Progress in Breeding for Seedless Grapes

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In an earlier report (1) this particular project in the breeding for seedless grapes was outlined in respect to the cooperation involved, the materials and methods employed, the results obtained to that date, and some of the more important data regarding the genetics of seedlessness. Especially was it reported that 84 seedlings had been obtained which bear seedless or near-seedless fruit.

Of the vines that have come into bearing during the two years since 1937, 124 have seedless fruit and these bring the total of such plants to the number of 208. Also some further data concerning the genetics of seedlessness have been obtained.

All of the 208 seedlings mentioned above produce stenospermocarpic (2) fruits. In such fruit there is pollination followed by fertilization in one or more ovules of an ovary. But the embryos do not mature and the seeds become shrivelled, small in size, and often soft and pulpy. There is considerable variation among the different seedlings in the degree of development of stenospermic seeds. When they are of relatively large size and are papery or gritty they may be termed near-seedless. The well known seedless grapes, Sultanina (Thompson Seedless), Sultanina Rose and Black Monukka have stenospermic seeds and these are usually of small size.

Facultative and Obligate Vegetative Parthenocarpy

Facultative vegetative parthenocarpy is frequent in the plants of the various cultures grown in this project, both for vines which bear stenospermocarpic fruits and for those which bear seeded fruit. In such cases the entirely seedless berries of decidedly smaller size are formed only when pollination and fertilization does not occur.

Vegetative parthenocarpy in these grapes is inherited independently of stenospermy or of the condition of functional ovules.

Obligate vegetative parthenocarpy only occurs in grapes when vegetative parthenocarpy is present together with the condition in which *all* ovules are non-functional in any fertilizations, as is the case in the Corinth grapes. The berries of this type are always of relatively small size. When berries of facultative development are in clusters along with stenospermic berries or seeded berries the difference in size is very striking. Evidently the stimuli (or growth substances) which result from fertilization and the developing embryos and seeds do not travel from ovary to ovary.

Progenies

Of the Corinth Grapes:—The Black Corinth, the Panariti, and the White Corinth grapes have been used as pollen parents with 25 differ-

[1]Journal Article No. 364, New York State Experiment Station.

[2]This project is one of cooperation between the writer, representing The New York Botanical Garden, and the members of the Department of Pomology of the New York State Experiment Station at Geneva, New York.

ent seeded grapes as seed parents and a total of 489 plants of the F_1 have fruited. Every one has borne seeded fruit. Some of them possess facultative vegetative parthenocarpy but in no case has this been combined with the abortion of all ovules. Several F_2 progenies are being grown but none of these seedlings have fruited.

Of Concord Seedless and Sultana:—These two grapes produce stenospermocarpic berries. Both yield viable pollen. The Concord Seedless was used as a pollen parent in 15 different combinations and 184 F_1 seedlings and also a considerable number of the F_2 have been grown to fruiting age. Every one of these had seeded fruit, but for some there was also facultative vegetative parthenocarpy. All the F_1 progeny of Sultana which have fruited (123 to date) bear seeded fruit. Plants of the F_2 have not yet fruited. Through an omission of the word "not" there is an error in the statement on the seventh line from the bottom of page 418 in Vol. 34 of the PROCEEDINGS OF THE AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE. The statement should read "It appears from these results that the stenospermy of the Sultana can not be considered as dominant to the seeded condition."

From Sultanina, Sultanina Rose, and Black Monukka:—As reported in 1937, the F_1 progenies of these grapes as pollen parents with seeded grapes as seed parents are composed of *both* seeded and seedless individuals.

Of combinations with Black Monukka, to date 47 seedlings have fruited of which 25 are seedless. Of the F_1 progenies of Sultanina 90 are seeded and 73 are seedless. Sultanina Rose is the pollen parent of 122 vines which have fruited and of these 46 are seedless. The seed parents used in this breeding do not yield seedless offspring when selfed or used in crosses with seeded grapes except in rare instances of mutation or possibly of recombination of hereditary factors. Yet the combination *seeded x stenospermocarpic* (in these particular grapes) gives both *seeded* and *stenospermocarpic* in the immediate generation in numbers that approach a 1:1 ratio. This suggests that there is a basic single allele relationship in which one parent is homozygous and the other heterozygous.

Of a Seedless Seedling:—Several of the new seedless grapes of the F_1 have imperfect flowers, hence it is evident that stenospermy is inherited independently of either the reflexed (imperfect) or the upright (perfect) types of stamen. Several of the new seedless vines which have perfect flowers have been used in further breeding both with sister plants that are seeded and with certain of the named seeded clones.

The first seedless plant of this breeding was seedling 10918 (later named Stout Seedless) and this has been employed in breeding with Golden Muscat, Keuka, Melton, Seneca, and a promising seedling, No. 8536. In every progeny there have been both seeded and seedless members, and the respective totals are, to date, 58 and 51. The largest single progeny, with Golden Muscat as the seed parent, consists of 22 seeded and 25 seedless. In the back cross with its own seed parent, for the progeny that have fruited 12 are seeded and seven are seedless. This seedling is of *seeded x stenospermocarpic* parentage; when it is

used in the same combinations there are again both *seeded* and *stenospermocarpic* in the F_1. This plant appears to be heterozygous for a fundamental dominant factor for stenospermy quite as do the Sultanina, Sultanina Rose and the Black Monukka clones.

Of F_1 Seeded Vines Which Have a Parent That Is Seedless:—In the progenies grown from selfed seed there has been extreme and general weakness of seedlings and this condition has interfered with genetic tests by selfing. A seeded seedling 10919, sib of 10918 and which has vigorous growth, was selfed and 781 seeds were obtained and planted. Only 14 of the seedlings lived to vineyard age and of these only six have fruited. One of these bore seedless fruit. Also there has been one seedless vine in the 23 members which have fruited of progenies obtained by crossing this plant (10919) with the seeded clones Keuka, Melton and Urbana. In this case the results suggest that *seeded* vines in the F_1 of *seeded x stenospermocarpic* may carry factors for stenospermy, or that the hybridization has induced mutation to such factors.

CONCLUSIONS

The segregation in the F_1 of *seeded x stenospermocarpic* when certain seedless grapes are used suggests a genetic relationship of ss x sS. But the Concord Seedless and the Sultana which also have stenospermocarpic berries do not give such results and are not to be considered as sS. Also at least some of the seeded sibs of the F_1 stenospermocarpic vines are not to be considered as pure ss in constitution. The wide variation in the degree of development in the stenospermic seeds for the 208 seedlings which bear stenospermocarpic seeds indicates that there are various modifying factors affecting expression of any fundamental factors that are assumed.

The 208 seedlings which bear seedless fruits are being evaluated and the most promising ones are being propagated for vineyard tests. They, and the best of their sibs which are seeded, are being used in further selective breeding, of which a considerable number of seedlings have not yet reached fruiting age.

LITERATURE CITED

1. STOUT, A. B. Breeding for hardy seedless grapes. *Proc. Amer. Soc. Hort. Sci.* 34: 416–420. 1937.
2. ———— Seedlessness in grapes. *N. Y. Agr. Exp. Sta. Bul.* 238. 1936.