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THE GENUS THAMNOBRYUM (NECKERACEAE, BRYOPHYTA) IN RUSSIA

РОД THAMNOBRYUM (NECKERACEAE, BRYOPHYTA) В РОССИИ

ELENA A. IGNATOVA[1] & MICHAEL S. IGNATOV[2]

ЕЛЕНА А. ИГНАТОВА[1], МИХАИЛ С. ИГНАТОВ[2]

Abstract

Five species of *Thamnobryum* are currently known in Russia: *T. alopecurum* (Hedw.) Niewl. ex Gang., *T. coreanum* (Cardot) Nog. & Z. Iwats., *T. neckeroides* (Hook.) E. Lawton, *T. subseriatum* (Mitt. ex Sande Lac.) B.C. Tan and *T. subserratum* (Hook. ex Harv.) Nog. & Z. Iwats. Lectotype of *Thamnobryum vorobjovii* (Laz.) Ochyra is selected; this species is synonymized with *T. neckeroides*; some collections identified by A.S. Lazarenko as *T. vorobjovii* belong also to *T. coreanum*. *Thamnobryum plicatulum* is excluded from the moss flora of Russia. *Thamnobryum alopecurum* occurs in the Caucasus and the Kaliningrad Province, its occurrence in NW European Russia and Russian Far East is not confirmed. *Thamnobryum neckeroides* grows in Asiatic Russia, including Russian Far East and southern Siberia; it is also recorded in the Caucasus (Abkhazia) and the Carpatian Mts. (Ukraine) for the first time. Other three species are known in the Russian Far East, mostly in its southern part, *T. coreanum* and *T. neckeroides* were also collected in Kamchatka. A key for the identification of these five species, their description, illustrations, ecological and distributional data are provided.

Резюме

В настоящее время в России известны 5 видов *Thamnobryum*: *T. alopecurum* (Hedw.) Niewl. ex Gang., *T. coreanum* (Cardot) Nog. & Z. Iwats., *T. neckeroides* (Hook.) E. Lawton, *T. subseriatum* (Mitt. ex Sande Lac.) B.C. Tan и *T. subserratum* (Hook. ex Harv.) Nog. & Z. Iwats. *Thamnobryum vorobjovii* (Laz.) Ochyra лектотипифицирован и синонимизирован с *T. neckeroides*; часть образцов, определенных А.С. Лазаренко как *T. vorobjovii,* относятся к *T. coreanum*. *Thamnobryum plicatulum* исключен из флоры мхов России. *Thamnobryum alopecurum* в России встречается на Кавказе и в Калининградской области, его нахождение на северо-западе страны и севере Дальнего Востока не подтверждено гербарными образцами. *Thamnobryum neckeroides* известен на Российском Дальнем Востоке, на севере Восточной Сибири и на юге Сибири до Алтая; вид также впервые приводится для Кавказа по образцу из Абхазии и для Карпат (Украина). Три остальных вида в России приурочены в основном к югу Дальнего Востока, *T. coreanum* и *T. neckeroides* также найдены на Камчатке. Даны ключ для определения 5 видов рода, их описание, иллюстрации, данные об экологии и распространении.

KEYWORDS: mosses, *Thamnobryum*, Neckeraceae, taxonomy, Russia, phytogeography, new records, *Thamnobryum vorobjovii*, lectotypification

In the recent check-list of mosses of East Europe and North Asia (Ignatov, Afonina, Ignatova et al., 2006) six species of *Thamnobryum* were reporded for the territory of Russia: *T. alopecurum* (Hedw.) Nieuwl. ex Gang. (the Caucasus, NW European Russia, Kaliningrad Province and Russian Far East), *T. coreanum* (Cardot) Nog. & Z. Iwats. (southern part of Russian Far East), *T. ne-*

[1] – Moscow State University, Biological Faculty, Geobotany Dept., Moscow 119991 Russia – Россия 119991, Москва, Московский университет, Биологический факультет, каф. геоботаники; e-mail: arctoa@list.ru

[2] – Main Botanical Garden, Russian Academy of Sciences, Botanicheskaya 4, Moscow 127276 Russia – Россия 127276 Москва, Ботаническая, 4, Главный ботанический сад РАН, e-mail: misha_ignatov@list.ru

ckeroides (Hook.) E. Lawton (southern Russian Far East, southern Siberia west to Altai Mts. and north of East Siberia), *T. plicatulum* (Sande Lac.) Z. Iwats., *T. subseriatum* (Mitt. ex Sande Lac.) B.C. Tan (southern Russian Far East) and *T. vorobjovii* (Laz.) Ochyra (endemic of southern part of the Russian Far East).

The subsequent revision of herbarium collections from H, LE, MHA, MW and VLA revealed a number of misidentifications. Collections of *T. vorobjovii* (Laz.) Ochyra from KW were also studied. These studies resulted in the following taxonomy of *Thamnobryum* in Russia.

THAMNOBRYUM Nieuwl., Amer. Midl. Naturalist 5: 50. 1917.

Type species – *T. alleghaniense* (Müll. Hal.) Nieuwl.

Plants robust or medium-sized, in loose and thick rigid tufts or patches, dark green, dull or slightly glossy. Primary rhizomatous stem creeping on substrate, with numerous unbranched dark red rhizoids. Secondary stem dendroid, erect in proximal part, not branched, forming a stipe, stipe leaves small, distant, appressed, mostly triangular, acuminate, costate, gradually or quickly enlargering and transiting into upper stem leaves; stem in distal frondose part arcuate, 2-3-pinnately or sparsely branched; branches complanately foliate or not, occasionally flagellate distally; upper stem leaves slightly to strongly concave, ovate-triangular, ovate-lanceolate or widely ovate, appressed to erect-patent, overlapping or not, acute to subobtuse; margin plane, coarsely serrate distally, serrulate to almost entire proximally. Branch leaves similar to upper stem leaves but usually smaller, loosely appressed or incurved, overlapping or ± distant; costa single, strong, ending at 0.9-0.95 of leaf length; distal and median laminal cells rounded-angular or rhombic, moderately thick-walled, smooth, occasionally elongate in few submarginal rows; lower laminal cells short rectangular to oblong, porose or not. Dioicous or autoicous. Perichaetial leaves longly acuminate, ecostate. Setae long, slightly arcuate distally, capsules erect to slightly inclined, oblong-ovate. Operculum conic, longly rostrate. Annulus deciduous. Peristome perfect hypnoid. Endostome with high basal membrane, wide segments and cilia as long as segments. Spores small. Calyptra naked.

The genus includes 25-40 species distributed mostly in temperate regions; 5 species are known in Russia. The name refers to shrubby habit of plants and comes from Greek θάμνος – shrub, βρύον – moss.

KEY TO IDENTIFICATION OF SPECIES OF *THAMNOBRYUM* IN RUSSIA

1. Branch leaves hardly to moderately concave, ovate-triangular, rather narrowly acute; submarginal cells in mid-leaf differentiated, being longer than cells of inner part of lamina ..... *T. alopecurum*
— Branch leaves moderately to strongly concave (except *T. coreanum*), ovate-lanceolate to widely ovate, ± broadly acute or obtuse; submarginal cells in mid-leaf not differentiated 2
2. In branch leaves median cells near costa elongate, not angular, with longest axes at 45° to costa; dorsal side of costa with unicellular teeth to almost smooth; plants autoicous 3
— In branch leaves median cells near costa isodiametric or short rectangular, angular, with longest axes parallel to costa; dorsal side of costa often with lamellate projections; plants dioicous 4
3. Stem and branch leaves ovate to widely ovate, strongly concave, widely acute to subobtuse, distinctly carinate near apex ..... *T. subseriatum*
— Stem and branch leaves ovate-lanceolate, moderately concave, more narrowly acute, ± flat near apex ..... *T. subserratum*
4 Lamina areolation obscure due to mamillose cells ..... *T. coreanum*
— Lamina areolation clearly visible, cells non-mamillose ..... *T. neckeroides*

1. **Thamnobryum alopecurum** (Hedw.) Nieuwl. ex Gang., Mosses E. India 5: 1452. 1976. – *Hypnum alopecurum* Hedw., Sp. Musc. Frond. 267. 1801. – *Thamnium alopecurum* (Hedw.) Bruch et al., Bryol. Eur. 5: 214. 1852, *nom. illeg.* Fig. 1.

