




Taxonomy and morphology of *Thalictrum* (Ranunculaceae) in New Guinea

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Summary. The genus *Thalictrum* L. in New Guinea is revised based on morphological evidence. Full descriptions of the genus and the four taxa recognised are given. Two species are recognised: *Thalictrum papuanum*, widespread across New Guinea, and a new species described here; *T. umbraticola*, endemic to west New Guinea. Two new varieties are described: *Thalictrum papuanum* var. *acutisegmentum* and *T. papuanum* var. *laticarpellum*. One new synonym of *Thalictrum papuanum* var. *papuanum* is established: *T. papuanum* var. *oranjense*. Keys to the taxa and distribution maps, as well as preliminary conservation assessments, are provided.

Key Words. Conservation, Indonesia, IUCN, Malesia, new species, systematics.

Introduction

Ranunculaceae are a cosmopolitan family that includes many well-known temperate wildflowers and ornamental plants, including buttercups, hellebores and anemones, as well as several pharmaceutically important taxa. According to the Plants of the World Online (POWO 2019), there are 52 accepted genera and 3766 accepted species of Ranunculaceae. The family is distributed almost worldwide but is most diverse in temperate and colder regions; it is relatively rare in the tropics (Culham 2007). Ranunculaceae are thought to have originated in montane temperate areas of the northern hemisphere (Ziman & Keener 1989). The family shows a wide variation in morphological characters, especially in floral organisation and fruit types (Tamura 1995). In New Guinea, three genera are present: *Clematis* L., *Ranunculus* L. and *Thalictrum* L. (Cámara-Leret *et al.* 2020). Ranunculaceae of Malesia have been revised by Eichler (1958), and the alpine species have been treated by van Royen (1982) and more recently in Utteridge (2006). Most species occur at high elevations; for example, in a checklist of Mt Trikora, Mangen (1993) documented 16 species of Ranunculaceae, with 14 taxa above and only two taxa below 3000 m.

As part of ongoing research into the plant diversity and conservation of New Guinea at the Royal Botanic Gardens, Kew, the genera of Ranunculaceae on the island are being revised as the first stage towards a *Flora Malesiana* account. As part of this work, a revision of *Thalictrum* is presented here. Upon investigation it was found that the existing species, *Thalictrum papuanum*, did not fit all the material examined

during this work. To account for all the variation, a new species was described as well as two further varieties.

The genus *Thalictrum* was first described by Linnaeus (1753: 545) and is considered one of the most diverse genera in the family in terms of the number of species and their morphological variation (Tamura 1995). It has T(= *Thalictrum*)-type chromosomes with the basic chromosome number $x = 7$ (Tamura 1993) and is included in the subfamily Thalictroideae (Wang *et al.* 2009). *Thalictrum* has great medicinal value as several species contain high levels of an anti-tumour drug, Thaliblastin (Thalicarpine) (Chen *et al.* 1993; Pajeva *et al.* 2004). All seeds of *Thalictrum* species investigated so far contain four unusual and diagnostically important fatty acids; two of these are the same as in *Aquilegia* L., whereas two have not been found in any other genus in Ranunculaceae (Aitzetmüller 1994). Comprising over 200 species (POWO 2019), *Thalictrum* is distributed in Eurasia, Americas, Africa and New Guinea (Mabberley 2008; Stevens 2001 onwards). In New Guinea it is represented by four endemic taxa (two species and two varieties).

Materials and Methods

Herbarium material and especially types deposited at B, BM, BO, CANB, E (online), GH, K, L, LAE, LUX (online), MU, P (online) and SING (online) were examined. Herbarium acronyms follow *Index Herbariorum* (Thiers, continuously updated). All cited specimens have been seen by the first author. Material was examined under a Leica M165 C binocular microscope at maximum magnification.

Nomenclatural practice follows Turland *et al.* (2018). Characters listed in the protologues and descriptions were compared to those present in herbarium material. Morphological terms follow Beentje (2016). Localities were manually georeferenced using locality information from herbarium specimens, paper maps and electronic gazetteers. Maps were made using Simple Mapp (Shorthouse 2010) with additional layers showing countries and relief. Assessment of conservation status was implemented using GeoCAT (Bachman *et al.* 2011) and follows the IUCN (2012) criteria.

Taxonomic Treatment

Thalictrum L. (Linnaeus 1753: 545); Linnaeus (1754: 242); van Royen (1982: 1293–1294); Riedl & Nasir (1991: 95–111); Riedl (1992); Akeroyd (1993: 290–292); Rau (1993: 132–143); Tamura (1993: 581–582); Tamura (1995: 474–475); Park & Festerling (1997: 258–271); Stace (1997: 95); Fu & Zhu (2001: 282); Park & Park (2008: 433–458, 2009: 89–99); Tamura (2011: 68); Soza *et al.* (2012: 180–192); Wang (2018: 56–57). Type: *Thalictrum foetidum* L. (Linnaeus 1753: 545; see Jarvis 1993: 883–884).

