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Syzygium setosum (Myrtaceae), a rare and endangered peat swamp tree in Southeast Asia: lectotypification, conservation status and a new record in Sumatra

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Abstract

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Syzygium setosum (King) I.M. Turner (*Myrtaceae*), a poorly known peat swamp tree endemic to Peninsular Malaysia, is recorded for the first time in Sumatra, Indonesia. This study was conducted based on morphological characters examined on herbarium specimens of the taxon preserved at various herbaria pertinent to the Southeast Asian flora. The description of *S. setosum* is amended following the new collections from Peninsular Malaysia and Sumatra. The distribution of this obligate peat swamp species is updated and includes the eastern side of Sumatra and the western side of Peninsular Malaysia. The conservation status of the taxon is assessed. With the available data, the taxon is provisionally assigned here as “Endangered” [EN] with the main threat coming from habitat loss. Field images of the taxon from Sumatra are provided. A lectotype is designated here for *Eugenia setosa* King.

Keywords

MYRTACEAE – *Syzygium* – Southeast Asia – West Malesia – Lectotypification

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Introduction

Syzygium Gaertn. (Myrtaceae) is predominantly a tree genus with over 1,200 species recorded in tropical and subtropical regions of the Old World (Low et al., 2022; BGCI, 2022; POWO, 2022). Although the genus is known to be the most species-rich woody tree genus in the world (BEECH et al., 2017), *Syzygium* can also be encountered as a small rheophytic shrub along riverine vegetation in Borneo or as a dwarf compact bush in the subalpine forest at over 2,000 m elevation in New Guinea (Low, 2021). The diversity of *Syzygium* is centred in Southeast Asia, in the biogeographical region known as Malesia (VAN STEENIS, 1950). As the genus is immensely rich in diversity, coupled with inadequate fertile herbarium specimens in flowering and fruiting stages for species distinction, taxonomic studies conducted in the Malesian region were primarily focused on geographical units such as Borneo (MERRILL & PERRY, 1939; ASHTON, 2011), Sumatra (WIDODO, 2011), Java (BACKER & BAKHUIZEN VAN DEN BRINK, 1965), Malay Peninsula (HENDERSON, 1949; KOCHUMMEN, 1978) and New Guinea (HARTLEY & PERRY, 1973).

The majority of the *Syzygium* species in the Malesian region fall within Indonesia, with over 300 *Syzygium* species estimated to occur in the country (CRAVEN, 2001; BGCI, 2022; POWO, 2022). Nevertheless, the inventory of *Syzygium* in Indonesia is incomplete, considering many parts of the country are poorly botanised (FRODIN, 2001; MIDDLETON et al., 2019; CÁMARA-LERET et al., 2020) and many new species have been discovered since the 2000s, including: ten species from Sumatra (WIDODO et al., 2010; WIDODO, 2011; WIDODO & CHIKMAWATI, 2016; WIDODO & LUCAS, 2018), six from Sulawesi (BRAMBACH et al., 2017; SUNARTI, 2020), nine from Indonesian New Guinea (SNOW & CRAVEN, 2010; HAMBALI et al., 2017; CRAVEN, 2019; MUSTAQIM et al., 2020; CRAVEN et al., 2021), and one from Lesser Sunda Islands (SUNARTI et al., 2022).

In late November 2020, an unidentified *Syzygium* tree was collected from the peat swamp forest by one of the authors (AR) from southeastern Sumatra. The collection is unique amongst all known Sumatran *Syzygium* in having reddish-brown erect bristly hairs evenly covering leafy twigs and inflorescence axes. Efforts were made to identify the collection in various herbaria and by examining literature concerning West Malesian or Sundaland *Syzygium*. Our findings concluded that this unidentified peat swamp *Syzygium* from Sumatra is *S. setosum* (King) I.M. Turner, a species previously recorded only from Peninsular Malaysia. We also discovered overlooked Sumatran materials identified as *Eugenia setosa* King and other collections made subsequently since 1918 in eastern Sumatra. *Syzygium setosum* thus occurs in Peninsular Malaysia and Sumatra, Indonesia.

The inventory of peat swamp flora in Southeast Asia received limited attention apart from a few studies conducted

in Indonesia and Malaysia between the 1950s to 1970s (WHITMORE, 1984). Today, as dry lowland resources become scarce in the region, peat lands are being drained and logged for utilisation. Generally, drained peat lands were converted into plantations, but they were also designated for development into urban areas. As such, peat swamp forest is one of the most threatened ecosystems in the world, and yet poorly documented botanically (POSA et al., 2011; MIETTINEN et al., 2017). For example, in the same locality as *Syzygium setosum* was discovered in southeastern Sumatra, two new tree species were discovered and named recently: *Disepalum rawagambut* Randi et al. (Annonaceae) (RANDI et al., 2022a) and *Lophopetalum tanahgambut* Randi et al. (Celastraceae) (RANDI et al., 2022b).

