

RANGE EXTENSION FOR *RICCIA NIPPONICA* AND COMMENTS ON THE *R. CRYSTALLINA* COMPLEX (RICCIACEAE, HEPATICAE)

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Abstract. For *Riccia nipponica* S. Hatt., previously regarded as a Japanese endemic, the paper gives the first records from the southern flank of the Russian Far East and Guizhou Province of China. These records considerably enlarge its known distribution area. New data on its morphological variability, ecology and distribution patterns are summarized and analyzed based on study of available material from East Asia. A morphological description and figures are given, with a key in table form for it and related taxa. Although closely related to the sub-cosmopolitan *R. crystallina* L., *R. nipponica* merits species rank.

Key words: distribution, ecology, endemic species, hepatics, phytogeography, *Riccia*, Ricciaceae

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INTRODUCTION

The genus *Riccia* L. is the largest and the most taxonomically difficult genus of marchantioid hepatics. It numbers at least 150 species worldwide (Bischler 1998), most diverse in areas of temperate to subtropical Mediterranean and continental climate. East Asia is one of the diversity centers of the genus; the taxonomic status and variability range of many species occurring there remain unclear. The genus has never been revised for Asia, though there are data for other regions such as the Mediterranean (Jovet-Ast 1986), Nordic countries (Damsholt 2002), Europe (Müller 1954), the British Isles (Paton 1999), India (Pande & Udar 1957, 1958, 1959; Meijer 1958; Srivastava 1964; Bapna & Kachroo 2000), Southern Africa (Perold 1999), North America (Schuster 1992) and some regions of South America (Hässel de Menéndez 1963; Jovet-Ast 1991, 1993, 2005; Gradstein & Costa 2003).

The eastern margin of East Asia has numerous endemic (at least so treated) taxa adapted to rather humid climate. Most of them are foliose genera, with a few exceptions for marchantioid taxa. Three

species of *Riccia* described from Japan belong to the latter group and are still regarded as Japanese endemics – *Riccia miyakeana* Schiffn. (Schiffner 1899), *R. nipponica* S. Hatt. (Shimizu & Hattori 1953) and *R. pubescens* S. Hatt. (Hattori 1943). However, there are no factors that might potentially limit their distribution outside of Japan.

In the course of a revision of *Riccia* for the Russian Far East and adjacent areas, we found specimens of the *R. crystallina* complex both from the Russian Far East and from Guizhou Province, China. Both specimens belong to *R. nipponica*, and this finding considerably enlarges the range of the species.

Riccia nipponica was described in 1953 by S. Hattori from Obi in Miyazaki Prefecture, Japan (Shimizu & Hattori 1953), characterized by (1) growing as large rosettes or hemirosettes, (2) the upper surface of the thallus bluish in younger parts and grayish green or yellowish in older parts, (3) the upper surface not or slightly lacunose towards the apex and sparsely lacunose in older ones, (4) lobes 2.5–5.0 mm wide, (5) the