Perennial *herbs*; glabrous, sometimes puberulous or with glandular hairs. *Roots* fibrous, sometimes tuberous. *Stems* often sulcate and branched, glabrous,

sometimes glandular. *Petioles* sheathing at base. *Leaves* basal and cauline, usually stipulate, 1–4 pinnate or ternate, rarely simple; basal leaves few to several, sometimes withered at flowering, petiolate; cauline leaves alternate, rarely opposite or verticillate, petiolate or sessile. *Leaflets* cordate to reniform, obovate, lanceolate to linear; margin lobed or crenate. *Inflorescence* terminal, occasionally also axillary, a cyme, a raceme or a panicle, sometimes reduced to a single flower. *Bracts* 1–2 (–3), leaf-like or absent. *Flowers* small, bisexual, rarely unisexual, actinomorphic. *Sepals* (3–) 4–5 (–10), petaloid, flat, white, yellowish-green, pink or purple, reniform or spatulate to lanceolate, 1–18 mm long, caducous in fruit. *Petals* absent. *Stamens* 5–many, usually more conspicuous than sepals; filaments linear, filiform to clavate or dilated above; anthers lateral, oblong to linear. *Carpels* free, 1-ovulate; style straight or hooked, usually persistent; stigma linear or deltoid. *Fruit* a head of achenes; achenes free, not to strongly compressed on both sides, body 1–3-ribbed on lateral sides, sessile or stipitate; persistent style short or long, straight, hooked to circinate (description includes taxa from outside New Guinea).

DISTRIBUTION. About 190 species, worldwide, mainly in temperate regions; two species in New Guinea.

Key to the species of *Thalictrum* in New Guinea

Herbs 4–30 cm tall. Petiole of cauline leaves 1–10 mm, petiolule of cauline leaves 1–5 mm. Inflorescence 1–3 (–4)-flowered. Achenes 3–5.5 × 0.5–1.5 mm, 3-ribbed. Elevation 2300–4000 m **1. T. papuanum**
Herbs (20–) 25–45 cm tall. Petiole of cauline leaves 13–23 mm long, petiolule of cauline leaves 5–15 mm. Inflorescence 4–6-flowered. Achenes 3.5–5.5 × 0.5 mm, 1–2-ribbed. Elevation 1200–1300 m **2. T. umbraticola**

1. *Thalictrum papuanum* Ridl. (Ridley 1916: 10); Eichler (1958: 6–7); van Royen (1982: 1294–1296); Tamura (1995: 487); Utteridge (2006: 416–418).

For type and synonyms see varieties.

Glabrous *herb*, 4–30 cm tall. *Roots* fibrous, rhizome slender. *Stems* erect, simple or occasionally branched. *Basal leaves* 1–9, blades (0.8–) 1.5–3 × (0.5–) 1–2.5 (–3) cm, biternate with 9 leaflets or sometimes tri-foliolate; petiole (1–) 1.5–6 (–8) cm; rachis (0.2–) 1–2.5 cm long; petiolule 0.1–1 cm long or leaflets sessile; terminal leaflet broadly elliptic, ovate to rhombic-ovate or suborbicular, (2.5–) 3–15 × 3–15 mm, 3–7-lobed, sometimes lobes crenate. *Cauline leaves* 1–2, alternate, tri-foliolate, biternate with 9 leaflets or simple; petiole 1–10 mm; rachis (1–) 2–5 mm; petiolule (0.5–) 1–5 mm long; terminal leaflet broadly elliptic to orbicular ovate, 3–9 (–13) × 3–11 (–12) mm, 3–5 (–7)-lobed, prominently palmately veined, base rounded,

sometimes cuneate to subcordate, apex sharply acuminate, mucronate to mucronulate, sometimes rounded, margin usually revolute. *Inflorescence* racemose, 2–3 (–4)-flowered, often reduced to a single flower; peduncle up to 6 cm long, sometimes slender and purple distally with white corms; pedicel erect or slightly recurved, (0.2–) 0.5–2 (–3) cm long. *Bracts* 1–2, simple, leaf-like, 1–5 mm long, ovate to lanceolate, entire or 1–3-lobed, shortly petiolate. *Flowers* bisexual, 4–8 (–10) mm across. *Sepals* 4–5, ovate to elliptic, 2–3 × 1–2 mm, white, purple or pink. *Stamens* 5–25; filaments white, pink to purplish, (1.5–) 2.5–3 (–3.5) × (0.25–) 0.5–1 mm, widest in the top third, base filiform, apex narrowly linear, narrower than anther. *Anther* 0.4–0.9 × 0.2–0.5 mm, obtuse at apex, connectives not projected. *Carpels* 6–14, erect, 2–4.5 × 0.5–1.1 mm, fusiform; at base 0.5–1.5 mm stipitate; style circinnately coiled inwards, (0.4–) 0.7–1.4 mm long; stigmatic surface along distal (0.3–) 0.5–1 mm of the style. *Achenes* 6–14, erect at first, later curving downwards, light purple to deep

pink, fusiform, falcate or obovate to lanceolate, compressed to strongly compressed, (2.3–) 3–5.5 × 0.5–1.5 mm, body 3-ribbed, dorsal suture straight or slightly convex or

concave, ventral suture strongly convex, at base (0.5–) 1–2.2 mm stipitate; style (0.5–) 1–2 mm long, circinnately coiled inwards.

