

publications, PP (top 10%) is arguably the most robust, size-independent proxy or indicator for quality of publications. This is the proportion of the publications of a university that, compared with other similar publications, belongs to the top 10% most frequently cited. It therefore has a normalizing effect across fields, publication year and document type. The ratio $q = \text{PP (top 10\%)/10}$, allows one to fractionalize this proxy, such that a value of 1.00 is the expected global norm.

If we consider q to be the quality indicator and P to be the zeroth-order indicator of performance, then it is possible to combine this to obtain a first-order indicator of performance qP and a second-order indicator of performance $X = q^2P$ (ref. 4). In this manner, the quantity term (P) and the quality term (q) can be integrated into a single composite term that serves as the best size-dependent proxy for total performance in the research context.

Figures 1 and 2 compare the performance of the IISc + 7 IITs cluster with that of NUS and NTU as we move from the 2006–09 to the 2012–15 window. From Figure 1 it is clear that the aggregated output of the Indian cluster is twice as that of NUS or NTU. However, on the quality proxy, NUS and NTU perform much higher than the global norm, while the Indian cluster is below global norm, and is in gradual decline over the years. The overall effect is clearly seen when the second-order indicator is displayed in Figure 2 – NUS and NTU far outperform the Indian cluster.

We use the Leiden 2017 data to decompose the research performance of the IISc + 7 IITs cluster and NUS and NTU into two components – size and quality. Not only do NUS and NTU outperform the IISc + 7 IITs cluster, they are also rising steeply in terms of quality of research while the Indian cluster is showing a gradual decline.

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Impatiens bhimgadensis (Balsaminaceae), a new species from Karnataka, India

The genus *Impatiens* L. (Balsaminaceae) consists of about 210 species in India¹ with 106 species (and 13 varieties) in the Western Ghats². *Impatiens* with over 95% of the species endemic in the Western Ghats, forms one of the primary centres of diversity in India. Recently, several new species from the Western Ghats, viz. *Impatiens minae*³, *I. johnsiana*⁴, *I. theuerkaufiana*⁵, *I. courtallensis*⁶, *I. sahyadrica*⁷, *I. neo-modesta*⁸, *I. sasidharanii* and a variety *hirsuta*⁹, *I. glabrata*¹⁰, *I. kawtlyana*, *I. taimushkulni*, *I. nilgirica* var. *nawtlyana*¹¹, *I. stolonifera*¹², and *I. mankulamensis* and *I. panduranganii*¹³ have been discovered.

During the floristic explorations by the authors in Talewadi, Bhimgad Wildlife Sanctuary, Belagavi district, Karnataka, during September 2014, an interesting species of *Impatiens* belonging to the Section: ‘Annuae’ was collected, which is found to be new to science, and the same is described here.

Taxonomy. *Impatiens bhimgadensis* Bhaskar & Sringswara sp. nov.

Impatiens bhimgadensis is distinct from its closely allied *I. rupicola* Hook.

f. and *I. ramosissima* Dalzell in having 3–4 mm long, straight and tapering spur in the lip. Type: India, Karnataka, Belagavi district, Talewadi, Bhimgad Wildlife Sanctuary, alt. 800 m 20.09.2014, V. Bhaskar & A.N. Sringswara 934 (holo, UASB!) (Figure 1).

Erect glabrous flaccid herbs, up to c. 50 cm high, often rooted at lower nodes; stems highly branched from the middle, terete, often with a vertical groove, glabrous, translucent, vertically spotted with red hydropetan cells, lower internodes 4–6 cm long. Leaves opposite-decussate, exstipulate, sessile or with c. 2 mm long petiole, lamina ovate, lanceolate, c. 3 × 1.4–1.5 cm, round or slightly cordate at base, obtuse or acute at apex, serrate, each serrature denticulate, upper leaves broad at base, auricled, sparsely hairy on veins above, hairs upwardly erect, glabrous below, eglandular. Flowers axillary, solitary, 1–1.25 cm across, pinkish or bluish, with a pair of purple streak on the inner sides of wing petals continuing with perpendicular honey guides of the same colour, pedicels erect, 3–3.5 cm long in flower and deflexed

