

Creased flowers of *Pharbitis Nil*

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(With 10 Text-figures)

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The Japanese morning glory, *Pharbitis Nil*, exhibits several types of double flowers (MIYAKE and IMAI 1927). The feathered flower ("Shishi" in Japanese) is characterized by supplementary petaloid pieces on corollas, which are creased, irregularly split, and sometimes deformed in monstrous forms. The "Shishi" flower has been popular among cultivators, and as the result of continuous improvement, now we have very peculiar types of feathered petals.

Incidentally, I obtained a few years ago a strain flowering "feathered" corollas, differing in some other points from the "Shishi". The pseudo-"Shishi" may be called "creased".

A description of creased in comparison with feathered

Creased seedlings have cotyledons usually a little crumpled (Fig. 1), but those of feathered have much curved ones (Fig. 2), and by this characteristic we can definitely indentify the "Shishi" seedlings among normals with flat cotyledons. Leaves of creased are nearly flat (Fig. 3) or slightly crumpled (Fig. 4), whereas those of feathered are strongly crumpled or rolled (Fig. 5). Creased has flowers similar to those of feathered; namely, its corollas are creased and irregularly split, with supplementary petaloid pieces (Figs. 3 and 4). Creased produces a few seeds on account of low fertility, but feathered is sterile in general. I have a feathered strain of high fertility, but this is quite an exception. The main difference between creased and feathered is in the characteristics exhibited on cotyledons and leaves.