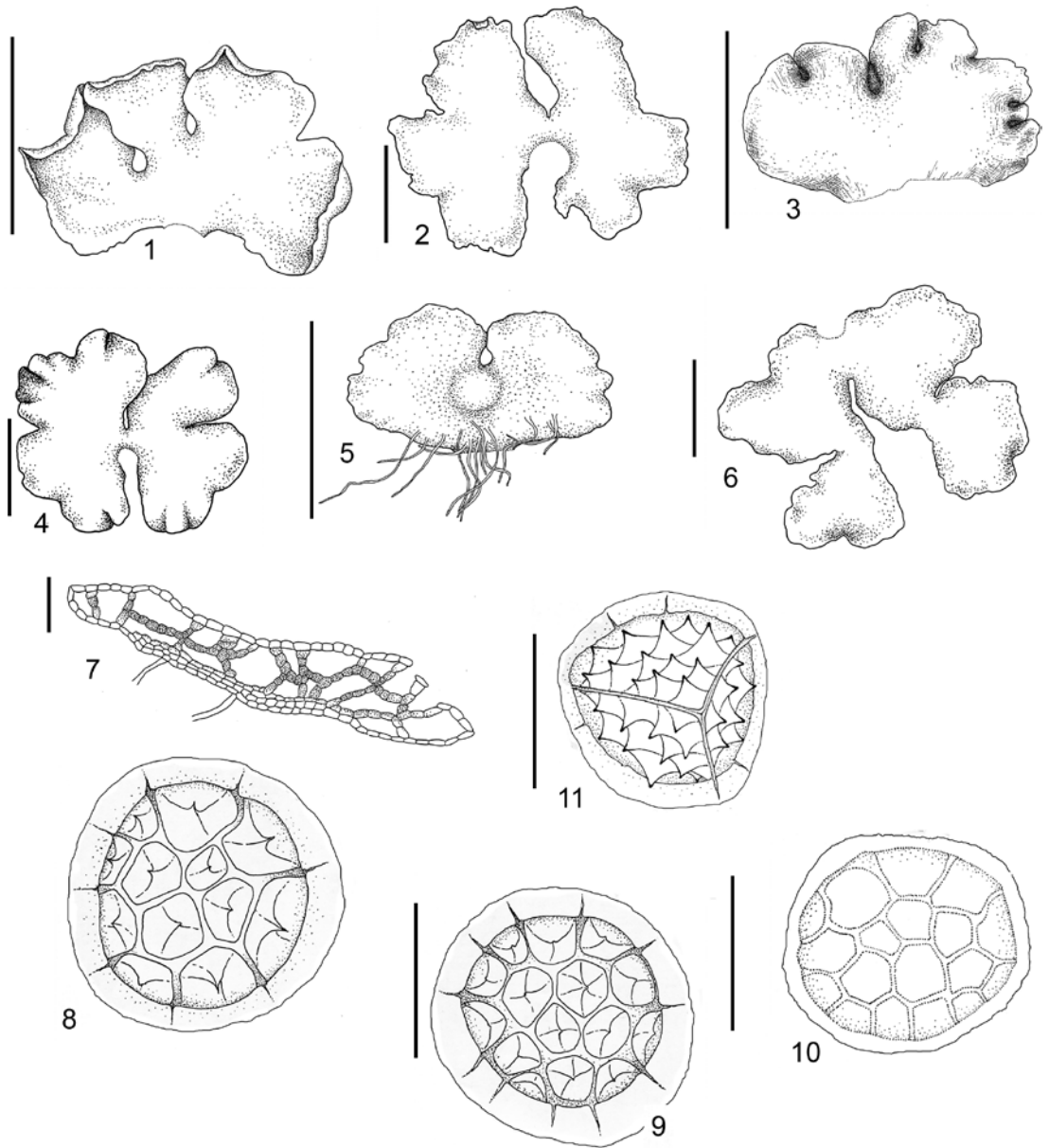


Fig. 1. *Riccia nipponica* S. Hatt. 1–4 & 6 – habit of plant, dorsal view, 5 – habit of plant, ventral view, 7 – cross section of thallus, 8–10 – distal face of spores, 11 – proximal face of spores (1, 2, 5–7, 9–11 from Khabarovsk Territory, 16 Sept. 1986, *Shelestova*, KPABG; 3, 4, 8 from Guizhou Province, 19 Nov. 2013, *Bakalin*, VBGI). Scale bars: 1–6 = 3 mm; 7 = 600 μ m; 8–11 = 45 μ m.

thallus 4–5 times wider than high in cross section, (6) the upper surface of older thallus segments and dried plants with a scruffy appearance because of disintegration of epidermal cells, (7) minute

ventral scales, (8) spores (60–)70–80 μ m in diameter, with large complete alveoli on the distal face, and (9) – finely dentate spore tetrahedral wings 8–12 μ m wide.

Most of the listed characters (1, 2, 3, 5, 6, 7, 8) are the same in *R. crystallina* L. (Jovet-Ast 1964), as it is most closely related to *R. nipponica*, but the latter differs from *R. crystallina* in having (i) lobes 2.5–5.0 mm wide (vs. 2.0–4.0 mm wide in *R. crystallina*), (ii) the spore distal surface with 4(–5) large complete alveoli across the spore diameter (vs. 5–10 complete alveoli), (iii) the wing (4–)6–8(–12) μm wide (vs. 3–6 μm wide), and (iv) the spine usually present in the center of alveoli (vs. spine absent). In both the Chinese and Russian specimens these differentiating features are more or less stable and may be used to confirm that *R. nipponica* merits species rank. As the present records are the first reports of the species outside of Japan, and in order to draw attention to this poorly known species which no doubt should be found in other areas of East Asia, here we describe its morphology from specimens examined, and indicate the differences from closely related taxa.

***Riccia nipponica* S. Hatt.**

Figs 1 & 2

J. Hattori Bot. Lab. 9: 38. 1953.

Plants crystalline; as discrete thalli, forming rosettes or hemirosettes. *Thalli* medium-sized, 2.5–5.0 mm wide, 5–7 mm long; 2–4-times furcate; *lobes* short, wide, obcordate; *upper surface* light green to somewhat bluish green, in older parts becoming whitish or yellowish; not or slightly lacunose towards the apex and sparsely lacunose in older parts; *apex* thick, rounded to shortly emarginate; *median furrow* distinct at apex, shallow; thallus margins raised, not incurved, rounded, obtuse. *Dorsal epidermis cells* almost globular, shiny, 45–56 μm wide; thin-walled. *Cross section* elliptical, not furrowed; 3–5 times wider than thick; *assimilation tissue* high, compact; 400–550(–600) μm thick, occupying 2/3–3/4 of thallus thickness in the middle; *air chambers* narrow near apex and wider toward base, in 1–2 layers in the middle. *Ventral tissue* parenchymatous, consisting of thin-walled cells; occupying 1/4–1/3 of thallus thickness in the middle. *Ventral surface* green; thallus midrib fleshy, 600–800 μm thick in cross section; relatively well-defined. *Rhizoids* smooth and pegged, hyaline, covering ventral surface of midrib of

