The genus *Tuyamaella* (Lejeuneaceae, Marchantiophyta) new to Thailand

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Abstract: Promma, C., Chantanaorrapint, S. & Zhu, R.-L. 2017. The genus *Tuyamaella* (Lejeuneaceae, Marchantiophyta) new to Thailand. – Herzogia **30**: 74–79.

The genus *Tuyamaella* is reported from Thailand for the first time. Three species are recognized in Thailand, namely *T. angulistipa*, *T. hattorii* and *T. molischii* var. *molischii*. Description and illustrations of *T. hattorii*, a rare species previously known only from Vietnam and Laos, are provided.

Zusammenfassung: Promma, C., Chantanaorrapint, S. & Zhu, R.-L. 2017. Die Gattung *Tuyamaella* (Lejeuneaceae, Marchantiophyta) neu für Thailand. – Herzogia **30**: 74–79.

Die Gattung *Tuyamaella* wird erstmals aus Thailand angegeben. Drei Arten werden aus Thailand gemeldet: *T. angulistipa*, *T. hattorii* und *T. molischii* var. *molischii*. Eine Beschreibung und Abbildungen von *T. hattorii*, einer seltenen Art, die bislang nur von Vietnam und Laos bekannt war, werden geliefert.

Key words: Liverworts, rare species, *Tuyamaella hattorii*.

Introduction

Thailand has a rich bryophyte flora (He et al. 2012, Chantanaorrapint & Sridith 2014, Inuthai et al. 2014, 2015, Chantanaorrapint 2015, Promma & Chantanaorrapint 2015). The most recent checklist of Thai liverworts and hornworts contains 376 species in 84 genera (Lai et al. 2008). In recent years, several additions to the liverwort flora of Thailand have been reported (Kornochalert et al. 2010, 2012, He et al. 2012, 2013, Sukkharak 2013, Wei & Zhu 2013, Chantanaorrapint & Pócs 2014, Chantanaorrapint & Sridith 2014, Inuthai et al. 2014, 2015, Wang et al. 2014, Lee et al. 2014, Pócs & Podani 2015, Promma & Chantanaorrapint 2015, Pócs & Chantanaorrapint 2016, Shu et al. 2016), including three new generic records: *Jubula* Dumort. (Sukkharak 2013), *Plagiochasma* Lehm. & Lindenb. (Chantanaorrapint & Sridith 2014), and *Frullanoides* Raddi (Wang et al. 2014).

The genus *Tuyamaella* S.Hatt. (Lejeuneaceae) was first described by Hattori (1951) based on *Pycnolejeunea molischii* Schiffn. It is an Asiatic and Oceanic genus only with six species and two varieties (Söderström et al. 2016). Most species of the genus grow on living leaves, tree trunks and twigs. *Tuyamaella* can be recognized mainly by the following set of morphological features: 1) leaf lobule large, with two teeth at apex, attached to the stem by a single stem cell, 2) ental hyaline papilla at the lobule apex, 3) one obcordate underleaf with retuse to bifid apex

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for two lateral leaves, 4) stem in transverse section with seven cortical cells and three medullary cells, 5) androecia with bracteoles throughout, 6) pycnolejeuneoid leaf sequence of gynoecial innovations (Zhu & So 1998, 2001). In appearance the genus is easily confused with *Cololejeunea* (Spruce) Steph. However, *Cololejeunea* is distinguished at once by the absence of underleaves (Zhu & So 2001).

Tuyamaella is known from many neighboring countries of Thailand, e.g. Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Philippines, Papua New Guinea, and Vietnam (Zhu & So 1998, 2000, 2001, Singh & Dey 2010) but has not previously been reported for Thailand (Lai et al. 2008). Probably this is due to the scarcity of bryological surveys in this country (Sukkharak & Chantanaorrapint 2014). During recent bryological expeditions in Thailand, the genus was found in northern and peninsular Thai regions. Further studies confirm that *Tuyamaella* contains three species in Thailand, which can be keyed out in the following key.

Key to the species of *Tuyamaella* in Thailand

1. Margin of leaf lobe lacking hyaline border ..... ***T. angulistipa***
1* Margin of leaf lobe bordered by hyaline cells **2**

2 Underleaf apex retuse or nearly truncate; leaf lobules less than 1/3 as long as leaf lobes; first tooth of leaf lobule never hammer-shaped, hyaline papilla small, situated on inner surface of leaf lobule at proximal base of first tooth ..... ***T. hattorii***
2* Underleaf bilobed to 1/2 of their length; leaf lobules 2/5–2/3 as long as leaf lobes; first tooth of leaf lobule hammer-shaped, hyaline papilla very large, situated on inner surface of leaf lobule at middle base of first tooth ..... ***T. molischii*** var. ***molischii***

1. *Tuyamaella angulistipa* (Steph.) R.M.Schust. & Kachroo, J. Linn. Soc., Bot. 56: 508. 1961

≡ *Pycnolejeunea angulistipa* Steph., Hedwigia 35(3): 123. 1896. **Type:** Malaysia. Perak, 2170 m, Wray 1563 p.p. (G).

