**IMPATIENS (BALSAMINACEAE) DIVERSITY AND CONSERVATION STATUS IN MOUNT SINGGALANG, WEST SUMATRA**

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**INTRODUCTION**

Sumatra has high floristic diversity. Unfortunately, forest damage in the island is among the highest in the world (Laurance 1999). Currently, forest destruction in Sumatra does not only occur in lowland forests, but also in mountain forests. Every year more than 1,000 km² of montane forest has been destroyed (World Wildlife Fund 2008). One of the mountains in Sumatra, Mt. Singgalang is also experiencing accelerated forest destruction. The bottom and middle of this mountain have been widely cleared for cultivation (Holmes & Rombang 2001). Besides, Mt. Singgalang has a high richness of flora and fauna and is home to many endemic species to Sumatra (World Wildlife Fund 2008). One of these endemic species is *Impatiens singgalangensis* Grey-Wilson.

In 1989, Grey-Wilson has described 20 new species and three new varieties from Sumatra. In the following years, several new species were discovered, such as *I. batanggadisensis* Utami, *I. marroninus* Utami, *I. rubricaulis* Utami, *I. tribuana* Utami & Nurainas, and *I. tujuhensis* Utami & T.Shimizu (Shimizu & Utami 1997; Utami 2005, 2009, 2011, 2012, 2013, 2020). Currently, ca. 30 species of *Impatiens* are found in Sumatra and mostly occurred in the montane forests (Grey-Wilson 1989; Utami 2020).

The species number of *Impatiens* is likely to grow further in line with discovery of new species in Sumatra. Therefore, the aim of this study was to add existing collections of the Herbarium Bogoriense and to complete the data of some *Impatiens* distributions, such as new distributions.
MATERIAL AND METHOD

Specimens from Herbarium Bogoriense (BO) were examined as well as its distributions based upon specimen localities were recorded. Inventory of Impatiens species in Mt. Singgalang, West Sumatra was carried in 2004 and 2021. In addition to field research, inspections of the collections and herbariums were also carried out in Herbarium Bogoriense (BO). The data collection method followed Rugayah et al. (2004).

Herbarium specimens are made by taking samples of Impatiens plants that are in flower or bear fruit, then are placed in a fold of old newsprint. Temporarily it preserved in 70% alcohol solution. Flowers and fruit are preserved separately in plastic bottles, while documentation is made for publication.

Conservation status followed IUCN Red List (2019) which is based on several aspects, such as population size, area of existence, and level of threat. Conservation status of examined species in this paper based on herbarium specimens and data collected in the field.

RESULT AND DISCUSSION

In 2004, the fieldwork was undertaken in Mt. Singgalang, West Sumatra, successfully collected I. singgalangensis. Subsequently, in 2021, the fieldwork was conducted by a student of Andalas University, Padang, found and collected several Impatiens from this mountain. These included I. buennemeijeri Grey-Wilson, I. diepenhorstii Miq., and I. delectans Ridl. which were collected for the first time. I. buennemeijeri was previously reported endemic to Mt. Malintang while the others were endemic to Mt. Kerinci (Grey-Wilson 1989).

Species description
1. Impatiens buennemeijeri Grey-Wilson. (Fig. 1)
Kew Bull. 44: 92 (1989). Type: Sumatra, G. Malintang, 1,250 m, July 1918, Bunnemeijer 3739 (holotype L; isotype BO).

Glabrous perennial herbs, up to 60 cm tall. Stems erect, simple. Leaves spirally arranged, petiole ca. 3 cm long; lamina ovate to elliptic, 7–10 x 2 cm, apex acuminate, base acute, margin crenate, lateral veins 5–10 pairs, pubescent between the lateral veins and glabrous beneath. Inflorescences 2–3 flowered racemes, peduncles ca. 2 cm long, bracts linear, ca. 1.5 cm long. Flower white yellow with flushed/redness around the edges of the two upper petals. Sepals lateral, two ovate ca. 1 x 0.4 cm, pale green, with some marron stripes on the underside of the lateral sepals; lower sepal shallowly navicular, ca. 1 x 0.8 cm, white with a maroon stripe abruptly constricted into a short, filiform spur, ca. 1 cm long, incurved toward the tip. Petals lateral petals united, ca. 1.7 x 0.5 cm, upper petals white yellow/pale yellow with redness around the edges, dorsal petal cucullate ca. 1 x 0.5 cm, when flattened, with a shallow keel-like crest above, pale green with maroon stripes inside, lower petal, ca. 0.5 x 0.2 cm, upper petal of each pair oblong to suborbicular, ca. 0.8 x 0.3 cm, white yellow with redness around the edges; lower petal of each pair oblong to sub oblong, ca. 0.5 x 0.3 cm, white with a maroon stripe and red. Ovary glabrous. Fruit unknown.

