

## *Vitis cinerea* as a Source of Desirable Characters in Grape Breeding<sup>1</sup>

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THE warm, humid areas of eastern North America, especially the Mississippi valley region and southeastern United States, present certain difficult conditions for grape growing. Few commercial grape varieties are well adapted to this region where long, warm growing seasons are combined with high atmospheric humidity and relatively high but erratic rainfall distribution during the growing period. Fungus diseases usually severely damage many varieties and cause serious losses. Cracking of the berries, uneven maturity, and injury from drouth and heat are encountered where poorly adapted varieties are grown in these areas. Rapid and extreme temperature changes in winter, with winter killing of buds and canes, are additional problems found in many parts of this region, the Mississippi valley especially.

Even though most of our present commercial varieties are not well adapted to this region it is significant that the wild grape flora is notable for the abundance of diverse species and variations of forms as well as numbers of plants. Among the native grape species is found the sweet winter grape, *Vitis cinerea* Engelm., a species of considerable interest for the many desirable characters which it offers to the grape breeder.

*V. cinerea* is found in its natural state growing in the bottom lands of streams where the very vigorous vines grow over and through the tops of the tallest trees, often eighty feet or more above the surface of the ground. These bottom land soils are usually a rich silt loam of high fertility and are often inundated by water at various times during the year. Occasionally vines are found growing on upland soils of lesser fertility where there is no water overflow, but here again the vines are always vigorous and attain a size similar to that which they reach in the bottom lands.

In 1948 a systematic collection of wild grape species was begun with the major effort concentrated on locating superior selections of *V. cinerea* for study and use in grape breeding. Thousands of wild vines, chiefly in the Illinois and Wabash river valleys and their tributaries, were examined and the superior types marked for observation and selection. In addition seed from the best vines was obtained and the resulting seedlings were grown in the vineyard for the same purpose. Since all native grape species in this region are dioecious the possibility of using male selections was not overlooked and during the blossoming period a special effort was made to study and evaluate these male vines also. This study and selection work with wild grape species has been carried on each year since that time and is continuing.

Wild plants of *V. cinerea* vary in vine and fruit characters just as cultivated varieties do. Because of the small size of the berries none

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of them are of any commercial value in themselves for fresh dessert fruit. The fruit is usually rather acid until frost or full maturity when it becomes sweet with a very refreshing and pleasant flavor. The skin and flesh are not astringent and the texture is rather tender and crisp, unlike the tough, stringy flesh and astringent skin of *V. labrusca*. No objectionable odors, flavors, or "foxiness" have been noted in any of the wild vines. The quality is surprisingly good despite the small berries and small but noticeable seeds. Great variation was noted in cluster size and shape, in number of clusters per shoot, in compactness of the berries in the cluster, and vigor of the shoots. No apparent variation was observed in color and shape of the berries—all were black and spherical in shape. The sugar content and acidity were generally high, although both varied somewhat with seasons and different clones. Resistance to the various diseases varied slightly but in general most were remarkably free of disease whether growing in natural surroundings or as cultivated plants in a vineyard.

Beginning with the crossing season of 1949, certain selected vines of *V. cinerea* growing in the wild were used as parents in combination with several commercial grape varieties. No reports of the extensive use of *V. cinerea* in grape breeding have been found in the literature, and it is felt that observations on the characteristics of these  $F_1$  seedlings and a comparison with both the commercial and wild parents may be of interest to other breeders.

Although *V. cinerea* has been used as a parent in crosses in most of the years since 1949 in combination with other wild species, viniferas, French hybrids and American hybrids, this report is based on crosses using the Golden Muscat and Seneca varieties of American hybrids as the pollen parents. Both of these varieties, attenuated labrusca-vinifera hybrids with predominantly vinifera characters, are well known productions of the Geneva, New York station.

#### PLANT AND FRUIT CHARACTERISTICS OF THE $F_1$ HYBRIDS

The  $F_1$  hybrids between *V. cinerea* and both Golden Muscat and Seneca have been fully hardy here. Seneca closely approaches a vinifera in its characteristics, is not reliably hardy here and, in most years, some injury to buds and wood occur. Golden Muscat is considerably hardier than Seneca and usually does not suffer from winter injury. The resistance of these  $F_1$ 's to high summer temperatures and drouth has been exceptional. No premature dropping of foliage or shriveling of the berries because of insufficient soil moisture has occurred. Foliage has remained green and luxuriant throughout the season as in the *V. cinerea* ancestor.

Disease resistance has received considerable attention in the breeding program and is perhaps the greatest problem encountered in areas of similar growing season climate. Both commercial parents are very susceptible to black rot and downy mildew. The *V. cinerea* parent is one of the most highly resistant to black rot of any grape species thus far studied. Downy mildew resistance is also very high and only under exceptional climatic conditions do a few scattered

leaves show an occasional infection of downy mildew. The  $F_1$ 's have shown an intermediate degree of resistance to black rot, varying from medium to only a trace on the berries, while similar seedlings derived from crosses between commercial varieties in adjacent vineyard rows have shown an almost complete loss of fruit from black rot infection. Downy mildew has not been noted on the  $F_1$ 's. Powdery mildew, anthracnose, and botrytis or ripe rot have not been a problem on either the parental varieties or the  $F_1$  hybrids.

