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Studies on the genus *Thysananthus* (Marchantiophyta: Lejeuneaceae) 1. *Thysananthus discretus* Sukkharak *et* Gradst. sp. nov.

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Abstract – The liverwort, *Thysananthus discretus* Sukkharak *et* Gradst. sp. nov. (Lejeuneaceae) is described from Western Melanesia (New Guinea, Solomon Islands). The new species stands out within *Thysananthus* on account of the leaves when moist clasping the stem, free underleaf bases with the well-developed auricles, and the strongly rigid stems with 14-18 cells wide ventral merophytes.

Lejeuneaceae / liverworts / morphology / taxonomy / *Thysananthus discretus* / Western Melanesia

INTRODUCTION

Thysananthus Lindenb. is a member of Lejeuneaceae subfamily Ptychanthoideae Mizut. (Mizutani, 1961; Gradstein, 1975) and probably contains about ten species, growing as epiphytes in rain forests and montane cloud forests throughout the tropics. The centre of diversity of the genus is in Southeast Asia with eight species occurring in the area (*T. aculeatus* Herzog, *T. appendiculatus* Steph., *T. comosus* Lindenb., *T. convolutus* Lindenb., *T. mollis* Steph., *T. montanus* Gradst. *et al., T. retusus* (Reinw. *et al.*) B. Thiers *et* Gradst. and *T. spathulistipus* (Reinw. *et al.*) Lindenb.). One species is known from the New World tropics (*T. amazonicus* (Spruce) Schiffn.).

In the course of a world-wide revision of *Thysananthus* we found that some collections from New Guinea and Solomon Islands represent a hitherto undescribed taxon. The new species, *Thysananthus discretus* Sukkharak *et* Gradst., is described and illustrated in this paper. In addition a key to the species is provided.

SYSTEMATIC TREATMENT

Thysananthus discretus Sukkharak *et* Gradst., **sp. nov.** **Figs 1-21**

Type. Indonesia, Papua ["Netherlands New Guinea, distr. Hollandia"], Cycloop Mountains, path Ifar-Ormoe, alt. 1220 m, 21 Aug 1961, *Royen & Sleumer 5896* (**holotype**, L; **isotypes**, JE, S). The epithet *discretus* refers to the free underleaf bases, which are not connate with the leaves.