Plants robust to very robust, rarely medium-sized; secondary stem to 10-15 cm long, primary branches 3-4 cm long. Stem leaves in frondose part of shoot ovate-triangular, rather narrowly acute, weakly to moderately concave, with ± flat apical part, 2.0-2.5×0.7-0.9 mm; laminal cells in mid-leaf 10-17×8-12 μm; submarginal cells elongate rectangular at places, differentiated from ±

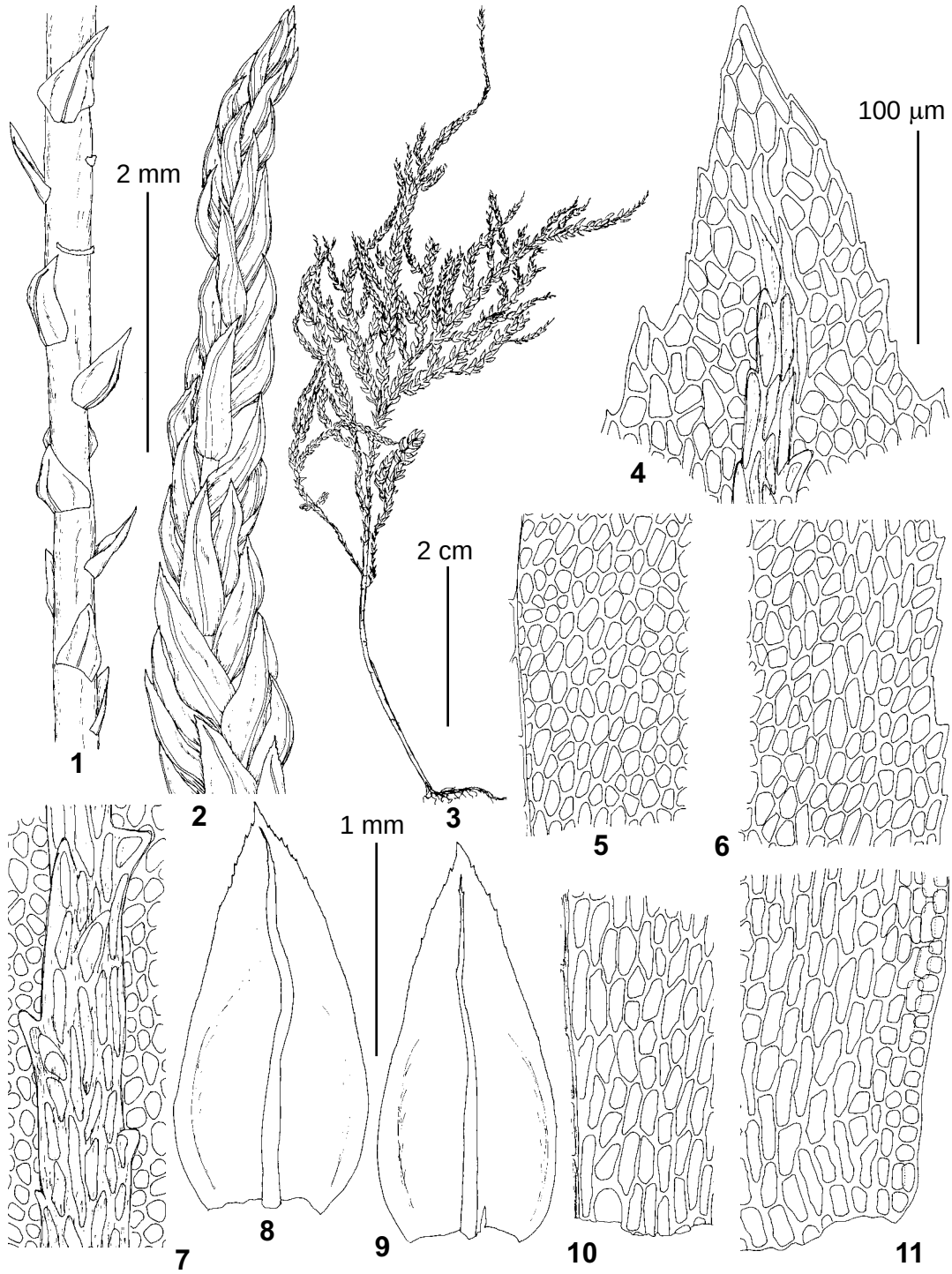

Fig. 1. *Thamnobryum alopecurum* (from Russia, Krasnodar Territory, Khosta, 3.VIII.2004, *Ignatov & Ignatova s.n.*, MHA): 1 – part of stipe, dry; 2 – branch, dry; 3 – habit, dry; 4 – cells of apical part of leaf; 5 – median juxtacostal cells; 6 – median marginal cells; 7 – dorsal side of costa in upper part of leaf; 8-9 – branch leaves; 10 – basal juxtacostal cells; 11– basal marginal cells. Scale bars: 2 cm for 3; 2 mm for 1-2; 1 mm for 8-9; 100 μm for 4-7, 10-11.

isodiametric polygonal cells of inner part of lamina. Branch leaves similar to stem leaves but smaller, loosely appressed or incurved when dry, patent when moist, ovate-triangular, occasionally narrowly ovate-lanceolate, to 1.8×0.8 мм. Dioicous, sporophytes rare. Seta 1.0-1.5 cm. Urn ca. 2 mm long. Spores 10-12 μm.

Selected specimens examined: CAUCASUS: **Krasnodar Territory**: Apsheron District, Mezmaj, 22.VI. 1928 *Leskov s.n.* (LE), 07.VIII.2003 *Ukrainskaya s.n.* (LE); Sochi surroundings, Achun Mt. slope, 2.XI.1960 *Katenin s.n.* (LE); between Adler and Tuapse, 9.VIII. 1929, *Sokolov s.n.* (LE); Khosta, Taxus and Buxus Forest (branch of Caucasian State Nature Reserve), 27.IX. 1967, *Sharikova s.n.* (LE), 27.X.1938 *Igoshina s.n.* (LE), 17.VIII.1935 *Vasiljeva s.n.* (LE), 6.IX.1938, Al'per ьs.n. (LE),13.XII.1947 *Il'jinskaya s.n.* (LE), 2.VIII.2004, *Ignatov & Ignatova s.n.* (MHA); Sochi District, Dagomys forestry, Golovinskaya dacha, 10.VI.1930 *Bryzzhev s.n.* (LE); Adler District, 2 km from Greek monastery, slope of Aibga Mt., 26.VII. 1948, *Raspopov s.n.* (LE); Imeretinskaya Bay, 28.VII. 1911, *Palibin & Vorobjev s.n.* (LE); **Adygeya Republic**: Majkop District, Guzeripl, 4.VII.1935, *Vasiljeva s.n.* (LE); Kamennomostskij, Rufabgo Creek valley, 30.VIII.1999, *Ignatov s.n.* (MHA); **Kabardino-Balkaria**: Cherek-Bezengijsky, between Kara-Su and Babugent, 850 m alt., 3.VIII.2004, *Ignatov et al. s.n.* (MHA); **Dagestan**: Kurinsky District, near Zizik, 1902, *Alexeenko s.n.* (LE).

Distribution. *Thamnobryum alopecurum* is known in most European countries (including Estonia and Latvia where it is a rare species), Macaronesia, North Africa, Middle East, the Caucasus; its records from the Russian Far East and Japan were based on misidentified specimens, and its occurrence in China needs confirmation. In coastal areas of the Black Sea of Russian Caucasus *T. alopecurum* is very common and abundant, while in inner part of Russian Caucasus it is rare. Its record reported at the end 18th century from St.-Petersburg vicinity is not confirmed by herbarium specimens (absent in LE), and the species was never collected in this area later; however, its finding there is not impossible as it is known in neighbouring areas of Estonia and Finland. In Kaliningrad Province *T. alopecurum* is also known only on the basis of old records of 19th century. In the Russian Far East (Kamchatka) the species was reported due to misidentification of specimens that belong to *T. coreanum* and *T. neckeroides*.

Ecology. In north-west Russia the species was reported from cliffs, more rarely from bases of tree trunks. In the Russian part of Caucasus it is very common and abundant in *Taxus* and *Buxus* woods, in beech and oak-beech forests close to coastal area of the Black Sea and in lower forest belt in the mountains. It grows on various substrates: rocks, soil, trunk bases of conifer and deciduous trees and on rotten wood, mostly in shaded places.

Species Distinction. *Thamnobryum alopecurum* is usually easily recognized due to its ovate-triangular upper stem and branch leaves with comparatively narrow acute apices; leaves are usually weakly to moderately concave, with flat apical part. Among the microscopic characters, the differentiated submarginal cells which are elongate to rectangular, being longer than inner laminal cells, are unique for *T. alopecurum*. It was the only species of the genus known in European Russia until recent finding of *T. neckeroides* in Adygea (Abolina, 2011); moreover, finding of *T. subserratum* from here is also possible (see comments under this species). *Thamnobryum neckeroides* has more strongly concave leaves, carinate near apex, with widely acute to subobtuse apices, with costa that often have multicellular laminate projections on dorsal side vs. mostly unicellular teeth on dorsal side of costa in *T. alopecurum*. It is more difficult to separate *T. alopecurum* from *T. subserratum* as the latter species has moderately concave leaves with more or less flat apical part; however, its leaves are ovate-lanceolate (not ovate-triangular), with wider angle at apex; there are no differentiated submarginal cells in stem and branch leaves, and cells near costa in mid-leaf are elongate-rectangular, not angular, forming clear oblique rows which is not a character of *T. alopecurum*.

