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Impatiens bungeusing (Balsaminaceae), a new species from the Northern Gayo Plateau, Sumatra, Indonesia

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ABSTRACT: *Impatiens* is a diverse genus within the Balsaminaceae family, comprising over 1,120 species. The northern Gayo Plateau of Sumatra, an island in Southeast Asia, is renowned for its rich *Impatiens* diversity. In this paper, we described and illustrated a new species named *Impatiens bungeusing* from this area. This species is most similar to *Impatiens vitellina* Grey-Wilson but differs in having the distinct abaxial leaf venation in a dry state (vs obscure), lateral sepals falcate-oblong (vs narrowly lanceolate), lower sepals with U-shaped spur (vs straight), broadly ovate dorsal petal (vs ovate), and ovate sub-rhomboidal upper lateral united petals (vs oblong). This discovery brings the total number of known *Impatiens* species in Sumatra to forty-eight.

KEY WORDS: Ericales, herbs, *Impatiens tapanuliensis*, *Impatiens vitellina*, Malesia, limestone plant, taxonomy, *Uniflorae*.

INTRODUCTION

Impatiens L. is a genus of herbaceous plants in the Balsaminaceae family. It consists of approximately 1,120 species (POWO, 2024). The genus is characterised by the herbaceous, sometimes succulent stem, simple leaves, and strongly zygomorphic flowers with lower sepals. Five petals are modified into one dorsal and two pairs of lateral petals. The genus is known for its explosively dehiscent capsule (Stevens, 2001). There are around 52 native *Impatiens* species in Indonesia, several of which have been described after the 2000s (Grey-Wilson, 1989; Shimizu and Utami, 1997; Utami and Wiriadinata, 2002, 2010; Utami, 2005, 2012; Utami, 2011; Utami and Nurainas, 2012; Mustaqim *et al.*, 2021, 2024). Sumatra is the center of diversity and endemism for the genus, followed by Java, and other Indonesian islands.

As predicted by Grey-Wilson (1989), the northern part of Sumatra remains relatively unexplored and is likely a region of high diversity. The central mountainous areas mostly belong to the Gayo Plateau, where several volcanoes are located in the northern part. The Gayo Plateau is divided into three regencies, Bener Meriah and Aceh Tengah Regency in the northern half, and Gayo Lues in the southern half. Despite its complex topography, which may have contributed to rapid diversification of species (Pigram and Davies, 1987), the region remains understudied.

Only three species of *Impatiens* had been formally documented from the northern Gayo Plateau: *I. eubotrya* Miq., *I. alboflava* Miq., with some uncertainty, *I. platypetala* Lindl (Grey-Wilson, 1989). To fill the knowledge gap, field expeditions were conducted in the region, resulting in the discovery of additional *Impatiens* species, including *I. vitellina* and the newly described *I. bungeilang* Mustaqim (Mustaqim *et al*., 2024). Among the collected specimens, three specimens from the Jagong Jeget area in the western part of the northern Gayo Plateau were found to be distinct from any published species. A comprehensive literature review and specimen examination confirmed that these specimens represent a new species, which is detailed in this study.

MATERIAL AND METHODS

The morphological descriptions of the specimens were prepared based on specimens collected from Jagong Jeget, Aceh Tengah, northern Sumatra, in 2022 and 2023. The preparation of this description follows the specific terminology of *Impatiens* outlined by Grey-Wilson (1989) and Ruchisansakun *et al.* (2018) and general morphological terms from Beentje (2016). The collected specimens were deposited in LGS and MEDA (acronyms following Thiers 2024). Morphological data were compared to type specimens accessed from JSTOR Global Plants (http://plants.jstor.org), recently collected materials of other species from the same area deposited in LGS as well as MEDA, and morphological descriptions in Grey-Wilson (1989) and relevant literature on Southeast Asian *Impatiens* (Backer and Bakhuizen van den Brink, 1963; Ruchisansakun et al., 2018; Utami, 2014; Suksathan and Ruchisansakun, 2022; Mustaqim et al., 2024). Measurements of the vegetative materials were done from dried herbarium materials, supplemented by

field notes, while floral parts were derived from fresh or ethanol-preserved material. A geographical distribution map was created using QGIS (QGIS Development Team, 2024). A preliminary conservation status assessment was conducted following the guideline of the IUCN Standards and Petitions Committee (2024) and the available data were compared to the IUCN Categories and Criteria (IUCN, 2012).

