Impatiens chenmoui (Balsaminaceae), a new species from southern Yunnan, China

Zheng-wei Wang¹, Qi Wang¹, Ru-hua Xu², Yu Zhang², Xiao-chen Li¹

¹ Eastern China Conservation Center for Wild Endangered Plant Resources, Shanghai Chenshan Botanical Garden, Shanghai 201602, China
² Yunnan Yelantang Biological Technology Co., Ltd., Kunming 650114, China

Corresponding author: Xiao-chen Li (xiaochenensis@gmail.com)

Academic editor: Hugo de Boer

Received 15 September 2022 | Accepted 14 November 2022 | Published 30 November 2022

Citation: Wang Z-w, Wang Q, Xu R-h, Zhang Y, Li X-c (2022) Impatiens chenmoui (Balsaminaceae), a new species from southern Yunnan, China. PhytoKeys 214: 83–95. https://doi.org/10.3897/phytokeys.214.94898

Abstract

Impatiens chenmoui (Balsaminaceae), a new species from southern Yunnan, China, was described and illustrated based on morphological and molecular evidence. This new species is morphologically most similar to Impatiens oblongata Ruchis. & Niet, but can be distinguished by 7–9 pairs of leaf veins, glabrous perianth, obovate upper petal, and capsule with trichome.

Keywords

China, Impatiens chenmoui, morphology, phylogeny, sect. Uniflorae

Introduction

The family Balsaminaceae contains two genera, the monotypic Hydrocera Blume (1825:241) and Impatiens Linnaeus (1753: 937) (APG Website, http://www.mobot.org/MOBOT/research/APweb/) Impatiens L. is a large genus of over 1000 species (Grey-Wilson 1980; Fischer 2004), mainly distributed in tropical and subtropical regions, with tropical Africa, Madagascar, southern India and Sri Lanka, eastern Himalayas (including SW China) and Southeast Asia as its five diversity centers (Song et al. 2003; Yuan et al. 2004; Yu et al. 2015). More than 270 species are currently known from China (Yu 2012), in which more than 200 species occurred in SW China (Chen et al. 2007), mainly distributed in Yunnan, Sichuan, Guangxi, Guizhou, and Xizang. Impatiens was divided into two subgenera, subgen. Clavicarpa S.X. Yu ex S.X. Yu & Wei Wang and subgen. Impatiens L. according to the latest phylogenetic studies. The
latter was further subdivided into seven sections (sect. *Fasciculatae*, sect. *Impatiens*, sect. *Racemosae*, sect. *Scorpioidae*, sect. *Semeiocardium*, sect. *Tuberosae*, and sect. *Uniflorae*) (Yu et al. 2015). Several new species of sect. *Uniflorae* have been described from India, Myanmar, Cambodia, Vietnam, and China. (e.g. Cho et al. 2017; Yang et al. 2017; Ruchisansakun et al. 2018; Kim et al. 2019; Zhang et al. 2020) in recent years.

In September 2019, during fieldwork in Mengla County, Yunnan, an unfamiliar *Impatiens* species was collected and transplanted to Shanghai Chenshan Botanical Garden. The flower blossomed in December 2020, indicating its unusual identity which may be new to science. In November 2021, we made a botanical trip back to Mengla County to collect flowers and fruit specimens. After careful comparison of relevant species from the adjacent area, we finally concluded that these specimens represent a species new to science, and described it here.

**Methods**

**Morphology study**

Morphological characters of the new species and related ones were compared based on living plants and herbarium specimens, including the digital resource of type specimens from JSTOR Global Plants (https://plants.jstor.org/). Herbarium specimens were examined in Chenshan Botanical Herbarium (CSH, index herbarium, http://sweetgum.nybg.org/science/ih/herbarium-list/?NamOrganisationAcronym=CSH), original protologues and relevant literature were also investigated.

