

# *Impatiens hedbergiae* (Balsaminaceae), a new species from the Tsaratanana Massif, Madagascar

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*Impatiens hedbergiae* from the Tsaratanana Massif in Northern Madagascar is described. It is similar to *Impatiens catati*, but differs in the lanceolate and alternate leaves, the lower sepal that is abruptly narrowed at the spur (vs. progressively narrowing into the spur), the shape of the dorsal petal that is only slightly rounded at the crest, and the lateral united petals where the lower petal bears a short acute tooth on the inner side. It is also similar to *Impatiens amoena*, but differs in the more narrow lanceolate leaves that are attenuate at the apex and base, the greater number of lateral fimbriae on the leaf margin, the smaller carmine-red flowers, and the lateral united petals bearing a tooth at the inner face. A key is provided to the red-flowered *Impatiens* from Madagascar with bucciniform lower sepal.

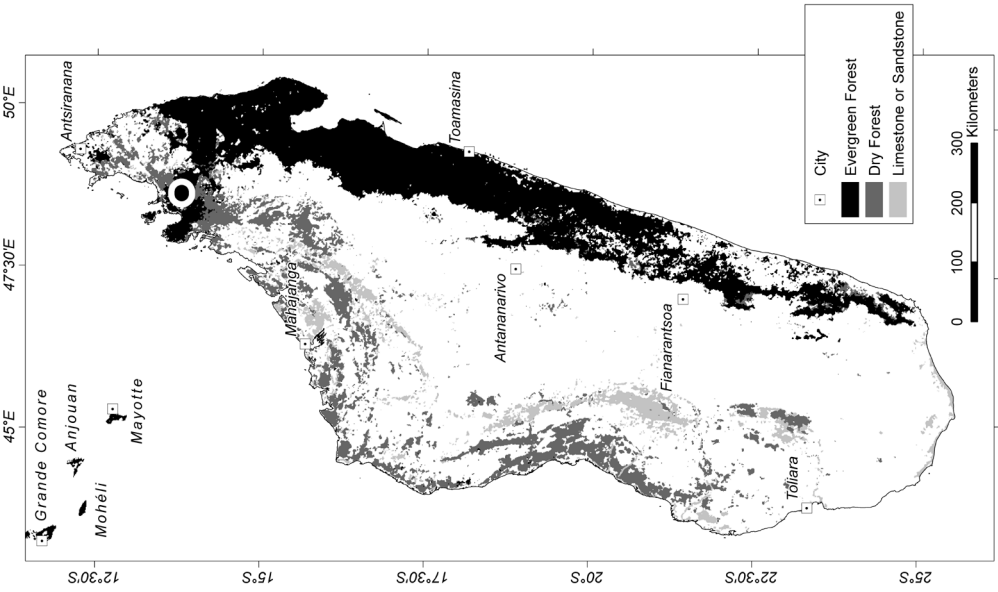
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## Introduction

Madagascar represents one of the global hotspots of biodiversity. This is especially true for the genus *Impatiens* L. (Balsaminaceae) which has a degree of endemism of 100%. For Madagascar, 110 species were known until recently, mainly described by Perrier de la Bâthie (1934, 1948) and Humbert (1956). During a revision of the Balsaminaceae for the *Flore de Madagascar et des Comores*, many new species were discovered, of which several have already been described (Fischer & Rahelivololona 2002; Fischer et al. 2003; Fischer & Rahelivololona 2004, 2007a, b; Abrahamczyk & Fischer 2015; Fischer & Rahelivololona 2015a, b, c, 2016).

Based on the presence of a bucciniform lower sepal with spur and a cucullate dorsal petal, numerous *Impatiens* species from Africa, Madagascar and India were assembled into one taxonomic group (Warburg & Reiche 1895, Grey-Wilson 1980). However, molecular data suggest that they evolved in different clades and share only an ornithophilous syndrome (Yuan et al. 2004; Janssens et al. 2006). Usually, the flowers are red, orange or yellow – rarely greenish.

