Sterile Hybrid Grape Made Fertile with Colchicine

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The following is quoted from T. V. Munson in Investigation and Improvement of American Grapes, 1900:

"It long has been the ambition of the writer to make hybrids of the Scuppernong with the finer, large cluster, tightly clinging true grapes, and thus secure the valuable properties of both in one combination. To combine the perfectly disease and heat and drouth resisting character of the Scuppernong, and its rich fruity flavor with the great cluster, persistent berry and other distinct flavors, and possibly the capability of growing readily from cuttings of the true grapes, would truly make an epoch in grape development worth a place in history."

Hybridization of bunch-type grapes (*Vitis vinifera, V. labrusca,* and others) with muscadine grape *(V. rotundifolia)* has been attempted numerous times in the past. The primary aims in attempting such crosses have been (1) to produce bunch grapes that can be grown successfully in the southern states, where at present mainly muscadine grapes are grown, and (2) to introduce into bunch grapes the resistance to various diseases and insect pests of *V. rotundifolia.*

Such hybridization has been obtained with difficulty, presumably because these species of bunch grapes have 19 pairs of chromosomes, whereas the muscadine grape has 20 pairs. And perhaps for the same reason, the few hybrid plants obtained have been nearly sterile, and have produced only a few berries. Two such hybrids, N.C. 6–15 and N.C. 6–16, from a cross of a seedling of the Malaga variety of *V. vinifera* with a male *V. rotundifolia* were obtained in 1917 by L. R. Detjen at the North Carolina Agricultural Experiment Station. These hybrids contained 39 (19 + 20) chromosomes, the expected number in such a hybrid. Patel and Olmo (2) give details about hybrids of this type and many problems connected with them.

In 1955 one available plant of N.C. 6–16 was treated with colchicine (1) in the greenhouse at Beltsville. One of the branches on the plant, the same year the treatment was applied, was found to have its chromosome number doubled in all tissues except the epidermis. The doubling of chromosome number is termed polyploidy, and the term colchiploidy (1) is used to describe doubling obtained by the use of colchicine. In 1956 only one flower cluster grew on the polyploid branch, and this developed into a bunch of 33 berries, whereas, only 2 berries developed from a flower cluster on a diploid branch (Fig. 1). Many other diploid flower clusters failed to set fruit.

In 1957, there were several bunches of grapes on the polyploid branch. Some of them were a little larger than the large bunch in Figure 1; others were about the same size or smaller. No fruits developed from several flower clusters on diploid branches. The fruit color was a very attractive purple; and the fruit skin was thin, but tough. The fruit was juicy and sweet; flesh texture was firm; the flesh separated from the skin readily and was not crisp as in *V. vinifera* grapes. The berries were comparable in size to those of Concord.

From the 33 berries of the polyploid bunch (Fig. 1) 48 seeds were obtained, and from these 42 seedlings

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were grown. The seedlings appear to be indistinguishable from one another in all observable characters. A few were examined cytologically; and all were tetraploids like the internal tissues of the branch on the original species hybrid and had 78 chromosomes. Two seeds were obtained from the two berries of the diploid branch, but only one germinated. The chromosome number of this seedling also was 78, the same as that of the seedlings from the large bunch. This one seedling appears to be identical with the ones obtained from the tetraploid berries. It will take a year or two to learn whether these seedlings are truly identical or different in some respects.

This is the first time that full fertility has been obtained in material derived from a cross of *V. vinifera* x *V. rotundifolia.* If these seedlings prove to be alike in all characters, selfing of the fertile hybrid will yield only plants identical with the tetraploid hybrid, except that all tissues in the seedlings, including the epidermis, will be polyploid. This would mean, therefore, that one tetraploid fertile hybrid will not provide an interchange of desirable characters of the different parental forms to produce genetically different seedlings. To obtain such an exchange of characters, which would result in differences in seedlings, a breeder would need additional tetraploid fertile hybrids, which would be genetically diverse. If these can be obtained, the desirable varieties may eventually be developed through adequate selection methods.

During the last three years (1955–57) hundreds of crosses were attempted; once by using 4x (tetraploid) muscadine vines (1) as female and 4x bunch grapes as male parents; and twice by using 4x grapes as female and 4x muscadines as male parents. It was hoped that such crosses would produce fertile hybrids directly for purposes of breeding and selection, without the intervening use of colchicine; but no fruit was obtained.