**Datasets preparation**

To resolve the phylogenetic position of the putative new species, two molecular markers ITS (ITS1–5.8S-ITS2) and *atpB-rbcL* were used in this study. Leaf material of the putative new species was collected from the field and stored with silica. Total genomic DNA was extracted with the modified CTAB method (Doyle and Doyle 1987) for library construction at Benagen (https://www.benagen.com). Paired-end sequencing of the whole sequences from both ends of 150 bp fragments was performed on the DNBSEQ T7, and about 2 Gb clean data were produced. The plastome and nrDNA were de novo assembled using the GetOrganelle pipeline 1.7.6.1 (Jin et al. 2020). Sequences of *atpB-rbcL* were extracted from the plastome annotated in Geneious Prime 2021.2.2 (https://www.geneious.com) with comparison to the published plastome of *Impatiens balsamina* L. (GenBank accession: MW411292) as reference. Sequences of ITS1–5.8s-ITS2 were extracted with ITSx 1.1.3 (Bengtsson-Palme et al. 2013). The ITS dataset and the *atpB-rbcL* dataset were respectively aligned using MAFFT v7.450 by default setting. (Katoh and Standley 2013) and concatenated for phylogenetic analysis (Chen et al. 2020). Species sampling was based on previous studies (Yu et al. 2015; Ruchisansakun et al. 2018). All the sequence GenBank accession numbers were listed in Appendix 1.
Phylogenetic analysis

Maximum Likelihood estimation (ML) and Bayesian inference analysis (BI) were performed on Phylosuite v1.2.2 (Zhang et al. 2020). For ML, GTR+F+R4 was selected as the best fit model for the ITS dataset, and GTR+F+R5 was selected as the best fit model for the atpB-rbcL dataset according to AICc by ModelFinder (Kalyaanamoorthy et al. 2017). Maximum likelihood was estimated using IQ-TREE (Nguyen et al. 2015) under the Edge-linked partition model for 2000 ultrafast (Minh et al. 2013) bootstraps. For BI, GTR+I+G was selected as the best fit model for both datasets according to AICc by PartitionFinder2 (Lanfear et al. 2017). Bayesian Inference phylogeny analysis was inferred using MrBayes 3.2.6 (Ronquist et al. 2012) under the partition model (2 parallel runs, 10,000,000 generations), in which the initial 25000 sampled data were discarded as burn-in. Tree files were visualized and annotated in Figtree v1.4.4 (http://tree.bio.ed.ac.uk/software/figtree/). Bootstrap (BS) and Posterior Probability (PP) values were used as an estimate of nodal robustness.

Result

The combined dataset was 1934bp in total, compromising 107 accessions/107 species, with Hydrocera triflora (L.) Wight. et Arn. selected as outgroup. Phylogenetic reconstruction of BI and ML produced similar topological structures (Fig. 1). The putative new species (marked in red) was resolved in the subgen. Impatiens sect. Uniflorae, forming a sister relationship with Myanmar species I. oblongata Ruchis. & Niet (PP = 0.957, BS = 94). Based on the morphological characters and phylogenetic result, we recognized this Impatiens species as a new species and described it here as Impatiens chenmoui Zheng W. Wang, Xiao C. Li & Qi Wang, sp. nov.

Taxonomic treatment

Impatiens chenmoui Zheng W. Wang, Xiao C. Li & Qi Wang ter, sp. nov.
urn:lsid:ipni.org:names:77309066-1
Figs 2, 3, Appendix 2

Type. CHINA. Yunnan province, Mengla county (勐腊县) Xiangming Yi nationality township (象明彝族自治乡) Kongming Mountain (孔明山) alt.1639m, 22°8'9.73"N, 101°8'48.86"E, 23 November 2021, Zhengwei Wang and Xiaochen Li, WZW04250 (Holotype: CSH0189505, CSH!; isotypes: CSH0192380, ZJFC!; CSH0189507, HZU!; CSH0189506, JJF!).

Diagnosis. Impatiens chenmoui is most similar to I. oblongata Ruchis. & Niet, but is distinguished by the glabrous dorsal petal, pedicel, and bracts, longer pedicel and spur, and fewer lateral sepals (Table 1).
Figure 1. Phylogenetic tree based on combined datasets of the nuclear ITS and plastid *atpB–rbcL* DNA sequences. The topological structure comes from Bayesian inference. Numbers near nodes are PP/BS, a dash ‘−’ indicates nodes not supported, subgen. *Clavicarpa* was collapsed.