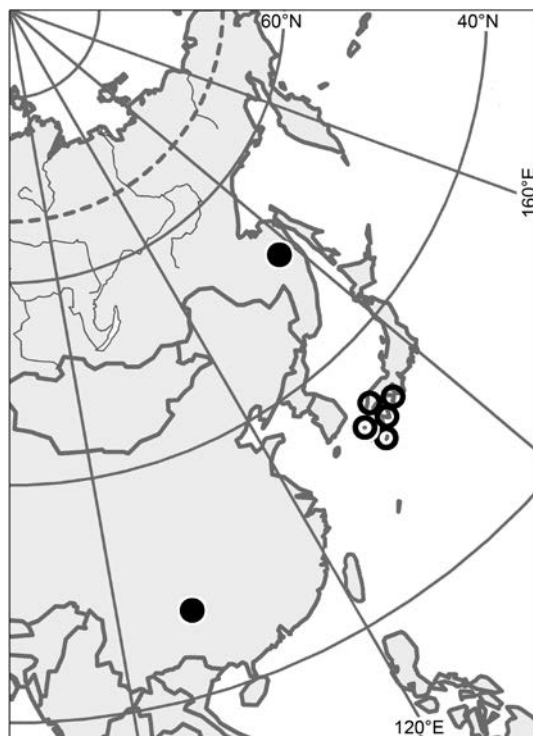


Fig. 2. Distribution of *Riccia nipponica* S. Hatt. ○ – previously known localities; ● – localities discovered during our study.

thallus. *Ventral scales* developed mostly near apex; inconspicuous hyaline, minute. *Monoicous*. *Antheridia* in two lateral rows along dorsal part of thallus, with *necks* hyaline, up to 150–180 μm long. *Archegonia* along thallus middle, with *necks* purple-brown, up to 180–210 μm long. *Sporangia* numerous, dorsal, slightly protruding ventrally. *Spores* 55–70(–78) μm in diameter; light to dark yellowish or brownish; *distal face* alveolate, with laminae forming 4–5(–6) complete, round alveoli across the face, 8–10(–12) μm in diameter; lamellae thin and low, usually with spine in center of alveoli; *proximal face* similar to distal surface or less regularly reticulate, with distinct trilete scar; *wings* (4–)6–8(–12) μm wide; *wing margin* crenulate to spinulose, sometimes erose.

SPECIMENS EXAMINED (newly reported areas asterisked): *RUSSIA, KHABAROVSK TERRITORY, Komsomolsk State Nature Reserve, Amur River Upland, mouth of Gorin River, Bichi Island ca 70 km downstream of

Table 1. Comparison of *Riccia* L. species morphologically similar to *R. nipponica* S. Hatt.

Character	<i>R. cavernosa</i> Hoffm.	<i>R. crystallina</i> L.	<i>R. nipponica</i> S. Hatt.
Growth form	narrow discrete thalli, rosettes or hemirosettes	discrete thalli, rosettes or hemirosettes	discrete thalli, rosettes or hemirosettes
Color of thallus upper surface	green, yellowish, or light- to grayish green, often with reddish secondary pigmentation	bluish to grayish but turning whitish upon drying in the field	light green to somewhat bluish green, in older parts becoming whitish or yellowish
Thallus segment width, mm	1.0–2.0(–2.7)	1.5–2.5(–4.0)	2.5–5.0
Dorsal epidermis	slightly to very distinctly lacunose or alveolate	not or very indistinctly perforated towards apex and often less conspicuously lacunose in older part of thallus	not or slightly lacunose towards apex and sparsely lacunose in older parts
Texture of thallus	spongy	somewhat compact	somewhat compact
Thallus cross section, width/ thickness ratio	1.5–2.5(–4.0)	2.5–4.0	3–5
Ventral scales	lacking	narrowly lunate, small, ephemeral	minute
Texture of thallus	not crystalline	glistening and crystalline	glistening and crystalline
Diameter of spores, μm	65–95	60–86	55–70(–78)
Spore distal face	lamellae irregular, short and low toward margin, often forming incomplete alveoli	with 7–10 complete small alveoli across spore diameter	with 4–5 large, complete alveoli across spore diameter
Tubercles or spines	without tubercles or spines at the angles	with tubercles or spines at the angles	with spine in center of alveoli, but not in angles
Width of spores wings, μm	3–8	3–4(–6)	(4)–6–8(–12)
Distribution	Subcosmopolite	Subcosmopolite	East Asian