Key to varieties:

1. Herbs 10–13 cm tall. Cauline leaves usually biternate with 9 leaflets. Leaflets sharply acuminate to mucronate at apex. Inflorescence 3 (–4)-flowered. Achenes 0.5–0.8 mm wide. Elevation 2300 m **b. var. acutisegmentum**
Herbs 4–30 cm tall. Cauline leaves tri-foliolate or biternate with 9 leaflets. Leaflets mucronulate at apex. Inflorescence 1–2 (–3)-flowered. Achenes 0.8–1.5 mm wide Elevation 2800–4000 m **2**
2. Herbs 5–7 cm tall. Petiole of basal leaves (1–) 1.5–3 (–4) cm. Cauline leaves usually biternate with 9 leaflets. Terminal leaflets of basal and cauline leaves the same size 3–6 × 3–6 mm. Achenes obovate to lanceolate, up to 1 mm stipitate. Elevation 3500 m **c. var. laticarpellum**
Herbs 4–30 cm tall. Petiole of basal leaves (1–) 2–6 (–8) cm. Cauline leaves usually tri-foliolate. Terminal leaflets of basal leaves larger than terminal leaflets of cauline leaves. Achenes falcate, at base (0.5–) 1–1.8 mm stipitate. Elevation 2800–4000 m **a. var. papuanum**

Thalictrum papuanum Ridl. var. **papuanum** (Ridley 1916: 10). Type: [Indonesia. Papua Province: Mt Jaya], Camp XIII–XIV, 13 Jan. 1913, *Kloss* s.n. (holotype BM!; isotype K!).

Thalictrum papuanum var. *oranjense* H.Eichler (1958: 7) **synon. nov.** Type: Indonesia. Papua Province: Oranje Mountains, Waterval biwak, 12 Feb. 1913, *Versteeg* 2474 (holotype L!; isotype BO!).

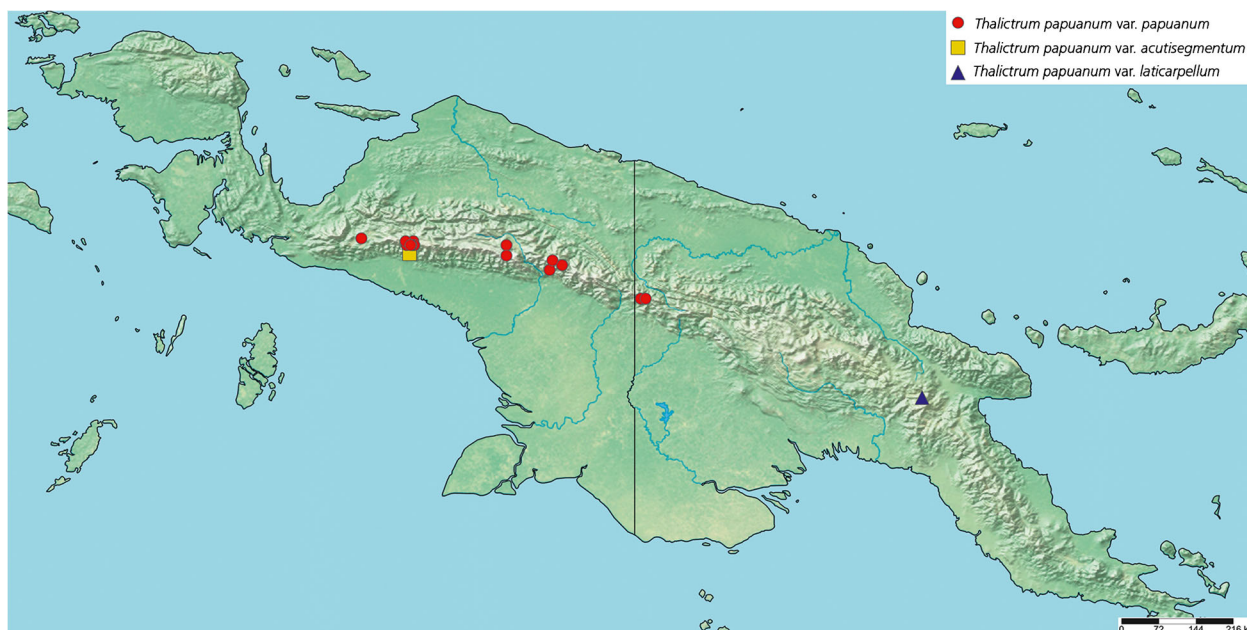
Herb, 4–30 cm tall. *Basal leaves* 1–8, blades (0.8–) 1.5–2.5 × (0.5–) 1–2.5 cm, biternate with 9 leaflets or sometimes tri-foliolate; petiole (1–) 2–6 (–8) cm; rachis (0.2–) 1–2.5 cm; petiolule 1–10 mm or leaflets sessile; terminal leaflet broadly elliptic, ovate or suborbicular, (2.5–) 10–15 × (3–) 8–15 mm, 3–5-lobed. *Cauline leaves* usually tri-foliolate, sometimes simple; petiole 1–10 mm; rachis (1–) 2–5 mm; petiolule (0.5–) 1–5 mm long; terminal leaflet (4–) 6–9 (–13) × (3–) 8–11 (–12) mm, 3–5 lobed, mucronulate at apex. *Inflorescence* 1–2 (–3)-flowered, peduncle up to 6 cm long; pedicel (0.2–) 0.5–1.5 (–3) cm long. *Bracts* 1–5 mm long, ovate to lanceolate, entire or 1–3-lobed. *Flowers* (4–) 6–8 (–10) mm across. *Sepals* 4 (–5), white, tinged purple or light purple. *Stamens* 8–15; filaments white to purplish, (1.5–) 2.5–3 (–3.5) × (0.25–) 0.5–1 mm, widest in the top third. *Carpels* (2–) 3.5–4.5 × 0.5–1.1 mm; at base 0.5–1.5 mm stipitate; style (0.4–) 0.7–1.4 mm long; stigmatic surface along distal (0.3–) 0.5–1 mm of the style. *Achenes* falcate, compressed, (2.3–) 3–5.5 × (0.5–) 0.8–1.5 mm; body 3-ribbed, at base (0.5–) 1–1.8 mm stipitate; style (0.5–) 1.2–2 mm long. Fig. 1.

