AN INVESTIGATION OF VITIS ARIZONICA (THE CANYON GRAPE) AS A POTENTIAL ROOTSTOCK IN WEST TEXAS[2]

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ABSTRACT

The Canyon Grape, Vitis arizonica, a species native to far west Texas, is evaluated for its use as a rootstock using six recently developed criteria. The study seeks to determine the suitability of V. arizonica as a rootstock for the purpose of grafting scions of Vitis vinifera (various varieties), the European wine grape, in an effort to enhance wine grape production in Texas. Propagation methods of V.arizonica from dormant, woody cuttings are assessed, as is the efficacy of grafting trials using both rooted and unrooted stock material. Field observations concerning the ecological requirements of V. arizonica are presented including the first report of a leaf-galling form of the grape phylloxera parasiting this species in its native habitat. The necessity of evaluating the performance of V. arizonica as a suitable stock under actual vineyard conditions is discussed, including trails being conducted at the Sul Ross State University experimental vineyard.

Key words: Vitis arizonica, V. vinifera, rootstock, scion, propagation, disease-resistance.

INTRODUCTION

Vitis arizonica Engelm. (the Canyon Grape), one of the 14 species of grapes native to Texas, occurs in the montane regions of far west Texas. It is the only species of grape documented as occurring in this area of Texas known as the Trans-Pecos (Powell, 1988). The species has been little studied with virtually no research concerning its use as a rootstock nor is it currently employed as a rootstock in viticulture. Possibly, its remote range in the southwestern United States and adjacent Mexico made it difficult to collect in the early years of rootstock research. Its western distribution may have seemed beyond the range of the pathogenic phylloxera and hence not worthy of consideration as a rootstock.

The purpose of this study is to investigate V. arizonica as a potential rootstock (stock), particularly for use in the Trans- Pecos Region of Texas in an effort to enhance production of V. vinifera wine grapes. The Trans-Pecos Region, which encompasses the high altitude Davis Mountain area, is new to viticulture. The Davis Mountains area has been cited as the most outstanding region of Texas to grow the high acid cultivars of V. vinifera (Perry & Bowen, 1974; McEachern, 1986). No stocks are employed in this region now. Should the need for a suitable rootstock arise, V. arizonica should be well adapted to serve as a stock in the Trans-Pecos.

Soil conditions vary greatly in the range of V. arizonica. Populations found in the Davis Mountains are rooted in non- calcareous acidic podzols (USDA, 1977). Some populations such as those in Black Gap Wildlife Management Area (BGWMA) are found in alkaline soils along the Rio Grande River. Although not collected for this study, populations are known from the highly alkaline soils of the Glass and Guadalupe Mountains. The range of the canyon grape is so great that it can probably be found in most soil types, with perhaps, the exception of saline soils.

Climatic conditions in the range of V. arizonica also vary considerably. Along the Rio Grande, the climate is very hot with mild winters and little freezing weather. In the upper reaches of the Davis Mountains, summers are mild but winters have prolonged periods of subfreezing temperatures (Perry and Bowen, 1974). One of the most adverse factors to viticulture in Texas, and in the Trans-Pecos particularly, is freezing weather in late spring that damages fruit set. A stock that would inhibit bud break by even a few days would be of great economic value. Bud break of V. arizonica is relatively late and so might serve well in this respect. The populations of V. arizonica occurring in the Trans-Pecos Region are genetically adapted to survive in the environment in which they naturally occur. It is this fact that makes this species worthy of consideration for use as stock in this region. Morton and Jackson (1988) have stressed the importance of considering the ecological conditions of rootstocks or stock progenitors when considering their potential as stocks.

Husmann (1930) stated that a good rootstock is resistant to soil borne diseases and injury, adapted to the soil type, and is compatible with the scion resulting in abundant fruit yields. Nesbitt (1974) amplified Husmann's criteria listing six general characteristics that make an ideal rootstock: (1) adapted to soil and climatic conditions of the geographic area of intended use, (2) easily propagated and grafted to the scion, (3) compatible with the scion cultivar forming a strong graft union, (4) has the correct vigor that induces good fruit set and maturation, (5) has practical immunity or resistance to pathological or entomological organisms found in the area of intended use, and (6) virus free. Because V. arizonica naturally occurs in the Davis Mountains Region, it obviously meets criterion one above. This study seeks to provide data concerning Nesbitt's criteria two and three, with additional observations and comments on the remaining criteria.

