**J. bio-sci. 15: 147-152, 2007** **ISSN 1023-8654**
http://www.banglajol.info/index.php/JBS/index

# KARYOTYPIC STUDY OF SEVEN TYPES OF *IMPATIENS BALSAMINA* L.

**U S N Momtaz, G Kabir[1], M M Ud-deen[2] * and N Yasmin[3]**

*Professor Sultanul Alam Cytogenetics Laboratory,*
*Department of Botany, University of Rajshahi, Rajshahi-6205, Bangladesh*
*[1] Dept. of Botany, 2 Dept. of Crop Science & Technology,*
*[3] Dept. of Agronomy & Agricultural Extension, University of Rajshahi, Rajshahi*

**Abstract**

Nuclear phenotype and chromosome characteristics of eight types of *Impatiens balsamina* L. were studied. The diploid chromosome number was found to be 2n=14 in all types of *Impatiens balsamina*. Interphase chromosome volume was found to range from 0.1665$\mu^3$ (violet type) to 0.3904 $\mu^3$ (red type). The maximum total chromatin length (24.73µm) was observed in pink type and minimum (11.70µm) in violet type. Maximum total frequency percent (50.00%) was found in both foreign types (red and violet) and minimum (48.03%) in violet type. The karyotype analysis revealed that there was no secondary constriction and sub-terminal chromosome in any of the seven types belonging to *Impatiens balsamina*. So, on the basis of karyotypic analysis the present findings indicated that all the types of *Impatiens balsamina* were of primitive nature.

**Key words:** Karyotype, Nuclear phenotype, *Impatiens balsamina* L.

## Introduction

The family Balsaminaceae includes 600 species under 4 genera distributed in North America, Africa, Asia and Europe (Willis 1973). The only economic value of the Balsaminaceae lies in the cultivation of Impatiens species as greenhouse or pot plant or garden ornamentals. Impatiens species are thus, extremely variable and taxonomically difficult. The specific limits of these species are not always clear due to complexity in evolution and accordingly the taxonomy of the group is also in a state of confusion. Bhaskar and Razi (1974) and Krishnaswamy *et al.* (2002) reported only some new chromosomal counts in 8 South Indian species of Impatiens. Bhaskar (1976), Gadella (1977, 1982) Rao (1978), Love (1982) and Zinoveva *et al.* (1982) noted only the haploid and diploid number of the chromosomes. The Balsaminaceae shows a wide range of basic chromosome numbers from 6 to 20 (Fedorov 1974). The reported gametic chromosome numbers are n=6, 7, 8, 9, 10, 11, 13 and 17 as well as their multiples (Chatterjee and Sharma 1970). They also suggested that x=7 to be the basic chromosome number for the genus Impatiens.

The chromosome number 2n=14 in Impatiens balsamina were reported by Raghuvanshi and Singh (1979). In Bangladesh there are many cultivated and wild types of Impatiens balsamina species which are used as ornamental plants. Cytological reports on this species in Bangladesh have not been reported yet. Therefore, an attempt was made to study the cytological aspects with special reference to karyological relationship among seven types of Impatiens balsamina available in Bangladesh.

## Materials and Methods

Seven types of Impatiens balsamina L. namely, Shada dopati (white), Lal dopati (red), Beguni dopati (violet), Golapi dopati (pink), Purple dopati (purple), Lal bedeshi dopati (red foreign) and Beguni bideshi dopati (violet

* *Corresponding author*: Mobile: +8801558340438, Email: muddeen05@yahoo.com

foreign) were used as plant materials in the present study. They were found to grow both in cultivated and wild forms. The seeds of these seven types of Impatiens balsamina were collected from different places of Rajshahi University campus.

For nuclear phenotype and karyotype analysis, fresh and dry seeds of seven types were spread over in petridishes with moistured filter paper for germination. The root tips of 1.0-1.5cm in length were fixed in 1:3 aceto-alcohol and preserved in 70% ethyl alcohol just after pretreatment with a saturated solution of Para-dichlorobenzene (PDB). Chromosome staining was done following Haque *et al.* (1976). Photomicrographs were made from the metaphase plate and the chromosomes were measured from cameralucida drawings. Nuclear volume (NV) was calculated using the formula for a sphere V=4/3 μr3 (Nayar *et al*. 1971). The nuclear volume divided by the somatic chromosome number gave the interphase chromosome volume (ICV). For karyotypic analysis chromosomes were classified according to the position of centromere and their arm length ratio (short arm/long arm). Chromosomes having the arm length ratio less then 0.50 were termed as sub-terminal (St), the arm length ratio between 0.51 and 0.75 as sub-median (Sm) and above 0.75 as median type (m) according to Kutarekar and Wanjari (1983).

