



## *Thismia brunneomitroides* (Thismiaceae), a new mycoheterotrophic species from southern Thailand

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### Abstract

Here we describe a new species of the mycoheterotrophic genus *Thismia* (Thismiaceae), *T. brunneomitroides*, discovered during a botanical survey in Khao Luang National Park, Peninsular Thailand. *Thismia brunneomitroides* resembles *Thismia brunneomitra* from Brunei Darussalam in that both species possess inner tepal lobes that are connate to form a mitre with three projections at the apex and large lateral appendage of the connective. However, it differs in having ivory flowers with twelve pale orange to brownish orange vertical stripes on the perianth tube and slightly dentate lateral appendage of the connective which does not exceed apical part of the connective. Descriptions, illustrations and a key to the 13 species of *Thismia* in the Thai-Malay Peninsula are provided.

**Key words:** mycoheterotrophy, taxonomy, *Sarcosiphon*

### Introduction

The genus *Thismia* Griffith (1844: 221) of Thismiaceae J.Agardh represents one of the most species-rich mycoheterotrophic genera (Jonker 1948, Merckx *et al.* 2013). To date, more than 60 species have been described worldwide, whereas the majority of those species were collected only once and some would be extinct (Jonker 1948). On the other hand, many new species have been discovered recently in Southeast Asian countries (e.g. Chantanaorrapint 2012, Tsukaya & Okada 2012, Dančák *et al.* 2013, Nuraliev *et al.* 2014, 2015, Truong *et al.* 2014, Chantanaorrapint & Sridith 2015, Hroneš *et al.* 2015, Tsukaya *et al.* 2017), suggesting that more species remain to be discovered especially in the tropical rain forests of Southeast Asia.

Here, we describe a new species *Thismia brunneomitroides* Suetsugu & Tsukaya, discovered in 2015 during a botanical survey in Khao Luang National Park, Peninsular Thailand, located in Thai-Malay Peninsula. The Thai-Malay Peninsula is one of the species diversity hotspots of the genus *Thismia* (Hroneš *et al.* 2015), and currently 12 species of *Thismia* are known from the area (e.g. Jonker 1948, Chantanaorrapint & Chantanaorrapint 2009, Chantanaorrapint & Sridith 2007, 2015, Chantanaorrapint *et al.* 2015, 2016). After a careful examination, the unknown plants were found to have a significantly different floral morphology from all the other known species as illustrated below and demonstrated in a revised key to the species of the genus *Thismia* in the Thai-Malay Peninsula.

## Taxonomic Treatment

*Thismia brunneomitroides* Suetsugu & Tsukaya, *sp. nov.* (Figs. 1 & 2)

Type:—THAILAND, Nakhon Si Thammarat Province, Khao Luang National Park, along trail to Kung Ching Waterfall, in lowland evergreen forest, 8°43'12.67"N, 99°40'31.11"E, elev. 285 m, 15 December 2015, *Tagane S., Toyama H., Nagamasu H., Rueangruea S., Hemrat, C., Keiwbang W. T4968* (holotype BKF!—a spirit collection, isotype TNS!—a spirit collection).

Diagnostic characters:—*Thismia brunneomitroides* is most similar to *Thismia brunneomitra* Hroneš, Koblrová & Dančák (2015: 173) from Brunei Darussalam in having inner tepal lobes connate to form a mitre with three projections at the apex and large lateral appendage of the connective. However, it differs from *T. brunneomitra* in having ivory flowers with twelve pale orange to brownish orange vertical stripes on the perianth tube (vs. brown to blackish flowers with twelve darker vertical stripes on the perianth tube) and slightly dentate lateral appendage of the connective which does not exceed apical part of the connective (vs. entire lateral appendage of the connective which exceeds whole apical part of the connective).