MATERIALS AND METHODS

Specimens of V. arizonica were collected in the Davis Mountains of Jeff Davis County, in the Del Norte Mountains in Brewster County, and along the Rio Grande River in the BGWMA also in Brewster County. Cuttings of dormant woody stems were taken in February of 1987 and 1988 and propagated in the greenhouse at Sul Ross State University. The basal ends of all cuttings were dipped in Hormodin 3 (0.8% indole-butyric acid [IBA] equivalent to 8000 ppm) to stimulate root initiation. Cuttings were placed vertically in containers of perlite/vermiculite to root. A misting chamber was employed for some cuttings. After ca. 90 days, rootings were transplanted into sterile potting media. Eight months after the initial collection, dead rootings were removed. Numbers of cuttings, rootings, and survivors were recorded for each population.

Three grafting trials were conducted using V. arizonica as the stock and various cultivars of V. vinifera as the scion. . Twenty grafts of V. vinifera cv. Cabernet Sauvignon were made to unrooted cuttings of V. arizonica. Grafted cuttings were placed in a misting chamber in order to promote both rooting and graft union formation simultaneously. In a second trial, 20 grafts of several V. vinifera cultivars were made to specimens of V. arizonica rooted in pots. In a third grafting trial 15 grafts of V. vinifera (various cultivars) were made on V. arizonica stocks also rooted in pots. In all three trials, grafts were kept in temperature controlled greenhouses. After ca. two months grafts were analysed for successful graft unions. Numbers of attempted and successful grafts were noted and recorded. In addition to the experimental trials described above, a descriptive analysis of V. arizonica was performed based on the literature and extensive field observations of this grape in its natural habitat.

RESULTS

As revealed in Table 1, V. arizonica propagates well from dormant, woody cuttings. When treated with IBA in the form of Hormodin 3,

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76% of all cuttings produced roots. Survival was also high. Cuttings collected from BGWMA rooted at an 80% success rate with all rootings surviving. The results of the grafting trials are presented in Table 2. In the first trial, conducted in March, only three out of 15 successfully rooted and formed graft unions. In the second trial, conducted in August, no successful unions formed. In the last trial, three out of 15 formed graft unions.

Table 1. Propagation of V. arizonica

Population & Treatment	No. cuttings	No. rootings	% rooted	No. survivors	% survivors
Davis H3*	57	39	68	38	66
Del Norte H3*	38	32	84	28	73
Black Gap H3M**	20	16	80	16	80
All	115	87	76	82	71

*H3 Application of Hormodin 3
**H3M Application of Hormodin 3 with misting

Table 2. Grafting trials of V. arizonica (stock) and V. vinifera (scion).

Date [2]	Scion	No. Attempted Cultivar(s)	No. Successful
March 1988	All Cabernet	20	03
August 1988	Various Cultivars	20	00
October 1988	Various Cultivars	15	03

[2]The March 1988 trial was made on unrooted stocks. The August 1988 and October 1988 trials were made on rooted potted stocks.

The first report of Daktulosphaira vitifoliae (the grape phylloxera) parasitizing V. arizonica was also documented. A leaf-galling form of the insect was found on some individuals in the Limpia Canyon area of the high Davis Mountains. No root infesting forms of the aphid were found.

DISCUSSION

Ease of propagation is an economically important trait for grape rootstocks. Because grapes are traditionally propagated vegetatively, an important consideration of rootstock selection is the capacity of a stock to be grown from cuttings or canes. Vitis arizonica can be propagated with good success. Thus, the ability of this species to root from cuttings enhances its attractiveness for use as a stock.

The ability of V. arizonica to form successful graft unions with scions of V. vinifera was not adequately documented by the study. Only six successful grafts were formed in 55 attempts. It may be noteworthy that five of the six successful unions were made to specimens of the BGWMA population of V. arizonica, indicating that this population may possess genetically controlled characteristics making it more compatible with V. vinifera scions.

