticolous, rarer saxicolous 7
7. Endostome present; secondary stems weakly branching; Europe . . . . . *Cryphaea (C. heteromalla)*
7. Endostome absent; secondary stems often strongly pinnately branching; Far East . . . . . *Forsstroemia (F. stricta, F. cryphaeoides, F. japonica)*

Cryphaea Web.

Plants slender to moderately robust, in dull, rarely glanced loose, dark-green tufts. Primary stems creeping, stoloniferous, with remote small scale leaves and rhizoid clusters at their bases. Secondary stems decumbent to spreading, regularly or rarely pinnately branching. Axillary hairs of 3-4 cells, 1 proximal cell papillose and colored, 2-3 distal cells smooth, colorless. Leaves erect or imbricate when dry, erect or wide-spreading when moist, concave, with ovate base and acute to acuminate upper portion; margin (in Russian species) reflexed or recurved in lower 1/3-2/3; subentire to denticulate above; costa usually single, reaching 4/5 of leaf length, rarely weak and forking to double. Upper lamina cells ovate to elliptic, smooth or papillose on both surfaces owing to projecting upper ends; mid-leaf cells ovate, alar cells subquadrate. Autoicous, capsules frequent, usually in groups of 2-4. Perichaetial leaves much larger than stem leaves, sufficiently differentiated, sheathing and abruptly awned, with stout excurrent, or rarer weak costa. Seta very short, capsules immersed, erect, symmetric, broadly-ovoid. Annulus well-differentiated. Operculum conic. Peristome double, inserted below the mouth. Exostome teeth papillose throughout, or on outer surface papillose above and smooth below. Endostome basal membrane low, segments well-developed (in Russian species), papillose above, smooth below. Calyptra mitrate, smooth or papillose. Spores medium to large, 18-40 μm.

The genus *Cryphaea* includes 30-50 species, distributed in warm-temperate to tropical regions, especially in Neotropics (Brotherus, 1925; Manuel, 1974). Rather few species are known in the temperate zone of the Holarctic. Two species occur in Europe: *C. heteromalla* (Hedw.) Mohr is rather widespread in oceanic and Mediterranean climates (also known from North Africa and Macaronesia), and *C. lamyana* (Mont.) C. Muell. is a rare moss of Atlantic Europe. The former species was collected once in Russian Northern Caucasus. In temperate North America *C. glomerata* Bruch et Schimp. ex Sull. has rather wide distribution in the Atlantic part of U.S.A., and three more species, *C. filiformis* (Hedw.) Brid., *C. ravenelii* Aust., and *C. nervosa* (Drumm.) C. Muell., occur mostly in the South-Eastern states. In Japan the only one species, *C. obovaticarpa* Okam., is known; it is a rare moss, differing from all the other species of the genus by large spores, and placed in a separate monotypic section *Obovatothecium* Okam. No *Cryphaea* species are reported from Himalayas. Redfearn and Wu (1986) listed 3 species in China – *C. heteromalla*, *C. sinensis* Bartr., and *C. levellei* Thér. Two latter species are known only by the original collections in southern China. Such geography of the genus makes rather unexpected the

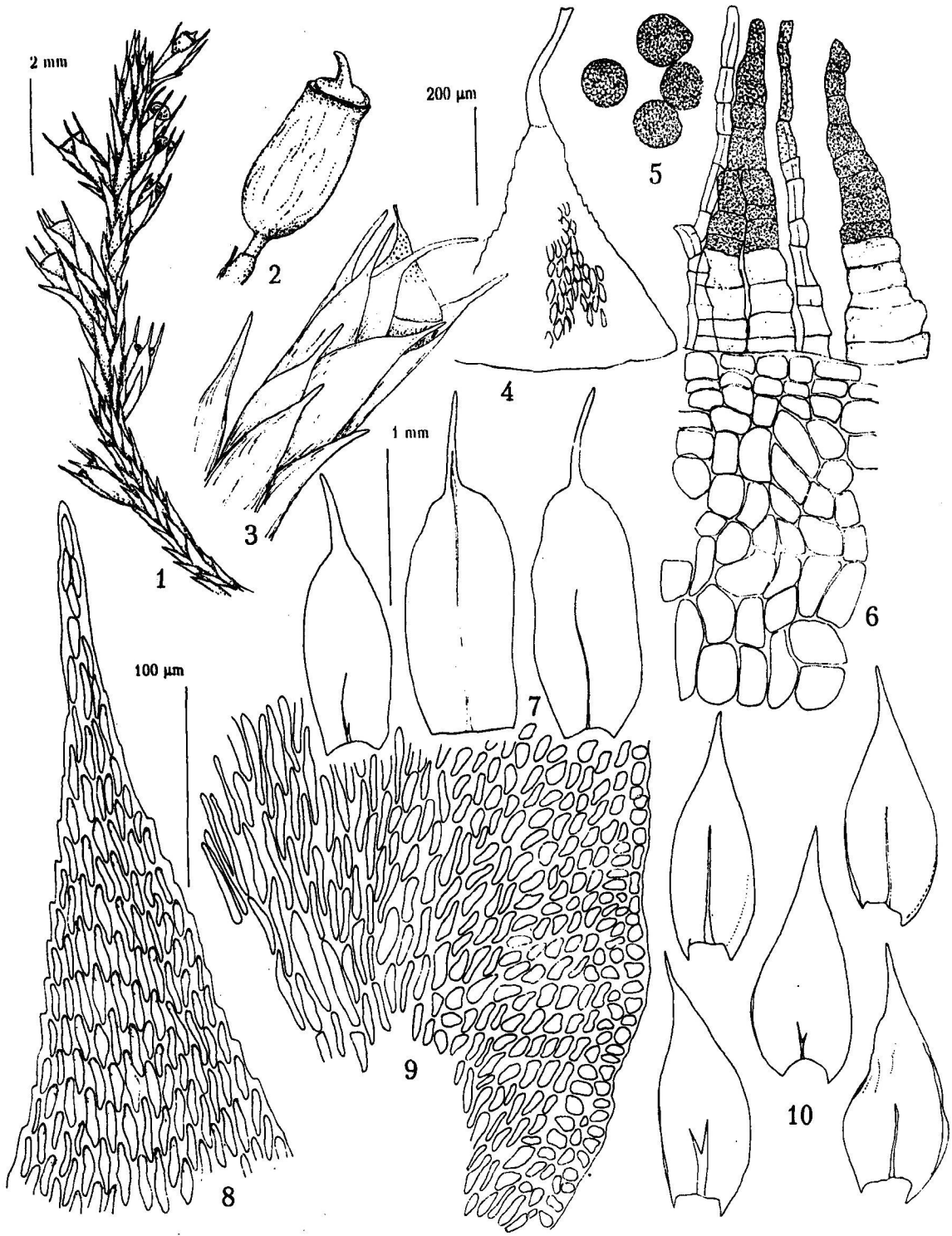


Fig. 1. *Cryphaea amurensis* Ignatov sp. nova (from the holotype, *Khabarovsk Territory, Levaya Bureya*, Grigor'eva 89-M-88): 1 – habit; 2 – capsule; 3 – perichaetium with capsule; 4 – calyptra; 5 – spores; 6 – portion of peristome and upper exothecium; 7 – perichaetial leaves; 8 – upper lamina cells; 9 – basal cells; 10 – leaves. Scale bars: 2 mm – for 1; 1 mm – for 2, 3, 7, 10; 200 µm – for 4; 100 µm – for 8, 9.

finding of a species of *Cryphaea* in boreal forests of the Russian Far East, in Khabarovsk Territory. Due to very weak costa and some other peculiarities it is described here as a new species.

KEY TO THE SPECIES OF *CRYPHAEA* IN RUSSIA

1. Plants regularly pinnate branching; costa stout, reaching 4/5 of leaf length; upper lamina cells ovate, short, up to 2:1; Europe . . . . . *C. heteromalla*
1. Plants rarely branching; costa weak, reaching 1/4-3/5 of leaf length, sometimes forking; upper lamina cells elongate, up to 4:1; East Asia . . . . . *C. amurensis*

Cryphaea amurensis Ignatov sp. nova

Figs. 1-8

Planta laxe caespitosa, fuscescenti-viridis, nitidula. Caules secundarii pauce ramosi, ad 15 mm longi, ramis simplicibus, 3 mm longis. Folia esicco suberecta, humida erectopatentia, e basi ovata, concava, raptim acuminata vel acuta, 1.5-1.7 mm longa, 0.6-0.7 mm lata, marginibus ad apicem denticulatis, inferne valde recurvis, costa brevi, furcata, in 1/4-3/5 evanida; cellulae superiores elongatae, 20-30 µm longae, 6-8 µm latae, papillosae, in medio folii ellipticae, basilares lineares, ad angulos numerosis subquadratae, 8-15 µm. Folia perichaetialia e basi vaginante oblonga abrupte aristata, costa debili, in 1/3-1/2 evanida vel percurrenta. Autoica. Seta circa 0.2 mm longa; theca ovalis, fuscidula, 0.9 mm longa; peristomium duplex; dentes exostomii pallidi papillosi, lanceolati, 170 µm longi, 40 µm lati; segmenta endostomii linearia, superne papillosa, 180 µm longa; operculum conicum; capyptra verrucosa, mitrata. Sporae 22-29 µm in diametro, parce papillosae.

A speciebus congeneribus costis brevibus debilibusqu praecipue differt.

Typus: Provincia Khabarovsk, jugum Dusse-Alin, Reservatum Bureense, in vallis fluminis Levaya Bureya, 2 km supra ostium torrentem Chapkhoz, Piceetum hylocomiosum, ad corticem Abietorum, 590 m alt. (51° 40' bor. – 134° 22' orient.). 16.VIII.1989 leg. O. V. Grigor'eva 89-M-88 (MHA).

Plants in dark-green to brownish, somewhat glanced tufts. Secondary stem rarely branching, up to 15 mm long, branches up to 3 mm long. Leaves erect when dry, spreading when moist, with ovate concave base and acuminate or acute upper portion, 1.5-1.7 mm long, 0.6-0.7 mm wide; margin denticulate above, subentire in mid-leaf, sometimes also denticulate near the base, tightly recurved at lower 2/3; costa weak, sometimes furcate, ending at 1/4-3/5 of leaf length. Upper lamina cells elongate, 20-30 µm×6-8 µm, papillose owing to projecting upper cell ends, mid-leaf cells elliptic, basal paracostal cells linear, in alars – subquadrate, 8-15 µm. Autoicous. Perichaetial leaves sheathing, abruptly narrowed in spinulose acumen, costa weak, reaching 1/4-1/2 of leaf length, or present in the upper leaf but disappearing at base, or percurrent, but along most of its length hardly discernable, being 1-2 cells wide (7-13 µm). Capsules arranged in groups by 3-5, mostly in two rows with the angle 60° in between. Seta very short, 0.2 mm long; capsules ovate, 0.9 mm long, pale-brown; peristome double, inserted below the mouth, exostome teeth lanceolate, 170 µm high, 50 µm wide at urn mouth, pale-yellowish, on outer surface coarsely papillose above, minutely granulose to smooth below, on inner surface papillose throughout; endostome segments linear, 180 µm high, 15 µm wide, slightly papillose above, smooth below; operculum conic; calyptra mitrate, coarsely papillose above. Spores 22-29 µm (average 26 µm), papillose.

Type: Khabarovsk Territory, Dusse-Alin Range, Bureya Reserve, Levaya Bureya River Valley 2 km upstream the mouth of Chapkhoz Creek, mossy spruce forest, on bark of *Abies*, 590 m alt. (51° 40'N – 134° 22'E). 16.VIII.1989 coll. O. V. Grigor'eva 89-M-88 (MHA).

In the preliminary list of Bureya Reserve (Ignatov & al., 1992) this species was misidentified as *Forsstoemia trichomitra*, since gametophytic characters of these species have much in common, particularly in short, weak and sometimes forking costa. Further studies of fertile material reveal however the perfect endostome and hairless calyptrae. The other peculiar characters of *Cryphaea* also confirm the generic placement of this moss – it has (1) very short seta; (2) perichaetial leaves subulate from sheathing base; (3) distribution of sporophytes in groups in different portions of stem; and (4) low to moderate papillae in upper corners of lamina cells. Therefore this species is described here as a new species of *Cryphaea*.

Cryphaea amurensis differs from probably all the species of the genus in the exceptionally weak costa (similar costae are known in *Forsstroemia trichomitra* and *Alsia californica* (Hook. et W.-Arn.) Sull.). In some leaves costa exceeds mid-leaf, but in this case costa is very thin, clearly discernable only under big magnification. The combination of papillae at upper end of cells, revolute leaf margin and elongate upper lamina cells is also unusual in *Cryphaea*. Also, *C. amu-*

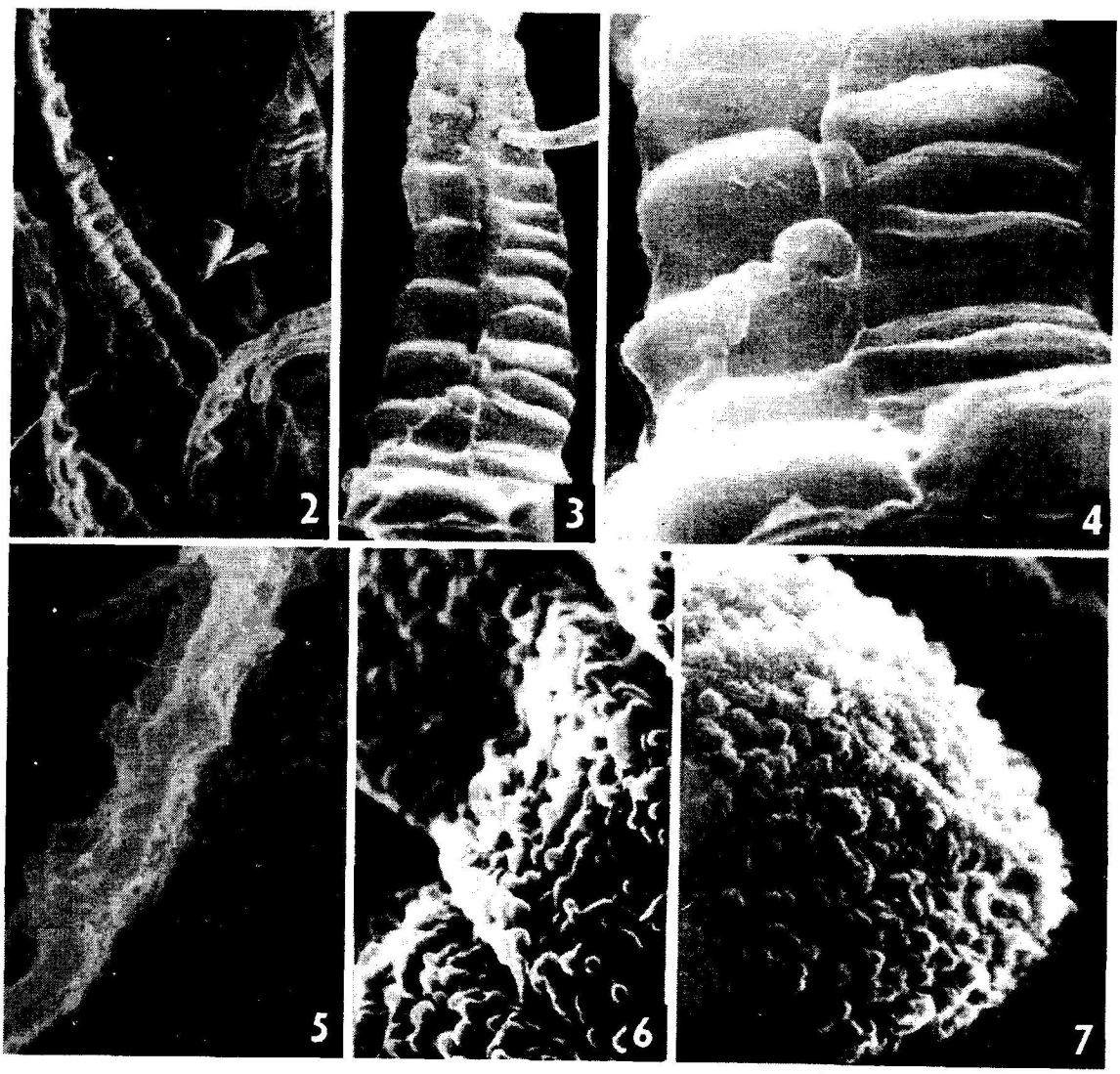


Fig. 2-7. *Cryphaea amurensis* Ignatov sp. nov. (from holotype): 2 – portion of peristome (750×); 3 – outer surface of exostome tooth (1050×); 4 – the same (2350×); 5 – endostome segment and inner surface of exostome (3300×); 6 – inner surface of exostome (7500×); 7 – spore (7500×). [SEM: ASID - 4D TEMSCAN-100CX (JEOL)]

rensis is peculiar in being somewhat glossy, while most species of the genus are fairly dull. Habitually, *C. amurensis* is probably more similar to *C. jamesonii* Tayl. (Mexico to northern South America and West Indies): both species (1) have rather slender habit due to leaves more or less gradually and longly acuminate; (2) are somewhat glossy due to moderately thick-walled lamina cells; (3) have elongate upper lamina cells; (4) are serrulate at margin above; (5) have revolute leaf margin. *C. jamesonii* differs however in stronger costa ending at 0.8-0.9 of leaf length and smooth upper lamina cells.

The differetiation of *C. amurensis* from the other East Asian species are as follow: (1) *C. obovaticarpa* is different in larger leaves (1.8-2.5 mm, not 1.5-1.7 mm), longer costa (2/3 of leaf length), and, especially, by larger spores (35-42 μm, not 22-29 μm); (2) *C. sinensis* differs in longer costa (ca. 0.8 of leaf length) and shorter upper lamina cells; also endostome was not found in *C. sinensis* (Bartram, 1935), though in even in old open capsules of *C. amurensis* it was present; (3) *C. levellei* was described as having a simple peristome and its systematic position remains unclear (Brotherus, 1925).

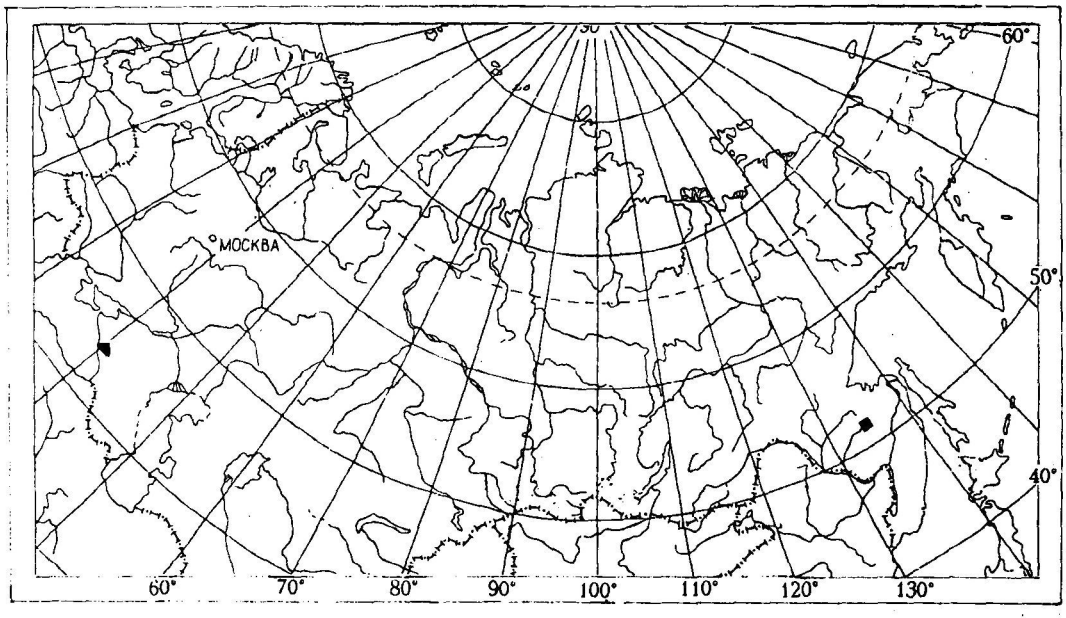


Fig. 8. Distribution of *Cryphaea amurensis* Ignatov sp. nova (square) and *C. heteromalla* (Hedw.) Mohr in Weber (triangle) in Russia.

Distribution: Cryphaea amurensis is known so far by holotype only.

Specimen examined: see the type.

Cryphaea heteromalla (Hedw.) Mohr in Weber, Tab. Calyptr. Operc. 1814. Figs. 8, 9

Neckera heteromalla Hedw., Sp. Musc. 202. 1801.

Plants in rigid, dark-green dull tufts. Secondary stem rather regularly pinnately branching, up to 2 cm long, branches up to 6 mm long. Leaves imbricate or erect when dry, wide-spreading when moist, with ovate concave base and broadly acute apex, up to 1.4-1.6 mm long, 0.6-0.7 mm wide; margin entire, tightly recurved at lower half; costa strong, ending at 3/4-9/10 of leaf length. Upper lamina cells ovate, 1.5-2:1, 11-15×7-8 μm, in alars subquadrate, ca 10 μm. Autoicous. Perichaetial leaves sheathing, abruptly narrowed into a spinulose acumen, up to 2.6 mm long; costa strong, filling the acumen. Seta very short, 0.2 mm long; capsules ovate, 1.1 mm long, pale-brown; peristome double, inserted well below the mouth, exostome teeth lanceolate, 430 μm high, 65 μm wide at urn mouth, papillose throughout; endostome segments linear, 350 μm high, two-cell wide above, 15 μm wide at base, slightly papillose above, smooth below, basal membrane ca. 70 μm high; operculum conic; calyptra mitrate. Spores ca. 20 μm, finely papillose.

Distribution: Cryphaea heteromalla is widespread in Atlantic Europe from Spain, Lusitania, Italy and Greece northward to southern Sweden, Great Britain, Ireland, Denmark, Netherlands; also it is reported from Azores and Canary Islands, Northern Africa and Middle East (Lebanon). The Chinese record (Redfearn & Wu, 1986) needs confirmation. In Russia *C. heteromalla* is known by the single collection from Northern Caucasus (Abramova & Abramov, 1961). The species was found on trunk of *Cupressus*.

Specimen examined: Krasnodarskij Territory, Adler, sovkhoz "Yuzhnye kultury" VIII-IX.1957. E. D. Shishkova (LE).

Dozya Sande Lac.