Fig. 1. Creased seedlings with slightly crumpled cotyledons



Fig. 2. Very young feathered seedlings with curved cotyledons

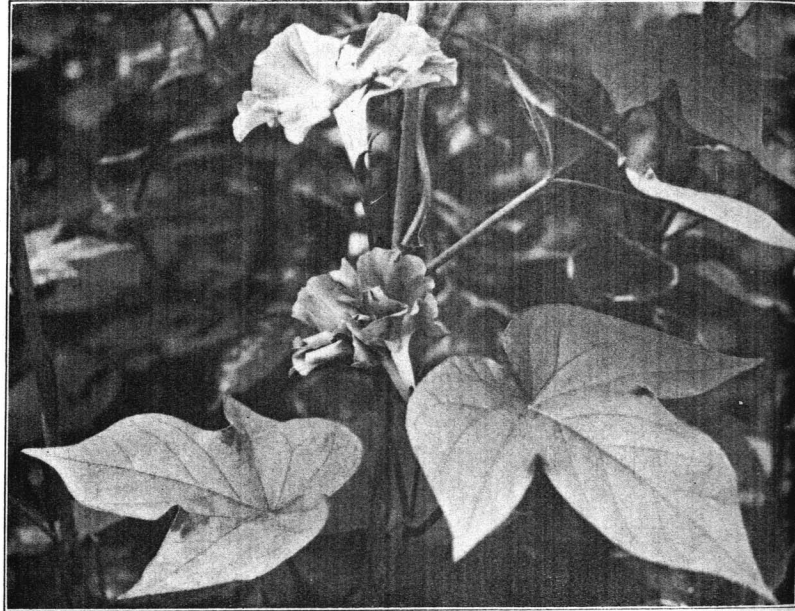


Fig. 3. Creased with nearly flat leaves

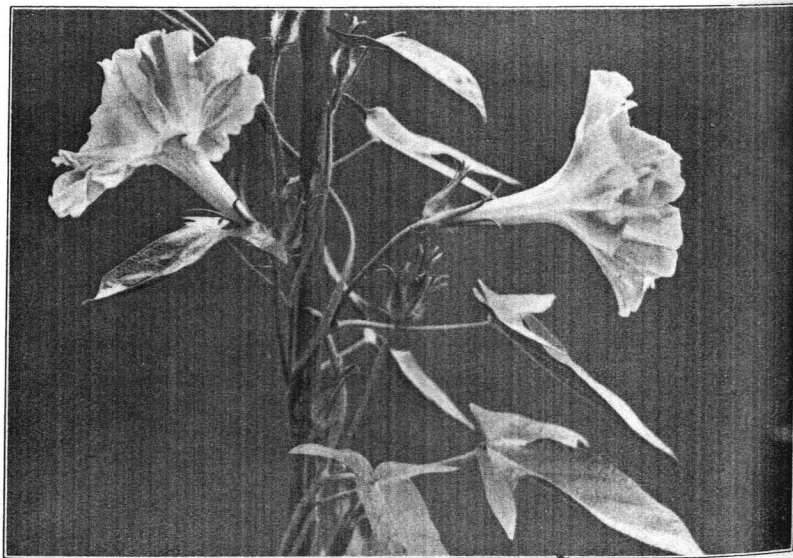


Fig. 4. Creased with slightly crumpled leaves

Origin of creased

At present creased is very rarely found in our gardens. Cultivators pay much attention to feathered and other types of double flowers, but little to creased. When the Japanese morning glory was at first intensely cultivated some 120 years ago, fanciers already had some deformed flowers, as shown in cuts of books published in those days. We cannot find feathered in those books, though creased specimens with nearly flat leaves are illustrated. For instance, *KADAN-ASAGAOTSÛ* (1815), *KENGYÛ-HINRUZUKÔ* (1815), *ASAGAO-SÔ* (1917), etc. illustrate several varieties of creased flowers by the name "Ranjishi". The first illustrations of feathered were made in *ASAGAO-SANJÛROKKASËN* (1854), *TOHISHÛ-KYÔ* (1857), *RYÔCHISHÛ* (1859), etc., and afterwards feathered became popular among cultivators. The fact that creased has nearly disappeared from gardens, while feathered got into popular favour can be easily accounted for. This owes evidently that feathered is easily identified in its seedling bed, while the identification of the creased seedling is rather difficult. The improved, monstrous flowers of either feathered and creased are complete or nearly sterile, so that they are raised through the so-called "parental stocks", which are normal in appearance but heterozygous for double flowers. If we could easily tell the "products" from the sister seedlings that came from the seeds collected on "parental stocks", much labour would be saved in the cultivation of the monstrous forms.



Fig. 5. Feathered with rolled leaves. Flower is split in much deformed petals

Inheritance

The hybrids obtained by crossing creased (fe^c) with normal (+) are normal; and in F_2 , segregation occurs into normal and creased in a simple ratio as shown in Table 1.

Table 1. F_2 from the cross between creased and normal

Cross	+	fe^c	Total
415 × RJ	125	53	178
SU × RJ	192	52	244
H30A × RJ	248	77	325
190 × RJ	121	38	159
455 × RJ	80	32	112
Total	766	252	1018

The results show the simple recessive nature of creased to normal. As was stated elsewhere (MIYAKE and IMAI 1925), feathered (fe) behaves as a simple recessive to normal, showing a heterozygous characteristic on the leaves. Both recessives, feathered and creased, when crossed, gave F_1 characterized by feathered; and in F_2 , feathered and creased are segregated into a 3:1 ratio as shown in Table 2.

Table 2. F_2 from the cross between creased and feathered

Cross	fe	fe^c	Total
H37 × RJ	179	64	243

Thus creased is again recessive to feathered. Therefore, feathered and creased constitute a triple series of allelomorphs with normal, the order of their dominancy being normal, feathered and creased.

Up to the present, seven sets of multiple allelomorphs have been detected in this plant, by counting the feathered group. Below are the genes constituting the multiple allelomorphs, with a description of the characters.

1. Normal (+), maple (m), willow (m^w); shape of cotyledon and leaf, split flower.
2. Normal (+), smeary (fd^s), faded (fd); flower pattern.

3. Normal (+), contracted (ct), star (ct^s); contraction of organs, flower shape.
4. Normal (+), yellow-inconstant (yⁱ), yellow (y); foliage colour, mutability.
5. Normal (+), crêpe (cp), reversed (cp^r); crêpe constitution of leaf, cup flower.
6. Margined-reduced (Mr-r), normal (+), margined-slight (mr-r^s); white margin of corolla.
7. Normal (+), feathered (fe), creased (fe^c); crumpling of leaf, feathering of corolla.