The first Madagascan species to be described with these characters were *I. humblotiana* Baill. (1881) and *I. catati* Drake (1896). Until the fundamental paper of Perrier de la Bâthie (1934), only these two species of the group



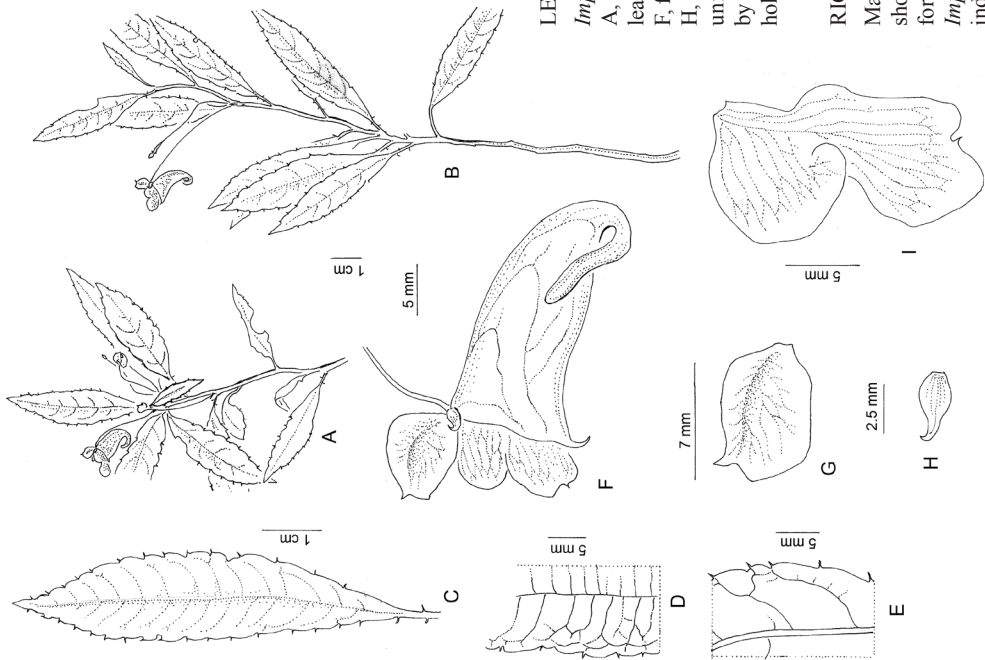
LEFT. Fig. 1.

*Impatiens hedbergiae*.

A, B, habit; C, leaf; D–E, leaf margin with fimbriae; F, flower; G, dorsal petal; H, lateral sepal; I, lateral united petals. All drawn by the author from the holotype.

RIGHT. Fig. 2.

Map of Madagascar showing cover of rain forest. The type locality of *Impatiens hedbergiae* is indicated by the circle.



were known from Madagascar. In 1934, Perrier de la Bâthie added *I. amoena* H.Perrier, *I. antongiliana* H.Perrier, *I. danguyana* H.Perrier, *I. eriosperma* H.Perrier, *I. fuchsioides* H.Perrier, and *I. fulgens* H.Perrier. Perrier de la Bâthie (1934) informally named this group "Humblotianae". Humbert (1956) described *I. perrieri* H.Humbert. Since that time, several new species have been collected on Madagascar. Fischer & Rahelivololona (2004) described *Impatiens renae* Eb.Fisch. & Raheliv., and subsequently (Fischer & Rahelivololona 2015b) *I. susan-nathansoniae* Eb.Fisch. & Raheliv. and *I. hendrikii* Eb.Fisch. & Raheliv.

All of these species are restricted to a single mountain area, with the exception of *Impatiens humblotiana*, which occurs in the mid-altitude rainforest of Eastern Madagascar at several localities, and *Impatiens catati*, which has been recorded in rainforests from a few mountains in South-Eastern Central Madagascar.

Most of these bird-pollinated taxa are restricted to high altitudes, usually not occurring below 950 m but ascending to almost 2600 m. *Impatiens renae*, *I. susan-nathansoniae* and *I. hendrikii* are endemic to Mt. Marojejy, *I. fulgens* occurs at Andasibe and Onivé, *I. antongiliana* is found on mountains west of the bay of Antongil, *I. amoena* is known from Mt. Manongarivo and the Tsaratanana Massif, and *I. danguyana*, *I. eriosperma*, *I. fuchsioides* and *I. perrieri* are only known from Tsaratanana.