Plants robust, in dense tufts; stems creeping, monopodially branching; densely foliated; with central strand. Pseudoparaphyllia absent. Axillary hairs of 4-5 cells, proximal 2 cells short and smooth; distal 2-3 cells oblong, minutely papillose. Leaves lanceolate, acuminate to attenuate, deeply plicate. Costa single, extending 4/5 of leaf length. Upper lamina cells rhomboid to elongate, basal paracostal cells long linear, colored, basal cells at margin quadrate, forming deeply colored alar area. All lamina cells thick-walled and smooth. Dioicous. Perichaetial leaves linear-lanceolate, tightly involute, costa less developed than in stem leaves. Calyptra cucullate. Capsules emergent to long exserted, oblong. Operculum rostrate. Annulus absent. Peristome single. Exostome teeth 16, lanceolate, smooth. Properistome absent, but central layers of the thick urn wall at mouth form parastome just outside of exostome base. Spores large, 35-80 μm in diameter, papillose.

Sporophytes of *Dozya japonica* were not seen in Russian collections. Their description is based on the

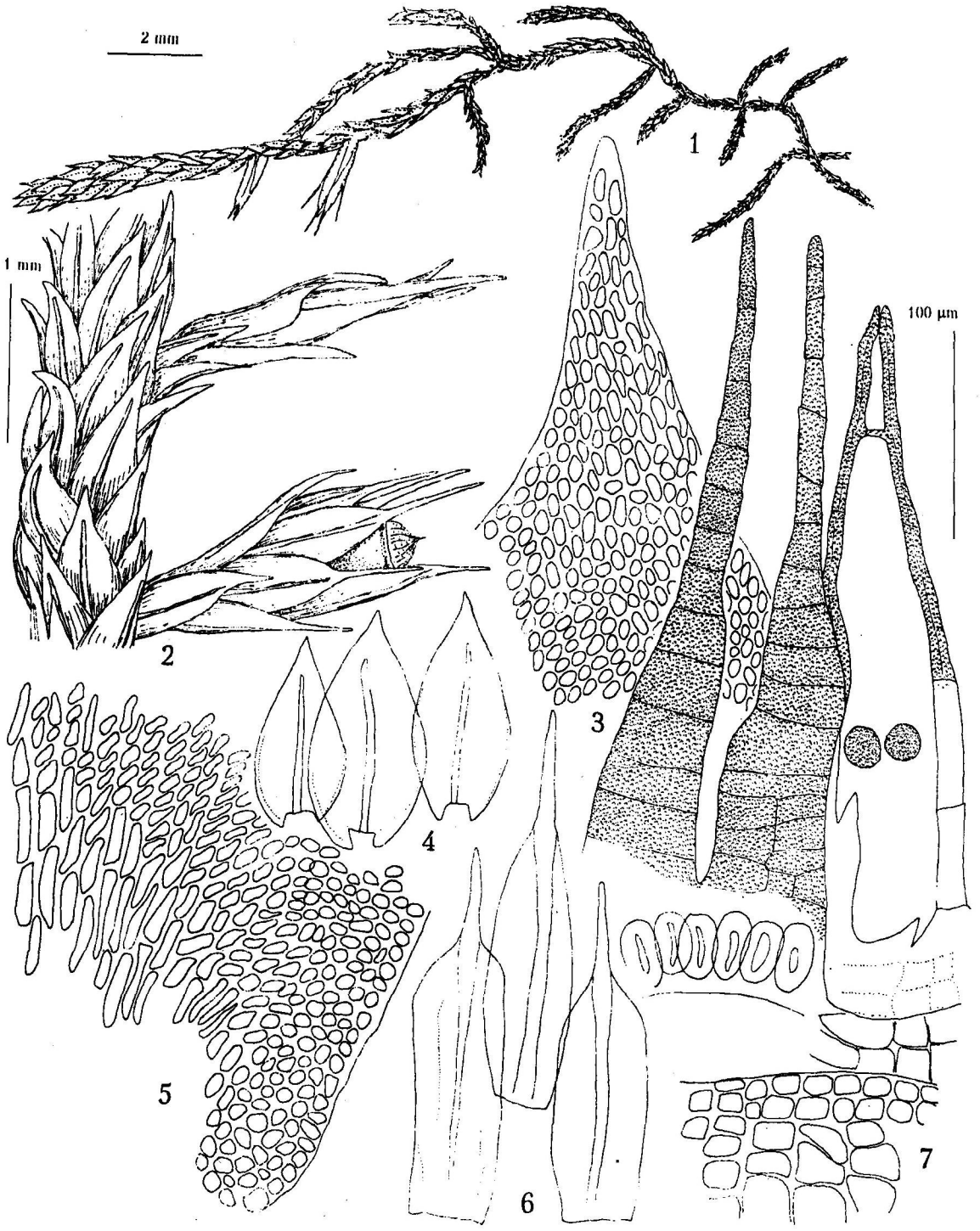


Fig. 9. *Cryphaea heteromalla* (Hedw.) Mohr in Weber (from *Krasnodarskij Territory, Adler.* VIII-IX. 1957. E. D. Shishkova): 1 – habit; 2 – portion of stem with perichaetia; 3 – upper lamina cells; 4 – stem leaves; 5 – basal cells; 6 – perichaetial leaves; 7 – portion of peristome with upper endothecium, annulus and spores. Scale bars – 2 mm – for 1; 1 mm – for 2, 4, 6; 100 µm – for 3, 5, 7.

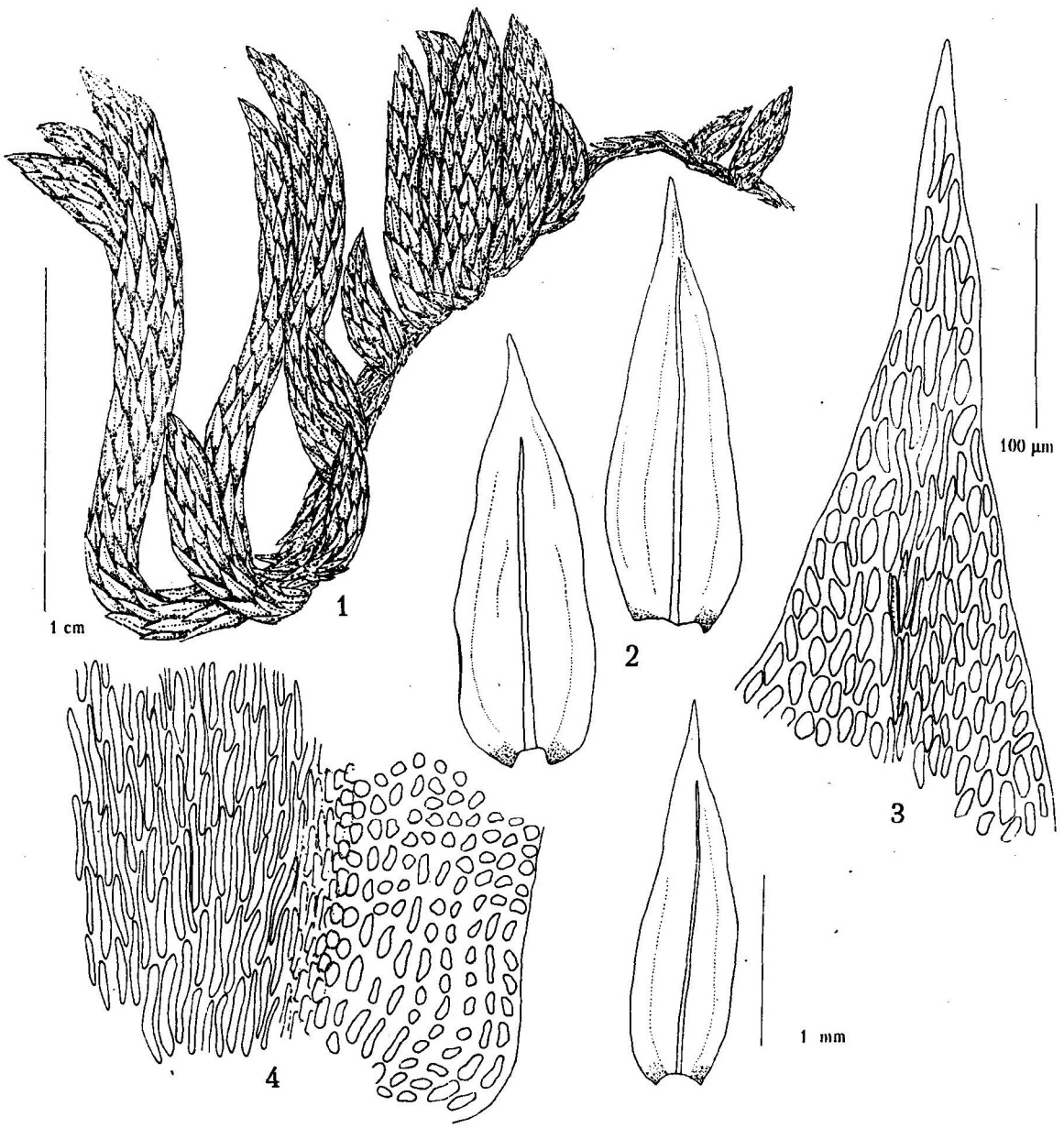


Fig. 10. *Dozya japonica* Sande Lac. in Miq. (from *Primorskij Territory, Ryazanovka* 14.IX.1985 Ignatov): 1 – habit; 2 – stem leaves; 3 – basal cells; 4 – upper lamina cells. Scale bars: 1 cm – for 1; 1 mm – for 2; 100 µm – for 3, 4.

paper of Akiyama (1987), who discussed in details the peristome structure and systematical position of the genus. The main peculiarities can be summarized as follow: capsule wall at peristomial level is very thick, composed of 3-4 layers of exothecial cells, then 3-4 layers of thin-walled irregular cells and 2 layers of peristomial cells (OPL and PPL, the IPL is absent). The thin-walled cells form a structure named by Akiyama as parastome (the term originally proposed in the description of peristome of *Buxbaumia*). Calyptra at the base is also multilayered (unilayered in all the other members of Leucodontaceae). These differences, combined with the absence of endostome and annulus, monopodial branching pattern and unusual structure of axillary hairs separate *Dozya* in its own monotypic subfamily Dozyoideae (Manuel) Ak-

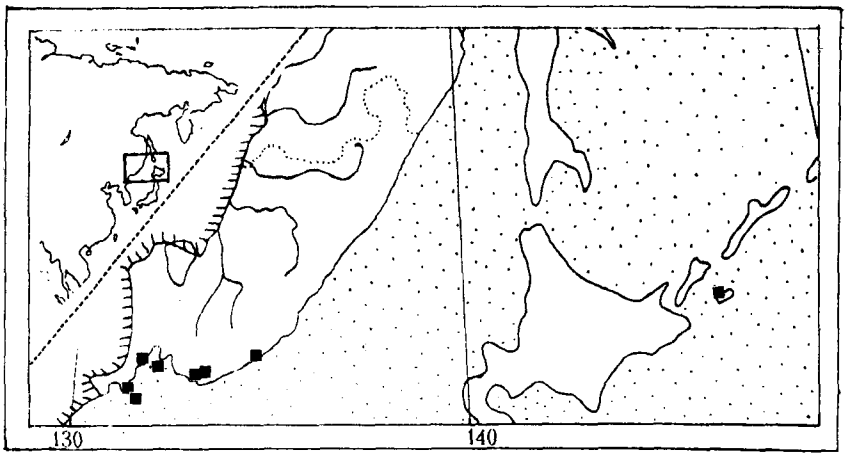


Fig. 11. Distribution of *Dozya japonica* Sande Lac. in Miq. in Russia.

iyama (within Leucodontaceae).

Dozya is a monotypic East-Asian genus, only recently found in the southern part of Russian Far East (Bardunov & Czerdantseva, 1982).

Dozya japonica Sande Lac. in Miq., Ann. Mus. Bot. Lugdum. 1865. Figs. 10, 11

Plants in dense reddish-brown tufts. Creeping part of stem up to 5 cm long, ascending part of stem and branches up to 1.5 cm long. Central strand present. Stem leaves lanceolate, attenuate at apices, 2-2.5 mm long, 0.6-0.8 mm wide; margin plane and entire. Costa single, strong, reaching about 4/5 of leaf length, the unistratose row of elongate cells extending costa to nearly the apex. Upper lamina cells ovate to elongate, 1:2-5, 20-50 μm long, ca. 10 μm wide. Alar cells deeply orange-brown, ±isodiametric, with luminae 5-10×5 μm and strongly incrassate porose walls of 6-8 μm thick.

Distribution: Japan (Kyushu, Shikoku, Honshu), Korea, China (Jilin), Russian Far East (southern part of Primorskij Province and Kuril Islands). Most of Russian collections were made on rock outcrops on sea coast; in one locality – on living and dead trunks of *Tilia*.

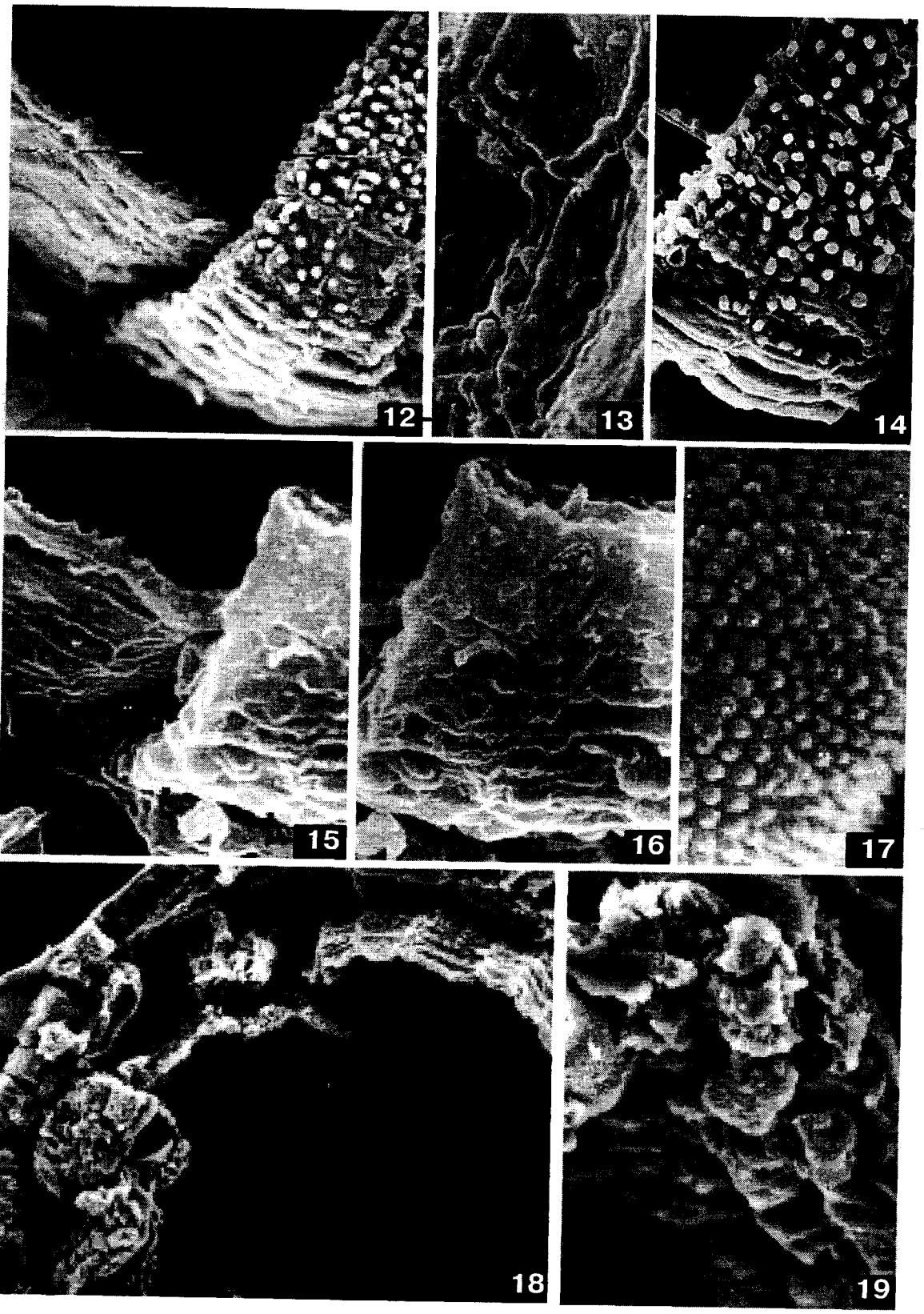
Specimens examined: PRIMORSKIJ TERRITORY: *Lazovskij Reserve* 18.IX.1987 Bardunov & al. (LE); *ibid.* 24.VIII.1986/ 28.IX.1988 Czerdantseva (VLA); *ibid.* 20.X.1986 Taran (VLA); *Khasan Distr., Ryazanovka* 14.IX.1985 Ignatov (MHA); *Vityaz Bay* 13.X.1987 Bardunov (IRK, MW); *Ol'ga Distr., Moryak-Rybolov* 11.IX.1977 Czerdantseva & Bardunov (VLA); *Popov Island* 2.X.1987 Czerdantseva & Druzhinina (VLA); *Steina Island* 1978 Kurentsova (VLA); SAKHALINSKAYA PROVINCE: *Kuril Islands, Shikotan* 30.VIII.1978 Czerdantseva (VLA, LE).

Leucodon Schwaegr.

Plants robust, usually dark-green to golden-brownish. Primary shoots creeping upon substrate, sympodially branching, remotely foliated by small lanceolate longly acuminate leaves. Secondary stems densely foliated; with or without central strand. Pseudoparaphyllia filamentous, lanceolate or absent. Axillary hairs of 3-7 cells, smooth, basal 1-2 cells brownish, upper cells oblong, colorless. Secondary stem leaves ovate to lanceolate, acuminate, deeply plicate, ecostate. Upper lamina cells rhomboid to elongate, basal central cells long linear, colored, basal cells at margin quadrate. All lamina cells thick-walled and smooth. Dioicous. Perichaetial leaves linear-lanceolate, tightly involute, ecostate, considerably enlarged after fertilization. Capsules immersed, emergent to long exserted, oblong. Operculum rostrate. Annulus well-differentiated, revolute. Peristome double. Exostome teeth 16, lanceolate to bifid, often perforate, smooth or papillose, spreading outward when moist, inward when dry. Endostome strongly reduced, forming only by a basal membrane without or with low segments (in *L. pendulus*). Properistome absent or forming by 1-3 cell layers adherent to outer surface of exostome. Spores large, 30-90 μm in diameter, papillose. Calyptra cucullate.

Three species of *Leucodon* were reported in Russia previously (Ignatov & Afonina, 1992). *L. sciuroides* was considered as a widespread species in most of its territory; *L. immersus* – a common species in the Caucasus, including the Russian Northern Caucasus; *L. pendulus* was

Figs. 12-19. Peristome structure of *Leucodon pendulus* Lindb. (12-14) [form *Kedrovaya Pad* 27.X.1977 Makarov # 21]; *L. flagellaris* Lindb. ex Broth. (15-17) [from Teberda Reserve, 17.VIII.1955 Abramova & Abramov] and *L. immersus* Lindb. (18-19) [Karasu 17.X.1983 Portenier]. 12 – outer surface of endostome and exostome, 800×; 13 – inner surface of endostome, 3650×; 14 – outer surface of exostome,1050×; 15 – outer surface of endostome and exostome, 4000×; 16 – outer surface of exostome, 2200×; 17 – spore, 30 000×; 18 – general view of peristome, 300×; 19 – outer surface of exostome with properistome, 1200× [SEM: ASID - 4D TEMSCAN-100CX (JEOL) - 13, 15-17; HITACHI - 405A - 12, 14, 18-19].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described from Russian Far East and later was found to be a common species in this region.

Two more species should be added now: (1) *L. flagellaris*, omitted in the "Check-list of mosses of the former USSR" (Ignatov & Afonina, 1992); it was described from the Caucasus, Georgia and found also in Northern Caucasus within the Russia; (2) *L. coreense*, rather widespread moss in the Russian Far East, previously identified as *L. sciuroides*; however Akiyama (1988a) elucidates the differences of these species, and *L. coreense* appears to be a common species in the Russian Far East, while *L. sciuroides* – to be a very rare species in the Far Eastern islands and totally absent in continental Far East.

KEY TO THE SPECIES OF *LEUCODON* IN RUSSIA

1. Pendent flagelliform shoots well developed .. 2
1. Pendent flagelliform shoots absent or poorly developed 3
   2. Pendent shoots 5-20 cm long, circinate; central strand absent; Far East ..... *L. pendulus*
   2. Pendent shoots 3-7 cm long, flexuose, not circinate; central strand present; Caucasus ..... *L. flagellaris*
3. Central strand absent; continental Far East ..... *L. coreense*
3. Central strand well-developed 4
   4. Capsule immersed; Caucasus . . *L. immersus*
   4. Capsule long exserted; widespread species ..... *L. sciuroides*
   4. Plants without sporophyte ..... see discussion under *L. sciuroides*

Leucodon pendulus Lindb., Acta Soc. Sci. Fenn. 10: 273. 1872. Figs.12-14, 20, 22

Lectotype (selected here): ad frontes fluminis Bureja, medio Julii 1862, F. Schmidt (LE).

Plants forming extensive green to dark green tufts on tree trunks and branches. Primary stem creeping, inconspicuous. Secondary stem without central strand, in proximal portion (2-4 cm) foliated by large erect leaves, ca. 2.0-2.5 mm. Many secondary stems continue in pendent shoots, bearing small (up to 1.0 mm) to medium-size leaves. Pendent shoots up to 20 cm long, often irregularly branching, stem and branch ends distinctly circinate. Leaves ovate, gradually acuminate, entire to crenulate, weakly to moderately plicate, up to 2 mm long, 0.6 mm wide. Upper lamina cells 35-45×5-7 μm; median lamina cells ovate, alar cells irregularly subquadrate, 10-15 μm. Alar region up to 1/4 of lamina length. Dioicous. Perichaetial leaves after fertilization up to 4 mm long. Seta 3-4 mm long. Capsule exserted, pale-brown, ovoid, 0.7-1.5 mm. Exostome teeth 16, lanceolate, outer surface smooth below, densely papillose above; inner surface papillose troughout; sometimes perforate above; some teeth remain laterally fused after operculum removal; endostome with high basal membrane and low segments, papillose, with the papillae clearly concentrated along old cell walls. Peristome absent. Spores papillose, 17-37 μm in diameter.

Practically it is nearly impossible to confuse *L. pendulus* because of its peculiar long-hanging circinate shoots. Only very young plants, composing mostly by large-leaved ascending shoots resemble somewhat *L. sciuroides*/ *L. coreense*. However even in this case *L. pendulus* has at least a few pendent stoloniferous shoots.

Leucodon pendulus is distinguished from all the other species of the genus by the presence of low endostome segments. By this reason *L. pendulus* was separated in the monotypic genus *Leucodontella* Nog. (Noguchi, 1947), later considered as a monotypic subgenus *Leucodontella* (Nog.) Nog. (Noguchi, 1968; Akiyama, 1988a). However the character of endostome presence seems inconstant - in studied capsules we found no segments. Also, as a differential character of this genus/subgenus Noguchi cited the small spore size (12-17 μm). However, Akiyama found large spores (16-30 μm), while in the lectotype some spores are up to 37 μm.