The genes in the respective series are arranged in the order of their dominancy. The multiple allelomorphs in the respective sets manifest certain characters in a qualitative or quantitative series.

Locus and linkage

Feathered is located, in the cordate chromosome, at the distance of 1.2 from the locus cordate (co) (MIYAKE and IMAI 1925). Creased, therefore, must also be closely linked with cordate. By crossing creased with cordate¹ (Fig. 6) I obtained normal-flowered F₁ plants (+/co) bearing normal leaves with broad median lobes; and in F₂, a linked segregation occurred, as indicated in Table 3.

Table 3. F₂ from the cross between creased and cordate, showing their linked segregation

Cross	+	+/co	co	fe ^c	fe ^c +/co	fe ^c co	Total
H30A × RJ	2	163	83	75	2	0	325
190 × RJ ..	1	82	38	37	1	0	159
455 × RJ ..	1	53	26	29	3	0	112
Total	4	298	147	141	6	0	596
Expected	4	294	149	145	4	0	596

$$\chi^2 = 1.191 \quad P = 0.94$$

¹ Leaves cordate; flowers single, funnel-shaped.

The expected numbers, which are perfectly in accordance with the data obtained, are calculated on the basis of 1·2 per cent of crossing over between the two genes, feathered and cordate.

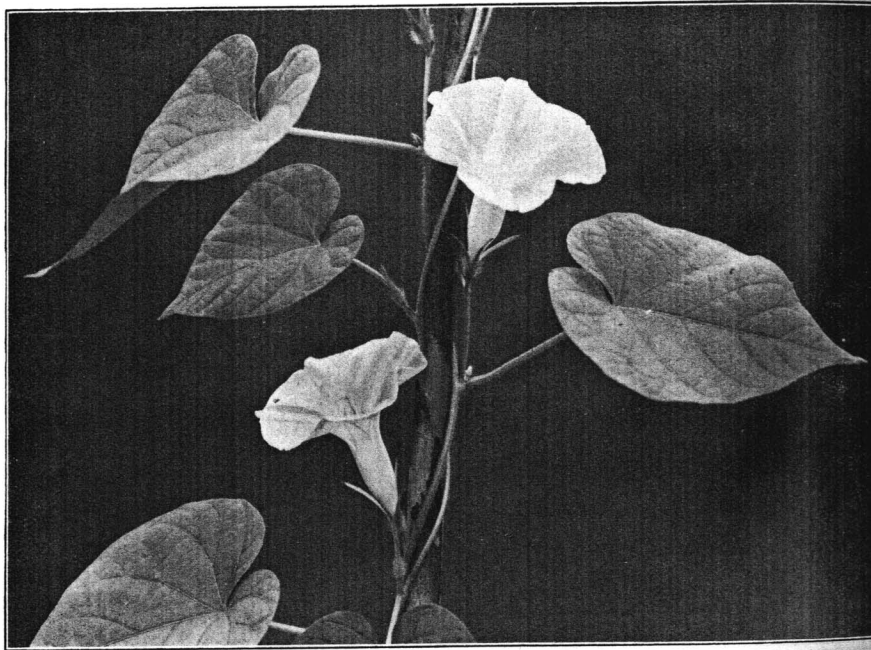


Fig. 6. Cordate

Crumpled-1 reaction

The crumpling of leaves is due to the manifestation of either crumpled-1 or crumpled-2, the former being located in the variegated chromosome and the latter in the delicate chromosome (IMAI 1926). The most common crumpling of leaves is related to crumpled-1. The leaves of feathered are much crumpled or rolled, but this characteristic is due to the manifold effect of the gene feathered. The combination of crumpled-1 with feathered results in a "grasped" leaf, which is strongly rolled (Figs. 7 and 8). Creased crumpled-1 compound is characterized by rolled leaves (Fig. 9). Creased leaves, which are heterozygous for crumpled-1, are also strongly crumpled (Fig. 10), but not so much as creased crumpled-1. Crumpled-1 is a recessive to the normal condition,