Material and methods

Fieldwork in Southeast Sumatra was conducted in 2020 in the Musi Banyuasin Regency, Sumatra Selatan Province, Indonesia. Herbarium specimens from BO, G, K and SING and online repositories such as Naturalis BioPortal website [<https://bioportal.naturalis.nl>] and GBIF [<https://www.gbif.org>] were consulted. In addition, type material of *Syzygium setosum* and closely related taxa were assessed from JSTOR Global Plants [<http://plants.jstor.org>]. General botanical terms used in this study largely follow BEENTJE (2012), whereas flower bud (hypanthium and pseudostalk) shape in *Syzygium* follows ASHTON (2011).

Results and discussion

Syzygium setosum (King) I.M. Turner in J. Singapore Natl. Acad. Sci. 22–24: 24. 1997 (Fig. 1).

= *Eugenia setosa* King in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 70: 120. 1901.

Lectotypus (designated here): MALAYSIA. Perak: Taiping, VIII.1888, *Wray 2704* (G [G00415921] image!; isolecto-: K [K000800015]!, SING [SING0056121]!).

Syntypi: MALAYSIA. Perak: Larut, c. 90 m, XII.1883, *King's Collector (Kunstler) 5266* (BM [BM000944152] image!, K [K000800016]!, P [P05209634] image!, SING [SING0056122]!, U [U.1439009] image!); Larut, c. 30 m, IX.1884, *King's Collector (Kunstler) 6601* (A [A00069563], G [G00415922] image!, GH [GH00069564] image!, K [K000800017]!); Larut, c. 90 m, XI.1884, *King's Collector (Kunstler) 6793* (K!, L [L.2515508] image!, P [P05209633] image!).

Small tree, to 10 m high, trunk to c. 6 cm diam., buttresses short to 5 cm high or absent, without stilt roots. Bark smooth with scattered lenticels, dark reddish-brown; inner bark pale cream; sapwood pale to dark cream. Twigs 1.5–3 mm across, covered with reddish-brown erect bristly hairs; internodes