**Description.** Herb annual. Stem erect, fleshy, glabrous, 12–35 cm tall. Leaves alternate, petioles 1–5 cm, leaf blade 9.5–2.5×1.6–3.5 cm, narrowly elliptic or oblong-lanceolate, apex acuminate or long acuminate, base cuneate, margin roughly crenate; adaxially dark green, pilose along veins, abaxially gray-green, glabrous, lateral veins 7–9 pairs. Inflorescences in upper leaf axils, 1–flowered. Pedicels green, glabrous, 2.5
New species of *Impatiens* from China

---

-2.7 cm long. Bracts linear, persistent, 2–3 mm long. Flowers solitary, axillary, pink, or lavender, with pair of darker pink and yellow dots at the base. Lateral sepals 2, inversely coiled, glabrous, green, 2 mm long. Lower sepal funnelform, 3–4×2–3 mm long, 2–3 mm in depth, eaves navicular, base gradually constricted into a spur, variable, usually 1.4–1.7 cm long, rarely absent, mouth oblique, ca. 5 mm wide, with ca. 2 mm long narrowly triangular tip. Dorsal petal circular, pink or mauve, 5–6×4–5 mm, apex acuminate, glabrous, ca. 2 mm long. United lateral petals sessile, 2–lobed, 6–8 mm long. Upper petal large, obovate, 6–7×2–5 mm, apex often concave. Lower petal small, axe-shaped, 7–8×1–3 mm, apex rounded, without auriculus at back. Stamens 5, filaments linear, subulate, pale pink, ca. 2–3 mm long, distally enlarged, anthers obtuse. Ovary fusiform, 5-carpellate, purple, 2–3 mm long, dorsal suture ridges with trichome. Capsule short fusiform, 12–18 mm long, 4–5 mm in diam, with trichome along ridges. Seeds obovoid, brown, ca. 2 mm long, slightly compressed, pubescent with spirally sculptured hairs.

**Phenology.** Flowering and fruiting from October to December.

**Distribution and ecology.** This new species was found under evergreen broad-leaved forest at an elevation of 1500–1700 m on the limestone mountain ridge, and was currently known as only one population in Mengla County, Yunnan, China. This distribution area is very close to the border with Myanmar and Laos. We assume that this species should be also distributed in Myanmar and Laos due to their similar habitat.

**Etymology.** The specific epithet “Chenmou” was dedicated to the famous Chinese collector and botanist, Chen Mou (陈谋) (1903–1935) who was one of the founders of the first botanical garden cataloged by the Classification System of Plants in China, and died during the collection trip through southern Yunnan, China. The Chinese name was given as “陈谋凤仙花”.

**Conservation status.** This species is currently known only from one population in the type locality. The population is located in the tourist area of Kongming Mountain, where it could be easily disturbed by human activities, such as road construction and illegal mining. The IUCN status proposed is Vulnerable (VU) based on IUCN (2022) guidelines.

**Additional specimens examined (Paratype).** China, Yunnan province, Mengla county, Xiangming Yi nationality township, Kongming Mountain. 24 Oct. 2019, Ruhua Xu and Yu Zhang, XRH001 (CSH!).

Table 1. Comparison of key features of *I. chenmoui* and *I. oblongata*.

| Taxonomic traits | *I. chenmoui* | *I. oblongata* |
|------------------|---------------|----------------|
| Dorsal petal     | Glabrous      | midrib and tip pilose |
| Pedicel          | 25–27 mm long, green, glabrous. | 18–20 mm long, pink, pilose. |
| Ovary hair       | Trichome      | Pilose          |
| Spur             | 14–17 mm long, glabrous, rarely absent. | 8–12 mm long, pilose. |
| Bracts           | Glabrous      | Pilose          |
| Lateral sepals   | 2, inversely coiled, glabrous | 2–4, upper pair pilose; lower pair glabrous |
Figure 2. *Impatiens chenmoui* sp. nov. A habit, B, C flower with long spur, D, E flower with spur nearly absent, F leaf base, G capsule, H dorsal petal, I spur, J lateral sepals, K united lateral petals, L ovary surrounded by stamens.
New species of *Impatiens* from China

