



Thismia jianfenglingensis (Thismiaceae), a new species of fairy lantern from Hainan Island, China

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Abstract

A new species of *Thismia* (Thismiaceae), *T. jianfenglingensis*, is described and illustrated from Hainan Island, China. The new species is similar to *T. hongkongensis*, displaying a urecolate perianth tube, a loose dome with six perianth lobes, six stamens, and three stigmas. *T. jianfenglingensis* differs from *T. hongkongensis* in the color and morphology of perianth tube, the position of outer perianth lobes, the morphology and appendage of connective apex, the morphology of stigmas. The new species is only reported to occur on Hainan Island, China and it is proposed to be Vulnerable (VU) according to the IUCN criteria for the conservation status of plant species due to having a population with a very restricted area of occupancy or number of locations such that it is prone to become critically endangered or even extinct in a very short time period.

Keywords: Burmanniaceae; conservation status; IUCN; taxonomy; tropical forest; vulnerable

Introduction

Thismia Griffith (1844: 221) is a genus of small, achlorophyllous mycoheterotrophic plants and consists of about 80 species distributed in temperate and tropical Asia, eastern and south-eastern Australia, New Zealand and the Neotropics (Chiang & Hsieh, 2011, Li & Bi 2013, Mar & Saunders 2015, Hareesh *et al.* 2018, Sochor *et al.* 2018, Dančák *et al.* 2018, Suetsugu *et al.* 2018). They prefer warm temperate and tropical environments and their origin can be traced from South America (Merckx *et al.* 2006, Merckx & Smets 2014, Sochor *et al.* 2018). *Thismia* species, commonly referred to as fairy lanterns, derive their carbon from associations with symbiotic fungi that form mycorrhizal associations with nearby autotrophic plants (Merckx 2013). These plants are very small and not easily found in the field, yet much of the diversity of fairy lantern species has recently been discovered (Sochor *et al.* 2018). Since 2011, more than 30 new species in this family have been described (Chiang & Hsieh, 2011, Li & Bi 2013, Mar & Saunders 2015, Hareesh *et al.* 2018, Sochor *et al.* 2018). In the APG III revision, Thismiaceae was recognized as a distinct family, having been separated from the greater Burmanniaceae (Merckx *et al.* 2009, APG III 2009). Currently, the family consists of five genera, however, the phylogenetic relationships of the many newly emerging species within each genus in the Thismiaceae, and in particular the genus *Thismia*, remain uncertain and warrant further study.

The collection of the small and relative rare *Thismia* species is uncommon, in part due to their inconspicuous habit in nature. Although in the last two decades, five species of *Thismia* including *T. gongshanensis* Li & Bi (2013 : 25), *T. hongkongensis* Mar & Saunders (2015 : 21), *T. huangii* P. Y. Jiang et. T. H. Hsieh in Chiang & Hsieh (2011 : 138), *T. taiwanensis* Yang *et al.* (2002 : 485) and *T. tentaculate* Larsen & Averyanov (2007 : 16) (Ho *et al.* 2009) have been described from south China, the collection of these species is still very uncommon, making verification

of their distribution and conservation status difficult. In the summer 2017, while conducting some field surveys in the Jianfengling forest reserve of Hainan Island, China, an unknown mycoheterotrophic dark red herb was found. Its morphology and habitat are illustrated below.



FIGURE 1. Flowering plants of *Thismia jianfenglingensis*.

Materials and methods

Several colonies of the *Thismia* species were found accidentally during some routine soil collection in the Jianfengling 60 ha Forest Dynamic Plot. The population encountered consisted of six flowering individuals. Plant images were obtained by micro photography using a stereomicroscope (ZEISS Stemi 2000-C) with a photometrics CoolSNAP CCD camera. The measurement of the plant's morphological characteristics was done using the Motic Image-Pro Plus 5.1 software. The original collections were pressed and dried for the preservation of herbarium type specimens.