In this paper, another new species from Tsaratanana, the highest peak of Madagascar, is described and dedicated to Inga Hedberg.

## Materials and Methods

The study is based on dried specimens from the following herbaria: BR, G, K, MO, NEU, P and TAN (acronyms after Holmgren *et al.* 1990) as well as living plants of related species from a field excursion to Mt. Marojejy in October 2014. A short history of exploration of *Impatiens* in Madagascar, as well as details on terminology and measurements, were provided by Fischer & Rahelivololona (2002).

## *Impatiens hedbergiae* Eb.Fisch., *sp. nov.* (Fig. 1, 2)

Type: Madagascar: Antsiranana, montagnes au Nord de Mangindrano (Haute Maevarano) jusqu'au sommets d'Ambohimirahavavy, sylve à lichens sur gneiss, 2000 m, 26.-28.1.1951, *Humbert & Capuron 25280* (P, holotype).

ETYMOLOGY: Dedicated to Inga Hedberg in recognition of her outstanding contributions to botany in Tropical Africa.

DESCRIPTION. Suffrutescent herb, up to 30 cm tall, entirely glabrous. Stem succulent, woody at the base, zig-zag-like. Leaves alternate, petiole 1.5-10 (12) mm long, with 1 or 2 pairs of extra-floral nectaries, lamina herbaceous, pale green below, dark green above, lanceolate, attenuate at base and apex, 55-75 × 12-16 mm, with 7-8 pairs of secondary veins, margin with up to 15 pairs of "fimbriae" (provisional term referring to the ± stiff and pointed erect structures in the sinuses of the teeth in many *Impatiens*). Inflorescence axillary, bracts lanceolate, 1-2 × 0.8-1 mm, peduncle short, 0.5-1 mm, with usually 2 flowers, pedicel up to 50 mm long. Flower with carmine dorsal petal, bearing a long greenish crest, lateral sepals pale green, lower sepal and spur and lateral united petals carmine-red. Lateral sepals broadly ovate, abruptly acuminate, acumen hook-like curved, 3-3.5 × 2 mm. Lower sepal navicular, 15-21 × 7 mm, 5 mm diameter at the middle, abruptly tapering into a curved narrow obtuse sacculate spur 5 × 1 mm, at the mouth of lower sepal a 2 mm long narrow filiform spur-like apicule on the lower side. Dorsal petal cucullate, 7 × 5-6 mm, dorsal crest 1.5 mm high, with a spur-like apicule 1 mm. Lateral united petals 14 mm long, upper petal 6-7 × 6 mm, rounded, lower petal 8-10 × 5-6 mm, slightly bilobed at the apex, with small acute tooth at the inner side. Anthers 5 mm long. Ovary 6 × 2.5 mm, glabrous.

HABITAT: Montane lichen forest, 2000 m.

DISTRIBUTION: Madagascar, Tsaratanana Integrated Natural Reserve, Mt. Ambohimirahavavy, only known from the type locality.