TAXONOMIC TREATMENT

Impatiens bungeusing Mustaqim & Ruchis., ***sp. nov.***

Figs. 1 & 2

***Type*:** Indonesia. Aceh Province: Aceh Tengah Regency, Jagong Jeget, Jagong, area pengairan (4°20'45.6"N 96°46'32.6"E), 2100 m asl, 11 January 23, *Mustaqim 2577* (holotype: LGS; isotype: MEDA).

Diagnosis: *Impatiens bungeusing* is similar to *Impatiens vitellina* Grey-Wilson. However, it differs in having the distinct abaxial leaf venation in a dry state (vs obscure), flowers with lower sepal having U-shaped spur (vs straight), broadly ovate dorsal petal (vs ovate), and ovate sub-rhomboidal upper lateral united petals (vs oblong) (Table 1).

Perennial, lithophytic or terrestrial ***herb*** to ca. 0.75 m tall. Stem fleshy, decumbent, laxly branched, internodes 0.3–2.5 cm long, glabrous. ***Leaves*** spirally arranged, petiole 1.1–3.5 cm long, 0.5–1 mm wide, with 2–3 elevated glands on each side, up to 0.75 mm high, glabrous. ***Lamina*** obovate, obovate-lanceolate, rarely elliptic, narrowly or broadly so, 6.5–12.8 × 3.5–6.2 cm, apex falcately acuminate, tip mucronate, base cuneate, margin crenate, glabrous; lateral veins 8–10 on each side of the midrib. ***Flowers*** in axillary racemes, 4–6-flowered; peduncle 2.8–5.2 cm long, 2–2.8 mm in diameter, green, glabrous; rachis 0.3–1.5 cm long, green, glabrous; flowers zygomorphic, 3.2–3.5 × 2.3–2.5 cm, 3.5–3.7 cm deep, yellow, lateral sepals green, lower sepal with red strikes inside, and upper lobes of lateral united petals with horizontal red strikes. ***Bracts*** narrowly triangular, up to ca. 7 × 1.8 mm when dry; persistent until anthesis. ***Pedicels*** horizontal, slightly declinate, ca. 33 mm long, ca. 1.25 mm in diameter, glabrous, green. ***Lateral sepals*** falcate oblong, 10–13.5 mm long including 1.8–2.5 mm long apical mucro, 3–3.5 mm wide, apex acute, narrowed into blunt mucro, tip glandular; glabrous. ***Lower sepals*** navicular to sub-bacciform, 22–24 mm long, 13–16 mm wide, 11–13 mm deep, apex mucronate, inside with red veins, abruptly constricted into 8–8.5 mm long U-shaped spur, tip rounded, slightly pale green, glabrous. ***Dorsal petal*** broadly ovate, 13–14 × 2.3–2.4 mm when flattened, slightly hooded, apex emarginate, tip with a short apicle, dorsally with a crescent-shaped crest, raised 1.5–2.5 mm high, but not prominent, glabrous on both sides. ***Lateral petals*** 2, free; upper lateral petals ovate, sub-rhomboidal, 10–11 × 12 mm, curved backward, apex acuminate, yellow with 6–7 red strikes along the nerves in the inner surface; lower lateral petals unequally obovate, 23–25 × 12–13.5 mm, apex rounded or obtuse, inner basal margin curved upward, with inner margin bearing a short mucro near the apex, yellow, glabrous. ***Androecium*** ca. 9 mm long, staminal head ca. 3.5 mm long, anthers ca. 1 mm long. Ovary glabrous, 5-loculed. ***Fruit*** fusiform, 5-lobed, mature green, fleshy, ca. 15 × 5 mm.

***Phenology*:** Flowering and fruiting in January and June.

***Distribution and ecology*:** Endemic to northern Sumatra: only known from the northwestern area of northern Gayo Plateau (Fig. 3). It grows in upper montane tropical rainforest on slopes, shaded habitat, on rocky and sandy soils or humus-rich soils, elevation from 2050 to 2310 m asl.

***Etymology*:** The specific epithet "*bungeusing*" is derived from the Gayo language. "Bunge" means flower, and "using" means yellow, reflecting the plant's bright yellow flowers.

