

WHITE FLOWERED VARIETIES OF *PRIMULA*
SINENSIS.

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[It was intended that this paper should be published simultaneously with an extensive memoir by Mr R. P. Gregory on inheritance in *Primula sinensis*. Mr Gregory's paper is already in type; but owing to its length and to delay incidental to preparation of the coloured Plates illustrating it, we have been obliged to hold it over for the next number of the *Journal*.—EDD.]

White Flowered Varieties. White flowered varieties of *Primula sinensis* are of two kinds, one with red or reddish stems (coloured stems) and the other with green stems. Coloured stemmed whites, when crossed with a variety with coloured flowers, yield an F_1 with white or tinged white flowers. Green stemmed whites, when similarly crossed, yield an F_1 with coloured flowers. Since the white or tinged white F_1 plants give rise, on selfing, to white and coloured flowered plants in the proportion of three white to one coloured, it is inferred that the coloured stemmed whites carry the factors for colour, but that pigment formation is inhibited by the presence of a dominant white factor. Since, also, green stemmed whites give rise, when crossed with a colour variety, to a coloured F_1 , it is inferred that they lack the dominant white factor as well as one or more of the colour-factors.

Thus, of white varieties of *Primula sinensis* hitherto investigated, those with coloured stems are "dominant whites," and those with green stems "recessive whites."

One exception to this rule is already known: the green stemmed, white variety Pearl having been shown to be a dominant white.

The purpose of this note is to record the existence of what appear to be exceptions to the rule of dominant white among coloured stemmed, white varieties.

The evidence is based on the gametic behaviour of Snow King, a variety which has white flowers and dark red stems.

Plants of Snow King, raised in 1908 from seed obtained from Messrs Barr, proved true to type, except for an occasional magenta flaking of the petals of a few plants. The variety again bred true to type in 1909.

In 1908, three plants of Snow King were used for crossing with the following coloured varieties:

Reading Pink (pale pink flowers, green stem).

Crimson King (dark red flowers, reddish stem).

Pink Stellata (pale magenta flowers, reddish stem).

A green stemmed variety with pink flowers a shade deeper than in Reading Pink, numbered 2 A.

It should be remarked that, in green stemmed, coloured flowered varieties of *P. sinensis*, the deeper flower colours of the self-coloured types are not fully developed. Such plants however carry the factors for the deep colours; for, when they are crossed with coloured stemmed varieties with pale coloured flowers, the deeper shades are fully developed in the coloured stemmed offspring.

The F_1 generations, obtained from the crosses between Snow King and the several plants enumerated above, were as follows:—

Expt. No.	Cross	Description of F_1 plants
20·2	Snow King × Crimson King ¹	10 tinged white : 9 magenta
52	Reading Pink × Snow King ¹	5 " " : 3 " "
200	Pink Stellata × Snow King	12 " " (nearly pure white)
2 A	(Green stem × Snow King, flowers pink)	8 pale magenta

A uniform F_1 family of whites or tinged whites occurs in only one of these crosses. In No. 2A, the F_1 consists of coloured flowered plants and, in Nos. 20·2 and 52, it is composed of tinged whites and coloured in about equal proportions.

¹ The same plant of Snow King was used in crosses 20·2 and 52.

In order to investigate the meaning of these results which are in disaccord with those obtained hitherto with coloured stemmed whites, coloured and white tinged plants of the F_1 generation were selfed, and the F_2 generation examined. The results were as follows:—

F₂ from coloured flowered F₁ plants.

Experiment No. 20·2, a magenta plant selfed.

F_2 .	Observed	20	coloured :	8	white and flaked	white.
	Calculated	21	"	7	"	"
	"	3	"	1	"	"

Experiment No. 52, two magenta plants selfed.

F_2 .	Observed	54	coloured :	19	white and flaked	white.
	Calculated	55	"	18	"	"
	"	3	"	1	"	"

Experiment No. 2 A1, two magenta plants selfed.

F_2 .	Observed	77	coloured :	22	white and flaked	white.
	Calculated	74	"	25	"	"
	"	3	"	1	"	"

F₂ from tinged white F₁ plants.

Experiment No. 20·2, a tinged white selfed.

F_2 .	Observed	29	white and tinged	white :	12	coloured.
	Calculated	33	"	"	8	"
	"	13	"	"	3	"

Experiment No. 52, two tinged whites selfed.

F_2 .	Observed	63	white and tinged	white :	15	coloured.
	Calculated	63	"	"	15	"
	"	13	"	"	3	"

Experiment No. 200·1, a white plant selfed.

F_2 .	Observed	13	white :	9	coloured.
	Calculated	18	"	4	"
	"	13	"	3	"

In the F_2 from coloured plants, we obtain approximately 3 coloured : 1 white, and in the F_2 from tinged white sister plants we have approxi-

mately 13 white (and tinged) : 3 coloured. A departure from the 13 : 3 ratio should be noted in Experiment 200·1. This must be attributed to the fewness of the F_2 plants grown, until more evidence can be obtained.