and c. 4 cm in fruit, erect in flower, deflexed in fruit, minutely pubescent with two lines of hairs. Lateral sepals two, linear, acute, almost as long as standard, smaller than wings, c. 5 × 0.75 mm, glabrous, pale pink. Lip funnel-shaped, mouth c. 5 mm long, distal end acute or acuminate, proximal part three-nerved, a small yellow ‘eye’ present inside, purplish honey guides visible outside and inside, generally light pink, usually glabrous, rarely with a few scattered hairs, base narrowed down to a short spur, 3–3.4 mm, straight, tapering, tip acute, white or pale green. Standard orbicular, c. 5 × 4 mm, slightly recurved, dorsally keeled, with a prominently enlarged pointed crest at base, crest c. 1.25 × 2 mm, sub-acute, anterior tip mucronate or apiculate, mucro and crest placed at same height, pink, usually glabrous or rarely hirtellous on the keel above. Wing petals two-lobed, distal lobe large, c. 1 cm long from base, broader lobe rhomboidal, c. 8.75 × 6.25 mm, pale pink or bluish, stipe c. 2 mm long, basal lobe small, fin-like, c. 3.75 mm long, distal part broad with two acute opposite ends,

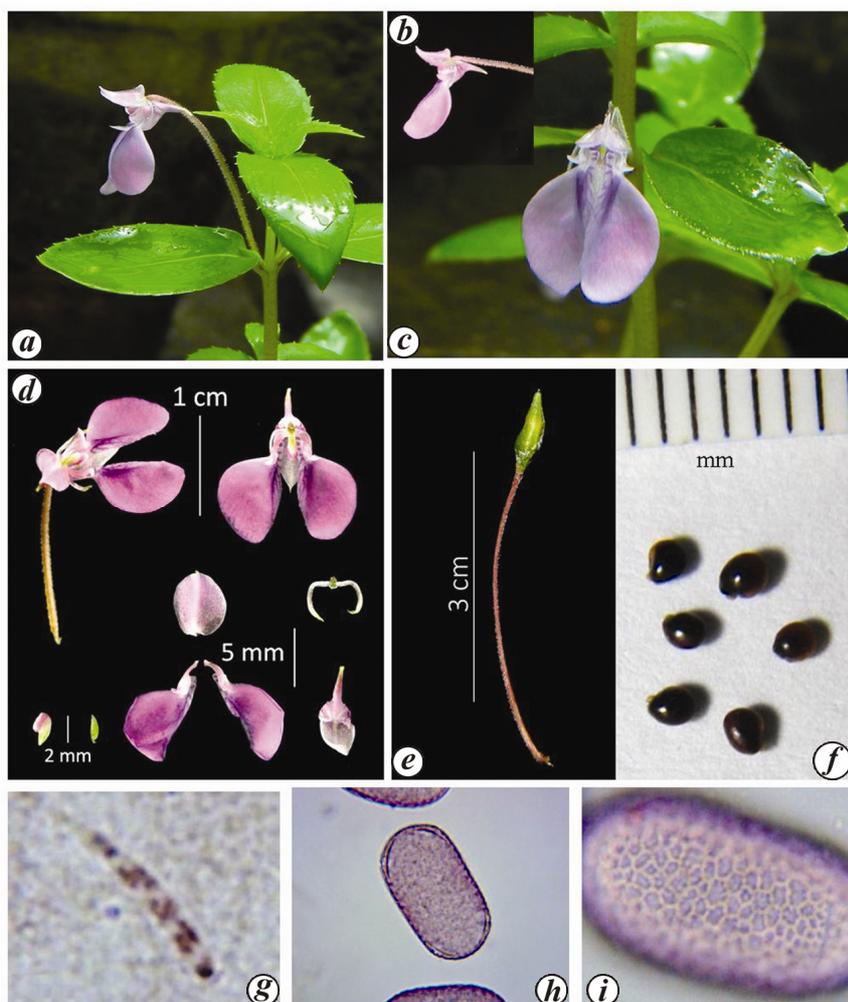


Figure 1. *Impatiens bhimgadensis* Bhaskar & Sringswar sp. nov. *a, b*, Habit of the plant showing lateral view of flower, hairy pedicel and standard with a crest; *c*, Front view of flower showing fin-like dorsal auricle with a pair of honey guides; *d*, Dissected floral parts; *e*, Fruit; *f*, Seeds; *g*, $n = 8$ chromosomes; *h, i*, Pollen four-colpate rectangular with reticulate exine sculpturing.

