

SOME NOTES ON FRAGARIA.

By C. W. RICHARDSON.

(With Two text-figures.)

Flower colour. Continuing my experiments recorded in this Journal (Vol. VII, No. 3, May 1918 and Vol. III, No. 3, Feb. 1914) I selfed in 1918 a pink double F_2 of my cross double flowering *vesca* × single pink and obtained a family of 110 all pink doubles. The shade of pink varied but little and never reached the stage of crimson.

On going over the plants of a cross-back (*virginiana* × *chiloensis*) F_1 × *chiloensis lucida*, to trace the last remnant of *virginiana* (which I failed to do), I lighted on many pink flowers and one plant with partially crimson flowers of abnormal shape. In the bud the petals were green or edged with crimson, on opening they showed white splashes on a green ground which rapidly turned crimson. The stamens and carpels were malformed and the flowers sterile. The general effect of the crimson was to make the flowers resemble pear blossom though the old petals were darker in colour. Runners taken with every care from the parts of this plant yielding abnormal flowers have flowered perfectly normally this season (1919).

Now in the ordinary pink *vesca*, colour appears in the early bud stage and is passed on to its descendants: but this colour must not be confused with that arising from damage by rain or grit, which is of frequent occurrence. To this latter condition may now be added damage from abnormal weather conditions causing defective nourishment, as in the so-called "summer" of 1918.

Double flowering. As already stated my F_3 doubles from doubles were all double, none were of the single, extra petalled F_1 type. Any very strong flowering plant of a garden variety, or of a species cross, may give rise to plants with extra petalled or even slightly doubled flowers, but I have not found this condition constant, still less capable of transmission from parent to child. The real double, never quite perfect, arises from a lasting change in the sex organs.

Foliage. The leaflets of *chinensis* are much rounder than those of *virginiana*. Crossed with *grandiflora* ♂ it produces a mixed progeny, having leaflets ranging from nearly as round as those of *chinensis* to rather longer than *virginiana*. Grading them from the roundest to the longest I classified 39 such plants in five groups as follows :

Roundest					Longest
9	10	6	3		11

The first three groups (with 25 plants) could be called round and the other two (with 14 plants) could be called long.

Similarly graded in point of thickness of leaf, four groups were made :

Thickest				Thinnest
10	15	12		2

The long may be thick and the round thin.

The object of this experiment was to test *grandiflora* for mixed origin and the result, to my mind, is conclusive—*grandiflora* resembles *chiloensis* or *chinensis* more than *virginiana*, but it is evidently heterozygous, and has probably arisen as a cross and not as a sport from either of those forms.

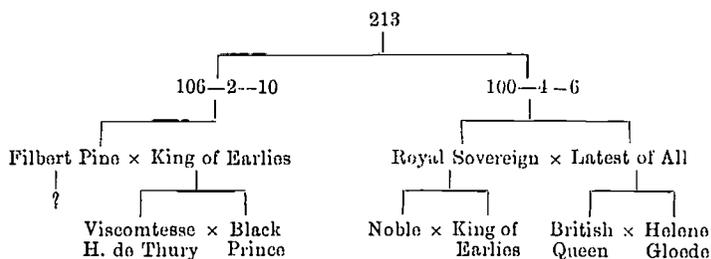
(*Chinensis* × *chiloensis*) F_1 ♀ × F_1 (Royal Sovereign × Givon's Late Prolific) (Plant family 211) gave F_1 plants with many leaflets, six in one case and frequently five, also normal trifoliate plants—13 normal, 11 abnormal—the numbers are small but point to equality. All the plants of this cross were very strong growing in every way. The foliage was dark in all cases. *Chinensis* ♀ × *elatior* ♂ (204) gave F_1 plants with very strong growing and light coloured foliage, so like *elatior* that if the cross had been made *elatior* ♀ × *chinensis* ♂ I would have repeated it, fearing some accident had taken place, but as all my *chinensis* plants are female, and cross backs with both parents show, in the small numbers at present to hand, unmistakable signs of segregation, I have no hesitation in accepting the cross as perfectly true— F_2 's from selfed F_1 's unobtainable up to now. *Chinensis* ♀ × *Daltoniana* (189) gave F_1 plants with large leaves of the *Daltoniana* type. F_2 unobtainable up to now.

F_2 plants from a cross (*chiloensis* × a garden variety) crossed back with another garden variety (208) still retain the excessive vigour of their foliage. The F_2 selected had leaves of slightly *chiloensis* type, and the cross back gave plants of the garden variety type in 45 cases out of 50.

