

Two New species of *Impatiens* (Balsaminaceae) from Myanmar

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Abstract

Impatiens yinyinkyii M.M.Latt, B.B.Park & Nob.Tanaka and *I. horizontalis* M.M.Latt, B.B.Park & Nob.Tanaka (Balsaminaceae) are described and illustrated. Those new species were discovered in Htamanthi Wildlife Sanctuary, northwestern Myanmar. Description, photographic data as well as the comparative characters with their similar species are provided. *Impatiens yinyinkyii* is similar to *I. masonii* Hook.f., but differs in having three dark purple blotches in center of flower, specifically at base of dorsal and upper petals of united petals. *Impatiens horizontalis* resembles *I. stenantha* Hook.f., *I. prostrata* Hook. f., *I. repens* Moon, *I. procumbens* Franch and *I. reptans* Hook. f. in having larger, glabrous and elliptic to lanceolate leaves, serrate margin with antrorse bristles, deeply bucciniform lower sepal, twisted spur with abruptly capitate tip, linear ovary, spheroid seed and finally uncommon conspicuous stout stem which is horizontally creeping.

Keywords: Burma, *Impatiens yinyinkyii*, *Impatiens horizontalis*, new taxon, Sagaing

Introduction

Impatiens L. is the genus in the Balsaminaceae with over a thousand species are mainly distributed across the Old-World tropic and subtropics especially in tropical Africa, Madagascar, southern India and Sri Lanka, the Sino-Himalayan region and Southeast Asia (Yuan, *et al.*, 2004; Ruchisansakun, *et al.*, 2018b). Up to 2003 from British colonization period, 46 species of *Impatiens* were recorded (Kress, *et al.*, 2003) in Myanmar. Later, many species, eg. *I. casseabriae* Y.H.Tan, S.S.Zhou & B.Yang (Yang, *et al.*, 2017), *I. tanintharyiensis* Ruchis., Suksathan & Saw-Lwin (Ruchisansakun, *et al.*, 2017), *I. decurva* Ruchis. & S.B.Janssens, *I. oblongata* Ruchis & Niet (Ruchisansakun, *et al.*, 2018a), have been described. A recent taxonomic revision of *Impatiens* in Myanmar recognized 65 species (Ruchisansakun, *et al.*, 2018b). Since then, two more taxa, *I. megacalyx* Y.H. Tan & H.B. Ding and *I. radiata* Hook.f. var. *mindatensis* S.Akiyama were described (Ding, *et al.*, 2019; Akiyama, *et al.*, 2018).

Yu *et al.* (2016) divided the genus *Impatiens* into two subgenera, *Clavicarpa* S.X. Yu ex S.X. Yu & Wei Wang and *Impatiens*, and further subdivided the latter subgenus into seven sections, *Semeiocardium* (Zoll.) S.X. Yu & Wei Wang, sect. *Tuberosae* S.X. Yu & Wei Wang, sect. *Racemosae* Hook. f. & Thomson, sect. *Impatiens*, sect. *Scorpioidae* S.X. Yu & Wei Wang, sect. *Fasciculatae* X.S. Yu & Wei Wang, and sect. *Uniflorae* Hook.f. & Thomson.

Expedition to Htamanthi Wildlife Sanctuary, Sagaing Region, northwestern Myanmar led us to collect further hitherto-undescribed species of *Impatiens*. They are described here as *Impatiens yinyinkyii* M.M.Latt, B.B.Park & Nob.Tanaka and *I. horizontalis* M.M.Latt, B.B.Park & Nob.Tanaka.

Materials and Methods

Floristic surveys were carried out in Htamanthi Wildlife Sanctuary, located in Hkamti and Homalin Townships, Hkamti District, Sagaing Region, northwestern Myanmar from November 2019 to February 2020 and from November, 2020 to February 2021. Two *Impatiens* specimens from those collections were taxonomically studied. Morphological investigations were made based upon the herbarium specimens and living materials in the field during the surveys. Measurements were made from either dried and fresh materials. The protologues of all published names along with all pertinent literatures on *Impatiens* were collated and reviewed. The terminology for descriptions followed Beentje (2016). The description was made based on the living plants in the field beside the herbarium specimens. Types are deposited in RAF and TNS.

Taxonomic treatment

Impatiens yinyinkyii M.M. Latt, B.B. Park & Nob. Tanaka, *sp. nov.* (Figs. 2 & 3)

Type:—MYANMAR. Sagaing Region: Htamanthi Wildlife Sanctuary, along high humid rocky stream, ca. 138–159 m elevation, N 25°16'25" and E 95° 20' 08 on 29 November 2020, *Myo Min Latt MY5938* (holotype-RAF, isotype-TNS).

Diagnosis: *Impatiens yinyinkyii* is morphologically similar to *I. masonii* Hook.f. but can be distinguished by having asymmetric flowers with three dark purple blotches in center of flower, specifically at base of dorsal and upper petals of lateral united petals, round apex dorsal petals, monochasial simple cymose inflorescence, lanceolate bract, pink anther, longer incurved spur and ovate and compressed seed (Table 1).

TABLE 1: Comparison of characters between *Impatiens yinyinkyii* and *I. masonii*.