Although the grafting trials produced a low rate of success, the results must be viewed with caution. The grafting was performed by a person without a great deal of experience in performing grafts. Furthermore, in the first trial some graft unions seemed to be forming well, but without simultaneous root formation by the stock. It has also been noted that the presence of viruses or mycoplasmas in the stock or scion can inhibit or even prevent callus formation and thus stock-scion union (Hartman and Kester, 1983). Stocks collected from the field were not treated to cleanse them of microbes and probably did contain viruses. At this time, it can only be stated that scions of V. vinifera cultivars can successfully be grafted to specimens of V. arizonica. Further trials should be conducted. The propagation and grafting trials only address Nesbitt's second and third criteria listed above. The remainder of this article will address the remaining criteria.

Even though most specimens of this grape are not large and vigorous, they attain considerable size in areas particularly well watered. Individuals with trunk diameters of ca. 4 inches, and greater, exist in the Davis Mountains (unpubl. data). The extent of the root systems of such large plants, although not recorded, must be extensive. The large size of some specimens indicate that, within a well watered vineyard, the Canyon Grape should support ample scion growth and fruit production, thus meeting Nesbitt's fourth criterion. Only field trials can indicate whether or not stock support might be overly ample.

Regarding Nesbitt's fifth criterion, that the stock should have practical immunity or resistance to pathogenic organisms found in the area of intended use, we note that although the resistance of V. arizonica to various soil pathogens is not well documented, the tolerance of this species to the grape phylloxera, Daktulosphaira vitifoliae, has been reported several times. Munson (1909) found that the species was moderately resistant to the grape phylloxera while testing specimens from Arizona. Hussman (1910), in his seminal rootstock research in California, stated that the species was not resistant to the grape phylloxera and so did not conduct field tests with it. Of the specimens treated by Boubals (1966), all were susceptible to the phylloxera biotype found in Europe. More recent work (Granett et al., 1985; Williams and Shambaugh, 1988) indicates that the insect is of several biotypes and forms varying symbioses with different species of grape. Additional field and greenhouse testing is needed to answer questions of tolerance of V. arizonica to the grape phylloxera. Nevertheless, our report of a leaf-galling form of this aphid on V. arizonica in the Davis Mountains calls for reanalysis of the published data. Renewed testing should consider populational differences of both the phylloxera and its host.

Mortensen (1938) found that cotton root rot, Phymatotrichum omnivorum, was one of the most significant limiting factors in growing Vitis species in Texas. Taubenhaus and Ezekiel (1936) reported that V. arizonica was moderately susceptible to the fungus. Significantly, however, Mortensen (1952) noted that one of three V. arizonica plants remained alive after 15 years in soil bearing cotton root rot. Therefore, the full relationship of V. arizonica to this fungus has not been well documented.

Nesbitt's final criterion holds that a good stock is free of viruses. The risk of transmitting viral infection from the stock to scion is an important consideration. There are, however, established procedures for "cleaning" plant material of viruses. They involve sterile micropropagation and/or thermal therapy (Hartmann and Kester, 1983; Barlass, 1987; Monette, 1986). Virus indexing is not within the scope of this study. Vitis arizonica, however, can undoubtedly be purged of viruses as has been demonstrated with other plant material.

CONCLUSIONS

Preliminary analysis of V. arizonica indicates that it may be suitable for use as a stock in the Davis and Del Norte Mountain region of Trans-Pecos Texas. Following Nesbitt's criteria V. arizonica merits further consideration and research. Experimental field trails under actual vineyard conditions should be conducted as soon as is practicable using this species of native grape. Sul Ross State University is currently completing the construction and planting of a 3.2 acre experimental vineyard on campus in which these tests will be carried out in West Texas under a working vineyard setting.

Being a native species, V. arizonica is adapted to the area of proposed use. It might serve well as a stock in alleviating the most critical problem of grape growing in the Trans-Pecos: late freeze damage to buds and inflorescences. Field trials can reveal, within a relatively short period of time, if V. arizonica stocks will delay bud break. It is suggested that this factor may be the most important in proposing this species for additional study.

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