Figure 3. *Impatiens chenmoui* sp. nov. A habit, B, C united lateral petals, D ovary surrounded by stamens, E flower front view, F, G lateral sepals, H spur, I dorsal petal, J–L leaves, M seed, N capsule, O, P long-spurred flower side view, Q non-spurred flower side view.
Note. New species of sect. *Uniflorae* discovered from Southeast Asia in recent years were mostly found distributed on mountain summits in an evergreen forest, which indicated that the stone mountain in this area was likely to be one of the speciation centers of this section. *Impatiens* species exhibited interspecific and even intraspecific variation in spur length, at least from our observation of the same population of *I. davidii* Franchet, *I. platysepala* Y. L. Chen, and *I. chenmoui*, which may be considered as retaining of a bimodal pollinated system of bee and lepidopteran (Ruchisansakun et al. 2016). Floristic survey and pollination ecology study in these regions’ *Impatiens* species is still insufficient, and more fieldwork is urgently needed.

Acknowledgements

Our deepest gratitude goes to three reviewers and subject editor Hugo de Boer, for their careful work and thoughtful suggestions that have helped improve this paper substantially. We are grateful to Mr. Tian-Yi Yu for his excellent illustration in the manuscript, Mr. Xin Zhong for his sharp photo of the seed, and Mr. Zhi-jin Wu and Mr. Hong-jin Wei for their help during the fieldwork. The corresponding author is also indebted to Miss Pi for her company during the epidemic of COVID-19. This study was supported by the project of the National Wild Plant Germplasm Resource Center for Shanghai Chenshan Botanical Garden (ZWGX2102), the project of the Special Fund for Scientific Research of Shanghai Landscaping & City Appearance Administrative Bureau (G212416, G222404).

Reference

Bengtsson-Palme J, Ryberg M, Hartmann M, Branco S, Wang Z, Godhe A, De Wit P, Sánchez-García M, Ebersberger I, de Sousa F, Amend AS, Jumpponen A, Unterseher M, Kristiansson E, Abarenkov K, Bertrand YJK, Sanli K, Eriksson KM, Vik U, Veldre V, Nilsson RH (2013) Improved software detection and extraction of ITS1 and ITS 2 from ribosomal ITS sequences of fungi and other eukaryotes for analysis of environmental sequencing data. Methods in Ecology and Evolution 4(10): 914–919. https://doi.org/10.1111/2041-210X.12073

Blume C (1825) Bijdragen tot de flora van Nederlandsch Indië? Nabu Press, 356 pp. https://www.biodiversitylibrary.org/item/9223#page/247/mode/1up

Chen YL, Akiyama S, Ohba H (2007) Balsaminaceae. In: Wu ZY, Raven PH (Eds) Flora of China, vol. 12 Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, 43–113. http://www.iplant.cn/foc/pdf/Balsaminaceae.pdf

Chen C, Chen H, Zhang Y, Thomas HR, Frank MH, He Y, Xia R (2020) TBtools: An integrative toolkit developed for interactive analyses of big biological data. Molecular Plant 13(8): 1194–1202. https://doi.org/10.1016/j.molp.2020.06.009

Cho SH, Kim BY, Park HS, Phourin C, Kim YD (2017) *Impatiens bokorensis* (Balsaminaceae), a new species from Cambodia. PhytoKeys 77: 33–39. https://doi.org/10.3897/phytokeys.77.11345
New species of *Impatiens* from China

Doyle JJ, Doyle JL (1987) A rapid DNA isolation procedure for small quantities of fresh leaf tissue. Phytochemical Bulletin 19: 11–15. https://webpages.charlotte.edu/~jweller2/pages/BINF8350f2011/BINF8350_Readings/Doyle_plantDNAextractCTAB_1987.pdf

Fischer E (2004) Balsaminaceae. In: Kubitzki K (Ed.) The Families and Genera of Vascular Plants VI. Springer Verlag, Berlin, 20–25.

Grey-Wilson C (1980) *Impatiens* of Africa. CRC Press, 57 pp.

