



Rediscovery of *Thismia neptunis* (Thismiaceae) after 151 years

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Abstract

Thismia neptunis, as many of its congeners, is a poorly understood species that has only been known from the type collection and its limited original description. In January 2017 it was rediscovered in the type area in the Gunung Matang massif, western Sarawak, Borneo, Malaysia. The paper provides the amended description and drawings of the species, very first available photographs and short notes on taxonomy and historical context of Beccari's work on *Thismia*.

Key words: *Brunonithismia*, Burmanniaceae, fairy lanterns, Kubah, Monte Mattán, Sarawak

Introduction

Thismia Griffith (1844: 221; fairy lanterns, Thismiaceae, or Burmanniaceae s.l.) is a genus of small mycoheterotrophic plants with the main centre of diversity in tropical Asia. Although the genus in the taxonomic sense exists since 1844, many species or populations have been being discovered only in the last decade. For instance, out of total of ca 76 species, 30 have been described since 2011 (Hunt *et al.* 2014, Chantanaorrapint *et al.* 2016, Cowie & Liddle 2016, Cooper 2017, Kumar *et al.* 2017, Sochor *et al.* 2017, Suetsugu *et al.* 2017, Sujanaopal *et al.* 2017, Tsukaya *et al.* 2017, Chantanaorrapint & Suddee 2018, Hroneš *et al.* 2018, Suetsugu *et al.* 2018, Sochor *et al.* 2018) and several others (ca >10) await formal description. The real diversity of fairy lanterns is therefore being uncovered only recently. At the same time, their preferred habitats, i.e. mostly primary tropical rainforests, have been facing unprecedented worldwide decline. Quite many species may therefore be already extinct now, particularly when we consider the fact that very many species appear to be stenoendemic, usually known just from the type collections. An illustrative example (although atypical in habitat and distribution) is *T. americana* Pfeiffer (1914: 123), which was observed in the type area for a few years after its first discovery in 1912, but has then never been found again despite many intensive searches (Merckx & Smets 2014). Therefore, it may seem somewhat paradoxical that new localities of formerly described taxa, although still not numerous, are being discovered mainly recently, in the time of massive landscape changes and conversions (e.g. Chantanaorrapint & Sridith 2007, Chantanaorrapint & Chantanaorrapint 2009, Tsukaya *et al.* 2014). Nevertheless, it is often unclear whether the new findings belong to some known, or rather to a new species (e.g. Tsukaya *et al.* 2014, Chantanaorrapint *et al.* 2015). One of the problems is insufficient description and documentation for the old names. In some extreme cases, e.g. *Thismia clandestina* (Blume 1850: 65) Miquel (1859: 616) which was described based on a fruiting specimen, unambiguous interpretation of the name becomes impossible (Suetsugu *et al.* 2017).

One of the species with incomplete documentation is *T. neptunis* Beccari (1878: 251). Its original description is restricted to external appearance and so is the original drawing, otherwise very detailed (Fig. 1). Other characters, particularly structure of connectives, which is crucial for *Thismia* species delimitation (Sochor *et al.* 2018), were unknown. In January 2017, the species was discovered in the type area, possibly the type locality, 151 years after its type collection. To our knowledge, it is only the second finding of the species in total. We therefore provide its amended description, inclusive internal characters, and very first photographic documentation of this iconic and, due to its peculiar appearance and also the name, almost mythical plant.