Results

Taxonomic treatment

Thismia jianfenglingensis Han Xu, H.J. Yang and S.Q. Fang, *sp. nov.* (Figs. 1–3). 尖峰水玉杯

Diagnosis:—*Thismia jianfenglingensis* most closely resembles *T. hongkongensis*, but differs from it by having the perianth tube dark-red and cylindrical-urceolate (not pinkish-white obpyriform-urceolate), the outer perianth lobes are embedded in the dome (not separated from the dome), the connective apex is slightly concave (not bidentate), the lateral appendage of the connective is entire (not trilobed) and the stigma lobe is acute (not rounded).

Type—CHINA. Hainan: Ledong County, Jianfengling National Nature Reserve, Wufengqu, 875 m, 18°43'41.0"N, 108°53'59.6"E, 20 June 2017, *Han Xu 2017001* (holotype CANT; isotype IBSC)

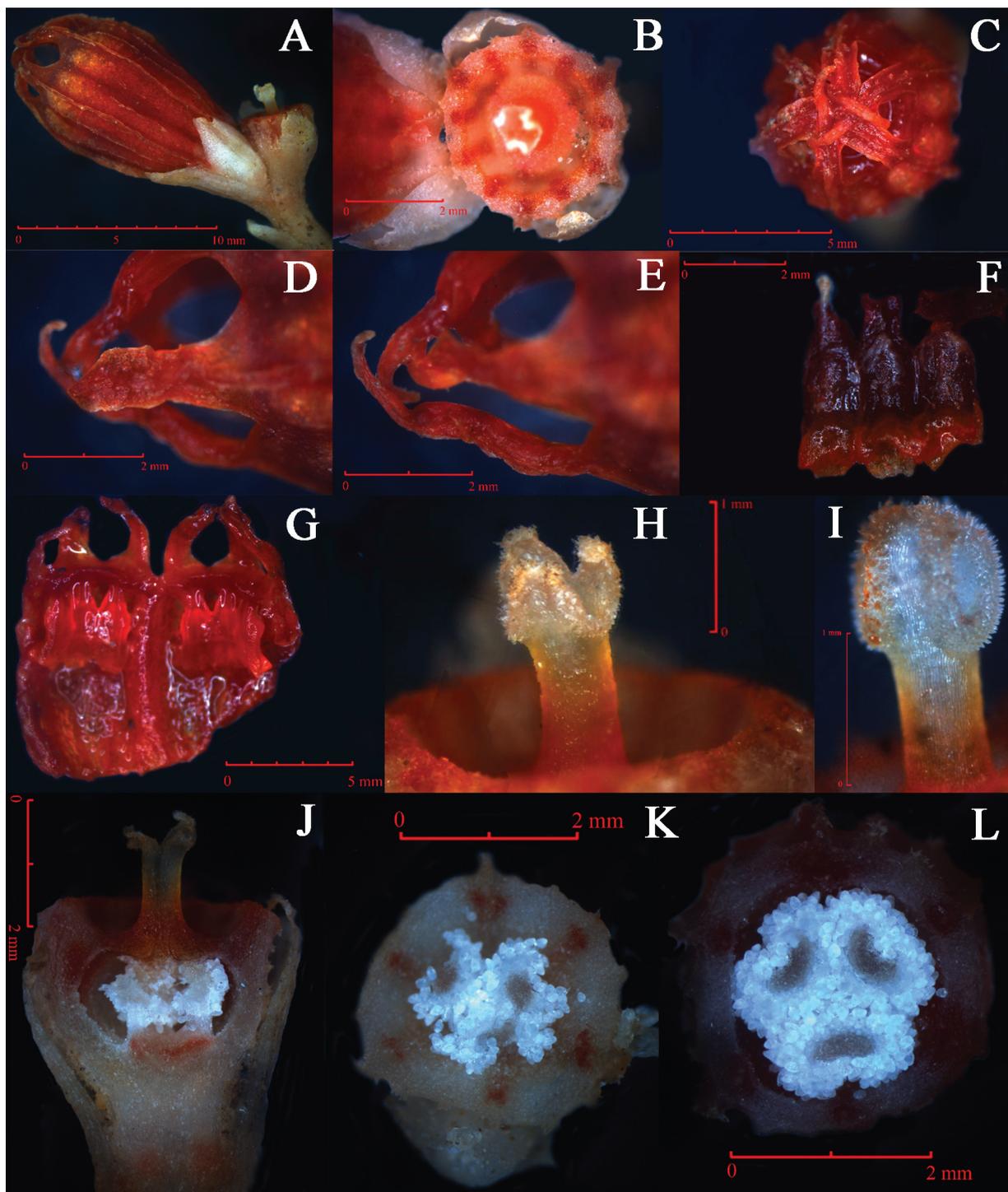


FIGURE 2. *Thismia jianfenglingensis*. A. Flowers; B. Transverse section of perianth tube; C. Lobes of perianth tube forming a net-cover or mitre; D. Inner lobes of perianth; E. Outer lobes of perianth; F. Stamens; G. Stamens 6 anatropous and hanging down at the upper inner margin of perianth tube; H–I. Stigma and its lobes; J. Longitudinal section of ovary; K–L. Transverse section of ovary.

Herbs, annual, without chlorophyll, myco-heterotrophic, with creeping vermiform and a ca. 1 mm thick rhizome. Stem white, unbranched, erect, and glabrous, ca. 3–4 cm long, 1.2 mm in diameter. Leaves 2–4, cauline, scale-like, whitish, elliptic lanceolate, entire, glabrous with blunt apex, 3–3.5 mm long, 1.5–2 mm wide. Flowers 