Colchiploidy in *Impatiens balsamina* L.
II. Studies in the C_2 generation

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Bose and Mukherjee (1966) were able to get a few promising plants from treatment of young seedlings with 0.2 per cent and 0.4 per cent colchicine solution for 12 hours. In the present investigation an attempt has been made to select colchiploids from the C_2 generation.

Materials and methods

One hundred seeds from promising C_1 plants of 0.2 per cent, 0.4 per cent and control were sown in seed pans. Seedlings were transplanted in six inch pots 25 days after sowing.

Observations

It can be observed from the Table 1 that the germination and survival of plants till maturity were highest in control and lowest in plants originating from 0.4 per cent colchicine treatment. The mean in plant height was, however, maximum in plants originating from 0.2 per cent colchicine treatment and minium in control. During the early period of growth most of plants originating from colchicine treated series looked stunted and bushy but later were similar in appearance to the control plants. Some plants originating from 0.2 per cent and 0.4 per cent colchicine treatment, however, remained such till maturity.

One plant originating from 0.2 per cent colchicine treatment was of dwarf habit and had deformed leaves. Three plants showed stunted growth and had the main stems bifurcated in the 0.4 per cent colchicine treated series. Another plant originating from 0.2 per cent colchicine was of dwarf habit and had deformed leaves. Although the length of the first internode did not reveal much difference between the control plants and those originating from colchicine treatments highest number of branches were found in plants originating from 0.4 per cent colchicine treatment and lowest in control. Observation on leaves showed peculiarities in leaf blade, leaf texture and margins of leaves. Some plants originating from 0.2 per cent colchicine treatment showed many leaves with leaf blades developed on one side only. In other cases odd shaped leaves were observed with white spots. The serration of the leaves were also different in comparison with the control.

Number of stomata per field decreased with the increase in colchicine treatment. Stomates and pollen grain of the biggest size were found in plants originating from 0.4 per cent colchicine treatment and pollen sterility was also highest here.

Plants originating from colchicine treatment flowered earlier than those of control but flowers of more or less of the same size were found in plants originating from all the treatments. Number of seeds per fruit were also more or less same in all the treatments.

Table 1. Plant growth, flowering and fruiting in C_2 generation of *Impatiens balsamina* L.

Observations \ Treatment	Control (Mean±S.E.)	Colchicine	
		0.2% (Mean±S.E.)	0.4% (Mean±S.E.)
No. of seeds per treatment	100	100	100
No. of seeds germinated	47	41	29
No. of plants surviving till maturity	28	24	23
Percent of control	100	85.70	82.14
Plant height (cm)	(39.10±1.282) (30.10−51.70)	(42.90±0.877) (37.00−48.50)	(41.99±0.546) (36.40−45.10)
Length of the first internode (cm)	(3.49±0.086) (2.5−4.0)	(2.99±0.066) (2.0−3.4)	(3.04±0.062) (2.5−3.5)
No. of branches per plant	(4.0±0.255) (2−7)	(5.35±0.232) (3−7)	(6.90±0.422) (3−10)
No. of stomata per field	(32.35±0.692) (25−43)	(30.03±0.793) (21−40)	(26.48±0.761) (18−36)
Length of stomata (μ)	(36.17±0.460) (28.00−40.00)	(43.87±0.490) (34.00−46.00)	(47.00±0.264) (34.00−50.00)
Breadth of stomata (μ)	(23.05±0.318) (20.00−26.00)	(34.35±0.301) (28.00−36.00)	(35.87±0.398) (28.00−38.00)
Length of pollen (μ)	(25.97±1.473) (19.25−41.58)	(37.96±0.646) (23.10−46.20)	(40.19±0.786) (26.95−50.05)
Breadth of pollen (μ)	(21.41±0.509) (19.25−41.58)	(22.60±0.438) (23.10−46.20)	(23.74±0.507) (26.95−50.05)
Percentage of pollen sterility	(2.86±0.786) (2.1−4.1)	(4.13±0.180) (2.1−6.1)	(5.47±0.636) (2.8−12.4)
First date of flowering (days)	(65.0±1.06) (59−72)	(63.4±0.75) (59−71)	(63.6±0.711) (60−69)
No. of flowers per plant	(18.0±0.710) (12−23)	(23.0±1.058) (14−36)	(28.5±1.053) (13−35)
Diameter of flowers (cm)	(3.83±0.034) (3.3−4.9)	(3.58±0.043) (2.8−4.3)	(3.48±0.046) (2.9−4.2)
First date of fruit set (days)	(68.45±1.015) (63−75)	(66.65±0.742) (62−74)	(66.80±0.687) (63−72)
No. of seeds per fruit	(12.17±0.584) (7−19)	(11.86±0.304) (6−19)	(12.20±0.271) (6−16)