***Preliminary IUCN conservation status assessment*:** Endangered: EN B1+B2ab(ii, iii). The species faces a high extinction risk due to its small Extent of Occurrence (EOO) of 1.5 km² and Area of Occupancy (AOO) of 8 km². During fieldwork conducted in many areas of the northern Gayo Plateau, including Mount Bur Ni Geureudong, Mount Bur Ni Telong, Mount Bur Ni Origon, Mount Bur Ni Pepanji, Mount Bur Ni Bias, Mount Bur Ni Kelieten, and the Mountainous area southwest of Jagong Jeget, this species was found only at the latter location. The species is restricted to two locations with an elevation range from 2050 to 2310 m asl. The species exhibits a limited distribution. It is threatened by habitat conversion within its range, primarily due to the expansion of coffee plantations and other agricultural activities. These threats could potentially impact more than half of all known populations. Based on the available data, we assess this species as Endangered (EN) following the categories and criteria in the IUCN (2012) and guidelines (IUCN Standards and Petitions Committee, 2024).

***Notes*:** *Impatiens bungeusing* belong to the *Impatiens* sec. *Uniflorae* based on its 5-carpellate ovary and short-fusiform capsule (Yu *et al*., 2016). This species is morphologically similar to *I. vitellina* and *I. tapanuliensis* Grey-Wilson (1989). However, *I. bungeusing* is more similar to *I. vitellina* due to its glabrous flower, while in *I. tapanuliensis*, there are some hairs in its floral parts, i.e. pedicel, lower and lateral sepals, and also dorsal petals, as well as leaves that mostly broadest below the middle of the lamina. However, The hooked spur of *I. bungeusing* readily distinguishes it from the two species. *Impatiens vitellina* is formally reported to occur in the southern half of the Aceh Province (Grey-Wilson, 1989). In the vegetative stage, the two species are hardly different from each other.

Table 1. Comparison of morphological characters of ***Impatiens bungeusing*** and ***I. vitellina***

Characters	*I. bungeusing*	*I. vitellina*
Leaves		
Number of lateral veins	8–10	(4-)5–10
Abaxial venation in dry state	distinct	obscure
Inflorescence		
Number of flowers	4–6	1–5
Lateral sepals		
Shape	falcately oblong	narrowly lanceolate
Length (cm)	1–1.35	0.4–0.5
Apex	acute with blunt mucro	acute to acuminate
Lower sepal		
Spur shape	U-shaped	straight
Spur length (mm)	8–8.5	9–14
Dorsal petals		
Dorsal crest	crescent-shaped	narrow obtuse
Lateral united petals		
Upper lateral petals shape	ovate-rhomboidal	oblong
Upper lateral petals color	yellow with 6–7 red veins	yellow with central, single red blotch
Additional literature	-	Grey-Wilson (1989)

