

Rediscovery in Singapore of *Orophea hastata* and *Uvaria clementis* (Annonaceae)

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Abstract. The rediscovery in Singapore of the tree species *Orophea hastata* and the woody climber *Uvaria clementis*, two Annonaceae species that were previously presumed to be nationally extinct, is documented. Species descriptions and photo plates of flowering material of the two species are provided. Both species are assessed as Critically Endangered at the national level.

Key words. critically endangered, *Cyathostemma hookeri*, *Orophea*, rediscovery, *Uvaria*

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INTRODUCTION

The pantropically distributed flowering plant family Annonaceae (about 2,500 species of trees, shrubs and woody climbers) is a characteristic and species-rich element of lowland tropical forests of both the Old and the New World. More than 1,100 species have been reported from the Asia-Pacific region (Turner, 2018).

Singapore's rainforest remnants harbor a rich native Annonaceae flora. 27 native genera and 76 native species have been recorded from Singapore (Lindsay et al., 2022) including four recent new records: *Artabotrys scortechinii* King (Chen et al., 2018), *Dendrokingstonia nervosa* (Hook.f. & Thomson) Rauschert (Lim et al., 2018), *Drepananthus pruniferus* Maingay ex Hook.f. & Thomson (Ng et al., 2020), and *Uvaria micrantha* (A.DC.) Hook.f. & Thomson (Lim et al., 2018). Seven species, viz. *Cyathocalyx sumatranus* Scheff., *Friesodielsia calycina* (King) Steenis, *Miliusa eupoda* (Miq.) I.M.Turner, *Monoon hookerianum* (King) B.Xue & R.M.K.Saunders, *Orophea hastata* King, *Trivalvaria macrophylla* (Blume) Miq. and *Uvaria excelsa* (Hook.f. & Thomson) King, were reported as Nationally Extinct in Lindsay et al. (2022). Here we report the recent rediscovery in Singapore of *Orophea hastata* and document the recent rediscovery of *Uvaria clementis* (Merr.) Attan., I.M.Turner & R.M.K.Saunders reported by Lindsay et al. (2022).

DISCOVERY AND SPECIMEN DETAILS

Orophea hastata, a tree species, was known from Singapore from only two historical collections from the late 19th century (H.R. Ridley 2111, 1891, Singapore, SING [SING0012200]; H.N. Ridley 8119, Oct 1896, Bukit Timah, SING [SING0044222], flowering and fruiting) before two flowering individuals were observed in the Bukit Timah Nature Reserve in December 2022. Collections were deposited in the Singapore herbarium (M.A. Niissalo SING 2022-1095, 1 December 2022, Bukit Timah Nature Reserve, Fern Valley, SING [fallen flowers]; D.C. Thomas & M.A. Niissalo 3496, 6 December 2022, Bukit Timah Nature Reserve, Fern Valley, SING [flowering branches, Fig. 1]).

Uvaria clementis, a woody climber, was known from only historical collections from the Singapore Botanic Gardens from the late 19th and early 20th century including flowering material from the Gardens' Jungle (Anonymous 4790, February 1893, Singapore Botanic Gardens, Gardens' Jungle, SING [SING0003211]) and fruiting material from cultivation (Anonymous s.n., 13 February 1935, cultivated in Singapore Botanic Gardens, SING [SING0219395]) before fallen flowers were observed in the Singapore Botanic Gardens Rainforest in September 2018. Subsequently, flowering material was collected from a large liana in 2020 (Fig. 2; J. Lau SING2020-165, 21 February 2020, SING [SING031094]) and cuttings were taken for propagation. The propagation efforts failed and this liana in the Singapore Botanic Gardens Rainforest has died in the meantime, but an additional collection of fallen flowers and leaves from MacRitchie in the Central Catchment Nature Reserve (D.C. Thomas, M.A. Niissalo & L.M. Choo 3444, 21 March 2021, MacRitchie, Shinto Shrine Trail, SING) shows that this species is still extant in Singapore.

Below, we provide descriptions of the two recently rediscovered species, photo plates documenting the collected flowering material, conservation assessments at the national level, as well as some notes on how to identify and differentiate them from closely related species in the Singapore flora.

