

Third Center of Domestication: Interaction between Genetics and Archaeological Sciences in Lands Devoted to Biodiversity of Grapevine Varieties

Stefano Del Lungo*

Department of Social Sciences and Humanities-Cultural Heritage (CNR-National Research Council), Institute for Archaeological and Monumental Cultural Heritage, Basilicata 85100, Italy

*Corresponding author: Lungo SD, Department of Social Sciences and Humanities-Cultural Heritage (CNR-National Research Council), Institute for Archaeological and Monumental Cultural Heritage, Tito Scalco (Potenza), Basilicata 85100, Italy, Tel: 390971427412; E-mail: s.dellungo@ibam.cnr.it

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Abstract

Genetic research into grapevines identifies the Third Center of Variety Domestication in central-southern Italy. The many stories written "on wine", even though molecular archaeology, do not mention it. Here we present the application of a different analytical system. Archaeology introduces into Genetics the components of Space (places and materials) and Time (documented history). The genetic relationships of vine varieties combine with those who identified them, places devoted to cultivation and containers for transportation. The Third Center becomes a defined geographical, historical and cultural setting and a macro-terroir, useful to the cultural and production growth of current vine growers. Originally it was called Siritis (from Siris, an Ionian colony in southern Italy with its grapevine varieties named Siricae) then it became Sibartide, Enotria and finally land of Amineae. The varieties selected here combine and colonise the western Mediterranean. Pinot Noir, Syrah and Aglianico with their genetic relationship are among the examples on which the research is founded. Then it's the first time that grapevines varieties enter directly a history, with their names and not a generic reference to the viticulture. The link of genetics to history gives their correct cultural and chronological location.

Keywords: Genetics; Archaeology; Vine variety; Enotria; Pinot; Syrah; Aglianico

The Basic Assumption and Methods

In a context populated by fantasies and suggestions about wine, and the web is full of them, it cannot rely on the randomness of a partial or indistinct knowledge of moments, conditions and situations, if they are documented by written sources and archaeological data. In a proven chain from multi-disciplinary research, these are the basis for setting up viticulture within a Domestication Center, the large geographic and cultural area where wild vines have been changed in domestic varieties, selected and cultivated. The story of each one is a piece of a complex mosaic, varied and intertwined, which sketches out the evolution of viticulture in Mediterranean territories and its expansion inland in Europe [1,2].

When a history of the grapevine and wine wants to be truly effective and not only evoking it is essential to have the history of each variety from ancient times to today. Detailed studies, whether into the relative relationships or into the historical and anthropological dynamics that locally has guided the cultivation, distribution and duration of varieties, are the main tools to keep viticulture in close relationship with the territories and produce uniqueness to support market competitiveness. The vine, the grape and the resulting wine are then cultural markers and the terroir becomes the product of the field and the work of the farmer considered in relation to the centuries [3]. Their aim joined to Cultural Heritage comes from their history and now the strict relationship with cultural human evolution and archaeological finds change finally a generic pot for wine into a pot used to trade 'that

wine' and not 'another', with all names it has received during its long evolution.

By the coefficient of identity and co-ancestry genetics highlines how a vine could be old in the relationship with another. It opens also the way to place a variety with its current name in the Timeline but doesn't distinguish a chronology or a cultural phase. DNA marks identity of each variety and is unaltered in the centuries; while the ampelography puts in evidence how different soil and climate can modify it from a site to another and its cultural evolution in a short time. So, the different ancestry degree of varieties, verified by historical written sources and DNA code, and the parental relationships of them draw a grid of reference [4]. It can easily put on top of the politic, social, economic and cultural condition of a place and read understanding an evolution never separate. Using for vine names the same graphical codes of linguistic science for ancestral words, every historical phasis will have varieties indicated at first by the current name (Pinot, Dureza, Aglianico, etc.) as a well-defined DNA profile without a specific time of reference.

The addition of characters (like [*name], *name and name), borrowed from linguistic, helps to distinguish the evolutionary stage reached at any given time. Taking, for example, the Aglianico vine variety, in the text may be referred to as [*Aglianico], because it is at its first stage of evolution but it is already Aglianico and not its progenitor. Then it will be *Aglianico at the time of the recognition and improvement of the variety, with following denomination. Finally it will be Aglianico, as we know today from the first documentary attestation. Many times ancient roman families rise the selection of vine varieties and give them their own name, easily recognisable by

linguistic analysis and interesting conformity of variety position in the evolutionary dendrogramma.