In 1956 some crosses were also attempted between the diploids of the two types of grapes, with self-sterile (reflex-stamen type) bunch grapes (varieties Franklin, Lindley, and selection U. S. 519–28) as female parents, and some perfect-flowered (hermaphrodite) muscadine selections as male parents. No set was obtained on flowers of Lindley; a few seeds were obtained from U. S. 519–28 and a heavy set was obtained from the cross with Franklin. It was with great surprise and satisfaction that we found, from cytological examination and from observation of some vegetative characteristics, that all of the 25 U. S. 519–28 seedlings and 98 percent of the 200 seedlings of the Franklin were true hybrids, and that such a high set was not due to contamination with pollen from other sources. Obviously there is a certain degree of sterility barrier involved in the cross of the two types of grapes, which apparently is increased when tetraploids are used.

About 75 of the most vigorous

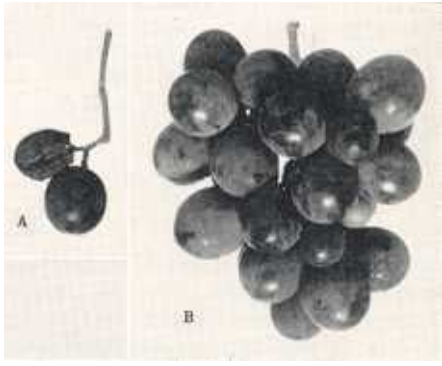

Fig. 1. **(A.) Grape bunch with two berries from a diploid branch of a hybrid of *V. vinifera* x *V. rotundifolia.* (B.) Bunch with several berries on a 4x fertile hybrid branch of the same vine obtained through colchicine treatment.**

diploid hybrid seedlings resulting from the cross of Franklin and U. S. 519–28 with the diploid muscadine grapes were selected and colchicine was applied to them. (For technique see reference 1.) It now appears that tetraploidy has been induced in some two dozen of these diploid hybrid seedlings. At the same time a few plants of the hybrid N.C. 6–15, mentioned previously, also were treated. There appear to be tetraploid changes among these also. If these colchiploids prove to be fertile like the colchiploid of N.C. 6–16, it should be possible to cross them and bring about segregation of characters, so that superior types combining the best characteristics of the bunch grapes and the muscadines can be selected.

The potentialities of this new, colchiploidy method of breeding grapes to combine the desirable characteristics of the bunch grapes and muscadines appear to be great. However, a great deal of work by many competent workers will be required to develop its full possibilities.

LITERATURE CITED

1. Dermen, Haig. Colchiploidy in grapes. Jour. Hered. 45:159–172. 1954.
2. Patel, G. I. and H. P. Olmo. 1955. Cytogenetics of Vitis: 1. The hybrid *V. vinifera* x *V. rotundifolia*. Amer. Jour. Bot. 42: 141–159. 1955.

Attention readers. If any of you should happen to know of a source of trees of the apple varieties Dyer, Cole Quince, Willow Twig or Black Gilliflower, please contact Mrs. Albert Kloppenborg at 901 East 7th Street, Newton, Iowa. She will be most grateful.

Apple Varieties in Indiana

The following paragraphs dealing with some of the newer apple varieties, are based on performance at Purdue University farms during 1957.

Idared: At the Purdue Experimental Farm at Bedford, Indiana, trees of Idared in their third growing season became severely infected with fireblight, to the extent that almost all of the trees will have to be removed. In comparison, only slight twig blight occurred on adjacent two year old trees of Jonathan, and none on two and three year old trees of Franklin, Ruby, Melrose and Crandall.

Ruby: At the Purdue Experimental Farm at Lafayette, three year old trees of Ruby produced their first specimen type fruit. The fruit, with a bright cherry red over-all skin color, was some of the most attractive ever grown in the area. Unfortunately the quality was only poor. Whether or not changes in culture, or time of harvest and storage would improve fruit quality is not known. The tree has the fault of being very upright, with narrow-angled crotches.

Davey: At the end of their seventh growing season, trees of Davey have remained extremely vigorous and productive at Lafayette. The fruit, however, continues to be heavily roped on the trees, develops very little color, and is too soft under Indiana conditions.

Erickson: This variety has good tree characteristics and appears to be highly resistant to disease at Lafayette. The fruit is semi-striped, cherry red over a green ground color. Lack of color and unevenness of color distribution do not make it very promising for Indiana.—*R. B. Tukey, Purdue University, Lafayette, Ind.*