



RESEARCH COMMUNICATION

# Extended distribution and assessment of conservation status of *Impatiens exilis* Hook. f. (Balsaminaceae) an endemic species of Eastern Himalaya

Daimalu Baro<sup>1</sup>, Amal Bawri<sup>2</sup>, Jyotishman Deka<sup>3</sup> & Sachindra Kumar Borthakur<sup>4</sup>

<sup>1</sup>Department of Botany, Tinsukia College, Tinsukia-786 125, Assam, India

<sup>2</sup>North Eastern Institute of Ayurveda & Folk Medicine Research (An Autonomous Institute under Ministry of Ayush, Govt. of India), Pasighat-791 102, Arunachal Pradesh, India

<sup>3</sup>Department of Botany, Assam Don Bosco University, Guwahati-782 402, India

<sup>4</sup>Department of Botany, Gauhati University, Guwahati-781014, Assam, India

\*Email: [daimalupbaro@gmail.com](mailto:daimalupbaro@gmail.com)



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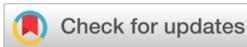
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## Abstract

The present communication reports an extended distribution of *Impatiens exilis* Hook. f., in North Eastern part of India. The species is so far reported from Sikkim only in India and endemic to eastern Himalaya. Present collection of *Impatiens exilis* Hook. f., from Panbari Range, Manas National Park, Assam extends its distribution territory to Assam in the North-Eastern Part of India. The analysis of its threat status suggests that the species is an endangered (EN) one. A detailed description with phenology and photographs has been provided for easy identification of the species.

## Keywords

*Impatiens*, Biodiversity, Extended Distribution, Conservation status, Eastern Himalaya, Endangered.

## Introduction

*Impatiens* L. is one of the dominant angiospermic herbaceous genera of Balsaminaceae with more than 1000 species (1) found all over the wet and subtropical regions of Asia, Africa and a few in temperate regions of Asia, Europe and North America (2, 3). In India, the genus is represented by about 250 species primarily distributed in the moist, mountainous region of Western Ghats, Eastern Himalaya and North-eastern states (4, 5). During the study of floristic diversity in Manas National Park in Assam, the authors came across a set of interesting species (6-8) including a member of the genus *Impatiens*. After analysis of the specimens and inspection of the related literature (5, 9, 10) the plant was recognized as *Impatiens exilis* Hook. f., hitherto not recorded from any other states of (Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland, and Tripura) of North Eastern India except Sikkim. Additional inspection of other relevant literature (2, 9-13) and herbarium specimens in the major Indian Herbaria (ARUN, ASSAM, BSHC and CAL) confirmed that the taxon is only reported from Sikkim in North East India. Hence, the present collection of *Impatiens exilis* Hook. f., from the Manas National Park, Assam extend its distribution beyond Eastern Himalaya and form an addition to the flora of Assam. The herbarium specimens are deposited at the Herbarium of Forest Department, Manas National Park and Department of Botany, Gauhati University for future reference. Details account of the taxon along with its photographs is provided.

Furthermore, the grave threats of continued change in land use patterns and climate changes in the foothills of the Himalayas, assessment of threat status of biodiversity has appeared as a thrust field of research (14, 15). Determination of the recent risk status of a species is vital in conservation, development of management action plan and drawing public attention towards the taxa (14, 15). Being an endemic species, an assessment of the threat status of *I. exilis* across the Himalayas based on IUCN criteria (16, 17) has also been carried out

## Materials and Methods

### Study area

Manas National Park (MNP) occupies an area of 500 sq. km and is located at the foothills of the Bhutan Himalayas in Baksa and Chirang districts, Assam, India in between 26°35'-26°50'N latitude and 90°45'-91°15'E longitude (Fig. 1). The National Park consists of three ranges namely -the