Meiotic chromosome count from control plants showed n=7 chromosomes while n=14 was observed in a few plants originating from 0.2 per cent and in one plant originating from 0.4 per cent colchicine treatment. Unlike the control plants, meitoic irregularities such as univalents, unequal separation of chromosomes at anaphase I and micronuclei were detected in the plants originating from colchicine treatment. While in the control ones regular tetrad formation was noticed, diad, triad, tetrad and pentads were noticed during pollen grain formation in the plants originatng from colchicine treatment.

Discussion

It is evident from the above observations that the plants originating from colchicine treatment were the tallest, number of stomates per field was less, stomates and pollen grains were bigger and pollen sterility was higher in comparison with the control. Flower size was, however, the same in control and in those originating from colchicine treatment. It may be pointed out in this connection that because of the difficulty in getting meiotic chromosome count of most of the plants, much reliance has been placed on stomatal frequency and size, pollen sterility and irregularities in meiotic division for the detection of polyploidy.

It may be further pointed out in this connection that because of the limitations in getting meiotic chromosome count of all or most of the plants in colchiploidy work, Eigsti and Dustin (1955) suggested that for the quick detection of polyploidy slow growth of plants, thicker and darker green leaves, bigger size of stomata and pollen grains, high sterility and bigger size of flowers and seeds should be taken into consideration, although they emphasized that the most accurate method of detecting polyploidy is by counting the chromosome number and comparing them with the diploid plants. Bali and Tandon (1957) pointed out that morphological changes and pollen size and sterility are the most reliable criteria for the detection of polyploidy than increase in stomatal size. It may be further pointed out that recently Derman and Diller (1962) determined polyploidy in some bunch grapes by pollen size and leaf characters. They marked 4–4 for plants with larger stomata and pollen grains and 2–4 for the plants which had only larger pollen grains, i.e., internal polyploidy. However, they also emphasized that the real detection of polyploidy should be based on chromosome count.

The regular distribution of chromosomes seen in anaphase I of control plants contributed to normal behaviour in later stages but in the treated ones unequal distribution at anaphase I was seen in many cases which along with the other meiotic irregularities like the formation of multivalents during synapsis, irregularities in pollen grain formation, disturbances in genotypic balance and physiology of reproduction could be taken as the causes for the finding of high pollen sterility in the treated ones (Darlington 1937, Kostoff 1940 and Elliott 1958).

So far as the morphological effects are concerned, which have been observed in some plants originating from colchicine treatment, it may be pointed out that bifurcation of stem has been explained on the basis of regeneration of affected meristem (Mackey 1951). Bishop and Aadlers(1954) has, however, explained it on the basis of latent expression of chromosomal effect. The dwarf habit of plant has been attributed to physiological causes by Gunckel (1957) who also took into consideration cytological factors associated with physiological changes. Excessive lateral branching has been explained by many to be due to direct bud stimulation (Johnson 1948) but Skoog (1935) has reasoned it to be due to destruction of auxin.

The present study on the C_2 generation in *I. balsamina* has shown considerable

scope for the selection of polyploid types on the basis of stomatal frequency and size, pollen size and sterility. The polyploids selected should, however, be checked for the chromosome number.

Summary

Tetraploid chromosome number of n=14 chromosomes has been counted in a few plants originating from 0.2 per cent colchicine treatment and in one plant originating from 0.4 per cent colchicine treatment while control plants have revealed n=7 chromosomes. Meiotic irregularities have been noted in the plants originating from colchicine treatment in contrast to regular meiotic divisions observed in the control plants.

Number of stomates per field decreased with the increase in colchicine treatment and stomates and pollen grains of the biggest size were observed in plants originating from 0.4 percent colchicine treatment.

Bifurcation of main stem and dwarf plant with deformed leaves were observed in a few plants originating from colchicine treatment.

Factors responsible for the origin of morphological abnormal types and cytological mechanism responsible for the meiotic irregularities observed have been considered.

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