DISTRIBUTION. Endemic to New Guinea. Indonesia, Papua Province: Mt Jaya, Orange Mountains, Paniai Lakes. Papua New Guinea: Star Mountains. Map 1.

SPECIMENS EXAMINED: INDONESIA, PAPUA PROVINCE: Wamena, between Habbema and Pabilylo, 3300 m, 19 Oct. 1992, *Argent* 92490 (E!); Mimika, Freeport Ind. Conc. Area, Meren Valley, 3800 m, 9 March 1998, *Baker et al.* 934 (K!); Mimika, Freeport Ind. Conc. Area, Mt Idenburg, S slopes, 4000 m, 11 March 1998, *Baker et al.* 950 (BO!, K!); Mt Jaya, site 87 E of Carstenz Meadow, 3540 m, 21 Nov. 1998, *Beaman* 12144 (BO!); Mimika, Freeport Ind. Conc. Area, N Canyon, to the E of Bakopa Valley, 3600 m, 20 March 1999, *Edwards* 4195 (K!); [Paniai] Wissel lakes region, 2900 m, 31 July 1939, *Eyma* 4987 (BO!); Mt Jaya, W Irian, Carstenz Mts, 3540 m, 13 Dec. 1971, *Hope* ANU 10844 (CANB!); Mimika, Freeport Ind. Conc. Area, near base of Tramway at Mill Site, 2800 m, 18 March 1999, *Johns* 9895 (BO!, K!); [Papua, Mt Jaya], Camp XIII–XIV, 13 Jan. 1913, *Kloss* s.n. (BM!, K!); Valentijn Mts, NE of Koruppun valley, trail from Lake Valley to base camp, 3290 m, 12 Aug. 1988, *Mangen* 1764 (BO!, GH!); Mt Jaya, W Agawagon Valley, 3230 m, 21 Aug. 1992, *Miller* 23590 (MU!); *ibid.*, 21 Aug. 1992, *Miller* 23623 (MU!); Mimika, Freeport Ind. Conc. Area, Pylon, road near Grasberg mine, 3800 m, 6 March 1998, *Puradyatmika et al.* 10342 (K!); Mimika, Freeport Ind. Conc. Area, Mt Idenburg, S slopes near drill pad, 4000 m, 11 March 1998, *Puradyatmika et al.* 10372 (BO!, K!); Mt Jaya, Carstenz Meadow, 3400 m, 28 April 1973, *Raynal* 17347 (K!, P!); Mimika, Freeport Ind. Conc. Area, Wanagon River Valley, 3470 m, 26 April 2000, *Utteridge et al.* 357 (BO!, K!); Oranje Mts, Waterval biwak, 12 Feb. 1913, *Versteeg* 2474 (BO!, L!). **PAPUA NEW GUINEA, SANDAUN PROVINCE:** Telefomin, Star Mts, Tarn in valley, N of Mt Capella, 3100 m, 18 April 1975, *Barker & Umba* LAE 67458 (E!, K!, L!); Telefomin, Sirius Mt, 12 & 23 April 1965, *Craig* 56



Fig. 1. Holotype of *Thalictum papuanum* Ridl. (BM! [BM000559558], © The Trustees of the Natural History Museum, London).