Thamnobryum coreanum (Cardot) Nog. & Z. Iwats., Misc. Bryol. Lichenol. 6: 33. 1972. – *Thamnium coreanum* Cardot, Bull. Soc. Bot. Genève, Sér. 2 3: 277. 1911. Fig. 2.

Plants comparatively small to medium-sized, dark green or yellowish green, dull. Secondary stem 2.5-4 cm long, pinnately or sparsely branched, branches 4-8 mm long. Stipe leaves small, triangular, gradually transiting to ovate upper stem leaves. Stem leaves of frond 1.5-1.8(-2.0)×0.6-0.8 mm, slightly concave to almost flat, occasionally

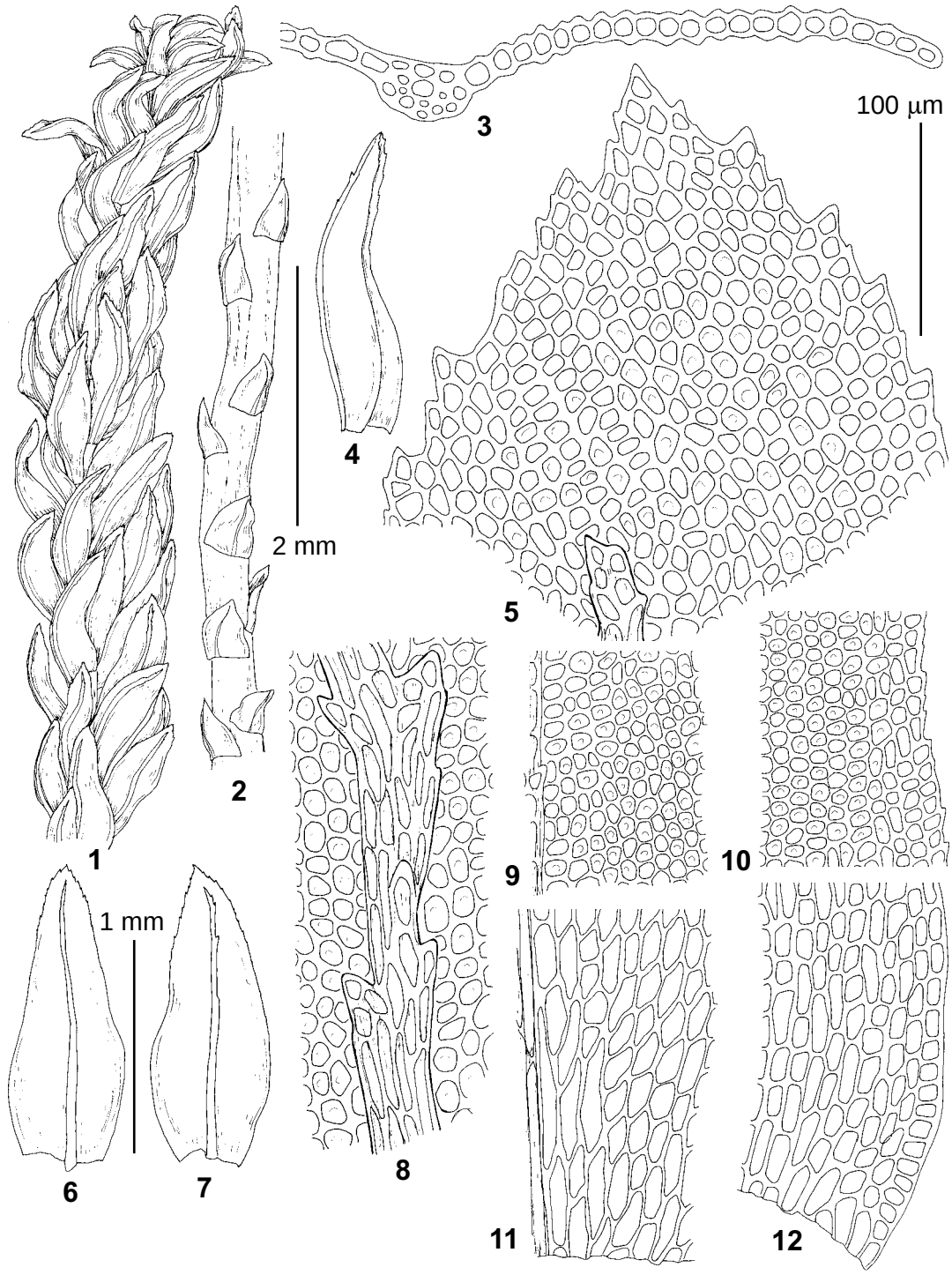

Fig. 2. *Thamnobryum coreanum* (from Russia, Primorsky Territory, Ussurijsky Nature Reserve, *Ignatov & Ignatova #06-3441*, MHA): 1 – branch, dry; 2– part of stipe, dry; 3 – leaf transverse section; 4, 6-7 – branch leaves; 5 – cells of apical part of leaf; 8 – dorsal side of costa in upper part of leaf; 9 – median juxtacostal cells; 10 – median marginal cells; 11 – basal juxtacostal cells; 12– basal marginal cells. Scale bars: 2 mm for 1-2; 1 mm for 4, 6-7; 100 μm for 3, 5, 8-12.

moderately concave, ovate, with broadly acute to subobtuse apex, widest above base; margins plane, coarsely serrate near apex, serrulate in mid-leaf, almost entire at base; costa strong, bent, gradually narrowing distally, smooth or toothed at back, occasionally forked distally, ending well below leaf apex; lamina areolation obscure, distal and median laminal cells small, irregular in shape and size, ± angular, polygonal, short rectangular or rhombic, 7-15×6-10 μm, moderately thick-walled, not porose, mamillose or inflated; mid-leaf cells near costa with longest axis mostly parallel to costa; basal laminal cells near costa short rectangular, 10-30×6-10 μm, thick-walled, not porose, basal marginal cells slightly shorter. Branch leaves similar to stem leaves but smaller, slightly to moderately concave and usually distinctly bent towards stem, occasionally carinate near apex, 1.3-1.5(-1.8)×0.5-0.6(-0.7) mm; costa in distal 1/2 usually with several dorsal spines and multicellular lamellate projections; lamina areolation similar to stem leaves. Dioicous, sporophytes unknown in Russia. [Perichaetial leaves ecostate, slightly concave, abruptly contracted into lanceolate point, to 1.3 mm long. Seta 2.3-2.6 cm long, slightly flexuose, reddish brown, slightly scabrose distally. Capsule oblong, urn ca. 3 mm long.]

Specimens examined: RUSSIA: **Primorsky Territory**: upper course of Suputinka River, Gorno-Taezhnaya Station [Ussurijsky Nature Reserve], Timokhin Klyuch, 21.X.1934, *A. Lazarenko s.n.* (LE) [sub *T. latifolium* (Br. Jav.) Par.]; Ussurijsky Reserve, Pravaya Komarovka Creek, *Ignatov & Ignatova #06-3441* (MW); Vladivostok surroundings, Okeanskaya Forestry, 19.VIII.1930, *A. Lazarenko s.n.* (LE) [sub *T. vorobjovii*]; Chernigovsky District, Elovaya Hill near Luntzy Village, 2.X.1934, *Lazarenko s.n.* (MHA) [sub *T. vorobjovii*]; Lazovsky Nature Reserve, 22.IX.1974, *Bardunov & Cherdantseva s.n.* (LE); Lazovsky District, Elomovsky Klyuch Creek, *Ignatov et al. #06-2176* (MHA); Kedrovaya Pad' Nature Reserve, 14.X.1974, *Bardunov s.n.* (LE); **Sakhalinskaya Province**: Sakhalin: Yuzhno-Sakhalinsk, territory of Botanical Garden, *Ignatov & Teleganova #06-304* (MHA); Dolinsk District, Sokol, Belaya Creek, *Ignatov & Teleganova #06-255* (MHA); Nevelsk District, Yuzhno-Kamyshovyj Mt. Range, Nevelsky Pass, 280 m alt., 17.IX.2009, *Pisarenko s.n.* (MHA); **Kamchatsky Territory**: Yuzhno-Kamchatsky Protected Area, slope of Koshelevsky Volcano, 29-30.VII.1990, *Czernyadjeva #26, 28, 529* (LE); Levyj Kikhchik River basin, 9-10. VIII.2001, *Czernyadjeva #77, 81, 82* (LE); Sredinnyj Mt. Range, NE slope of Alney Mt., Kirevna River, Upper Kireunskie thermal springs, 21.VIII.2001 *Czernyadjeva #27* (LE).