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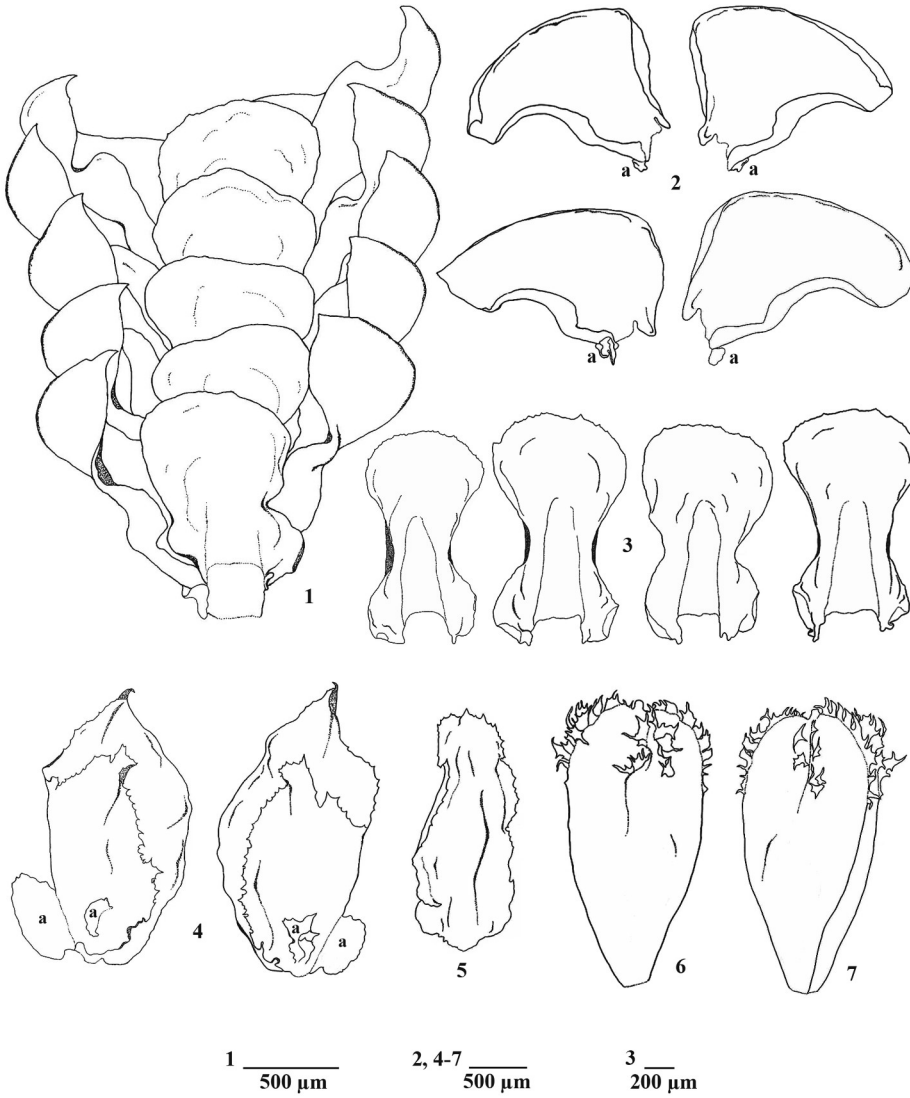
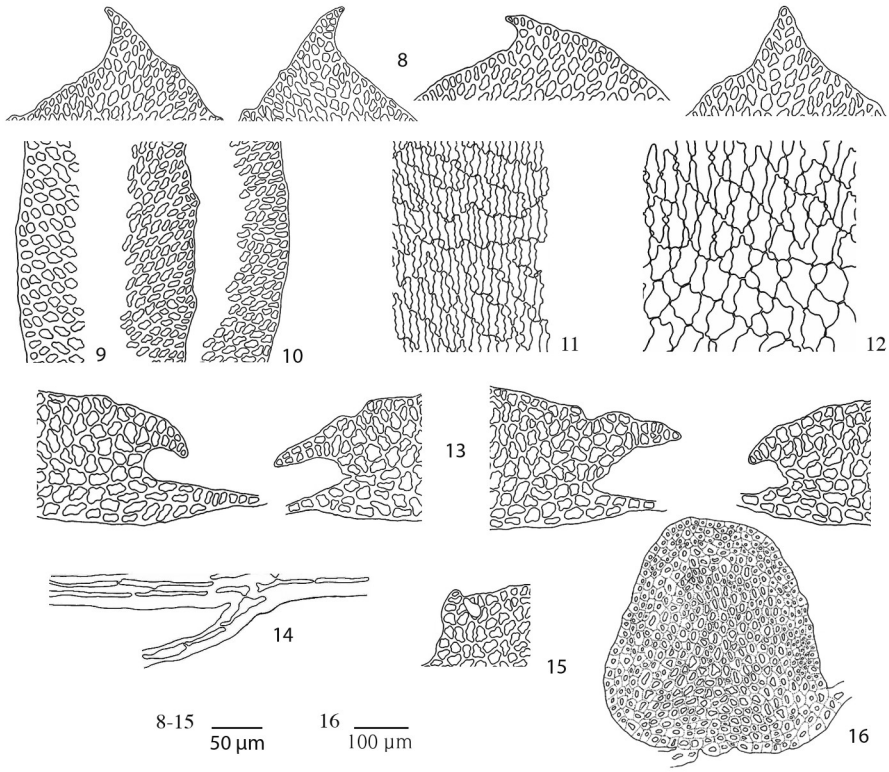


Figs 1-7. *Thysananthus discretus* Sukkharak *et* Gradst. **1.** Portion of shoot, ventral view. **2.** Leaves, ventral view. **3.** Underleaves. **4.** Female bracts. **5.** Female bracteole. **6.** Perianth, dorsal view. **7.** Perianth, ventral view. (1-3 from the holotype; 4-7 from *Royen & Sleumer 5907* [L]). a = appendage.

