
Pip shape echoes the origins and history of modern grapevine diversity (*Vitis vinifera* L.)

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Abstract

Since the Iron Age, grape cultivation became a central aspect of French culture, economy and geopolitics. From an ecological point of view it also deeply shaped agricultural, ecosystem and landscape dynamics. The structure and identity of modern French wine regions started to take form during the first centuries A.D. and were maintained since then. Even if many aspects of ancient wine production are nowadays well documented archaeologically, little is known about the cultivated grape itself: what are the biological, geographical and chronological origins of modern grape varieties, or "cépages" still remain unclear and very little is known if and how they were assembled to produce wine in the different regions. Archaeological excavations provide large number of grape pips, relatively well preserved, due to waterlogged conditions in some structures. Morphometrics, the quantitative description of shape, helps to characterize these ancient pips sampled from different sites and periods, comparing them to reference collections of modern pips of both wild and domesticated grapes. We first explore the shape diversity of modern *Vitis vinifera* seeds in relation to subspecies (wild vs. domesticated), main uses of grapes, geographic origin and various phenotypic and genetic characteristics of varieties. The comparison of ancient to modern morphotypes brings evidence of the cultivation of an important, and unsuspected, varietal diversity in southern Gaul which seems to occur even at the scale of the individual site. For early times of wine production in Gaul, some pips present a wild morphotype. The evolution of "domesticated" morphotypes are quantified in time and space.

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