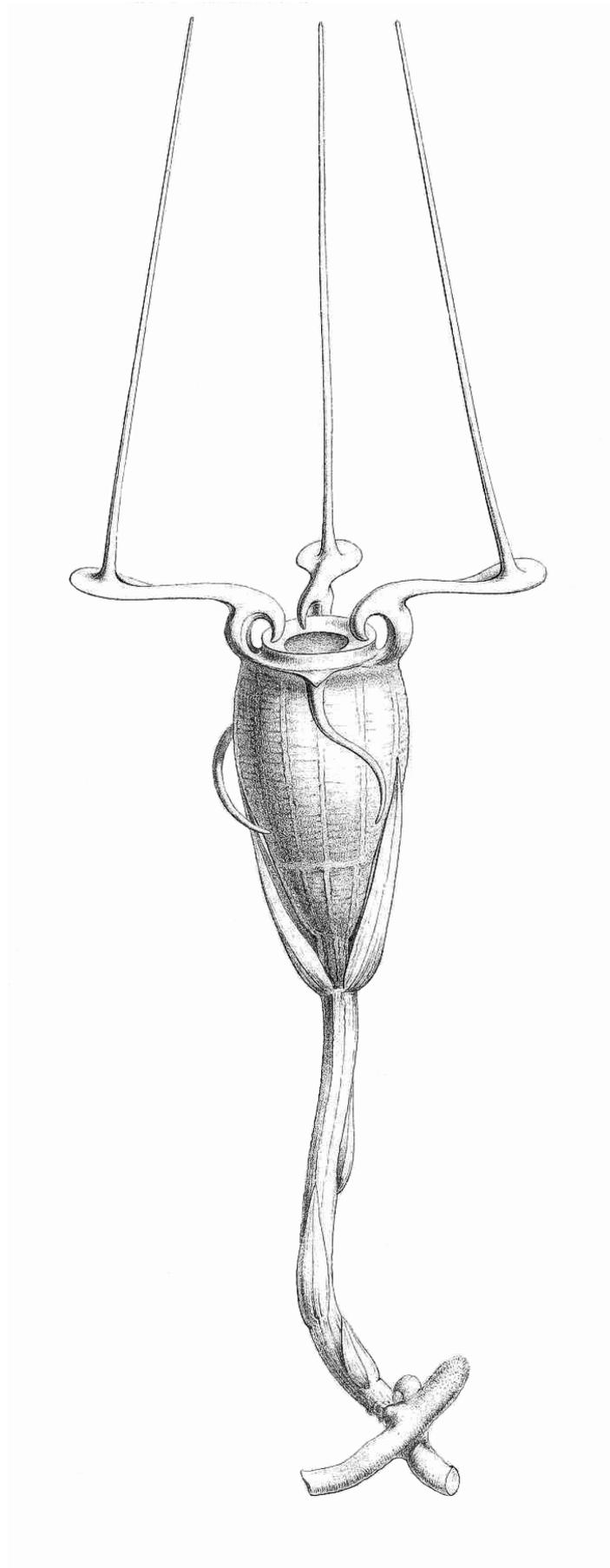


FIGURE 1. Original Beccari's drawing of *Thismia neptunis* (from Beccari 1878).