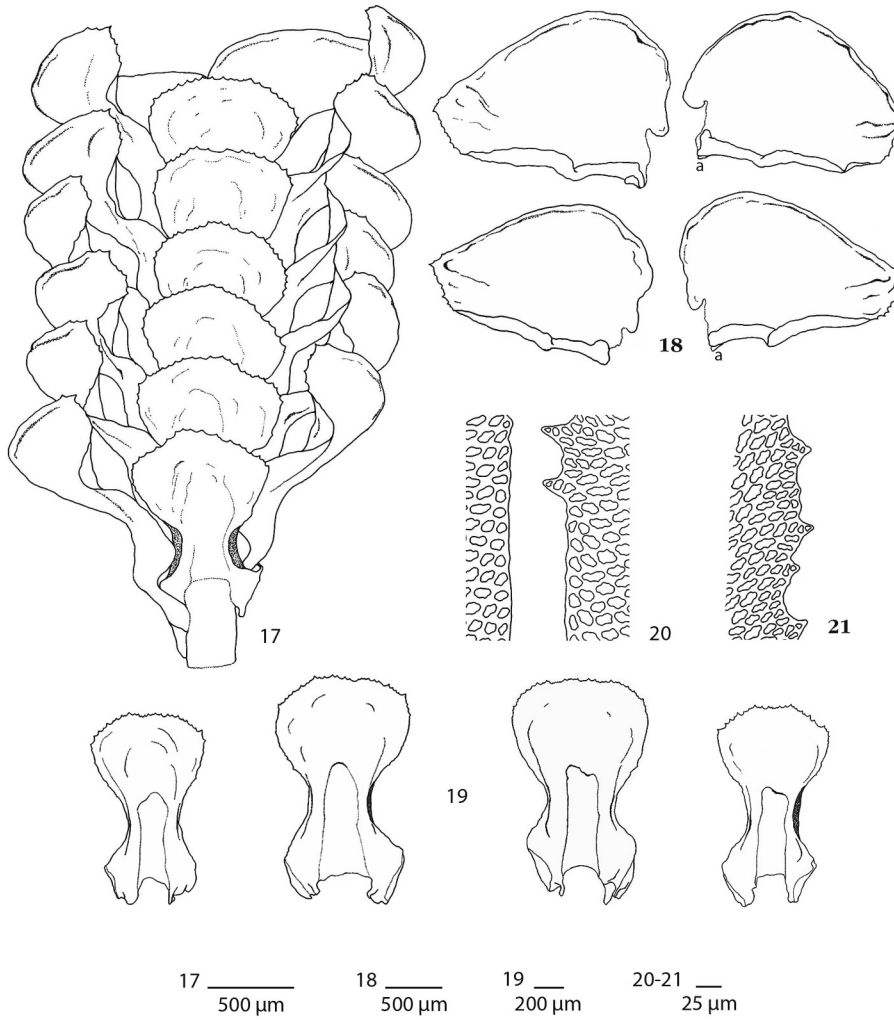
Caulis rigida, 14-18 cellulis lata ventralibus. Folia asymmetrica rotundata. Amphigastria libera, ad basim auriculata.

Plants with vigorous shoots, yellowish brown in herbarium specimens, up to 6.5 cm long × 2-3 mm wide, habit deliquescent with projecting growth, turning upwards and becoming ascending to erect, irregularly (1)-pinnate, branches *Lejeunea*-type. ***Stems*** strongly rigid; ventral merophyte 14-18 cells wide; in cross



Figs 8-16. *Thysananthus discretus* Sukkharak *et* Gradst. **8.** Leaf apices. **9.** Dorsal margin cells of leaf lobe. **10.** Ventral margin cells of leaf lobe. **11.** Median cells of leaf lobe. **12.** Basal cells of leaf lobe. **13.** Leaf lobule apices. **14.** Underleaf base in longitudinal section. **15.** Inner surface of lobule apex showing hyaline papilla. **16.** Cross section of stem. (All from the holotype).