It was noticeable that some of the white plants of F_2 from white and coloured F_1 , showed a considerable increase of flaking as compared with that observed in certain plants of Snow King. Among those flaked, white plants from coloured F_1 plants, there occurred one or two plants bearing flowers with a very faintly tinged ground.

Further investigations will, it is hoped, demonstrate the significance of these facts.

On the basis of the numbers obtained in F_2 , we arrive at the following conclusions:—The plant of Snow King used in Experiment No. 200, which gives a tinged F_1 , is homozygous (WW) for the dominant white factor.

That used in Experiment No. 2 A, which gives a magenta F_1 , is homozygous (ww) for the absence of the dominant white factor. Since the flowers of this plant are white, it lacks a colour factor. That is, its gametic constitution is cw . Since the stem is red, the loss of colour factor has regard only to the flower and not the stem.

Writing Snow King cw and plant 2A, Cw ,

$$F_1 = Cw = \text{coloured.}$$

The plant of Snow King used in Experiments Nos. 20·2 and 52 which give both coloured and tinged white in F_1 , is heterozygous (Ww) for the dominant white factor. Since the variety as a whole breeds true to whiteness, the heterozygous (Ww) plants must lack colour factors. Their gametic constitution is cWw .

Snow King (cWw) \times Crimson King or Reading Pink (Cw).

$$\begin{array}{rcl}
 F_1 = CcWw, \text{ white or tinged white and} & & Ccww, \text{ coloured.} \\
 F_2 = 9 \begin{array}{c} | \\ Cw \end{array}, 3 \begin{array}{c} | \\ cW \end{array}, 3 \begin{array}{c} | \\ Cw \end{array}, 1 \begin{array}{c} | \\ cw \end{array}. & & F_2 = 1 \begin{array}{c} | \\ Cw \end{array}, 2 \begin{array}{c} | \\ Ccw \end{array}, 1 \begin{array}{c} | \\ cw \end{array}. \\
 = 9 \text{ white} + 3 \text{ white} + 3 \text{ coloured} + 1 \text{ white} & & 3 \text{ coloured} : 1 \text{ white.} \\
 = 13 \text{ white} : 3 \text{ coloured.} & &
 \end{array}$$

In order to investigate further the nature of the factors necessary for the production of colour in *Primula sinensis*, plants of recessive white Snow King were crossed with the recessive white, green stemmed varieties of Ivy leaf (for a plant of which we are indebted to Mr Bateson) and Snow-drift.

From Ivy leaf \times Snow King an F_1 was obtained consisting of 4 flaked white on dark red stems, and 1 flaked white on reddish stem. Snow-drift by Snow King yielded an F_1 consisting of 24 magenta flowered plants with reddish stems. Thus a fully coloured F_1 is obtained as the result of a cross between two white flowered varieties. The F_2 generation from these crosses has not yet been obtained.

Table of Flower and Stem colour in F_2 .

	Expt. No.	Stem			Flower colour				No. of plants not flowered	Cross
		Reddish	Dark red	Green	Magenta	Pink	White and tinged	Pale pink		
F_2 family from magenta F_1 plants	20-2-1	23	—	—	14	3	6	—	—	Snow King \times Crimson King
	—	—	5	—	3	—	2	—	—	
F_2 family from tinged white F_1 plant	20-2-2	28	—	—	3	6	17	—	2	—
	—	—	15	—	3	—	12	—	—	
F_2 families from magenta F_1 plants	52-3	23	—	—	10	7	6	—	—	Reading Pink \times Snow King
	—	—	9	—	8	—	1	—	—	
	—	—	—	2	—	—	2	—	—	
	52-5	27	—	—	17	1	8	—	1	
F_2 families from magenta F_1 plants	—	—	7	—	6	—	—	—	1	—
	—	—	—	7	—	—	2	5	—	
	52-4	32	—	—	7	2	23	—	—	
	—	—	9	—	—	—	8	—	1	
F_2 families from magenta F_1 plants	—	—	—	14	—	—	12	2	—	—
	52-6	15	—	—	—	1	14	—	—	
	—	—	5	—	3	—	2	—	—	
	—	—	—	5	—	—	4	—	1	
F_2 families from 2 magenta F_1 plants	2A1	21	—	—	16	—	4	—	—	2d \times Snow King
	—	—	5	—	5	—	—	—	—	
	—	—	—	6	—	—	1	4	—	
	2A5	39	—	—	30	—	9	—	—	
F_2 family from white F_1 plant	—	—	8	—	5	—	3	—	—	—
	—	—	—	21	—	—	6	16	—	
F_2 family from white F_1 plant	200-2	17	—	—	7	—	10	—	—	Pink Stellata \times Snow King
	—	—	5	—	2	—	3	—	—	