Map 1. Known distribution of *Thalictum papuanum* var. *papuanum*, *T. papuanum* var. *acutisegmentum* and *T. papuanum* var. *laticarpellum* in New Guinea.

& 104 (CANB!, LAE!); Star Mts, camp 2, Tel Basin, 2950 m, 9 April 1975, *Touw & Veldkamp* 6383 (CANB!, L!); Star Mts, camp 10, Dagabulon, 3400 m, 5 May 1975, *Veldkamp* 6631 (CANB!, K!, L!); Telefomin, top of ridge, track from Tamanagabip to the E end of Mt Capella, 3300 m, 12 April 1975, *Vinas LAE* 67083 (CANB!).

HABITAT. Upper montane and subalpine forest, subalpine shrubbery, scrub and meadow and alpine grassland. Growing on strongly weathered limestone rocks, in shallow high elevation valleys and on old landslide scars; elevation: 2800 – 4000 m.

CONSERVATION STATUS. This is a geographically widespread species. The extent of occurrence (EOO) is estimated to be over 39,000 km². It is inferred from the number of specimen records and the availability of suitable habitat that the area of occupancy (AOO) also exceeds the values needed for a threatened category. This species is therefore assessed as of Least Concern (LC), according to IUCN (2012). The region remains poorly explored botanically and under-collected and field surveys are needed to determine the current distribution, population size and habitat status of this species.

PHENOLOGY. Flowering and fruiting from Feb. to Dec.
NOTES. *Thalictum papuanum* var. *papuanum* is distinct on account of the combination of these characters: glabrous herb up to 30 cm tall with basal leaves usually biternate, sometimes tri-foliolate, filaments (1.5 –) 2.5 – 3 (– 3.5) × 0.5 – 1 mm, widest in the top third, narrowed at apex and filiform at base, achenes compressed, falcate, 3 – 5.5 × (0.5 –) 0.8 – 1.5 mm,

at base (0.5 –) 1 – 1.8 mm stipitate and with (0.5 –) 1.2 – 2 mm long style.

Thalictum papuanum var. *oranjense* is not recognised as distinct. It was described by Eichler (1958: 7) based on a single collection from the Oranje Mountains [= part of the Jayawijaya range including Mt Trikora], which he stated differed in shorter stem, only up to 10 cm, usually having a single flower, basal leaves usually ternate with shorter leaflets 3 × 4 mm, cauline leaves ternate to simple, in having fewer stamens, 7 – 12 with smaller filaments 2 × 0.25 mm and in having smaller achenes 2.3 × 0.75 mm. We have found this falls within the variation of the taxon across its range. The taxon is now known to be widely distributed through much of the central mountain range of New Guinea, and the modern collections from Papua New Guinea have expanded the known range. The type locality of Mt Jaya is now positioned centrally within the distribution area.

***Thalictum papuanum* Ridl. var. *acutisegmentum* Borosova var. nov.** Type: Indonesia, Papua Province: N end of Hanekam tunnel, Mt Jaya, 14 Aug. 1998, Marsden 189 (holotype K!).

<http://www.ipni.org/urn:lsid:ipni.org:names:77218846-1>

Herb, 10 – 13 cm tall. *Basal leaves* 3 – 7, blades 1.5 – 3 × 1.5 – 3 cm, biternate with 9 leaflets; *petiole* (1.5 –) 3 – 4 (– 7) cm long; *rachis* 0.5 – 1 cm long; *petiole* 1 – 5 mm long; *terminal leaflet* broadly elliptic, rhombic-ovate or suborbicular, 6 – 9 × 5 – 10 mm, 5 – 7-lobed.