Leucodon pendulus produces mature spores in late summer to autumn, not in winter as in all the other species of the genus.

Distribution: Japan (Hokkaido), Korea, China (North-West Provinces: Heilungkiang, Kirin (Jilin), Lianoing), Russian Far East (continental part and Sakhalin Island). In Russian Far East *L. pendulus* typically grows in abundance in dark forests of *Picea yezoensis* and *Abies spp.*, on trunks and twigs of *Pinus, Picea, Abies, Quercus, Fraxinus, Acer, Betula, Tilia, Almus, Syringa,* and on climbing stems of *Actinidia*; rarer it occurs in more dry coniferous+broad-leaved forests and broad-leaved forest.

Selected specimens examined: AMURSKAYA TERRITORY: *Zeya River Basin, between Vozdvizhenskoye and Toko Lake* 19.VII.1911 Prokhorov & Kuzeneva (LE); *Zeya River Basin, Bomnak* 19.VII.1909 Prokhorov; *Zeya River Basin, Dzintangra Creek* 3.VII.1911 Nikiforov (LE); *Dzeltulak Distr.* 2.IX.1939 Dikovskij (LE); *Tukuringra Mts., Erakingra Creek* 23.VII.1915 Prokhorov & Kuzeneva (LE); *Arkhara Distr. 10 km NW of Kundur* 3.VII.1985

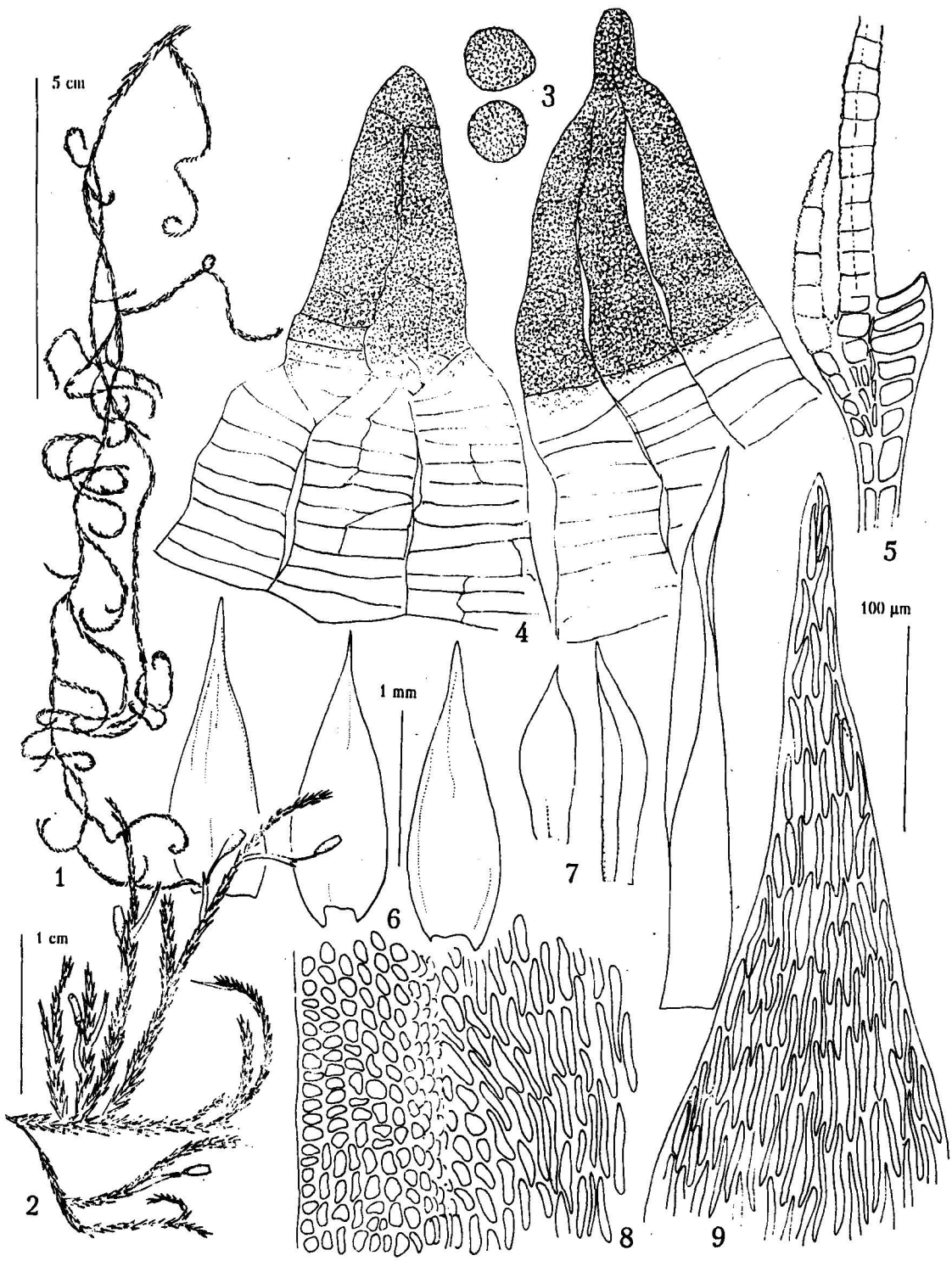


Fig. 20. *Leucodon pendulus* Lindb. (1 – from *Primorskij Territory, Kondratenkovo* Woroschilov # 6682, 2-9 – from the lectotype, *fl. Bureja*, VII.1862, F. Schmidt): 1 – habit of pendent shoot; 2 – habit of ascending shoot; 3 – spores; 4 – portion of peristome; 5 – longitudinal section of peristome; 6 – stem leaves; 7 – perichaetial leaves; 8 – basal cells; 9 – upper lamina cell. Scale bars: 5 cm – for 1; 1 cm – for 2; 1 mm – for 6, 7; 100 µm – for 3-5, 8, 9.

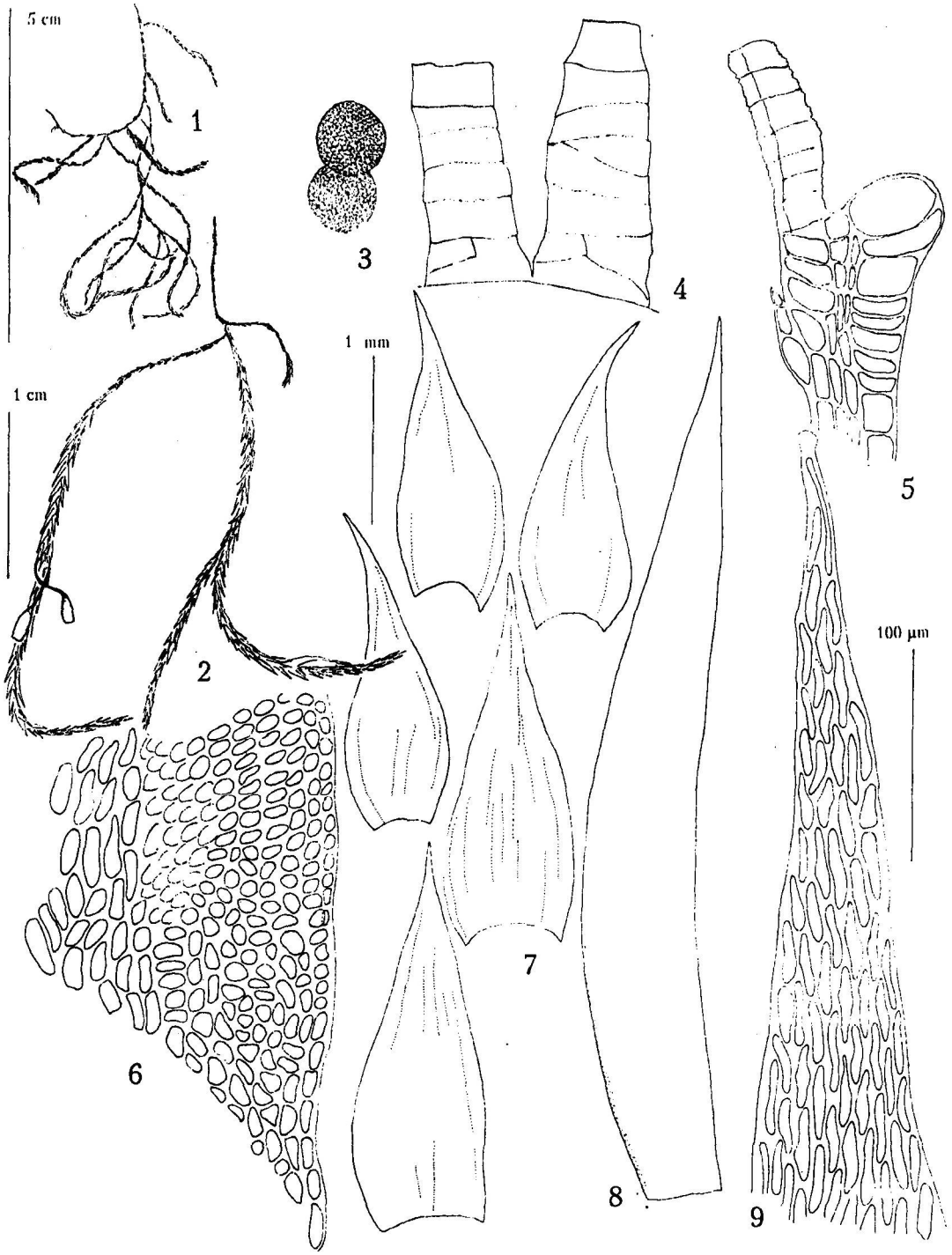


Fig. 21. *Leucodon flagellaris* Lindb. ex Broth. (from *Teberda Reserve*, 17.VIII.1955 A. L. Abramova & I. I. Abramov): 1 – habit of pendent shoots; 2 – habit of ascending shoot; 3 – spores; 4 – portion of peristome; 5 – longitudinal section of peristome; 6 – basal cells; 7 – stem leaves; 8 – perichaetial leaf; 9 – upper lamina cells. Scale bars: 5 cm – for 1; 1 cm – for 2; 1 mm – for 7, 8; 100 µm – for 3-6, 9.

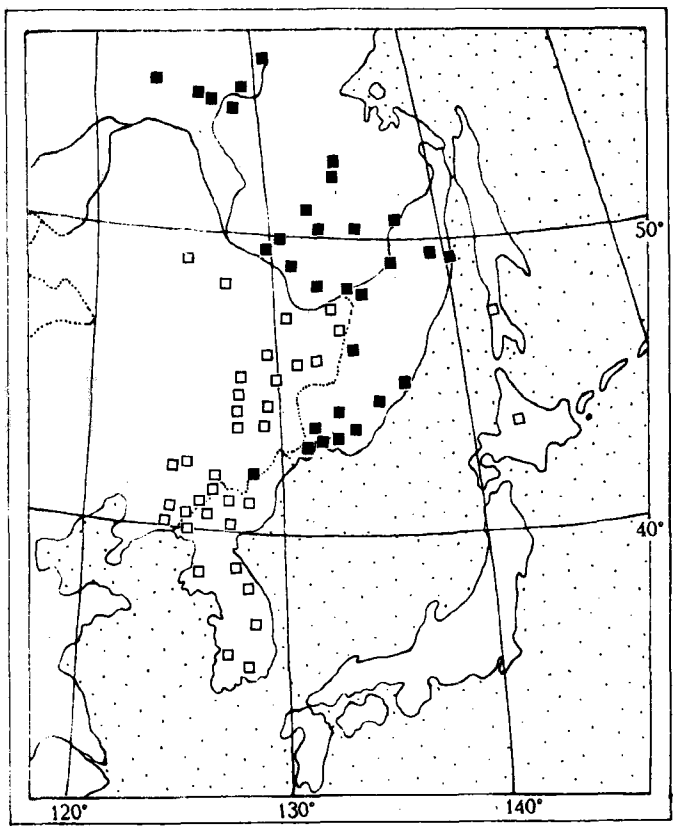


Fig. 22. Distribution of *Leucodon pendulus* Lindb. (Chinese, Japanese and Korean localities supplemented from maps of Koponen & al., 1983 and Akiyama, 1987).

Fedoseev (MW); *Arkhara River, Gongor Creek* 1.IX.1904 Krjukov (MHA); *Khinganskij Reserve* 30.VI.1987/ 1.VII.1987 Czerdantseva (VLA); KHABAROVSK TERRITORY: *ad frontes fluminis Bureja* medio Julii 1862, F. Schmidt (LE – lectotype); *Choechzier* VII.1867 Przevalskiy (*Leucodon dimorphum* Elenkin sp. n. in shed., LE); *Bolshechoechzirskij Reserve* 7.VIII.1983/ 9.VIII.1983 Czerdantseva (VLA); *Bureya River, Ust-Niman* 20.IV.1938 (MHA); *Sutar River Basin, Russkaya Creek* 15.X.1926 Selivanov (LE); *Radde* 23.VIII.1909 Fedtschenko (LE); *Upper Amgun River, Alkij Creek* 25.VII.1951 Orlov (LE); *Tyrma River, Lonkomuni Creek* 10.VII.1909 Dokturovskij (LE); *Malmyzh* 14.VII.1975 Karyanko (LE); *Komsomolsk Distr., Pochepta* 19.IX.1965 A. Nechaev (LE); *Birobidzhan* 1950 anonym (LE); *Badzhal Mts., Elbin Creek* 13.VI.1910 I. Kuznetsov (LE); *Korfovskaya* 14.IX.1946 L. Vasileva (MW); *Lower Amur River, Innokentievskoye Lake* 30.IX.1930 N. Savicz (LE); *Dusse-Alin Mts., Levaya Bureya River, 590 m alt.* 16.VIII.1989 Grigor'eva (MHA); *Petropavlovka* 3.VII.1965 Kleshaeva (MHA); *Komsomolskij Reserve* 24.VI.1985/ 27.VI.1985/ 28.VI.1985 Czerdantseva (VLA); *Sovgavanskij Distr., Akur River* 16.VII.1972 Czerdantseva (VLA); PRIMORSKIJ TERRITORY[1]: *Sudzukhinsij Reserve* 27.IX.1944 Zhudova & Pokrovskaya (MW); *ibid.* 17.VI.1946 Zhudova (MW); *Shkotovo Distr., Maikhe-Daubikhe Plateau* 31.V.1947 V. Rosenberg (MW); *Suputinskij Reserve, Kondratenkovo* 7.VIII.1952 Woroschilov # 6682 (MHA); *Kedrovaya Pad* 27.X.1977 Makarov # 21 (MHA); *ibid.* 7.X.1954 Vasil'eva (VLA); *Chuguevka Distr., 700 m alt.* 6.IX.1990 Ishbirdin (MHA); *ibid.* 30.VIII.1974 Czerdantseva (VLA); *Dal'negorsk Distr., upper Bolshaya Ussurka River* 21.IX.1970 Ardeeva (VLA); *Sikhote-Alin Reserve* 28.V.1956 Shemetova (VLA); *Ussurijskij Reserve* 5.X.1969 Ardeeva (VLA);

Leucodon flagellaris Lindb. ex Broth., Acta Soc. Sci. Fennicae 19(12): 138. 1892.

Figs. 15-17, 21, 23

Plants in green to yellowish green tufts. Primary stem creeping, with inconspicuous scale leaves. Secondary stem with central strand, foliated by large leaves, erect when dry, erect-spreading when moist, 2.0-2.5 mm long. Slender flagelliform pendent shoots up to 5-7 cm long, rare branching, flexuose, arise either from primary stems or from secondary stems; pendent shoots bear small (up to 1.0 mm) to medium-sized leaves, the size of leaves is usually constant within each shoot. Leaves ovate, gradually acumi-

[1] – many names of settlements and rivers were renamed in Primorskij Territory in 1920s and 1970s; we use names as they given on labels; some frequently used here renamings are (old/new): Sudzukhinskij Reserve/Lazovskij Reserve; Suputinskij Reserve/Ussurijskij Reserve; Suczan River/Partizanskaya River; Maikhe River/Ilistaya River; Maikhe-Daubikhe Plateau/Artemovsko-Arsenievskoe Plateau; Woroschilow/Ussurijsk; Nikolsk-Ussurijskij/Ussurijsk; Fanza/Rucz'i; Lefu River/Ilistaya River; Tsemukhe River/Shkotovka River.

nate, entire to crenulate, moderately plicate. Upper cells 30-35×5-7 μm; median lamina cells ovate 18-23×7-9 μm, alar cells irregularly subquadrate, 10-15 μm. Alar region up to 1/4 of lamina length. Dioicous. Perichaetial leaves after fertilization up to 5.5 mm long. Seta 3-5 mm long. Capsule exserted, pale-brown, ovoid, 1.5 mm long. Exostome teeth 16, lanceolate, papillose above, smooth below; endostome with basal membrane, without segments, smooth outside; papillose inside. Properistome absent. Spores papillose, 26-45 μm in diameter.

Leucodon flagellaris was compared by Brotherus with widespread Eurasian *L. sciuroides*, from which it differs in habit, numerous flagelliform shoots, larger and especially longer leaves with more long acumen and bigger upper lamina cells. The available material does not confirm that leaves of *L. flagellaris* are markedly larger than in *L. sciuroides*, but length to width ratio in *L. flagellaris* is greater (ca. 3:1 versus ca. 2:1 in *L. sciuroides*). Additional differences of *L. flagellaris* include the short seta, ovoid capsule, absence of properistome. By these characters and by the presence of flagelliform pendent shoots *L. flagellaris* is close to *L. pendulus*. *L. flagellaris* differs from *L. pendulus* in the presence of central strand in secondary stems, and also in *L. flagellaris* slender flagelliform shoots are shorter and not circinate. The flagelliform pendent shoots of *L. flagellare* are similar to those of *L. flagelliformis* C. Muell., an endemic of Central China. However *L. flagelliformis* differs in the absence of central strand, narrow lanceolate longer leaves (2.8-3.3 mm long, not 1.8-2.3 mm), longer seta, (7-10 mm, not 3-4 mm), and the presence of properistome.

Distribution: Leucodon flagellaris was described from two localities in Caucasus in Georgia: "Radscha, in mont. Bereteli pr. Uzeri, ad corticem Fagi (planta mascula); Svania, parce in silvis inferioribus ad ripam orientalem fluminis Neuskra 1000-1100 m". The collection from the former locality, "Imeretia, in alps Bereleti pr. Uzeri (fl. Rion), ad truncos arborum. 3.VII.1877. A. H. & V. F. Brotherus", was studied in LE and found to fit the description, except the plants are female. Therefore the additional studies of Brotherus collections are necessary for lectotypification. Later *L. flagellaris* was collected in two localities in Northern (Russian) Caucasus, in Teberda and Caucasian Reserves. The former collection, made by A. Abramova and I. Abramov, has sporophytes. Also, Podpera (1954) reported this species from Kashmir at 3300-3800 m, Duell (1985) – from Turkey, and Corley and Crundwell (1991) – from Corfu Island (Ionic Sea, Greece). In both Russian localities *L. flagellaris* was found in forest of middle elevations, on dead trunks of *Abies nordmanniana* (Stev.) Spach.

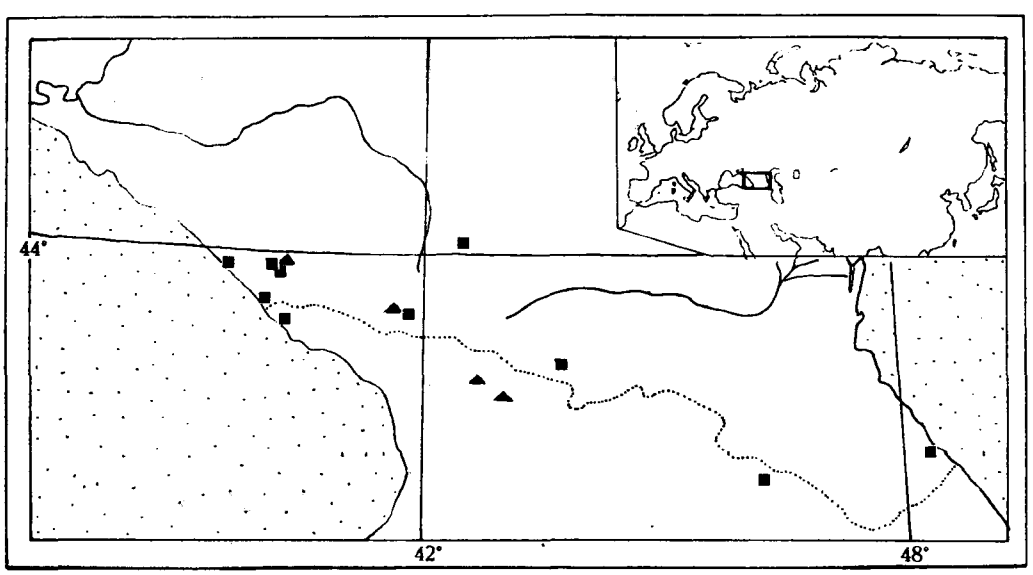
Specimens examined: [Karachaevo-Cherkesskaya Republic], Teberda Reserve, Mukhu Creek canyon, 1400 m elev. 17.VIII.1955 A. L. Abramova & I. I. Abramov (LE); *Krasnodar Territory, Caucasian Reserve, Maikop District, Oshtek Peak* 30.VII.1935 L. Vasil'ev (LE).

Leucodon sciuroides (Hedw.) Schwaegr., Sp. Musc., Suppl. 1, 2: 1. 1816. Figs. 24, 25

Fissidens sciuroides Hedw., Sp. Musc. 161. 1801.

Plants in loose tufts, dark green above, reddish-brown below, up to 5 cm long. Secondary stems ar-

Fig. 23. Distribution of *Leucodon flagellaris* Lindb. ex Broth. (triangles) and *Leucodon immersus* Lindb. (squares) in Caucasus.