Tuyamaella angulistipa is easily separated from other species by the lejeuneoid leaf sequence of lateral branches and the lack of hyaline marginal leaf cells. The species has been well described and illustrated by Kachroo & Schuster (1961), Tixier (1973), Thiers (1983), and Zhu & So (2000).

Habitat and ecology: *Tuyamaella angulistipa* occurs on tree trunks, branches, sometimes also on living leaves, and rarely on decaying logs. The known altitudinal range of the species is 30–1950 m (Zhu & So 2000). In Thailand, this species was found on tree trunk in montane forests at 1330 m.

Distribution: Cambodia, China, India, Indonesia, Malaysia, Papua New Guinea, and Vietnam (Tixier 1973, Zhu & So 2000, Manju et al. 2012), new to Thailand.

Specimens examined: China, Hainan, Ledong Co., Jianfengling National Forest Park, Main Peak, 18°42'45.41"N, 108°52'33.30"E, 1070 m, 7 Aug. 2015, Rui-Liang Zhu et al. 20150807-96 (HSNU); Mingfenggu, 18°44'35"N, 108°50'34"E, 984 m, 16 Aug. 2015, Rui-Liang Zhu et al. 20150806-14 (HSNU). Malaysia. Pahang. Fraser's Hill. Epiphyllous, March 1929, R. E. Holttum s.n. p.p. (NY). **Thailand**, Nakhon Si Thammarat, Khao Luang National Park, Khao Luang, 8°29'25.04"N, 99°44'53.59"E, 1330 m, 19 Mar. 2013, S. Chantanaorrapint & C. Promma 2397 (HSNU, PSU).

2. *Tuyamaella hattorii* Tixier, Rev. Bryol. Lichénol. 31(3/4): 188. 1962 [1963]

Type: Vietnam, Blao, épixyle sur *Melanostoma* sp., en bordure de jardins de thé, 700 m, 5.VI. 1962, Tixier s.n. (PC not seen)

Plants pale yellowish green in herbarium, ca. 5–8 mm long. Shoots 1.9–2.2 mm wide, irregularly branched, leaf sequence of branches tuyamaelloid. Stem 80–100 µm in diameter, transverse section consis-

ting of 7 cortical cells and 3 medullary ones; ventral merophytes 2 stem cells wide. Rhizoids numerous, fasciculate, nearly hyaline or slightly brown, arising from rhizoid disk at base of underleaves, always wider than long. Leaves imbricate, spreading from stem at an angle of 70º–80º. Leaf lobes ovate, ± slightly falcate, plane, 0.95–1.28 mm long, 0.55–0.75 mm wide, apex rounded, dorsal margin usually strongly arched, margin almost entire, bordered by 1–3 rows of hyaline cells; marginal cells hyaline, rectangular, 15–34×12–18 µm, thin-walled without trigones and intermediate thickenings; median cells isodiametric to hexagonal, 18–27×16–27 µm, thin to slightly thick-walled, trigones medium-sized to rather large, intermediate thickenings occasionally seen; basal cells elongate, 22–50×12–17 µm, thin-walled, trigones large, intermediate thickenings frequently present. Leaf lobules ovate, inflated, 1/4 (–1/3) as long as the lobe, 0.24–0.32 mm long, 0.13–0.19 mm wide, free lateral margin usually incurved, bordered by over 15 quadrate to rectangular cells, apex obliquely truncate, with 2 teeth; first tooth 2–3 cells long, 1–2 cell wide at base; second tooth 1–2 cells long, sometime obsolete; hyaline papilla oblong, 14.5–19.5×8–10 µm, situated on the inner surface of the leaf lobule at proximal base of first tooth; keel arched. Underleaves remote, nearly transversely inserted to stem, broadly obcordate in outline, ca. 4 times as wide as stem, 0.28–0.32 mm long, 0.34–0.37 mm wide, always wider than long, apex retuse or nearly truncate, lateral margin slightly crenulate. Asexual reproduction not seen. Androecia not seen. Gynoecia terminal on short or long branches, with an athecal innovation, innovation leaf sequence pynolejeuneoid; bract lobe orbicular-ovate, ca. 1 mm long, ca. 0.75 mm wide, apex rounded, bract lobule small, ligulate to oblong, 1/4–1/3 as long as bract lobe, retuse or obtuse at apex; bracteole ligulate to oblong, ca. 0.42 mm long, ca. 0.28 mm wide, shallow bilobed, sinus V-shaped; perianth obovate, ca. 0.9 mm long, ca. 0.8 mm wide, 4-keeled (2 ventral, 2 lateral, ventral keel indistinct), surface smooth, beak long, 4–5 cells long, ca. 0.15 mm long. Sporophytes not seen.