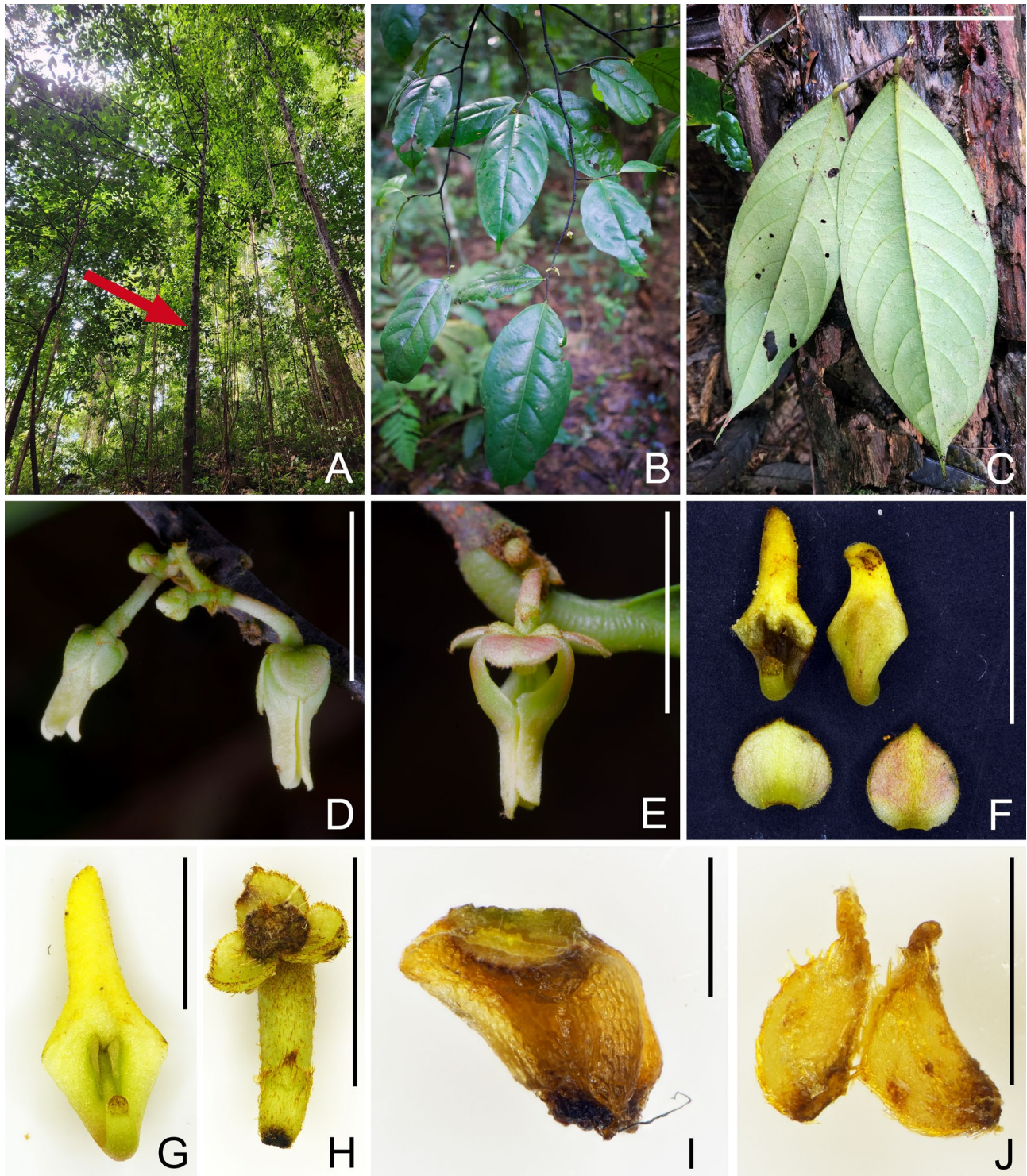


Fig. 1. *Orophea hastata*. A, tree habit, red arrow indicates the individual; B, leafy branches; C, leaves, abaxial surface (scale bar = 8 cm); D, inflorescence (scale bar = 10 mm); E, flower, side view (scale bar = 10 mm); F, petals, inner petal (upper two petals in image), outer petal (lower two petals in image), adaxial side (left) and abaxial side (right) (scale bar = 10 mm); G, inner petal, adaxial surface with nectary (paired slits) (scale bar = 5 mm); H, pedicel and calyx, petals, stamens and carpels removed (scale bar = 5 mm); I, stamen, side view (scale bar = 0.5 mm); J, two ovaries (scale bar = 1 mm). All from D.C. Thomas & M.A. Niissalo 3496 (SING). Photographs: A, C, F–J: D.C. Thomas; B, D, E: M.A. Niissalo.

