Collecting *Vitis berlandieri* from Native Habitat Sites

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Lime content is the major difference between Northern American and European vine growing soils. This resulted in significant difficulties in the development of rootstocks for European conditions at the end of the 19th and the beginning of the 20th century. It was only the introduction of *Vitis berlandieri* as a breeding partner that led to lime tolerant rootstocks. Despite this key role of *V. berlandieri* for European viticulture, only a few accessions have so far been used for breeding purposes. In most cases these vines were only used because they were available in Europe at this time. The genetic range of the species is certainly much larger and has so far not been utilized. To preserve and evaluate genetic diversity in *V. berlandieri*, grape berries were collected in September 2005 from a large range of natural stands in Texas, United States. 86 individual vines were sampled. The collection locations were found in thirteen counties and across a distribution from N 31° 23′ to N 29° 43′ and W 100° 2′ to W 97° 26′. Berries were sent to USDA, Geneva, NY and seeds collected and shipped to Geisenheim for germination. Vines will be planted in germplasm collections and evaluated for their rooting and grafting ability, their lime tolerance, and other viticultural features. Superior types will then be utilized in the Geisenheim rootstock breeding program.

The response to the phylloxera epidemic in Europe was that at Geisenheim at the end of the 19th century rootstock breeding was initiated. At this time there were only a small number of individuals of each of the wild species available for breeding. These were mostly selections from the North American wild species *Vitis riparia*, *Vitis rupestris* und *Vitis berlandieri.* Although there is independence of flowering time and flowering type (male vs. female), hybridization was accomplished among these species and selections. Rootstock breeding also incorporated *V. vinifera*. The result was rootstock varieties that had varying amounts of phylloxera resistance or tolerance, rooting ability, affinity to scion varieties, and adaptation to different soil types.

All the rootstocks in use today in principal derive from these very few individuals of the wild species of North America. Only a small germplasm pool or genetic variation has been be utilized in rootstock breeding, even among these three species. In contrast to the narrow genetic base of our rootstocks, the variation among viticultural soils is large, including pH, drainage, salinity, other chemical constituents, etc. In order to improve the adaptation of rootstocks to soils, we should examine new genetic diversity among the primary rootstock species.

In contrast to the non-European wine producing countries, such as the United States, where low lime content is typical, the European wine producing countries have many soil types with high lime content. Initially the lack of adaptation of the rootstocks to these lime soils was a serious problem. The crosses *of V. riparia* and *V. rupestris* were not well adapted to the lime soils and iron deficiency chlorosis was the result in the scions. To improve the adaptation of the rootstock to lime soils, *V. berlandieri* was introduced as a breeding partner in rootstock improvement. *Vitis vinifera* also was examined as a partner in breeding for rootstocks adapted to lime soils, but this is a problem because of the phylloxera susceptibility of *V. vinifera* and its unsuitability for use as a parent in rootstock breeding.

Carl Börner (1880-1953) working in the 1930's described the true biological resistance to phylloxera coming from the North American wild species *V. cinerea.* A large part of his breeding program, which were mostly *Vitis riparia* x *Vitis cinerea* hybrids, were determined to be highly resistant to phylloxera and also demonstrated excellent viticultural characteristics. After a long period of selection, three rootstocks (Börner, Rici, Cina) were introduced into the wine production and grapevine cultivation. Although they have excellent resistance to phylloxera and broad utility in viticulture, they are not well adapted to lime soils and show chlorosis on high lime content soils. In the 1990s in Geisenheim a new program was initiated to breed new rootstock varieties. The aim of the breeding is complete phylloxera resistance in combination with lime soil adaptation and chlorosis resistance. This extensive program began in 1992.

In rootstock breeding *V. berlandieri* has been the best partner in breeding rootstocks for adaptation to limestone soils. This is why *V. berlandieri* has shown up over and over again in the pedigrees of rootstocks used on limestone soils. However, only a small sample of *V. berlandieri* selections were used in breeding, because only a few were available in Europe at the time. Were these the best selections for adaptation to limestone soils? This gave us this idea to explore the natural home of *V. berlandieri*, to collect there a wide variety of genetic diversity of this species for future breeding, with the hope to collect material that would be useful in improving rootstock adaptation to lime stone soils.

Collection locations and details

In September 2005 we collected lots of grapes and berries from *V. berlandieri* in their natural habitat in Texas, with the intention to use the seeds as a source of germplasm. All collection information, with latitude and longitude and habitat descriptions, is available from the corresponding author. The species of Texas live together, side by side in the same habitat, but we did not encounter many natural hybrids. The individual vines are male or female flowering, unlike the cultivated species, and so the plants are not self-pollinating. The difference in flowering times is thought to be responsible for maintenance of pure species populations with minimal interspecific hybridization in nature.

The soil of the Edwards Plateau is built from dark, stony, clay over limestone. It is on this soil that the *V. berlandieri* is most commonly found. However, this species is also found on the alluvial soils of the riversides. Here on the flat riverbanks are most often found the bigger leafed formed of the species, as water is abundant. On the hillsides where there is only a shallow soil layer due to the erosion of thousands of years, only the small leafed types are found. This demonstrates the great variability of this species and shows its tolerance not only of limestone soils but also its drought tolerance.

In the area around Fredericksburg, in Gillespie County, west of Austin, are found many small creeks and stands of large trees. There *V. berlandieri* vines grow thick trunks, growing up to the highest point of the trees and spreading onto the canopy. In contrast is the area of Blanco County, which is fairly dry. In this area the growth of *V. berlandieri* is less vigorous and only reaches heights of 2 – 3 m. The grapes are mostly smaller and the ripening of the grapes is not uniform, with ripe and green berries found in the same cluster; dark blue berries with brown, ripe seeds, and immature berries with unripe seeds.

Results and discussion

To genetically sample a great range of *V. berlandieri* and collect it for use in breeding, the collection trip of September 2005 went to the natural habitat in central Texas. We sampled many individual wild plants and berries and 86 individual wild plants and the same number of wild stands or populations. The counties in which we collected are Bandera, Bell, Blanco, Burnet, Coryell, Edwards, Gillispie, Hays, Kendall, Kerr, Kimble, Real, and Travis. The berry samples were delivered to the United States Department of Agriculture, Grape Genetics Research Unit, Geneva, New York. About 80,000 seeds were extracted, and 35,117 were sent to Geisenheim. At the Department of Grapevine Breeding and Grafting, Geisenheim the seeds were planted and grown. The seedlings will be planted into the test vineyards and evaluated for rooting ability, callusing, lime tolerance, and different growth habits. The best of these will then be used as breeding partners in the new rootstock cross breeding program.

Literature

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