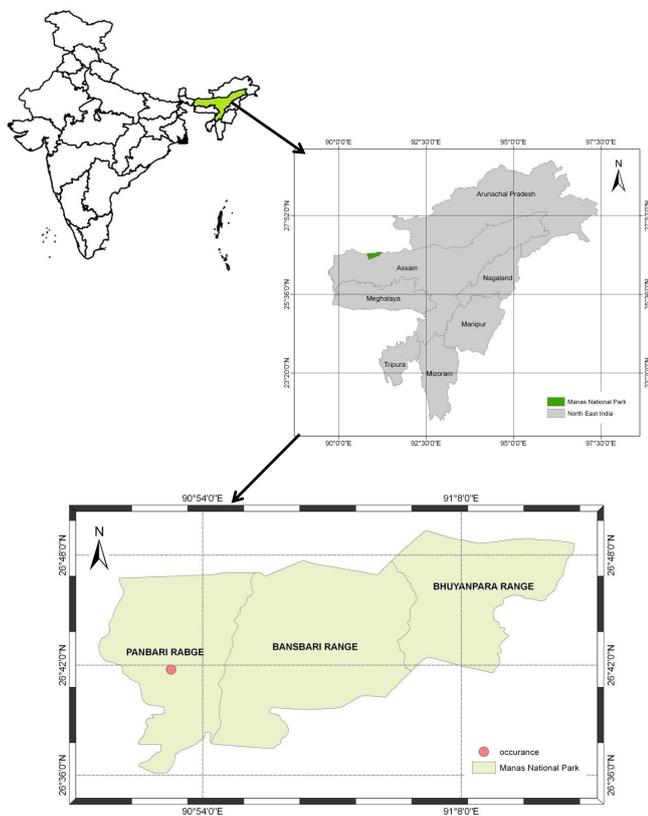


Fig. 1. Distribution records of *Impatiens exilis* in Assam, India.

Western Range with its headquarters at Panbari, the Central Range with its headquarters at Bansbari and the Eastern Range at Bhuyapara. The main vegetation types of MNP comprises of Sub-Himalayan light alluvial semi-evergreen forests in the northern parts, East Himalayan mixed moist and dry deciduous forests (the most common type), low alluvial savanna woodland and Assam valley semi-evergreen alluvial grasslands (7).

### Methods

While floristic survey was carried out in MNP, Assam, India, individuals of *Impatiens exilis* were recorded from Panbari range in 2017. Comprehensive description of the species

was made and herbarium specimens were prepared following the standard procedure (18). The identity has been confirmed by checking the protologue description and inspecting an image of the type specimen. The threat status of *I. exilis* was evaluated following IUCN versions 3.1 and 4.0 criteria B (geographical range) and D (population size) (16, 17). Geo-coordinates of occurrence of the species were recorded and collected from other sources: (i) herbarium records (E, CAL & K) and (ii) records from Bhutan Biodiversity Portal (BBP, <https://biodiversity.bt> accessed 10 May, 2020). In case of herbarium specimens lacking geo-coordinates, Google Earth™ was used for geo-referencing the herbarium label data. Based on the recorded geo-coordinates of the present locality, type locality and other area of occurrences, the Extent of Occurrence (EOO) and Area of Occupancy (AOO) of the populations were assessed using the conservation assessment tool extension developed by the Royal Botanic Gardens, Kew (19) in Arc View. For AOO, a 2 × 2 km grid cell size was used. The pilot assessments thus generated for EOO and AOO were then subjected for comparison with the IUCN criteria for assigning the threat status of the species.

## Results

### Taxonomic description

*Impatiens exilis* Hook. f., *Rec. Bot. Surv. Ind.*, 4: 13 & 19. 1905.

### Type

### India

Pomomng, Darjiling, 23 August 1869, C. B. Clarke 879b (Type, K, K000694677 Image!)