Variation in foliage. The lack of chlorophyll is such a fluctuating character in *Fragaria* that one is not attracted to it as a study, when

there are so many other plants giving more certain examples of the phenomena. Yet occasionally it is impossible to neglect a demonstration, such an one I found in my family 213 (of which more to come). Here last May, 40 plants were normal—6 appeared normal, 6 showed signs of variegation, 8 were variegated, 5 chosen as normal have grown well and remained normal. Five of the doubtfully variegated have shown variegation, the remaining doubtful plants have not grown well. This looks like 46 normal to 14 variegated, which may very well be 45 to 15, or 3 to 1. I found the fruit of some of the variegated plants was mottled, but other fruits on the same plants were not. The only clue I have to this "sporting" is the fact that some of my selfed Royal Sovereigns were variegated, and accordingly the descendants may carry this character.

Fruit-Flavour. In the pedigree given below I quote the parents of garden varieties as generally accepted and have no reason to doubt them. In any case they are not all important.



Filbert Pine selfed in 1909, out of 100 plants only 30 had fruit the quality of which could be estimated in 1911 and 1912; of these about 6 had fruit with fair or good flavour. I have since devised a scale in which a perfectly flavoured fruit would receive 12 marks and one with a very bad flavour 1 mark. Taking the well-known plant *Royal Sovereign* as an example, I would award it 8 marks; but a plant with no flavour would receive 6 marks. If this system had been in use I would in no case have given more than 8 and in many cases but 3. *Filbert Pine* is not a good plant as it is exceptionally liable to pests, but it has a good flavour—a 9 mark one may be.

King of the Earlies selfed in 1909, out of 100 plants only 3 had fruit the quality of which could be estimated in 1912. Some people think well of this plant, but I merely say "it is a matter of taste."

Royal Sovereign selfed in 1909, out of 130 (perhaps 150 as there were some little things which never grew out of the first leaf, early primitive.

stage) only 32 had fruit the quality of which was estimated in 1911 and 1912. On my present system of marking I would have classed these :

3 given 3, 2 given 4, 3 given 5, 2 given 6, 7 given 7, 12 given 8, 3 given 9.

The remaining 98 plants were bad or wanting in flavour.

Latest of All selfed in 1909, out of 75 plants 28 had fruit the quality of which was estimated, these would have been marked :

5 given 4, 13 given 5, 1 given 6, 1 given 7, 7 given 8, 1 given 9.

Of the remaining plants most would have been given 6. I have often wondered if this is as good a plant as British Queen; it is hardly as good in flavour, but it has other good qualities.

From the above it will be seen that the parent plants when selfed give very few plants of good flavour.

"106." Out of 72 plants only 6 had fruit the quality of which could be estimated. Of these 106-2-10 had the best, probably better than either parent; it would have received 9 marks.

"100." Out of 50 plants only 3 had fruit the quality of which was estimated. Of these 100-4-6 was quite the best, certainly better than either parent, and would have received 9 marks. So we have two parents recessive for flavour.

"213." Plants from this cross made in 1914 and planted out in 1918 gave the following result, out of 37 :

1 given 3, 3 given 4, 6 given 5, 3 given 6, 5 given 7, 15 given 8, 2 given 9, 2 given rather over 9.

The above records point to the fact that flavour is a character built up of several characters, which may depend on several factors. Some years ago Miss F. Durham very kindly extracted a volatile essential oil from strawberries, and helped me in other experimental work of this nature, which satisfied me that an essence was present in strawberries. No doubt the amount of sugar in the plant is a factor on the + side in flavour, but I have not ventured to go into this up to the present. I am strongly disposed to think that all ripe strawberries have just begun to ferment, as flavour appears to be stronger in fruit verging on the over ripe stage. I must add many strawberries have a horrible flavour—some friends I "tried them on" said they resembled cold mutton that had slightly turned. This is probably due to the presence of a flavour and absence of all sweetness, though unripe fruit is often of good flavour yet slightly sharp. Before leaving this subject I should like to add—I no

longer believe size is a deterrent to flavour. They are both very complex characters, so the chances of uniting them are small. Added to this, they are not the only characters the fruit grower wants when he sends his baskets by train etc. to market.