Distribution. The area of *Thamnobryum coreanum* is restricted to the northern part of SE Asia, it extends from Korea and Japan (Hokkaido and Honshu) to Primorsky Territory, Sakhalin and Kamchatka in Russia. It is not included into check-list of mosses of China (Redfearn et al., 1996); however, in H there are two specimens of the species from this country, one from Heilongjiang (H3141686) and one from Sichuan Province (H3141685).

Ecology. The species grows mostly in mixed conifer & broad-leaved forests in valleys of rivers and creeks, in flood-valley *Chosenia* stands, on various substrates: bases of tree trunks, soil, rocks and cliff ledges at banks of streams and brooks and in dry brook beds; once it was collected on subalpine meadow (Kamchatka).

Species Distinction. *Thamnobryum coreanum* is most similar to *T. neckeroides* in habit, size of plants, leaf shape and costa structure; both species have branch leaves moderately concave, occasionally carinate distally, with widely acute to subobtuse apical part and with multicellular laminate projections on dorsal side of costa. They differ in dull vs. slightly glossy plants and mamillose or inflated laminal cells making lamina areolation obscure vs. non-mamillose cells and clear areolation.

Thamnobryum neckeroides (Hook.) E. Lawton, Moss Fl. Pacific Northwest 245. 1971. – *Hypnum neckeroides* Hook., Musci Exot. 1: 58. 1818. – *Thamnobryum obtusatum* (Lindb. & Arnell) Bard. & Czerd., Listost. Mhi Yuzhnogo Primor'ya 71. 1982. – *Porotrichum obtusatum* Lindb. & Arnell, Kongl. Svenska Vetenskapsakad. Handl., n.s. 23(10): 158. 1890.

Thamnobryum vorobjovii (Laz.) Ochyra, J. Hattori Bot. Lab. 64: 342. 1988. Syn. nov. – *Thamnium vorobjovii* Laz., Trudy Dal'nevost. Fil. Akad. Nauk S.S.S.R., Ser. Bot. 2: 897. 1937.

Figs. 3-4.

Plants medium-sized to large, green to dark green, slightly glossy. Secondary stem (2.5-)3-5(-8) cm long, sparsely to pinnately branched, branches 4-15 mm long. Stipe distinct or indistinct, longer or shorter than frondose upper part;

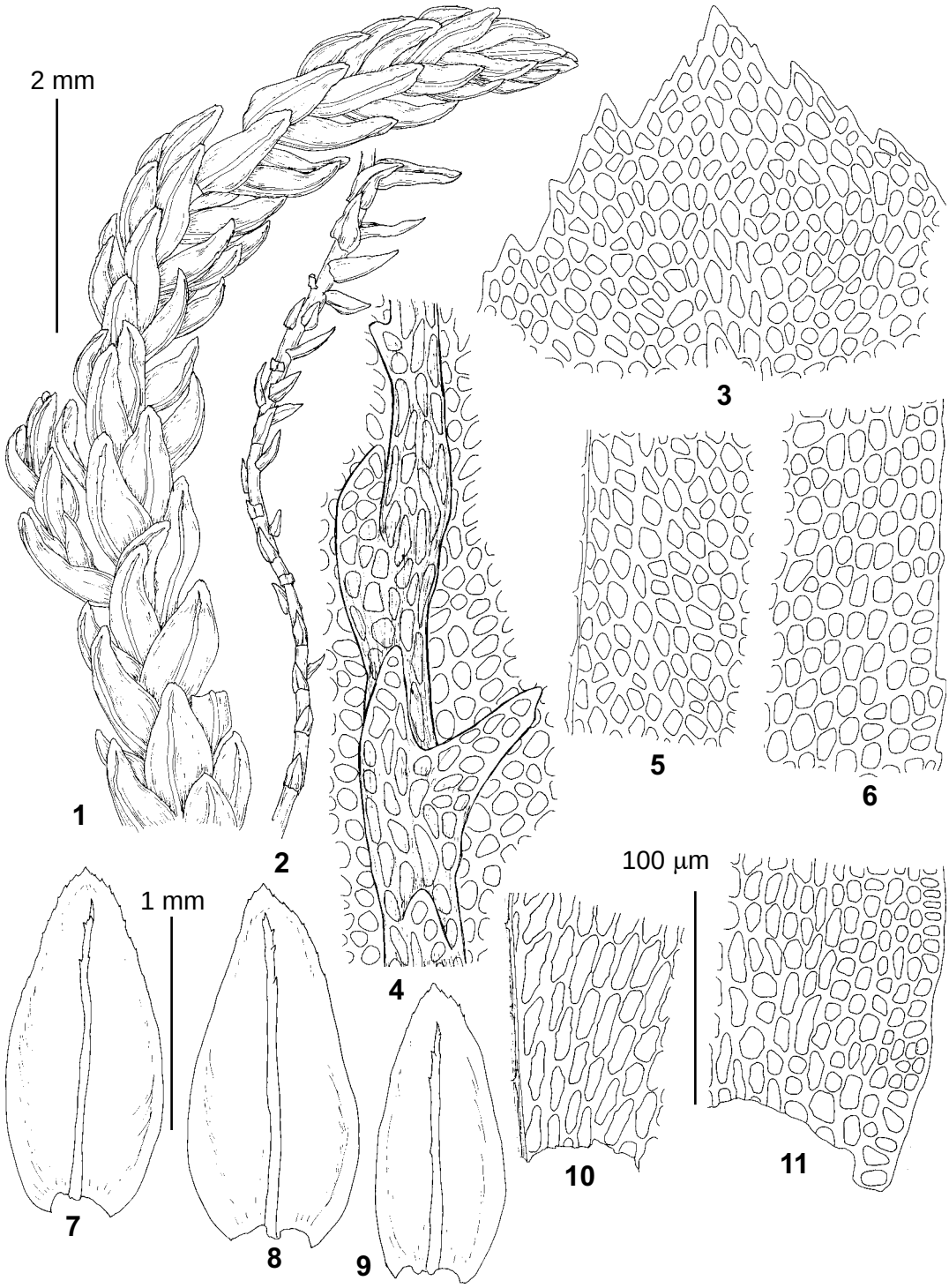

Fig. 3. *Thamnobryum neckeroides* (from Russia, Primorsky Territory, Olkhovaya Mt., *Ignatov et al., #06-2429*, MHA): 1 – branch, dry; 2 – part of stipe, dry; 3 – cells of apical part of leaf; 4 – dorsal side of costa in upper part of leaf; 5 – median juxtacostal cells; 6 – median marginal cells; 7-9 – branch leaves; 10 – basal juxtacostal cells; 11– basal marginal cells. Scale bars: 2 mm for 1-2; 1 mm for 7-9; 100 μm for 3-6, 10-11.

stipe leaves small, triangular, gradually transiting to ovate upper stem leaves. Stem leaves of frond 1.5-2.3×0.7-2.3 mm, moderately to strongly concave, ovate to widely ovate, with broadly acute to subobtuse apex, widest at proximal 1/4–1/3; margins plane, coarsely serrate near apex, serrulate in mid-leaf, almost entire at base; costa strong, bent, gradually narrowing distally, usually toothed at back with 1-3-celled teeth, ending few cells below leaf apex; lamina areolation clearly visible, distal and median laminal cells mostly rhombic, 12-30×6-12 μm, moderately thick-walled, not or weakly porose, smooth; mid-leaf cells near costa with longest axes mostly parallel to costa; basal laminal cells near costa elongate rectangular, 25-65×10-12 μm, moderately thick-walled, weakly porose, basal marginal cells slightly shorter. Branch leaves similar to stem leaves but smaller, moderately to strongly concave and usually distinctly bent towards stem, mostly carinate near apex, 1.5-2.0(-2.3)×0.5-0.8(-1.2) mm; costa in distal 1/2 usually with several dorsal spines and multicellular lamellate projections; lamina areolation similar to that of stem leaves. Dioicous, sporophytes rare, present in few collections from Russia. Perichaetial leaves ecostate, slightly concave, tapering into acuminate apex, to 2.0 mm long.Setae 1.8-2.2 cm long, reddish brown. Capsules erect or slightly inclined, urn ca. 1.8-2.2 mm long. Spores ca. 10 μm, papillose.