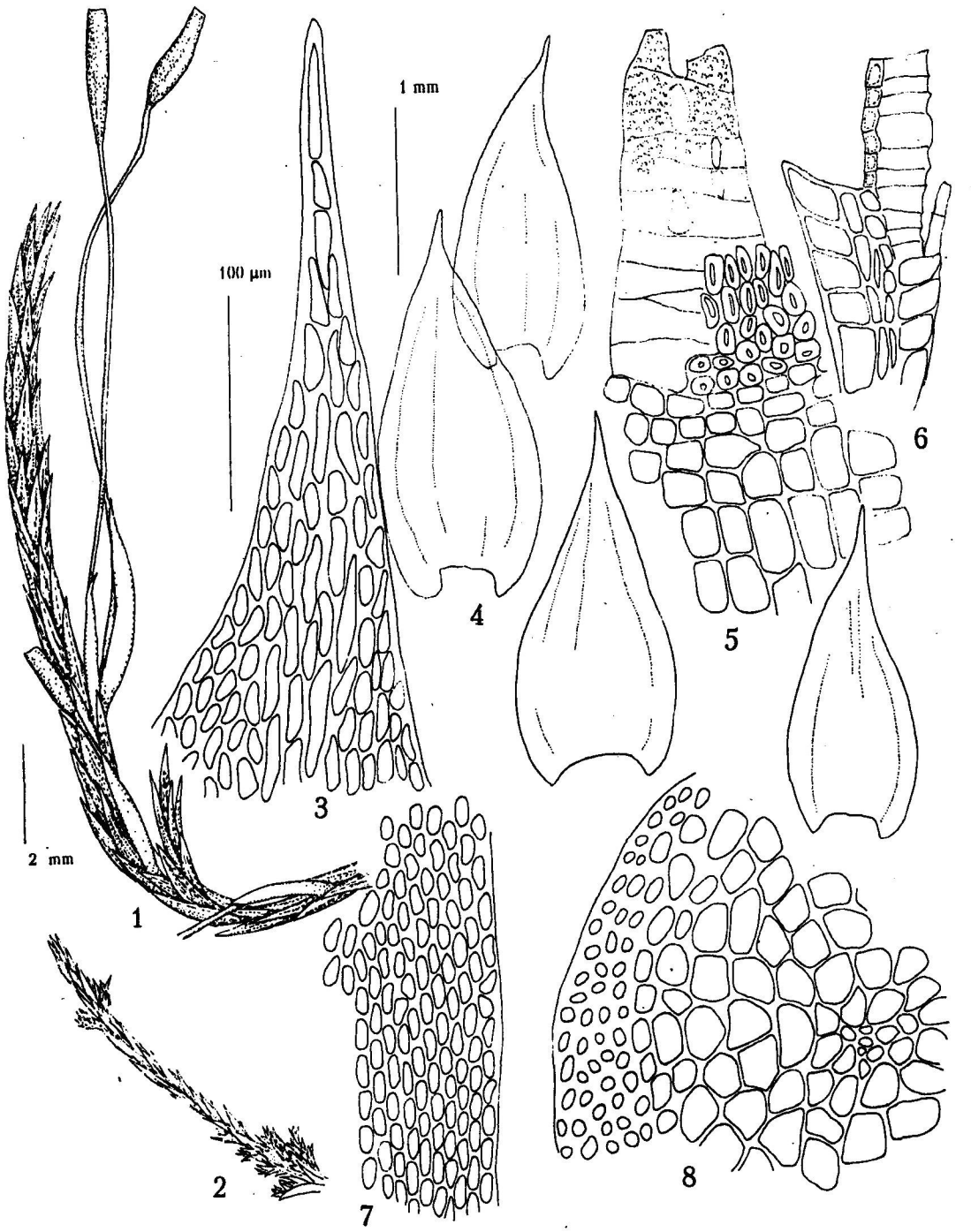


Fig. 24. *Leucodon sciuroides* (Hedw.) Schwaegr. (from *Altai, Yurga* Ignatov 21/32): 1 – habit; 2 – shoot with brood branches; 3 – upper lamina cells; 4 – stem leaves; 5 – portion of peristome; 6 – longitudianal section of peristome; 7 – cells of leaf margin at 2/3 of leaf length; 8 – secondary stem cross section. Scale bars: 2 mm – for 1, 2; 1 mm – for 4; 100 µm – 3, 5-8.

cuate-ascending, with central strand, densely foliated, up to 1-2.5 cm long. Leaves appressed when dry, sometimes slightly secund, erect when moist, ovate-cuspidate, concave, strongly plicate, ca. 1.8-2.3 mm long, 0.8-1.0 mm wide; margin plane, entire; apical cells often form uniseriate row of 2-3 cells. Upper lamina cells 30-40(55)×5-8 µm; median lamina cells ovate, 10-25×5-8 µm, alar cells irregu-

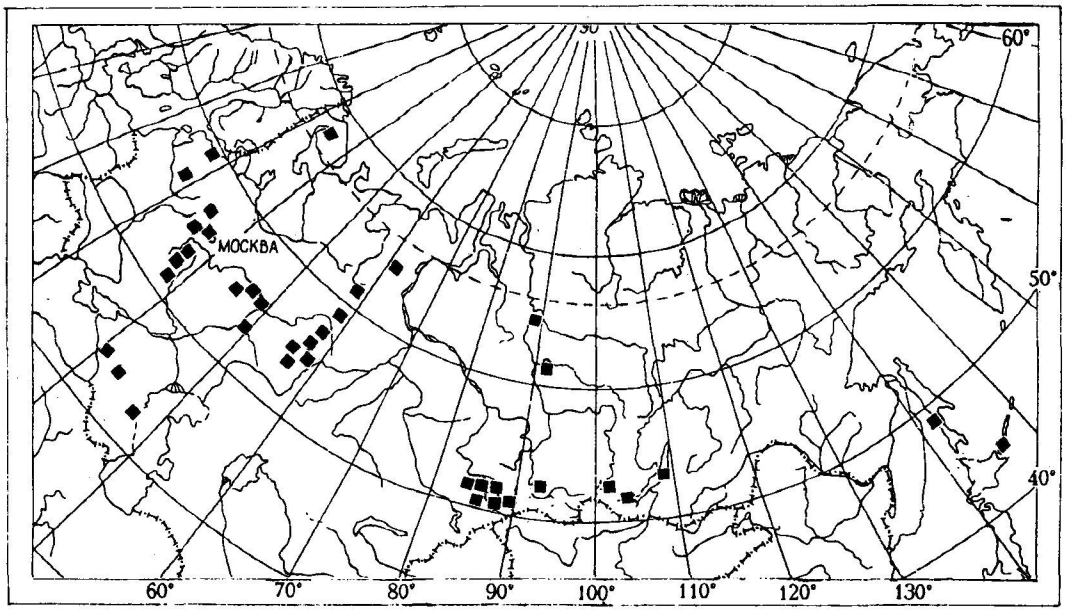


Fig. 25. Distribution of *Leucodon sciuroides* (Hedw.) Schwaegr. in Russia.

larly subquadrate, ca. 10 μm. Alar region mostly up to 2/3 of lamina length. Dioicous. Perichaetial leaves after fertilization 2.5-4 mm long. Seta 3.5-10 mm long. Capsule exserted, dark-brown, ovoid-cylindric, up to 2 mm long. Exostome teeth 16, lanceolate, densely papillose and sometimes perforate above, smooth below; endostome with low basal membrane, sparsely papillose. Properistome present. Spores faintly papillose, 25-35 μm in diameter. Vegetative reproduction by means of brood branchlets.

Akiyama (1988a) stated, that only Eurasian *L. sciuroides* and North American *L. brachypus* Brid. var. *andrewsianum* Crum et Anderson possess brood branchlets. However we observed brood branchlets also in *L. immersus* (marked in *specimens examined* of *L. immersus* by *"prop!"*). These three species have well-developed central strand in stem and their leaf characters are strongly overlapping. Also all three species have more or less similar one-layered properistome. Therefore the differences between these three species include only the length of seta and consequently the capsule position:

- exserted in *L. sciuroides* (seta length to perichaetial leaves length ratio – 1.5-3);
- emergent in *L. brachypus* (the ratio – 0.5-0.8);
- immersed in *L. immersus* (the ratio – 0.2-0.5).

The exact identification of sterile plants of this group seems not always possible. North American plants provide no problem to name, since the only species, *L. brachypus* is known in that region with capsules. Some identifications of *L. sciuroides* from this area are considered as dubious (Crum & Anderson, 1981). The only other North American species of *Leucodon, L. julaceus* (Hedw.) Sull. has a quite different appearance.

Eurasian situation is more complicated since only sterile plants are known in most of its territory. Thus, only indirect evidence can be used to argue that most of Eurasian collections belong to *L. sciuroides*. This is the distribution of sporophytes.

Sporophyte-bearing plants of *L. sciuroides* are known in Russia only from Altai Mts. (the shore of Teletzkoye Lake, *Ignatov* 21/32, and Kairu Creek, *Ignatov* 15/73). Also sporophytes were seen in specimens from Western European countries (Austria, Germany, Italy, Greece) and Caucasus (Abkhazia, Sukhumi, on *Quercus* 21.VIII.1963 Abramov LE!). Akiyama (1988a) illustrates the capsulae-bearing plants from Japan. In all these regions sporophyte-bearing collections are much rarer than sterile or female specimens. We have studied 54 specimens from Ukraine (0 sporophyte found), 8 from Byelorussia (0), 110 form European Russia (0), 80 from Asian Russia (2), 2 from Russian Far East (0). About 2/3 of collections form Russia lack any gametangia; most of other were female. In about 280

studied collections from the Caucasus, both Russian and non-Russian, sporophytes were found in 1 collection of *L. sciuroides* and in about 30 collections of *L. immersus*. So *L. immersus* can be considered as a species producing sporophytes ±frequently, while *L. sciuroides* – as a species, producing sporophytes very rare. Therefore, the absence of capsule-bearing plants of *L. immersus* in Russia outside Caucasus can be interpreted as the real absence of this species outside Caucasus.

Due to highly variable gametophytic characters in both *L. immersus* and *L. sciuroides* we failed to find any reliable character for their identification in sterile condition. So, we are enable to name for sure a sufficient part of Caucasian collections of *Leucodon*.

Typically *L. immersus* has more robust plants with more falcate leaves, leaf margin is more denticulate, but all these features are strongly overlapping. Brood branchlets are very characteristic for *L. sciuroides*, but in many collections of *L. immersus* we also found brood branchlets. They are usually rather few, however in capsule-bearing collections of *L. sciuroides* brood branchlets are also very few, if any. Probably, however, the numerous occurrence of brood branchlets can be a diagnostic character of *L. sciuroides*.

The differences between *L. sciuroides* and *L. coreense* are discussed under the latter species.

Distribution: West Europe (nearly all the countries, from southern limit northward to Norway, Sweden and Finland), Macaronesia, Northern Africa, Middle East (Turkey, Israel), Caucasus, Urals, Siberia (eastward to Baikal Lake), Mongolia (northwest), Himalayas, Kuril Islands, Japan (from Hokkaido to Kyusyu). Reported also from East Africa and China. However, new publications on East African moss flora list only *L. dracenae* Solms. in Vent., a superficially similar species. Chinese records from NW China (Gao & Chang, 1986; Koponen & al. 1983) list *L. sciuroides*, but not list *L. coreense*. At the same time Akiyama (1988a) reported from this area only the latter species. In continental Russian Far East all the specimens, previously identified as *L. sciuroides*, appear in fact to be *L. coreense*. Consequently, we suspect that NE-Chinese records of *L. sciuroides* also belong to *L. coreense*. Interesting is the disjunctive occurrence of *L. sciuroides* in Pacific islands – in Japan, Kuril Islands and Sakhalin.

In West Europe, eastward to Baltic countries and West Ukraine *L. sciuroides* is a common epiphyte. However in the lowlands of European Russia it is a rather rare species, occurring in old deciduous forest on trunks of *Quercus, Tilia, Acer, Fraxinus, Populus*. In XIX centure *L. sciuroides* was much more common species in all places where historical comparisons were undertaken: in Kiev Province in Ukraine (Virchenko, 1991), Tallin surroundings in Estonia (Tamm, 1984), Moscow Province in Russia (Ignatov & Ignatova, 1990). Today *L. sciuroides* is widespread in Northern Caucasus, South Ural mountains (Bashkiria) and mountains of South Siberia (Altai and Sayans). In mountain areas *L. sciuroides* grows at lower and middle elevations, typically not exceeding the tree-line. The ability to grow on rocks (both calcareous and moderately acidic) allow this species to penetrate northward up to 68° in Kola Peninsula, 64°30' in Ural Mts., 65°30' in Eastern Siberia.

Selected specimens examined: EUROPEAN RUSSIA: *Murmansk Prov., Khibiny Mts., Lovczorr* 5.VIII.1948 Schljakov (LE); *Murmansk Prov., Khibiny Mts., Vudyavrczorr* 17.VIII.1948 Schljakov (LE); *Leningrad Prov., Lomonosov Distr., Voronino* 14.VIII.1935 Lapshin (LE); *Pskov Prov., Opoczka Distr.* 30.VII.1914 Rudneva (LE); *Moscow Prov., Kunzevo* 20.IV.1891 Zickendrath (MW); *Moscow Prov., Mozhaisk Distr., Porecz'e* 20.IV.1988 M. Ignatov (MHA); *Tula Prov., Filatovo* 6.V.1900 Zickendrath (LE); *Lipezk Prov., Galichya Gora* 24.IV.1967 Grigor'evskaya (MW); *Woronezh* 15.III.1877 Brotherus (LE); *Nizhnij Novgorod Prov., Arzamas* 1893 Zickendrath (LE); *Chuvashskaya Republic, Shumerlya* 10.VIII.1947 A. Semenova (LE); *Tatarskaya Republic* 15.VI.1947 Ariskina (LE); *Samara Prov., Zhiguli* 24.VII.1945 Z. P. Mironova (LE); NORTHERN CAUCASUS: *Dagestan Republic, Gunib* 15.VII.1961 G. Nepli (MW); *Karachaevo-Czerkesskaya Republic, Teberda Reserve* 12.VII.1993 Onipchenko (MW); URALS: *Subarctic Urals, Tumen Province, Berezovo Distr., Tykatlova Creek* 17.VII.1949 Kuvaev (LE); *Sverdlovsk Prov., Kyzyltash* 16.VII.1940 Igoshina (LE); *Chelyabinsk Prov., Kyshtym Distr., Kyzyltash* 16.VII.1940 Igoshina (LE); *Chelyabinsk Prov., Troizk Distr., Ui Creek* 5.VII.1991 Bezgodov (MW); *Perm Prov., Chusovaya River* 24.VI.1973 Sitnikova (LE); *Perm Prov., Us'va River* 4.VI.1994 Ignatov #343 (MW); *Bashkirian Republic, Burzyan Distr., Muradymovo* 10.IX.1990 Ignatova #11/90 (MW); *Bashkirian Republic, Beloretzk Distr., Bretyak* 12.IX.1990 Ignatova 13/101, 13/81, 13/88, 13/119, 13/123 (MHA); *Perm Prov., Visherskij Reserve, Moiva Creek* 5.VII.1994 Bezgodov N°373 (MW); SIBERIA: *Baikal Lake (NE), Svyatoi Nos* 27.VI.1956 Bardunov & Kaplin (IRK, LE); Irkutsk Prov., Pokojniki Creek 17.VII.1957 Bardunov & Djachenko (LE: MUSCI URSS Exs. N°178); *Yenissej River, Miroedikha* (ca. 65 30'-55 40'E) 26.V.1914 Kuznetsov & Reverdatto (LE); *Middle Yenissej River, Baikit Distr., Stolbovaya Creek (ca. 62°N)* 27.VI.1992 Shcherbina (MW); *Altai 440-2200 m alt.* Ignatov 0/1081; 0/678; 21/32; 0/1083; 0/1085; 0/1086; 34/75; 0/1087; 0/113; 0/47; 0/1082; 0/1084; 9/129; 15/64; 15/73; 9/16; 25/125; 15/39; 34/77; 0/1088; 36/139; 8/318; 8/326; 0/2066 (MHA); FAR EAST: *Kuril Islands, Shikotan* 2.III.1955 Kusakin (LE); *Sakhalin Island, Uglegorsk Distr., Krasnopol'e* 27.VII.1954 Lyubarskij #34 (LE).

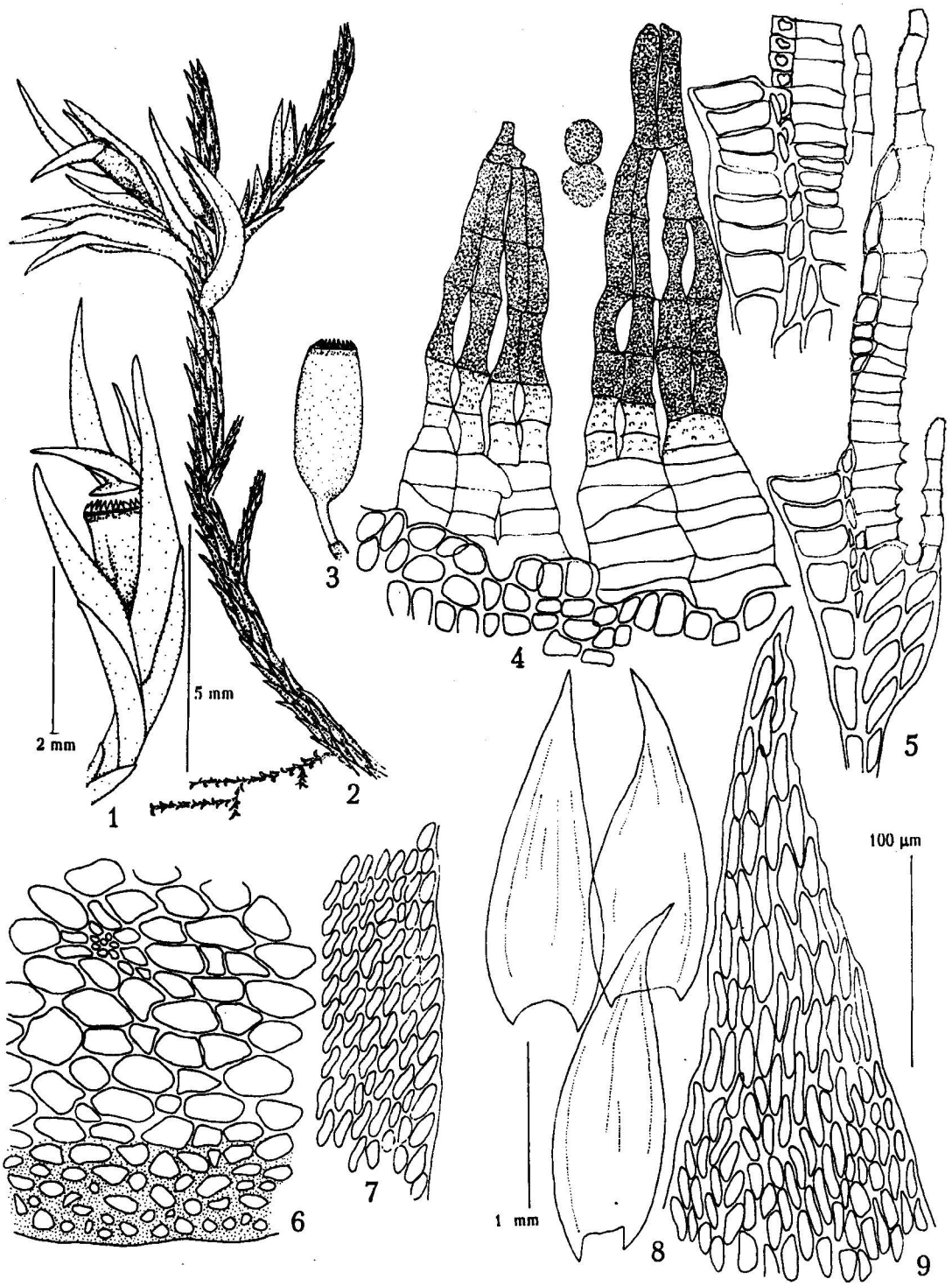


Fig. 26. *Leucodon immersus* Lindb. (from *Kabardino-Balkar Republic, Karasu* 17.X.1983 Portenier): 1 – perichaetium with capsule; 2 – habit; 3 – capsule; 4 – portion of peristome; 5 – longitudianal sections of peristome; 6 – secondary stem cross section; 7 – cells of leaf margin at 2/3 of leaf length; 8 – stem leaves; 9 – upper lamina cells. Scale bars: 5 mm – for 2; 2 mm – for 1, 3; 1 mm – for 8; 100 µm – 4-7, 9.

Leucodon immersus Lindb., Oefv. Forh. Finska Vetensk.-Soc. 12: 72. 1870.
Figs. 18, 19, 23, 26

Lectotype (selected here): "ad pedem Ararat majoris, Chodzko 1854" (LE)[1].

Leucodon caucasicus Jur. et Milde, Verh. Zool-Bot. Ges. Wien 20: 599. 1870.

Lectotype (selected here): Haussknecht. Iter orientale 1868: Piribasar et Restch (LE).[2]

Plants in loose tufts, dark green to reddish-brown below, up to 7 cm long. Secondary stems arcuate-ascending, with central strand, densely foliated, up to 1-2.5 cm long. Leaves appressed when dry, sometimes falcate secund, erect when moist, ovate-cuspidate, acuminate, concave, strongly plicate, ca. 2.0 mm long, 0.8 mm wide; margin plane, ±crenulate. Upper lamina cells 30-40×6-8 μm; median lamina cells ovate, 15-20×5-7 μm, alar cells irregularly subquadrate, ca. 10 μm. Alar region mostly up to 2/3 of lamina length. Dioicous. Perichaetial leaves after fertilization up to 3.5 mm long. Seta 0.3-0.5 mm long. Capsule immersed, dark-brown, ovoid-cylindric, ca. 1.8 mm long, 0.8 mm wide. Exostome teeth 16, lanceolate, densely papillose and sometimes perforated above; smooth below; endostome with low basal membrane, sparsely papillose. Properistome present. Spores papillose, (20)30-48 μm in diameter. Vegetative reproduction by means of brood branchlets.

Differentiation from *L. sciuroides* discussed under that species.

Distribution: Leucodon immersus is widespread in Caucasus and also reported from Turcomania in Middle Asia, Iran, Israel, Turkey, Bulgaria, South Ukraine (Kherson Prov. – Podpera, 1954). In Northern Caucasus this species grows from sea level up to 1500 m alt., on rocks and tree trunks. Labels indicate *Castanea, Juglans, Euonymus, Caprinus,* but this is obviously an incomplete list of phorophytes.

Selected specimens examined (only the specimens with sporophytes are listed; presence of brood branchlets indicated as "prop!"): NORTHERN CAUCASUS: *Kabardino-Balkar Republic, Karasu, 1000 m alt.* 17.X.1983 Portenier – prop! (MHA); *Adler Distr., Krasnaya Polyana* 22.VII.1948 Raspopov (MW); *Khosta* 6.IX.1938 V. Alper (LE); *Caucasian Reserve, Aibga Peak* VI.1951 N. Ariskina #50 (LE); *ibid.* 19.VII.1948 Rasionov (LE); *ibid.* 10.IX.1937 anonym –prop! (LE); *between Adler and Tuapse* 16.IX.1929 Sokolov (LE); *Tapsug Distr.,* 18.VI.1930 Ya. Vasilev – prop! (LE); *Dagestan Republic, Kazbek Distr.,* 21.V.1960 Amiraliev – prop! (LE); *Dagestan Republic, Derbent* 5.VII.1927 Sheludyakova (LE); *Zheleznovodsk* 14.IX.1928 Schteinberg (LE).