**Key to red-flowered *Impatiens* of Madagascar with bucciniform lower sepal**

1. Leaves subopposite or verticillate ..... 2
1. Leaves alternate ..... 5
2. Plants entirely glabrous ..... 3
2. Plants in younger parts or at base of internodes hairy ..... 4
3. Leaves large, 65-175 × 22-40 mm, seeds with whitish vesicles, lamina  
with 16-22 pairs of fimbriae and 8-12 pairs of lateral secondary veins ..... **I. catati**
3. Leaves smaller, 20-50 × 10-15 mm, seeds smooth, lamina  
with 8-10 pairs of fimbriae and 4-5 pairs of lateral secondary veins ..... **I. fulgens**
4. Lamina thin, oblanceolate, 30-60 × 10-15 mm, few hairs at base of internodes,  
seeds with long hairs ..... **I. eriosperma**
4. Lamina coriaceous, ovate-elliptic, 25-50 × 8-20 mm, young stem covered  
with long hairs, seeds glabrous and smooth ..... **I. danguyana**
5. Plants glabrous ..... 6
5. Plants hairy ..... 12
6. Petiole 15-30 mm long ..... 7
6. Petiole less than 15 mm long ..... 10
7. Spur narrowing abruptly at lower ¼ ..... **I. perrieri**
7. Spur narrowing progressively ..... 8
8. Petiole with 6-8 fimbriae, leaf lamina rounded at base and apex,  
lateral united petals with obtuse lobes ..... **I. renae**
8. Petiole with usually 2 fimbriae, leaf lamina acute at base and apex ..... 9
9. Dorsal petal with high rounded crest, lateral united petals with upper petal exceeding  
lower petal, lower sepal gradually narrowing into spur, leaves not coriaceous .. **I. humblotiana**
9. Dorsal petal only slightly rounded, lateral united petals with lower petal exceeding upper  
petal, lower sepal abruptly narrowing into spur, leaves coriaceous ..... **I. susan-nathansoniae**
10. Leaf lamina not exceeding 35 × 17 mm ..... **I. antongiliana**
10. Leaf lamina 36-80 × 15-25 mm ..... 11
11. Lateral united petals bearing a tooth at inner face, dorsal petal carmine red with  
greenish crest, lateral sepals green, lower sepal 15-21 × 7 mm, spur 5 × 1 mm,  
leaf-lamina with 15 pairs of fimbriae ..... **I. hedbergiae**
11. Lateral united petals lacking a tooth at inner face, dorsal petal yellow with  
red-orange crest, lateral sepals red, lower sepal 25-28 × 10 mm, spur 4-5 × 2-3 mm,  
leaf-lamina with 3-5 pairs of fimbriae ..... **I. amoena**
12. Stem zig-zag-like, lower petal entire at apex, lower sepal hairy,  
tapering abruptly into orange-red spur ..... **I. fuchsioides**
12. Stem straight, lower petal distinctly bilobed at apex, lower sepal glabrous,  
tapering gradually into short saccate whitish-red spur ..... **I. hendrikii**

The Tsaratanana Massif consists of volcanic rocks, and bears the highest summit of Madagascar with 2876 m a.s.l.

CONSERVATION STATUS: *Impatiens hedbergiae* is restricted to the Tsaratanana Massif, which is an Integrated Natural Reserve, where it has never been recollected since 1951. However, the Tsaratanana Massif is very difficult to access, and at least the high altitude vegetation is still intact. Despite the occurrence in a protected area the species should be considered as vulnerable. Unfortunately, I have no information about the population size and vegetation at the type locality.

PHENOLOGY: Flowers have been recorded in January and February.

NOTES. *Impatiens hedbergiae* is similar to *Impatiens catati*, but differs in the lanceolate and alternate leaves, the lower sepal that is abruptly narrowed at the spur (vs. progressively narrowing into the spur), the shape of the dorsal petal that is only slightly rounded at the crest, and the lateral united petals where the lower petal bears a short acute tooth on the inner side. It is also similar to *Impatiens amoena*, but differs in the more narrow lanceolate leaves that are attenuate at the apex and base, the greater number of pairs of lateral fimbriae on the leaf margin (15 vs. 3-5 pairs in *Impatiens amoena*), the smaller carmine-red flowers with carmine dorsal petal, the long greenish crest, the green lateral sepals (vs. yellow dorsal petal with red-orange crest and red lateral sepals in *I. amoena*), the smaller lower sepal with spur (15-21 × 7 with spur 5 × 1 mm vs. 25-28 × 10 with spur 4-5 × 2-3 mm in *I. amoena*), and the lateral united petals bearing a tooth at the inner face.