Selected specimens examined: RUSSIA: **Kemerovo Province**: Tashtagol District, Mountain Shoriya, Klyuchevoe Forestry, upper course of Kuchisu Creek, 15.VII. 1976, *Gudoshnikov s.n.* (LE). Mariinsk District, Mariinsk surroundings, Archekassky Kryazh Mts., 8.VI. 2007, *Pisarenko # op02316* (LE); Novokuznetzk District, Kuznetzky Alatau Mts: northern slope of Obutuk Mt., between Berezovaya and Krestovaya Creeks, 12.VIII. 1940, *Kolokol'nikov s.n.* (LE). near Uval settlement, Elban Mt., c. fr. juv., 05.VII. 2008, *Pisarenko s.n.* (LE); **Novosibirsk Province**: Iskitim District, Bukharikha settlement surroundings, 13.VI.1994, *Pisarenko s.n.* (LE); **Altai Republic**: Artybash District: northern shore of Teletzkoe Lake, Yailyu, 24.VI. 1991, *Ignatov #1/1* (MHA); Kamga River basin, Sredniy Shaltan Creek, 6.VI.1989, *Ignatov #0/1061* (MHA); [**Krasnoyarsk Territory**]: Jenisei, Novo- Saljeskaja, 65° 5' n. lat., 11.VII.1876, *H. W. Arnell s.n.* (S) [type of *Porotrichum obtusatum* Lindb. & Arnell]; **Primorsky Territory**: Shkotovo District: Shcherbatyj Klyuch Creek, upstrem Chernyj Klyuch, 13.X.1934, *Kabanov & Kolesnikov s.n.* (LE); Khualaza, 1000 m a.s.l., 19.X.1933, *Lazarenko s.n.* (LE); upper course of Maikhe River N of Novo-Khotunichi Settlement, 3.VIII. 1927, *Transhel' s.n.* (LE); Terney District, Sigekhoba River basin, Serebryanyj Klyuch – Beloborodovo, 14.IX.1935, *Kolesnikov s.n.* (LE); Chernigovsky District, Elovaya Hill, Luntzy Settlement surroundings, 2.X. 1934, *Lazarenko s.n.* (LE). Partizansk District, Kamenistyj Creek south of Olkhovaya Mt., *Ignatov et al #06-2429* (MHA); Ussurijsky Nature Reserve, Kamenka Creek, *Ignatov & Ignatova #06-2886* (MHA); Lazovsky District, Elomovsky Klyuch Creek, *Ignatov et al. #06-2165* (MHA); Sudzhukhinskij [Lazovskyj] Nature Reserve, upper course of Bol'shoj Ifal' Creek, 11.IX.1944, *Zhudova & Pokrovskaya s.n.* (LE); Kedrovaya Pad' Nature Reserve, 11.IX.1978, *Bardunov s.n.* (VLA) [sub *T. plicatulum*]; **Sakhalinskaya Province**: Sakhalin: Yuzhno-Sakhalinsk, Rogatka Creek valley, *Ignatov & Teleganova #06-332* (MHA); Dolinsk District, Sokol, Belaya Creek, *Ignatov & Teleganova #06-795* (MHA); Korsakov District, Tonnino-Anivsky Peninsula, Igrivaya Creek, 130 m alt., 16.IX.2009, *Pisarenko #op03185* (MHA); Kuril Islands: Iturup, Reidovo, 8.IX.1980, *Bardunov & Pressman s.n.* (VLA) [sub *T. sandei*]; Kunashir, Ruruj Volcano, *Ignatov #06-1221* (MHA); Shikotan, Notoro Mt., 200 m alt., *Bakalin #K-43-11-07* (VLA); **Kamchatsky Territory**: middle course of Bannaya River, Sarajnaya Creek, 12.VIII.2002, *Czernyadjeva #67* (LE).

ABKHAZIA: Bzybsky Mt. Range, its northern spur Akh-aga, 2300 m alt., 9.VIII.1984, *Radzimovskaya s.n.* (LE). LATVIA: Taleinsky District, Slitere, ancient sea shore, "Sinie gory", 11.VIII. 1953, Abolina #219 (LE). UKRAINE: Zakarpatskaya Province, Tyachevsky District, Karpatian Nature Reserve, Ugol'skoe Forestry, 800 m alt., 25.VIII.1991, *Ripa s.n.* (MW).

Distribution. Mastracci (2003) added some new localities worldwide and summarized known data on distribution of *Thamnobryum neckeroides*: western and eastern North America, Asia (Russian Far East, southern Siberia and one disjunct locality in the north of East Siberia, South Corea, China and India), Europe (Czech Republic, Germany and Italy) and New Zealand. Later the species was also found in Austria (Köckinger et al., 2008). Our study of herbarium collections in LE and MW has revealed some additional localities of *T. neckeroides:* it is reported here for the first time from the Caucasus (Abkhazia) and the Carpatian Mts. in Ukraine. Subsequently the species has been found in the Russian part of Caucasus, Adygea (Abolina, 2011). Abolina et al. (2011) also provide its records from Latvia.

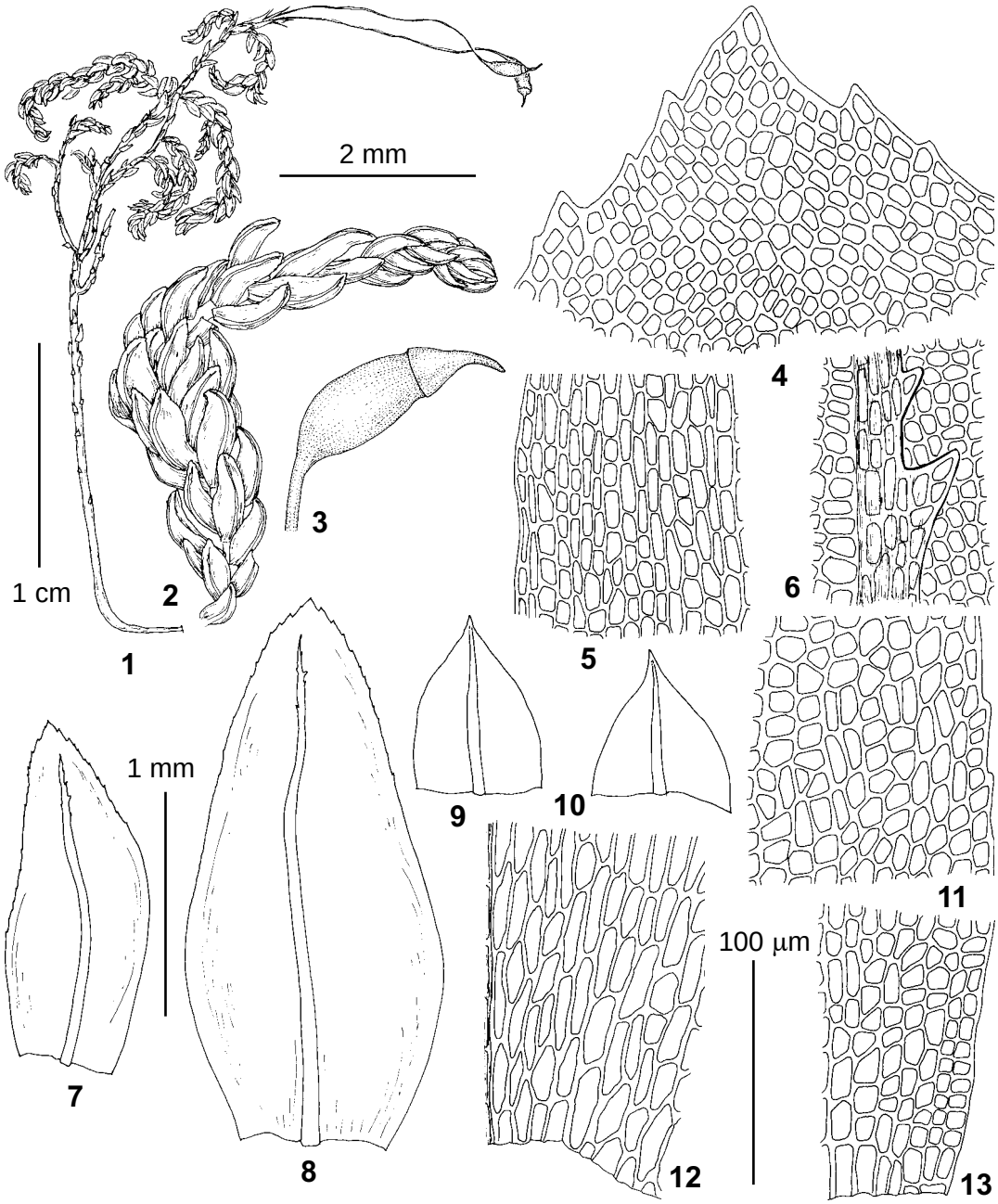

Fig. 4. *Thamnobryum neckeroides* (from lectotype of *Thamnium vorobjovii* Laz., KW): 1 – habit, dry; 2 – branch, dry; 3 – capsule; 4 – cells of apical part of leaf; 5 – cells of median part of stipe leaf; 6 – dorsal side of costa in upper part of leaf; 7 – branch leaf; 8 – secondary stem leaf; 9-10 – stipe leaves; 11 – median laminal cells; 12 – basal juxtacostal cells; 13 – basal marginal cells. Scale bars: 1 cm for 1; 2 mm for 2-3; 1 mm for 7-10; 100 μm for 4-6, 11-13.