The only insect which has been noted to cause damage on the unsprayed  $F_1$  seedlings has been the grape leaf folder. The foliage of these seedlings is like that of their *V. cinerea* parent in the relative abundance of hairs on the underside of the leaves and this condition apparently is very favorable for this insect. It attacks the commercial parents with less severity, presumably because they have less leaf hairs.

In vine growth the  $F_1$ 's are vigorous to very vigorous and more closely approach their *V. cinerea* parent in this respect. Under extreme drouth conditions or heavy competition from dense weed growth the  $F_1$  hybrids have been greatly superior to their commercial parents in vigor.

Time of bloom has been intermediate between the blooming periods of the parental varieties. *V. cinerea* is a notably late blooming species, often blooming two or three weeks after the commercial parents. Fertility has been good on the  $F_1$ 's, measured either as berry set per cluster or number of clusters per shoot, and appears to be satisfactory.

None of the  $F_1$ 's matured fruit as early as the early parental variety Seneca or as late as the *V. cinerea* parent. In both of the crosses with Seneca and Golden Muscat, (the latter variety matures in midseason to slightly later), maturity of the seedlings appeared to be intermediate between the commercial parents and the *V. cinerea* parent. The ability of the mature fruit clusters to hang on the vine for extended periods of time without deterioration in quality or loss of fruit through disease, shriveling, or dropping from the clusters was very marked and this character appears to parallel the wild species parent.

Cluster size has been very promising in the  $F_1$ 's with predominantly large, relatively compound clusters, as in the wild parent. The clusters are also very attractive, being fairly long, tapering, often shouldered or branched and with fairly loose to slightly compact arrangement of the berries. Berry sizes have been intermediate between the parents, none being as large as the commercial parents nor as small as the *V. cinerea* parent. Shape of berry has ranged from spherical, as in the wild parent, to ovate, as in the commercial parents, with most berries spherical.

The fruit of all seedlings has been black like the wild parent; no reds, whites or intermediate colors have been noted. Both commercial parents are pale yellow colored and they appear to be recessive to the black berry color of *V. cinerea*. The berries on the  $F_1$  hybrids have been well attached to the pedicels and no shelling from the

clusters was noted. No cracking of the berries due to variable moisture conditions or powdery mildew infection has been observed.

Seed size in the  $F_1$  hybrids is intermediate between the medium large size seeds of the commercial parents and the very small seeds of the *V. cinerea* parent.

The sugar content of the expressed juice has been exceptionally high in many of these  $F_1$  hybrids. Readings on a hand refractometer have shown soluble solids to run as high as 28 per cent, with most of the readings above 20 per cent. In this respect these hybrids have exceeded most of the seedlings derived from crosses of commercial varieties. Some of these seedlings have exceeded both the commercial and wild parents in soluble solids. No acidity measurements of the juice were made except to note by taste. In most of these seedlings the acidity appeared to be moderate to moderately high, as in the *V. cinerea* parent, and greater than either of the commercial parents.

It is well known that personal opinion as to what constitutes desirable and undesirable quality in grapes varies widely between individuals. No "foxiness" or objectionable flavors and aromas were noted in these seedlings. The Golden Muscat has a muscat flavor which varies in intensity with different seasons but no muscat flavor was detected in any of the seedlings having Golden Muscat as a parent. Although most of the  $F_1$ 's were judged to be moderately high in acidity, it was not objectionable nor was any astringency in either flesh or skins noted. The consistency of flesh and skin were judged to be generally favorable with no evidence of toughness or marked change from the skin inward toward the seeds. While the smaller size of the berries made the seeds more noticeable than in the commercial parents, the seeds were smaller and easily freed from the flesh. None of these  $F_1$  seedlings could compare with their commercial parents as table varieties, chiefly because of their smaller sized berries. It does not appear that desirable berry size will be achieved in the  $F_1$  generation.

It is believed that the most valuable characters of *V. cinerea* which appear to be transmitted to its progenies in crosses with commercial grape varieties are the following:

(a) Adaptability to areas of high temperatures and humidities during the growing season; (b) High resistance to grape diseases; (c) Vigorous vines of good fertility; (d) Large, attractive, compound clusters; (e) Good quality berries free of "foxiness" or other objectionable flavors and aromas; (f) High sugar content of the fruit; (g) Long keeping ability of the fruit after maturity.

It should be possible to incorporate these features of *V. cinerea* in our commercial grape varieties and develop new varieties well adapted to warm humid areas where most varieties now in existence do not flourish. Moreover it should be possible to add new and improved qualities to the fruit which would further improve our cultivated grapes and increase their value and desirability.