**Results and Discussion**

In the present study, the diploid chromosome number was found to be 2n=14 in all types of Impatiens balsamina (Table 1 and Figs. 1a-7b). The highest nuclear volume was found to be 5.4658μ3 in red type and the lowest was 2.3310 μ3 in violet type of Impatiens balsamina. Lafontaine (1974) suggested two types of the structural organization in plant cell nuclei (chromocentric and reticulate). In the present investigation interphase nuclei of meristematic cells of all the types of Impatiens balsamina were found to be chromocentric. The interphase chromosome volume (ICV) was found to be highest (0.3904μ3) in red type and lowest (0.1665μ3) in violet type. However, interphase chromosome volume was found to be directly proportional to the diploid chromosome number in cells. Lafontaine (1974) and Nagl and Fusening (1979) stated that chromocentric nuclear organization was assumed to be governed by small size of chromosomes and low DNA content. This statement holds true somehow for all types of Impatiens balsamina in this investigation. Since all of them mostly contained small chromosomes.

The results of karyotype analysis are presented in Table 2 and cameralucida drawings in Figures 1a-7b. Karyotypic differences were observed regarding chromosome length, total chromatin length (TCL), total frequency percent (TF%) etc. among the types studied. The highest chromosome length was found to be 4.50 μm in pink type and lowest was 1.50 μm in red, violet and purple type. The total chromatin length (TCL) was found to range from 11.70 μm (violet type) to 24.73 μm (pink type). The highest total frequency percent was found to be 50.00% in red foreign and violet foreign type and lowest was 48.03% in violet type. On the basis of TF% the violet type may be supposed as somewhat advanced one having the smallest total frequency percent (48.03%) and the red foreign and violet foreign possessing the largest total frequency percent (50.0%) may be considered as the primitive one. Medium (M), relatively short (S1) and short (S2) chromosomes were found in all the types. Large (L) type chromosomes were found in the pink, red foreign and violet foreign types only. Metacenteric (m) and sub-metacentric (Sm) chromosomes were found in all types of Impatiens balsamina. But sub-terminal (St) chromosome was not found in any of the types studied. It was also observed that the metacentric type of chromosomes was found to be higher than sub-metacentric type in all the types. Metacentric chromosomes were found in all the types except red and purple where both metacentric and sub- metacentric chromosomes were present. The number of metacentric chromosomes and lacking of sub-metacentric chromosomes as observed in the present findings indicated that all the types of Impatiens balsamina species to be primitive type.

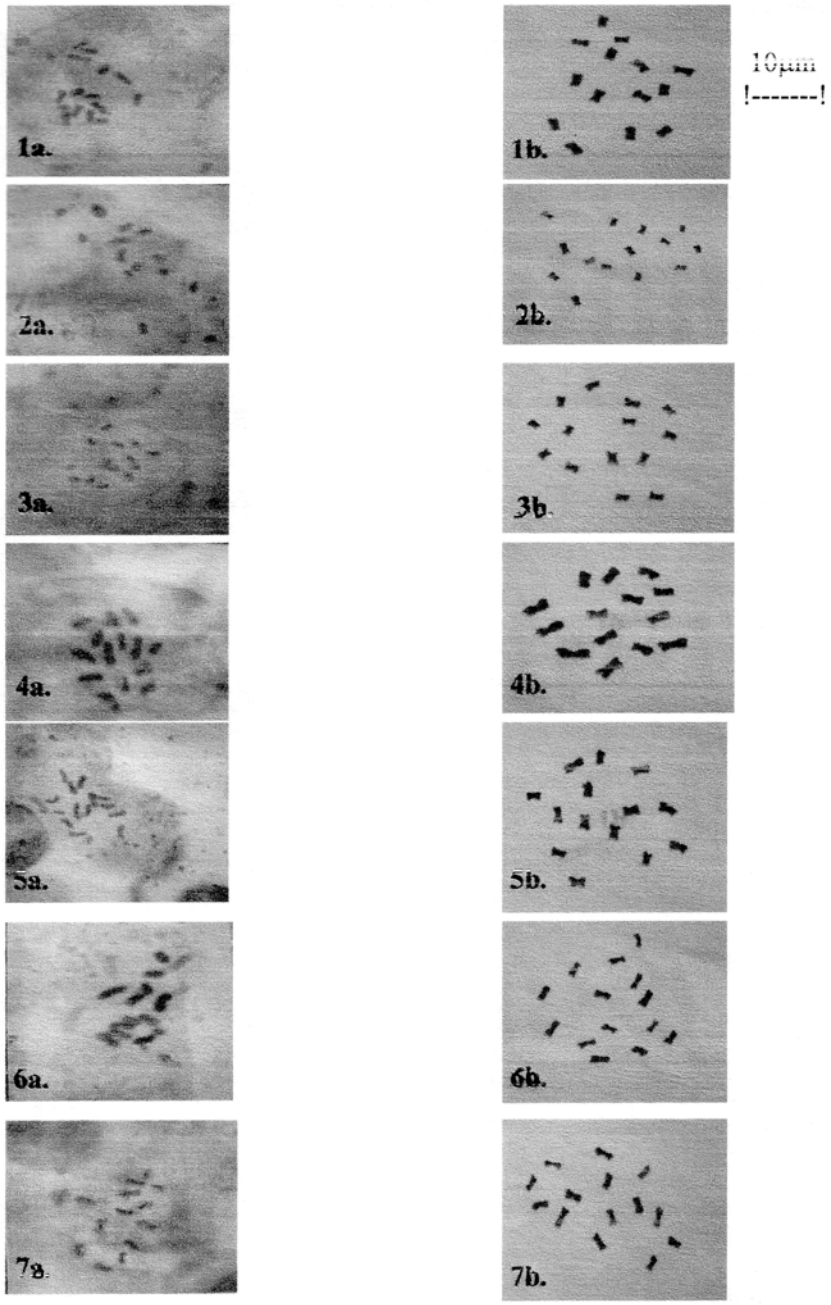
**Table 1**. Nuclear phenotype in seven types of *Impatiens balsamina* L.

