

**ADDITIONS TO SEEDLING MORPHOLOGY
OF THE GENUS *IMPATIENS* (BALSAMINACEAE)**

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Recently I reported that the seedlings of the genus *Impatiens* (Balsaminaceae) were so diversified as to require classification into 2 major groups and 8 subgroups (Shimizu 1982). Following to this report, the present paper aims to add some more knowledge to seedling morphology of the genus. The terminology is same with that used in my previous paper.

I should like to mention, with many thanks, that this study was partly supported by the Grant of the Ministry of Education, Science and Culture, No. 58340039.

Materials and Methods

The seedlings of 7 species of *Impatiens* were newly observed, 5 from Thailand, 1 from Malaya and 1 from Java. The seeds were collected through the Botanical Expedition of Shinshu University in 1979 and in 1982, except those of *I. platypetala* given by Mrs. S. Takao. They had been kept in an ice box at about 2°C in Matsumoto until sown in pots in the middle of April 1984. The seedlings were observed in July and August according to the species and the degree of development.

The sources of seeds are shown below with indication of the voucher specimens of the seedlings. These specimens are all preserved in the herbarium of Shinshu University (SHIN).

- Impatiens bunnackii* T. Shimizu Loei : Tham Photiyarn, Chum Phae Distr., 350 m, foot of limestone cliff, T. Shimizu et al. T-28547. Seedling, T. Shimizu 29794.
- I. cardiophylla* Hook. f. Prachuab Khirikhan : Khao Klong Wan, Muang Distr., 10~50 m, limestone slope, T. Shimizu et al. T-28757. Seedling, T. Shimizu 29795.
- I. muscicola* Craib Chiang Mai : Doi Chiang Dao, Chiang Dao Distr., 2100 m, open limestone ridge, T. Shimizu et al. T-21207. Seedling, T. Shimizu 29796.
- I. nalampoonii* T. Shimizu Lampang : Thamphathai Forest Park, Ban Huad, Ngao Distr., 400 m, on limestone, F. Konta et al. T-29667. Seedling, T. Shimizu 29797.

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- I. peltata* Hook. f. Phattalung : Khao Tham Khu Ha, Muang Distr., 10~80 m, dry limestone hill, T. Shimizu et al. T-29001. Seedling, T. Shimizu 29798.
- I. platypetala* Lindl. Java. Mt. Gede, S. Takao s.n. Seedling, T. Shimizu 29799 & 29800.
- I. psittacina* Hook. f. Chiang Mai : Doi Chiang Dao, Chiang Dao Distr., 730~1300m, bamboo thicket on limestone, T. Shimizu et al. T-20837. Seedling, T. Shimizu 29801.
- I. racemosa* Hook. f. Chiang Mai : Doi Angka, near the top of Doi Inthanon, Com Thong Distr., 2500 m, edge of evergreen forest, F. Konta et al. T-29796. Seedling, T. Shimizu 29538.
- I. ridleyi* Hook. f. Selangor : Batu cave, Kuala Lumpur, ca. 50 m, limestone cliff, T. Shimizu & F. Konta M-27965. Seedling, T. Shimizu 29802.
- I. siamensis* T. Shimizu Kanchanaburi : Khao Phab Pha, Sai Yok National Park, Sai Yok Distr., 100~320 m, shady limestone, T. Shimizu et al. T-28533. Seedling, T. Shimizu 29803.

One of the species above-mentioned, *I. bunnackii*, is not described as yet. It will be published in an other journal in the near future.

Description

Here the morphological description of seedlings of each species is given according to grouping proposed in my previous paper. The seedlings examined or re-examined in this study are all included in Group I which is characterized by epigeal cotyledons.

