Genetic Control of Tendril Distribution in a Grapevine Rootstock Hybrid Population

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Grapevine tendril distribution is a characteristic of varieties and species. We examined the tendril distribution on a population of seedlings from a 161-49C x (V. labrusca x V. mustangensis) hybridization. 161-49C is a V. riparia x V. berlandieri hybrid that ordinarily bears tendrils in a discontinuous pattern. Although the V. labrusca x V. mustangensis parent frequently demonstrates more than two tendrils in sequence, it does show nodes without tendrils and as such cannot be described as strictly continuous in its tendril distribution.

Grapevine tendrils and clusters (inflorescences) are found at the node opposite a leaf. Cultivars and species exhibit some variation in tendril distribution, the phyllotactic patterning of which nodes have tendrils (or clusters) and which do not. Most Vitis species and cultivars have two nodes with tendrils followed by a node without a tendril (Mullins et al., 1992; Gerrath et al., 1998). This pattern is called intermittent tendril distribution. However, in the North American species V. labrusca and some V. labrusca interspecific hybrids, a tendril is found at every node (continuous tendril distribution). Some interspecific hybrid cultivars have an intermediate tendril distribution, with more than two nodes in a row bearing tendrils, but with occasional tendril-free nodes. Cousins et al. (2005) reported exploratory studies in the genetic control of phyllotactic patterning. Here we report in-depth analysis of a population segregating for tendril distribution patterns.

Materials and Methods
161-49 (V. riparia x V. berlandieri) is a pistillate flowered rootstock cultivar that ordinarily bears two tendrils per three nodes. Q126 is a staminate flowered V. labrusca x V. mustangensis hybrid in the collection of the National Clonal Germplasm Repository at Davis, California (accession number DVIT 1456); this repository holds part of the United States Department of Agriculture National Plant Germplasm System grape collection. Q126 bears more than two tendrils in three nodes, but is not fully continuous (skip nodes are found). 161-49 was crossed to Q126 in 2004. We collected the seeds from ripe fruit and moist stratified them for at least three months prior to germination. The seeds were sprouted on blotter paper in an incubator and the germinated seeds were transferred to individual 2.5 cm square pots. The seedlings were transplanted to individual 3 gallon pots and staked. Vines were grown in a greenhouse in Geneva, New York with supplemental light. Tendril distribution was screened at twelve successive nodes beginning at the first node with a tendril. 103 seedlings were screened successfully at twelve nodes.

Results and Discussion
There were five classes of seedlings, respectively those with 8, 9, 10, 11, and 12 tendrils in 12 nodes (Figures 1). The mean number of tendrils per 12 nodes is 9.50 and the variance is 2.47.

Q126 does not bear tendrils at all nodes (although at more nodes than 161-49C), so it is perhaps surprising that we found that nearly a quarter of the seedlings (20) bore 12 tendrils in 12 nodes. These seedlings apparently exceed the tendril density on their male parent. Nearly half of the seedlings bore 8 tendrils in 12 nodes, identical to 161-49C.
Figure 1: Tendrils found in the first 12 nodes of hybrid seedlings.

The distribution of tendrils patterning in this population suggests segregation of alleles of relatively few genes. It is tempting to assign seedlings with 8 and 9 tendrils into one class (total 60) and the remaining seedlings into another class (total 43), but experimental evidence to support such an assignment is completely lacking. What is the importance of the transgressive segregation observed here? Does this reflect substantial environmental influence on the distribution of tendrils, quantitative inheritance, or epistatic relationships between essentially qualitatively acting alleles? The evaluation of additional populations derived from crosses among plants in the several classes is needed in order to answer these questions.

Are twelve nodes sufficient to identify categories of tendril distribution? It may be that blurring between categories is reduced as more nodes are evaluated per plant, both over the length of shoots and over several seasons. To test the stability of tendril distribution it will be necessary to follow individual seedlings through early screening into multiple year vineyard evaluation. Could a seedling with an entirely intermittent tendril pattern (as evaluated at the 12 node stage) switch to an entirely continuous pattern at some later stage in life, such as upon sexual maturation? This is unknown. Future study of tendril distribution will include mating designs and vineyard studies that will allow us to address the questions of stability of tendril distribution in an individual seedling and assignment of seedlings to phenotypic classes.

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Literature Cited