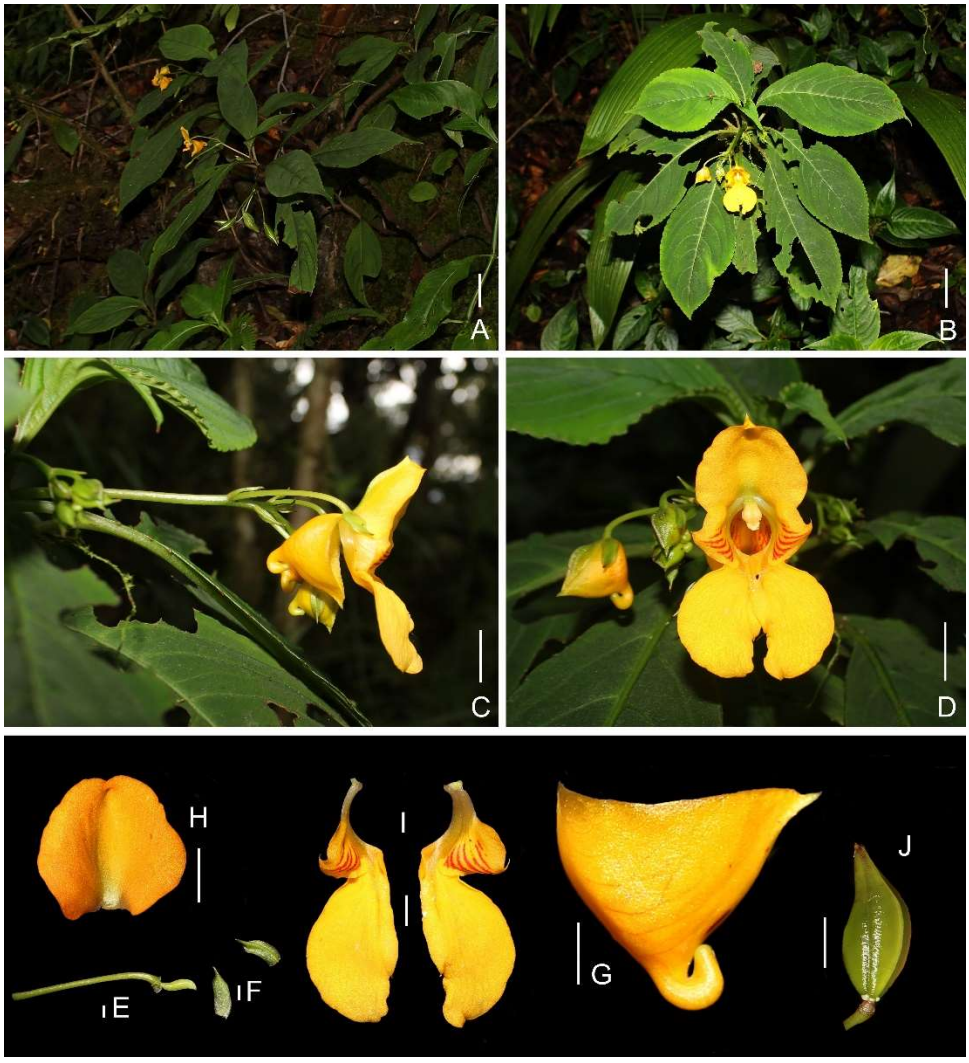

Fig. 2. Morphology of ***Impatiens bungeusing*** Mustaqim & Ruchis., sp. nov. **A.** Plants in habitat. **B.** Living plant. **C.** Inflorescence. **D.** Flower. **E.** Lateral sepals. **F.** Dorsal petals. **G.** Lateral united petals. **H.** Lower sepal. **I.** Pedicel and ovary. **J.** Fruit. Scale: A = 4 cm, B = 3 cm, C–D = 1 cm, E = 2 mm, F = 3 mm, G–J = 5 mm. Photographs by Wendy A. Mustaqim.