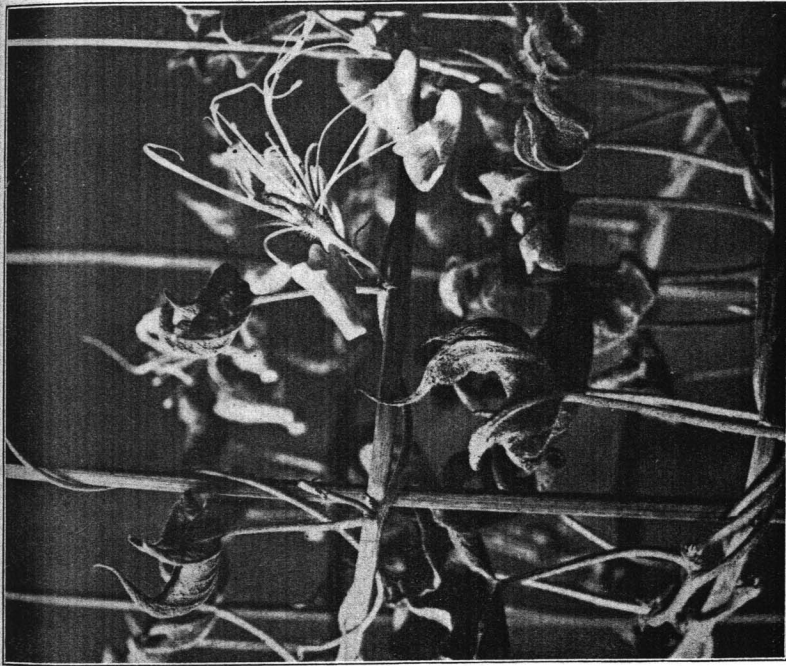


Fig. 8. Feathered crumpled-1. Flower is split and deformed in bell-shaped petals. Cultivated in a pot for ornamental purpose