- I. bunnackii* Subgroup A (Fig. 1) Hypocotyl indefinitely elongating. Cotyledons with petiole 6~7 mm long, densely pubescent on the adaxial side; blade thick, nearly orbicular, up to 12 mm by 11 mm, densely minute-pubescent above, irregularly serrate on the upper half, emarginate at apex, cornute below to hold the testa. Internodes never elongating. Leaves spiral, congested on top of the hypocotyl, minutely pubescent on both sides, glandulose on the lower surface at the base.
- I. cardiophylla* Subgroup B (Fig. 2) Succulent, neither pubescent nor glandulose. Hypocotyl 8~10 mm long. Cotyledons dropping in the 5th leaf stage; petiole up to 7 mm long; blade entire, nearly orbicular, up to 12 mm by 12 mm, emarginate at apex. Epicotyl about 2 mm long in the 3rd leaf stage. Leaves alternate, serrate with 6~8 teeth on each side.
- I. nalampoonii* Subgroup B (Fig. 3) Wholly glabrous. Hypocotyl up to 2.5 cm long. Cotyledons dropping in the 5th to 6th leaf stage; petiole 5~6 mm long; blade chartaceous, broadly elliptic, up to 9 mm by 7 mm, emarginate at apex. Epicotyl 0.8~1.5 cm long in the 6th leaf stage. Leaves pseudo-alternate, internodes in the

- 6th leaf stage 1 mm, 3 mm, 0.8 mm, 1 mm and 0.2 mm in order ; blade glandulose on the lower surface at the base.
- I. peltata* Subgroup B (Fig.4) Succulent, neither pubescent nor glandulose. Hypocotyl about 3mm long. Cotyledons with petiole 6~7 mm long ; blade nearly orbicular, 18mm by 15 mm, emarginate at apex, brittle. Epicotyl about 2mm long in the 2nd leaf stage. Leaves alternate, serrate with 4~5 teeth on each side.
- I. ridleyi* Subgroup B (Fig.5) Neither pubescent nor glandulose. Hypocotyl about 1cm long in the 3rd leaf stage. Cotyledons nearly orbicular, up to 7 mm by 7 mm, emarginate at apex. Epicotyl about 2.5 mm in the 3rd leaf stage. Leaves alternate.
- I. siamensis* Subgroup B (Fig.6) Wholly glabrous. Hypocotyl about 1.5 cm long. Cotyledons dropping in the 4th leaf stage ; petiole up to 8mm long; blade nearly orbicular, 9mm by 8 mm, emarginate at apex. Epicotyl about 3mm long in the 3rd leaf stage. Leaves alternate, serrate, with lowest teeth glandulose.
- I. psittacina* Subgroup C (Fig.7) Hypocotyl up to 5cm long. Cotyledons with petiole up to 8 mm long ; blade nearly orbicular, up to 12 mm by 12 mm. Epicotyl elongating up to 2.5 cm in the 4th leaf stage. The first and second leaf opposite, the third and fourth nearly opposite. Other characters should be referred to my previous paper.
- I. muscicola* Subgroup C (Fig.8) Hypocotyl up to 4.5 cm long. Cotyledonary blade minutely serrate. Other characters should be referred to my previous paper.
- I. platypetala* Subgroup E (Fig.9) Hypocotyl 3~5 cm long. Cotyledons dropping in the 7th to 8th leaf stage ; petiole 1.2~1.5 cm long ; blade chartaceous, nearly orbicular, up to 1.5 cm by 1.4 cm, emarginate at apex. Epicotyl elongating, 4~6 cm long in the 6th leaf stage. Leaves all cruciate at least in the 6th leaf stage, not verticillate, conspicuously with 2~4 pairs of stipular glands, slightly pubescent above.
- I. racemosa* Subgroup D (Figs.10 & 11) Hypocotyl rarely not elongated. Cotyledons dropping in the 2nd to 6th leaf stage, not always caducous. Other characters should be referred to the previous paper.

Discussions

With some modification of my previous classification (Shimizu 1982), the seedlings of Southeast Asiatic species of the genus *Impatiens* could be grouped to 2 major groups and 7 subgroups by the following key.

1. Cotyledons epigeal, opposite and petiolate.Group I
2. Hypocotyl elongated ; cotyledons above ground surface.
3. Hypocotyl indefinitely elongated ; epicotyl never elongated ; cotyledonary blade cornute beneath, velutinous on the abaxial side as well as petiole.