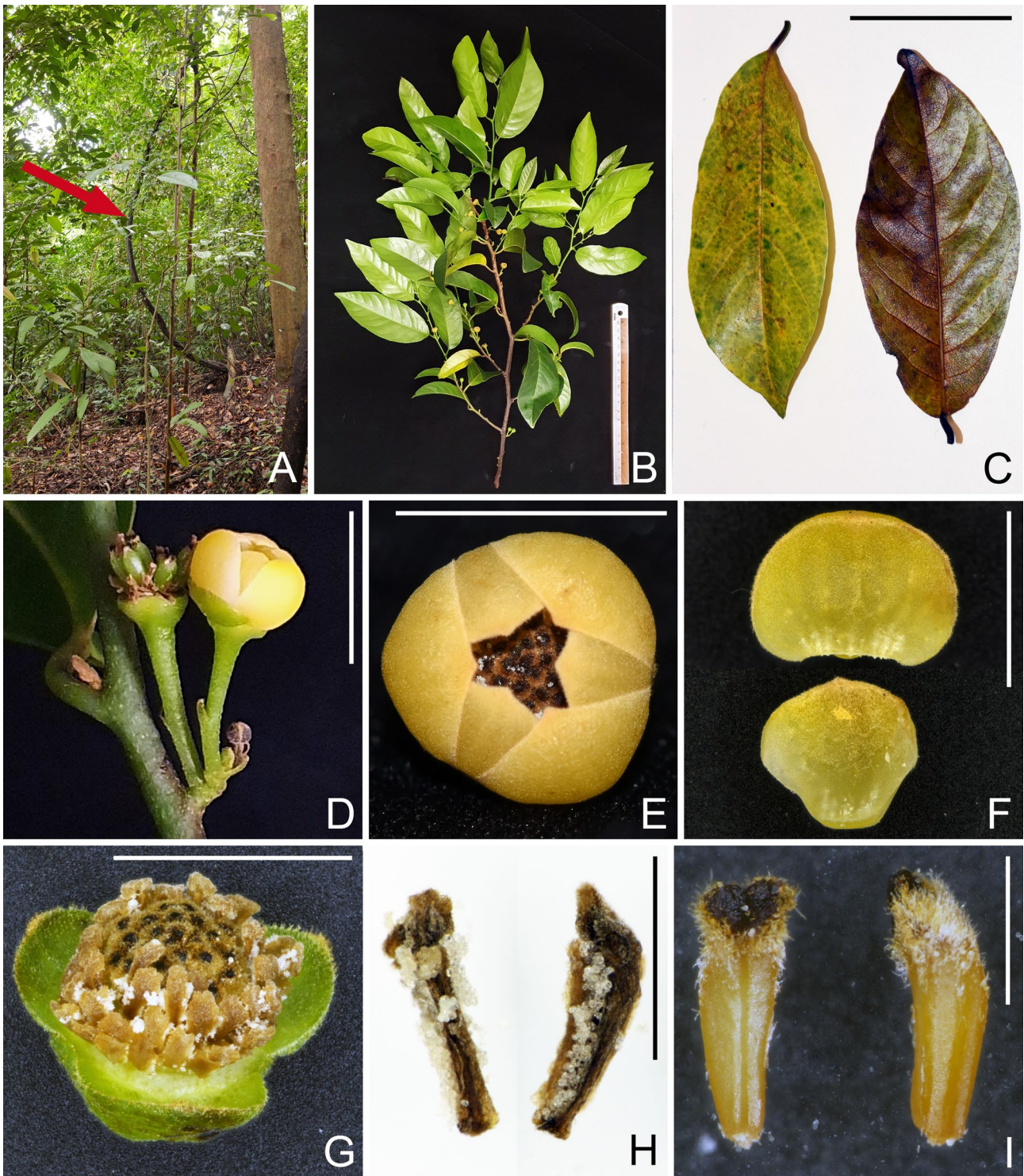


Fig. 2. *Uvaria clementis*. A, liana habit, red arrow indicates the individual; B, flowering, leafy branch; C, fallen leaves, adaxial surface (left) and abaxial surface (right) (scale bar = 5 cm); D, inflorescence, side view (scale bar = 10 mm); E, flower, top view (scale bar = 7 mm); F, petals, adaxial surface (upper: outer petal; lower: inner petal; scale bar = 4 mm); G, flower, petals removed showing the sepals, stamens and ovaries (scale bar = 4 mm); H, two dried stamens with dehiscent pollen sacs (scale bar = 1 mm); I, two carpels (scale bar = 1 mm). All from J. Lau SING2020-165 (SING). Photographs: A: Parusuraman Athen; B–I: D.C. Thomas.