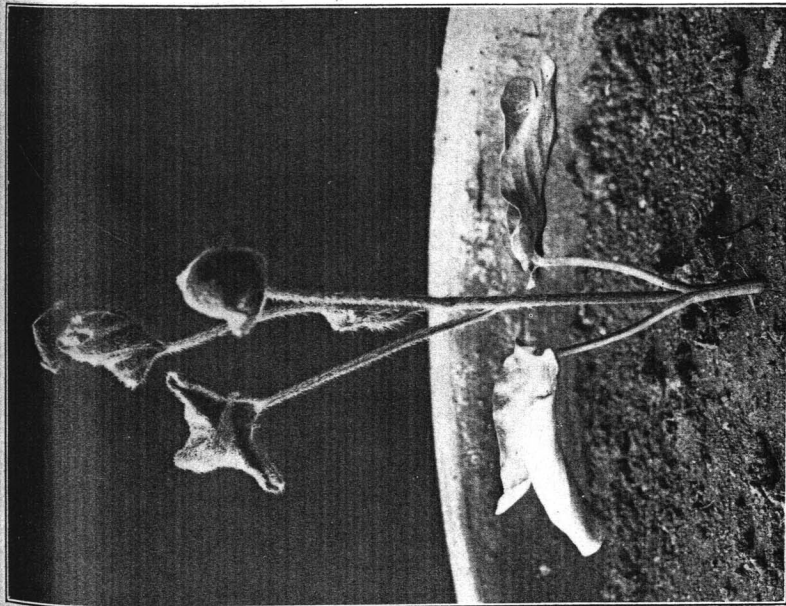


Fig. 7. Feathered seedling with "grasped" leaves



Fig. 9. Creased crumpled-1

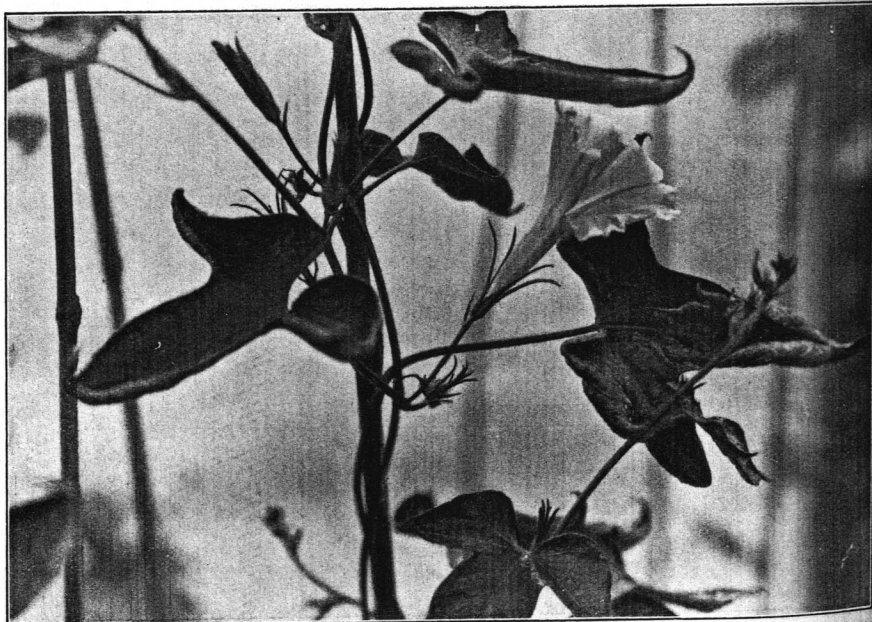


Fig. 10. Creased heterozygous for crumpled-1

but it acts as a dominant working on a creased genotype, though the dominance is incomplete. The same relation is also observed on certain other genotypes, such as delicate, crêpe and deformed. Therefore, crumpled-1 exhibits a phenomenon of "reversal of dominance", acting on different genotypes.

In a previous paper (IMAI in press), I presented F_2 data segregating 180 normal, 58 variegated, 42 feathered, 12 feathered variegated, 15 even, 0 even variegated, 45 deformed and 10 deformed variegated. Even (ev) was applied to creased, by adopting the nearly even characteristic of laminae. At that time, I thought that even (creased) was a recessive modifier of feathered, making the curved leaves nearly flat. From such a point of view, the data above cited may be incorrectly regarded as exhibiting linkage between even (creased) and variegated. The F_2 above shown made also an additional segregation for crumpled-1. Crumpled-1 acting as a dominant to the normal on a creased (even) genotype and being linked with variegated at 14.9 per cent of recombination due to crossing over (IMAI and TABUCHI in press), the contents of creased segregates should show linkage assortment as to the genes crumpled-1 and variegated. Actually, the creased segregates are composed of 42 plants with crumpled-1 leaves, 12 plants with variegated crumpled-1 leaves, 15 plants with flat leaves and no plants with variegated flat leaves, which were formerly regarded as 42 feathered, 12 feathered variegated, 15 even (creased) and 0 even variegated. Therefore, creased (even) is not linked with variegated, but with cordate. The name "creased" seems better than "even" for the pseudo-"Shishi" and it will be used hereafter.

Summary

1. Creased is an old variation occurring under intense cultivation. Cotyledons a little crumpled; leaves nearly flat or slightly crumpled; and corollas creased and irregularly split, with supplementary petaloid pieces, like those of feathered. Fertility of creased is low.

2. Notwithstanding the fact that creased dates far older than feathered and that they both bear similar monstrous flowers, the former has nearly disappeared in our gardens, while the latter is popular among cultivators. This owes evidently to the easy identifiability of feathered seedlings by their cotyledons, which are considerably curved upwards.

3. Creased constitutes a triple series of allelomorphs with normal and feathered, the order of their dominance being normal, feathered

and creased. The other six cases of multiple allelomorphs are described.

4. Creased is linked very closely with cordate, as feathered is, or at 1.2 per cent of crossing over. The locus of creased (or feathered) is in the cordate chromosome.

5. The recessive gene crumpled-1 acts as a dominant, working on a creased genotype as well as on delicate, crêpe and deformed specimens, and therefore the gene exhibits a phenomenon of "reversal of dominance".

References

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