Small, achlorophyllous mycoheterotrophic herbs. Underground parts coralliform, slightly branched towards the apex, hairy, whitish brown. Stem 5.0–8.0 cm tall, ascending to erect, simple, sparsely shortly hairy, ivory. Leaves spirally arranged, appressed, scale-like, triangular, ca. 5 mm long, 2–3 mm wide at base, apex acute, margin entire, pale orange to pale brown, membranaceous, glabrous. Inflorescence terminal, (1–)2–4 flowered. Floral bracts 3, similar in shape to leaves but slightly larger, 5–7 mm long, 3–3.5 mm wide at base, keeled, enveloping base of flower, pale orange to pale brown. Flowers bisexual, 1.3–1.6 cm long, 0.7–0.8 cm wide at top of perianth tube; perianth actinomorphic with 6 tepals fused to a perianth tube; outer surface verrucose with 12 longitudinal ribs, ivory with 12 vertical pale orange to brownish orange stripes; inner surface slightly verrucose, ivory; outer tepal lobes absent; inner tepal lobes well-developed, connate at top and forming mitre with three lateral holes, 4–6 mm in height; holes transversally elliptic to almost circular, 2–4 mm high, 3–5 mm wide; mitre pale orange to reddish-brown, topped by three acute projections. Annulus absent. Stamens 6, pendulous from top of perianth tube, pale brownish orange; connectives flattened, ribbon shaped, connate to form tube; individual connective bearing 4 whitish thecae with 2 tufts of glandular hairs on adaxial side; teeth on free apical part terminated by tuft of glandular hairs, mostly 2, both teeth obtusely triangular, similar in shape and size; rarely 3, middle lobe narrowly triangular, lateral lobes larger, obtusely triangular teeth on free apical part; lateral appendage of connective flattened, wing-like, slightly dentate, not exceeding apical part of the connective, with marginal glandular hairs. Style short, ca. 0.4 mm long, with 3 bilobed stigmas, stigma ca. 1.2 mm long; ovary cup-shaped, with 12 pale brownish orange vertical ribs on surface. Capsule cup-shaped, pale brownish orange, strongly verrucose, topped by basal ring of perianth tube and withered style and stigmas. Seeds not seen.

**Etymology:**—The new species is named after the great morphological similarity to *T. brunneomitra*.

**Habitat and Ecology:**—Less than 10 individuals were found in shaded understory of lowland evergreen forest. No other mycoheterotrophic species were found in the locations in which the new *Thismia* were collected.

**Preliminary conservation assessment:**—Critically Endangered, [CRD1]. (IUCN2012). *Thismia brunneomitroides* is currently known only from a single population in lowland evergreen forest in Khao Luang National Park. The population contains less than 10 mature plants, and at present we are not aware of any other locality where this species persists. Therefore, *T. brunneomitroides* is classified as CR under Criterion D1.

**Taxonomic notes:**—*Thismia brunneomitroides* apparently belong to the section *Sarcosiphon* Blume (1850: 65) in having a coralliform underground part and inner tepal lobes fused at the top and forming a mitre. Among the members of the section *Sarcosiphon*, *T. brunneomitroides* is most similar to *T. brunneomitra* in having inner tepal lobes connate to form a mitre with three projections at the apex and large lateral appendage of the connective (Hroneš *et al.* 2015), but these two species are distinguished by morphological characters shown in Table 1. *Thismia brunneomitroides* also resembles *T. episcopalis* (Beccari 1877: 250) Mueller (1891: 235) but differs by the mitre having 3 acute projections at apex (vs. obtuse without any projection in *T. episcopalis*) and mostly 2 teethed apical part of connective (vs. 3 teethed apical part of connective). Among Thai species, *T. brunneomitroides* is similar to *Thismia* sp. recently recorded as '*T. clandestina*' (Blume 1850: 65) Miquel (1859: 616) by Chantanaorrapint *et al.* (2015) from Peninsular Thailand. *T. brunneomitroides* and '*T. clandestina*' in the sense of Chantanaorrapint *et al.* (2015) share outer morphological appearance such as ivory flowers with twelve pale orange to brownish orange vertical stripes on the perianth tube and verrucose outer surface of perianth tube. However, *T. brunneomitroides* is distinguished from '*T. clandestina*' *sensu* Chantanaorrapint *et al.* (2015) by the mitre having 3 longer acute projections at apex (vs. very short acute projections at apex in '*T. clandestina*' of Thailand) and much larger stigmas (ca. 1.2 mm long in *T. brunneomitroides* vs. ca. 0.5 mm

long in '*T. clandestina*' of Thailand). It should also be noted that *T. clandestina sensu* Chantanaorrapint *et al.* (2015) may be different taxonomic identity from *T. clandestina* (Blume) Miq. described from Java (Miquel 1859, Smith 1911) because *T. clandestina sensu* Chantanaorrapint *et al.* (2015) has somewhat different morphological characters from *T. clandestina* from Java such as the teeth on the free apical part of connective (mostly 1, wide, triangular vs. 2–3, asymmetrical, with additional several bristlelike laciniae) and size of mitre (6 mm vs. 2–4 mm in height; Smith 1911, Hroneš *et al.* 2015, Chantanaorrapint *et al.* 2015). Further exploration will be needed to elucidate the taxonomic identity of '*T. clandestina*' in the sense of Chantanaorrapint *et al.* (2015).