2–3, subsessile, terminal, and arranged in a cincinnus. Bracts 3, 4–5 mm long, elliptic. Corolla actinomorphic, glabrous, deep orange-red in color. Floral tube urceolate with 12 ribs on its surface, 8 mm long, 7 mm in diameter. Perianth lobes numbering 6 in 2 whorls. Outer lobes linear, 3–3.5 mm long, 1 mm wide, apex oblique triangular, and lacking appendage. Inner

lobes linear, 2.5–2.8 mm long, 1 mm wide, apex narrowly triangularly and extended into a filiform appendage. The lobes are imbricate without adhesion and form a loose dome with six holes in a woven manner; holes elliptic, 1.0–1.2 mm wide, 1.8–2.0 mm high. Stamens 6, 3.5–4 mm long, anatroous, and hanging down at the upper inner margin of the perianth tube, dark-red; filaments free, 0.7 mm long; connective broad and flattened, laterally connate to form a tube, ca. 3 mm long, glabrous; apical end of the individual connective slightly concave, without any processes, and a slightly exceeding lateral appendage; lateral appendage large, nose-shaped, glabrous; each stamen with two separate thecae, 2 mm long, abaxial. Ovary inferior, obconical, 3 mm long, 3.5–4 mm in diameter; carpels 3, laterally connate to form one chamber; placenta columnar, free central, and trilobed to base; ovules numerous on each lobe of the placenta; style translucent red, cylindrical, and glabrous, 1.3–1.5 mm long, 0.5 mm in diameter; stigma 3, triangular, entire, translucent white, margin in a slightly reverse roll and bearing short prickles. Fruit and seeds not seen.