SPECIES DESCRIPTIONS

Orophea hastata King (Fig. 1)

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 61(1) (1892) 83; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 40; Ridley, Fl. Malay Penins. 1 (1922) 71; Sinclair, Gard. Bull. Singapore 14 (1955) 397; Kochummen, Tree Fl. Malaya 1 (1972) 83; Keßler, Blumea 33 (1988) 68; Turner, Gard. Bull. Singapore 45 (1993) 31; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 116; Leonardía & Keßler, Blumea 46 (2001) 152; Lindsay et al., Gard. Bull. Singapore 74(Suppl. 1) (2022) 147. **Type:** King’s Collector [H.H. Kunstler] 7323, Peninsular Malaysia, Perak, Larut, March 1885 (lectotype K [K000574783], designated by Leonardía & Keßler (2001: 152); isolectotypes BM [BM000547322], G [G00237992], L [L0047804], LE [LE00012513]).

Small tree, up to 13 m tall. **Leaves** lamina elliptic, more rarely ovate, 7–22 × 3–9.9 cm, base obtuse to rounded, apex bluntly acuminate, secondary veins in 6–7 pairs, lamina glabrous above, with long straight adpressed brown hairs along midrib below, petiole 2–7 mm long, with ascending long, straight brown hairs. **Inflorescence** in leaf axils, bearing a few flowers. **Flowers** with pedicel 1.5–3 mm long, with many ascending adpressed golden-brown hairs. Sepals ovate-triangular, c. 1 × 1.5 mm, with short adpressed golden-brown hairs outside, glabrous within. Outer petals yellowish or yellowish tinged with red, broadly ovate, 2–4 × 2.5–5 mm, with scattered adpressed golden-brown hairs outside and a dense marginal fringe, glabrous within, inner petals yellowish, clawed, hastate, claw 2–3 mm long, 0.5 mm wide, limb long acute triangular, c. 5–9 mm long, 2–4 mm wide, apex long acute, with very short pale hairs on margins and paired glands in slits adaxially. Stamens 9 in two whorls (6 + 3), carpels 12(–16). **Fruits** with pedicel c. 1 cm long, monocarp to 6, globose c. 1.5 cm in diameter, drying red-brown, rather shiny, stipe 2–4 mm long, 1–1.5 mm wide. **Seed** 1 per monocarp.

Distribution. Endemic to Peninsular Malaysia and Singapore.

Ecology. Lowland forest.

Provisional conservation assessment. In Singapore, only two mature individuals are known, which were recorded in a primary rainforest remnant in the Bukit Timah Nature Reserve. Consequently, this species is here assessed as Critically Endangered (CR/D) at the national level.

Notes. The species description is based on material from Peninsular Malaysia and Singapore. The flowers of *Orophea* species are very small and delicate in comparison to species of most other Annonaceae genera and characteristically have few stamens and show clawed inner petals that are much larger than the outer petals, connivent and form a roof over the reproductive flower organs while leaving large apertures at the base between the petal claws (Figs. 1D, E; Keßler, 1988; Leonardía & Keßler, 2001). The character combination of nine stamens, usually 12 carpels, as well as hastate inner petals with protracted tips and nectaries in the form of paired slits on the adaxial side (Figs. 1F, G) allowed the identification of the material at species level (see identification key in Leonardía & Keßler, 2001).

Uvaria clementis (Merr.) Attan., I.M.Turner & R.M.K.Saunders (Fig. 2)

Novon 21 (2011) 166; Turner, Gard. Bull. Singapore 64(2) (2012) 443; Turner, Gard. Bull. Singapore 70(2) (2018) 694; Leeratiwong et al., Thai Forest Bull., Bot. 49(2) (2021) 241; Lindsay et al., Gard. Bull. Singapore 74(Suppl. 1) (2022) 150. **Basionym:** *Artabotrys clementis* Merr., J. Straits Branch Roy. Asiat. Soc. 85 (1922) 174. **Type:** M. Ramos 1667, Malaysia, Sabah, Sandakan and vicinity, September–December 1920 (lectotype K [K000786696], designated by Attanayake et al. (2011: 167); isolectotype A [A00039703]).