IUCN (2022) Guidelines for Using the IUCN Red List Categories and Criteria. Version 15.1 Prepared by the Standards and Petitions Committee. https://www.iucnredlist.org/resources/redlistguidelines

Jin JJ, Yu WB, Yang JB, Song Y, dePamphilis CW, Yi TS, Li DZ (2020) GetOrganelle: A fast and versatile toolkit for accurate de novo assembly of organelle genomes. Genome Biology 21(1): 1–31. https://doi.org/10.1186/s13059-020-02154-5

Kalyaanamoorthy S, Minh BQ, Wong TKF, von Haeseler A, Jermiin LS (2017) ModelFinder: Fast model selection for accurate phylogenetic estimates. Nature Methods 14(6): 587–589. https://doi.org/10.1038/nmeth.4285

Katoh K, Standley DM (2013) MAFFT multiple sequence alignment software version 7: Improvements in performance and usability. Molecular Biology and Evolution 30(4): 772–780. https://doi.org/10.1093/molbev/msq010

Kim BY, Won H, Phourin C, Lim CK, Shin JS, Kim YS, Cho SH (2019) *Impatiens cardamomensis* (Balsaminaceae), a new species from Cambodia. Korean Journal of Plant Taxonomy 49(4): 319–323. https://doi.org/10.11110/kjpt.2019.49.4.319

Lanfear R, Frandsen PB, Wright AM, Senfeld T, Calcott B (2017) PartitionFinder 2: New methods for selecting partitioned models of evolution for molecular and morphological phylogenetic analyses. Molecular Biology and Evolution 34(3): 772–773. https://doi.org/10.1093/molbev/msw260

Linnaeus C (1753) Species Plantarum 2. Laurentius Salvius, Stockholm, 937 pp. https://www.biodiversitylibrary.org/page/358958#page/379/mode/1up

Minh BQ, Nguyen MA, von Haeseler A (2013) Ultrafast approximation for phylogenetic bootstrap. Molecular Biology and Evolution 30(5): 1188–1195. https://doi.org/10.1093/molbev/mst024

Nguyen LT, Schmidt HA, von Haeseler A, Minh BQ (2015) IQ-TREE: A fast and effective stochastic algorithm for estimating maximum-likelihood phylogenies. Molecular Biology and Evolution 32(1): 268–274. https://doi.org/10.1093/molbev/msu300

Ronquist F, Teslenko M, van der Mark P, Ayres DL, Darling A, Höhna S, Larget B, Liu L, Suchard MA, Huelsenbeck JP (2012) MrBayes 3.2: Efficient Bayesian phylogenetic inference and model choice across a large model space. Systematic Biology 61(3): 539–542. https://doi.org/10.1093/sysbio/sys029

Ruchisansakun S, Tangtorwongsakul P, Cozien RJ, Smets EF, Van der Niet T (2016) Floral specialization for different pollinators and divergent use of the same pollinator among co-occurring *Impatiens* species (Balsaminaceae) from Southeast Asia. Botanical Journal of the Linnean Society 181(4): 651–666. https://doi.org/10.1111/botj.12427

Ruchisansakun S, Suksathan P, Van Der Niet T, Smets EF, Lwin S, Janssens S B (2018) Three new species of *Impatiens* (Balsaminaceae) from Myanmar. Phytotaxa 338(1): 063–074. https://doi.org/10.11646/phytotaxa.338.1.5
Song Y, Yuan YM, Kupfer P (2003) Chromosomal evolution in Balsaminaceae, with cytological observations on 45 species from Southeast Asia. Caryologia 56(4): 463–481. https://doi.org/10.1080/00087114.2003.10589359

Yang B, Zhou SS, Maung KW, Tan Y H (2017) Two new species of *Impatiens* (Balsaminaceae) from Putao, Kachin State, northern Myanmar. Phytotaxa 321(1):103–113. https://doi.org/10.11646/phytotaxa.321.1.4

Yu SX (2012) Balsaminaceae of China. Peking University Press, 214 pp.