Distribution: I. buennemeijeri is actually endemic to Sumatra and previously was found in Mt. Malintang and Mt. Sago (Grey-Wilson 1989). However, it was recently discovered on Mt. Singgalang. This mountain is located approximately 116 km from Mt. Malintang. According to Nurainas et al. (2020), this species is also found in Jambi.

Habitat/Ecology. In Mt. Singgalang, this plant was collected in montane forest, moist places, at ca. 1,406 m asl.

Conservation status. The preliminary conservation status is DD (Data Deficient).

Flowering time: March to June.

Specimens examined. Sumatra. West. G. Malintang, Bunnemeijer 3739 (BO); G. Sago, July 1918, Bunnemeijer 369 (BO); NU 0254, Feb. 2021.

Figure 1. Impatiens buennemeijeri. (A) front view, (B) part of flower. a). A pair of lateral united petals, b). Lower sepal and spur, c). dorsal petal, d). a pair of lateral sepal, e). Gynoecium. (Photo by Firham)
2. Impatiens delectans Ridl. (Fig. 2)
Fed. Mal. States Mus. 8:4:24 (1917). Type: Sumatra, G. Kerinci, 2,190 m, 25 April 1914, Robinson & Kloss s.n. (holotype BM; isotype K).

Decumbent perennial herb up to 30 cm. Stems glabrous, thin, weakly. Leaves spirally arranged, lamina ovate to elliptic 1–6 x 0.3–2.4 cm, apex acuminate, margin crenate, each tooth terminated by a distinct, filiform appendage, lateral veins 2–6 pairs, pubescent between the lateral veins above, and glabrous beneath, petiole 1–2 cm, stipitate, glands on each side. Inflorescence: 1-flowered. Flowers yellow; peduncle 6–14 mm, long, often bearing superfluous bracts. Bracts linear, 3–4.5 mm long. Pedicels slender, 8–12 mm long. Petal lower sepal narrowly navicular, 10–14 x 3–5 mm, abruptly constricted into a straight spur 8–12 mm long. Dorsal petal cucullate, ca. 6–14 x 8–12 mm, when flattened, with a “keel like” crest above. Lateral united petals 15–28 mm; upper petal of each pair oblong 4–9 x 2–4 mm; lower petal of each pair obliquely ovate, 13–17 x 10–12 mm, asymmetrical, obtuse. Ovary glabrous. Fruit unknown.

Distribution: Endemic to Mt. Kerinci, W. Sumatra (Grey-Wilson 1989). Recently, this species is also found in Mt. Singgalang for the first time, at 1,406 m asl. Mt Kerinci is located about 178 km to Mt. Singgalang, at an altitude of 3,805 m asl.

Habitat: 1,400–2,500 m asl., on the forest floor
Flowering time: March to June
Conservation status: Preliminary conservation status DD (Data Deficient).

Specimens examined: West Sumatra, Mt. Kerinci. April 1920, Bünnemeijer 9845 (BO) & May 1920; Bünnemeijer 9998 (BO); NU 0255, Feb. 2021.

Figure 2. I. delectans. (A) side view, (B) front view. Photo by Firham

3. Impatiens singgalangensis Grey-Wilson. (Fig. 3A)
Kew Bull. 44: 79 1989. Type: Sumatra, G. Singgalang. May 1918. Bünnemeijer 2618 (holotype BO; isotype L).

Stoloniferous, perennial herb 13–35 cm, tall. Stems branched, glabrous. Leaves spirally arranged, congested towards the stem apices, lamina narrowly lanceolate-elliptic, 4.5–15 x 2–3 cm, apex acute to acuminate, margin serrate; lateral veins 9–11 pairs, pubescent between the lateral veins above, pubescent along the midrib and lateral veins beneath; petiole 1.5–4 cm long. Inflorescence 2 yellow. Peduncle 3 flowered, sub umbellate raceme. Flowers yellow. Peduncle 3–5 cm long, glabrous. Bracts linear-lanceolate, 3.5–8 mm long, caducous. Pedicels slender, 12–22 mm long. Lateral sepall ovate, 6–8 mm long, acuminate, glabrous. Lower sepall shallowly navicular, 8–11 x 3 mm, abruptly constricted into a filiform spur, 15–28 mm long. Dorsal petal cucullate, ca. 12 mm long, 12 mm wide, when flattened with a shallow crest above, glabrous. Lateral united petals 20–26 mm long, upper petal of each pair oblong, 8–14 x 5–9 mm; lower petal of each pair asymmetrical, oval-oblanceolate 14–22 x 8–10 mm. Ovary glabrous. Fruit unknown.

Distribution: This species was locally endemic to Mt. Singgalang (Grey-Wilson 1989). According to Nurainas et al. (2020), this species is also found in Lubuksulasih, Solok.