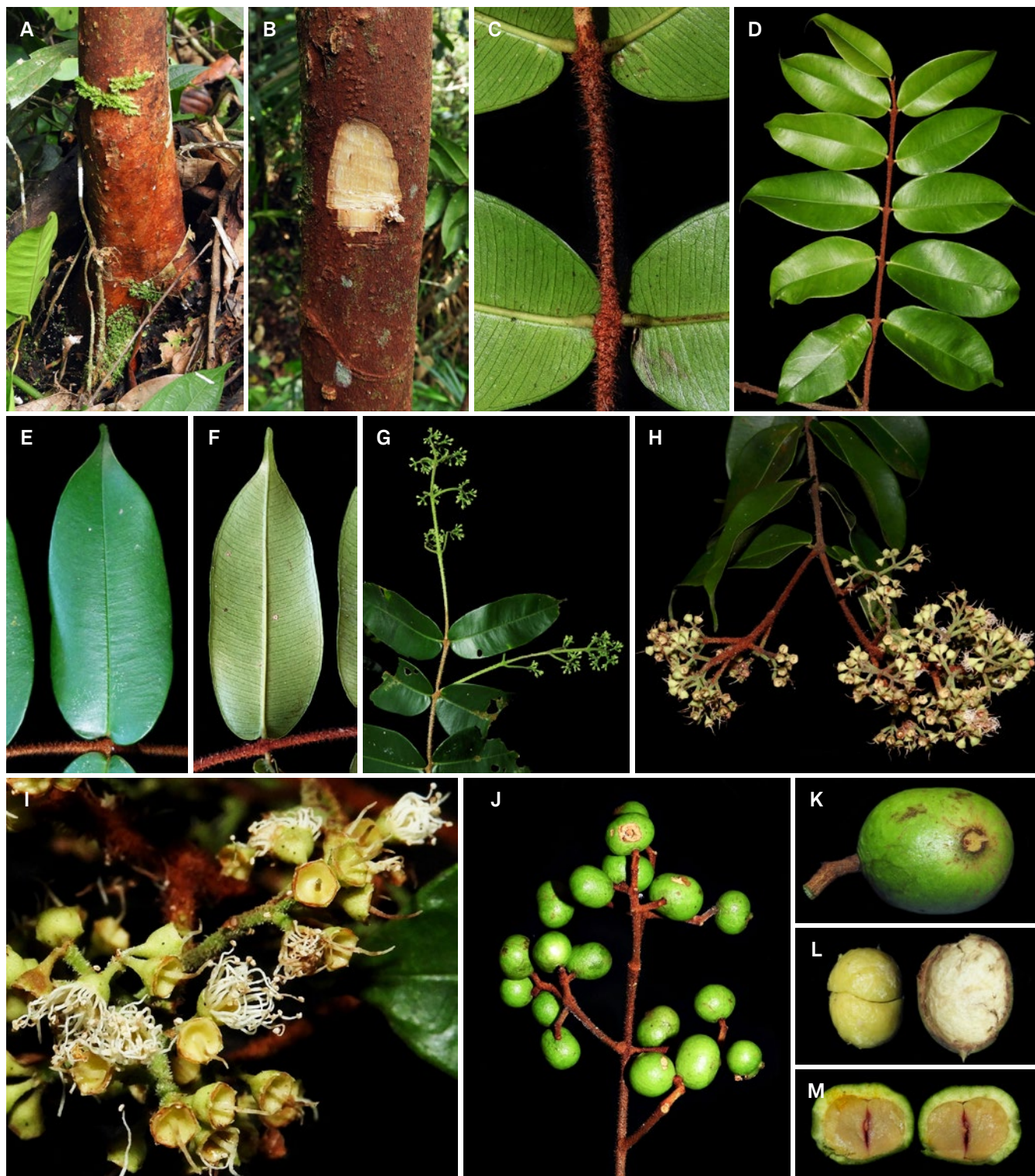


Fig. 1. – *Syzygium setosum* (King) I.M. Turner. **A.** Base of trunk showing the buttress; **B.** Close-up of the flush trunk showing pale cream inner bark and pale to dark cream sapwood; **C.** Close-up of a twig showing reddish-brown erect bristly hairs; **D.** Leafy branch showing opposite leaf arrangement; **E.** Adaxial (upper) leaf surface; **F.** Abaxial (lower) leaf surface; **G.** Immature terminal and axillary inflorescences; **H.** Mature inflorescences showing open flowers; **I.** Close-up of open flowers; **J.** Close-up of an infructescence; **K.** Apical view of a fruit; **L.** Seeds (left) and inner part of the carpel (right); **M.** Longitudinal section of a fruit. [Randi GB-052, BO] [Photos: A. Randi]

1.5–4.5 cm long, straight. *Petioles* 1.5–3 mm long, sparsely covered with short erect hairs. *Leaves* lamina elliptic to oblong, 3.5–8.5 × 0.9–3.5 cm, lower surfaces punctate; base rounded to cordate; apex caudate, margins slightly revolute; midrib sunken and glabrous on the upper surface, prominent and sparsely hairy on lower surface; primary secondary veins 26–35 pairs, basal most veins nearly perpendicular, otherwise upward diverging at c. 75° from the midrib; intercostal veins less distinct from primary secondary veins, forming somewhat inconspicuous veins at the upper quarter; intramarginal veins 1, 0.5–1 mm from the margin, hardly looped. *Inflorescences* a paniculate cyme of numerous flowers, terminal and in the upper axils, solitary or up to 3 in the apex of a leafy twig; rachis 4–10 cm long, covered with coarse and wiry erect hairs, white at first, turning reddish-brown during anthesis; floral bracts triangular, c. 0.5 mm long, acute. *Flowers* 5-merous, buds clavate, obconical, c. 5 mm long, c. 3 mm wide. *Hypanthium* obconical, c. 2.5 mm long, outer surface tuberculate without hairs, tapering abruptly to c. 1 mm long pseudostalk. *Calyx* lobes 5, triangular, c. 0.1 mm long, apex pointed, persistent after anthesis. *Petals* 5, likely somewhat cohered together and falling off as a pseudocalyptra, c. 2 mm across. *Stamens* c. 22; filaments 2–4 mm long, white; anthers broadly oblong, c. 0.4 mm long, cream (fide HENDERSON, 1949). *Style* cylindrical, gradually narrowed from the base towards the apex, 4–5 mm long, white. *Fruits* subglobose to nearly globose, c. 1.8 × 2.2 cm, maturing from green to yellowish-green when ripe, shallowly excavated at the apex and sometimes with remnants of the calyx lobes; mesocarp light green, becoming white inwards. *Seeds* solitary, cotyledonary intrusion absent.