Altogether genetics, classic written sources and archaeological data change a historic Center of Grapevines Varieties Domestication in a tangible macro-terroir for vine growers. Genetics marks the position of a variety in the evolutionary dendrogramma. Archaeological sciences (ancient and medieval topography at first) mark the vine variety position into a Timeline and may discover 'which', 'who', 'when' and 'where' every one examined before has token. Then they investigate and elaborate the varietal diversification with the method of 'interdisciplinary diachrony' [5]. Indeed, by comparing and crossing data and tools of philological, historical, archaeological, anthropological, epigraphic and linguistic research (genesis and use of a name for places and objects) the fundamental steps of an agricultural and cultural evolution are identified and set out the origin of the varieties known in the Mediterranean and Europe.

As way of experiment here is reconstruct the identity of the Third Center of Grapevine Varieties Domestication [6], strictly connected with the genesis of Greek colonies and their meeting with local inhabitants, named Enotrians because very ables to cultivate vines joined to pole. The city-territory relationship, examined in-depth in Greek historiography, is compared and integrated with the genetic relationships of the grape varieties. It therefore assesses the cultural relations established between one city and another, improving the understanding of what may have been the contribution of each city in the varietal diversification and distribution to indigenous populations. It is also investigated whether viticulture was introduced in the absence of a previous one, or if it was renewed with the comparison between agricultural practices and a different value given to the variety of the place.

Substrate, influence and integration

In genetics, central-southern Italy is the Third Center of Variety Domestication, i. e. the third stage that the vine varieties (*Vitis vinifera* L.) and related culture (capacity to domesticate, select, cultivate and spread) have made together ('demic diffusion') or separately ('cultural diffusion') the journey from the Caucasus to the West [7,8].

For the Third Center the chronological extremes, which are the stages of domestication and selection of varieties in the long term, are between the Recent Bronze Age (1250 BC) and Roman times, with a key timeline from the Iron Age (X-IX century BC) to Hellenism (IV-III century BC) [6]. Peoples and cultures, described by Greek historiography since the sixth century BC and then by Latin from the third onward, develop knowledge, communicate know-how, intertwine relationships, even in conflicting ways, and alternate. Through biological material exchanges and the comparison of cultural practices the ability to domesticate the vine, to select it, to grow it and make wine is refined [7].

The Greeks synthesised all this in the name of a territory, Enotria (Figure 1) [9]. Identified between the Laos, Crati, Bradano, Ofanto and Sele rivers, it was formalised in the sixth century BC, long before the geopolitical expression of 'Megale Hellas' (Magna Grecia) was purported. By making it Hellenic, the meaning of 'the land of the vine cultivated with the support of a pole' (the oinótron) with two fruiting canes became an alternative to their kàmax (or kàrax), of archaic tradition. The Romans would not have time to acquire this name but they grasped the value and extended it to the concept of Italy (Italy Appennines), attributing to their empire the record for wine making.



Figure 1: A traditional "enotrian" vineyard in land of Santo Spirito (Moliterno, Potenza, Basilicata) into the centuriatio grid (agrarian partition) of the Grumentum roman colony. Local vines varieties, mixed with international, are supported by a pole (the oinótron).

Enotria and then Italy, together, help more than any other perspective to identify and delineate the Domestication Center even in its basic components: Historical, cultivational and cultural [1]. The historical component is a set of assumptions and earlier wine experiences (the 'substrate') that allow to better frame 'from when' the useful knowledge to transform a geographical area into a 'Center' was developed [2]. For the Italian peninsula the multi-stratification of Greek sources suggests and formulates connections with the Aegean area and the continental regions of Ancient Thessaly, Locris, Beothia, Corinth, Achaia and Arcadia [2].

The second component (cultivation) corresponds to the external 'influence', which the East towards Italy and then Italy towards western European territories (today's France and Spain) have exerted [4-6]. They have contributed to the transfer of viticulture and varieties from one place to another, defining suitable and therefore privileged, areas.

Finally, the third (synonymous with 'integration') is a consequence of the previous and defines two long-lasting conditions. The plant material may have indeed reached Italy exclusively from the East (Aegean-Anatolian area) and have been spread among indigenous communities unaware of viticulture [6]. Or it may have been introduced parallel to others already existing in the area, with contact and sharing of knowledge between local populations and the Greek colonisers.