Characters	<i>I. yinyinkyii</i>	<i>I. masonii</i>
Habit	terrestrial or lithophyte, perennial	terrestrial, annual
Plant height/length	up to 60 cm high	50–100 cm high
Stem	erect	erect
Leaves arrangement	opposite decussate	opposite decussate
Leaves shapes	linear	narrowly elliptic
Leaves margin	serrate, antrorse bristles at the top of teeth	serrate
Leaves size	0.8–1 × 10.5–11 cm	1–5 × 6–cm
Petiole	petiolate, up to 7 mm long	sessile, 2 mm long
Stipules	estipulate	globose stipular glands
Inflorescences	axillary, pedunculate, monochasial simple cymose	axillary, pedunculate, fascicle
Flower color	pinkish purple to dark purple	pink
Bracts	narrowly lanceolate	triangular
Marks on floral parts	dark purple blotch at center	no marks
Numbers of sepal	2	2
Lateral sepals	lanceolate	ovate-lanceolate
Lower sepal	navicular	deep navicular
Spur	curved, glabrous, tapering, up to 4.5 cm long	straight or incurved, 2.3–7 cm long
Dorsal petal	orbicular, curved like boat	broadly elliptic, flat, recurved backward
United lateral petals	connate, free lobes	free
Lower lateral petal	ovate	ovate-elliptic
Upper lateral petal	orbicular	falcate
Anther	pink filament, pink anther	yellow anther
Ovary	fusiform	fusiform
Fruit	fusiform	fusiform
size of fruit	1.2 cm long	c. 1.6 cm long
Seed	ovate and compressed like sesame seed	ellipsoid

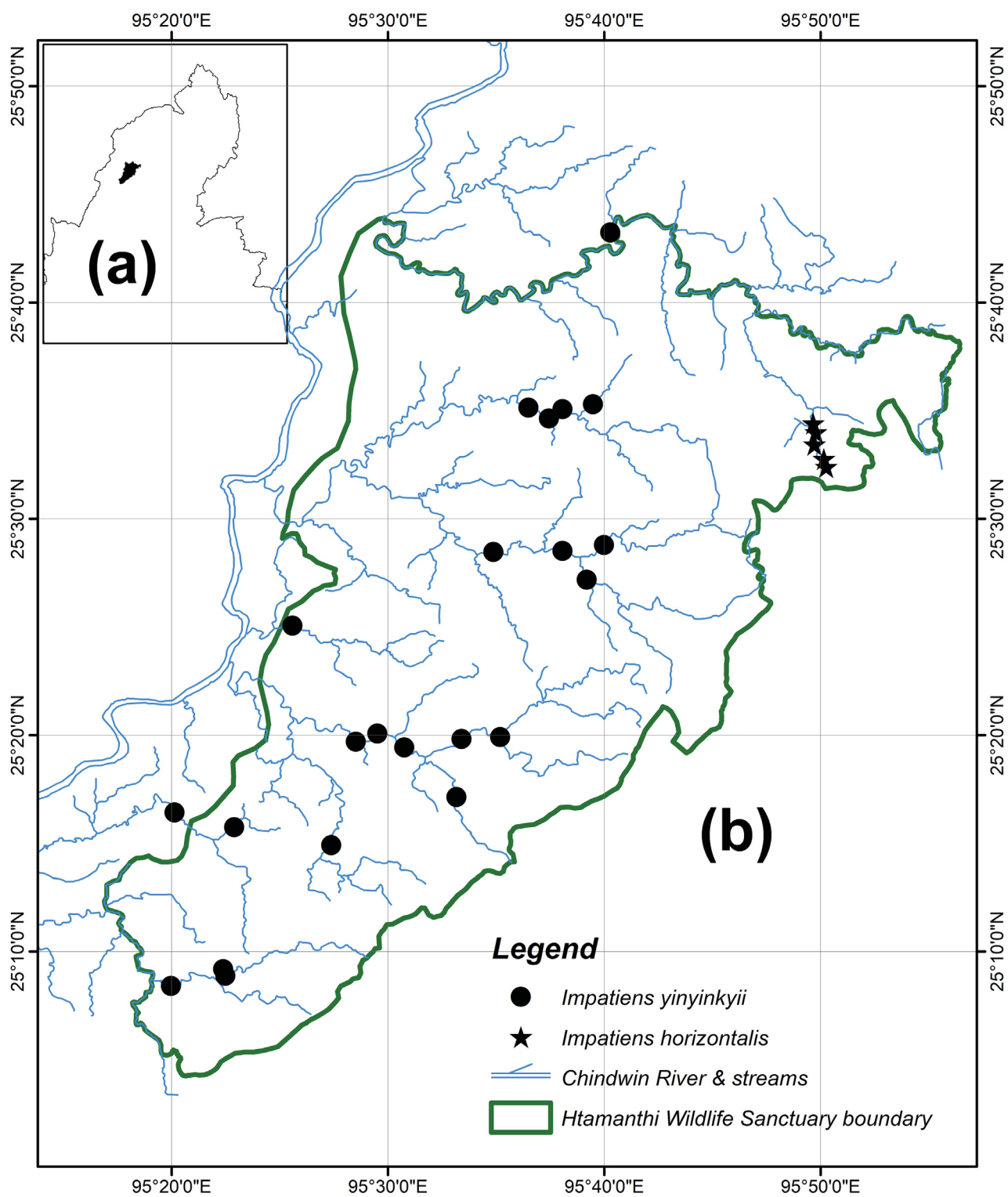


FIGURE 1. Locations of (a) Htamanthi Wildlife Sanctuary and (b) where *Impatiens yinyinkyii* (black circles) and *Impatiens horizontalis* (black stars) were discovered.