Ecology. In the territory of Russia *T. neckeroides* occurs mostly in temperate areas of southern Far East and humid places in Altai Mts. with mild climate (Teletzkoe Lake surroundings) and similar areas in Kemerovo and Novosibirsk Provinces. It grows in fir and mixed conifer & broad-leaved forests in stream and river valleys, in *Pinus sibirica* forests, poplar stands in valley, mostly

on rocks and wet cliffs in shady places, occasionally also on tree trunk bases and roots, rotten wood and soil. However, in the Caucasus it was collected above tree-line, at 2300 m a.s.l., in crevices of limstone cliffs near brook. Habitat of this species in north Siberian locality is unknown, but it was likely collected in forested Jenisey River valley.

Species Distinction. Glossy plants, ovate, concave leaves with widely acute to subobtuse apices and dorsally serrate costa, often with multicellular lamellate projections, non-mamillose, rhomboidal upper laminal cells are the diagnosic characters of *T. neckeroides*. Its differences from *T. alopecurum* and *T. coreanum* are discussed under these species. In some cases it is difficult to separate *T. neckeroides* from *T. subserratum*; the latter species can be recognized by elongate rectangular laminal cells in mid-leaf near costa, forming clearly oblique rows, at an angle of 45° with the costa, whereas corresponding cells of *T. neckeroides* are trapezoidal or rhomboidal, with longest axes mostly parallel to costa. In addition, dorsal side of costa in branch leaves of *T. subserratum* is less strongly serrate to almost smooth, without multicellular lamellate projections, and laminal cells near leaf apex are elongate-rhombic vs. shortly rhombic to subquadrate in *T. neckeroides*. Moreover, *T subserratum* is autoicous, *T. neckeroides* dioicous.

Taxonomy. Lazarenko (1937) described *Thamnium vorobjovii* from Primorsky Territory. He compared this new species with *T. alopecurum*, and among its diagnostic characters he mentioned smaller size of plants (2-3 cm high vs. 5-15 cm in *T. alopecurum*), lamina areolation of stipe leaves (short rectangular and quadrate cells, 2-3:1 vs. linear cells, 5-10:1), and smaller size of branch leaves. Also illustration of *T. vorobjovii* (Lazarenko, 1937, Fig. 1) shows ovate, widely acute stem leaf with strongly serrate dorsal side of costa which is not a character of *T. alopecurum*, but is very similar to *T. neckeroides* and *T. coreanum*.

Main collections of A.S. Lazarenko are in KW. Ochyra (1988) stated that the holotype of *Thamnium vorobjovii* Laz. is in KW, however, with no citation of label data of the specimen, but providing only habitat information from the protologue. The holotype of *Thamnium vorobjovii* was not designated by the author. In protologue 17 specimens of this species were listed. Thirteen of them we have found in KW, and nine of them agree in all diagnostic characters with *T. neckeroides,* whereas four other specimens belong to *T. coreanum*; five specimens cited in protologue are not in KW, LE and VLA. Only one of these specimens, 15.X. 1934, has capsules. As capsules are described in the protologue, this specimen is selected as a lectotype.

The original description does not include information on cell mamillosity, the most important character for differentiation between *T. neckeroides* and *T. coreanum*. However the absence of information on cell mamillosity 'as default' is usually considered as the absence of mamillae; also, the illustration of Lazarenko shows smooth cells (in stipe leaf), albeit in frontal view only.

Lamina areolation of stipe leaf in lectotype of *T. vorobjovii* shows great variability in cell shape (Fig. 6: 5); many cells exceed 2-3:1. It does not differ from the cell structure of stipe leaves in other specimens of *T. neckeroides*. This character is not widely used currently as diagnostic in *Thamnobryum*; we did not observe considerable difference in cell shape in stipe leaves between *T. neckeroides* and *T. alopecurum*.

Lectotype of *Thamnium vorobjovii* Laz. (selected here): Далекий Схід, Усурійська обл. Верхів'я р. Майхэ. Ключ, що впадае в Анікіну Падь. На скелях. 15.X.1934 Leg. & det. А. Лазаренко [Primorsky Territory, Shkotovo District, Anikina Pad', on rocks, 15.X.1934, *Lazarenko s.n.*] (KW #12822). Fig. 4.

As the lectotype also belongs to *T. neckeroides,* we synonymize *T. vorobjovii* with this species.

Other specimens identified by A.S. Lazarenko as *T. vorobjovii* that belong to *T. neckeroides*: [Primorsky Territory]: Shkotovo District: Maikhe River basin, forest in valley of Peishula Creek, 8.IX.1930, (LE); Anikina Pad', on rocks in forest, 14.X.1934 (KW #12849); Khualaza Mt., on cliffs in forest, 18.X.1933 (KW #12830). Vicinity of Vladivostok: Okeanskaya Station, in forest on cliffs, 6.VIII.1930 (KW #12820); Okeanskaya Lesnaya Dacha, 19 kvartal, in wet ravine on rotten log, 19.VIII.1930 (KW #12821). Popov Island, on cliffs in forest, 16.IX.1930 (KW #12827). Chernigovsky District, Lysaya Hill in Lunza vicinity, 3.X.1934 (KW #12839); Elovaya hill in Lunza vicinity, on cliffs, 1.X.1934 (KW #12837); same place and date, on soil (KW #12815). Pos'etsky District, Sidim

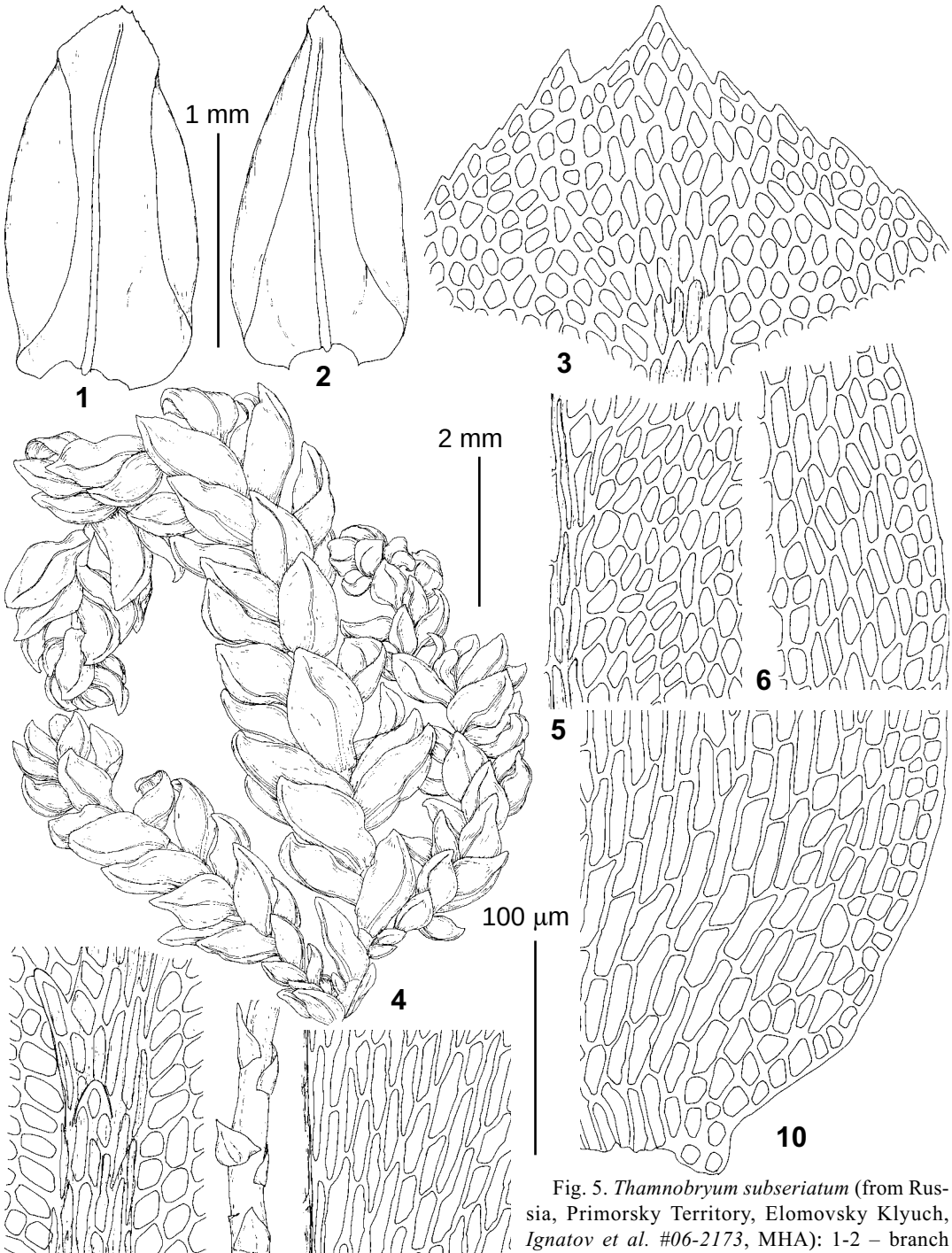

Fig. 5. *Thamnobryum subseriatum* (from Russia, Primorsky Territory, Elomovsky Klyuch, *Ignatov et al. #06-2173*, MHA): 1-2 – branch leaves; 3 – cells of apical part of leaf; 4 – branches, dry; 5 – median juxtacostal cells; 6 – median marginal cells; 7 – dorsal side of costa in upper part of leaf; 8 – part of stipe, dry; 9 – basal juxtacostal cells; 10 – basal marginal cells. Scale bars: 2 mm for 4, 8; 1 mm for 1-2; 100 μm for 3, 5-7, 9-10.