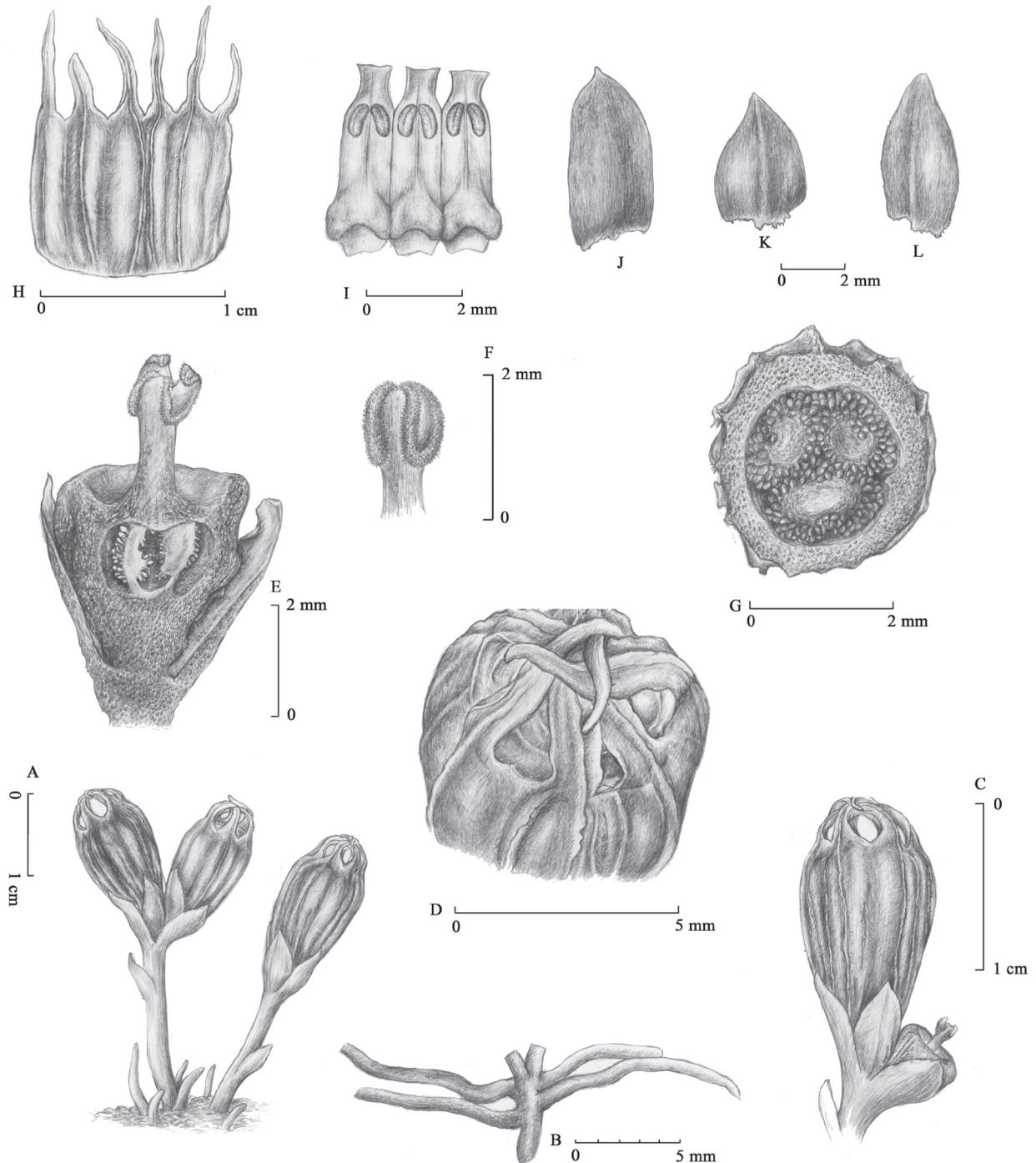


FIGURE 3. *Thysmia jianfenglingensis*. A. Flowering plant; B. Rhizome; C. Flowers; D. Lobes of perianth tube forming a net-cover or mitre; E. Longitudinal section of ovary; F. Stigma; G. Transverse section of ovary; H. Perianth tube; I. Stamens; J–L. Bracts.

Phenology:—Fl. June–July.

Distribution and habitat:—This is the first documented report of *Thismia* and the type species, *T. jianfenglingensis* in Hainan Island. Thus, we presume the distribution of the species is limited to Jianfengling National Nature Reserve on Hainan Island, China. It grows in tropical montane rain forest at an elevation of about 875 m, although it is likely rare. This species was collected right next to an *Engelhardia roxburghiana* tree (Juglandaceae). The dominant tree species in the Jianfengling forest include of *Livistona saribus* (Arecaceae), *Cryptocarya chinensis* (Lauraceae), *Alseodaphne hainanensis* (Lauraceae), *Lithocarpus fenzelianus* (Fagaceae), *Prismatomeris tetrandra* (Rubiaceae) (Xu *et al.* 2015).

Etymology:—The specific epithet for this species is related to place of its collection. Jianfengling is the name of the National Nature Reserve in Hainan, China.