Yu SX, Janssens SB, Zhu XY, Lidén M, Gao TG, Wang W (2015) Phylogeny of *Impatiens* (Balsaminaceae): Integrating molecular and morphological evidence into a new classification. Cladistics 32(2): 179–197. https://doi.org/10.1111/cla.12119

Yuan YM, Song Y, Geuten K, Rahelivololona E, Wohlhauser S, Fischer E, Smets E, Kupfer P (2004) Phylogeny and biogeography of Balsaminaceae inferred from ITS sequence data. Taxon 53(2): 391–403. https://doi.org/10.2307/4135617

Zhang CF, Peng S, Tian J, Hu GW, Wang QF (2020) A new species and a newly recorded species of *Impatiens* (Balsaminaceae) from Yunnan, China. Plant Science Journal 38(4): 437–447. https://doi.org/10.11913/PSJ.2095–0837.2020.40437

Zhang D, Gao F, Jakovlić I, Zou H, Zhang J, Li WX, Wang GT (2020) PhyloSuite: An integrated and scalable desktop platform for streamlined molecular sequence data management and evolutionary phylogenetics studies. Molecular Ecology Resources 20(1): 348–355. https://doi.org/10.1111/1755-0998.13096

**Appendix I**

**Table A1.** Species and sequences sampling list with Genbank accession number.

| Species                        | ITS     | atpB–rbcL |
|-------------------------------|---------|-----------|
| *Hydrocera triflora*           | AY348853 | DQ147895  |
| *Impatiens apalophylla*        | KP776061 | KP776011  |
| *Impatiens aquatilis*          | AY348745 | DQ147811  |
| *Impatiens arguta*             | AY348746 | DQ147812  |
| *Impatiens aureliana*          | AY348747 | DQ147814  |
| *Impatiens balansae*           | KP776062 | KP776012  |
| *Impatiens balsamina*          | AY348749 | DQ147816  |
| *Impatiens beoniifolia*        | AY348752 | DQ147819  |
| *Impatiens bicornuta*          | AY348754 | DQ147821  |
| *Impatiens blnii*              | KP776063 | KP776013  |
| *Impatiens campanulata*        | AY348758 | DQ147822  |
| *Impatiens capensis*           | AY348759 | DQ147823  |
| *Impatiens chekiangensis*      | KP776064 | KP776014  |
| *Impatiens chinommou*          | OP035808 | OP095354  |
| *Impatiens chinensis*          | AY348761 | DQ147825  |
| *Impatiens chihsuiensis*       | KP776065 | KP776015  |
| *Impatiens chihulengensis*     | KP776066 | KP776016  |
| *Impatiens chlorosepala*       | KP776067 | KP776017  |
| *Impatiens clavigera*          | KP776068 | KP776018  |
| *Impatiens conchibracteata*    | AY348765 | DQ147829  |
| Species                  | ITS          | atpB–rbcL    |
|-------------------------|--------------|--------------|
| Impatiens corchorifolia | AY348767     | DQ147831     |
| Impatiens cuspidata     | AY348769     | DQ147832     |
| Impatiens cyanantha     | AY348770     | DQ147833     |
| Impatiens cyathiflora   | AY348777     | DQ147834     |
| Impatiens cymbijfera    | KP776069     | KP776019     |
| Impatiens davidii       | KP776070     | KP776020     |
| Impatiens decurva       | MF979085     | MF979082     |
| Impatiens delavayi      | AY348773     | DQ147836     |
| Impatiens desmantha     | AY348774     | DQ147837     |
| Impatiens drepanophora  | AY348776     | DQ147838     |
| Impatiens duclouxii     | KP776071     | KP776021     |
| Impatiens faberi        | AY348778     | DQ147841     |
| Impatiens falcifer      | KP776072     | KP776022     |
| Impatiens fischeri      | AY348781     | DQ147843     |
| Impatiens fiscicornis   | AY348782     | DQ147844     |
| Impatiens flanaganae    | AY348783     | DQ147846     |
| Impatiens florulenta    | MF979087     | MF979084     |
| Impatiens forrestii     | AY348784     | DQ147847     |
| Impatiens fragicolor    | KP776073     | KP776023     |
| Impatiens gongshanensis | KP776074     | KP776024     |