- Subgroup A
3. Hypocotyl definitely elongated, up to 5 cm long ; epicotyl elongated ; cotyledons neither cornute nor velutinous.
 4. Epicotyl much shorter than hypocotyl. Leaves all alternate. Subgroup B
 4. Epicotyl well elongated up to nearly as long as hypocotyl. Leaves all or partly opposite.
 5. First and second leaf opposite ; the others alternate. Subgroup C, D
 5. Leaves all opposite, at least by the 6th leaf stage. Subgroup E
 2. Hypocotyl never elongated ; cotyledons on ground surface. Subgroup F
 1. Cotyledons hypogeal, lateral and sessile. Group II
 2. Cotyledons swollen up to 6 mm long. Leaves alternate, except the first and the second one. Subgroup G
 2. Cotyledons hardly swollen. Leaves all opposite. Subgroup H

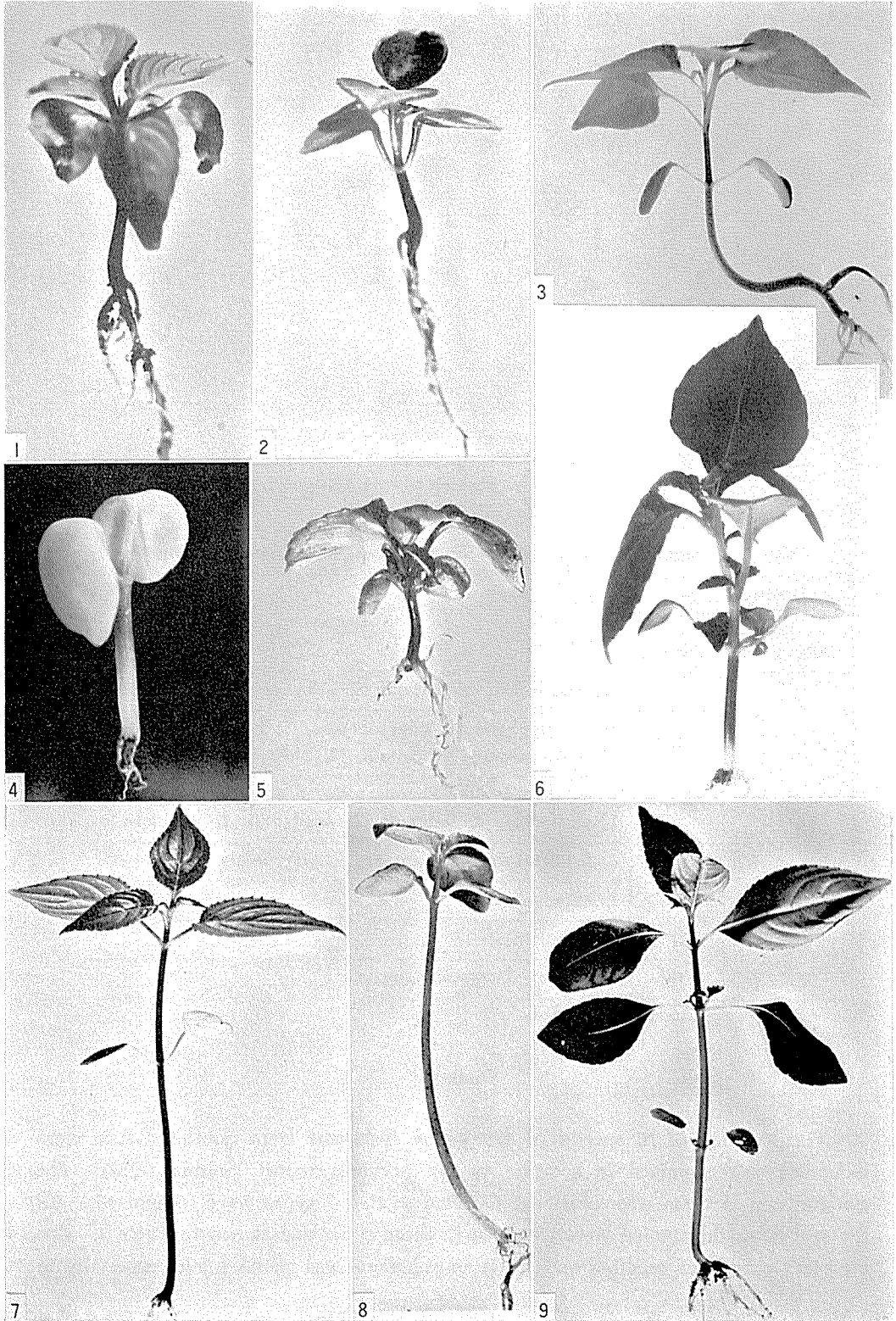
Here Subgroup D, represented by *I. racemosa* and defined by caducous cotyledons, was put together with Subgroup C, because the cotyledons of *I. racemosa* were found not always caducous as noted above. *I. psittacina*, which was previously classified in Subgroup B, was removed to Subgroup C. The seedlings of this species show strictly opposite as to the first and the second ones. Thus, each group and its representatives are listed in Table 1.

