

STUDIES ON INHERITANCE OF PETUNIA HYBRIDS

MINOR THESIS IN HORTICULTURE

SUBMITTED BY

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CROSS BREEDING EXPERIMENTS

WITH THE PETUNIA

History of the petunia. * The petunia as we have it today is a strange compound of two original species which were introduced into cultivation less than three quarters of a century ago. The first petunia to be discovered was found by Commerson on the shores of the La Plata in South America and from the dried specimens which he sent home, the French Botanist, Jussieu, constructed the genus *Petunia* and named the plant *Petunia nyctaginiflora*. The plant appears to have been introduced into cultivation in 1823. It was a plant of upright habit, thick, sticky leaves and stems, and long tubed white flowers, which exhale a strong perfume at nightfall. This plant, nearly or even wholly pure, is not infrequently found in old gardens of today, and fair strains of it can be had in the market. The stem leaves of this species are said to be sessile, but the lower leaves in strong specimens are often conspicuously narrowed into long petioles. This old fashioned petunia is a coarse growing plant.

The second species of petunia first flowered in the Glasgow Botanical Garden in July 1831 from seeds sent the fall before from Buenos Ayres by Mr. Tweedie: and in 1837 an excellent colored plate was made of it under the name of *Salpiglossis integrifolia*. This is a neater plant than the other with a procumbent base, narrower leaves and smaller violet purple flowers which have a very broad or ventricose tube scarcely twice longer than the slender calyxlobes. This neat little plant has been known under a variety of names, two or three botanists referred it to *Nierembergia*. Lindley was the first to refer

* Survival of the unlike Bailey.

it to the genus *Petunia*, and called it *Petunia violacea*, the name which it still bears.

Petunia violacea was early hybridized with the older white *petunia*, *Petunia nyctaginiflora*, and as early as 1837 a number of these hybrids indistinguishable from the common garden forms of today were illustrated in colors in the *Botanical Magazines*. These hybrid *petunias* were even described as a distinct species, *Nierembergia Atkinsonia*. Harrison says in the Florida ^{cultural} cabinet the impregnation of *P. violacea* and *P. nyctaginiflora* has produced several very charming varieties, such as pale pink with a dark center, sulphur with dark center, white with dark center, and others streaked and veined. It would be interesting to know if *P. intermedia*, which was introduced about the same time as *P. violacea* and which appears to be lost to cultivation, entered into any of these early hybrids. Our garden *petunia*, therefore, started as hybrids; but the most singular part of the history is that the true old *Petunia violacea* is lost to cultivation.

The most singular development in these hybrid *petunias* is the appearing of the very broad mouthed fringed flowers with short sessile and more or less trough-like leaves. These highly developed forms may not come true from seed, hence they are propagated from cuttings, but they do not always come true even from cuttings.

The capsules resulting from each cross were carefully laid on a large piece of paper till they were thoroughly dry, then the seed was planted. The seeds from each cross were sowed in a separate seed pan to eliminate possible chances of the seed getting mixed.

When the *P₁* plants bloomed, they were bagged as the parents, but they of course needed no cross-pollination for this generation.

Methods. Petunia seed procured from Henry A Dreer was sown in February, 1910, in the greenhouse and given the usual treatment for such plants. After the majority of the plants had bloomed and thus showed that they would breed true to type, certain plants were selected for parents.

Before the flowers that were selected for the female parents unfolded, they were emasculated by taking a pair of sharp-pointed forceps and making a small opening in the corolla large enough to remove the anthers. These emasculated flowers were then bagged to avoid possible insect or wind pollination. Other plants of another variety and having certain apposing characters were bagged to furnish pollen for the emasculated flowers of the former variety. In order to have reciprocal crosses, flowers of both varieties entering into the cross were emasculated and bagged, and other flowers intended to furnish pollen were also bagged.

Each variety of parents was given a number and listed in a notebook and described under that number. When a flower was pollinated a paper label giving the number and six of each of the parents was tied on the peduncle of the pollinated flower. This label may read thus: 1♀ X 4♂- 10. A label on each artificially pollinated peduncle not only indicates the capsule that had been artificially pollinated but it avoids possible interchanging of the capsules when they are curing.

The capsules resulting from each cross were carefully laid on a large piece of paper till they were thoroughly dry, then the seed was planted. The seeds from each cross were sowed in a separate seed pan to eliminate possible chances of the seed getting mixed.