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## Literature

- Abrahamczyk, S. & Fischer, E. 2015. *Impatiens elianae*, a new species from central Madagascar, and notes on the taxonomic relationship of *Impatiens lyallii* and *I. trichoceras*. *Phytotaxa* 226: 83–91.
- Baillon, M.H. 1881. Sur une Balsamine de Madagascar. *Bull. Mensuel Société Linnéenne Paris* 1: 286.
- Drake, E. del Castillo. 1896. *Impatiens catati*. In: Grandidier, A. (ed.), *Histoire physique, naturelle et politique de Madagascar, Atlas* vol. 2, t. 170A.
- Fischer, E. & Rahelivololona, M.E. 2002. New taxa of *Impatiens* (Balsaminaceae) from Madagascar I. *Adansonia* 24: 271–294.
- Fischer, E. & Rahelivololona, E. 2004. New taxa of *Impatiens* (Balsaminaceae) from Madagascar III. *Adansonia* 26: 37–52.
- Fischer, E. & Rahelivololona, E. 2007a. New taxa of *Impatiens* (Balsaminaceae) from Madagascar IV. *Adansonia* 29: 269–315.
- Fischer, E. & Rahelivololona, E. 2007b. New taxa of *Impatiens* (Balsaminaceae) from Madagascar V. *Adansonia* 29: 317–332.
- Fischer, E. & Rahelivololona, M.E. 2015a. New taxa of *Impatiens* (Balsaminaceae) from Madagascar VI. *Impatiens otto-eleonora*, a new species from Masoala Peninsula, and notes on the taxonomic relationships of *Impatiens firmula* and *I. hildebrandtii*. *Phytotaxa* 217: 155–163.
- Fischer, E. & Rahelivololona, M.E. 2015b. New taxa of *Impatiens* (Balsaminaceae) from Madagascar VII. Two new species of *Impatiens* from Mt. Marojejy, Madagascar. *Phytotaxa* 239: 213–222.
- Fischer, E. & Rahelivololona, M.E. 2015c. New taxa of *Impatiens* (Balsaminaceae) from Madagascar IX. *Impatiens lutzii*, a new species from Montagne d'Ambre National Park. *Phytotaxa* 239: 183–189.

- Fischer, E. & Rahelivololona, M.E. 2016. New taxa of *Impatiens* (Balsaminaceae) from Madagascar VIII. *Impatiens max-huberi*, a new species from from Marojejy and Anjanaharibe-Sud. *Phytotaxa* 244: 191–195.
- Fischer, E., Wohlhauser, S. & Rahelivololona, E. 2003. New taxa of *Impatiens* (Balsaminaceae) from Madagascar II. A collection from Masoala Peninsula. *Adansonia* 25: 17–31.
- Grey-Wilson, C. 1980. *Impatiens of Africa*. Balkema, Rotterdam.
- Holmgren, P.K., Holmgren, N.H. & Barnett, L.C. 1990. *Index Herbariorum, part I: the Herbaria of the World*. New York Botanical Garden, New York.
- Humbert, H. 1956. Contributions à l'étude de la flore de Madagascar et des Comores (fascicule 5). *Not. Systemat.* 15: 113–134.
- Janssens, S., Geuten, K., Yuan, Y.-M., Song, Y., Küpfer, P. & Smets, E. 2006. Phylogenetics of *Impatiens* and *Hydrocera* (Balsaminaceae) using chloroplast *atpB-rbcL* spacer sequences. *Syst. Bot.* 31: 171–180.
- Perrier de la Bâthie, H. 1934. Les *Impatiens* de Madagascar. *Arch. Botanique* 7 (1933) Mémoire 1: 1–124. Caen.
- Perrier de la Bâthie, H. 1948. Révision des *Impatiens* de Madagascar et des Comores. *Mem. Acad. Sci.* 67: 1–16.
- Warburg, O. & Reiche, K. 1895. Balsaminaceae. In: Engler H. & Prantl, K. (eds), *Die Natürlichen Pflanzenfamilien*, teil 3, abteilung 5, pp. 383–392. Engelmann, Leipzig.
- Yuan, Y.-M., Song, Y., Geuten, K., Rahelivololona, E., Wohlhauser, S., Fischer, E., Smets, E. & Küpfer, P. 2004. Phylogeny and biogeography of Balsaminaceae inferred from ITS sequences. *Taxon* 53: 391–403.