Size of Fruit. Till this year I have never had a family producing large fruit as the rule. From the family 211 (*chinensis* × *chiloensis*) × garden strain I obtained fruit displacing 8, 10, 10, 11, 12, 12, 12, 12, 12·5, 13, 13·5, 14, 15, 16, 16·5, 17, 18, 18, 19, 20, 22, 24, and 28 c.c. of water. The fruit measured was in no case the largest borne by any plant. The largest fruit measured was slightly slug-eaten and displaced 32 c.c. of water. Other families of garden varieties, growing alongside this, gave fruit of 18 to 22 c.c. as the largest, and small fruits of 5 to 8 were very frequent. This 211 family chiefly consists of hard-growing, multi-fruit-stemmed and very heavy cropping plants, but the fruit has next to no flavour, and its shape may be any form of carpet bag, clenched fist, cock's comb or globe, with seeds yellow or dark crimson to nearly black.

The cross (*chinensis* × *Daltoniana*) has only given me three seeds; but it is worth noting that the flowers are borne in trusses and not singly as in *Daltoniana*, following in this the cross (*Daltoniana* × *vesca*).

The cross (*chinensis* × *elatior*) has not given me any seed up to now, but I have reason to believe it may do so in the future. The flowers are described below.

Runners. There seems to be a morphological resemblance between runners and flower stems. Last autumn I had several cases of runners flowering before they made foliage or rooted; runners from these have behaved normally. This summer a plant from the *chinensis* × *elatior* cross produced flowers with very long stems, and from the flower trusses runners grew (Fig. 1). This cross in 1915 gave one plant which continued from December to March or April to send out fresh trusses from the trusses which had flowered. (I have no photograph of this unfortunately.)

Sex. *Chinensis* ♀ × *Daltoniana*. Out of 22 well-established plants 7 ♀. 7 ♂ or ♀ and 8 *blind* plants. Most of the plants that flowered had done so the previous year, but not one of the *blind* plants had.

Chinensis ♀ × *elatior* ♂. Out of 25 plants which had been three summers in the ground only nine have flowered. Fig. 2 shows five types of flowers from five plants. Following my rule of classifying plants as female or males and hermaphrodites I count these 1 female and 8 male or hermaphrodite. The pollen is good in the latter class.

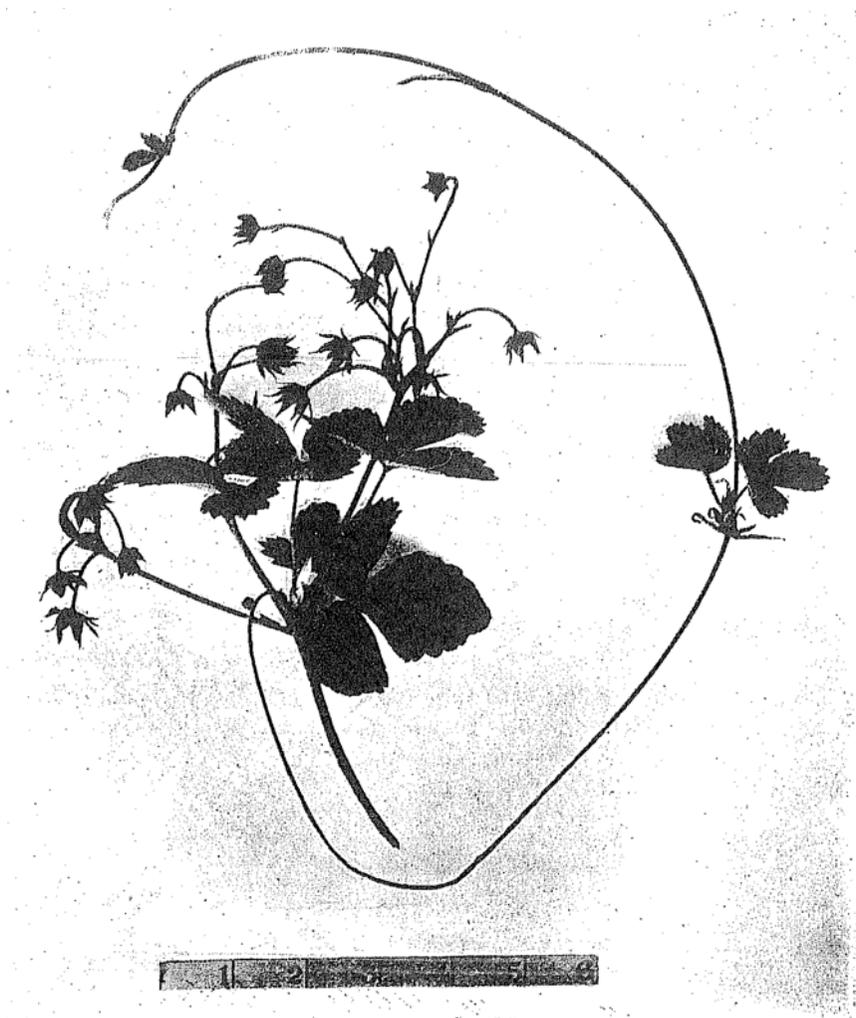


Fig. 1. *Chinensis* × *elatior*.