Leucodon coreense Card., Beih. Bot. Centralbl. 17: 23. 1904. Figs. 27, 28

Plants in loose tufts, dark green above, reddish-brown below, up to 5 cm long. Secondary stems arcuate-ascending, without central strand, densely foliated, up to 1.5 cm long. Leaves appressed when dry, sometimes slightly secund, erect when moist, ovate-cuspidate, concave, strongly plicate, ca. 1.6-2.0 mm long, 0.7-0.8 mm wide; margin plane, entire. Upper lamina cells 25-35×6-8 μm; median lamina cells ovate, ca. 20×8 μm, alar cells irregularly subquadrate, ca. 10 μm. Alar region up to 1/2-1/3 of lamina length. Dioicous. Perichaetial leaves after fertilization 2.5-3.5 mm long. Seta ca. 4 mm long. Capsule exserted, dark-brown, ovoid-cylindric, 1.8-2.0 mm long, 0.8 mm wide. Exostome teeth 16, lanceolate, densely papillose and sometimes perforated above, smooth below, about 200 μm long; endostome with low basal membrane, sparsely papillose. Properistome present. Spores papillose, 25-35 μm in diameter.

The species in very close to *L. sciuroides* and differs from it mainly by the absence of central strand. Also, brood-branchlets were never observed in *L. coreense*, and the alar region of this species in typically extend up to 1/2-1/3 of leaf length, while in *L. sciuroides* up to 2/3-3/4.

Distribution: Japan (Honshu), Korea, Eastern and North-Eastern China (central-eastern region: Guishou, Jilin, Hunan, Hubei, Shensi), Taiwan, Russian Far East. Russian collections were made in conifer+broad-leaved and in broad-leaved forests, on *Abies, Acer, Quercus, Tilia, Fraxinus, Carpinus, Betula, Ulmus, Phellodendron,* and occasionally also on rocks and rotten logs.

Specimens examined: AMURSKAYA TERRITORY: *Khinganskij Reserve* 30.VI.1987/ 4.VII.1987/ 6.VII.1987 Czerdantseva (VLA); KHABAROVSK TERRITORY: *Khor-Amur interfluve, Sidimi River, Nemptu Creek* 22.VIII.1927 V. Savicz (LE); *Bolshekhekhzirskij Reserve* 5.VIII.1983/ 15.VIII.1983/ 12.VIII.1981/ 9.VIII.1981 Czerdantseva (VLA); *Komsomolsk Reserve* 22.VI.1986/ 20.VI.1986/26.VI.1985 Czerdantseva (VLA); *Malyj Khingan, Londoko* 15.X.1929 V. Vasil'ev (LE); *between Bidzhan and Daur* 25.VII.1909 B. Fedtschenko (LE); PRIMORSKIJ TERRITORY: *Suputinskij Reserve* IX.1961 L. Vasil'eva & Ardeeva (LE); *Kedrovaya Pad Reserve* 15.VII.1926 Saverkin (LE); *ibid.* 12.X.1954 L. Vasil'eva (LE, VLA); *ibid.* 17.IX.1958 Ardeeva; *Sudzukhinskij Reserve* 25.IX.1944/ 19.VII.1944/ 21.VIII.1944/ 2.VIII.1945 Zhudova (LE); *Ussuri* 1860 Maximowicz (LE);

[1] – The protologue indicate "ad pedem montis Ararat majoris Armeniae". Since 1921 this area belongs to Turkey.

[2] – The territory of Iran, southern shore of Caspian Sea (modern spelling – Rasht)

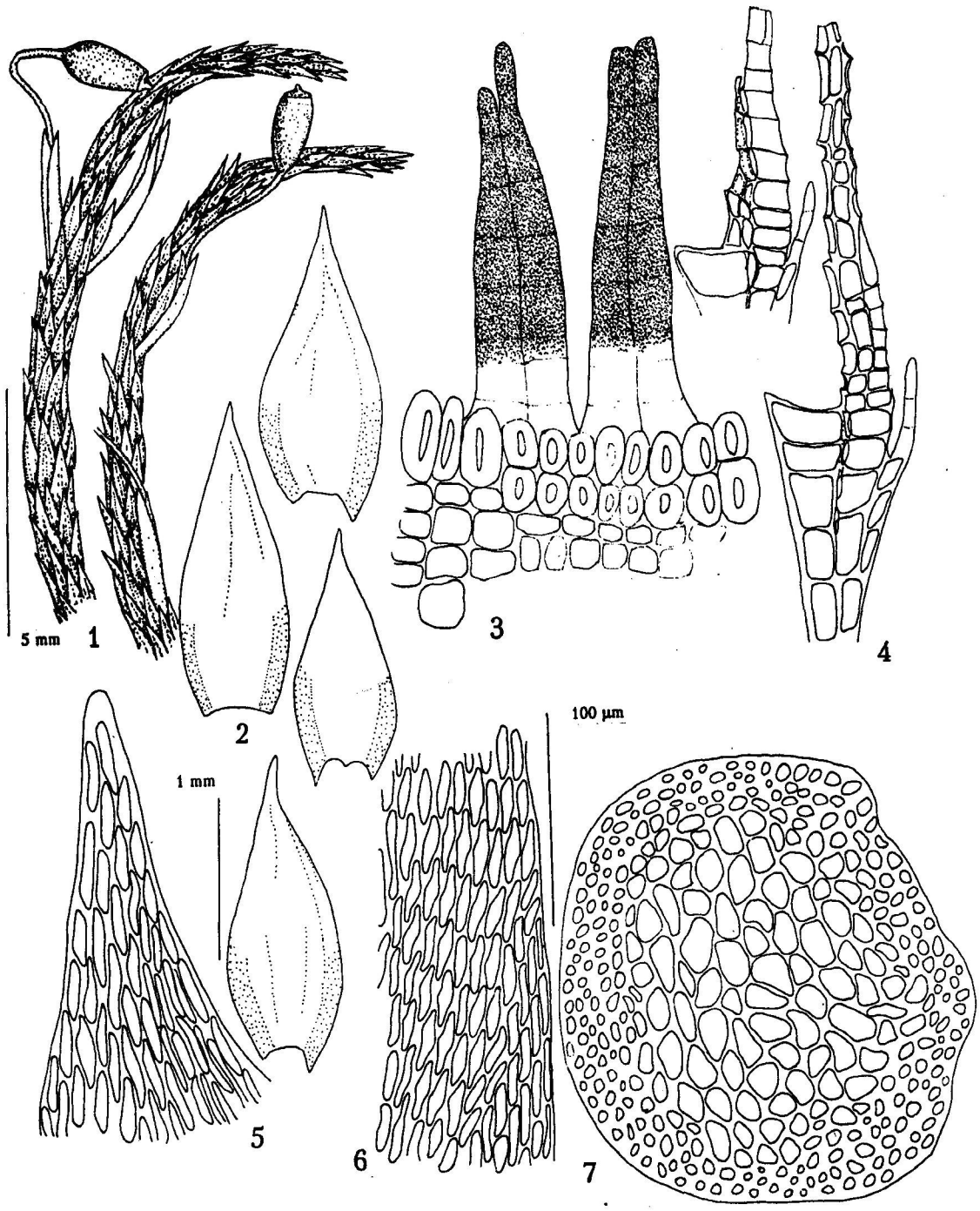


Fig. 27. *Leucodon coreense* Card. (from *Kedrovaya Pad Reserve* 12.X.1954 L. Vasil'eva): 1 – habit; 2 – stem leaves; 3 – portion of peristome; 4 – longitudianal section of peristome; 5 – upper lamina cells; 6 – cells of leaf margin at 2/3 of leaf length; 7 – secondary stem cross section. Scale bars: 2 mm – for 1; 1 mm – for 2; 100 µm – 3-7.

Lazovskij Distr., Lazovskij Reserve 22.IX.1987/ 21.VIII.1986/ 20.IX.1988/ 23.VIII.1988 Czerdantseva (VLA); *Ussurijskij Reserve* 9.VIII.1975/ 7.VII.1974/ 16.VII.1974/24.VIII.1974 Czerdantseva (VLA); *Chuguevka Distr.* 23.VII.1980 Czerdantseva (VLA); *ibid.* 8.VII.1976 N. Timofeeva (VLA); *Ternej Distr., Sikhote-Alin Reserve* 20.VI.1979/ 17.VI.1979/ 17.VI.1979 Czerdantseva (VLA); *Anuchino Distr., Tikhorecznoe* 30.VI.1988 Czerdantseva

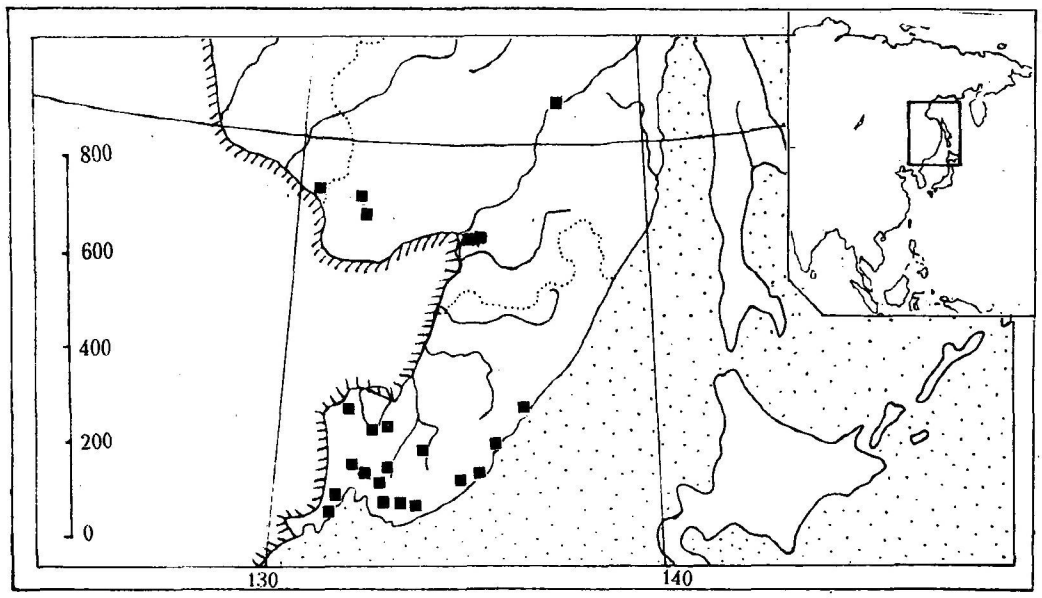


Fig. 28. Distribution of *Leucodon coreense* Card. in Russia.

(VLA); *Partizansk Distr., Lozovoj* 13.IX.1974/ 15.IX.1974 Bardunov & al. (VLA); *Spassk Distr., Slavyanka* 18.VII.1981 Czerdantseva (VLA); *Dal'negorsk Distr.* 8.X.1978 Gambaryan (VLA); *Olga Distr. Shcherbakovka* 29.VIII.1977 Bardunov & Czerdantseva (VLA); *Suczan River, between Fanza and Takhe* 8.IX.1913 V. Komarov (LE); *Khanka Lake, Lefu River, Meshchanka* 26.VI.1913 V. Komarov (LE); *Khanka Lake, Dvoryanka* 6.IX.1931 B. Schischkin (LE); *Shkotovo Distr., Maikhe River* 7.IX.1930 Lazarenko (LE); *Nikolsk {Ussurijsk}* 1905 Suizev (LE); *Shkotovo Distr. Tsemukhe* 22.VI 1947 B. Kolesnikov (LE); *Upper Suputinka River* 11.X.1934 Lazarenko (LE).

Antitrichia Brid.

Plants robust with indistinctly differentiated primary stems and mostly horizontal secondary stems, irregularly to subpinnately branched. Axillary hairs of 3-5 cells, 1-2 proximal short cells colored, 2-3 distal elongate cells colorless. Leaves erect when dry, spreading when moist, with ovate lower part and acuminate apex; not or indistinctly plicate; margin revolute to the base of acumen, entire except the sharply serrate acumen. Costa strong, reaching ca. 3/4 of leaf length, usually with short supplementary palmate costae at the base. Lamina cells smooth, thick-walled, elongate in upper and middle lamina, rhomboid in juxtacostal basal area, subquadrate in alar region. Dioicous. Perichaetial leaves much enlarged, represented mostly by sheathing base, abruptly narrowed in short rigid subula. Seta erect to somewhat flexuose. Capsules exserted, oblong-cylindric to cylindric. Annulus present. Operculum conic-rostrate. Peristome teeth lanceolate, striolate below, smooth to faintly papillose above; endostome without basal membrane, with linear fragile segments. Spores medium to large, finely papillose. Calyptra cucullate, naked.

Antitrichia curtipendula (Hedw.) Brid., Muscol. Recent. Suppl. 4: 136. 1819[1818].

Figs. 29-31

Neckera curtipendula Hedw., Sp. Musc. 209. 1801.

Plants robust, in golden or golden-green loose tufts. Secondary stem mostly horizontal, up to 6 cm long, irregularly branched, branches attenuate, up to 1.7 cm. Stem leaves 2.5-3.0 mm long, ovate, acuminate, entire except the strongly serrate apex, teeth sharp and at least some teeth backward curved, uppermost cell bicornute owing to big sharp mamillae spreading at 160°. Margin revolute all along except the apex. Main costa strong, reaching 3/4 of leaf length, supplementary costae 2-4, about 0.1-0.2 of leaf length. Upper lamina cells up to 30-45×7-8 μm, median leaf cells ovate, 17-23×6-7 μm; cells in alar region subquadrate, ca. 7 μm. Perichaetial leaves up to 6 mm long, 1.5 mm wide, ecostate or nearly so. Seta ca. 15 mm long, red-brown, flexuose. Capsules ca. 2 mm long, ovoid-cylindric. Exostome teeth distinctly striolate below, papillose above. Spores 20-30 μm in diameter.

Only incomplete broken peristome have been seen in one collection from Caucasian Reserve. Other collections are sterile or female. *A. curtipendula* is easy to identify due to characteristically backward-curved teeth in leaf apex and supplementary costae.

Distribution: *Antitrichia curtipendula* is wide-

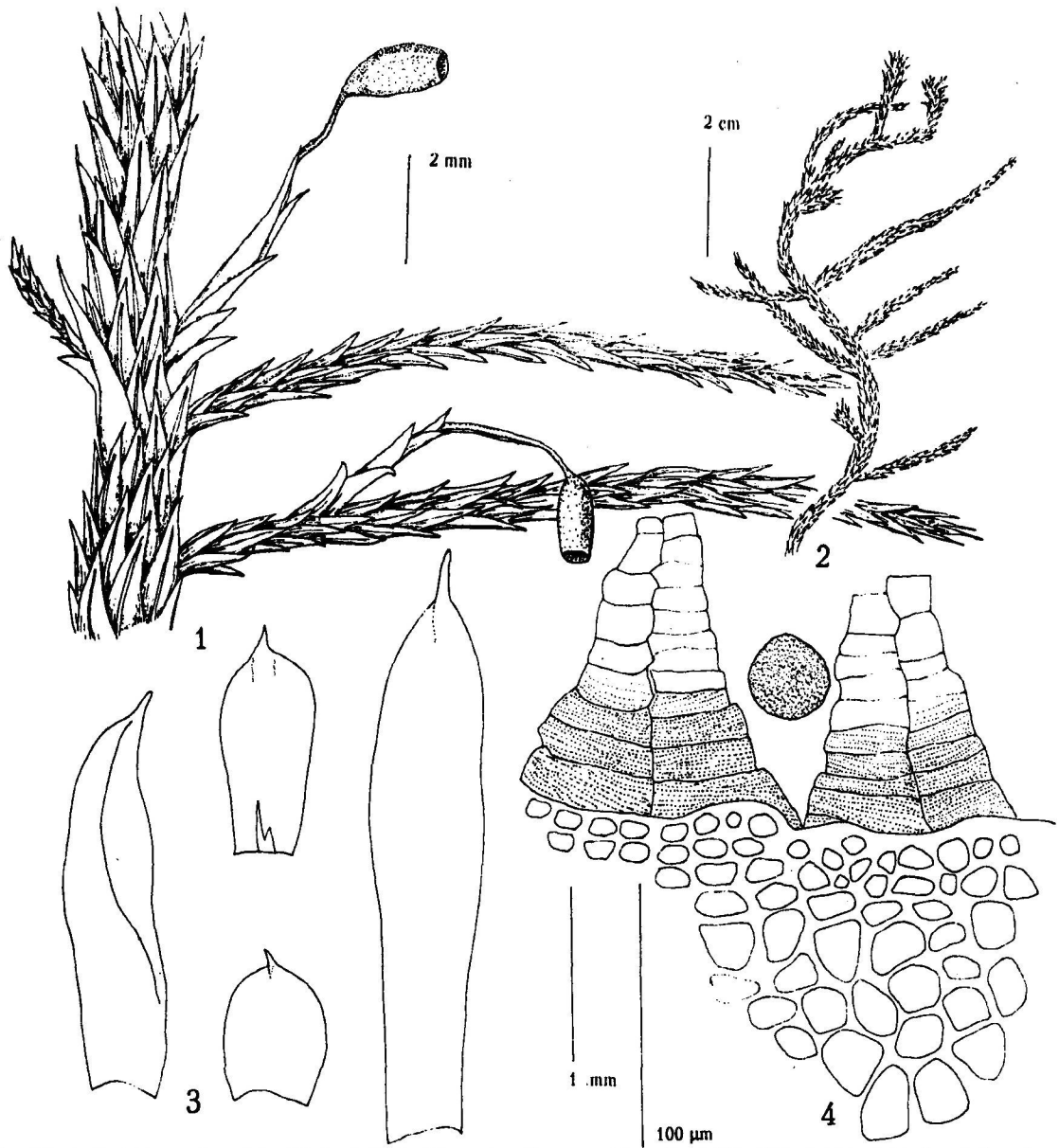


Fig. 29. *Antitrichia curtipendula* (Hedw.) Brid. (*Caucasian Reserve, Aibga Peak* VI. 1951 Ariskina): 1, 2 – habit; 3 – perichaetial leaves; 4 – portion of peristome and spore. Scale bars: 2 cm – for 2; 2 mm – for 1; 1 mm – for 3; 100 µm – for 4.

spread in Western North America (from California to southeastern Alaska and Aleutian Islands), rare in eastern North America (Newfoundland), South Greenland, Iceland, Macaronesia, widespread in most of the territory of West Europe, especially in Mediterranean region, penetrating northward to Great Britain, Norway, Sweden, Finland. The Eastern limit of *A. curtipendula* in Europe is close to the western border of the former USSR: it includes Karelia, Leningrad Prov., Estonia, Latvia, Byelorussia, West Ukraine, Krym, Caucasus (in nearly all these areas *A. curtipendula* is a rare sporadic moss). Also it is known from Middle East (Turkey, Israel), Northern Africa, Ethiopia, Kenya, Uganda, Zaire, Tanzania, Malawi. Russian collections were made from granitic rocks and *Alnus* trunks. Collections from NW Russia were made in lowland, from Northern Caucasus – from middle elevations.

Specimens examined: KARELIA: *Karelia lagodensis, Sortavala* 5.VIII.1914 Oesch. (LE); *Karelia lagodensis, Valamo* 28.VI.1874 Lindberg (LE); *Karelia australis, Suursaeri* 8.VIII.1868 Brenner (LE); *Sandal Lake* Savich # 1182, 1183, 1184, 1185 (LE); LENINGRAD PROVINCE: *Krasnogvardeisk Distr., Elizavetino* 9.VIII.1932 Zinserling (LE); NORTHERN CAUCASUS: *Karachaevo-Czerkesskaya Republic, Teberda Reserve, Muchu Creek Canyon, 2300 m elev.* 31.VII.1994 V. Onipczenko # 554

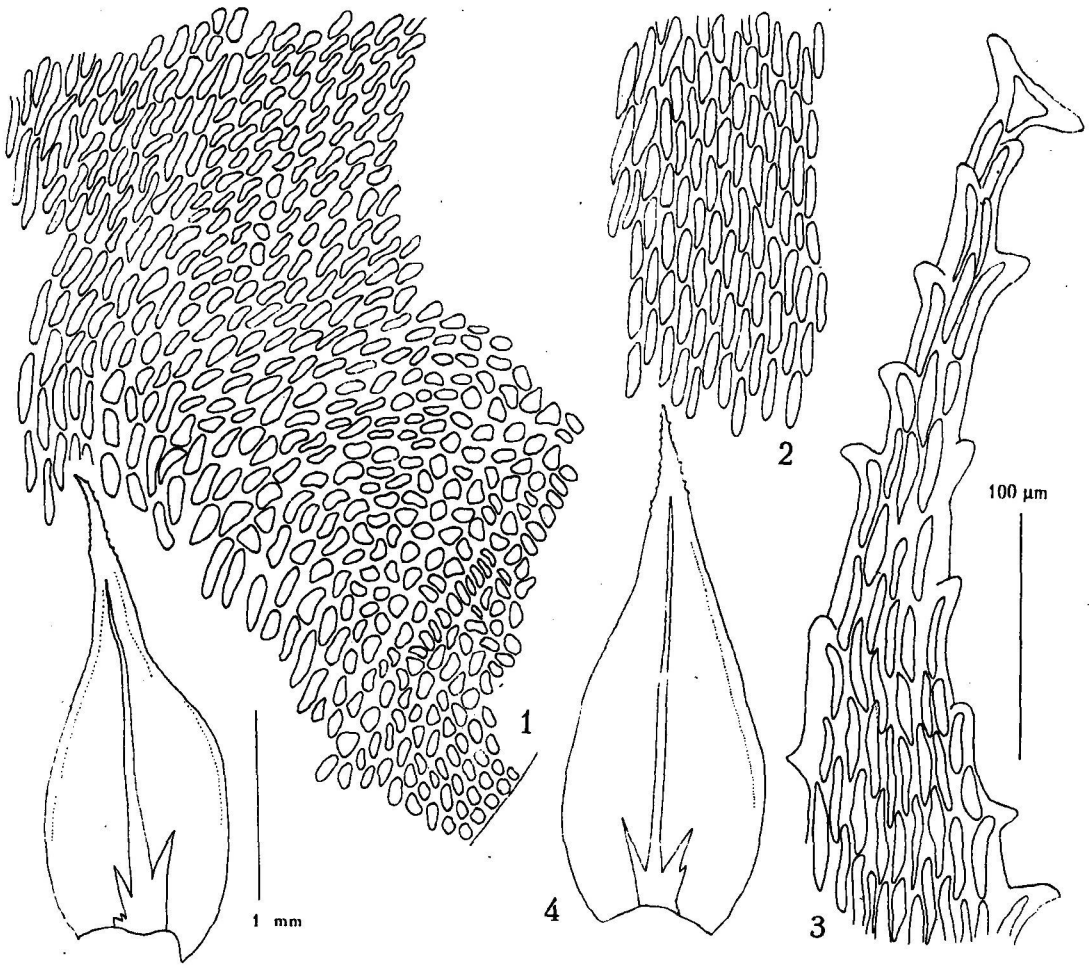


Fig. 30. *Antitrichia curtipendula* (Hedw.) Brid. (*Caucasian Reserve, Aibga Peak* VI. 1951 Ariskina): 1 – basal cells; 2 – mid-leaf cells; 3 – upper lamina cells; 4 – leaves. Scale bars: 1 mm – for 4; 100 µm – for 1-3.