Our recent study on the ovary of the *Impatiens* species has revealed that the species bearing connate wing petals are always four-carpellate (Shimizu & Takao 1982 & in press). It should be put stress that the seedlings have close relation to these floral characters. The species belonging to Subgroup A and B are all four-carpellate. The members of Subgroup A, in addition, are characterized by very few number of ovules, at most 2 in an ovarian locule, showing Type II as to the growth of ovules. In the case of Subgroup B, the ovule number is 2 to 6 in a locule and the ovular growth shows Type I (Shimizu & Takao 1982 & in press).

On the other hand, the five-carpellate species, characterized by separate wing petals, show 6 types of seedlings. *I. psittacina* is rather exceptional. It is four-carpellate, but should be grouped to Subgroup C by the opposite first pair of leaves. The ovular growth of this species belongs to Type I, likewise in the members of Subgroup B.

Figs. 1~9 Seedlings of some Southeast Asiatic species of *Impatiens*

- 1 : *I. bunnackii* (×1), 2 : *I. cardiophylla* (×1), 3 : *I. nalampoonii* ×0.8,
- 4 : *I. peltata* (×1.4), a cotyledon and the second leaf fallen, 5 : *I. ridleyi* (×0.8), young branch appearing at the axile of cotyledons, 6 : *I. siamensis* (×0.9), young branch appearing at the axile of cotyledons, 7 : *I. psittacina* (×0.7), 8 : *I. muscicola* (×1) and 9 : *I. platypetala* (×1.4), young branches appearing at the axile of cotyledons and the first pair of leaves.





Figs. 10~11 Seedlings of *I. racemosa* ($\times 0.7$)
 10 : Showing a normal form, 11 : Showing an abnormal form without elongated hypocotyl.

Table 1. Seedling classification of Southeast Asiatic species of *Impatiens*

Seedling type (Shimizu 1982)		Species
Major group	Subgroup	
I	A	* <i>I. bunnackii</i> , <i>I. charanii</i> , <i>I. salaengensis</i> , <i>I. macrosepala</i>
	B	* <i>I. cardiophylla</i> , <i>I. hongsonensis</i> , <i>I. kerriae</i> , <i>I. larsenii</i> , * <i>I. nalampoonii</i> , * <i>I. peltata</i> , * <i>I. ridleyi</i> , * <i>I. siamensis</i>
	C, D	<i>I. chiangdaoensis</i> , <i>I. muscicola</i> , <i>I. patula</i> , <i>I. phluangensis</i> , <i>I. psittacina</i> , <i>I. racemosa</i> , <i>I. santisukii</i> , <i>I. violiflora</i>
	E	<i>I. griffithii</i> var. <i>sarcantha</i> , * <i>I. platypetala</i>
	F	<i>I. chinensis</i>
II	G	<i>I. longiloba</i>
	H	<i>I. masoni</i> , <i>I. pseudochinensis</i>

* Newly examined in this study.

Summary

The seedlings of 10 species of the genus *Impatiens* from Southeast Asia were examined or reexamined in addition to my previous report (Shimizu 1982). The classification of them was somewhat modified so that 7 types were recognized. All the species so far studied were classified in these types and shown in Table 1. The correlation between seedling and floral morphology was pointed out, especially in

the group of four-carpellate species.

I am so much obliged to Mrs. S. Takao for her kind provision of seed samples of *I. platypetala* from Java.

References

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