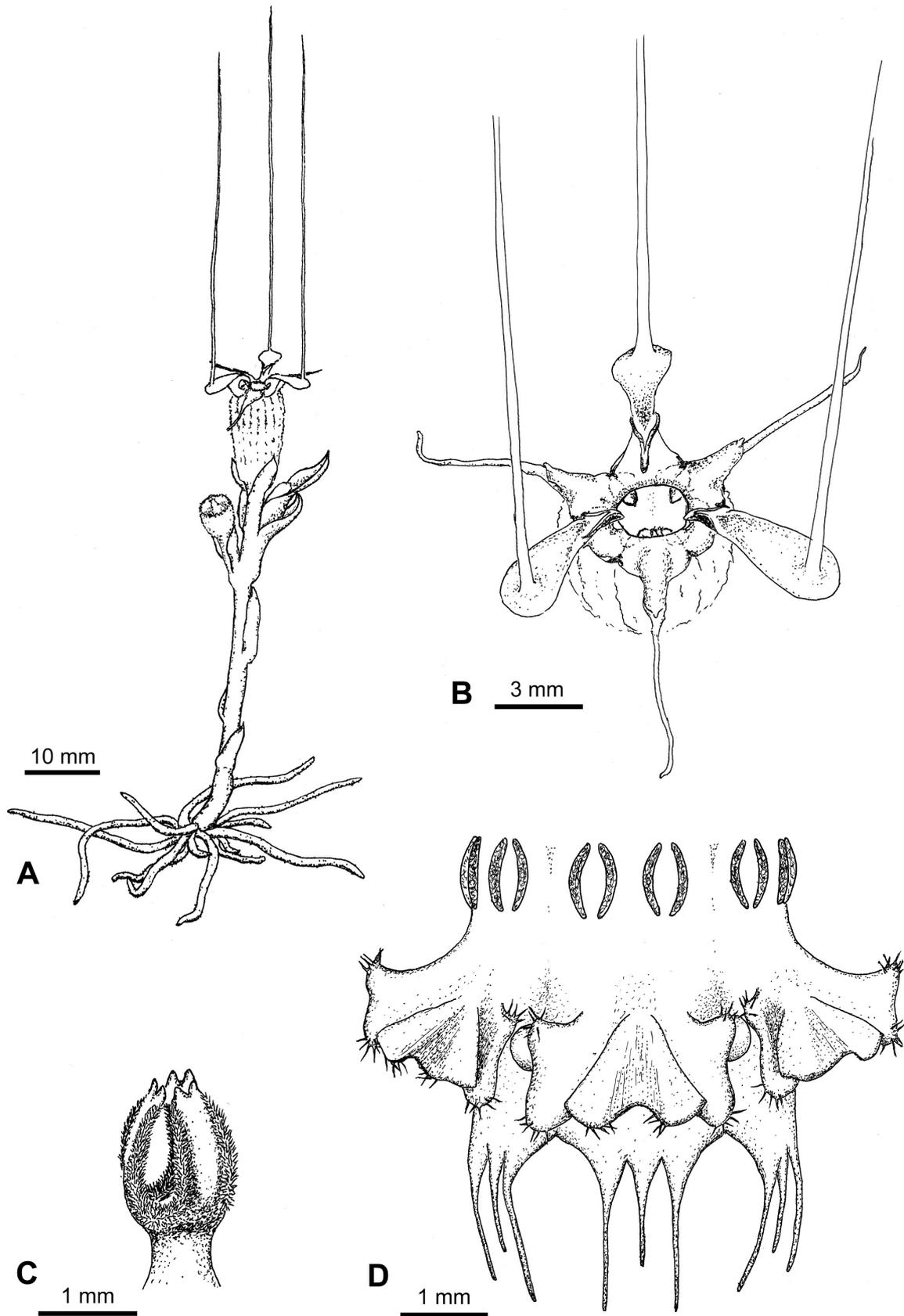


FIGURE 2. *Thismia neptunis*: flowering plant (A), upper view of flower (B), stigma (C), outer view of connective tube (D). Drawn by K. Janošíková.

Material and Methods

The studied population consisted of two flowering individuals and one bud. Morphological characters were studied using hand lens (30–60× magnification) and macro photography. Collected specimen was thoroughly compared with original drawing (Fig. 1) and description given in protologue of *T. neptunis* and with digital image of holotype in FI via JSTOR Global Plants (2017) initiative.

Taxonomic treatment

Thismia neptunis Beccari (1878: 251), Figs 1–3

Type:—MALAYSIA. Ragiato di Sarawak, Mattang. April 1866. *O. Beccari p.b. 1508* (holotype FI-B 013453!)