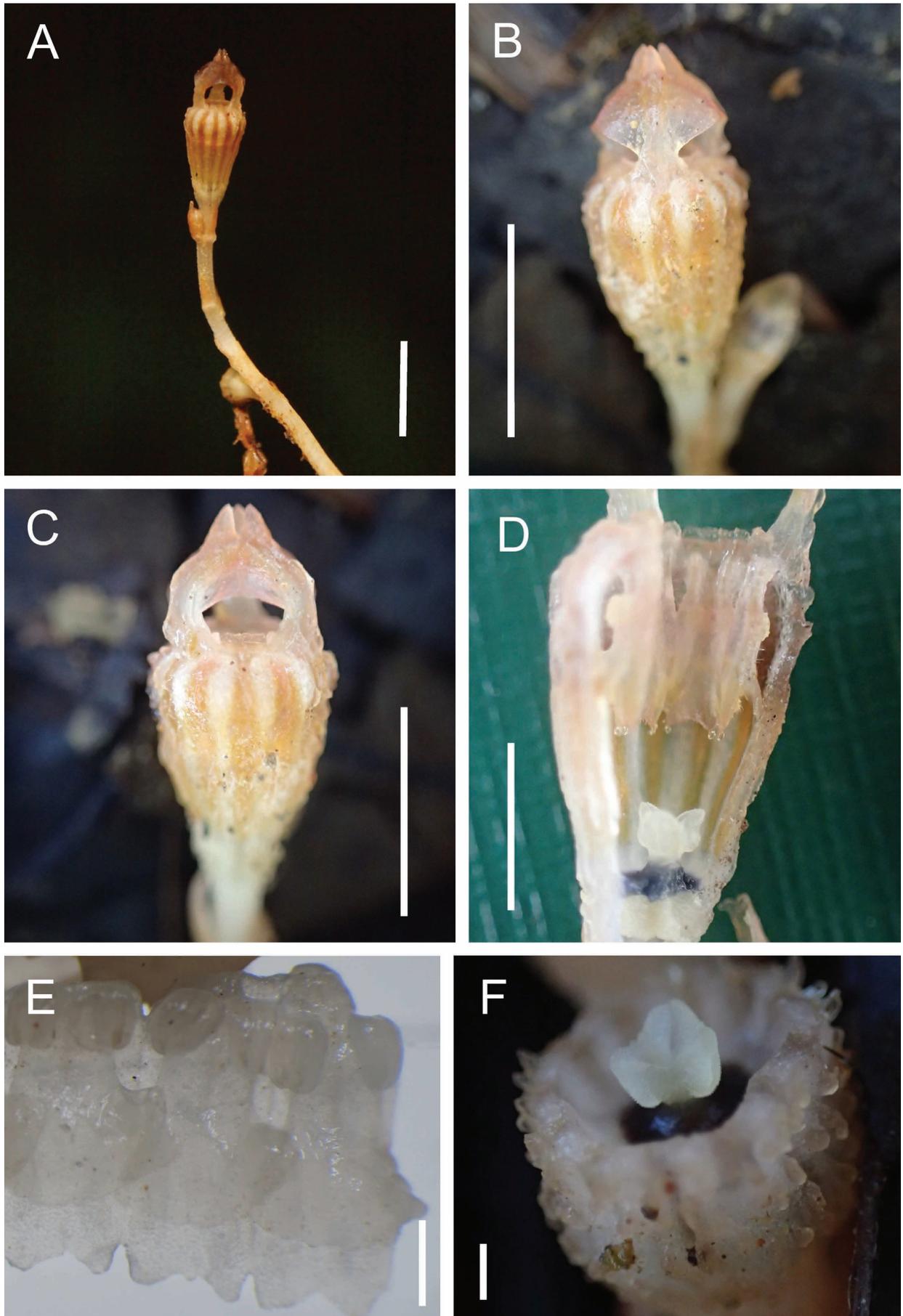
**TABLE 1.** Morphological comparison of *Thismia brunneomitroides* and *T. brunneomitra*.