(MW); *Krasnodar Territory, Adler Distr., Caucasian Reserve, Aibga Peak* 6.IX.1937 Lazarenko (LE); *ibid.* VI.1951 N. P. Ariskina (LE); *ibid.* 26.VII.1948 Rasionov # 51 (LE).

Forsstroemia Lindb., Oefv. K. Vet. Ak. Foerh. 19: 605. 1863.

Plants medium to large, in green to yellow-brown tufts. Primary stem sympodial, creeping, with small leaves and clusters of rhizoids. Secondary stem monopodial, regularly or irregularly pinnately branching. Central strand in secondary stem absent; cortical cells in stem with strongly thickened walls, differentiated in 3-5 rows. Pseudoparaphyllia linear-lanceolate. Axillary hairs of 4 cells; distal three cells elongate, hyaline, proximal cell pigmented, short. Stem leaves erect to appressed when dry, spreading to nearly squarrose when moist, ovate to ovate-lanceolate, acute to acuminate, concave, margin plane or narrowly recurved in lower half, entire or serrulate above. Costa present, single and reaching 4/5 of leaf length or weak, short, often branching to double. Lamina cells thick-walled, smooth, isodiametric to shortly elongate above, in mid-leaf and basal juxtacostal area – elongate, irradiating toward margin, where cells are shorter, at basal margin – subquadrate to transversely rectangular. Branch leaves differ in smaller size and shorter costae. Dioicous or autoicous. Perichaetial leaves lanceolate, after fertilization becoming 2-3 times larger than stem leaves, costate, rarely ecostate. Paraphyses elongating after fertilization. Seta straight to somewhat flexuose. Capsule exserted to immersed, cylindric, stomata absent. Annulus absent or composed by 1-2 rows of small cells. Exothecial cells rectangular or irregular. Peristome pale, inserted below the mouth. Exostome teeth 16, smooth to faintly granulose, entire or perforated above. Endostome strongly reduced, known mostly as fragmentary adherings to exostome, rarely segments are free. Operculum conic to obliquely ros-

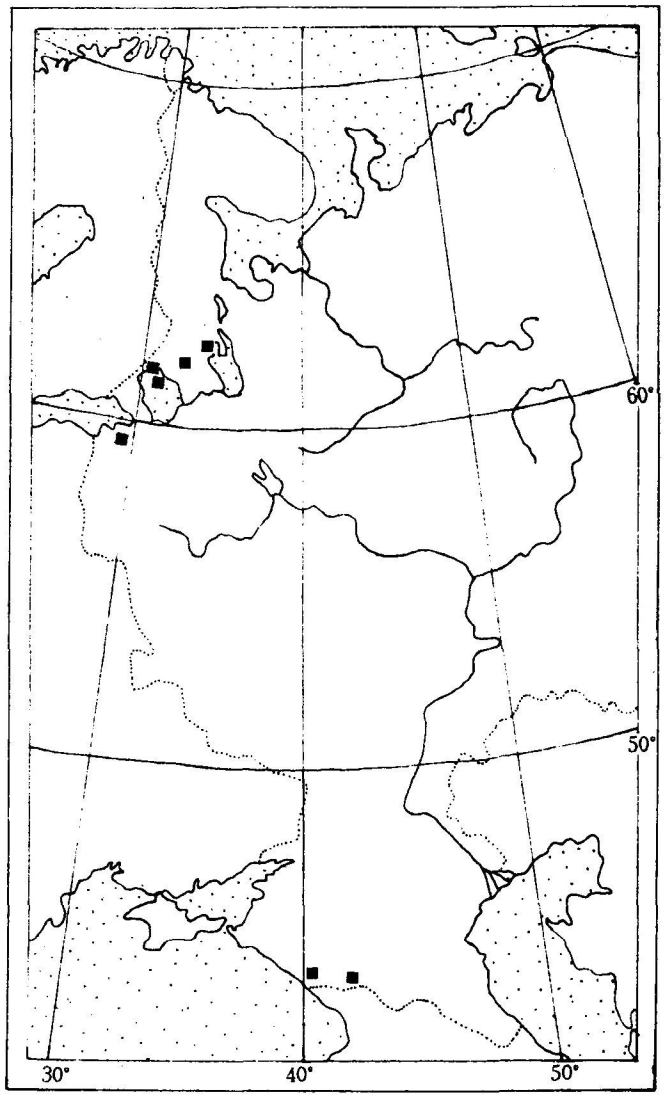


Fig. 31. Distribution of *Antitrichia curtipendula* (Hedw.) Brid. in Russia.

trate. Calyptra cucullate, hairy. Spores spherical, minutely papillose, medium-sized, sometimes proliferating in capsules.

The genus *Forsstroemia* has been revised recently in world-wide scope by Stark (1987), who provided careful morphological descriptions and illustrations of all the species and discussed taxonomic problems. Stark recognized in the genus 10 species and 1 subspecies. One species, *F. stricta* Lazarenko, however remained untreated, since original material was not available for the author. Provisionally *F. stricta* was linked to *F. japonica*. Thanks for the help of curator of KW, L. Ya. Partyka, we have studied this specimen and found that *F. stricta* is closely related to *F. producta* (Hornsch.) Par., pan-subtropical and tropical species. However, we consider it as a distinct species by reasons discussed below.

Key to the species of *Forsstroemia* in Russia

1. Costa in secondary stem leaves weak and forking, upper lamina cells elongate (4-8:1) 2
1. Costa in secondary stem leaves ending well above mid-leaf, ending in mid-leaf or below, upper lamina cells short (1-3:1) . . . 3
   2. Dioicous, sporophytes unknown; secondary stems 10-15 cm long; branches slenderly attenuate . . . . . *F. noguchii*
   2. Monoicous, usually with sporophytes; secondary stems 3-5 cm long; branches not slenderly attenuate . . . . . *F. trichomitra*
3. Plants rarely branched; stem leaves ovate, broadly acute, 1.4-1.6 mm long; capsule shortly cylindric, exserted . . . . . *F. stricta*
3. Plants densely pinnate to bipinnate; secondary stem leaves ovate in lower part, acuminate, 0.8-1.7 mm; capsule ovoid to globose, immersed, emergent to shortly exserted 4
   4. Plants regularly pinnate; branches of ± equal length; distal branch leaves shortly acute; brood branchlets often present; capsules exserted or emergent; stem leaves rather long-acuminate; perichaetial leaves long-acuminate from ovate base . . . . . *F. japonica*
   4. Plants irregularly pinnate; branches unequal, often having flagelliform ends; distal branch leaves longly acuminate; brood branchlets absent; capsules immersed; stem leaves short-acuminate; perichaetial leaves linear-lanceolate . . . . . *F. cryphaeoides*

Forsstroemia cryphaeoides Card., Bull. Soc. Bot. Genève, ser. 2, 1: 132. 1909. Figs. 32,35

Forsstroemia kusnezovii Broth., Rev. Bryol. Lichénol. 2: 7. 1929.

Forsstroemia mandschurica Broth., Rev. Bryol. Lichénol. 2: 8. 1929.

Secondary stem up to 3 cm, irregularly pinnately branching, branches up to 8 mm. Stem leaves ovate, acute to shortly acuminate, entire, 0.9-1.2 mm long, 0.4-0.6 mm wide. Costa single and reaching 0.8-0.9 of leaf length. Branch leaves 0.5-0.9 mm, with costa 0.6-0.8 of leaf length. Upper lamina cells isodiametric to shortly elongate, 10-12×8-10 μm, mid-leaf cells of the same size, basal cells at margin transversely rectangular 8×10 μm. Dioicous. Perichaetial leaves linear-lanceolate (margin ±parallel in lower 0.6-0.7 of leaf), costa 0.8-0.95 of its length. Seta 0.5-1.0 mm, straight. Capsule immersed, ovoid, 1.2×0.8 mm. Exostome teeth 16, 200 μm long, 50 μm wide, sparsely granulose below. Endostome fagmentary. Spores 17-28 μm.

Forsstroemia cryphaeoides and *F. japonica* are closely related and Stark concluded that the reliable diagnostic characters include only few sporophytic and sporophyte-associated characters: vaginula length, calyptra length, shape of perichaetial leaves and also rather small overlap has the length of seta. The combination of shape and size of perichaetial leaves with the length of seta makes the character of capsule position (immersed in *F. cryphaeoides* and shortly exserted in *F. japonica*) also reliable. In sterile condition *F. cryphaeoides* can be identified by smaller and broadly ovate stem leaves. However, Stark calculated that this character leads to 10% of erroneous identification. Important character neglected by Stark is the branching pattern – irregular in *F. cryphaeoides* and fairy regular in *F. japonica*. This regularity in the latter species depends on two factors: (1) branches are straight on most of their length having angle of ca. 45° with the stem; (2) most branches are of ±same length. In *F. cryphaeoides* branches curve and their upper parts are almost parallel to the stem; also the length of branches is highly variable. So, the pinnate structure, reminiscent that of *Abietinella* or *Haplocladium* is readily seen in *F. japonica*, while the first glance on the tuft of *F. cryphaeoides* reveal mostly parallel foliated axes (so the plant reminiscent *Heterocladium macounii*). Other good character is the shape of distal branch leaves, shortly acute in *F. japonica* and long acuminate in *F. chrypaeoides*. Also the brood branchlets are present in about a half of collection of *F. japonica*, while they were never observed in *F. cryphaeoides*.

F. kusnezovii was synonymized with *F. cryphaeoides* by Noguchii (1969) and *F. mandschurica* – by Gao (1977). Available isolectotypes of both species in LE confirm these opinions, supported also by Stark (1987).

Distribution: China (Liaoning), Japan (Honshu, Shikoku); Russian Far East (continental part). Stark cited in the list of specimens the exsiccate of Verdorn form Stavropolskiy Kray, Zmeinaja Gora. Stavropolskiy Kray, or Stavropolskiy Territory is in the Northern Caucasus, while Zmeinaja Gora – the type locality of *F. kusnezovii*, in the Far East. Obviously "Stavropolskiy Kray" is an erroneous addition to the label. Russian collections of *F. cryphaeoides* were made only in southern part of Primorskij Territory, in mixed coniferous (*Pinus koraiense, Abies holophylla*) + broad-leaved forest and broad-leaved forest, on trunks of *Carpinus, Acer, Kalopanax, Tilia, Abies, Chosenia, Syringa*, and sometimes on rocks.

Specimens examined: PRIMORSKIJ TERRITORY: *Ussuriiskij State Reserve* Ardeeva 3.IX.1968 – ♂, ♀, c. fr.; *ibid.* Czerdantseva 5.X.1969 – c. fr./ 24.VII.1974 – c. fr. (VLA, MHA); *ibid.* Czerdantseva & Nesterova 18.VII.1974 (VLA, MHA); *ibid.* Timofeeva 18.VIII.1975 – ♂ (VLA, MHA); *ibid.* 18.VII.1974 Bardunov & Czerdantseva (VLA, MHA); *ibid.* 27.IX.1961 Vasil'eva – ♂ (VLA, MHA); *Partizansk District, Lozovyj Range* Bardunov & Czerdantseva 15.IX.1974 (VLA); *Shkotovo Distr., Zmeinaya Gora* Lazarenko 9.IX.1930 (LE); *Shkotovo Distr., Kharitonovka* Transchel IX. 1929 – ♀(LE); *Okeanskaya* Kusnezov 4.X.1909 – ♂ (isotype of *F. kusnezovii* Broth., LE); *Bukhta Feljdgausena* Paljczevskij 24.X.1905 – ♂ (isotype of *F. mandschurica* Broth., LE).

Forsstroemia japonica (Besch.) Par., Ind. Bryol. 499. 1896. Figs. 33, 35

Lasia japonica Besch., Ann. Sci. Nat. Bot., 7, 17: 357. 1893.

Secondary stem up to 3 cm, regularly pinnately branching, branches up to 5 mm. Stem leaves ovate, acuminate, entire, 1.0-1.7 mm long, 0.5-0.6 mm wide. Branch leaves up to 0.4-1.0 mm with costa 0.2-0.7 of the leaf length. Costa single and reaching 0.6-0.9 of leaf length. Upper lamina cells isodiametric to shortly elongate, 10-12×8-10 μm, mid-leaf cells of the same size, basal cells at margin subquadrate, ca. 10 μm. Dioicous. Perichaetial leaves ovate-lanceolate, longly acuminate, apex filiform, 2.5-3.8 mm long, 0.6-0.8 mm wide; costa 0.5-0.8 of its length. Seta mostly ca. 2.0 mm, straight. Capsule emergent or shortly exserted, ovoid-globose (before operculum removal), 1.2×0.7 mm. Annulus of 1-2 rows of small

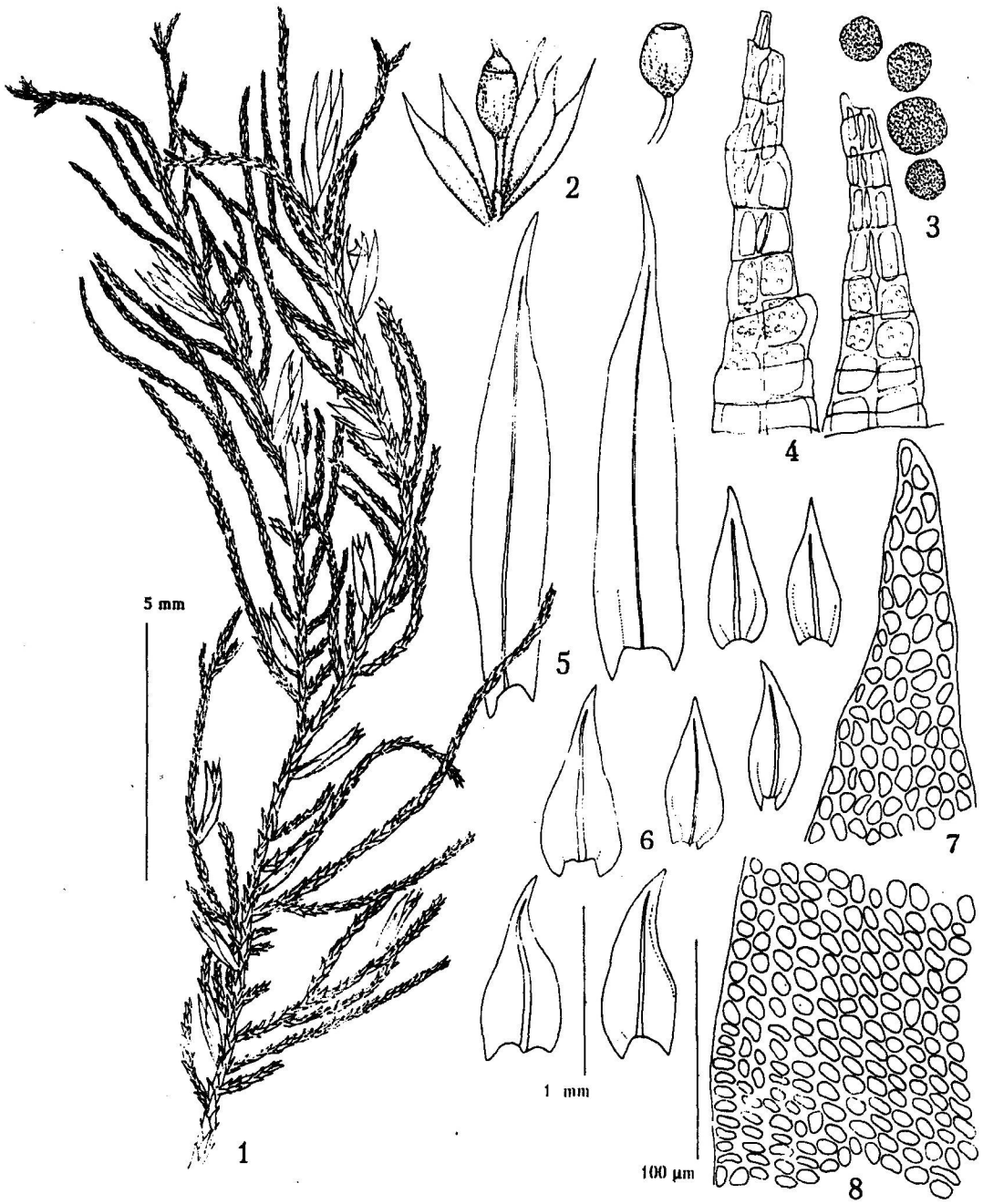


Fig. 32. *Forsstroemia cryphaeoides* Card. (from *Ussuriiskij State Reserve* 5.X.1969 Czerdantseva): 1 – habit of female plant (dry); 2 – capsules (wet); 3 – spores; 4 – portion of peristome; 5 – perichaetial leaves; 6 – stem leaves; 7 – upper lamina cells; 8 – basal cells at margin. Scale bars: 5 mm – for 1, 2; 1 mm – for 5, 6; 100 µm – for 3, 4, 7, 8.

cells. Exostome teeth 16, 200 µm long, 40 µm wide, with clear trabeculae on outer surface. Endostome as fragmentary adherings, or with free segments, 80 µm. Spores 15-30 µm. Vegetative reproduction by means of brood branchlets clustering at ends of branches.

Most collections of *F. japonica* have only female plants; male plants were seen only in two collections. No one collection has both sexes, newertheless many female plants have fertilized perichaetia, and in 4 collections capsules were

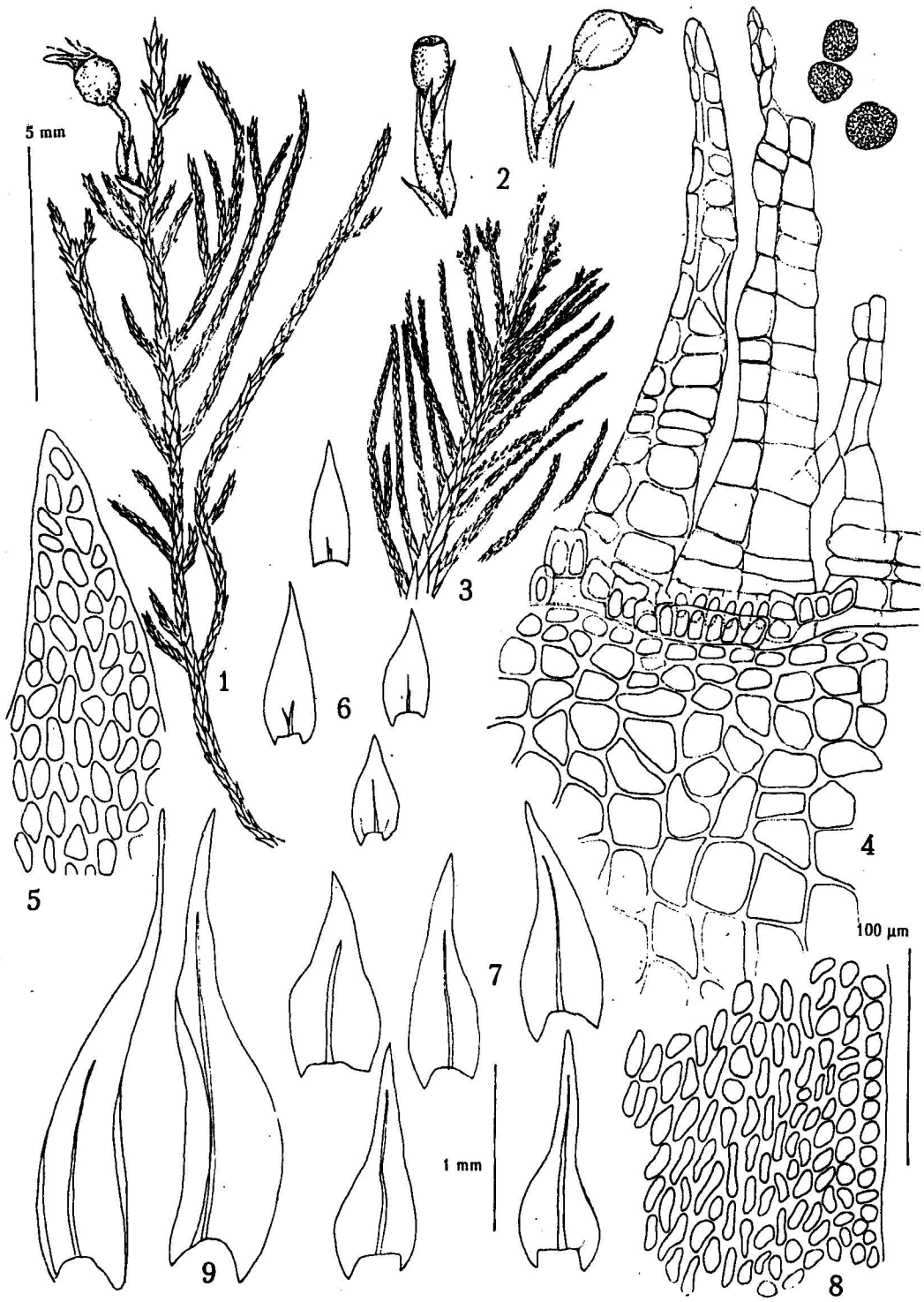


Fig. 33. *Forsstroemia japonica* (Besch.) Par. (1-2 and 4-8 from *Lazovskij Reserve, Petrov Island* 20.IX.1987 Bardunov & Czerdantseva; 3 – from *Ussuriiskij Reserve* 2.X.1969 Czerdantseva): 1 – habit of female plant (dry); 2 – capsules (wet); 3 – shoot with brood branchlets (female plant); 4 – portion of peristome, with upper exothecium and spores; 5 – cells of upper lamina; 6 – branch leaves; 7 – stem leaves; 8 – basal cells at margin; 9 – perichaetial leaves. Scale bars: 5 mm – for 1-3; 1 mm – for 6, 7, 9; 100 µm – for 4, 5, 8.