Description:—Terrestrial achlorophyllous herb, ca. 9 cm tall when flowering. *Roots* ca. 0.7–1.5 mm thick, hardly branched, vermiform, creeping, cream-coloured to light brown. *Stem* ascending, simple or simply branched, ribbed, whitish or creamy, glabrous, ca. 4 cm long. *Leaves* 3–5, appressed to erecto-patent, scale-like, of the same colour as stem, narrowly triangular with acute apex, entire, with prickle-like transparent processes on abaxial side, 5–8 mm long and ca. 2 mm wide at the base. *Floral bracts* 3, similar to leaves, but larger and slightly curved, up to 12 mm long. *Flowers* 1–3. Perianth actinomorphic with 6 tepals fused into an urceolate perianth tube with free, unequal apical lobes; perianth tube 12 mm long and 7 mm wide at the widest point, whitish, partly transparent (upper part therefore seemingly orange due to connectives shining through), with 12 thin longitudinal ribs and ca. 12 transverse bars; longitudinal ribs white in lower half and dark orange in upper half, widened between bases of filaments and forming dark orange to reddish ± rhombic spots between perianth lobes; perianth tube apex ± flat, without prominently raised annulus, opening 2.2 mm in diameter; outer perianth lobes ± conical, pointed, ca. 10 mm long, including a 7 mm long filiform appendage arising from the abaxial side; inner lobes with a complex three-segment structure; proximal segment claw-shaped, pointed towards the perianth tube opening, reddish-brown; middle segment ± flat (basally triangular in section), obovate in outline, growing horizontally from central abaxial part of the proximal segment; distal segment growing vertically from centre of the middle segment, filiform, gradually tapering towards apex, yellowish-brown, 4.5 mm long. *Stamens* 6, hanging against perianth lobes; filaments short, flat, reddish on sides, otherwise yellow adaxially and whitish with orange longitudinal stripe abaxially; connectives broad and flattened, laterally connate to form a tube, almost glabrous (long hairy only around thecae and on lateral appendage), shortly papillose, vivid orange in the proximal part to orange-red at the distal end; interstaminal glands prominent, hemispherical, placed between bases of lateral appendages; appendages at the distal margin of connective three, filiform, two longer (1.6 mm), one in the middle shorter (1.1 mm long); lateral appendage not reaching the connective apex, hairy and reddish at margins, composed of three lobes, lateral lobes (vertical) obtusely fishtailed, central lobe wavy (with a distinct longitudinal ridge between two furrows). *Ovary* obconical to cup-shaped, whitish to light beige, almost completely surrounded by bracts. *Style* light beige, ca. 1 mm long, stigma 3-lobed with lobes long, flat, erect, bicuspidate and reddish on top. *Capsule* cup-shaped, whitish to light beige, on elongated pedicel. *Seeds* not seen.

Additional specimens examined:—MALAYSIA. Sarawak, Kuching, Kubah National Park, 0.4 km NE of Matang Wildlife Centre. Coordinates WGS 84: 1°36'41"N, 110°9'48"E, elevation 38 m, 26 January 2017. *M. Sochor* and *Z. Egertová BOR51/17* (OL 35279).

Habitat and ecology:—The only known locality is in primary lowland mixed dipterocarp forest on a river alluvium. *Thismia* species are generally accompanied by other mycoheterotrophic plants; in this case it was *Sciaphila* cf. *alba* Tsukaya & Suetsugu (2015: 284). Albeit pollination ecology was not studied, ca. seven flies of family Sciaridae (Diptera) and one individual of family Braconidae (Hymenoptera) were observed being stuck on inner perianth lobes of the two flowers (Fig. 3A, D, E, F). Although the braconid was probably only a coincidental victim, the flies may represent potential pollinators, as several dipteran taxa have been reported as visitors and probable pollinators of fairy lanterns (Li & Bi 2013, Mar & Saunders 2015). Nevertheless, why had they been attracted to and finally trapped on the perianth lobes surface can only be speculated. Tepals are apparently hydrophilic (possibly as a mean of maintaining turgor in the long thin appendages) as indicated by a number of rain drops persisting on them long after the rain. But they do not appear to be sticky and no other particles tended to be trapped on them either in the field or during our manipulation. Therefore, the insects seem to have been attracted by smell (or other signals) of the flowers and accidentally drowned on the wet surface of perianth lobes.