section orbicular-subelliptic in shape, 360-500 µm high × 260-445 µm wide, composed of 76-80 epidermal cells surrounding 365-381 medullary cells in 16-22 layers, epidermal cells not larger than medullary cells, all cells with thickened walls, walls of epidermal cells brownish, those of medullary cells hyaline. ***Leaves*** imbricate, when dry suberect and strongly convolute, when moist clasping the stem (not spreading outwards), attached to the axis along a J-shaped line of insertion and covering the whole length of the straight lateral merophytes; dorsal lobes asymmetrically ovate, 1.4-2.3 × 1-1.8 mm, strongly concave in ventral view, apex apiculate, dorsal base auriculate, auricle 100-150 × 125-160 µm, dorsal margin entire or with 1-4 triangular teeth, the teeth consisting of up to 4 cells, being 2-3 cells wide at base and ending in a row of 1-2 cells, ventral margin upcurved over most of its length, becoming flat near the apex, entire or with 3-8 triangular teeth, the teeth consisting of up to 5 cells, 2-3 cells wide at base and ending in a row of 1-2 cells; leaf cells elongate-hexagonal with acute ends, marginal lobe cells 10-12 × 10-12 µm, median cells 32-45 × 5-7 µm, basal cells 37-62 × 17-25 µm, vitta cells absent, cells wall thick, trigones large, cordate to bulging and irregularly rounded, often becoming coalesced, intermediate thickenings 0-1 per cell wall, the cell lumen appearing vermicular; oil bodies *Calypogeia*-type, 4-5 per cell, toward leaf base more numerous, up to 8 per cell (*Gradstein 3894*). ***Lobules*** rectangular,



Figs 17-21. *Thysananthus discretus* Sukkharak *et* Gradst. **17.** Portion of shoot, ventral view. **18.** Leaves, ventral view. **19.** Underleaves. **20.** Dorsal margin cells of leaf lobe. **21.** Ventral margin cells of leaf lobe. (All from *Streimann 13622* [JE]). a = appendage.

0.6-0.7 × 0.1-0.2 mm, ± 1/4× lobe length, inflated, keel curved, the surface smooth; foliar appendages under keel on one or both sides or not developed, orbicular-oblong, 215-375 × 85-150 µm; the free margin and keel meeting each other at an oblique angle of ca. 45°, free margin slightly upcurved, apex with one triangular tooth, the tooth consisting of 5-12 cells, 2-4 cells wide at base and ending in a row of 1-2 cells; hyaline papilla pyriform, 25-27× 12-15 µm, at or near the proximal base of the tooth on the inner surface of the lobule. ***Underleaves*** imbricate, broadly oblong to rectangular, 1.2-1.9 × 0.8-1.4 mm, 2-2.5× stem width, apex broadly rounded to truncate, toothed, the teeth consisting of 1-6 cells, 2-3 cells wide at base and ending in a row of 1-2 cells, margins entire, recurved, central region gibbous, underleaf bases auriculate, the auricles 100-275 × 200-400 µm,

underleaf bases not connected with leaves, insertion line slightly arched; cells 20-25 × 5-7 µm, becoming longer towards the base of the underleaf; underleaf attachment bistratose. ***Dioicous***. ***Androecia*** terminal-intercalary on lateral branches, bracts and bracteoles in 6-10 pairs, bracts hypostatic, ovate, 0.7-0.8 × 0.5-0.6 mm, apex acute, margins entire, lobules strongly inflated; bracteoles similar to underleaves; antheridia 2 per bract. ***Gynoecia*** terminal on elongated branches, with 2 lejeuneoid innovations, innovations repeatedly fertile, forming a dichasial pattern; bracts in one pair, obliquely spreading to subsquarrose, lobe ovate, 2.4-2.7 × 1.2-1.5 mm, apex apiculate, with 8-9 triangular teeth, the teeth consisting of 3-5 cells, 2-3 cells wide at base and ending in a row of 1-2 cells, appendages under keal on one or both sides or not developped, orbicular-oblong 48-95 × 25-55 µm; lobules broadly ovate, 2/3× lobe length, apex apiculate, appendages on middle of basal part or not developped, orbicular-oblong 30-42 × 13-25 µm; bracteoles spathulate, 2.3-2.4 × 1.1-1.3 mm, apex emarginate, 1/2× bracteole length with triangular teeth, the teeth consisting of 3-7 cells, 2-3 cells wide at base and ending in a row of 1-2 cells, margins entire, slightly recurved, central region gibbous. ***Perianths*** exserted to 1/2, oblong, 2.5-2.6 × 1.1-1.3 mm, apex truncate, surface sharply 3-keeled, keels in upper 1/3 with numerous laciniate teeth, the teeth 3-9 cells long; beak 97-125 µm, 4-7 cells long; appendages on basal part of keel or not developped. **Sporophyte** not seen.