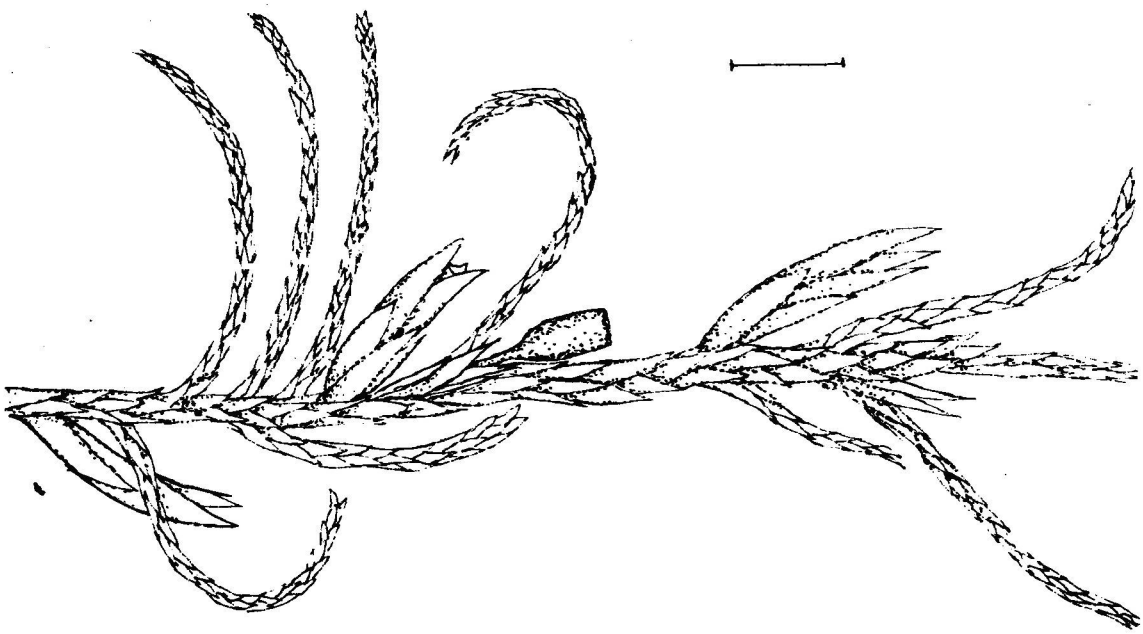


Fig. 34. Putative hybrid of *Forsstroemia cryphaeoides* Card. and *F. japonica* (Besch.) Par. (from *Ussuriiskij State Reserve* 24.VII.1974 Czerdantseva). Scale bar – 1 mm.

seen. However mature operculate capsules were found only in one collection, so the intact peristome was studied only from it. All open capsules have only brocken peristome remains.

The presence of endostome segments in *F. japonica* makes this species unique in the genus. Also *F. japonica* is peculiar in having: (1) distinct trabeculae on the outer surface of endostome; (2) deciduous annulus; (3) brood branchlets. This character set seems enough to separate *F. japonica* in its own genus. However, we conservatively retain *F. japonica* in *Forsstroemia*, because: (1) endostome segments were found so far only in one capsule; (2) strong gametophytic similarity of *F. japonica* and *F. cryphaeoides*, and their probable hybridization.

The possible hybridization of these two species was noted by Stark (1987), since the collection from Ussurijskij Reserve (Ardeeva, 3.IX.1968) have both female plants of *F. japonica* and male plants of *F. cryphaeoides*. In our part of this collection (VLA, MHA) there are also female plants of *F. cryphaeoides*. So, this mixed collection is rather an argument against their easy hybridization. However, one collection from the same Reserve (Czerdantseva, 24.VIII.1974) provides a real evidence of hybridization: most part of collection is typical *F. cryphaeoides*, but one shoot has several perichaetia+capsules of *F. cryphaeoides*-type and one perichaetium+capsule of *F. japonica*-type (Fig. 34). Both seta length and shape of perichaetial leaves refer the latter perichaetium to *F. japonica*. We need therefore to admit that the shape of perichaetial leaves is determined not only by the mathernal plants, but also (or mostly) by the paternal one. The intercalar growth of perichaetial leaves started soon after fertilization and a kind of induction from developing sropophyte, probably, takes place. Certainly, the peristome structure in *F. japonica* and its possible hybridization with *F. cryphaeoides* need further studies.

Distribution: Japan (Hokkaido, Honshu, Shikoku) and Russian Far East (continental part, Sakhalin and Kuril Islands). We have seen no collections from Sakhalin, but Stark cited collection from Makarov in FI. Also Stark reported this species from Korea, without specimen citation. Russian collections of *F. japonica* were made in broad-leaved forest and mixed coniferous (*Pinus koraiense, Abies holophylla*)+broad-leaved forest, on trunks of *Carpinus, Acer, Quercus, Betula, Tilia, Abies,* and sometimes on rocks.

Specimens examined: PRIMORSKIJ TERRITORY: *Ussuriiskij Reserve* Czerdantseva 2.X.1969 – ♀/ 9.VII.1974 – ♀/ 7.VII.1974 – ♀/ 16.VII.1974 – ♀ (VLA, MHA); *ibid.* Ardeeva 3.IX.1968 – ♂ (VLA, MHA); *Lazovskij State Reserve* Bardunov & Czerdantseva 20.IX.1974 – ♀/ 18.IX.1974 – ♂ (VLA, MHA); *Lazovskij Reserve, Petrov Island* Bardunov & Czerdantseva 20.IX.1987 – ♀ (VLA, MHA); *Lazovskij Distr., Preobrazheniya* Czerdantseva 23.VIII.1986 (VLA, MHA); *Sedanka* Lazarenko 29.VIII.1930 (LE); *Okeanskaya* Sinova 2.VI.1926 – ♀ (LE);

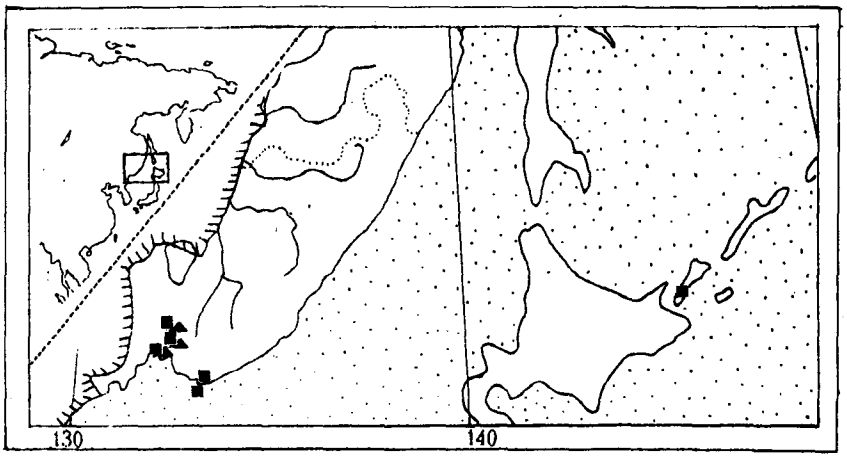


Fig. 35. Distribution of *Forsstroemia cryphaeoides* Card. (triangles) and *F. japonica* (Besch.) Par. (square) in Russia.

ibid. Woroschilow 5234 – ♀ (MHA); *Maikhe* Rozenberg 21.VI.1947 – ♀ (LE); *Vladivostok Distr., Lyanchikhe* Woroschilow 2.VIII.1952 6625 (MHA); *Suputinskij Reserve* Bardunov 9.IX.1962 – ♂ (IRK, MHA). SAKHALINSKAYA PROVINCE: *Kunashir Island, Alekhina Cape* Czerdantseva 5 VIII 1978 – ♀ (VLA, MHA); *Kunashir Island, between Alekhino and Goryachee Lake* Czerdantseva 4.VIII.1978 – ♀ (VLA, MHA).

Forsstroemia stricta Lazarenko, Bot. Zhurn (Kiev) 2(1): 84. 1941. Figs. 36, 37

Secondary stem up to 5 cm, remotely pinnately branching, branches straight to somewhat arcuate, up to 8 mm. Stem leaves ovate, acuminate, entire, 1.2-1.4 mm long, 0.6-0.7 mm wide. Costa reaching 0.7-0.8 of leaf length. Upper lamina cells isodiametric to shortly elongate, 10-18×7-10 μm (in broad apex) to elongate, 15-30×7-10 μm (in attenuate apex); in mid-leaf cells 13-20×7-10 μm; basal cells at margin subquadrate, 10-15 μm. Dioicous (only female plants were seen). Perichaetial leaves ovate-lanceolate, ca. 2.5 mm long, costa about 0.5 of its length. Seta mostly ca. 2.0 mm long, straight to flexuose. Capsule shortly exserted, shortly cylindric, 1.0×0.6 mm. Exothecial cells 1.5-3.0:1 Exostome teeth 16, 270 μm long, 20-30 μm wide. Spores 20-30 μm.

Forsstroemia stricta was little commented by Stark (1987), who stated that judging from the original description this species in number of characters is close to *F. japonica*, but differs from this taxa in broadly ovate leaves, weak costa in perichaetial leaves, etc.

The possible affinity with the group of *F. producta* (Hornsch.) Par. and *F. indica* (Mont.) Par. was not discussed, probably since widespread *F. producta* is autoicous and *F. indica* has too far distribution in South India and Taiwan. Both *F. indica* and *F. producta* have (1) rather rare pinnate branching; (2) ovate stem leaves; (3) cells ovate nearly throughout the leaf, only in apexes of some leaves with more attenuate tips cells are elongate; (4) capsules ± cylindric; (5) capsules position on both secondary stems and branches. The same five characters are present also in *F. stricta*. However, its is different from dioicous *F. indica* (1) in the weak costa in perichaetial leaves (in *F. indica* it reaches 0.7-0.9 of leaf length); (2) short capsule, 1.0 mm long (in *F. indica* 1.1-2.1 mm, mean length 1.8 mm); (3) rather broad apex of stem leaves; (4) entire perichaetial leaves (coarsely serrate in apex in *F. indica*). *F. stricta* differs from *F. producta* only by sex condition, autoicous in the latter species. All other characters of *F. stricta* fit within the range of *F. producta*. So the status of *F. stricta* depends almost on the evaluation of the character of sexual condition.

From the evolutionary point of view the complex *F. producta-F. indica-F. stricta* in East Asia can be assumed as a single phylum, produced on the border of its area dioicous derivates. The southern derivate, *F. indica*, received some additional morphological differences. The northern population, *F. stricta*, differs from ancestral *F. producta* exclusively by the dioicous sexuality. Taxonomic resolves could be different. The inclusion of *F. stricta* within the range of *F. producta* makes inconsistent also the differences between *F. producta* and *F. indica* (since the sexual condition is the main difference between them). The reducing both *F. stricta* and *F. indica* into infraspecific taxa of *F. producta* seems possible. However, being unfamiliar with *F. indica*, we prefer here to follow Stark' revision and retain *F. indica* and *F. producta* as

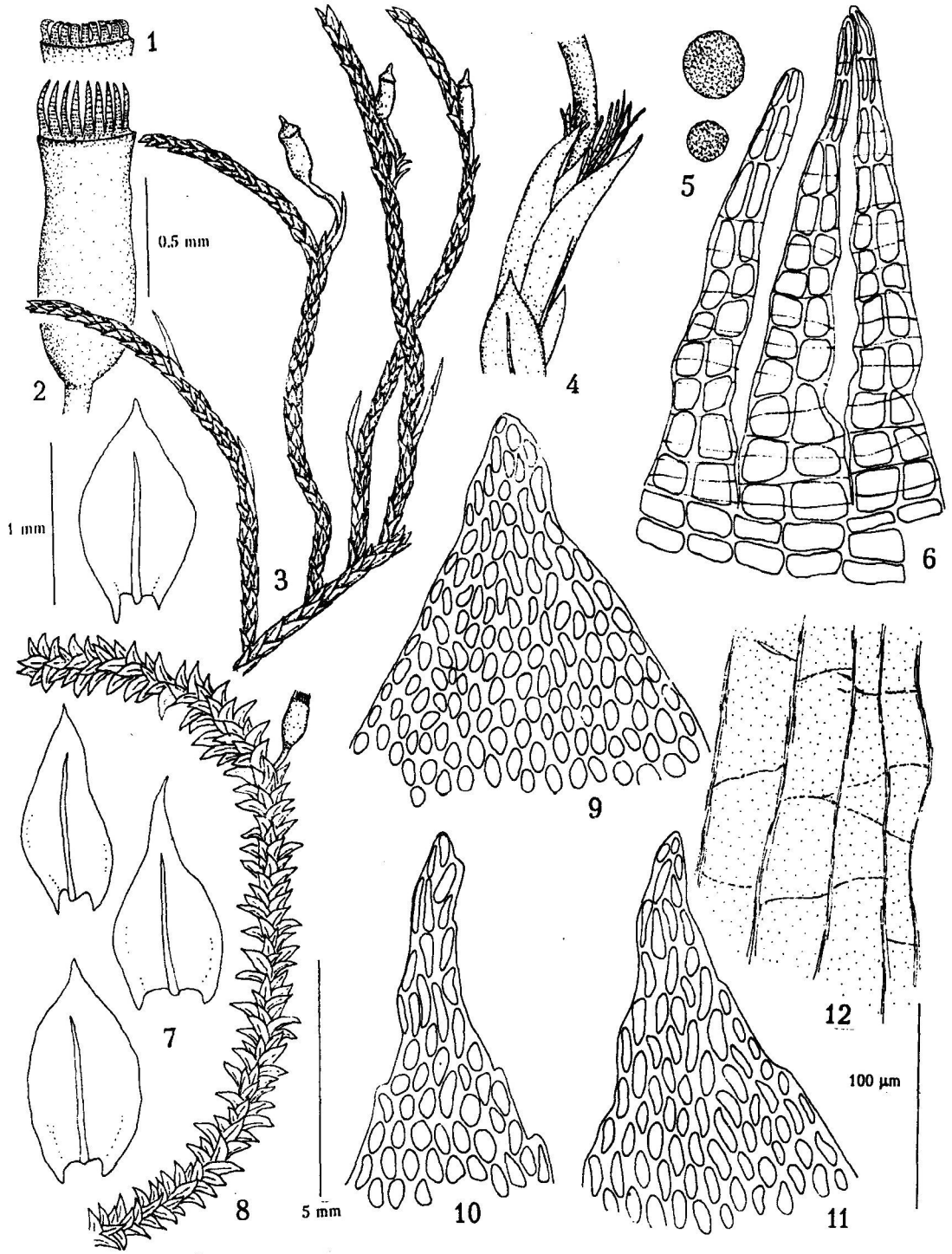


Fig. 36. *Forsstroemia stricta* Lazarenko (from the lectotype: *Primorskij Territory, Peishula* 10.X.1933 Lazarenko): 1 – peristome teeth when dry; 2 – peristome teeth when wet; 3 – habit (dry); 4 – perichaetium; 5 – spores; 6 – portion of peristome; 7 – stem leaves; 8 – habitus (wet); 9-11 – upper lamina cells; 12 – exothecium in middle part of urn. Scale bars: 5 mm – for 3, 8; 1 mm – for 7; 0.5 mm – for 1, 2, 4; 100 µm – 5, 6, 9-12.

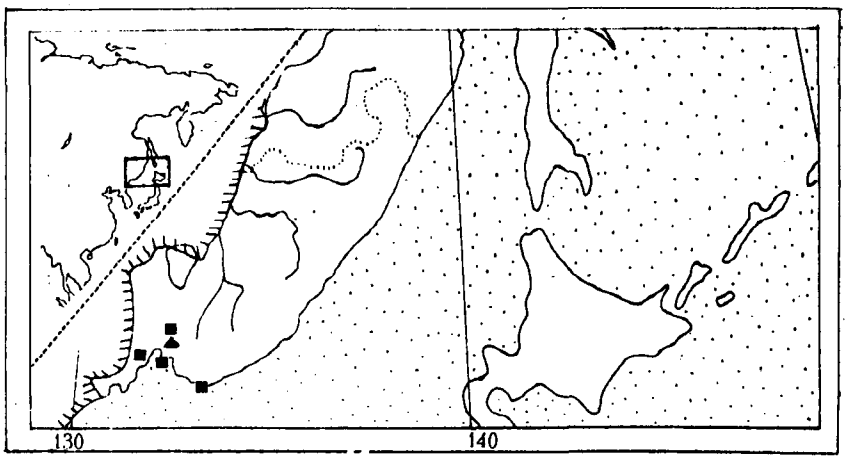


Fig. 37. Distribution of *Forsstroemia trichomitra* (Hedw.) Lindb. (square) and *F. stricta* Lazarenko (triangle) in Russia.

two species. However, this conception suggests the specific rank for *F. stricta*.

Distribution: known only from the type locality.

Specimen examined: PRIMORSIJ TERRITORY: *Shkotovo Distr., Upper Maikhe River, Peishula, on rotten log* 10.X.1933 A. Lazarenko (KW). The lectotypification of *F. stricta* was made by Ochyra (1988), but with incomplete citation of the label.

Forsstroemia trichomitra (Hedw.) Lindb., Oefv. Foerh. Kongl. Sv. Vetensk.-Akad. 19: 605. 1863. Figs. 37-39

Pterigynandrum trichomitrion Hedw., Sp. Musc. 82. pl. 16: f. 1-6. 1801.

Plants in loose brownish-green, somewhat glanced tufts. Secondary stem up to 3 cm long, rather regularly pinnate branching, branches up to 8 mm long. Stem leaves lanceolate, longly acuminate, concave, 2.5-2.8 mm long, 0.7-0.9 mm wide; margin plane, entire to minutely crenulate; costa reaching 0.2-0.4 (0.5) of leaf length; branch leaves smaller, 1.0-2.0 mm long, 0.3-0.5 mm wide, costa 0.1-0.4 of leaf length or absent. Upper lamina cells ovate-elongate, 30-35 μm long, 6-10 μm wide; mid-leaf cells longer up to 70 μm, marginal cells in mid-leaf ca. 20-30×10-13 μm; basal cells at margin shortly ovate to transversely rectangular, ca. 8-12 μm. Autoicous. Perichaetial leaves up to 2.5-3.8 mm long, 0.6-0.8 mm wide, with long slender subulate acumen, ecostate. Capsules shortly exserted; seta 1.5-2.0 mm long, capsule ca. 1.5×0.7 mm; exostome teeth lanceolate 300×50 μm. Spores 20-30 μm, sometimes germinating in capsule.

Forsstroemia trichomitra often produces sporophytes and therefore it is easy to identify. The differentiation from related *F. noguchii* discussed under that species. The second close species is *F. neckeroides* Broth., described from Mandshuria, Hantoheva, close to Russian border. This species can be expected in Russian Far East too. It resembles *F. trichomitra* in relatively large stem leaves (2.0-3.0 mm) with elongate upper cells, but differs in (1) immersed capsules; (2) costa in stem leaves usually markedly exceeds mid-leaf, and (3) typically *F. neckeroides* has more robust tumid plants.

Distribution: Forsstroemia trichomitra is distributed in warm climates with the summer maximum of precipitation. In North Hemisphere it occurs in Eastern Asia (Russian Far East, Japan, East China, Taiwan, Nepal) and Eastern North America (from SE Canada, Ontario, through all the eastern states of U.S.A. to Mexico). Also it is known in South America (Uruguay, Paraguay, Argentina, southern Brasil) and East Australia. Australian population is considered by Stark as a separate subspecies, *F. trichomitra* ssp. *australis* (C. Muell.) Stark. In Russia *F. trichomitra* is known in southern part of Primorskij Territory. It grows in mixed coniferous (*Pinus koraiense, Abies holophylla*) + broad-leaved forests and in broad-leaved forests, on trunks of *Acer, Ulmus, Abies, Tilia, Chosenia, Syringa* (sometimes growing in abundance and reaching 7 m above the ground); rarer it occurs on rocks.

Specimens examined: PRIMORSIJ TERRITORY: *Kedrovaya Pad Reserve* 22.VIII.1977 Czerdantseva (VLA); *ibid.* 10.IX.1958 Ardeeva (VLA); *Ussuriiskij Reserve* 7.VII.1974/ 5.X.1969/ 19.VIII.1975 Czerdantseva (VLA); *ibid.* 19.VIII.1975 Timofeeva (VLA); *Pesczanyj Peninsula* 30.IX.1961 Bardunov (VLA); *Vladivostok Distr., Okeanskaya* 28.IX.1950 Woroschilov #5234 (MHA); *Lazovskij Distr., Lazovskij Reserve, Island Petrova* 20.IX.1974 Bardunov & Czerdantseva (VLA).

Forsstroemia noguchii Stark, Misc. Bryol. Lichenol. 9: 182. 1983. Figs. 40, 41

Plants in very loose brownish-green, somewhat glanced tufts. Secondary stem up to 15 cm long, with numerous long pinnate branches, becoming flagelliform above. Rare secondary branching occurs. Stem leaves lanceolate, acuminate, concave, 1.0-1.8 mm

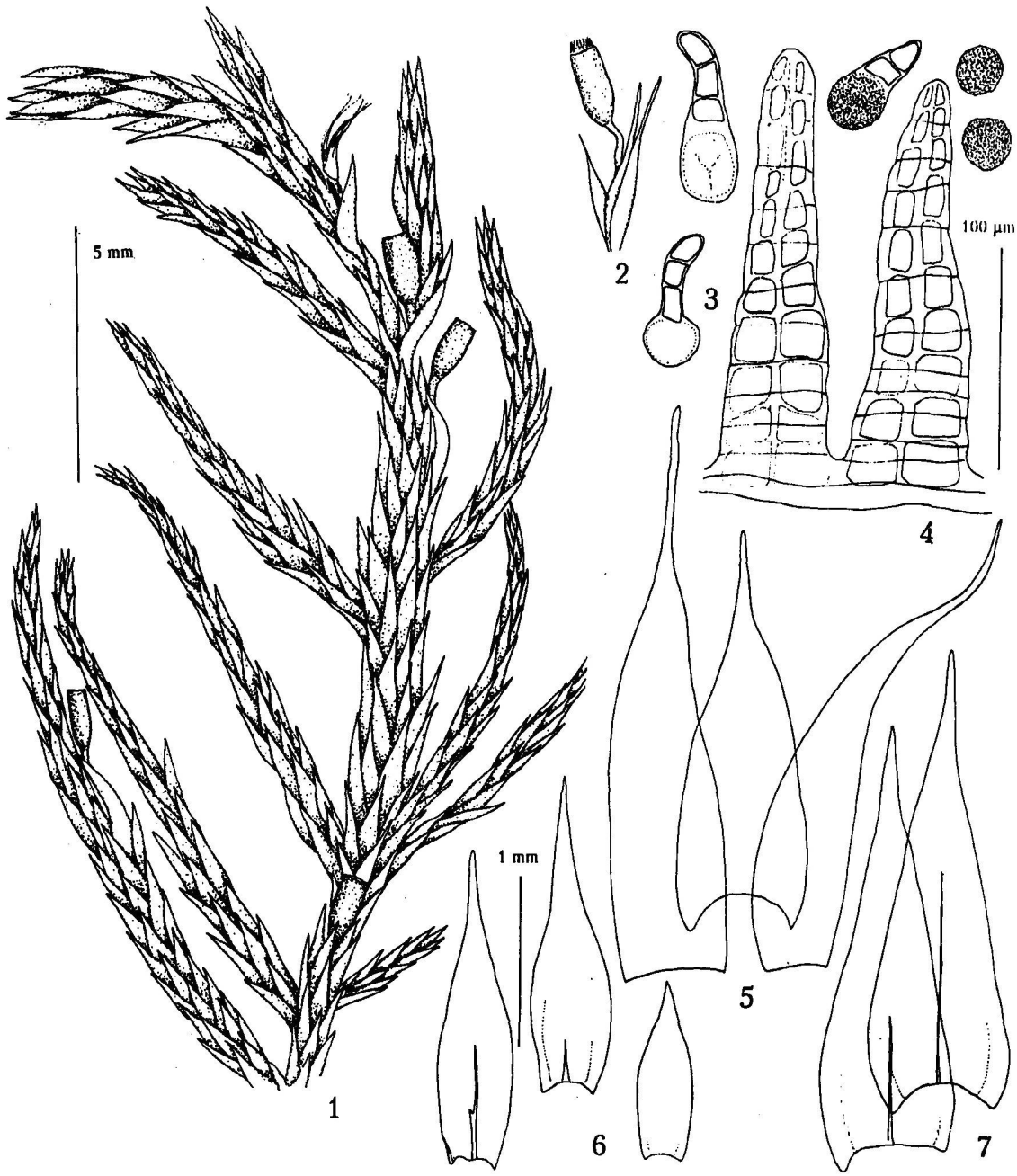


Fig. 38. *Forsstroemia trichomitra* (Hedw.) Lindb. (from *Ussuriiskij State Reserve* 5.X.1969 Czerdantseva): 1 – habit (dry); 2 – perichaetium with capsule (wet); 3 – spores; 4 – portion of peristome; 5 – perichaetial leaves; 6 – branch leaves; 7 – stem leaves. Scale bars: 5 mm – for 1, 2; 1 mm – for 5-7; 100 µm – for 3, 4.

long, 0.4-0.7 mm wide; margin plane, entire to minutely crenulate; costa reaching 0.2-0.4 of leaf length. Upper lamina cells ovate-elongate, 25-32 µm long, 7-8 µm wide; mid-leaf cells longer up to 60 µm, marginal cells in mid-leaf 20-25×7-8 µm; basal cells at margin subquadrate, 10-13 µm. Proximal branch leaves similar to stem leaves; distal branch leaves up to 0.3 mm, with very short costae. No sporophyte and gametangiae seen.