Perennial herb, upto 30 cm tall. Leaves alternate, blade lanceolate, oblong-ovate, 3-6 cm × 1.5-2.5 cm, margin crenate with minute hairs, attenuate at base, acute at apex, adaxially dense hairy, abaxially nearly glabrescence. Inflorescences racemose, axillary, arise from the axils of upper leaves; peduncle short, with minute hairs; pedicels reddish in colour, 2.5-3.6 cm, pubescent. Flowers purple, 1.2-1.8 cm long. Lateral sepals 2, ovate, 3-6 mm × 0.1-0.2 mm; lower sepal purple, 3-3.2 cm long, spur straightly elongated; lateral sepals reddish in colour, 3-4 mm × 1-2 mm. Dorsal petal red purple, 7-9 mm × 5-6 mm, cucullate; lateral united petals deep red-purple, oblong, 6-12 mm long; the upper lobe oblong, 10-12 mm × 2-3 mm; the lower lobe broadly oblong to oblong, 5-7 mm × 2-4 mm. Stamens 5, enclosing the ovary, anther lobes obtuse. Capsules greenish, short and linear (Fig. 2.)

### Flowering

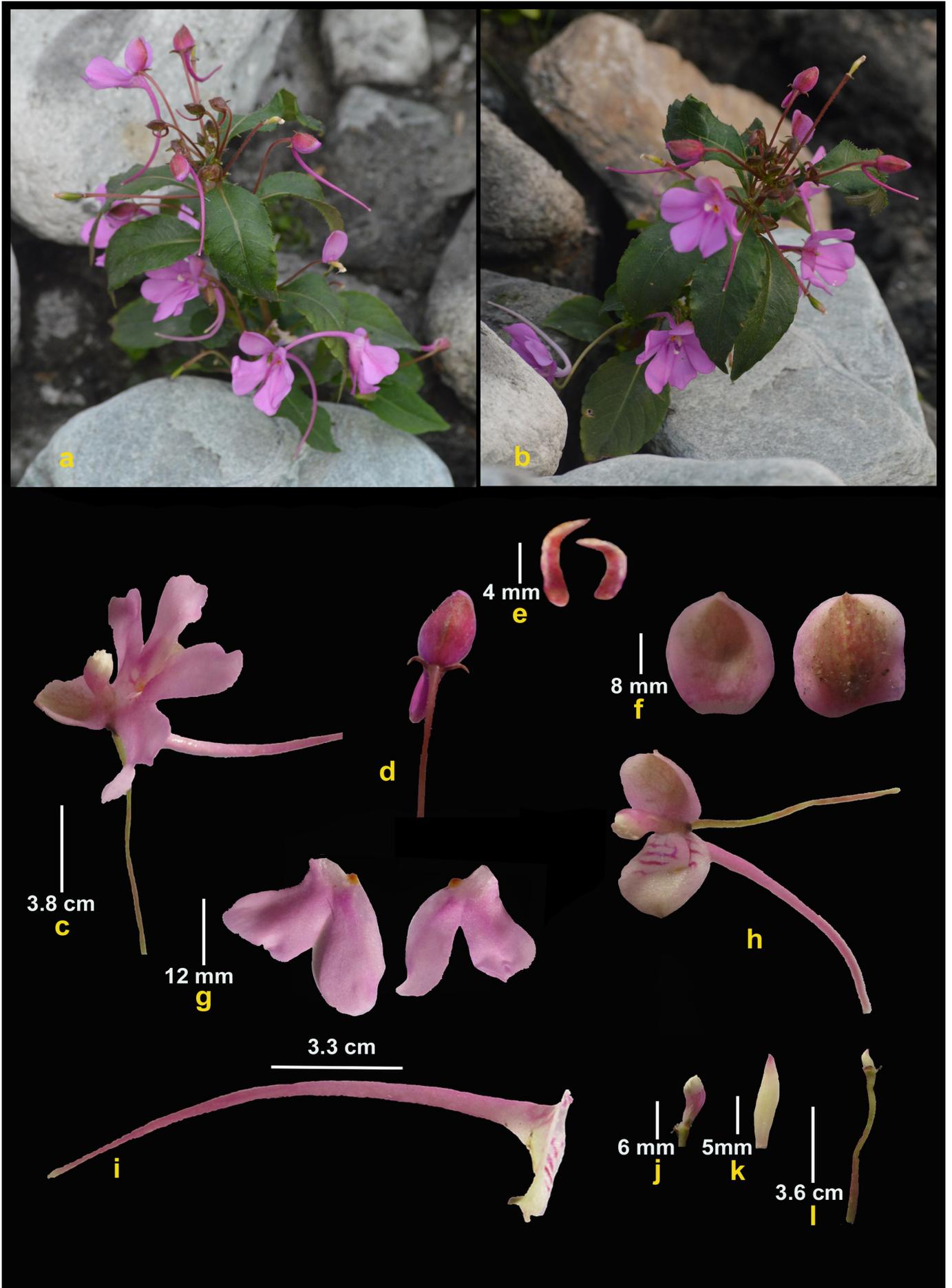
February-March.