Seimchan settlement, 50°45'N, 137°40'E, sandy-loam bank, mixed with *R. frostii*, with sporophytes, 16 Sept. 1986, *Shelestova, s.n.* (VBGI; as *R. huebeneriana*); *CHINA, GUIZHOU PROVINCE, Kaijiang County, Xiang Zhi Stream, 26°46'59,5"N, 106°54'44,5"E, agricultural land in countryside, clay on rice field margin, with sporophytes, 19 Nov. 2013, *V.A. Bakalin #China52-1-13* (VBGI; KPABG; as *R. cavernosa*); JAPAN, Obi-cho, Minaminaka-gun, 7 March 1950, *S. Hattori #16015* (TNS); *ibidem*, on soil, 5 Feb. 1953, *S. Hattori & D. Shimizu #51535* (NICH, holotype of *R. nipponica*); FUKUOKA PREFECTURE, 5 Jan. 1958, *Yu. Kuwahara* (LE, KPABG, VBGI - Hepaticae Japonicae Exsiccatae, Ser. 1: 22); Ibaragi-ken, Joshu-shi, Higashi-Mati, Fukuoka, near Toshuko Bridge, 13 Dec. 2007, *Q. Latiff* (HIRO 247230; as *R. cavernosa*); HONSHU, Hiroshima-ken, Higashi-hiroshima-shi, Kagamiyama, on soil, 19 April 2001, *M. Itouga #3826* (HIRO; as *Riccia*); Saitama-ken, Saitama-shi, Midori-ku, Minuma, on moist soil in nursery garden, 8 Nov. 2007, *M. Itouga #4067* (HIRO; as *Riccia*); SHIKOKU, Kochi-ken, Nagaoka-gun, Motoyama-cho, Sukefujii, on moist soil in rice field, 24 Jan. 2008, *H. Deguchi #37896* (HIRO 247484; as *Riccia*).

DIFFERENTIATION. *Riccia nipponica* is most closely related to *R. crystallina* and *R. cavernosa*. The main differences are given in Table 1. Confusion with other taxa seems hardly possible. As is evident from the table, some features intergrade from one to another species, which may reflect the recent divergence of these taxa.

VARIATION. The studied specimens vary in spore size, number of alveoli across spore diameter, and width of spore wing. The spores from the Khabarovsk Territory specimen are smaller [(53)–55–65 μm in diameter] than in the Japanese and Chinese specimens (65–78 μm). Typically, as described by Shimizu and Hattori (1953), the spore distal face has 4 large complete alveoli across spore diameter, but in our studied specimens we found 4(–5) large complete alveoli in Japanese plants (*Hattori*, 7 March 1950), 4–5(–6) complete alveoli in plants from Khabarovsk Territory, and 4 large complete alveoli in Chinese plants. Spore wing width varies even within one

sporangium from 4–6 µm to 8–10(–12) µm. Unlike the specimens from the Russian Far East and Japan, the Chinese specimens have a noticeably lacunose dorsal surface resembling *R. cavernosa* in appearance, but other features like spore size and ornamentation coincided with those of the plants from Japan described by Shimizu and Hattori (1953). The likely explanation of these discrepancies is wider morphological variability than was suggested before (Shimizu & Hattori 1953).

ECOLOGY. The habitat of *Riccia nipponica* in Japan is fine earth in subtropical broadleaved, mostly evergreen forest with high annual precipitation in Myazaki and Fukuoka Prefectures, rather similar to the conditions prevailing where the species was collected in Guizhou Province, China. In contrast, its locality in the Russian Far East belongs to the so-called ‘Ussuri taiga’ zone (mixed coniferous-broadleaved forest in the contact zone of temperate and boreal vegetation), where it inhabited a sandy-loamy stream bank together with *R. frostii* Austin. Probably the latter is a relict locality and reflects the area’s ancient connections with the warm-temperate plant cover of East Asia.

DISTRIBUTION. Earlier *R. nipponica* was treated as a Japanese endemic; there it is more or less common on Honshu, Shikoku and Kyushu Islands (Yamada & Iwatsuki 2006; Higuchi 2011; our data). Both of our records are from areas far from the nearest known locations in Japan: over 2000 km north to Khabarovsk Territory and ca 2300 km southwest to Guizhou Province. In view of the great distance between these currently known localities, we expect *R. nipponica* to be found in many other areas in East Asia in the course of future investigations.

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