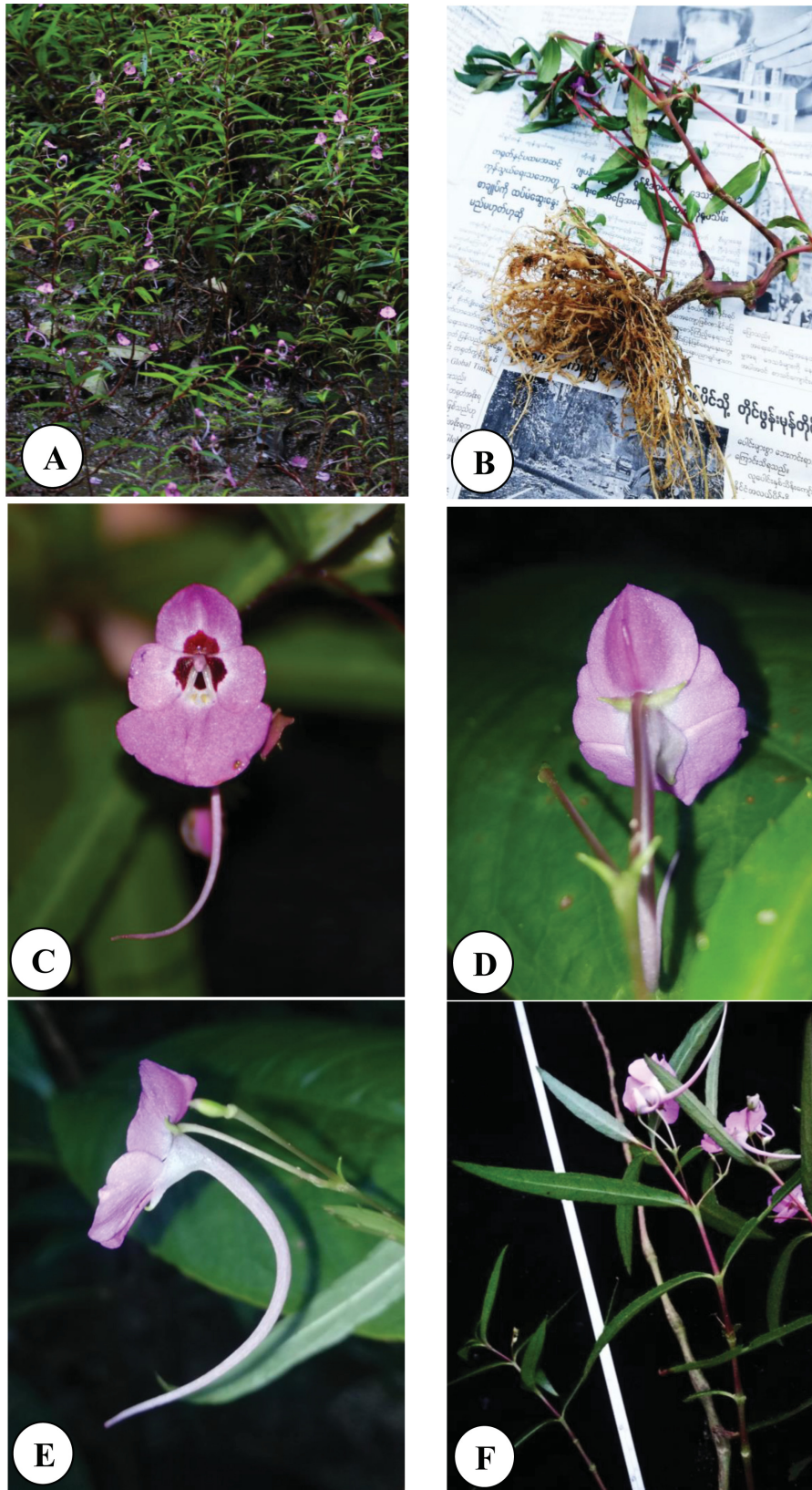


FIGURE 2. *Impatiens yinyinkyii*; A. growing on ever-moist rock wall of stream, B. roots with small tubers, C. front view, D. dorsal view, E. side view of flower and F. inflorescences and leaves arrangement.