### Fruiting

March-April.

### Habitat

Tropical moist rocky and shady slopes near the river bank. The habitation of the species is facing the risk of soil erosion



**Fig. 2.** *Impatiens exilis* Hook. f.: (a-b) Habit; (c) Flower; (d) flower bud; (e) Lateral sepals; (f) Dorsal petal (dorsal view and ventral view); (g) lateral united petals; (h) frontal view of Dorsal petal and lower sepal; (i) Lower sepal; (j) Androecium; (k) gynoecium; (l) pedicel with gynoecium

due to flood in the recorded site, the number of mature individuals observed was less than 100 individuals.

### Distribution

India: Sikkim (East Sikkim and North Sikkim), West Bengal (Darjeeling and Kalimpong) Assam (Manas National Park, Panbari Range, present record); Bhutan (Trongsa and Deothangng); Nepal (Dharan and Gandaki Zone).

### Specimen examined

#### India

Assam: Manas National Park, Panbari range, [26° 40'22.59"N, 90°48'55.68"E, 500 m], 10 June, 2017, *D. Baro 1014*(GUBH and Herbarium of MNP); Pomonng, Darjiling, 23 August 1869, *C. B. Clarke 879b* (**Type K**, K000694677 Image!); Darjiling, 1901, *R. Pantling 1244* [K, (K000694676 Image!)]; North Sikkim, Way to Mangam, 25 August 2016, *R. Gogoi and A. Kumar 73606* (CAL); Quizig, 1 September 2017, *R. Gogoi and A. Kumar 73630* (CAL);

#### Bhutan

Buta, 28 June 1914, *R.E. Cooper & A.K. Bulley 1039A* [E, (E00848056 Image!)];

#### Nepal

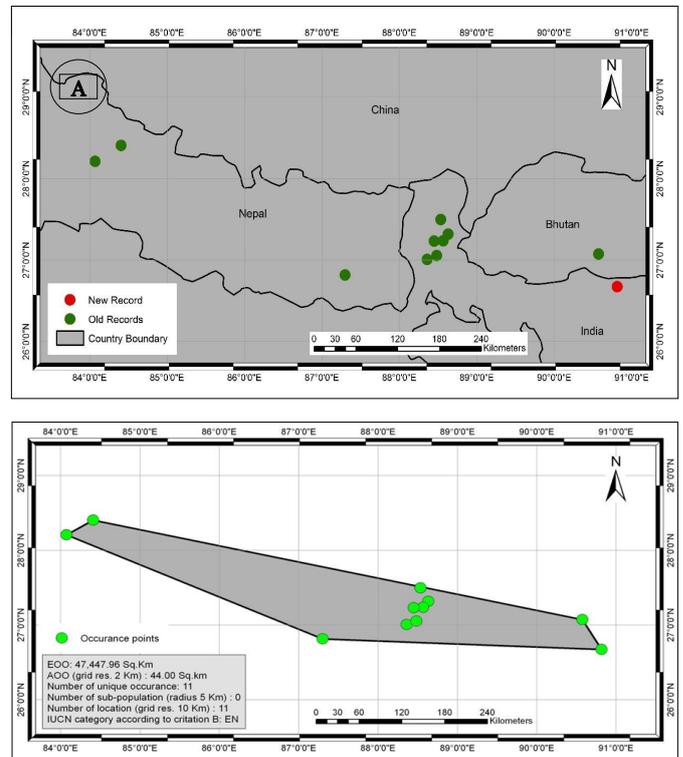
Pohlara, 07 September 1954, *Stainton, Sykes & Williams 7135* [E (E00848051 Image!)]]; Dharan, 13 August 1972, *J.F. Dobremez 1439* [E, (E00533662 Image!)]]; Gandaki Zone, 16 August 2008, *Manaslu 2008 expedition 20811275* [E, (E00774763)]]