Habitat and ecology: *Tuyamaella hattorii* is known only on living leaves (Tixier 1973). In Thailand this species was found in lowland forests at an altitude of ca. 300–500 m.

Distribution: Vietnam, Laos (Tixier 1973), new to Thailand. In Thailand this species seems to be very rare and is hitherto known only from a scanty sample from Umphang Wildlife Sanctuary in Tak.

Specimens examined: Laos, Paksong, 29 Dec. 1968, P. Tixier 4198 (PC, HSNU). **Thailand**, Tak, Umphang, Umphang Wildlife Sanctuary, Thi Lo Su Waterfall, 300–500 m, 25 Sept. 2009, Chantanaorrapint 2636B (HSNU, PSU).

Taxonomic notes: *Tuyamaella hattorii* can be recognized by the tuyamaelloid leaf sequence of branches, the leaf lobes with a hyaline border, the unbilobed underleaves with a retuse or nearly truncate apex, the second lobule tooth 1–2 cells long or obsolete, and the small hyaline papilla, situated on the inner surface of the leaf lobule at the proximal base of the first tooth (Fig. 1). The species is similar to *T. molischii* in having bordered leaves and branches with a tuyamaelloid leaf sequence. The latter species, however, is easily separated by the bilobed underleaves, larger leaf lobules with a hammer-shaped first tooth, and a very large hyaline papilla. The Thai plants of *T. hattorii* agree well with the description in Tixier (1973) even though the first tooth is only 2–3 cells long (2–5 cells long according to Tixier [1973]).

3. *Tuyamaella molischii* (Schiffn.) S.Hatt. var. ***molischii***, Nat. Sci. Mus. Tokyo 15: 76. 1944.

≡ *Pycnolejeunea molischii* Schiffn. ex Molisch, Pfl.-biol. Japan: 146. 1926. nom. nud.; Schiffn., Ann. Bryol. 2: 97. 1929. **Type:** Japan. Hiroshima Pref., Miyajilna I., Dec. 1924. Molisch s.n. (FH, W).

Tuyamaella molischii var. *molischii* is readily recognized by the tuyamaelloid leaf sequence of the branches, the hyaline border of the leaf lobes, deeply bilobed underleaves, and the first lobule tooth 1–2 cells long with a hammer-shaped terminal cell. *Tuyamaella molischii* contains three varieties, which were well illustrated and described by Mizutani (1961), Kachroo & Schuster (1961), Tixier (1973), Thiers (1983), Zhu & So (2001).

Habitat and ecology: *Tuyamaella molischii* var. *molischii* occurs on living leaves, tree trunks, branches, and decaying logs at altitudes of 600–1600 m (Zhu & So 2000). The Thai collections are from living leaves in montane forests at altitudes between 980 and 1460 m.

Distribution: China, Japan, Malaysia, and Vietnam (Tixier 1973, Zhu & So 2000, Zhu & So 2001, Zhu & Lai 2003), new to Thailand. *Tuyamaella molischii* var. *molischii* is the most common member of *Tuyamaella* in East Asia.