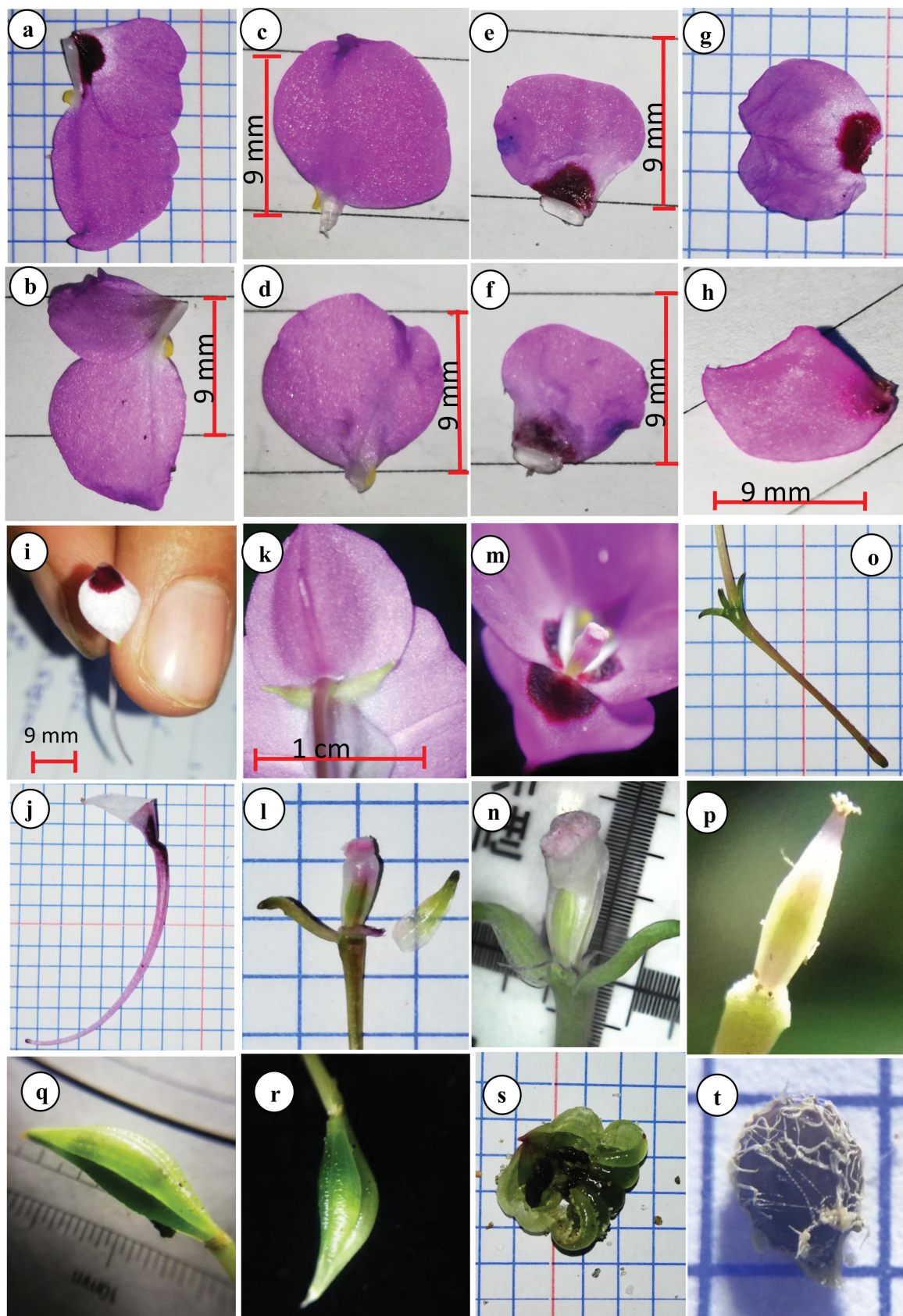


FIGURE 3. Detail floral parts of *Impatiens yinyinkyii*; **a–b.** adaxial and abaxial surfaces of united lateral petals, **c–d.** adaxial and abaxial surfaces of upper lateral petals **e–f.** adaxial and abaxial surfaces of lower lateral petals, **g–h.** adaxial and abaxial surfaces of dorsal petals, **i–j.** lower sepal, **k.** pair of lateral sepal, **l.** gynoecium with lateral sepal, **m.** gynoecium at the center of floral parts, **n.** ovary covered by anther under microscope, **o.** peduncle, floral bracts and stalk, **p.** ovary after over flowering, **q–s.** unmaturing, maturing and broken fruit and **t.** seed.

Perennial herb, terrestrial or lithophyte. **Stems** up to 60 cm high, erect, cylindrical, tapering up, glabrous, dull purple, nodes swollen, up to 7 mm in diameter, internodes glabrous, up to 3 cm long, up to 5 cm in diameter, root fibrous up to 5th node, having small white tubers, sometimes node touch ground produce small root, very branching, succulent. **Leaves** 0.8–1 × 10.5–11 cm, opposite decussate arranged, glabrous, linear, tip acuminate, base attenuate, margin serrate, antrorse bristles at the top of teeth, venation clear, up to 6 veins, 45 degrees with mid-vein, tapering to margin, abaxial surface dark green, abaxial surface pale green, petiole 7 mm long, glabrous. **Inflorescence** axillary, monochasial simple racemes, 5 cm long, 2 flowered, peduncle glabrous, purple, 2 cm long. **Flowers** zygomorphic, pinkish purple with dark purple blotches at the center, glabrous; pedicels slender, up to 1.5 cm long, ca. 1 mm in diam., dull purple. **Bracts** ca. 1 × 2 mm, narrowly lanceolate, apex acuminate, base cuneate, green, glabrous. **Lateral sepals** 2, lanceolate, transparent, green, dull purple blotch at base on abaxial surface, 1 × 4 mm, acuminate tip, broad base. **Lower sepal** navicular, pale purple, broadly elliptic mouth, white with dark purple blotch at base, acuminate apex, 5 × 7 mm, yellow base, spur curved, glabrous, tapering, up to 4.5 cm long