Forsstroemia noguchii is closely related to *F. trichomitra* and was previously reported in

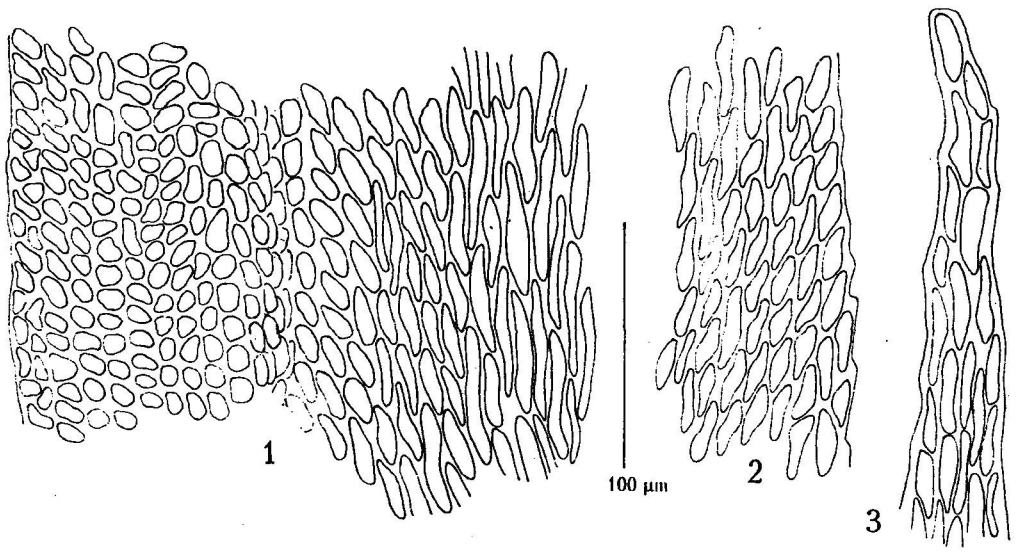


Fig. 39. *Forsstroemia trichomitra* (Hedw.) Lindb. (from *Ussuriiskij State Reserve* 5.X.1969 Czerdantseva): 1 – basal cells; 2 – mid-leaf cells at margin; 3 – upper lamina cells. Scale bar 100 µm for 1-3.

Siberia as the latter species (Bardunov, 1969, 1974). These two species are similar in stem leaf shape and size, and in rather short and weak costa. *F. noguchii* differs from *F. trichomitra* in dioicous sexual condition and still unknown with sporophytes, while *F. trichomitra* is autoicous and most of its collections bear capsules. In Russian material of *F. noguchii* neither perigoniae, nor perichaetia were seen, though both sexes and postfertilized perichaetial leaves are reported from Japan and China (Stark, 1987). Also, *F. noguchii* is peculiar in having very large plants, and in numerous slender, attenuate, distally flagelliform branches.

Distribution: Forsstroemia noguchii is a rare moss known from only 5 localities in Japan (Honshu, Shikoku), central China (Hubei, Schen-si) and Eastern Sayan Mts. of South Siberia. In the latter place *F. noguchii* is known in Tunkinskaya Valley near Arschan, at 1000-1100 m alt., growing on vertical walls of big calcareous rocks.

Specimens examined: Eastern Sayan Mountains, Tunkinskij Range, Kingara Creek near Arschan, 1000 m alt. 13.VI.1962 Bardunov (paratype, IRK, MHA); *Eastern Sayan Mountains, Tunkinskij Range, Arschan,* 1100 m alt. 13.X.1972 Bardunov (IRK, MHA).

Leptodon Mohr

Plants in green to brownish-green dull tufts. Primary stem creeping, with small remote leaves and bundles of reddish rhizoids. Secondary stem with linear paraphylliae, rolled up and coiled at the tip when dry; when wet stem and primary and secondary branches are flattened ends of branches are flagelliform. Axillary hairs 4-5 cells long; distal two-three cells hyaline, elongate, proximal two cells pigmented, short. Secondary stem leaves more or less complanate, asymmetrically ovate to ligulate, broadly obtuse at apex, entire, costa single, reaching about mid-leaf. Cells at leaf apex shortly-rhombic to subquadrate, toward the leaf base elongate. Branch leaves are similar, but smaller.

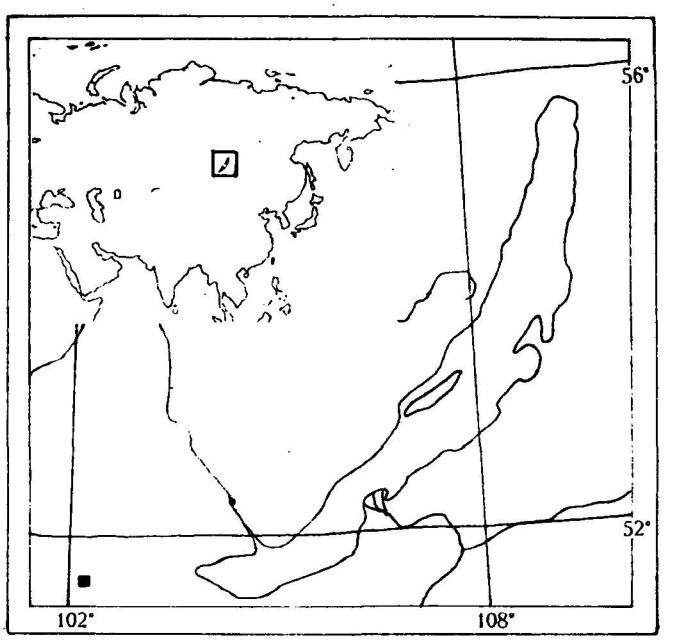


Fig. 40. Distribution of *Forsstroemia noguchii* Stark in Russia.

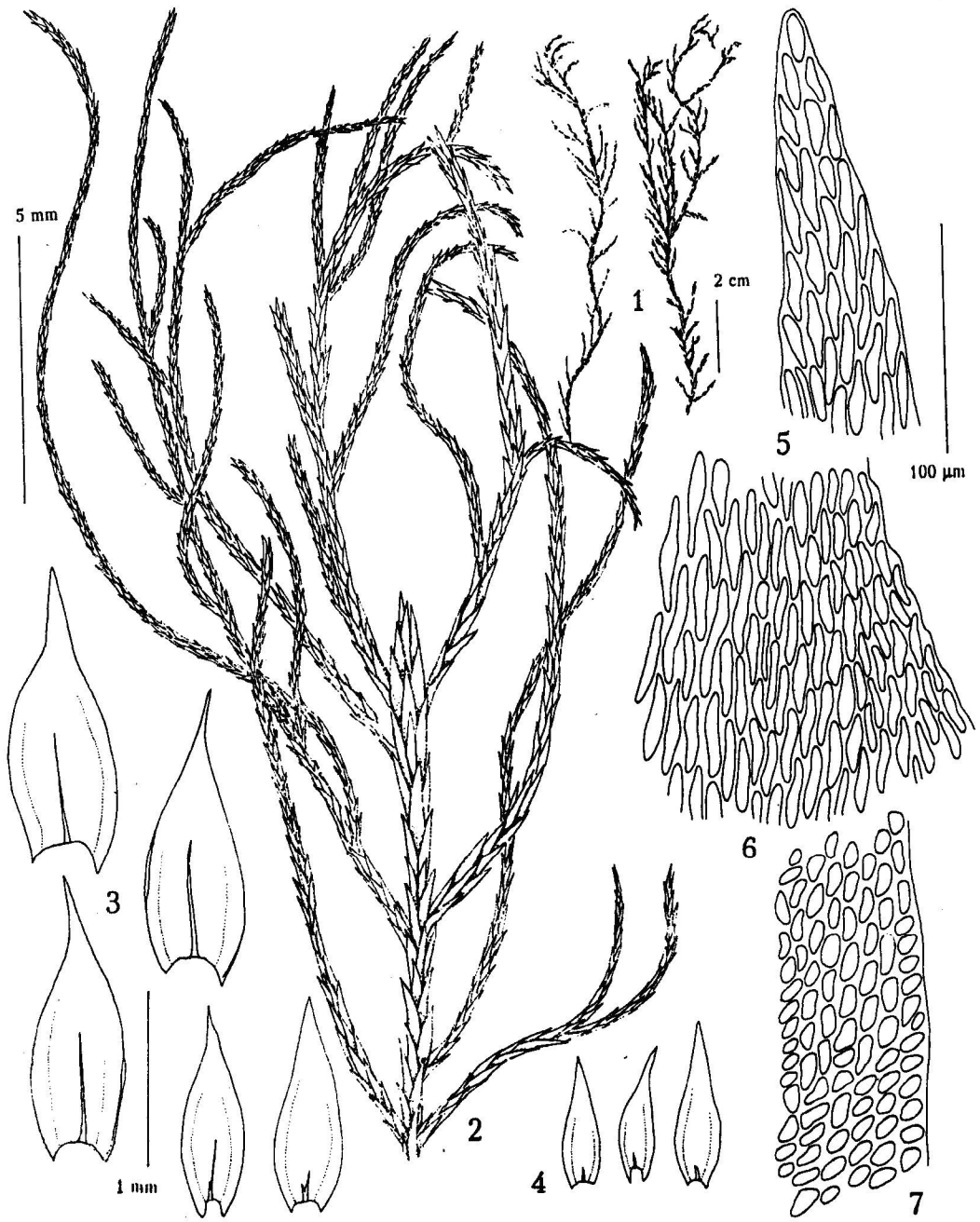


Fig. 41. *Forsstroemia noguchii* Stark (from the paratype: *Tunkinskij Range, Kingara Creek* 13.VI.1962 Bardunov): 1, 2 – habit; 3 – stem leaves; 4 – branch leaves; 5 – upper lamina cells; 6 – mid-leaf cells at margin; 7 – basal cells. Scale bars: 2 cm – for 1; 5 mm – for 2; 1 mm – for 3, 4; 100 µm – 5-7.

Dioicous. Perichaetial leaves much enlarged, lanceolate. Vaginula with numerous long paraphysoid hairs. Capsule shortly exserted, straight, cylindric. Annulus absent. Operculum shortly rostrate. Calyptra cucullate, hairy. Peristome double. Exostome teeth well-developed, lanceolate, papillose. Endostome with basal membrane, segments reduced.

Leptodon smithii (Hedw.) Weber et Mohr, Index Mus. Pl. Crypt. 2. 1803. Figs. 42, 43

Hypnum smithii Hedw., Sp. Musc. 264. pl. 68 f. 5-7. 1801.

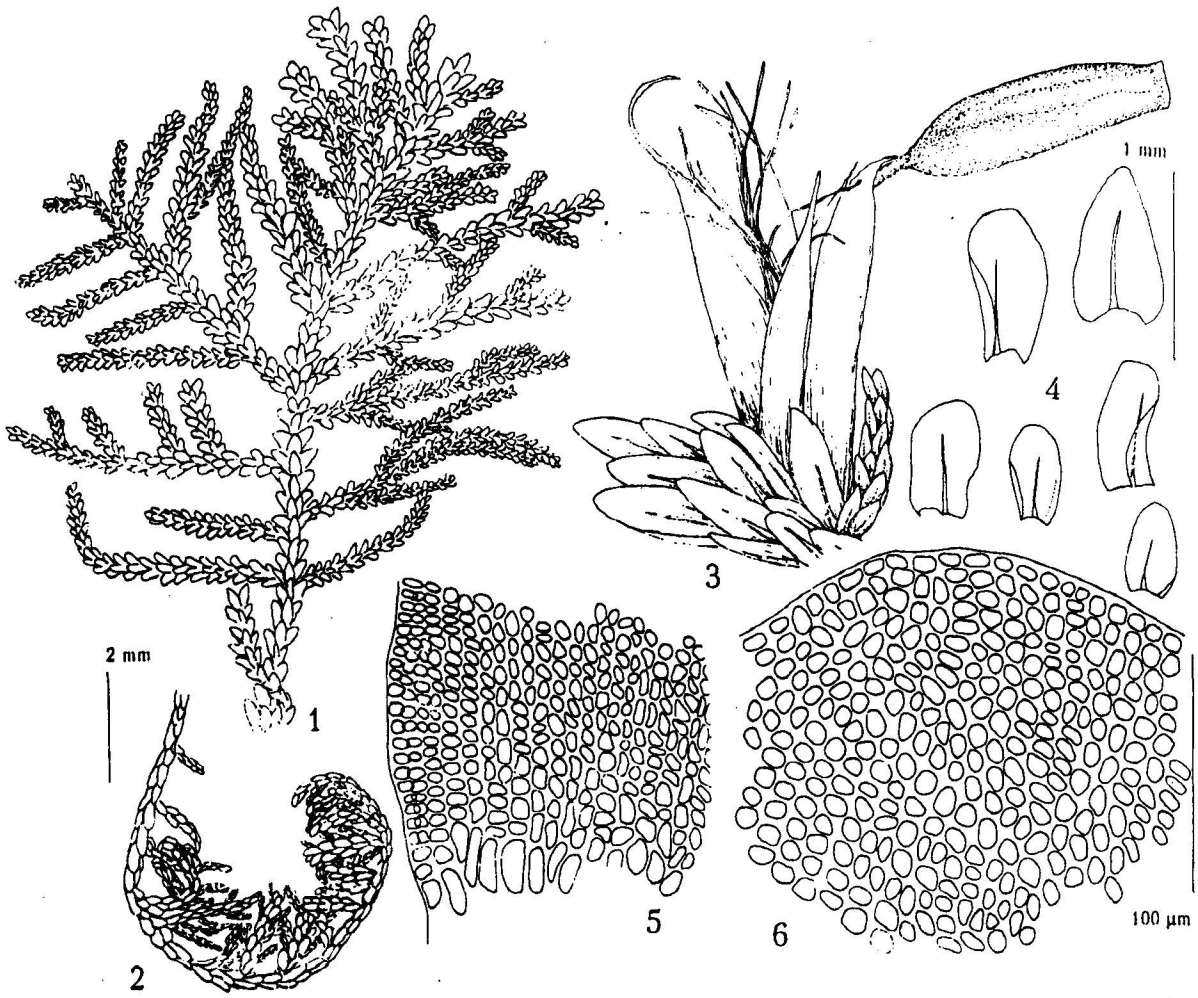


Fig. 42. *Leptodon smithii* (Hedw.) Weber et Mohr (1-2 and 4-6 – from *Archipo-Ossipovka* 12.VIII.1958 I. Abramov; 3 – from *Georgia, Batumi Bot. Garden* 4.VII.1961 A. Abramova & I. Abramov): 1 – habit (wet); 2 – habit of the same shoot in dry condition; 3 – perichaetium and capsule; 4 – stem leaves; 5- basal cells; 6 – upper lamina cells. Scale bars: 2 mm – for 1, 2; 1 mm – for 3, 4; 100 µm – for 5, 6.

Secondary stem up to 3 cm long. Stem leaves 0.5-0.9 long, 0.3-0.5 mm wide. Cells at leaf apex shortly-rhombic to subquadrate, 5-12×7-10 µm. Perichaetial leaves up to 2.5 mm. Seta ca. 2 mm. Capsule shortly exserted, cylindric, 1.4 mm long.

Sporophytes are unknown in Russia, but seen in Georgia in West Caucasus (with old incomplete peristomes). The drawings of capsule and its dimensions are based on Georgian collection (Adzharskaya ASSR, Batumi Bot. Garden, on *Cupressus* 4.VII.1961 A. Abramova & I. Abramov – MHA).

Distribution: Leptodon smithii is widely distributed in Mediterranean countries in South Europe, Caucasus, Krym (Crimea), Middle East and North Africa and also in Canary Islands and Madeira; in Europe it is known northward to Ireland, Great Britain, Germany, Netherlands, Czechoslovakia. One locality has been reported recently from North America in Colorado by Nelson (1973), who provided also the map of the world distribution of this species. *L. smithii* is known in East Africa from Ethiopia to Tanzania and also in Southern Hemisphere in New Zealand, southeastern Australia, West Patagonia and Chili, Juan Fernandez Islands, South Africa. In Russia *L. smithii* is known only on Caucasian coast of Black Sea, where it is the common epiphyte on trunks of deciduous trees (*Quercus, Fraxinus, Carpinus*) and *Cupressus*, reaching up to 5 m and more above the ground. It occurs on trunks in relatively xeric and sunny habitats and occasionally grows also on rocks. All the known collections were made from the proximity to the coast (several kilometer), from elevations less than 200 m. In Georgia the distribution of *L. smithii* is principally the same.

Specimens examined: NORTHERN CAUCASUS: *Soczi* 6.VII.1986 J. Vana (LE); *ibid.* 21.VII.1926 Zerov (LE);

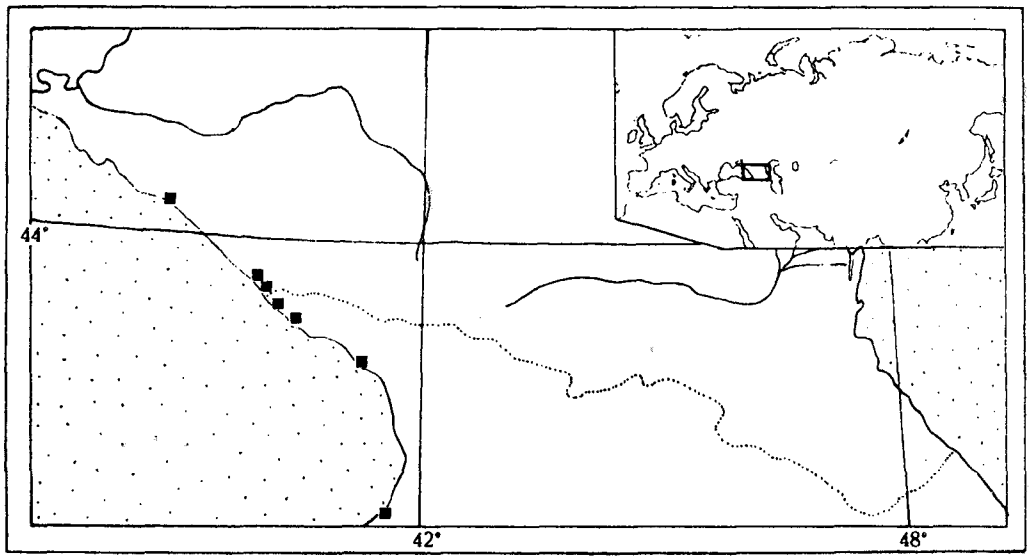


Fig. 43. Distribution of *Leptodon smithii* (Hedw.) Weber et Mohr in Russia.

ibid. 23.VII.1926/ 25.VII.1926 Gorodkova (LE); *Hosta* 18.VIII.1935 Vasil'eva (LE); *Archipo-Ossipovka* 12.VIII.1958 I. Abramov (LE: Hepaticae et Musci URSS Exsiccati, 85).

DOUBTFUL RECORD

Pterogonium gracile (Hedw.) Sm., Engl. Bot. 15: 1085. 1801.

Pterigynandrum gracile Hedw., Spec. Musc.: 80. 1801.

This species was reported from Moscow Province by Stephan (1792), as *Hypnum gracile*. Stephan's herbarium was burned in 1812, during the war with Napoleon Bonaparte. The epiphytic bryophyte flora of Moscow Province in previous centures was more rich (Ignatov & Ignatova, 1990), so this record seems not impossible. At the same time it is not especially probable, since all the documented records are too remote. The north-eastern limit of *P. gracile* in Europe includes Norway, Sweden, Estonia, Czechoslovakia, Hungary, Bulgaria, Krym (Crimea) Peninsula, Caucasus (Georgia, Armenia, Azerbaijan). The finding of *P. gracile* in Northern Caucasus is obviously expected.

Pterogonium gracile is characterized by the medium-sized plants, broadly ovate leaves, coarsely serrate above. Costa absent to short and double, sometimes its branches additionally forking. Upper lamina cells are shortly ovate, papillose owing to projecting upper cell ends. Dioicous. Capsules exserted. Annulus present. Peristome double, endostome with developed segments. Calyptra hairy, cucullate.

Systematic position of *Pterogonium*, a monotypic genus, is problematic. Most bryologists place it in Leucodontaceae; alternative approaches accomodate it in Anomodontaceae or its own family Pterogoniaceae. Details of the peristome structure of *Pterogonium* and its systematic position discussed by Akiyama (1988b).

AKNOWLEDGEMENTS

The authors are deeply thankful to curators of KW, LE and IRK, L. V. Partyka, O. M. Afonina and L. V. Bardunov for the loan of original collections; to D. A. Petelin for making to our disposal rich collections from Khabarovsk Territory; to G. V. Serezhkina and V. R. Filin for the help with SEM. Also A. K. Skvortsov kindly checked the Latin diagnosis, and Barbara Murray improved the English of the early version of manuscript. We are much obliged to Marshall R. Crosby and Benito C. Tan for the help with rare literature. The research project was partly supported by the grant M97000 of the International Science Foundation.

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