When the F₁ plants bloomed, they were bagged as the parents, but they of course needed no emasculation; for this generation is to be

self-fertilized. It was found, however, that the pollen from a flower would not pollinate the stigma of its own flower nor that of any flower on that plant, or if it did take, the ovary would live only a short while and die. In this particular these varieties are similar to the *P. violaceae* and *P. hybrida* which Saunders ^a states do not self fertilize

^a Saunders, E. R., Studies in the Inheritance of Doubleness in Flowers of *Petunias*. *Journal of Genetics* Vol. I, 1, P.47: Nov. 1910.

readily. Therefore, flowers having the same parentage and of the same type, but not from the same plant were interpollinated, the same having been bagged before the flowers opened. In case of the F_1 the flowers had tied to their peduncle a paper label stating the numbers of both parents involved and the characters that distinguish this particular type. Many of the crosses showed more than one type, hence it was necessary to select both parents of the same type and to designate the type on the label. Thus on each label one has the characters of the parents designated by their numbers and the type of the individual written on the label. For instance 5♀X15♂10 C mg T-mot. p. bl. X same would mean that the parents in 1910 were 5♀ and 15♂, and the offspring that enter into this cross have magenta corolla, a mottled throat and blue pollen. Care was exercised in selecting parents in the F_1 to interpollinate those flowers that showed the same dilution of color and the same general characteristics. Many of the differences in shades of color of the different types were merely different color dilutions.

Description of Parents.

#1 Snow Ball. Corolla is white with the outside of the throat purple and some purple on the veins on the inside of the corolla. The pollen is a greenish blue; leaves small compared with those of #4.

#4 Pure White. The corolla is white, except the throat for a space of three lobes is mottled with purple. We shall hereinafter speak of mottled as a light ground having numerous dark veins interwoven as it were in the white. The pollen is white. The corolla is a greenish white; leaves large; plant robust and large.

#2 Roy Morn. The corolla throat is white, but some plants show the corolla tube, purple or yellow mottled. The corolla is a light pink with veins that are a darker shade of pink; the main vein extends to the middle of the corolla lobe. The pollen is a cream white; leaves medium sized; plant robust.

#5. The corolla is light pink with veins that are heavier pink very much as #2; the throat is white, but for a space of three lobes it is mottled with yellow and purple. The pollen is creamy white; leaves large and wide.

#15. Dwarf Inimitable. The corolla is magenta having a throat that is white to to purple outside, and inside mottled with a bluish purple. The pollen is purplish blue; leaves medium sized.

DESCRIPTION OF CROSSES.

- ♀ 1 W. mottled throat, pol. blue. X
- ♂ 4 W. " " " white. (procal)

The plants generally are large and coarse, having broad leaves and few flowers compared with the progeny of all the other crosses.

Three of the plants are almost identical with the parent #1. The corolla is a bluish white having a throat for a space of three petal lobes mottled purple and white. The throat has an almost white ground in which numerous purple threads are woven. The pollen is blue like the ♀ parent, #1. These plants are smaller and have some what smaller leaves than the parent #4 and larger than the parent #1. Five of the plants are very large and course in growth as the ♂ parent. The corolla, however, is quite unlike either parent; it being a dark shade of mauve, while the throat is very darkly mottled with purple so much so that at a glance it appears as a deep purple, but at closer observation it presents the mottled effect. Here we note the corolla is a dark color, while both parents had a white corolla, but the throat is mottled as the ♀ parent #1. The pollen is also blue like that of the ♀ parent. One of these parents #1 we observe shows the presence of the purple pigment by slight purple markings on some of the veins of the corolla. Now, when some foreign element is introduced the former pigment relations is destroyed and the pigment is no longer confined to certain spots, but is spread over the whole corolla. Or it may be that there are two factors in the parents that simply need to be brought together to produce the required color, just as in chemistry we may bring together two colorless liquids and produce a very brilliant color. Two plants differed from all the others in that they had small leaves and weak growth and the corolla is a magenta. The corolla, however, shows its white parents by very small tips of white on the point of some of the corolla lobes. The throat is mottled with purple and the pollen blue; in these last two characters it is like the ♀ parent #1.

♂ 1 X 4 ♀ (reciprocal).

Here, as in the reciprocal, the plants are large broad leafed and course;

also the plants producing the light flowers have somewhat smaller leaves and weaker growth just as the reciprocal. Ten of the plants have a mauve corolla which is not unlike the color of the reciprocal. The corolla throat is mottled with purple and the pollen is blue just as that of the reciprocal. Four plants have leaves somewhat smaller than those having the mauve flowers. The corolla of the flowers from two of these plants is a very pale lavender or a blueish white, the corolla throat and the pollen being blue. Two other plants produced flowers having a white corolla with a mottled throat, thus resembling the light flowers of the reciprocal and the ♂ parent # 1.

The essential data concerning this cross and the reciprocal is given below in tabulated form.