Bay, Brikner Cape, on rocks in forest, 29.X.1934 (LE). Kedrovaya Pad' Reserve,mixed forest, N-faced slope, on NW side of rock, 28.VII.1926, coll. Siverkin (LE). Suchanskaya Railway, on rocks along Shzherbatyj Klyuch, vicinity of Luk'yanovka Station, 13.X.1934, coll. Kabanov (LE). Southern Sikhote-Alin' Mts., Tachinchzhan Mt. Range, Sydagou River, broad-leaved valley forest, on rocks and soil, 23.IX.1936, coll. Kolesnikov (LE). Suputinka Creek upper course, Gorno-Tayozhnaya Station Reserve, on rocks, 12.X.1934 (LE). Mironov Klyuch, cliffs, 23.X.1934 (LE).

Other specimens identified by A.S. Lazarenko as *T. vorobjovii* that belong to *T. coreanum*: [Primorsky Territory]: Shkotovo District, Peishila Creek, at tree base, 8.IX.1930 (KW #12832). Pos'etsky District, Sidim Bay, Brikner Cape, on rocks in forest, 29.X.1934 (KW #12828). Gorno-Tayozhnaya Station Reserve: Mironov Klyuch, on rocks, 23.X.1934 (KW #12824); cliffs above Kamenka Creek, 11.X.1934 (KW #12840); Timokhov Klyuch, on rocks along creek bed, 22.X.1934 (LE).

Thamnobryum subseriatum (Mitt. ex Sande Lac.) B.C. Tan, Brittonia 41: 42. 1989. – *Thamnium subseriatum* Mitt. ex Sande Lac., Ann. Mus. Bot. Lugduno-Batavi 2: 299. 1866. – *Thamnobryum sandei* (Besch.) Z. Iwats., Misc. Bryol. Lichenol. 6: 33. 1972. – *Thamnium sandei* Besch., Ann. Sci. Nat., Bot., sér. 7, 17: 381. 1893. Fig. 5.

Plants medium-sized to large, light green, slightly glossy. Secondary stem 3-5(-7) cm long, sparsely to subpinnately branched, branches turgid, 5-20 mm long. Stipe distinct or indistinct, often shorter than frondose upper part. Stem and branch leaves of frond similar, 1.5-2.0[-3.0]×0.8-1.2 [-2] mm, strongly concave, carinate at apex, ovate to broadly ovate or almost rounded, widest at mid-leaf, broadly acute to subobtuse at apex; margins plane, coarsely serrate near apex, serrulate in mid-leaf, almost entire at base; costa moderately strong, bent, gradually narrowing distally, with few distant sharp teeth at back, ending few cells below leaf apex; distal and median laminal cells short rectangular, rhombic or irregular, 12-25×6-10 μm, moderately thick-walled, not porose; mid-leaf cells near costa in oblique rows, with longest axes at 45° to costa; basal laminal cells near costa elongate rectangular, 25-50×8-10 μm, moderately thick-walled, not or weakly porose, basal marginal cells in 1-2 row subquatrate or short rectangular. Autoicous, sporophytes rare, seen only once in collections from Russia. Perichaetial leaves ecostate, broadly ovate, shortly acuminate, ca. 1.5 mm long. Setae 1.0-1.3 cm long, brown. Capsules suberect or inclined, urns ca. 1.8-2.2 mm long. Spores 12-17 μm.

Specimens examined: RUSSIA: **Primorsky Territory**: Ussurijsky Nature Reserve, upper course of Artyomovka River, 230 m alt., *Ignatov #08-200* (MHA); Ussurijsky Reserve, Grabovaya Mt., 18.VII. 1974, *Cherdantseva & Nesterova s.n.* (VLA, MHA); upper course of Suputinka River, Gorno-Taeozhnaya Station Reserve, 11.X.1934, *Lazarenko s.n.* (LE, MHA); Khasan District, near Primorskaya Settlement, Kedrovaya Pad' Nature Reserve, 7.IX.1953, *Voroshilov #7132* (MHA); Lazo District, Elomovsky Klyuch, *Ignatov et al. #06-2173*, MHA; vicinity of Vladivostok, Popov Island in Petr Velikij Bay, 16.IX.1930, *Lazarenko s.n.* (LE); Pos'etsky District, Sidim Bay, Brikner Cape, 29.X.1933, *Lazarenko s.n.* (LE); vicinity of Vladivostok, Okeanskaya, Korejskaya Hill, 10.X.1930, *Lazarenko s.n.* (LE); Shkotovo District, Shkotovo, 23.VIII.1930, *Lazarenko s.n.* (LE).

Distribution. According to Tan (1989) the distribution of *T. subseriatum* is restricted to Japan and northeastern China. It occurs also sporadically in southern part of Russian Far East. Most previous records of *T. plicatulum* in Russia are based on misidentified specimens of *T. subseriatum*.

Ecology. The species grows on ledges of wet cliffs and on shady rocks in mixed and broad-leaved forests in creek valleys.

Species Distinction. Diagnostic characters of *T. subseriatum* include turgid foliage of branches, broadly ovate, strongly concave leaves, carinate near apex, widely acute to subobtuse. Oblique cell rows in mid-leaf near costa and absence of multicellular teeth on dorsal side of costa separate the species from *T. neckeroides*. Differences from *T. subserratum* are discussed under this species.

Thamnobryum subserratum (Hook. ex Harv.) Nog. & Z. Iwats., J. Hattori Bot. Lab. 36: 470. 1972 [1973]. – *Neckera subserrata* Hook., Icon. Pl. 1: pl. 21: f. 7. 1836. – *Thamnium subserratum* (Hook.) Besch., Ann. Sci. Nat., Bot., sér. 7, 17: 382. 1893. Fig. 6.

Plants medium-sized to robust, green or dark green, slightly glossy. Secondary stem 3-5(-7) cm long, sparsely to subpinnately branched, branches ± complanate, 5-20 mm long, with shorter branchlets. Stipe distinct, ± equal to frondose upper part or longer, occasionally shorter. Stem lea-