Dorsal petal orbicular, 9 × 9 mm, curved like boat, 4 mm deep, pinkish purple with dark blotch at base, 2 crests on abaxial surface, margin entire, apex and base rounded. **United lateral petals** connate, asymmetric, lobes free; upper petals 7 × 8 mm, orbicular, apex rounded to truncate, pinkish purple with round dark purple block at base; lower petals ovate, asymmetric pinkish purple, 8 × 10 mm, apex acute, oblique, base rounded, auricle yellow with claw or projection, 1 mm long, vein on abaxial surface, overlap and connect to upper petal with whitish petioloide auricle. **Androecium** Stamens pink, 3 mm long, 1 mm width, narrow base, green, 5 lobed, persistent above ovary after over flowering. **Gynoecium** Ovary green, 3 mm long, 1 mm in diameter, glabrous. **Fruits** fusiform dehiscent capsules, asymmetric, slightly curved, tapering both ends, 1.2 cm long, up to 5 mm in diameter, glabrous, 5 lobes, dark green upper 3 lobes, pale green lower 2 lobes. **Seeds** ovoid like sesame seed, compressed, apex pointed, round base, brown, covered by white nets, ca. 1.5 mm long, up to 6 per capsule

Habitat and ecology: *Impatiens yinyinkyii* grows on the ever-moist rock and rocky wall of the perennial stream under the sunlight. It is light demander but very sensitive to high temperature and drought. This species is very common and many populations can be found on the rock along streams throughout the Htamanthi Wildlife Sanctuary.

Phenology: Flowering in November to January before summer season.

Distribution: Myanmar. Thus far known only from the type locality.

Vernacular name: “Yin Yin Kyi Dan-pan” (proposed here). “Dan-pan” is a local name of *Impatiens* in Myanmar.

Etymology: The specific epithet is an honor to Yin Yin Kyi (1947–2021), a Myanmar taxonomist at Forest Research Institute, for her contribution to the Myanmar local flora. She published “A checklist of the trees, shrubs, herbs and climbers of Myanmar” by revising the original works by J. H. Lace “List of trees, shrubs, herbs and principal climbers, etc. recorded from Burma” in cooperating with the Smithsonian Institution.

Note: *Impatiens yinyinkyii* is assignable to subgenus *Impatiens*, sect. *Uniflorae* Hook.f. & Thomson based on its fascicled inflorescence, and short fusiform capsules.

IUCN Red Data Category: This species seems to prefer wet and cold rock along the bank of the stream. It cannot survive on alluvial sediment and dry rock. We observed that some died off because of cover by sediment and camping along the stream. In addition to such impacts, cutting the trees along the stream should be prohibited to reduce the soil erosion and to regulate riparian ecosystem. Therefore, based on the latest IUCN criteria, *Impatiens yinyinkyii* is proposed to be Near Threatened (NT) (IUCN, 2022).

Key different characteristics between *Impatiens yinyinkyii* and *I. masonii* are mentioned in Table.1.

Impatiens horizontalis M.M. Latt, B.B. Park & Nob. Tanaka, *sp. nov.* (Figs 4 & 5)

Type:—MYANMAR. Sagaing Region: Htamanthi Wildlife Sanctuary, Khamthi Township, Khamthi District, ca. 173–196 m elevation, N 25° 33' 59" and E 95° 49' 40" on 6 January 2021, *Myo Min Latt MY5939* (holotype-RAF, isotype-TNS).

Diagnosis: *Impatiens horizontalis* is morphologically similar to *Impatiens stenantha* Hook.f. but can be distinguished by being horizontally creeping stem on the surface of gravel soil along the stream, elliptic to linear leaf, coriaceous, serrate margin with bristles, axillary inflorescence and pure golden yellow flower without marks; in spite of similar creeping habit, it is distinguished from *I. prostrata* Hook. f. by having narrowly elliptic to linear leaf, serrate, antrorse bristle between teeth, glandular stipulate, twisted spur with abruptly capitate tip, linear and glabrous ovary and spheroid, ex-arillate, glabrous seed; from *I. repens* Moon by having not succulent and stout stem and racemose inflorescence; from *I. procumbens* Franch and *I. reptans* Hook. f. having not erect stem and branches, narrowly elliptic to linear, glabrous leaf, glandular stipulate, oblong sepals, deeply bucciniform lower sepal, twisted spur with abruptly capitate

tip, lanceolate, twisted, obtuse lower later petal, triangular upper lateral petal, linear ovary, oblanceolate—linear fruit (Fig-4&5).