Distribution and ecology. – Peninsular Malaysia (Perak and Selangor), Malaysia, and Sumatra (Sumatra Utara and Sumatra Selatan Provinces) (Fig. 2). *Syzygium setosum* occurs in lowland peat swamp forests up to c. 90 m. In Sumatra Selatan Province it is commonly found in primary peat swamp forests that are constantly wet and flooded periodically (*Randi GB-052*). In Peninsular Malaysia, *S. setosum* can also occur in regenerated degraded peat swamps (*Chew & Mohd. Nazri FRI78690*).

Conservation status. – *Syzygium setosum* is a rare obligate peat swamp forest tree restricted to Peninsular Malaysia (Malaysia) and Sumatra (Indonesia). So far, this taxon is known from 16 herbarium specimens, 13 of which were made between the late 19th century to the mid-20th century. Based on these collections, the species extent of occurrence (EOO) is estimated to be 138,373 km², and its area of occupancy (AOO) is estimated to be 48 km². The primary conservation concern for the species is habitat loss linked to human activities such as agricultural exploitation, logging, rapid expansion of urban areas and forest fire, which have increased significantly since

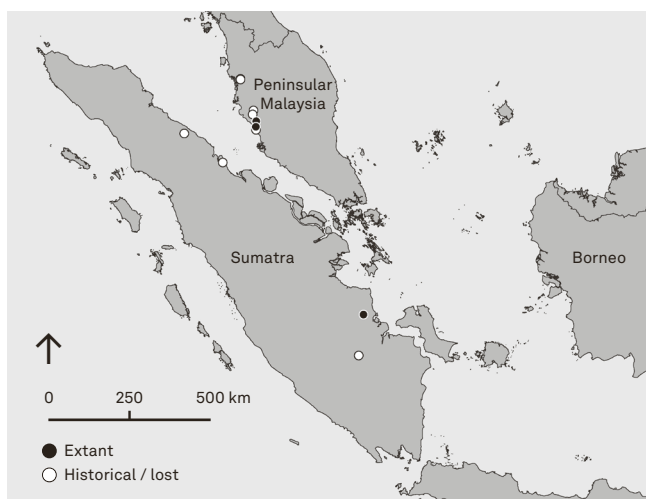


Fig. 2. – Geographical distribution of *Syzygium setosum* (King) I.M. Turner. Extant populations of the taxon are represented by black solid circles, while likely extinct populations are represented by white circles.

the 1960s. Degraded peat lands caused by human activities are prone to forest fires and the effects of climate change further exacerbated its intensity and occurrence as seen in the region in recent years (HUIJNEN et al., 2016; BUDININGSIH et al., 2022). Due to rapid land use change, the area of peat swamp forest in Southeast Asia declined between 1990 and 2015 from 76 % to 29 % of the area (a loss of 4.6 Mha), with a corresponding increase of 11 % to 50 % in agricultural area (MIETTINEN et al., 2017), comprising both small-scale farms and large-scale industrial plantations (POULTER et al., 2021). Of the remaining peat swamp forest, only 42 % is in official protected areas (WIJEDASA et al., 2018). Due to this decline in peat swamp forests, many historical localities of *S. setosum* are now lost. Analyses show that for this species, the EOO and AOO have declined by more than 50 % in the last three generations (c. 15 years for three generations according to Low et al., 2022), and the loss of peat forest is ongoing and therefore population decline is suspected to also be continuing. Therefore, considering this population decline, and that the taxon now only exists in fewer than five locations, the AOO is less than 500 km² and there a continuing decline in habitat (as supported by the Global Forest Watch data [<https://www.globalforestwatch.org>]), and loss of several subpopulations, *S. setosum* should thus be assigned a conservation status of “Endangered” [EN A2c+4c; B2ab(iii,iv)] based on IUCN Red List categories and criteria (IUCN, 2012) and guidelines (IUCN, 2022). This conservation status may require reassessment as more botanical surveys in Peninsular Malaysia and Sumatra are being carried out.

Notes – *Eugenia setosa* was described by George King in 1901 based on four collections, namely *Wray 2704*, *King’s*

Collector (Kunstler) 5266, 6601, and 6793, from Perak in Peninsular Malaysia (KING, 1901). HENDERSON (1949) expanded the taxon distribution to include Selangor based on two collections, *Mohd. Nur SFN34068* and *Symington FMS44033*. Later, TURNER (1997) transferred *E. setosa* to *Syzygium*, following other regional studies accepting SCHMID's (1972) proposal to recognise *Syzygium* as distinct from *Eugenia* s.s. Amongst all known Malayan *Syzygium*, *S. setosum* is characteristic in having reddish-brown erect bristly hairs on the twigs and inflorescence axis, panicle inflorescences, lamina with rounded to subcordate bases, numerous secondary nerves (26–35 pairs) and small flowers (c. 5 × 3 mm).

