

INHERITANCE OF FRUIT COLOUR IN THE *SOLANUM NIGRUM* COMPLEX

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ABSTRACT

In the *Solanum nigrum* complex there is wide variability in the fruit colour. In 17 accessions representing diploids, tetraploids and hexaploids, dark shining blue, dull blue, bright red, orange red, yellowish-red and translucent green were observed in the different accessions. Blue is inherited as dominant over red and translucent green; however, the results obtained in crosses between blue and translucent green cannot be explained on the basis of this simple relationship and it is tentatively assumed that duplicate genes are involved in this case. In the tetraploids *S. nigrum*, *S. villosum* and *S. miniatum* the different shades of red seem to be controlled by alleles at the same locus.

INTRODUCTION

THE different species and races in the *Solanum nigrum* L. complex representing diploids ($2n = 24$), tetraploids and hexaploids enjoy very wide distribution throughout the world. During our studies on the cytogenetics of the complex in the 17 accessions representing all the three cytological races, procured from different geographical regions, much variation in fruit colour has been observed (Table I). The fruit colour in general is shining dark blue in diploids, orange to brilliant red in tetraploids and dull dark blue in hexaploids. Some interesting observations have been recorded on the inheritance of fruit colour in the different hybrids and their colchicine amphiploids and the results are presented in this communication.

RESULTS AND DISCUSSION

The Indian diploid *S. nigrum* S 14 with shining dark blue fruits was crossed to the Indian natural tetraploid *S. nigrum* S 33 having bright red berries. The resulting hybrids, being triploids, were completely male and female sterile. The hexaploids produced on colchicine treatment of these

TABLE I

Table showing species, chromosome number and fruit colour in the *Solanum nigrum* complex included in the present study

S. No.	Species name	Accession number	Chromosome No. (n)	Fruit colour	Source
1	<i>S. nigrum</i> L.	.. S 14	12	Shining dark blue	University Campus, Waltair, India
2	"	.. S 30	12	"	Rice Fields, Vizianagaram, India
3	"	.. S 31	12	"	Guntur, India
4	<i>S. nodiflorum</i> Jacq.	S 16	12	"	Royal Botanic Gardens, Kew
5	<i>S. americanum</i> Mill.	S 9	12	"	Hortus Botanicus Hauensis, Denmark
6	<i>S. gracile</i> Dun.	.. S 144	12	"	Westland, New Zealand
7	<i>S. photeinocarpum</i> Nak. et Odashi.	S 35	12	"	Nagayo, Japan
8	<i>S. nigrum</i> L.	.. S 15	24	Bright red	Pedapalla, A.P., India
9	"	.. S 33	24	"	Simhachalam, India
10	<i>S. luteum</i> Mill.	.. S 6	24	Orange-red	Hortus Botanicus Hauensis, Denmark
11	<i>S. villosum</i> Dun.	.. S 18	24	"	Royal Botanic Gardens, Kew
12	"	.. S 135	24	Yellowish to orange-red	Denmark
13	<i>S. miniatum</i>	.. S 28	24	Bright coral red	Institute Botanique, Coimbra, Portugal
14	<i>S. nigrum</i> L.	.. S 11	36	Dull dark blue	Shyamnagar, India
15	"	.. S 15	36	"	Hortus Botanicus Hauensis, Denmark
16	"	.. S 8	36	"	New Zealand
17	<i>S. memphiticum</i> Mart.	S 26	36	Translucent green	Denmark

triploids showed pale blue colour of their berries (Fig. 1). In three of the plants raised from the seeds of these synthetic amphiploid berries were having pale blue colour. Likewise, the triploid hybrids, obtained from the cross between *S. nodiflorum* S 16 with shining dark blue berries and *S. villosum* S 18 bearing orange-red berries, were sterile. These triploid hybrids on treatment with colchicine in turn produced hexaploids which were invariably self-sterile. However, the amphiploid was setting fruits when pollinated with pollen from the natural hexaploids S 8, S 11 and S 15. In all such crosses the fruits on the synthetic hexaploid were invariably dull dark blue.

The berry colour of these synthetic hexaploids was blue even when the pollen of *S. memphiticum* S 26 (with translucent green fruits) was used for pollination (Fig. 2). From these observations the genetic symbolization is given as shown in Figs. 1 and 2, where blue is dominant over red.