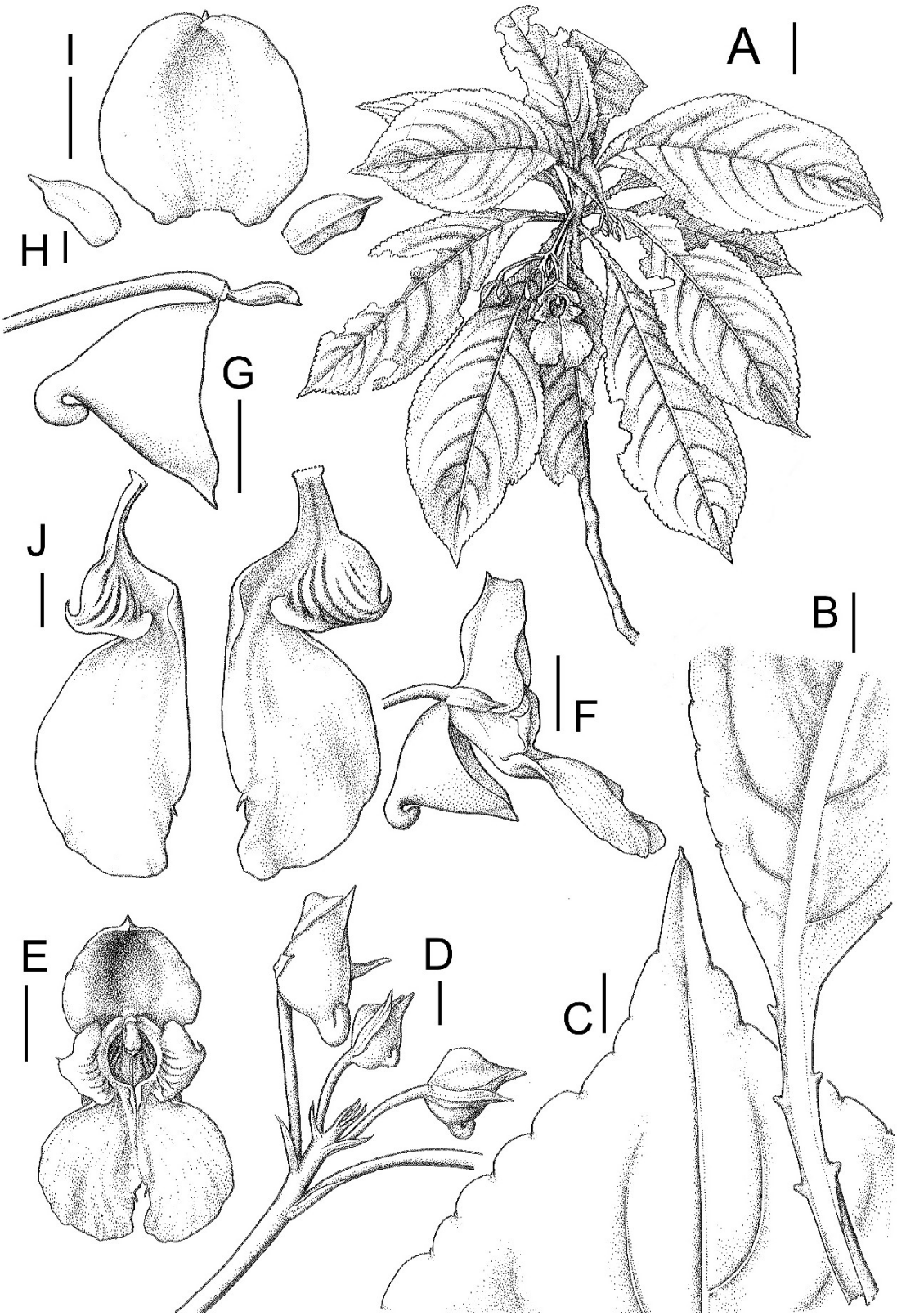

Fig. 1. Morphology of ***Impatiens bungeusing*** Mustaqim & Ruchis., sp. nov. **A.** Plant. **B.** Leaves showing petiole. **C.** Leaves showing apex and margin. **D.** Inflorescence. **E.** Flower, frontal view. **F.** Flower, lateral view. **G.** Pedicel, lower sepal, stamens, and ovary. **H.** Lateral sepal. **I.** Dorsal petal. **J.** Lateral united petals. Scale: A = 3 cm, B–D = 5 mm, E–G = 1 cm, H = 3 mm, I–J = 5 mm. Illustrated by Yuanito Eliazar.