Other reddish hairy West Malesian *Syzygium* species include *S. fulvotomentosum* P.S. Ashton, *S. hirtum* (Korth.) Merr. & L.M. Perry, and *S. villiferum* (Ridl.) Masam. However, only *S. hirtum* has erect bristly hairs similar to *S. setosum*, while both *S. fulvotomentosum* and *S. villiferum* have velvety downy hairs. *Syzygium fulvotomentosum* is a northern Borneo endemic, and differs from *S. setosum* in having a petiole up to 10 mm long (vs. up to 3 mm long in *S. setosum*), cuneate leaf bases (vs. rounded to cordate in *S. setosum*), and flowers up to 10 mm long (vs. up to 4 mm long in *S. setosum*). Both *S. hirtum* and *S. villiferum* occur in Sumatra and Borneo. The latter differs from *S. setosum* in its larger leaves (c. 24–38 × 6.5–14 cm) and flowers (c. 12 × 7 mm), while the former differs from *S. setosum* in having fewer lateral nerves (c. 25 pairs) and larger flowers (c. 15 × 8 mm).

Neither HENDERSON (1949) or TURNER (1997) designated a lectotype for this name. Among the four syntypes cited in the protologue, we designate the most informative specimen, *Wray 2704* at G, as the lectotype. It is worth noting that *King's Collector (Kunstler) 6601* at K was annotated anonymously with the number “2” above the number “1”, giving the impression of being numbered “6602” instead of “6601”. Otherwise, the label information is identical to in the other duplicates deposited at A, G, and GH. In SING, two specimens numbered *King's Collector 6602* are identified as *Dacryodes incurvata* (Burseraceae).

The purported habit of *Syzygium setosum* was originally described as a shrub or creeper according to the label information of some specimens (e.g. *King's Collector (Kunstler) 5266, 6793*). Based on the herbarium specimens and living plants examined, in Sumatra this species rather corresponds to a tree. A woody plant species may exhibit different growth habits in a highly humid environments, such as freshwater swamp forests, peat swamp forests or montane (mossy) forests. As the specimens described as “creeping” lack the morphological characteristics of a typical climber, such as hooks, tendrils, sticky pads, twining stems and stem roots, it is likely that the collector came across individuals behaving atypically in a very humid environment in the swamps. Additional studies are needed to clarify this issue.

Additional specimens examined. – INDONESIA. **Prov. Sumatra Selatan:** Sungai Lalang Petaling, 11.XII.1979, *Anon. TFB357* (L [L.2515506] image!); Musi Banyuasin Regency, Bayung Lencir Distr., Muara Medak village, conservation area of PT Tri Pupajaya forest production concession, 1°46'15"S 104°12'07"E, 10 m, 30.XI.2020, *Randi GB-052* (BO). **Prov. Sumatra Utara:** Tebing Tinggi, 25.VIII.1918, *Bruinier 76* (L [L.2515507] image!); Labuhan Batu, Labuhan Bilik, 17.X.1928, *Lörzing 14275* (L [L.2515504] image!).

MALAYSIA. Perak: Larut, c. 90 m, I.1884, *King's Collector (Kunstler) 5447* (SING [SING0352109]); Larut, c. 90 m, VI.1884, *King's Collector (Kunstler) 6202* (M [M017111], SING [SING0352111]); Hilir Perak, Hutan Melintang Forest Reserve, Compartment 11, 13.IX.1967, *Ng FRI5696* (K, KEP [KEP99003]); Telok Anson, Changkat Jong, Sungai Hidup, 17.II.1975, *Mohd Shah & Mahmud MS3463* (KEP [KEP5678], SING [SING0152144]). **Selangor:** Kuala Selangor, Sungai Tinggi (Sungai Tengi), 8.5th mile, 19.VII.1937, *Symington FMS44003* (KEP [KEP99005]); Kuala Selangor, Sungai Tinggi (Sungai Tengi), 13.X.1937, *Md. Nur SFN34068* (KEP [KEP99004], L [L.2515509], SING [SING0352110]); Kuala Selangor, Sungai Karang Forest Reserve, NSPSF Expedition, Trail 6, 3°40'34"N 101°11'05"E, 23 m, 1.VII.2013, *Lim & Mohd. Nazri FRI72900* (K, KEP [KEP238582]); Kuala Selangor, Tanjung Karang, off Trail 4, 3°31'20"N 101°10'37"E, 25 m, 4.VII.2013, *Chew & Mohd. Nazri FRI78690* (K, KEP [KEP233315], SING [SING0215314]!).

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