| Types | Chromosome number (2n) | Nuclear volume ($\mu^3$) | Interphase chromosome volume (ICV) $\overline{X} \pm$ SE ($\mu^3$) |
|---|---|---|---|
| White | 14 | 3.9746±0.8902 | 0.2840±0.0635 |
| Red | 14 | 5.4658±1.336 | 0.3904±0.095 |
| Violet | 14 | 2.3310±0.5518 | 0.1665±0.0394 |
| Pink | 14 | 2.3448±0.8381 | 0.1674±0.0598 |
| Purple | 14 | 2.5828±0.656 | 0.1844±0.0468 |
| Red-foreign | 14 | 3.5067±0.8942 | 0.2504±0.0638 |
| Violet-foreign | 14 | 4.1080±1.0741 | 0.2934±0.0767 |

**Table 2**. Total chromatin length (TCL), total frequency (TF %) and karyotypic formula (KF) in seven types of *Impatiens balsamina* L.

| Types | Ploidy | Range of chromosome length ($\mu$m) | TCL ($\mu$m) | TF% | K.F. | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | M | $S_1$ | $S_2$ |
| White | 2x | 2.24-3.00 | 17.88 | 49.38 | - | $3M^m$ | $4S_1^m$ | - |
| Red | 2x | 1.50-3.00 | 13.85 | 48.66 | - | $M^m$ | $2S_1^m$ | $3S_2^m+S_2^{Sm}$ |
| Violet | 2x | 1.50-2.24 | 11.70 | 48.03 | - | - | $S_1^m$ | $6S_2^m$ |
| Pink | 2x | 3.00-4.50 | 24.73 | 49.25 | 4Lm | $3M^m$ | - | - |
| Purple | 2x | 1.50-3.00 | 17.60 | 48.92 | - | $3M^m$ | $2S_1^m+S_1^{Sm}$ | $S_2^m$ |
| Red-foreign | 2x | 2.24-3.74 | 21.72 | 50.00 | 2Lm | $4M^m$ | $S_1^m$ | - |
| Violet-foreign | 2x | 2.24-3.74 | 20.22 | 50.00 | Lm | $4M^m$ | $2S_1^m$ | - |

L = large, M = medium, $S_1$ = relatively short, $S_2$ = short, m = metacentric and $S_m$ = sub-metacentric.




**Figs. 1a-7a.** Photomicrographs of somatic metaphase chromosomes in seven types of *Impatiens balsamina* L. (Ca. 650x). **1b-7b.** Camerlucida drawings of the same chromosomes in seven types of *Impatiens balsamina* L. **1a and 1b.** = white, **2a and 2b.** = red, **3a and 3b.** = violet, **4a and 4b.** = pink, **5a and 5b.** = purple, **6a and 6b.** = red foreign and **7a and 7b.** = violet foreign.

The karyotype analysis in seven types of Impatiens balsamina were found to show same number of chromosome (2n=14). Chatterjee and Sharma (1970) stated x=7 to be the basic number of Impatiens balsamina. Jones and Smith (1966) also suggested that same basic number (x=7) for the genus Impatiens. The chromosome number of Impatiens balsamina 2n=14 were also reported by Raghuvanshi and Singh (1979) and Khoshoo (2000). The formation of an aneuploid series prior to polyploidy in Impatiens balsamina (2n=14) was reported by Govindarajan and Subramanian (1986).