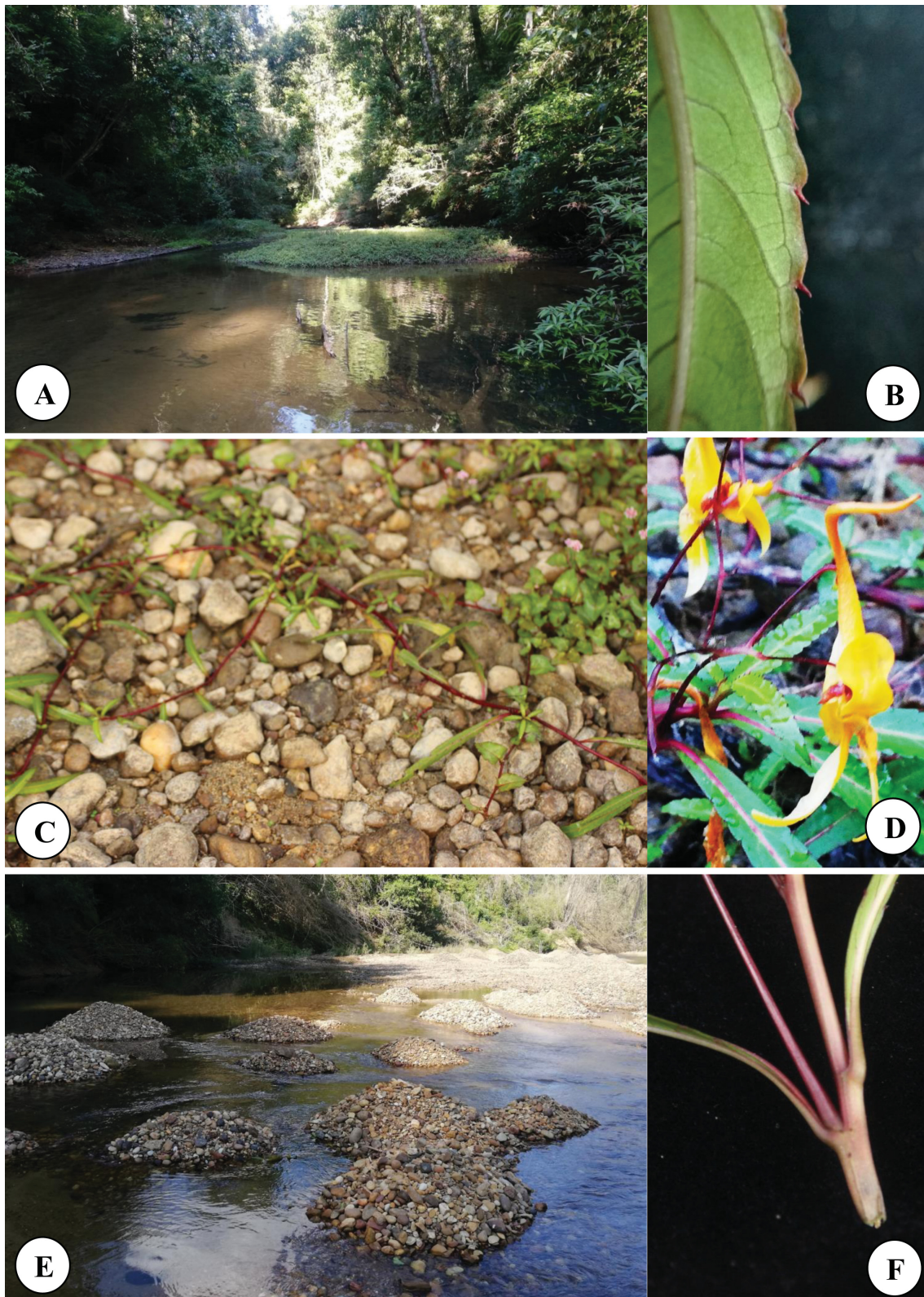


FIGURE 4. *Impatiens horizontalis*; **A.** horizontally growing on gravel stony island in a stream, **B.** Leaf margin, **C.** creeping on gravel stony habit, **D.** inflorescences **E.** gold mining and **F.** leaf arrangement, stem and peduncle of inflorescences.