Characters	<i>Thismia brunneomitroides</i>	<i>T. brunneomitra</i> <sup>1)</sup>
number of flowers	(1–)2–4	1(–2)
perianth coloration	ivory with 12 longitudinal pale orange to brownish orange stripes	brown to blackish with 12 longitudinal dark brown stripes
outer surface of perianth tube	verrucose to strongly verrucose	smooth to slightly verrucose
outer perianth lobes	absent	absent
height of mitre (mm)	4–6	5–7
mitre apex	not fully connate with three short erect acute projections	not fully connate with three short erect obtuse projections
teeth on free apical part of connective	mostly 2, all teeth obtusely triangular, all similar in shape and size; rarely 3; middle lobe narrowly triangular, lateral lobes larger, obtusely triangular	3, middle lobe narrowly triangular, lateral lobes larger, obtusely triangular
hairs on apical part of connective	present	present
lateral appendage of the connective	slightly dentate, not exceeding apical part of the connective	large, entire, exceeding whole apical part of the connective

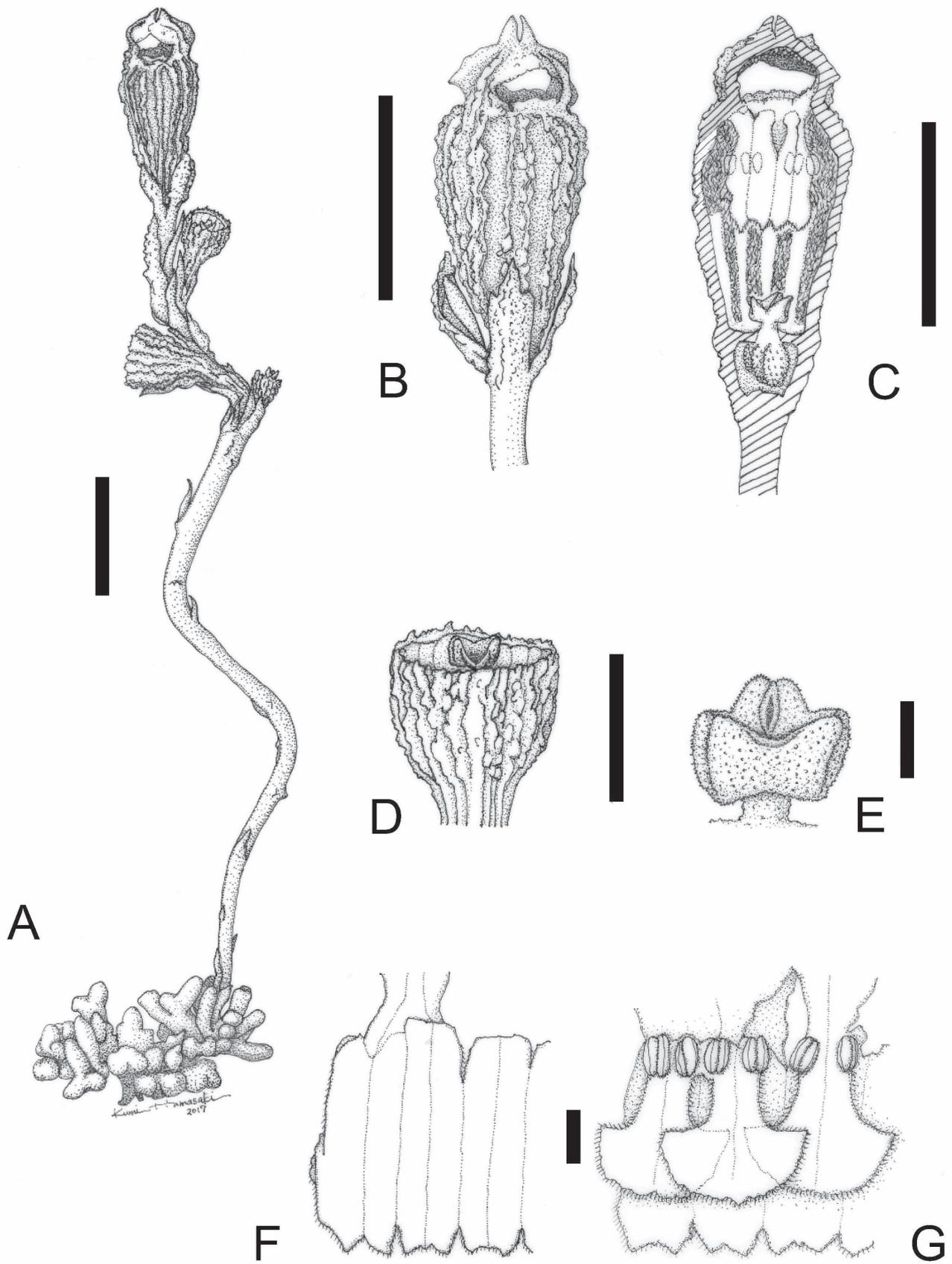
1) from Hroneš *et al.* 2015

**Key to the species of *Thismia* in the Thai-Malay Peninsula (modified after Chantanaorrapint *et al.* 2016)**

1. Inner perianth lobes free, spreading or erect .....2
- Inner perianth lobes connate at the apex to form a mitre .....10
2. Perianth lobes equal in length and size .....3
- Perianth lobes unequal in length and size, inner ones larger .....9
3. Appendages of perianth lobe hairy ..... *T. chrysops*
- Appendages of perianth lobe glabrous .....4
4. Stem several. Flowers 4–6 ..... *T. racemosa*
- Stem simple. Flowers 1–3 .....5
5. Perianth lobes narrowly triangular or linear-lanceolate, flat, without filiform appendages ..... *T. fumida*
- Perianth lobes triangular, with filiform appendages on the outer surface .....6
6. Leaves and bracts bearing glandular hairs on dorsal surface ..... *T. grandiflora*
- Leaves and bracts glabrous .....7
7. Perianth without transverse bars inside. Apex of stamens with 2 teeth ..... *T. claviformis*
- Perianth with transverse bars inside. Apex of stamens with 1 or 3 appendages .....8