### Threat status

*Impatiens exilis* is yet to be listed in the Red data book of Indian plants (20) and in the IUCN Red List (21). The populations of this taxon have been found living at a serious status at the forest edge along riverside. There are natural pressures like soil erosion in the habitat, which may completely eradicate the existing populations. Assessment of the risk status using IUCN versions 3.1 and 4.0 has also been carried out. We estimated the Area of Occupancy and Extent of Occurrence of the species as 44 Sq.km. and 47,447.96 Sq.km respectively (Fig. 3). During the last three years, we have also noticed a continuing decline in the quality and territory size of the habitat. Accordingly, we ranked the species as Endangered based on the B2 a & b (iii) IUCN Red List Categories and Criteria: Version 3.1.

### Discussion

Although this North-Eastern Part of India has been aptly explored botanically many times by the different botanists since the period of Roxburgh (18, 22-28), none had reported the existence of this species from the region. Present records of *I. exilis* is a new addition to the flora of Assam, and represent an eastern ward distributional extension of this plant species in the Himalaya. The species *I. exilis* is found endemic to the Eastern Himalayan region with limited distribution and population and categorized as Endangered which warrants its conservation.



**Fig. 3. A.** Distributional status of *Impatiens exilis* in the Eastern Himalaya (Green dots represent the old distribution records and red dots represent the present distribution record for the species. **B.** Threat status assessment of *Impatiens exilis*. (Green dots represent the distribution records for the species, grey polygon the convex hull used for calculation of the Extent of Occurrence (EOO). The bottom left grey inset summarizes the EOO and AOO values.

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### Authors contributions

DB and AB carried out the fieldwork and drafted the manuscript. JD prepared the map and analyse the threat status of the species as per IUCN Red List criteria. SKB reviewed the manuscript and supervised the work. All authors read and approved the final manuscript.

### Compliance with ethical standards

**Conflict of interest:** Authors do not have any conflict of interests to declare.

**Ethical issues:** None.

### References

- Morgan RJ. *Impatiens: The Vibrant World of Busy Lizzies, Balsams and Touch-me-nots*. Timber Press, Portland, USA. 2007.
- Vivekananthan K, Rathakrishnan NC, Swaminathan MS, Ghara LK. Balsaminaceae. In: Hajra PK, Nair VJ, Daniel P. editors. Flora of India. Vol.4. Bot Surv India. Howrah. 1997; p.229.
- Grey-Wilson C. *Impatiens of Africa*. A. A. Balkema, Rotterdam. 1980.