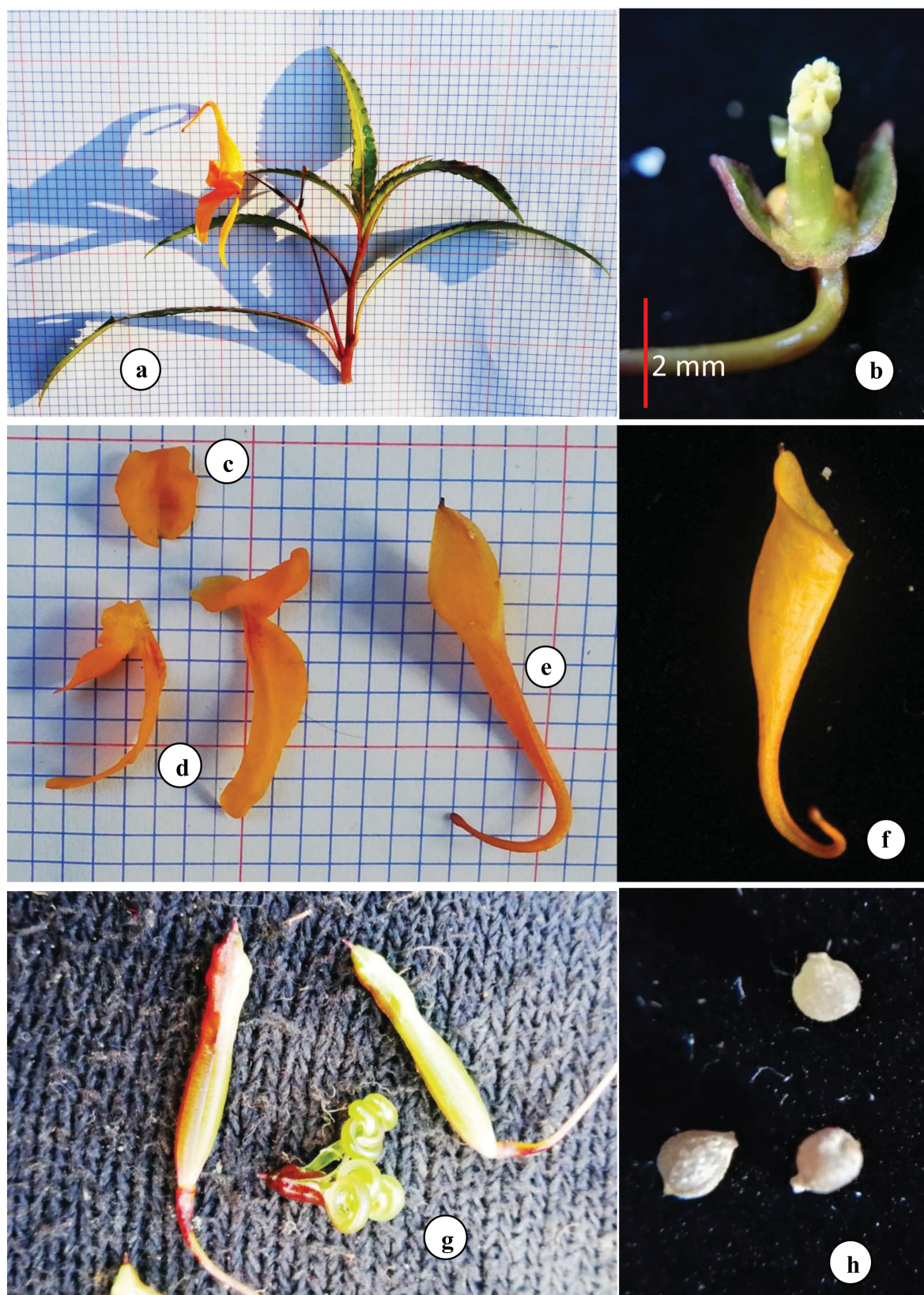


FIGURE 5. Detail floral parts of *Impatiens horizontalis*; **a.** leaf arrangement and inflorescences, **b.** pair of lateral sepals and gynoecium **c.** dorsal petal **d.** united lateral petals, **e–f.** front and side view of lower sepal, **g.** matured and broken fruit and **h.** seeds

TABLE 2. Comparison of characters between *Impatiens reptilicaulis* and its allied species.

Characters	<i>I. horizontalis</i>	<i>I. stenantha</i>	<i>I. prostrata</i>	<i>I. repens</i>	<i>I. procumbens</i>	<i>I. reptans</i>
Habit	rheophyte, perennial, on the gravel island along the stream	terrestrial, annual, understories of mixed forests on slopes	terrestrial, Annual	terrestrial, annual, on rock	annual, moist places by streams	annual, moist places at watersides on hills
Plant height/length	1 m or longer	30-60 cm height	20-40 cm long	20cm long	1 m or longer	ca. 1 m long
Stem	not succulent, stout, creeping horizontally, roots at each node, branches not erect	erect	glabrous, prostrate creeping	succulent, weak, creeping, rooting at some of the nodes, diffusely branched	prostrate or procumbent, nodes with few roots; branches erect	prostrate or procumbent, stout, simple
Leaves arrangement	alternate	alternate	alternate	alternate		alternate
Leaves shapes	narrowly elliptic to linear, glabrous	elliptic-ovate or lanceolate	ovate to ovate lanceolate, minutely pubescent	ovate cordate or orbicular	ovate, ovate-elliptic, or ovate-lanceolate	ovate, ovate-elliptic, or ovate-lanceolate
Leaves margin	serrate, antrorse bristle between teeth	coarsely crenate, setose between teeth	serrate	filiform appendages on the margin	serrulate	crenate-serrate or serrate
Leaves size	12-13.5 × 0.8-1 cm	7-15 × 3-5 cm	2.8-3 × 1.3-1.5 cm	1.3 × 1.9 cm	2-3 × 1-1.5 cm	5-7 × 2.5-3.5 cm
Petiole	1 - 1.5 cm long	0.5-3cm long	about 0.5-2 cm long	0.9-2.1 cm	0.5-1 cm	1-2 cm
Stipules	glandular stipulate	stipulate glandular sessile or stipitate	exstipulate	exstipulate	exstipulate	exstipulate
Inflorescences	axillary, racemes, peduncle shorter than leave, 2 - 5 flowered	axillary and terminally, peduncle shorter than leave, racemose, more than 3 flowered	axillary or subterminal, long peduncled racemes, 1-5 flowered	axillary, solitary	in upper leaf axils, peduncle shorter than leave, 1- or 2-flowered	in upper leaf axil, 2 or 3-flowered
Flower color	golden yellow	yellow	yellow	bright yellow	golden yellow	yellow

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TABLE 2. (Continued)

Characters	<i>I. horizontalis</i>	<i>I. stenantha</i>	<i>I. prostrata</i>	<i>I. repens</i>	<i>I. procumbens</i>	<i>I. reptans</i>
Numbers of sepal	2	sometimes 4	2	3	2	2
Bracts	2 bracts, glabrous	ovate-lanceolate	aducous	linear-lanceolate, inconspicuous	with small bracts	ovate-lanceolate
Lateral sepals	oblong	Orbicular or oblong	ovate	ovate-oblong	obliquely ovate, subfalcate, slightly thick	ovate, curved-falcate
Lower sepal	deeply bucciniform	bucciniform	bucciniform,	deeply navicular, with white hairs	navicular	subnavicular
Spur	twisted and tip abruptly capitate	tip cornute-rostellate, with a slightly curved	straight, curved or hooked	hooked	incurved	incurved
Dorsal petal	obovate to orbicular	orbicular	orbicular	orbicular, cucullate	orbicular	orbicular
Lower lateral petal	lanceolate, twisted, obtuse	oblong to linear, twisted, acute	orbicular or obovate, not toothed along inner margin	oblong	obovate-oblong, subtetragonous, apically not acuminate, not elongated into a long filamentous hair	orbicular
Upper lateral petal	triangular	ovate - oblong (triangular)	orbicular or obovate	broadly oval or oblong	obovate-oblong, free	dolabriform
Ovary	linear, glabrous	fusiform	fusiform	fusiform, densely pubescent	fusiform	fusiform
Fruit	oblanceolate –linear, glabrous	clavate, glabrous	linear	fusiform, tomentose or pilose	linear	linear
size of fruit	ca. 2.5 cm long with 3 mm in diameter	1.2 - 2 cm long	0.8 - 2 cm long	ca. 1.1 cm long	ca. 1 cm long	ca. 1.5 cm long
Seed	spheroid like chickpea, ex-arillate, glabrous, 2-3 seeds	obovoid, compressed, opaque	oblong, compressed, ex-arillate, naked or papillose, glabrous, many seeds	glabrous		oblong or obovoid

