Digital morphometric analysis of North American *Vitis* growing in a common garden

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Phenotypic plasticity offers the opportunity for plants to adjust to changing environments. This dynamic observation has been made in many taxa across their geographic ranges. Common gardens allow researchers to examine effects of environment on phenotypes among various taxa and genotypes from across the species' geographic range. Here we use two economically important North American grapevines (*Vitis riparia* and *V. rupestris*) to study leaf morphology in a common environment. Leaf morphology is highly variable in the genus *Vitis*, and has been used to differentiate species and grape varieties. However, environmental conditions are thought to impact leaf morphology as well, and in many cases it is unclear if leaf morphology corresponds to current species boundaries. By applying elliptical fourier descriptors (EFD) and generalized procrustes analysis (GPA) to digital images of leaves growing on vines in a common garden, we compare variation in shape, lobing, and sinus features among genotypes and between species. Leaves were sampled from an experimental vineyard in the Kemper Center at the Missouri Botanical Garden (MBG); the vineyard included four *V. riparia* genotypes and five *V. rupestris* genotypes with between 1-8 clones/genotype. For each of the 64 accessions collected from the vineyard, a single primary shoot was selected and all leaves from that shoot were removed. Leaf order along the shoot was maintained. The leaves were numbered in the images so that leaf number corresponds to number along the shoot. Leaves were scanned and custom Image J macros were used to extract outlines of leaves and to measure circularity and aspect ratios of leaves. Analysis of leaf shape was conducted using Elliptical Fourier Descriptors (EFDs) followed by Principal Component Analysis (PCA) using the program SHAPE. Raw leaf images were used for General Procrustes Analysis (GPA). Digital leaf morphometrics developed for cultivated *V. vinifera* ssp. *vinifera* can be used to differentiate closely related *Vitis* species. *Vitis rupestris* leaves had higher aspect ratios, while *V. riparia* had lower circularity values. These data demonstrate that under common conditions, multiple genotypes of *V. riparia* and *V. rupestris* differ in leaf shape. These results will be used in future work that integrates ion concentration and water use efficiency data for the common garden plot.