(*Chinensis* × *chiloensis*) × *Garden* (211): 24 plants gave 12 ♀, 12 ♂ or ♀. The number of plants in all these cases is small, but I give the figures to add to my former list 183 ♀, 155 ♂ or ♀. So things now stand 203 ♀, 173 ♂ or ♀.

Compared with the normal, with three leaflets, *Monophylla* is degenerate in foliage and frequently in flower: on the other hand crosses between species frequently give multi-foliolate plants which seems to point to the fact that the three leaf plant has not fully developed; the flowers of such plants are sometimes quite perfect, e.g. the *chinensis* × *garden* cross, and sometimes degenerate, e.g. the *virginiana* × *vesca*

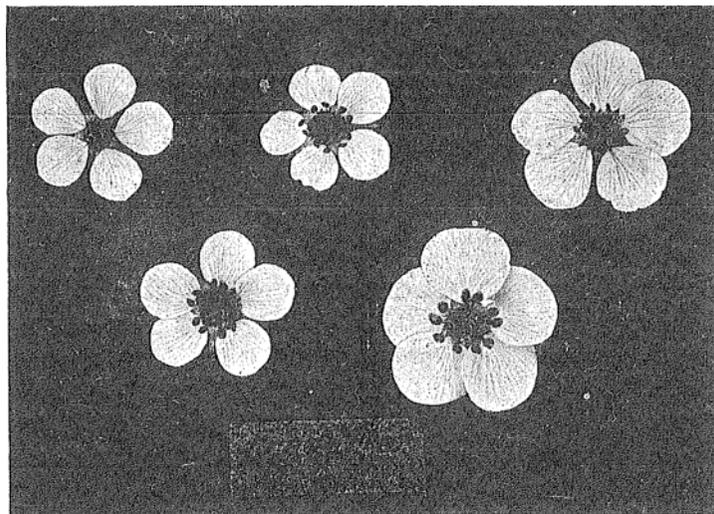


Fig. 2.

cross where very few set seed and there is little pollen, but what there is seems good. *Chinensis* × F_2 (*virginiana* × *vesca*) set seed freely, which has germinated very well. One may expect a strong race of plants from a cross with *chinensis* or *chiloensis*, and it is more than likely such a race will produce five or even six leaflets on the end of the leaf stalk and two more leaflets on the stalk some three inches lower down. With plants breeding true for flavour it will be possible to make these robust crosses produce fruit of good flavour. Such crosses produce fruit with large seeds, and if they produce these seeds in large numbers the fruit will be large and of good form. The actual shape can no doubt be arranged by crossing with plants of the shape desired; there is some evidence that long is dominant to round, but at present this is a little confused by

fruit-doubling or trebling and taking a spade-like or cock's comb shape. There is some difficulty at present in breeding pure hermaphrodites as some free flowering plants set very little fruit, and plants from seed of such fruit are far from uniform in the amount of fruit they set. I had *virginiana* and Hautbois males which never set seed whether grown indoors or out.

Last Autumn, Winter and Spring seed was germinated under glass: (1) exposed to sunlight, (2) under one thickness of thick white paper, (3) in the dark. The results of many tests were so conflicting that the satisfactory conclusion was come to that light has very little definite effect on the germination of strawberry seed. Whilst engaged on these experiments I found seed from the same fruit might take five days or ten weeks to germinate, as a rule the larger the seed the sooner it germinated, but this was not invariably the case.

In conclusion I am very glad once again to be able to thank the John Innes Horticultural Institution for the facilities afforded me in carrying on my experimental work. A season which has demanded more watering than is generally required in this country has been helpful in encouraging the production of pollen, but has largely reduced the size of fruit and checked the growth of shallow rooting varieties.

NOTE. The plants named "*chinensis*" in these and other notes published in this Journal were obtained from the Royal Botanic Gardens, Kew, in 1910, where the parent plants are still to be found. This name does not appear in *The Index Kewensis*, but is used in the private records at Kew where reference is made to these plants. The plants are very hairy, smaller, lighter in colour and less shiny than *chiloensis*. I would class them as a subspecies of *chiloensis*, whether they came from China or not. Plants crossed with known species gave in the F_1 families individuals which appeared to be alike in all points except six. Unfortunately all the plants are ♀ so I have not been able to self.

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