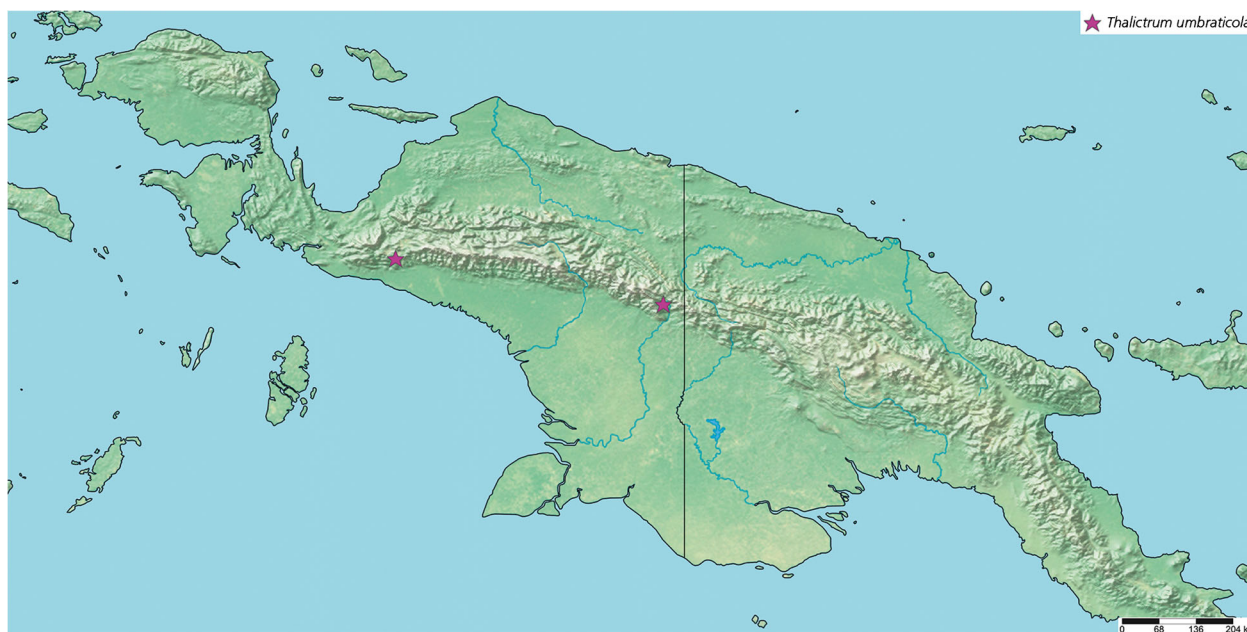
Fig. 2. Holotype of *Thalictrum papuanum* Ridl. var. *acutisegmentum* Borsova (K! [K000171074], © copyright of the Board of Trustees of the Royal Botanic Gardens, Kew).



Fig. 3. Holotype of *Thalictrium papuanum* Ridl. var. *laticarpellum* Borosova (K! [K000575511], © copyright of the Board of Trustees of the Royal Botanic Gardens, Kew).



Fig. 4. Holotype of *Thalictum umbraticola* Borosova (L! [L1740670]), © Naturalis Biodiversity Center, Leiden, reproduced with permission).



Map 2. Known distribution of *Thalictum umbraticola* in New Guinea.

Cauline leaves usually biternate with 9 leaflets; petiole 2–5 mm long; rachis 4–5 mm long; petiolule 2–4 mm long; terminal leaflet 6–9 × 5–9 mm; (3–) 5 (–7)-lobed, leaflets sharply acuminate to mucronate at apex. *Inflorescence* 3 (–4)-flowered, branched; peduncle 2–6 cm long; pedicel slender, red, (0.5–) 1–2 cm long. *Bracts* 2–5 mm long, ovate, entire or 1–3-lobed. *Flowers* 4–6 mm across. *Sepals* pink. *Stamens* 15–25; filaments pink, 2–3 × 1 mm, widest in the top third. *Carpels* 4–4.5 × 0.5–0.7 mm; at base c. 1.5 mm stipitate; style 0.8–1.2 mm long; stigmatic surface along distal 0.5–1 mm of the style. *Achenes* falcate, strongly compressed, 4–5 × 0.5–0.8 mm, body 3-ribbed, at base 1.5–2 mm stipitate; style 1–1.5 mm long. Fig. 2.

RECOGNITION. This variety is unique in the following combination of characters: 10–13 cm tall herb, cauline leaves usually biternate with 9 leaflets, leaflets sharply acuminate to mucronate at apex, inflorescence 3 (–4)-flowered and achenes up to 0.8 mm wide.

DISTRIBUTION. Endemic to Papua Province in Indonesia, and currently only known from the type collected from the northern end of the Hanekam Tunnel in the Mt Jaya region. Map 1.

SPECIMEN EXAMINED. INDONESIA, Papua Province: N end of Hanekam tunnel, Mt Jaya, 14 Aug. 1998, Marsden 189 (holotype K!).

HABITAT. Disturbed lower montane forest, *Casuarina* zone; elevation: 2300 m.

CONSERVATION STATUS. Since there is only one collection of this variety and in the absence of information on threats, a conservation category of Data Deficient

(DD) is proposed for this variety. Further field surveys in the area are recommended.

PHENOLOGY. Collected flowering and fruiting in Aug. **ETYMOLOGY.** From the Latin *acutus*, pointed, and *segmentum*, segment, referring to the sharply acuminate apices of the leaflets.

NOTES. The new variety described here, *Thalictum papuanum* var. *acutisegmentum*, is morphologically similar to *T. papuanum* var. *papuanum* in its overall size, having basal leaves biternate with similar size leaflets, filaments the same shape and size and achenes strongly compressed, falcate, long stipitate and with style circinnate.