Conservation status:—This species grows in the Jianfengling National Nature Reserve. In spite of many field surveys, only six individuals have been found. Taking into consideration the reproductive capacity of *Thismia* and the protected habitats where this species grows, more populations may be found in the future. However, in 2018, we visited the locality where the new species was collected but found no individuals. Therefore, we believe that the new species should be assigned the Vulnerable (VU) conservation status according to IUCN Red List criteria, indicating a population with a very restricted area of occupancy or number of locations such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period (IUCN 2019).

Discussion

This first report of a newly-described, rare plant from Hainan Island, China, *T. jianfenglingensis* is significantly different from other fairy lantern species found in China. This species most closely resembles *T. hongkongensis* in growth habit and overall appearance. *T. jianfenglingensis* differs from *T. hongkongensis* in dark-red cylindrical-urceolate perianth tube (not pinkish-white obpyriform-urceolate), the outer perianth lobes invariably being embedded in the dome with six holes (not spread outward and separated from the dome with three holes), slightly concave and glabrous connective apex (not two teeth adorned with trichomes), entire lateral appendage of the connective (not distinct trilobed), acute shape of the stigma lobes (not rounded). Therefore, all these significant differences on the dome, the connective and the stigma between *T. jianfenglingensis* and *T. hongkongensis* support the recognition of this new species.

Ovary morphology varies greatly among species of *Thismia*. It is stated that *Thismia*, as a genus, has three carpels that form a unilocular ovary with three parietal placentas or with three placental columns; stigmas three or one (Jonker 1938, Maas *et al.* 1986, Wu *et al.* 2010). To date, there are six species of *Thismia* found in China, distributed in Yunnan (*T. gongshanensis*), Guangdong (*T. hongkongensis*), Hongkong (*T. hongkongensis* and *T. tentaculata*), Taiwan (*T. taiwanensis* and *T. huangii*) and Hainan Island (*T. jianfenglingensis*), respectively. *T. jianfenglingensis* has three carpels with three placental columns and three stigmas, which is typical character of Old World fairy lantern species. Based on the difference on carpel, column and stigma morphology, we would expect that *T. jianfenglingensis* might have a close phylogenetic relationship with *T. hongkongensis*, *T. tentaculata*, *T. taiwanensis* and *T. huangii* which has three carpels with three placental columns and three stigmas, but be evolutionarily distinct from *T. gongshanensis*, which only has two carpels and two parietal placentas, with two simple stigmas (Li & Bi 2013). Such distinctions may be helpful for subgenera classification in the future.

Key to six *Thismia* species found in China

1. Inner tepal appendage 10–33 mm, longer than perianth tube.
2. Perianth tube bright yellow; stigma 2..... *T. gongshanensis*
2. Perianth tube translucent-white or white; stigma 3.
3. Annulus translucent-white; outer tepal lobes ovate, inner tepal lobes spatulate; inner tepal appendage translucent-white, 28–33 mm..... *T. taiwanensis*
3. Annulus bright yellow; outer tepal lobes broadly triangular, inner tepal lobes narrowly triangular; inner tepal appendage orange-red, ca. 17 mm..... *T. tentaculata*
1. Inner tepal appendage 1–4 mm, shorter than perianth tube.
4. Perianth tube white; inner tepal appendage 1 mm; connective apex with glandular hairs; stigma lobe with a long hair..... *T. huangii*
4. Perianth tube pinkish-white or deep orange-red; inner tepal appendage 3–4 mm; connective apex without glandular hairs; stigma lobe hairless.
5. Perianth tube pinkish-white; connective apex with two distinct teeth and adorned with trichomes..... *T. hongkongensis*
5. Perianth tube deep orange-red; connective apex nose-shaped, glabrous..... *T. jianfenglingensis*

Acknowledgments

The authors gratefully acknowledge Ms. Yunxiao Liu from South China Botanical Garden, Chinese Academy of Sciences for preparing the illustration. This work was financially supported by the National Non-profit Institute Research Grant of CAF (Grant number: CAFYBB2017QC003) and the State Key Laboratory for Conservation and Utilization of Subtropical Agro-bioresources (Grant number: SKLCUSA-b201718). A. Corrales was partially funded by the Ewel postdoctoral fellowship at University of Florida.

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