Chromosome Numbers and Breeding Behavior of Hybrids Among Celebes, Java, and New Guinea Species of *Impatiens* L.[1]

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Abstract. **The chromosome numbers of 2 species from Celebes were 2n=8. Interspecific hybrids among Celebes species, Celebes × Java, and Celebes × New Guinea *Impatiens* were sterile, with 2n=8, 12, and 20, respectively. Some of these hybrids were considered ornamentally desirable.**

The objectives of this study were to obtain breeding and cytological data among *Impatiens* from the general area of Indonesia and New Guinea and to obtain ornamentally improved hybrids of the New Guinea group. Previously I reported that most New Guinea *Impatiens* hybridized among themselves (1), and further, that sterility among New Guinea × Java *Impatiens* was related to differences in chromosome numbers of their parents (2).

All but one of the following *Impatiens* spp. in this study (Table 1) were obtained as rooted cuttings from the Plant Introduction Station, U. S. Department of Agriculture, Glendale, Maryland.

All plants were greenhouse grown under natural illumination at about 23.9°C day/18.3 night. About 5-10 pollinations were made per cross. No attempt was made to obtain reciprocal crosses whenever a cross seemed successful. About 20-25 seedlings from each progeny were selected at random and grown to maturity for evaluation and breeding tests, the remaining seedlings were discarded soon after germination. The seedlings were selfed, cross-pollinated, and backcrossed to both parents and observed for seed set.

Pollen samples were stained with acetocarmine for microscopic observation. Chromosome counts of root tips were made by standard acetocarmine techniques after pretreatment with 0.2% colchicine for 2 hr before fixation in Carnoy's.

Successful crosses are listed in Table 2. About 50% of the pollinated flowers failed to set, but this was probably because they were pollinated during the nonreceptive stages. About 60-80% germination was obtained for all except NG15 × C35 which had 20-30% germination. The seedlings came into bloom 3-4 months after germination and attained maximum size within 6 months.

The chromosome numbers of the species from New Guinea (1) and Java (2) had been determined previously as 2n=32 and 16, respectively. The chromosome numbers of the species from the Celebes, (C26 and C35) were 2n=8 which is lower than most species in the genus (5). Chromosome counts of several seedlings from Celebes × Celebes, Celebes × Java, and Celebes × New Guinea proved to be 2n=8, 12, and 20 as expected (Table 2).

The hybrids showed mostly poorly stained pollen grains of various sizes. No seed set was obtained from selfing or intercrossing among the hybrids, or from backcrossing. Apparently these species must have evolved in geographically isolated areas over long periods, accumulating genic and cytological differences. In this respect, it is interesting to note that Clevenger (4), citing diverging evolutionary patterns in the development of floral pigments, concluded that *I. platypetala aurantiaca* Steen was not too closely related to *I. platypetala*. The dominant floral pigment of *I. platypetala* is malvidin (3), and that of *I. platypetala aurantiaca* is aurantinidin (3, 6). The difference in chromosome numbers between *I. platypetala* (2n=16) and *I. platypetala aurantiaca* (2n=8) also shows dichotomy in their evolutionary development.

All hybrids having C26 as one parent had somewhat glossy leaves, and flowers ranged from pale to deep yellowish-orange. The outstanding characteristics of C26 are its pale yellowish-orange flowers and glossy green leaves.

C35 hybrids had flower colors from pale to deep yellowish-orange, some of which were extremely bright. C35 is outstanding for its bright yellowish-orange flowers and free-flowering characteristics. Some of its hybrids tended to be free-flowering.

The white, lavender, mauve, and red floral pigments of the New Guinea spp. either were absent or were present but masked by the yellowish-orange pigment of C26 and C35. Hybrids of the

Table 1. Source and origin of *Impatiens* species.

Code	P. I. No.	Species	Source	Remarks
NG4	349588	unidentified	New Guinea	
NG5	354254	*I. schlecteri* Warb.	New Guinea	
NG15	354252	*I. mooreana* Schltr.	New Guinea	
NG19MF	354266	*I. linearifolia* Warb.	New Guinea	male fertile sport
J21C	349629C	*I. platypetala* Lindl.	Java	
J21D	349629D	*I. platypetala* Lindl.	Java	
C26	366029	unidentified	Celebes	
C35		*I. platypetala aurantiaca* Steen cv Tangerine	Celebes	from Norfolk Botanical Gardens

Table 2. Chromosome numbers in hybrids from Celebes, Java, and New Guinea *Impatiens*.

Crosses[z]	Avg seed per capsule[y]	No. seedlings matured	Chrom. no. (2N)[x]
J21C × C35	15	25	12
NG4 × C35	20	16	20
NG5 × C35	5	16	20
NG15 × C35	26	14	20
C26 × J21C	15	25	12
C26 × C35	30	25	8
J21C × C26	19	20	12
C26 × J21D	20	25	12
C26 × NG5	20	16	20
C26 × NG4	30	16	20
C26 × NG19MF	20	16	20

[z] J = Java (2n=16), N = New Guinea (2n=32), C = Celebes (2n=8)
[y] From 4-6 capsules.
[x] Based on counts of 3 seedlings per progeny.