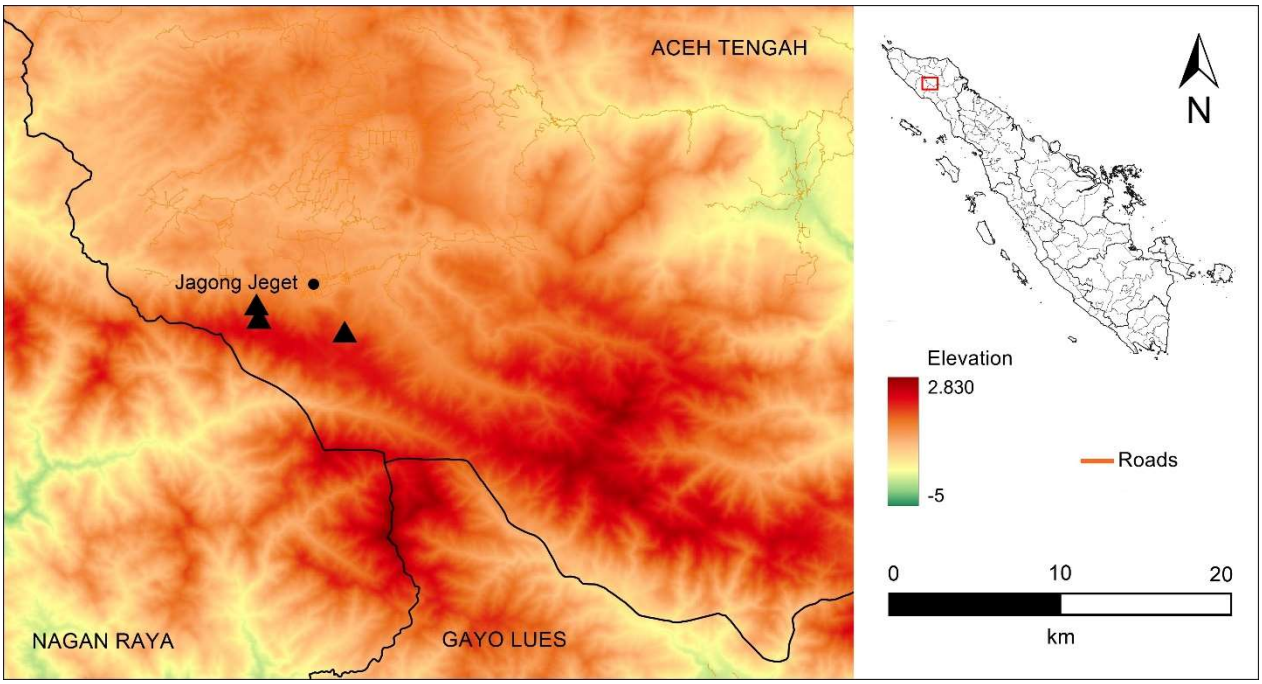

Fig. 3. Geographical distribution of ***Impatiens bungeusing*** Mustaqim & Ruchis. in northern Gayo Plateau, Sumatra, Indonesia.

This discovery brings the total number of formally reported Impatiens species in the northern Gayo Plateau to six: *I. alboflava*, *I. bungeilang*, *I. bungeusing, I. eubotrya*, *I. platypetala* and *I. vitellina*. The first species recorded is *I. platypetala*, recorded during van Daalen 1907 exploration from the Gayo Plateau to the Batak Plateau in the Sumatera Utara Province (Kempees, *s.dat.*; Grey-Wilson, 1989). Next, other two species were collected during the 1934 Cornelis G.G.J. van Steenis' expedition: *I. alboflava* and *I. eubotrya*. In 2022, an exploration conducted by the first author yielded the finding of *I. vitellina* (specimen no. *Mustaqim et al. 2685*, stored in LGS). Since then, only in early 2024, a new endemic species is finally described from this area named *I. bungeilang* Mustaqim (Mustaqim *et al*., 2024). From all these species in the northern Gayo Plateau, *I. bungeusing* can be recognized by the flowers with U-shaped lower sepal's spur.

***Additional specimens examined*:** Indonesia. Aceh Province: Aceh Tengah Regency, Jagong Jeget, Jagong, Paya Dedep (4°21'30.1"N 96°44'04.9"E), 2050 m asl, 15 June 2023, *Mustaqim et al. 2728* (LGS, MEDA); *ibid*. Paya Dedep (4°21'15.5"N 96°44'03.3"E), 2250 m asl, 15 June 2023, *Mustaqim et al. 2732* (LGS, MEDA); *ibid*. Paya Dedep (4°21'07.4"N 96°44'04.9"E), 2310 m asl, 15 June 2023, *Mustaqim et al. 2734* (LGS, MEDA).

Amended Key to *Impatiens* of Sumatra

(modified from Grey-Wilson, 1989: 71, couplet 25 and further)

25 Lateral sepals with one or more gland-tipped teeth along the margin; leaf lamina ciliate ..... ***I. acehensis***
– Lateral sepals not toothed; leaf lamina not ciliate (except in *I. pyrrotricha* var. *pyrrotricha*) 26
26 Dorsal petal without a pronounced keel-like crest; plant entirely glabrous ..... 26'
– Dorsal petal with a pronounced 1–4 mm high, keel-like crest; plants pubescent, at least in part, rarely entirely glabrous ..... …… 27 (including *I. pyrrhotricha*, *I. tapanuliensis*, and *I. junghuhnii*)
26' Lower sepals spur hooked, U-shaped; lateral sepals 10–13.5 mm long ……..... ***I. bungeusing***
– Lower sepals spur straight to slightly curving; lateral sepals 4–5 mm long ……..... ***I. vitellina***

Key to northern Gayo Plateau *Impatiens*

1a. Leaves arranged in whorls or opposite 2
1b. Leaves spirally arranged 3
2a. Lower sepal bucciniform; spur c. 16 mm long and thickened without thickened part …….. ***I. bungeilang***
2b. Lower sepal shallowly navicular; spur 23–28 mm long and thickened for the upper 3/5 part …… ***I. platypetala***
3a. Flowers white, arranged in fascicles, without or with very short peduncle ..... ***I. alboflava***
3b. Flowers yellow, arranged in racemes, with well-developed peduncle of at least 2.5 cm or longer 4
4a. Lower sepals bucciniform; flowers asymmetric ..... ***I. eubotrya***
4b. Lower sepals navicular; flowers zygomorphic 5
5a. Lower sepals spur U-shaped; lateral sepals 10–13.5 mm long …..… ….....
..... ***I. bungeusing***
5b. Lower sepals spur straight to slightly curving; lateral sepals 4–5 mm long ..... ***I. vitellina***

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