Thalictum papuanum var. *acutisegmentum* is recognised by sharply acuminate leaflets, biternate cauline leaves, 3 (–4)-flowered inflorescence and narrower achenes. The description is based on the study of several duplicates of a single collection. This combination of characters was only observed in these specimens and not in any other collections studied. However, since there is some overlap in characters with var. *papuanum*, more collections are needed to determine if this taxon is sufficiently distinct to be recognised at species level.

***Thalictum papuanum* Ridl. var. *laticarpellum* Borosova var. nov.** Type: Papua New Guinea, Mt Piora, Eastern Highlands Province, 31 Aug. 1975, Sands 1577 (holotype K!).

<http://www.ipni.org/urn:lsid:ipni.org:names:77218847-1>

Delicate *herb*, 5–7 cm tall. *Basal leaves* 5–9, blades 1.2–1.8 × 0.8–2 cm, biternate with 9 leaflets; petiole (1–) 1.5–3 (–4) cm, white, filamentous; rachis 2–5 mm long; petiolule 1–3 mm long; terminal leaflet broadly elliptic, rhombic-ovate or suborbicular, 3–6 × 3–6 mm, 3–5-lobed. *Cauline leaves* biternate with 9 leaflets, rarely tri-foliolate; petiole 2–5 mm; rachis 4–5 mm; petiolule 2–4 mm; terminal leaflet 3–6 × 3–6 mm; 3–5-lobed, prominently veined, mucronulate at apex. *Inflorescence* 1–2-flowered; peduncle 4–6 cm long, slender, purple distally to 3 cm high from small white corms; pedicel 0.7–0.8 cm long. *Bracts* 2 mm long, lanceolate, entire. *Flowers* c. 6 mm across. *Sepals* purple. *Stamens* 5–10; filaments 3 × 0.5 mm, widest in the top third. *Carpels* 3–3.5 × 1–1.5 mm; at base up to 1 mm stipitate; style 0.8–1.2 mm long; stigmatic surface along distal 0.5–1 mm of the style. *Achenes* obovate to lanceolate, strongly compressed, 4 × 1.5 mm, body 3-ribbed, base up to 1 mm stipitate; style 1 mm long. Fig. 3.

RECOGNITION. This variety is unique in the following combination of characters:

Delicate, 5–7 cm tall herb, cauline leaves usually biternate with 9 leaflets, terminal leaflets of basal and cauline leaves the same size 3–6 × 3–6 mm, mucronulate at apex, inflorescence 1–2-flowered, achenes obovate to lanceolate, up to 1 mm stipitate, 1.5 mm wide.

DISTRIBUTION. Endemic to Papua New Guinea, Mt Piora. Map 1.

SPECIMEN EXAMINED. PAPUA NEW GUINEA, Mt Piora, Eastern Highlands Province, 31 Aug. 1975, *Sands* 1577 (holotype K!).

HABITAT. High level areas of sub-alpine tussock heath; elevation: 3500 m.

CONSERVATION STATUS. Since there is only one collection of this variety and in the absence of information on threats, a conservation category of Data Deficient (DD) is proposed for this variety. Further survey in the area is recommended.

PHENOLOGY. Collected flowering and fruiting in Aug.

ETYMOLOGY. From the Latin *latus*, broad, and *carpellum*, carpel, referring to the broader carpels compared with the other varieties.

NOTES. This new variety, *Thalictrum papuanum* var. *laticarpellum*, is morphologically similar to *T. papuanum* var. *papuanum* in its overall size, having basal leaves biternate, filaments the same shape and size and achenes strongly compressed, stipitate and with circinnate style. *Thalictrum papuanum* var. *laticarpellum* is recognised by its terminal leaflets of basal and cauline leaves being the same size (3–6 × 3–6 mm) and mucronulate at the apex, having a 1–2-flowered inflorescence, achenes obovate to lanceolate, up to 1 mm stipitate and 1.5 mm wide. This combination of characters was only observed in these specimens and not in any other collections studied.

***Thalictrum umbraticola* Borosova sp. nov.** Type: Indonesia. Papua Province: Star Mts, Sibil Valley, Oemboek, 15 May 1959, *Kalkman* 4055 (holotype L!; isotypes BM!, CANB!, GH!).