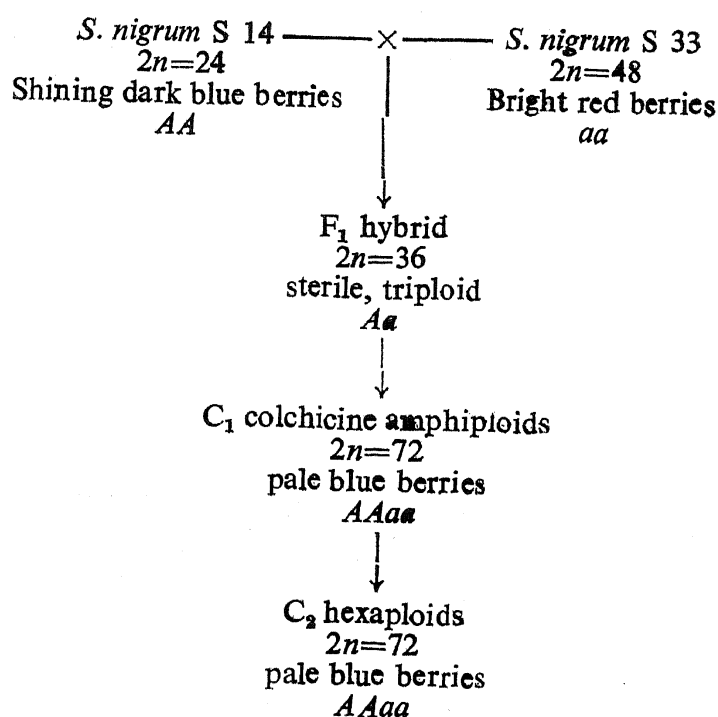


FIG. 1. Inheritance of fruit colour in crosses between Indian diploid and tetraploid races of *S. nigrum*.

The two diploids referred to above, viz., S 14 and S 16 were intercrossed and the F_1 , F_2 and F_3 had all shining dark blue berries.

The two tetraploids used in the above crosses, *S. nigrum* S 33 with bright red berries and *S. villosum* S 18 with orange-red berries, were also hybridized. The F_1 and all the F_2 plants had red fruit colour and the intensity of colour was intermediate between those of the two parents. Similar was the result in crosses between *S. miniatum* S 28, a tetraploid with bright red berries from Portugal and *S. villosum* S 18. Therefore in the tetraploids studied it appears that alleles at the same locus are involved in the production of red colour.

When *S. memphiticum* S 26 was hybridised with any race of *S. nigrum* hexaploid the F_1 had blue berries. It was found that blue colour was inheri-

ted as dominant over orange-red, bright red and translucent green. However, the inheritance of green or blue berry colour in hexaploids seems to be a rather complex phenomenon. In the F_1 hybrids of the cross made between *S. nigrum* S 11 (dull dark blue) and *S. memphiticum* (translucent green) fruits were exclusively pale blue. In the F_2 progeny of this hybrid