In the present study the chromosomes in general were graded being mostly medium to short in size and the constrictions were either median to submedian in position. However, same species with different flower colours in case of Impatiens balsamina shows certain minute chromosomal differences from allied species, suggesting its distinct status. This is further indication of the fact that structural rearrangements have also been important factors in evolutions. The morphology of chromosomes was found to vary among different types and the difference in the total chromatin length can be regarded as one of the most important factors in their evolutionary trend. According to Stebbins (1950) and Huziwara (2000) the decrease in total chromatin length is one of the factors that is responsible for evolution. On the basis of this factor violet type having minimum chromatin length (11.70 µm) may shows tendency towards advanced and pink type with maximum chromatin length (24.73 µm) may be considered as primitive. Such a reduction in chromatin length might be due to the erosion of the chromatid segments during the course of evolution.

When the karyotype asymmetry is taken into consideration the asymmetrical karyotypes are supposed to be more advanced than the symmetrical ones (Stebbins 1950). Among the different types of Impatiens balsamina in the present study all the type having maximum number of metacentric chromosomes may be considered as the most primitive. But none of them showed sub-terminal chromosome, which is the characteristic of advanceness. However, on the basis of karyotype analysis in the present study along with the number of metacentric chromosomes and lacking of sub-terminal chromosomes as observed in all the types of Impatiens balsamina species may be considered them as primitive type.

**References**


Bhaskar V and Razi B A (1974) New chromosome counts in South Indian Impatiens L. *Proc. 61st Ind. Sci. Cong.* Abst. 35.

Bhaskar V (1976) IOPB Chromosome number reports. *Taxon* **25(1):** 155.

Chatterjee A and Sharma A K (1970) Chromosome study in Geraniales. *Nucleus* **13:** 179-200.

Fedorov A N A (1974) *Chromosome Numbers of Flowering Plants*. Otto Koettz Science Publishers. N-624 W. Germany.

Gadella W J (1977) In IOPB Chromosome number reports. *Taxon* **26(2/3).**

Gadella W J (1982) In IOPB Chromosome number reports. *Taxon* **31(3).**

Govindarajan T and Subramanian D (1986) Karyotaxonomy of South Indian Balsaminaceae. *Cytologia* **51:** 107-116.

Haque A. Ali M A Wazuddin M and Khan M A (1976) Squash method for the mitotic chromosomes of grasses. *Current Science* **45(10):** 382-383.

Huziwara Y (2000) Karyotype analysis in some genera of compositae VIII. Further studies on the chromosome of Aster. *Amer. J. Bot*. **49:** 116- 119.

Jones K and Smith J B (1966) The Cytogeography of Impatiens L. *Kew. Bull*. **20(1):** 63-72.

Khoshoo T N (2000) Cytology of some Impatiens species. *Cytologia* **10:** 55-74.

Krishnaswamy S, Muthulingam and Raman V S (2002) Cytomorphological studies in the genera Impatiens, Lupinus, Viola and Antirrhinum. *South Indian Hort*. **17:** 28-33.

Kutarekar D R and Wanjari K B (1983) Karyomorphological studies in some of the varieties of bengal gram (*Cicer arietinum* L.).*Cytologia* **48:** 699-705.

Lafontaine J G (1974) In : Busch H (ed). The cells nucleus. VI. I. Academic Press, New York, London. pp. 149-185.

Love A (1982) In IOPB Chromosome number reports. *Taxon* **31(2) :** 102-105.

Nagl W and Fusening H P (1979) Types of chromatin organization in plant nuclei. *Plant Sys. Evol. Suppl*. **2:** 221-233.

Nayar G G, George K P and Gopal-Ayengeer A R (1971) The relation between cytological abnormalities and interphase chromosome volume in plants growing in a high radiation area. *Radiation Bot.* **11:** 175-178.

Raghuvanshi S S and Singh D N (1979) Comparative radiosensitivity of different varieties of Impatiens balsamina L. *Cytologia* **44:** 11-121.

Rao R V S (1978) New basic chromosome number of three in the genus Impatiens. *J. Ind. Bot. Soc.* **57:** 77.

Stebbines G L Jr (1950) Variation and Evolution in Plants. Columbia University Press. New York. pp. 69-72.

Wills J C (1973) A Dictionary of the Flowering Plants and Ferns. 1st Ed. (Revised by H K Airysha). University Press, Cambridge. pp. 56.

Zinoveva A F, Stahevitch K and Grant W F (1982) In IOPB Chromosome number reports. *Taxon* **31(2):** 35-37.