| Impatiens barae         | KP776075     | KP776025     |
| Impatiens bians         | AY348791     | DQ147849     |
| Impatiens hongkongensis | KP776076     | KP776027     |
| Impatiens huananensis   | KP776077     | KP776028     |
| Impatiens imbecilla     | AY348796     | DQ147851     |
| Impatiens inaperta      | AY348797     | DQ147852     |
| Impatiens lateristachys  | KP776078     | KP776030     |
| Impatiens laxiflora     | KP776079     | KP776031     |
| Impatiens lecomtei      | AY348802     | DQ147855     |
| Impatiens leptocaulon   | KP776080     | KP776032     |
| Impatiens macrovexilla  | KP776082     | KP776034     |
| Impatiens malipoensis   | KP776083     | KP776035     |
| Impatiens margaritifera | KP776084     | KP776036     |
| Impatiens mengzegoana   | AY348806     | DQ147858     |
| Impatiens meruensis     | AY348807     | DQ147859     |
| Impatiens monticola     | AY348810     | DQ147860     |
| Impatiens muscicola     | KC905500     | KC905547     |
| Impatiens napoensis     | AY348811     | DQ147861     |
| Impatiens neglecta      | KP776087     | KP776038     |
| Impatiens noei          | KC905504     | KC905548     |
| Impatiens noli–rangere  | KP776088     | KP776039     |
| Impatiens nubigena      | KP776089     | KP776040     |
| Impatiens nyamana       | KP776090     | KP776041     |
| Impatiens oblongata     | MF979086     | MF979083     |
| Impatiens omeiana       | KP776092     | DQ147864     |
| Impatiens oxyanthera    | AY348814     | DQ147865     |
| Impatiens parviflora    | AY348816     | DQ147866     |
| Impatiens pattula       | KC905509     | KC905549     |
| Impatiens phuluangensis | KC905517     | KC905554     |
| Impatiens platychlaena  | AY348818     | DQ147867     |
| Impatiens platypetala   | AY348819     | DQ147868     |
| Impatiens poculifer     | AY348820     | DQ147870     |
| Species            | ITS      | atpB–rbcL |
|--------------------|----------|-----------|
| Impatiens principis | KP776096 | KP776026  |
| Impatiens pritzelii | AY348821 | KP776045  |
| Impatiens pseudoviola | KP776097 | KP776046  |
| Impatiens purpurea  | AY348823 | KP776046  |
| Impatiens racemosa  | KP776098 | KP776047  |
| Impatiens radiata   | AY348824 | KP776047  |
| Impatiens rectangula | AY348825 | KP776047  |
| Impatiens rubrostriata | AY348828 | KP776047  |
| Impatiens santiskii | KC905528 | KC905559  |
| Impatiens scabrida  | KP776099 | KP776048  |
| Impatiens scullyi   | KP776100 | KP776048  |
| Impatiens scutisepala | AY348830 | KP776048  |
| Impatiens sicalifer | KP776101 | KP776049  |
| Impatiens sodenii   | AY348832 | KP776049  |
| Impatiens spathulata| KP776102 | KP776050  |
| Impatiens stenosepala | AY348835 | KP776051  |
| Impatiens sulcata   | KP776103 | KP776051  |
| Impatiens sunkoshiensis | KP776104 | KP776052  |
| Impatiens tianmuensis | AY348838 | KP776053  |
| Impatiens teitensis | AY348840 | KP776054  |
| Impatiens tienmuhanica | KP776105 | KP776054  |
| Impatiens tortisepala | KP776106 | KP776054  |
| Impatiens trichosepala | AY348843 | KP776054  |
| Impatiens tuberculata| KP776107 | KP776055  |
| Impatiens tubulosula | KP776108 | KP776056  |
| Impatiens uliginosa  | AY348845 | KP776057  |
| Impatiens usambarensis | AY348847 | KP776058  |
| Impatiens violiflora | KC905541 | KP776059  |
| Impatiens walleriana | AY348849 | KP776059  |
| Impatiens wenshanensis | KP776110 | KP776059  |
| Impatiens wilsonii   | KP776111 | KP776059  |
| Impatiens xanthina   | AY348850 | KP776059  |
| Impatiens yaoxianensis | KP776112 | KP776059  |
Appendix 2

Figure A1. Holotype of Impatiens chenmoui sp.nov.