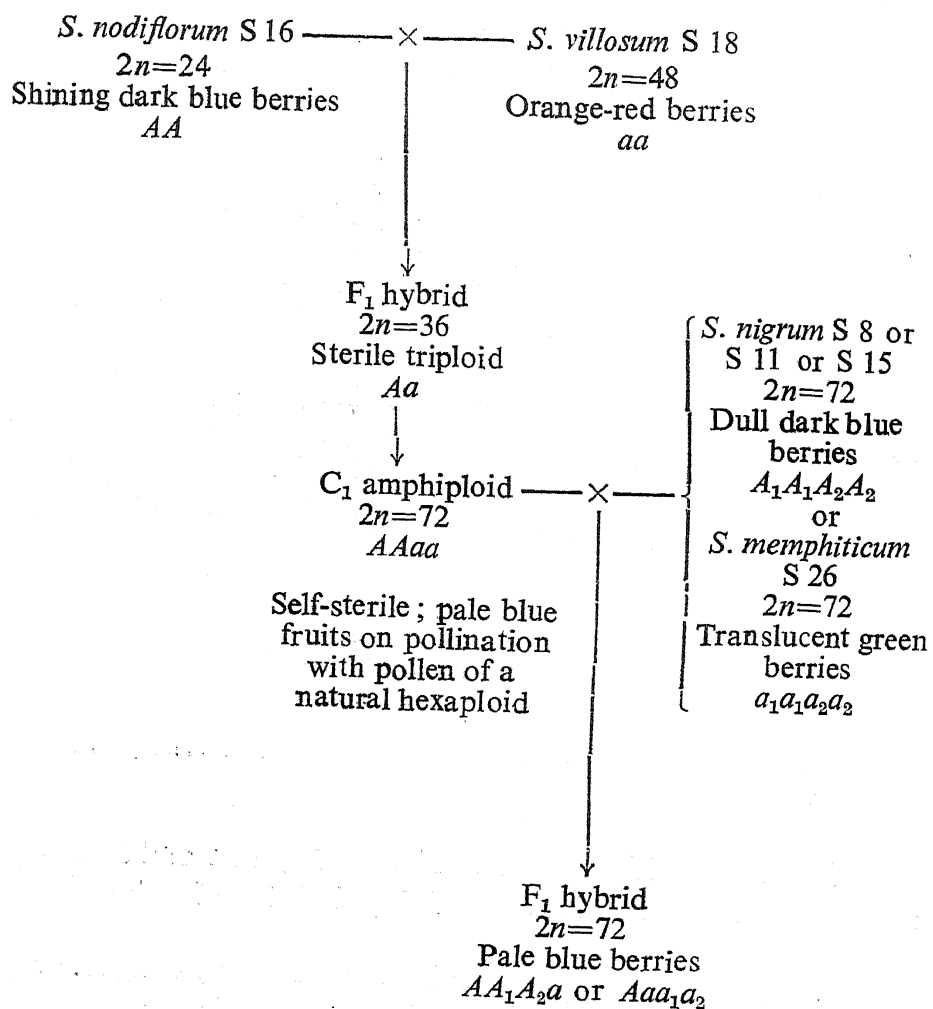


FIG. 2. Inheritance of fruit colour in crosses involving *S. nodiflorum* and *S. villosum* and their polyploid derivatives.

one of the 30 plants raised had developed berries with mosaic colour, while all the rest had blue berries. Berries of this particular plant had a pale translucent green colour except for the patch of pale blue colour developed at their attachment with the fruit stalks. In the F_2 generation of the reciprocal cross 19 of the 20 plants had pale blue berries, while one had completely translucent green berries (Fig. 3). Further, when the F_1 hybrid of the cross, *S. memphiticum* \times *S. nigrum*, which had pale blue berries, was back-crossed

as female parent to *S. memphiticum* (translucent green fruits) the three plants that were available had developed translucent green berries only. The segregations observed in the F_2 generation fit into 15:1 ratio of blue: green with a low χ^2 value ($\chi^2 = 0.44$; $p = 0.7-0.5$). From this it appears probable that the character has duplicate gene inheritance and the factors are represented in Fig. 3. The basis for the expression of mosaic colour pattern, with a pale blue spot at the attachment region but otherwise green fruit produced in one of the F_2 plants, is not clear, but one possible explanation is that in the F_2 segregants a particular genotype induces a recessive allele to mutate to dominant state producing blue pigment, somewhat similar to the a_1 being mutated to A_1 in the presence of *Dt* in maize observed by Rhoades (1941).

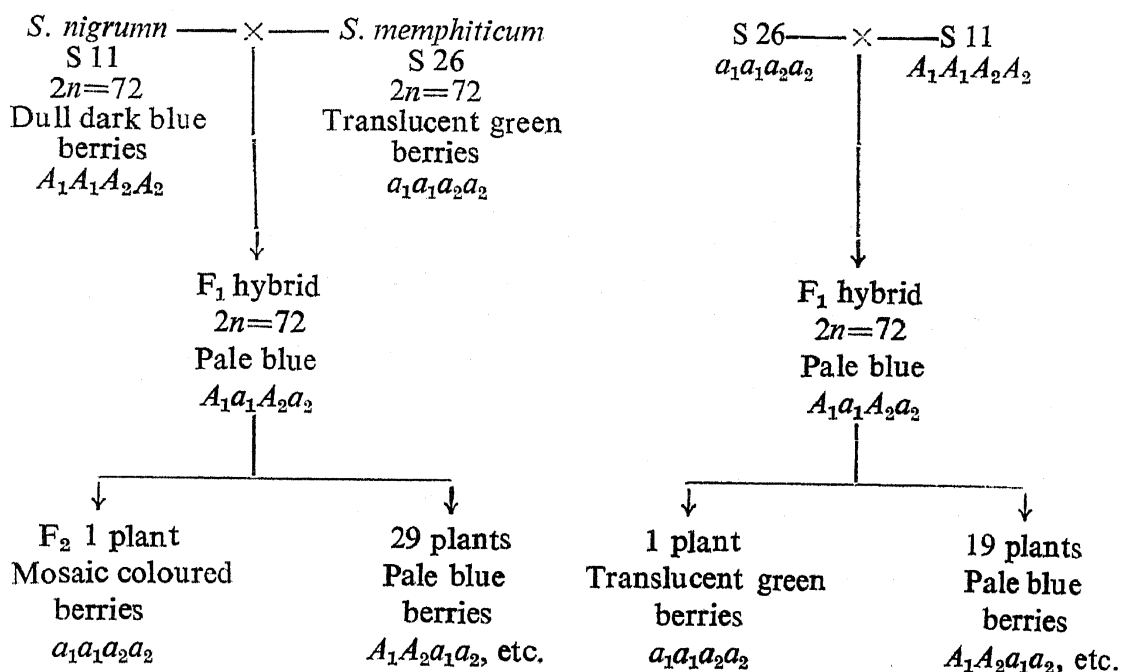


FIG. 3. Inheritance of fruit colour in reciprocal hybrids between two hexaploids *S. nigrum* and *S. memphiticum*.

ACKNOWLEDGEMENTS

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REFERENCE

- Rhoades, M. M. .. "The genetic control of mutability in maize," *Cold Spring Harbor Symp. Quant. Biol.*, 1941, 9, 138-44.