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Java spp. had 2 or 4 distinct, purplish spots near the throat of the flower. Plant, leaf, and flowers of the hybrids were intermediate between the parents in size.

A few plants of C26 × C35, C26 × J21C, NG5 × C35, and NG15 × 35 were considered ornamentally superior to their parents.

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Overwintering of Evergreens in Plastic Structures[1]

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Abstract. **The overwintering of evergreens without irrigation in plastic structures was best accomplished in a house oriented in a north-south direction and covered with milky polyethylene. Dehydration of evergreens in a structure covered with clear polyethylene and oriented in an east-west direction was attributed to high vapor pressure gradients that occurred in clear days. Evergreens overwintered in structures covered with clear polyethylene should be inspected periodically and irrigated as necessary to prevent desiccation.**

Nurserymen in the northern part of the U.S. have found it desirable to utilize various types of storage structures for overwintering plants. Just prior to 1874, I. E. Ilgenfritz of Monroe, Michigan constructed the first nursery storage cellar in the country to protect plants that *"would be likely to be injured during the winter if left in the open ground."* Another advantage was to facilitate early shipment of plants in the spring (1).

Since the 1960 review of Mahlstede and Fletcher (3) on the storage of nursery stock, a new development in the overwintering of evergreens has been the use of structures covered with polyethylene film (4). This method is popular since the quality of the foliage of plants protected by plastic often is superior to field-overwintered plants and is less expensive than other storage methods. A major problem is that evergreens frequently have been injured when stored under polyethylene. Research was undertaken to identify the factors contributing to successful storage of evergreens in polyethylene (plastic) structures and to provide recommendations for their use.

In the fall of 1969, 4 plastic houses 3.7 × 2.4 m and 2.1 m high, constructed according to specifications (2), were covered with 4-mil clear polyethylene or 4-mil milky polyethylene film. One house of each type was oriented E-W and N-S. During the first week in Nov., the houses were stocked with 4 species of evergreens: *Taxus cuspidata* Sieb. & Zucc (spreading Japanese yew), *Thuja occidentalis* L. (American arborvitae), *Juniperus chinensis* 'Pfitzeriana' Mast. (Pfitzer juniper) and *Rhododendron catawbiense* Michx. (Mountain rose bay). The *Taxus, Thuja* and *Rhododendron* was field dug in early Oct. and put into 25 cm "Kieding" pots. The *Juniperus* were container-grown in 3.7 liter metal pots. Four plants of each species were put into each house. One-half of the plants were mulched with wood shavings placed around and above the containers to a depth of 10 cm.

To obtain leaf temp 6-mil thermocouples were attached to the underside of a *Rhododendron* leaf or inserted into needles of a *Taxus* and *Thuja* about 0.8m above the ground in each house. Air temp was measured by white-colored thermocouples (insensitive to radiant heating) and a recording potentiometer.

At the end of Nov., when it was certain that the sensing elements were functioning properly, the houses were closed and made as air tight as possible. Inside and outside temp during selected weather conditions were recorded during the winter storage period. When the houses were opened in late March, the physiological condition of each plant was rated on a scale of 1 (dead) to 5 (excellent).

The experiment was repeated in the fall and winter of 1970 with the addition of a recording weekly hygrothermograph in each house. Leaf and air temp were recorded periodically and survival ratings were made after 5 months.

Plant survival was excellent both years in the N-S oriented house covered with milky plastic; all plants survived the storage period in a healthy, vigorous condition (Table 1). Survival was poorest in the E-W house covered with clear plastic; all *Taxus, Thuja* and *Rhododendron* were dead. The *Juniperus* were in excellent condition in all houses. In the other 2 houses (milky plastic, E-W and clear plastic, N-S, plant survival was intermediate.

Temperature. The differences in house temp were related primarily to building orientation and to the type of polyethylene used (Fig. 1). Houses oriented E-W had a much greater heat buildup than N-S. Milky polyethylene reduced the difference between air and leaf temp and lowered the maximum

Table 1. Effect of house orientation, type of polyethylene film, and mulching on evergreens overwintered in plastic structures.

Structure orientation	Species	Physiological rating[z]			
		Clear film		Milky film	
		Mulched	Unmulched	Mulched	Unmulched
East-West	*Taxus*	1.0	2.5	5.0	5.0
	Thuja	1.0	2.0	5.0	5.0
	Juniperus	5.0	5.0	5.0	5.0
	Rhododendron	1.0	1.5	3.2	4.0
North-South	*Taxus*	3.0	5.0	5.0	5.0
	Thuja	1.0	5.0	5.0	5.0
	Juniperus	5.0	5.0	5.0	5.0
	Rhododendron	2.0	2.0	5.0	5.0

[z]1 (dead) to 5 (excellent).

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