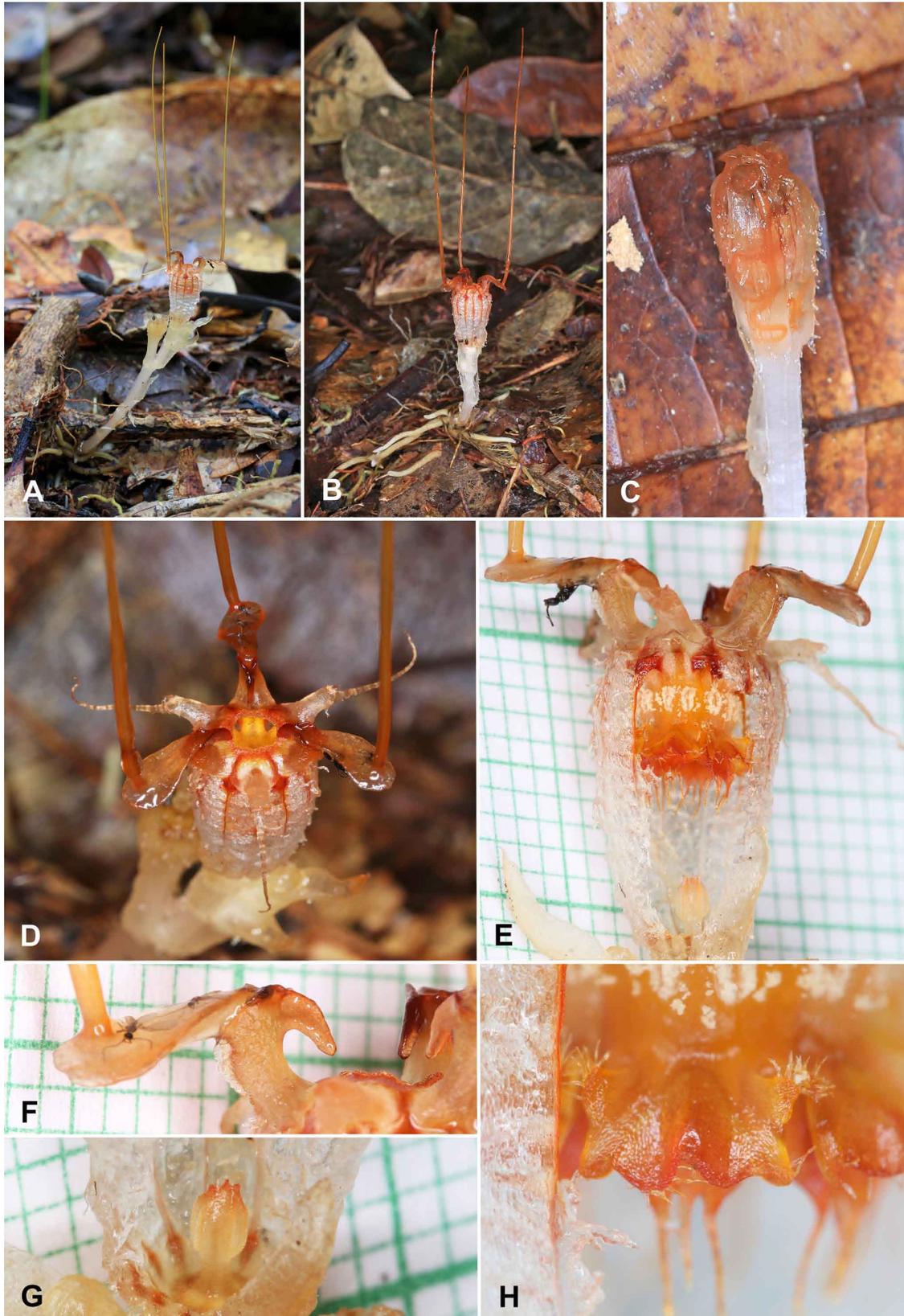


FIGURE 3. *Thismia neptunis*: flowering plants (A, B), bud (C), detail of flower (D), section of floral tube and outer view of connective tube (E), detail of inner perianth lobe (F), stigma (G), lateral appendage (H).

Distribution:—The species is known from a restricted area in western Sarawak, Borneo, Malaysia. Beccari (1878) described the locality simply as “Monte Mattán” or “Mattang”, which is an area now generally known as Matang massif which Kubah National Park is part of it. The present locality is placed at the park’s western border and may be identical or close to that of Beccari.

Conservation status:—The extent of occurrence (EOO) and the area of occupancy (AOO) of *T. neptunis* cannot be estimated because the species is only known from the type area/locality. Its inconspicuous appearance may potentially contribute to our limited knowledge on its distribution as it may be easily overlooked in the field. Nevertheless, due to the facts that 1. it is probably restricted to primary lowland rainforests, i.e. a habitat that has experienced a significant reduction in Sarawak in the last decades; 2. the only known population occurs in a primary forest just around 100 m from its edge and the whole locality is therefore susceptible to changes in plant community composition due to edge effect (Qie *et al.* 2017); and 3. its known population can be estimated to just a few (<50) individuals, it fulfils criteria B2, C2 and D of critically endangered species (CR) according to the IUCN Red List Categories and Criteria (IUCN 2012).