8. Apex of stamens with 1 thick-filiform appendage. Perianth lobes with appendages more than 15 mm long ..... *T. alba*
- Apex of stamens with 3 thick-filiform appendages. Perianth lobes with appendages up to 10 mm long ..... *T. aseroe*
9. Stigma lobes acuminate ..... *T. arachnites*
- Stigma lobes truncate ..... *T. javanica*
10. Underground part vermiform. Top of the mitre with 3 fovea ..... *T. nigricans*
- Underground part coralliform. Top of the mitre without 3 fovea .....11
11. Top of the mitre with 3 slender claviform appendages ..... *T. clavigera*
- Top of the mitre lacking claviform appendages .....12.
12. Top of the mitre with 3 very short acute projections. Apex of stamens obtuse to shallowly 3-lobed. Stigma ca. 0.5 mm long ..... *T. clandestina sensu* Chantanaorrapint *et al.* (2015)
- Top of the mitre with 3 longer acute projections. Apex of stamens 2-lobed, rarely 3-lobed. Stigma ca. 1.2 mm long ..... *T. brunneomitroides*



**FIGURE 1.** *Thismia brunneomitroides* from the type locality. A. Flowering plant. B–C. Flowers. D. Longitudinal section of perianth tube with anthers and style. E. Stamen with lateral appendage and thecae, outer view. F. Style. Bar = 1 cm (A–C), 5 mm (D) and 1 mm (E–F).



**FIGURE 2.** *Thismia brunneomitroides*. A. Flowering plant. B. Flower. C. Longitudinal section of flower. D. Immature fruit. E. Style. F. Stamen with apical lobes, inner view. G. Stamen with lateral appendage and thecae, outer view. Materials from *Tagane et al. T4968*. Drawn by Kumi Hamasaki. Bar = 1 cm (A–C), 5 mm (D) and 1 mm (E–G).

## Acknowledgements

We are grateful for the Department of National Parks, Wildlife and Plant Conservation for permitting the botanical inventory in the protected areas. Chandee Hemrat and Wittawat Keiwbang (BKF) are acknowledged for their kind help in the field trip. We are also grateful to Kumi Hamasaki for providing excellent line drawings. This study was financially supported by the Environment Research and Technology Development Fund (S9 & 4-1601 to TY) of the Ministry of the Environment, Japan, JSPS KAKENHI (17H05016 to KS), Asahi Glass Foundation (to HT) and BKF.

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