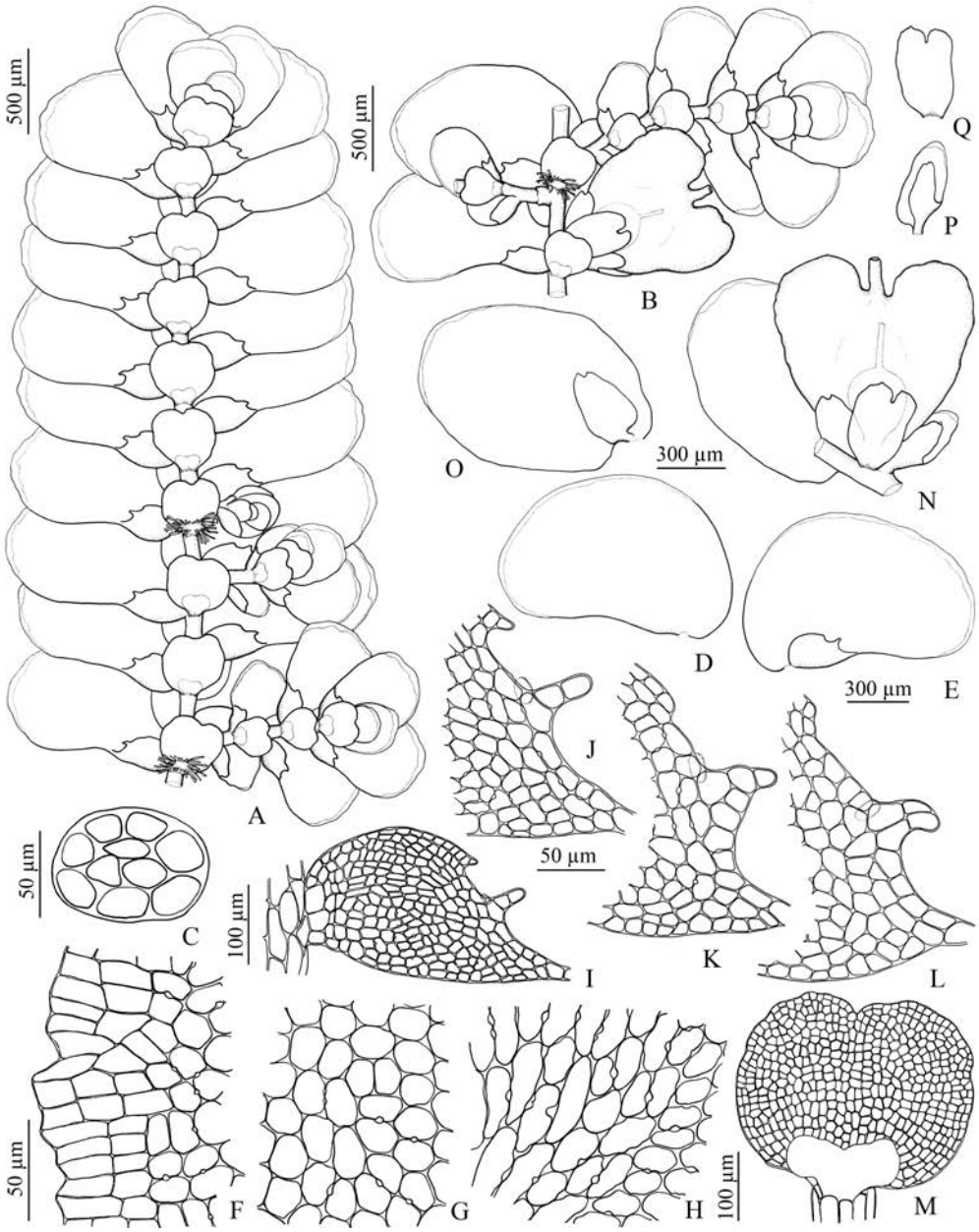

Fig. 1: *Tuyamaella hattorii* Tixier. **A**–**B** – Portions of plant, ventral view, **B** – with gynoecium branch, **C** – Transverse section of stem, **D**–**E** – Lateral leaves, **D** – dorsal view, **E** – ventral view, **F** – Apical marginal cells of leaf lobe, **G** – Median cells of leaf lobe, **H** – Basal cells of leaf lobe, **I** – Leaf-lobule, **J**–**L** – Apices of leaf lobules, **M** – Underleaf, **N** – Gynoecium, **O**–**P** – Female bracts, **Q** – Female bracteole. All drawn from S. Chantanaorrapint 2636B (PSU).

Specimens examined: China, Guangdong, Shenzhen, Yantian, Meishajian, 22°36.947'N, 114°16.703'E, 430 m, 15 Oct. 2007, Rui-Liang Zhu et al. 20071015-48 (HSNU); Guangxi, Shangsi Co., Fangchenggang City, Shangsi Co, Shiwandashan National Forest Park, Sanchahe, 21°53. 689′N, 107°54. 384′E, epiphyllous, 382 m, Rui-Liang

Zhu et al. 20100822-41D (HSNU); Zhejiang, Longquan, Fengyangshan National Nature Reserve, 27°53.18.8′N, 119°10.10.4′E, on tree trunks, 28 Jul. 2006, Rui-Liang Zhu et al. 20060728-36. **Thailand**, Nakhon Si Thammarat, Khao Luang National Park, Khao Luang, 8°29'28.21"N, 99°44'43.82"E, 1460 m, 18 Mar. 2013, S. Chantanaorrapint & C. Promma 2268 (HSNU, PSU); Khao Nan National Park, San Yen, 1200 m, Apr. 2008, S. Chantanaorrapint 1752 (EGR); Khao Ramrome Mt., ca. 980 m, 7 Mar. 2016, S. Chantanaorrapint & O. Suwanmala 168D (PSU). **Vietnam**, Tam Dao National Park, 1100 m, 21 Jul. 2001, M.-J. Lai 20010721-13 (HSNU), Cuc Phuong National Park, 600 m, 20 Aug. 2001, M.-J. Lai 20010820-12 (HSNU).

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