Table 1. Comparison of *Impatiens bhimgadensis* with *I. rupicola* Hook. f. and *I. ramo-sissima* Dalzell

Characters	<i>Impatiens bhimgadensis</i>	<i>Impatiens ramosissima</i>	<i>Impatiens rupicola</i>
Leaves	Ovate-lanceolate, sparsely scabrid hairy on veins above	Oblanceolate, hispid villous or scabrid or villous above	Obovate, oblong, scabrid hairy or glabrescent above
Flower colour	Pale pink or bluish	Deep pink or purple	Pale pink, bluish-purple, whitish-pink
Floral parts (standard, lateral sepals, lip)	Glabrous	Prominently hairy, scabrid or pilose	Glabrous or glabrescent
Lip and spur	Lip funnel-shaped, tapering into 3–3.4 mm long straight spur	Lip conical and tapering into 2 mm long hooked spur	Lip cymbiform, round, about 2 mm long hooked spur, arising abruptly from base of lip
Pedicel	3–3.5 cm in flowers, 4 cm in fruit, finely pubescent	c. 1.5 cm in flowers, 3.5 cm in fruit, prominently hairy	c. 3 cm in flowers, c. 4 cm in fruit, pubescent or glabrous
Dorsal auricle in wings	0.3–0.4 mm long	0.5–1 mm long	c. 1 mm long
Wing petals	c. 1 cm long	c. 1.2 cm long	1.2–1.5 cm long

white or pale pink, dorsal auricle short triangular, with a pair of perpendicular blue bands, 0.3–0.4 mm, inner side with prominent dark blue honey guides. Stamens with white filaments, anthers deep pink, pollen pale pink. Ovary linear, acute. Capsules c. 1 cm long, inflated in the middle, acuminate with a short beak, glabrous, c. six-seeded; seeds spherical, 1–1.5 × 1.8 mm smooth, black, shining.

Micro-morphological characters. *Pollen morphology*: Four-colpate, rectangular, 33–35 × 20 µm, exine simple reticulate, reticulum fine, muri thick, obscurely dupli-baculate, lumen 3 × 3, 3 × 2, 2 × 2 µm, intra-luminal bacules seemingly present. Chromosome number: $n = 8$.

Etymology: The species is named after the type locality, Bhimgad Wildlife Sanctuary.

Phenology: Flowers in August–September and fruits in October.

Ecology: A small population found growing amidst grasses, *Habenaria heyneana*, *Eriocaulon* spp., *Crinum* sp., etc. on lateritic soil in a valley on the way to Wroughton's free-tailed bats cave in the sanctuary.

Distribution and conservation status. Presently it is known only from the Bhimgad Wildlife Sanctuary in the Western Ghats of Belagavi district, Karnataka. The habitat in the type locality is fairly intact. The conservation status is presently assessed as Data Deficient according to IUCN categories¹⁴, needing

survey of similar habitats in adjoining areas.

Impatiens bhimgadensis is morphologically similar to *I. rupicol* Hook. f. and *I. ramosissima* Dalzell (reinstated by the first author in a separate publication) of section *Annuae*, but differs in many characters (Table 1).

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Occurrence of live rhodolith bed of *Lithophyllum kotschyannum* Unger (Corallinaceae: Lithophylloideae) in Palk Bay: first record from India

Rhodoliths are nodular form of marine free-living, non-geniculate, crustose coralline red algae, resembling the corals. The communities, in which they dominate are referred to as 'rhodolith beds', 'rhodolites' or 'maerl'. Rhodoliths assume different sizes, shapes and forms (small thalli-like, twig-like, large round shaped, branching/unbranching, etc.) based on different factors such as water motion, bioturbation, grazing, fouling, bleaching, etc.¹. The thin encrusting forms of crustose coralline algae strengthen the reef frame against mechanical destruction, whereas the contribution of unattached rhodoliths towards

strengthening the reef frames is not significant². Rhodolith beds provide habitat for many associated invertebrates and macro-flora and are recognized as environmental recorders³ as they contribute in palaeoclimatic reconstructions over a broad range of temporal and spatial scales⁴. These coralline algae produce growth bands with a morphology and chemistry that record environmental variation³.

Rhodolith beds are ubiquitous and occur from low intertidal zone to depths of over 150 m in tropical to polar sea⁵. In India, rhodolith beds are reported from the Aramda reef member (Late Pleisto-

cene to Holocene) of Chaya Formation, Gujarat⁶, wherein the sectional studies of the bed revealed the presence of non-geniculate coralline algal genera such as *Lithoporella*, *Lithothamnion*, *Lithophyllum*, *Porolithon* and *Sporolithon*. During the underwater surveys conducted in the coral reefs of Mandapam region, Palk Bay (79°8'44.785"E, 9°17'35.955"N to 79°9'4.294"E, 9°17'37.355"N), rhodolith beds spanning about 30,000 m² were found encrusting over the dead (partly or fully) corals (Figure 1 a, b). *Lithophyllum kotschyannum* Unger was dominant among the rhodoliths in the reef region. The seaward side of the reef crest was