Rheophyte creeping on gravel stony island in the stream. **Stem** horizontally creeping, 1 m or longer, red, slender, glabrous, glandular on the streak line on stem, internode up to 5 cm long, 3 mm in diam.; roots from each node, glabrous, pink. **Leaves** alternate, petiolate 1–1.5 cm long, glandular stipulate, glabrous, coriaceous, narrowly elliptic to linear, 0.8–1 × 12–13.5 cm, margin serrate, dark purple antrorse bristle at the ends of lateral veins between the teeth, mid and lateral veins conspicuous on abaxial surface, tip acuminate, attenuate; petiole dull red, glabrous, up to 1.5 cm long. **Inflorescence** axillary, raceme, up to 8.5 cm long, 2–5 flowers, indefinite, peduncle glabrous, dull red, swollen at the base, tapering to tip, up to 5.5 cm long, 2.5 mm in diam. at base, 1 mm in diam. at top. **Flower** golden yellow, up to 4 cm long, up to 2.5 cm across; 2 floral bracts, elliptic, acuminate, 0.5 × 1.5 mm, glabrous; pedicel up to 2 cm long, glabrous, dull red. **Lateral sepals** 2, persistent, dull red, oblong, 2 × 5 mm, acuminate, both surfaces glabrous, united at base each other. **Lower sepal** bucciniform, 3.5 cm long, 6 × 8 mm across the mouth, funnel 1.5 cm long, cuspidate, tongue at mouth, pointed, 3 × 3 mm, yellow, distal part gradually tapering into a twisted spur with curved end, dull red tip, capitate. **United lateral petals** connate, asymmetric, distorted and twisted, lobes free; **lower petal** golden yellow, red mark at base, like a pair of rabbit's ears, knife shape, lanceolate, twisted, asymmetrical, 4 × 25 mm, margin undulate, obtuse, both surface glabrous, united with upper petal, veins clear; **Upper petal** golden yellow, liver shape or triangular, asymmetrical, 5 × 17 mm, margin undulate, acuminate, base united with base of lower petal, both surface glabrous. **Dorsal petal** golden yellow with red marks on abaxial surface, obovate to orbicular, 7 × 7 mm, round tip, tapering base, both surface glabrous. **Androecium** erect, yellow styles, 1 mm long, united base. **Gynoecium** ca. 3 mm long, yellow stigma. **Ovary** green, 2 mm long, 1 mm in diam. **Fruit** straight, slender, oblanceolate to linear, 5 lobed, tapering to base, swollen tip, green with dull red stripes, glabrous, 2.5 cm long, 3 mm in diameter. **Seeds** spheroid like chickpea, ex-arillate, glabrous, 2–3 seeds, occupy at top of fruit.

Habitat and ecology: *Impatiens horizontalis* horizontally grow and a creeper on gravel stony island frequently flooded along the perennial stream in evergreen forest and is light demander. It hardly survives on other types of soil.

Phenology: Flowering in January–February before summer season.

Distribution: Myanmar. Thus far, limited populations were found on less than 5 gravel islands only along the Nam Phet La stream in Htamanthi Wildlife Sanctuary.

Vernacular name: “Nam-phet-la Dan-pan”, meaning Dan-pan of Nam-pha-lar stream.

Note: *Impatiens horizontalis* is assignable to subgenus *Impatiens* sect. *Racemosae* Hook.f. based on its racemose inflorescence, linear capsule and 4 lateral sepals with 2 reduced inner ones. We proposed the local name of the species as “Nam-phet-la Dan-pan” because it was firstly found only along Nam Phet La stream in Htamanthi Wildlife Sanctuary.

IUCN Red Data Category: *Impatiens horizontalis* could be seriously threatened due to the gold mining along the stream of the habitat (Fig-3-E). Therefore, based on the latest IUCN criteria, *Impatiens horizontalis* is proposed to be Critically Endangered (CR) (IUCN, 2022).

Hooker (1872) noted that there were two varieties under *I. stenantha* and one of them perhaps a different species. *I. horizontalis* is also allied to *I. prostrata* Hook. f., *I. repens* Moon, *I. procumbens* Franch and *I. reptans* Hook. f.. However, *I. horizontalis* distinctly differ from all such four species by the key characters described in several literatures (Moon, 1824; Wight, 1840; Arechaveleta, *et al.*, 1886; Franchet, 1887; Trimen, 1893; Hooker, 1908; Hooker, 1913; Wu, *et al.*, 2007)(Table 2).

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