Chemistry: sesquiterpenes, diterpenes and sterols (Gradstein *et al.*, 1985, under *T. convolutus* sample nr. 49).

Distribution and ecology: *Thysananthus discretus* is thus far known only from Western Melanesia: Papua (Indonesia), Papua New Guinea and the Solomon Islands. It occurs in rain forests and montane cloud forests and was collected at 760-2700 m. The new species grows as an epiphyte on tree trunks, branches and stems of treelets. In the view of its local abundance, it indicates that the flora of Western Melanesia still remains poorly known and that exciting discoveries may still be made in this floristically unusually rich part of the world.

Additional illustration: Gradstein *et al.* (2002, p. 73, Fig. 45, as *T. convolutus*).

Specimens examined:

INDONESIA. PAPUA: the type specimens; Cycloop Mts., *Royen & Sleumer 5907* (JE, L). — **WEST PAPUA:** Eipomek-Tal, 4° 25' S 140° 01' E, *Hiepko & Schultze-Motel 2218, 2403* (JE).

PAPUA NEW GUINEA. CENTRAL: Boridi, *Carr 13531* (JE). — **EASTERN HIGHLANDS:** Daulo Pass, 6° 03' S 145° 14' E, *Streimann 17990* (JE); Gahavisuka Provincial Park, 6° 01' S 145° 25' E, *Streimann 18201* (JE). — **MOROBE:** Wau, Mt. Kaindi, *Gradstein 3778, 3856, 3894, 3910* (GOET), *Schuster 67-5786, 67-5787, 67-5792, 67-5791/c, 67-6282* (JE), *Streimann 22497* (JE, LAE), *Streimann & Bellamy 17690* (JE, S, W); Araulu logging area, 7° 28' S 146° 48' E, *Streimann 13622* (JE, LAE); Slate Creek & Gumi Creek Divide, 7° 10' S 146° 28' E, *Streimann 13861* (JE); Spreader Divide, 7° 16' S 146° 06' E, *Streimann & Tamba 11878* (JE, LAE), *Streimann 11846* (LAE), *Streimann 26036* (JE); Aseki-Bulolo Road, *Streimann 20051, 20103*, *26135* (JE). — **WESTERN HIGHLANDS:** Jimi-Waghi Divide, 5° 43' S 144° 38' E, *Streimann 20916* (JE, LAE), *20911* (LAE).

SOLOMON ISLANDS. GUADALCANAL: Mt. Papomanatsen, *Braithwaite 4773* (JE).

DISCUSSION

Thysananthus is subdivided into two subgenera, subgen. *Thysananthus* and subgen. *Sandeanthus* B. Thiers *et* Gradst., based on differences in leaf position and areolation (Thiers & Gradstein, 1989). The new species *T. discretus* is a member of

subgenus *Thysananthus* and is recognized the underleaf bases, which are not connate with the leaves, the presence of well-developed auricles at underleaf bases, the strongly rigid stems with 14-18 cells wide ventral merophytes, and the leaves which, when moist, are clasping the stem. Free underleaf bases, which are not connate with the leaves, is an unusual character in *Thysananthus* and occur otherwise in the New Guinean endemics *T. mollis* and *T. montanus*, and (occasionally) in the widespread *T. retusus*. These three species are readily distinguished from *T. discretus* by the vittate leaves. All other species of *Thysananthus* have leaves that are connate with the underleaf bases on one side (Sukkharak & Gradstein, submitted). The differences between *T. discretus* and other members of the genus are shown in the key to species of *Thysananthus* given below.

Collections of *Thysananthus discretus* were previously identified as "*T. appendiculatus*", "*T. convolutus*", or "*T.* sp.". The new species is most closely related to widespread Malesian *T. convolutus* and was illustrated as *T. convolutus* by Gradstein *et al.* (2002: Fig. 45). The illustration clearly shows the free underleaves characteristic of the new species, which are not connected with the leaves, and the presence of well-developed auricles at the underleaf bases. *T. discretus* shares with *T. convolutus* the asymmetric leaves but differs from the latter by (1) leaves when moist clasping the stem (squarrose in *T. convolutus*), (2) free underleaf bases, with well-developed auricles (underleaf bases connate with leaves on one side and without auricles in *T. convolutus*), and (3) strongly rigid stems, with 14-18 cells wide ventral merophytes and medulla 16-22 cell layers high (less rigid stems, with 8-10 cells wide ventral merophytes and 14-17 layers high medulla in *T. convolutus*). The new species may also be confused with *T. appendiculatus*, a species endemic to New Guinea which may possess auricled underleaf bases like *T. discretus*. However, the leaf lobes in *T. appendiculatus* are symmetric and widely spreading when moist, while in *T. discretus* they are asymmetric and clasping the stem when moist. In addition, leaf and underleaf bases are connected in *T. appendiculatus* while in *T. discretus* they are never connected.