4. Bhaskar V. Taxonomic Monograph on *Impatiens* L. (Balsaminaceae) of Western Ghats, South India: The Key Genus for Endemism. Centre for Plant Taxonomic Studies. Bangalore. 2012;1-283.
5. Gogoi R, Borah S, Dash SS, Singh P. Balsams of Eastern Himalaya - A Regional Revision. Botanical Survey of India, Kolkata. 2018; p 216.
6. Baro D, Borthakur SK, *Clerodendrum hexangulare* D. Baro and S. K. Borthakur: A new species from Manas National Park of Assam. NeBIO. 2016;7(4):133-37.
7. Baro D, Borthakur SK. Climbing Angiosperms of Manas National Park, Assam: Diversity and Ethnobotany. Biosci Discov. 2017; 8 (2):158-65.
8. Baro D, Bawri A, Borthakur SK. Rediscovery of a threatened species *Crotalaria meeboldii* Dunn (Fabaceae). Rheedea. 2019; 29(4):17-20. <https://dx.doi.org/10.22244/rheedea.2019.29.4.03>
9. Hooker JD. An Epitome of the British Indian species of *Impatiens*. Records of Bot Surv India. 1904-1906; 4:1-58.
10. Akiyama S, Ohba H, Wakabayashi M. Taxonomic notes of the East Himalayan species of *Impatiens*: studies of Himalayan *Impatiens* (Balsaminaceae). In: Ohba H, Malla SB, editors. The Himalayan Plants: Vol. 2. University Museum, University of Tokyo, Tokyo. 1991;1:67-94. <https://doi.org/10.1111/j.1095-8339.1992.tb00270.x>
11. Akiyama S, Ohba H. Studies of *Impatiens* (Balsaminaceae) of Nepal 1. *Impatiens amplexicaulis* Edgew. and *I. chungtienensis* Y. L. Chen. Bull Natl Mus Nat Sci Ser B. 2015a; 41(3):113-24.
12. Akiyama S, Ohba H. Studies of *Impatiens* (Balsaminaceae) of Nepal 2. *Impatiens jurpia*, *I. urticifolia* and Allied Species. Bull Natl Mus Nat Sci Ser B. 2015b; 41(4):161-78.
13. Hooker JD, *Impatiens* L. In: Hooker JD, editor. Flora of British India, Vol.1. L. Reeve & Co., London, UK. 1875;440-64.
14. Tali BA, Ganie AH, Nawchoo IA, Wani AA, Reshi ZA, Assessment of threat status of selected endemic medicinal plants using IUCN regional guidelines: A case study from Kashmir Himalaya. J Nat Conserv. 2014;23:80-89. <https://doi.org/10.1016/j.jnc.2014.06.004>
15. Tali BA, Khuroo AA, Nawchoo IA, Ganie AH. Prioritizing conservation of medicinal flora in the Himalayan biodiversity hotspot: An integrated ecological and socio-economic approach. Environ Conserv. 2019;46(2):147-54. <https://doi.org/10.1017/S0376892918000425>
16. IUCN. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels. Version 3.1. IUCN Species Survival Commission, Gland and Cambridge. 2001.
17. IUCN. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels. Version 4.0. IUCN Species Survival Commission, Gland and Cambridge. 2012.
18. Jain SK, Rao RR. A Hand Book of Field and Herbarium Method. Today and Tomorrow Publishers, New Delhi. 1977.
19. Moat J. Conservation Assessment Tools Extension for ArcView 3.x. Version 1.2. GIS Unit, Royal Botanic Gardens, Kew. 2007.
20. Nayar MP, Sastry ARK. Red Data Book of Indian Plants, Vol. 1-3. Bot Surv India, Kolkata. 1987-90.
21. IUCN. The IUCN Red List of Threatened Species. 2020. Retrieved 20 May 2020. <http://www.iucnredlist.org>.
22. Kanjilal UN, Kanjilal PC, Das A, De RN, Bor NL Flora of Assam. Vol. 1-5. Government Press, Shillong. 1934-40.
23. Roxburgh WA. Flora Indica. vols. 2. Carey W. Wallich N. editors. Serampore. 1820-24.
24. Roxburgh WA. Flora Indica. vols. 3. Carey W. editor. Serampore. 1832.
25. Wallich N. Plantae Asiaticae Rariores. Vols. 3. London. 1820-32.
26. Griffith W. Journals of Travels in Assam, Myanmar, Bhutan, Afghanistan and neighbouring countries. Calcutta. 1847. <https://doi.org/10.5962/bhl.title.79660>
27. Jain SK, Hajra PK. On the botany of Manas Wildlife Sanctuary. Bull Bot Surv India. 1975; 17:75-86.
28. Dessai JRN, Janarthanam MK. The genus *Impatiens* (Balsaminaceae) in the northern and parts of central Western Ghats. Rheedea. 2011;21(1):23-80.

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