Taxonomic affinities:—Having free perianth lobes of unequal length and shape, *T. neptunis* belongs to section *Thismia* (*Euthismia* Schlechter, 1921: 34), subsection *Brunonithismia* Jonker (1938: 242). This group comprises nine species (Kumar *et al.* 2017, Suetsugu *et al.* 2018) of very diverse morphology as for symmetry of perianth, modification of perianth lobes and structure of connectives. Half of the species are, nevertheless, only poorly documented. *Thismia neptunis* is unique among other fairy lanterns in the very complex three-segmental structure of inner perianth lobes that are terminated by long filiform appendage pointing vertically upwards. This striking morphology led Schlechter to creation of monotypic section *Sarawakia* Schlechter (1921: 35) within his system of *Thismia* (Schlechter 1921). However, his approach has not been generally accepted (Jonker 1938, Kumar *et al.* 2017).

Beccari was also well aware of morphological uniqueness of *T. neptunis*. In the protologue (Beccari 1878), he stated that *T. neptunis* seems to have connectives similar to *T. brunonis* Griffith (1844: 221). However, *T. brunonis* have apical part of the connective covered by numerous short teeth (Griffith 1845) while *T. neptunis* have only three rather long appendages. Nevertheless, Beccari himself was not absolutely sure about the character of connectives as he studied only two pressed and dried plants. In having whitish perianth tube with 12 orange streaks *T. neptunis* superficially resembles *T. javanica* Smith (1910: 32) and *T. arachnites* Ridley (1905: 197). Both of them, nevertheless, differ in having short rounded outer perianth lobes and simpler spreading inner perianth lobes, and the latter species also in having “numerous short teeth” at the apical end of connectives. Connectives of *T. javanica*, although similar at a first glance, differ from those of *T. neptunis* in colour (white vs. orange, respectively) and three short teeth at the apex, each bearing 1–2 long hairs of similar length (vs. three unequal filiform appendages in *T. neptunis*). *Thismia neptunis* is so far the only known member of subsection *Brunonithismia* occurring in Borneo.

Odoardo Beccari as a collector of *Thismia*

Odoardo Beccari (1843–1920) was an Italian botanist who is considered one of the founding figures of biological research in Sarawak (Boyce & Wong 2007). He spent three years (1865–1868) in Borneo and another four years (1872–1876) in other Sunda Islands, mainly New Guinea (Pichi Sermolli & van Steenis 1983). Although his main object of interest was palms (Arecaceae), he collected and described hundreds of other plant species, among them also six species of *Thismia*, the number not yet surpassed by any other collector. One of these species originates from New Guinea (*Thismia crocea* (Beccari 1878: 249) Smith (1909:193)), one from Singapore (*Thismia aseroe* Beccari (1878: 252)) and the others from Sarawak (*Thismia clavigera* (Beccari 1878: 251) Mueller (1891: 235), *T. episcopalis* (Beccari 1878: 250) Mueller (1891: 235), *T. neptunis* and *T. ophiuris* Beccari (1878: 252)). Interestingly, three of these species come from one locality in southwestern Sarawak called by Beccari as “monte Mattán”. This refers to Gunung Matang, a mountain massif included in present-day Kubah National Park, northwest of Kuching. This area was Beccari’s favourite place during his stay in Sarawak in 1865–1868 and he spent many months in a forest hut called “Vallombrosa” on eastern flanks of the massif (Beccari 1902). Beccari himself gave only very limited information about collecting localities of the three *Thismia* in Matang which was however a common practise in those times. On the other hand, he gave an interesting description of ecological requirements of *Thismia* species, probably the first of its kind. He writes in his book *Nelle foreste di Borneo* (Beccari 1902) that *Thismia* and other achlorophyllous plants were a reward for his patient and careful search in places where the forest was thickest, the shade densest and the soil richest. This unambiguously illustrates that Beccari was aware of ecology of *Thismia* and he probably systematically searched for them in Matang. The current locality of *T. neptunis* is on the other side of the Matang massif than Beccari’s hut used to exist and it is hard to say if it is identical with the *locus classicus*. The massif itself is not huge and it is not difficult for experienced person to walk across it. As the forests of the Matang massif has been preserved almost unaltered since Beccari’s stay, we believe that the chance for rediscovery of the two remaining species described by Beccari from this locality, i.e. *Thismia episcopalis* and *T. ophiuris* is still high.

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