Habitat: Montane Forest, 1,460–2,200 m asl.
Flowering time: April to June
Conservation status: The preliminary conservation status is DD (Data Deficient).

Specimens examined: Sumatra. West. G. Singgalang, May 1918, Bünnemeijer 2618 (BO); Tokuoka T., Murakami, Y., Kanaya, T., Utami, N. and Girmansyah, D. (T-0568); Tokuoka T., Murakami, Y., Kanaya, T., Utami, N. and Girmansyah, D. (T-0574); Tokuoka T., Murakami, Y., Kanaya, T., Utami, N. and Girmansyah, D. (T-0576)
4. *Impatiens diepenhorstii* Miq. (Fig. 3B)

Fl. Ind. Bat. Supp. 297 (1860) & in Illstr. Fl. Ind. Archip. 101 (1871). Type: W. Sumatra, Padang, Bukit Silit (holotype U). *I. korthalsii* Miq. Illustr. Fl. Ind. Archip. 100 (1871). Type: West Sumatra. G. Malintang & Pulo Besi., *Korthals* s.n. (holotype L).

Perennial stoloniferous herb, 5–35 cm tall. *Stems* decumbent to erect, slender, rooting at the lower nodes, glabrous. *Leaves* spirally arranged; lamina lanceolate-elliptic-oblanceolate, 4–14 x 1.5–4.6 cm, apex acuminate, margin crenate, lateral veins 3–7 pairs, usually sparsely pubescent between the lateral veins above, petiole 0.5–2.7 cm long. *Inflorescence* 2–3 flowered raceme, frequently reduced to a single flower. *Flowers* yellow, often with reddish markings on the upper petals. *Peduncle* slender 16–38 mm long, glabrous. *Bracts* inconspicuous, linear, 2–5 mm long. Lateral sepals narrowly ovate to lanceolate, 3–5 mm long, somewhat asymmetrical. Lower sepals shallowly navicular, 6–9 x 2.5–5 mm, abruptly constricted into a slightly curved filiform spur 5–23 mm long. Dorsal petal sub cucullate, 3–9 x 5–7 mm, when flattened with a shallow crest above. Lateral united petals, 15–27 mm long; upper petal of each pair oblong to reniform, 3–5 x 1.5–2 mm; lower petal of each pair obliquely oval to ovate 13–19 x 9–13 mm, slightly emarginate distally along the inner margin. *Ovary* glabrous. *Fruit* capsule fusiform, 9–15 x 3–5.5 mm, glabrous.

*DISTRIBUTION.* Endemic to West Sumatra. Grey-Wilson (1989) recorded this species was found in several mountains in West Sumatra including Mt. Kerinci, Mt. Malintang, and Mt. Singgalang.

*Habitat:* Montane Forest, 1,406 m asl.

*Flowering time:* March to August

*Conservation status:* The preliminary conservation status is DD (Data Deficient).

*Specimens examined:* April 1918, *Leeffmans* 26 (BO), May 1918, *Bünnemeijer* 2657 (BO), June 1918, *Bünnemeijer* 2864 (BO, L), 1927, *Yates* 2453 (BO); *NU* 0256, Feb, 2021.

**Figure 3. (A) I. singgalangensis Grey-Wilson and (B) I. diepenhorstii Miq. Photo by Firham**

**Key to the species of *Impatiens* on Mt. Singgalang**

1a. Flower white yellow with flushed/redness around the edges of the two upper petals, lower sepals shallowly navicular, white with a maroon stripe abruptly constricted into a short, filiform spur, incurved toward the tip .................................*I. buennemeijeri*

1b. Flower yellow, lower sepal narrowly navicular, abruptly constricted into a straight spur..................2

2a. Inflorescence has 1 flower, decumbent perennial herb .................................................................*I. delectans*

2b. Inflorescence with 2–3 flowers, stoloniferous perennial herb..........................................................*I. singgalangensis*

3a. Inflorescence 2, peduncle 3 flowered, sub umbellate raceme; flowers yellow. Dorsal petal cucullate, glabrous.................................*I. singgalangensis*

3b. Inflorescence 2–3 flowered raceme, frequently reduced to a single flower; flowers yellow, often with reddish markings on the upper petals. Dorsal petal sub cucullate .................................................*I. diepenhorstii*

**CONCLUSION**

Based on of exploration carried out in Mt. Singgalang in 2004 and 2021, four species of *Impatiens* were collected, namely *I. singgalangensis*, *I. buennemeijeri*, *I. delectans* and *I. diepenhorstii* of which three of them, *I. buennemeijeri*, *I. delectans* and *I. diepenhorstii* are new distribution records in Sumatra, especially in Mt. Singgalang.

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