Parents	No. of plants	Relative size of leaf	color of corolla	color of throat	color of pollen
1		smaller than #4	white	mottled	blue
4		large	"	"	white
/4♂	3	smaller than #4	"	"	blue
	5	very large	mauve	dark	"
	1	small	magenta tipped white	mottled	"
1♂ 10	10	large	mauve	mottled	"
	2	smaller	very light lavender	"	"
	2	"	white	"	"

Here we see one parent had white pollen and a white corolla tube, but all the progeny have dark pollen and dark corolla tubes, therefore, we conclude that this character is dominant, since the same thing occurs in the reciprocal.

5 ♀ Pink corolla, throat pollen w. X 15 ♂ rose, throat purple, pollen+blue.

Three of these plants are large leafed and robust. The corolla is pink having veins of deeper pink; the throat and pollen are both white, this in every respect resembling the ♀ parent #5. Ten plants have rather small leaves, and a magenta corolla, with a blue and some what mottled throat and blue pollen, thus resembling the ♂ #15. We see in a general way one third of the flowers are like the ♀ parent and two thirds like the ♂ parent.

15 ♀ X /5 ♂ (reciprocal!)

Generally the leaves and plants of this cross are larger than the ♀ parent #15 and smaller than the ♂ #15. While the plants producing pink flowers of the reciprocal had leaves as large as the parent, it resembled those plants producing the magenta flowers; for it had leaves larger than the one parent and smaller than the other. When the corolla first unfolds, it is a rich velvety maroon color, but when it is full blown, it is a bright magenta. The throat varies from light mottled with purple to a blue with heavier markings of purple, thus giving the mottled effect. All the plants of this reciprocal are essentially the same as to color and size.

The pollen is blue.

We observe that all 15 the progeny resembles the parent in color of the corolla, the throat, and the pollen, while the reciprocal splits in two, one third resembling one parent and two thirds resembling the other parent and also like the progeny of the reciprocal.

The above data will be given below in a tabulated form.

Parents:	No. of plants:	size of leaf:	color of corolla:	color of throat:	color of pollen:
15		smaller than #5	pink	white	white
5		large	rose	mottled purple	blue
♀ / 15 ♂	6	large	pink	white	white females
	10	small	magenta	mottled purple	blue
5 ♀ / 5 ♂	all	between parents	"	"	"

1 ♀ W. Mottled throat pollen blue / 2 ♂ pink throat mot. pol. W.

The result of this cross is in one sense a mosaic of colors for every plant shows the white and dark colors; but the dark color is a purple, while the dark point of the cross is pink and the pollen

of the cross is always blue while that of one parent was white. The interesting thing about this cross is that the plants bloom very profusely, even more profusely than the reciprocal; however, one of the parents, the ♀ is a very shy bloomer. Therefore, not all the characters are mosaics. The flowers vary from white with a very narrow purple stripe (about 2 mm. in width) at the union of the petals to a purple flower having just a tip of white on the point of the petals. The white and purple always maintain the same relative position, namely the purple at the juncture of the petals and the white in the middle of the petal. The pollen is blue and the throat always mottled.

2 ♀ × 1 ♂

A very striking and peculiar variation is shown in this cross. In the reciprocal of this cross where the males and females change places, every plant produced flowers that exhibited a partial mosaic composed of purple and white. Here, however, we find not only this mosaic as in the reciprocal, but also several different shades of solid color that were not exhibited in the parent, and also another type of mosaic. In this work there was only one other case where the reciprocals did not contain the same types though perhaps the colors are always in the same proportion, different types in reciprocals are not often reported.

The following are the types occurring in this cross:

3 plants have mauve flowers; 2 are light lavender with the petals tipped with white; 2 delicate pink which is darker near the margin than in the center; 1 crimson with white tips that extends as a stripe about half way down the corollo; 1 mauve with very slight white tips on three of the petals; 2 very light pink with white

stripe to center; 3 purple with white stripes and varying in relative amounts of white and purple just as in the reciprocal. These plants produced flowers identical with those of the reciprocal. 1 plant produced flowers having a white tipped mauve corolla on which were numerous white dots, thus giving another and very striking type of mosaic coloring.

Tabulated results of 2 ♀ / 1 ♂

Parents	No of plants	color of: corolla	color of throat	Color of pollen.
1 ♀		white	mottled	blue
2 ♀		pink with veins of darker pink	white	white
2 ♀ 1 ♂	3	mauve	mottled	blue
	2	light lavender tip ped with white	"	"
	2	delicate pink	"	"
	1	crimson with white tips	"	"
	1	mauve with slight white tips	"	"
	2	light pink with white strips	" "	"
	3	purple with white strips	"	"
	1	striped mauve corolla with white dot	"	"

1 ♀ / 2 ♂ (all plants) mosaic.