A foliar appendage is developed at the base of the keel in leaves (Figs 2, 18) and bracts, the mid-basal portion of bract lobules (Fig. 4), and perianths of *Thysananthus discretus*. Foliar appendages may occur on bracts and perianths in all species of *Thysananthus* but are rare on vegetative leaves (only in *T. discretus*, *T. appendiculatus* and *T. convolutus*; Sukkharak & Gradstein, submitted). In *T. discretus* the appendages are present on one or both sides of the stem and are sometimes lacking, while in *T. appendiculatus* and *T. convolutus* they are always found on one side of the stem only, on leaves that are free from underleaf bases and opposite to leaves that are connected with underleaf bases. Moreover, the foliar appendages of *T. convolutus* are always curved towards the stem while in *T. discretus* and *T. appendiculatus* they are straight or curved.

Thysananthus discretus is a rather polymorphic species with respect to the dentation of leaves, which varies from edentate (Figs 1, 2) to ± strongly dentate (Figs 17, 18). The variation in leaf dentation observed in *T. discretus* is not uncommon in Lejeuneaceae, however, and also occurs in, e.g., *T. convolutus*, *Bryopteris filicina* (Swartz) Nees (Gradstein, 1994), *Archilejeunea planiuscula* (Mitt.) Steph. (Thiers & Gradstein, 1989; Gradstein *et al.*, 2002), and in the genus *Lejeunea* (Reiner-Drehwald & Goda, 2000).

Key to the species of *Thysananthus*

1. Leaves when dry convolute. Leaf cells elongate (*Thysananthus* subgen. *Thysananthus*) 2

1. Leaves when dry widely spreading, loosely reflexed or plane. Leaf cells (except for vitta) subisodiametric (*Thysananthus* subgen. *Sandeanthus*) ..... *T. retusus*
   2. Leaf lobes without vitta. Underleaf bases free or connected with leaves on one side 3
   2. Leaf lobes with vitta. Underleaf bases free 9
3. Leaf lobes asymmetrical with the apex positioned towards the ventral side of the leaves 4
3. Leaf lobes symmetrical, apex not positioned towards the ventral side of the leaves 8
   4. Leaves when moist squarrose or clasping the stem. Underleaf bases free or connected with leaves on one side 5
   4. Leaves when moist spreading out widely. Underleaf bases connected with leaves on one side 6
5. Ventral merophyte 14-18 cells wide. Leaves when moist clasping the stem. Underleaf bases free, with well-developed auricles ..... *T. discretus*
5. Ventral merophyte 8-10 cells wide. Leaves when moist squarrose. Underleaf bases connected with leaves on one side, without auricles ..... *T. convolutus*
   6. Underleaves spathulate, recurved. Male bract lobules epistatic or hypostatic. Neotropical ..... *T. amazonicus*
   6. Underleaves obovate, flat or channeled/hollow. Male bract lobules hypostatic. Paleotropical 7
7. Dorsal base of leaves auriculate. Underleaves flat. Perianth laciniate, teeth 3-5 cells long ..... *T. comosus*
7. Dorsal base of leaves without auriculate. Underleaves channeled/hollow. Perianth dentate, teeth 1-2 cells long ..... *T. aculeatus*
   8. Keel of leaves on one side of the stems with a foliar appendages (on the side where leaves and underleaves are free) ..... *T appendiculatus*
   8. Keel of leaves without foliar appendage ..... *T. spathulistipus*
9. Leaves when dry convolute or laterally appressed to the stem. Leaves lanceolate, toothed ..... *T. mollis*
9. Leaves when dry convolute. Leaves oblong, entire ..... *T. montanus*

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