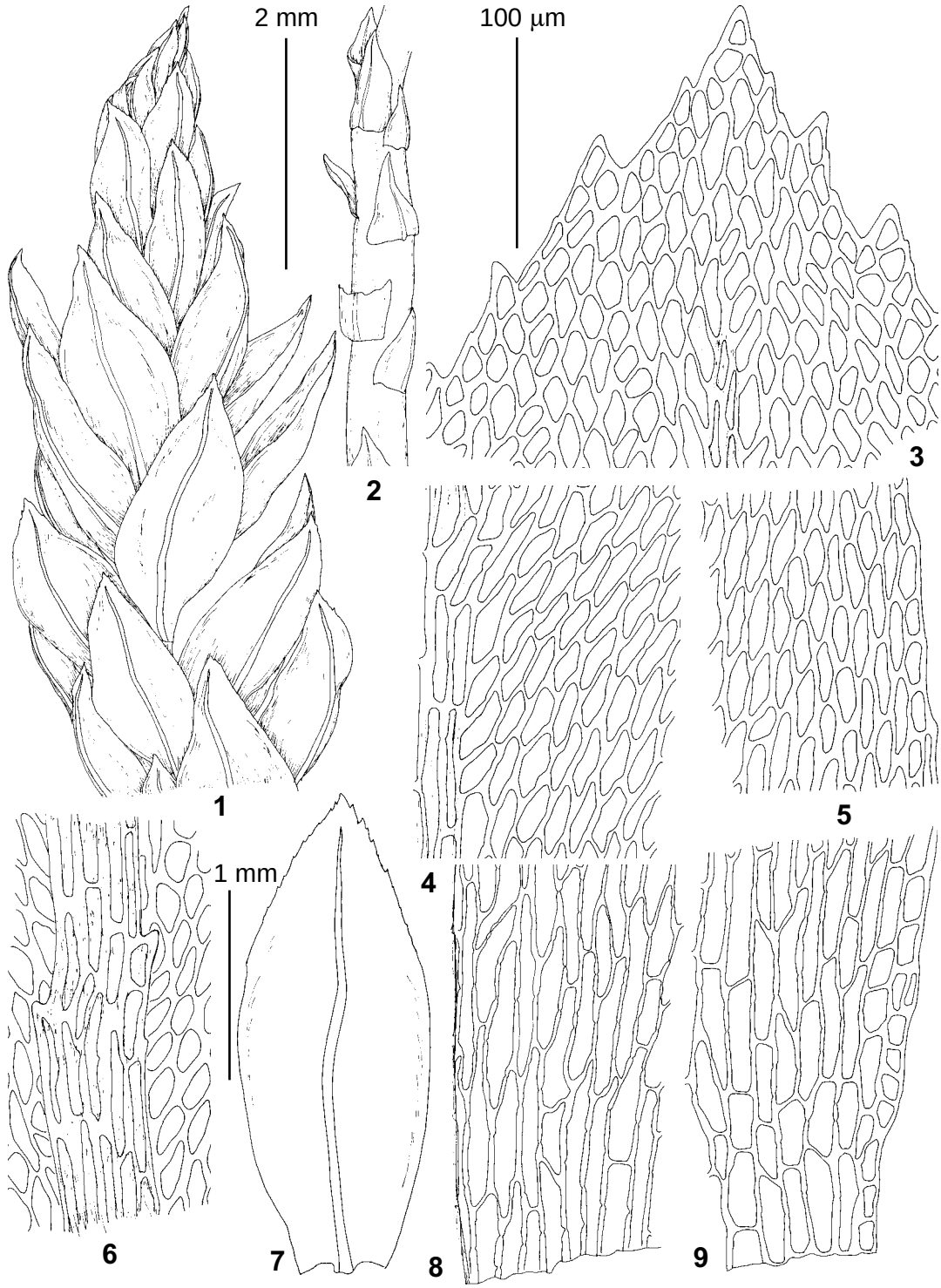

Fig. 6. *Thamnobryum subserratum* (from Russia, Sakhalinskaya Province, Kunashir Island, *Ignatov #06-1906*, MHA): 1 – branch, dry; 2– part of stipe, dry; 3 – cells of apical part of leaf; 4 – median juxtacostal cells; 5 – median marginal cells; 6 – dorsal side of costa in upper part of leaf; 7 – branch leaf; 8 – basal juxtacostal cells; 9 – basal marginal cells. Scale bars: 2 mm for 1-2; 1 mm for 7; 100 μm for 3-6, 8-9.

ves of frond 1.7-2.5×0.8-1.5 mm, slightly or moderately concave, flattened at apex, ovate, widest at proximal 1/4-1/2, broadly acute; margins plane, moderately serrate near apex, serrulate from mid-leaf to base; costa moderately strong, weakly bent, gradually narrowing distally, smooth or weakly serrulate at back, ceasing mostly well below leaf apex; distal and median laminal cells rhombic, elongate-rhomboidal or short rectangular, 10-20×5-7 μm, with moderately thickened, occasionally slightly uneven walls; mid-leaf cells near costa oblong, in clear oblique rows, with longest axes at 45° to costa; basal laminal cells near costa elongate rectangular to linear, 35-70×5-8 μm, with moderately thickened, not or weakly to moderately porose walls, basal marginal cells in 1-2 rows short rectangular. Branch leaves similar to stem leaves, but smaller, 1.5-2.0×0.7-1.0 mm, more coarsely serrate near apex, occasionally with few sharp teeth on dorsal side of costa. Autoicous, sporophytes rare, not seen in collections from Russia.

Selected specimens examined: ASIA: RUSSIA: **Sakhalinskaya Province**, Kuril Island, Kunashir, NW foothills of Ruruj Mt., 20 m alt., *Ignatov #06-1906* (MHA). [**Primorsky Territory**], Gorno-Tayozhnaya Station Reserve [Ussurijsky Reserve], Kamenskaya Creek, 11.X.1934, *Lazarenko s.n.* (LE) [sub *T. latifolium* (Br. Jav.) Par.]. CHINA: **Hunan Province**: Shi-Men Co., Hu-Ping-Shan Nature Reserve, Shi-Nian-Zhi-He, *Koponen et al. #53424* (H); Sanzhi Co., Badagondshan, Tiejianyanwu, *Rao #58998* (H); Wugang Co., Yunshan National Forest Park, *Enroth #50117* (H); **Guizhou Province**, Jiandkou Co., Fanjing Mountain Nature Reserve, Tan #91-1107 (H); **Yunnan Rrovince**: Yangby Co., vicinity of Shimenguang, *Redfearn et al. #748*, det. J. Enroth (H3141845). JAPAN: Okinawa Pref., Isl. Iriomote, Urauchi River, Daini-yamagaya-Futamata-Daichiyamagaya, 28-29.III.1937, coll. *K. Saito* (sub *T. plicatulum*), det. M. Mastracci, 1997 (H 14789).

EUROPE: SWEDEN: Sm[åland], Hesselby, Vadadalen, VI.[18]88, coll. *R. Tolf* (sub *Porotrichum alopecurum* var. *smolandicum* Tolf), det. M. Mastracci, 2001(H3141525); Sm[åland], Pelarna, Walklef, 7.VI.1986, coll. *R. Tolf* (sub *Porotrichum alopecurum* var. *robustum* nom. nudum), det. M. Mastracci, 2001 (H3141524).

Taxonomy and distribution. A review of the nomenclature history of *T. subserratum* as well as *T. subseriatum* was provided by Tan (1989); he solved some problems concerning the use of these names and presented an overview of their known distribution. He also pointed out that the Japanese species, *T. plicatulum* (Sande Lac.) Z. Iwats. is "uncomfortably similar" to *T. subserratum*, but did not make formal synonymization as he did not see type specimen of the former species. We also failed to find any sufficient differences between Japanese specimens of *T. plicatulum* and Chinese or any other specimens of *T. subserratum*. The same opinion is reflected in an annotation note of M. Mastracci, who re-identified a specimen of *T. plicatulum* from Japan as *T. subserratum* (H 14789). On the other hand, Mastracci (2003) stated that the North American species, *T. alleghaniense* (Müll. Hal.) Nieuwl. is a synonym of *T. subserratum* on the basis of his unpublished data. We also agree that North American specimens of *T. alleghaniense* are very similar to the specimens of *T. subserratum*; their descriptions provide very similar diagnostic characters. However, detailed study, including comparison of type specimens is needed for final decision in this case and in the case of *T. plicatulum*.

Summarizing currently known data, we can outline that *T. subserratum* has a wide distribution in SE Asia "from the Himalayas, India, Sri Lanka, and Indochina to Philippines and Borneo" (Tan, 1989). Our study adds two collections from the Russian Far East, both from its continental part and Kuril Islands. We have also seen numerous collections of the species from Hunan Province in China. *Thamnobryum subserratum* was also recently reported from Europe: Latvia (Mastracci, 2003; Abolina et al., 2011) and Austria (Köckinger et al., 2008). There are also two specimens of the species from Sweden identified by M. Mastracci (probably unpublished), H3141525 and H3141524. They were identified by the collector, R. Tolf, as *T. alopecurum*, but he described a new variety, var. *smolandicum* Tolf on the basis of one collection and named another one as var. *robustum,* but did not publish it.

It is likely that *T. subserratum* has wide circumpolar distribution mostly in mountains of temperate areas; new findings in European countries and in the Caucasus could be expected.

Ecology. In Kunashir Island *T. subserratum* was collected on rock among the high-grass com-

munity near hot springs; the collection in Primorsky Territory was made on cliffs along creek in mixed forest. According to the label information from other areas it also grows in the forest belt, mostly on cliffs and rocks, occasionally at bases of tree trunks.

Species Distinction. Differences of *T. subserratum* from *T. alopecurum* and *T. neckeroides* are discussed under these species; see also Mastracci (2003) and Frahm (2009). It is most difficult to differentiate *T. subserratum* from *T. subseriatum*, as these two species have similar lamina areolation and concave leaves. However, branch leaves of *T. subserratum* are only slightly to moderately concave, flattened near apex vs. strongly concave, always carinate at apex leaves in *T. subseriatum*. Tan (1989) provides some additional characters for the separation of *T. subserratum* and *T. subseriatum*: costa diminishing well below the apex, often more than five cells from the tip vs. nearly reaching the apex or ceasing about five cells from it; abaxial side of costa almost smooth vs. with several strong teeth or lamellate projections; perichaetial bracts long acuminate, larger than vegetative leaves and rather conspicuous vs. shortly acuminate and small in size, hidden among the branch leaves; capsules ovoid to oblong vs. oblong-elongate.

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