<http://www.ipni.org/urn:lsid:ipni.org:names:77218848-1>

Glabrous *herb*; (20–) 25–40 cm tall. *Roots* fibrous, rhizome slender. *Stems* erect, branched. *Basal leaves* 6–10, blades 3–7 × 3–9 cm, biternate with 9 leaflets; petiole 4–12 cm; rachis 1–4.5 cm long; petiolule 0.3–1 cm long; terminal leaflet broadly elliptic, ovate or suborbicular, (9–) 11–18 × (8–) 10–15 (–18) mm, 5 (–7)-lobed. *Cauline leaves* 1–2, alternate, tri-foliolate, rarely biternate with 9 leaflets or simple; petiole 13–23 mm; rachis (if present) and petiolules 5–15 mm long; terminal leaflet broadly elliptic to orbicular ovate, 9–13 (–15) × 9–12 (–16) mm, 3–7-lobed, prominently palmately 3–5-veined, base rounded, sometimes cuneate to subcordate, apex mucronulate, margin slightly revolute. *Inflorescence* racemose, 4–6-flowered, branched; peduncle (4–) 8–13 cm long; pedicel erect or slightly recurved, (0.5–) 1–3 (–4) cm long. *Bracts* 1–2, leaf-like, 4–13 (–15) mm long, ovate to lanceolate, entire or lobed. *Flowers* (3.5–) 4–5.5 mm across. *Sepals* 4, ovate to elliptic, 2 × 1 mm, white to light purple. *Stamens* 8–15; filaments white, (1.5–) 2–2.5 × 0.2–0.5 mm, widest in the top third, base filiform, apex narrowly linear, narrower than anther. Anther 0.5 mm long, obtuse at apex, connectives not projected. *Carpels* 6–9, erect, white at base, light red at apex, 2.5–3 × 0.5 mm, fusiform; at base 0.5–1 mm stipitate; style linear, coiling inwards, 1–1.5 mm long; stigmatic surface along distal 0.5–0.8 mm of the style. *Achenes* 6–9, erect at first, later curving downwards, fusiform, falcate, strongly compressed, 3.5–5.5 × 0.5 mm, body 1–2-ribbed, dorsal suture usually straight, ventral suture usually convex, 0.5–1 mm stipitate; style 1.5–2 mm long, circinnately coiled inwards. Fig. 4.

RECOGNITION. *Thalictrum umbraticola* is unique in the following combination of characters: style circinnately coiled inwards at apex, 6–9 achenes, 1–2-ribbed on each side, 3.5–5.5 × 0.5 mm, basal leaves few, blades up to 9 cm long with leaflets up to 1.8 cm long and it grows at relatively low elevations (1200–1300 m), under arching limestone rock, in very damp and rather dark habitat.

DISTRIBUTION. Endemic to West Papua; Star Mountains (Sibil valley, Oemboek) and Paniai lakes. Map 2.

SPECIMENS EXAMINED. INDONESIA: [Paniai] Wissel lake region, biv. 12–14, [1200 m], 7 Jan. 1939, *Eyma* 4248 (BO!, K!, L!); Star Mts, Sibil valley, Oemboek, 1200–

1300, 15 May 1959, *Kalkman* 4055 (BM!, CANB!, GH!, L!).

HABITAT. Under arching limestone rock, very damp, rather dark, lower montane forest; elevation: 1200 – 1300 m.

CONSERVATION STATUS. Due to sparsity of herbarium material and in the absence of information on threats, a conservation category of Data Deficient (DD) is proposed for this species; having only two collections does not allow us to calculate EOO or AOO. Further surveys in the area are recommended.

PHENOLOGY. Flowering and fruiting from Jan. to May.

ETYMOLOGY. From the Latin *umbra*, shade, and *-cola*, dweller, referring to the shady habitat of this species.

NOTES. *Thalictrum umbraticola* is morphologically close to *T. javanicum* Blume and *T. uncatum* Maxim. (as delimited by Zheng *et al.* 2018) in height, glabrous habit and styles hooked at apex. It differs conspicuously from *T. javanicum* in the basal leaves (*T. umbraticola* biternate vs *T. javanicum* 3 – 4 ternate), stipitate achenes (stipe 0.5 – 1 mm vs achenes sessile) and style length (1 – 2 mm vs 0.6 – 1 mm); and from *T. uncatum* in leaf blade size (3 – 7 × 3 – 9 cm vs 9.5 – 13 × 15 cm) and style length (1 – 2 mm vs 2.2 – 3 mm). It differs from both in the smaller sepals (2 × 1 mm), fewer stamens (15), shorter filaments ((1.5 –) 2 – 2.5), shorter anthers (0.5 mm) and fewer carpels (6 – 9).

Acknowledgements

We thank the curators and staff of the following herbaria for access to or loan of material and their assistance: Jacek Wajner (BM), staff of Herbarium Bogoriense (BO), Brendan Lepschi (CANB), Erzsébet Gyöngy (E), Anthony R. Brach (GH), Nicolien Sol (L), Tiberius Jimbo and Thomas Magun (LAE), Odile Weber (LUX), Dr Michael A. Vincent (MU), Florian Jabbour (P) and Serena Lee M.L. (SING). The comments and suggestions of two anonymous reviewers were extremely useful and we thank them for helping to improve the manuscript; we also thank Carmen Puglisi for useful discussions and constructive comments.

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