Cyathostemma hookeri King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 61(1) (1892) 10, nom. illegit., superfl.; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 38; Ridley, Fl. Malay Penins. 1 (1922) 28; Sinclair, Gard. Bull. Singapore 14(2) (1955) 223; Keng, Gard. Bull. Singapore 27 (1974) 71; Keng, Concise Fl. Singapore, vol. 1, Gymn. Dicot. (1990) 12; Turner et al., J. Singapore Natl Acad. Sci. 18 & 19 (1990) 61; Turner, Gard. Bull. Singapore 45 (1993) 29; Turner & Tan in Wee & Ng (ed.), First Look Biodivers. Singapore (1994) 110; Ng & Wee (ed.), Singapore Red Data Book (1994) 274; Turner, Gard. Bull. Singapore 47 (1997 [‘1995’]) 110; Utteridge, Blumea 45(2) (2000) 386; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 214; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 30, 103, 190.

Large woody climber. **Leaves** lamina elliptic to obovate, 6.5–21 × 3–7 cm, base convex to concavo-convex, apex acute and often shortly acuminate, secondary veins in 9–12 pairs, lamina glabrous above, glabrous except for a very sparse indumentum of simple and few-branched stellate hairs along the midrib below; petiole 4–10 mm long, very sparsely hairy with simple and stellate hairs to glabrescent. **Inflorescence** leaf-opposed or internodal, 1–3-flowered. **Flower** pedicels 7–11 mm long, hairy. Sepals broadly ovate, 2–3 × 3–5 mm, glabrous or sometimes sparsely hairy towards the margins adaxially, sparsely hairy abaxially. Petals subequal in size in the outer and inner whorl, but petals of the outer whorl with a broad base and of the inner with a conspicuously narrowed base (clawed), yellow, elliptic to ovate, 4–5 × 3–4 mm, with vertical furrows when dried, abaxially hairy, adaxially papillate. Stamens and carpels many. **Fruits** with pedicel up to 15

mm long, monocarps 4 to 20 or more, ellipsoidal to cylindrical, 21–45 × 15–26 mm, apex rounded, not or indistinctly apiculate, glabrous, stipitate, stipe to 49 mm long, to 3 mm wide. **Seeds** up to 8 per monocarp.

Distribution. Thailand, Malaysia (Peninsular Malaysia, Borneo), Singapore, Indonesia (Sumatra, Borneo), Brunei.

Ecology. In Singapore, this species was collected in primary and old secondary lowland forest.

Provisional conservation assessment. In Singapore, only a few mature individuals were observed in primary or old secondary rainforest. Consequently, this species was assessed as Critically Endangered (CR/D) at the national level (Lindsay et al., 2022).

Notes. The species description is based on material from Peninsular Malaysia and Singapore. *Uvaria clementis* belongs to a group of small-flowered species that were previously classified in the genus *Cyathostemma* (see revision of *Cyathostemma* by Utteridge [2000]). Phylogenetic analyses have shown that *Cyathostemma* is non-monophyletic and that species previously classified in *Cyathostemma* are nested within *Uvaria* (e.g., Zhou et al., 2012; Meade & Pannell, 2018). The petals of *Uvaria clementis* are yellow, very small in comparison to the vast majority of *Uvaria* species, and the inner petals are clawed (Figs. 2D–F). Similarly small and clawed petals can be found in two other *Uvaria* species reported from Singapore: *Uvaria excelsa* (Hook.f. & Thomson) King and *Uvaria griffithii* L.L.Zhou, Y.C.F.Su & R.M.K.Saunders. *Uvaria excelsa* is presumed nationally extinct in Singapore. It can be differentiated by leaf laminae that are densely hairy below, whereas the leaf lamina is sparsely hairy to glabrous below in *Uvaria griffithii* and *Uvaria clementis*. The latter two species can be easily differentiated as *Uvaria griffithii* usually has emarginate to narrowly cordate or sometimes convex leaf lamina bases, flowers in long-pedunculate and frequently cauliflorous thyrsoids composed of multiple cymes, and ovaries that are densely hairy or have longitudinal lines of hairs, whereas *Uvaria clementis* has convex or concavo-convex leaf bases (Figs. 2B, C), the flowers are in short-pedunculate, leaf-opposed or internodal cymes (Figs. 2B, D), and the ovaries are glabrous apart from a ring of hairs below the stigma (Fig. 2I).

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