This type of relationship with local growing experts in the domestication of plants, which archaeobotany and genetics have started to highlight [9,10], forced the Greek colonisers to admit their pre-existence (thus the 'perception'). However, since in a Hellenic-centric cultural model it is unacceptable that other peoples, outside of Greece, have achieved a significant level of civilisation, Greek culture transformed the local varietal characteristics in distant Hellenic ancestry typicality. Their origins therefore refer back to heroic times, populating the Enotria in Mycenaean age with heroes (most notably the Thessalian Philoctetes) [3] who became the bearers of true civilisation.

The Achaeans cite them directly. In the memorandum handed down by epic the Achaeans/Mycenaeans overlap the Achaean colonisation of the southern Italy Ionian coast (end VIII-half VII century BC) with the establishment of the cities of Caulonia, Squillace, Croton, Sybaris and Metaponto [11,12]. For viticulture the production and trading of objects, such as the famous Eastern-Greek cup (kotyle) of Nestor

(725-700 BC) in Pithekoussai (island of Ischia) [13], are the result of cultural fusion that Greek settlers made between the local vine cultivation and the Mycenaean experience in the domestication of the wild vine, joined to trees [14,15].

According to the Odyssey, composed in a period very close to the time of colonisation, the 'vineyards' are situated on hills (α, 193) or on plains, close to the city (η, 112-131), and 'domestic vine trees' (staphylê, ε, 69) are alongside wild varieties (άmpeloi, in κ, 110-111, 358). The grapes are white, red and black (ε, 165 and 265), and the varieties are chosen favouring a substantial uniformity in the environmental needs and cultivation characters. The only difference is in the time of ripping, ranging from early too late. They are combined so as to ensure a continuous harvest in the months when harvesting normally takes place, from August to November (η, 120-126), thus averting the risk of complete harvest loss due to environmental or anthropogenic factors.

The meeting of Odysseus with the Cyclops (κ, 346-374), Hephaestus's blacksmith collaborators, became almost a symbol of a decayed Mycenaean civilisation (interruption of the metallurgical activity: picking of grapes at will, not harvesting), has a genuine connection in the Poggiomarino archaeological site (valley of the Sarno river; Campania), on the south-eastern slopes of Mount Vesuvius. Like in Sicily for the Cyclops, traditionally placed on Mount Etna, the village, distributed on small islands, lies near a volcano and is specialised in metalworking. It belongs to the culture of the 'pit Tombs', which continued until the beginning of the sixth century BC, and to the activity of supporting industry, in agriculture, the selection, domestication and cultivation of vines (shoots and seeds), practised directly on one of the islands (southern embankment MAF 29A, islet IA, channel MAF 3, essay 2A) [16,17] already during the last years of the tenth and the first half of the ninth century.

At present it marks the moment when the Third Domestication Center is active through communities who domesticate wild varieties in the territory, simultaneously to possible imports of plants from the Aegean-Anatolian network (Second Center) not yet quantifiable in percentage terms. Poggiomarino is at the top of a vast area suited to vines, which in the same period Villanovan cultivation defines on the Picentini Mountains and the plain below. The town of Pontecagnano (Salerno, Campania) is its centerpiece, being the market of the metal extracted from the mid Tyrrhenian deposits and other kinds of exchanges. Euboeans are attracted by it and in Pithekoussai, the island of 'cup of Nestor' on one of the metal routes, they set up the first Greek colony known in the West (between 790 and 770 BC), with workshops and laboratories for the transformation of gold [18]. Through this colony, Boeotian and Thessalian cultures, bearers of pre-dionysian epic, cultural and cultivation traditions meanwhile linked by the myth of the East (the Phoenician King Cadmus, the Thessalian Athamas, Ino's wife, and her son Melicertes), come into contact with Italy, setting another cultural and interpretive cornerstone for the Third Center, that is the bond or cross reference with Boeotia and Thessaly [19-21].

Greek colonies and Italics in the vine varieties selection

Contact between settlers and locals, as stated in the Odyssey are sometimes conflictual. At the beginning of the seventh century BC the Colofonis, on the run from Ionia, land in , not far from the Achaean Metaponto. They conquered the "Trojan" colony Siris, slaughtering the *Chones*, its inhabitants, and rebuild it (680-670 BC?) [22]. What follows is a peaceful trading penetration and the Greek Siris quickly builds a hegemony on the hinterland, calling it Siritide (from which

arises the valley Val Sinni and Mount Sirino) [23]. The reference to the tradition of the Trojans does foreshadow an evolved local population, equal to the Greeks, and an organisation of viticulture in the manner described by the epic, with possible exchange of knowledge on varieties and practices (Figure 2).

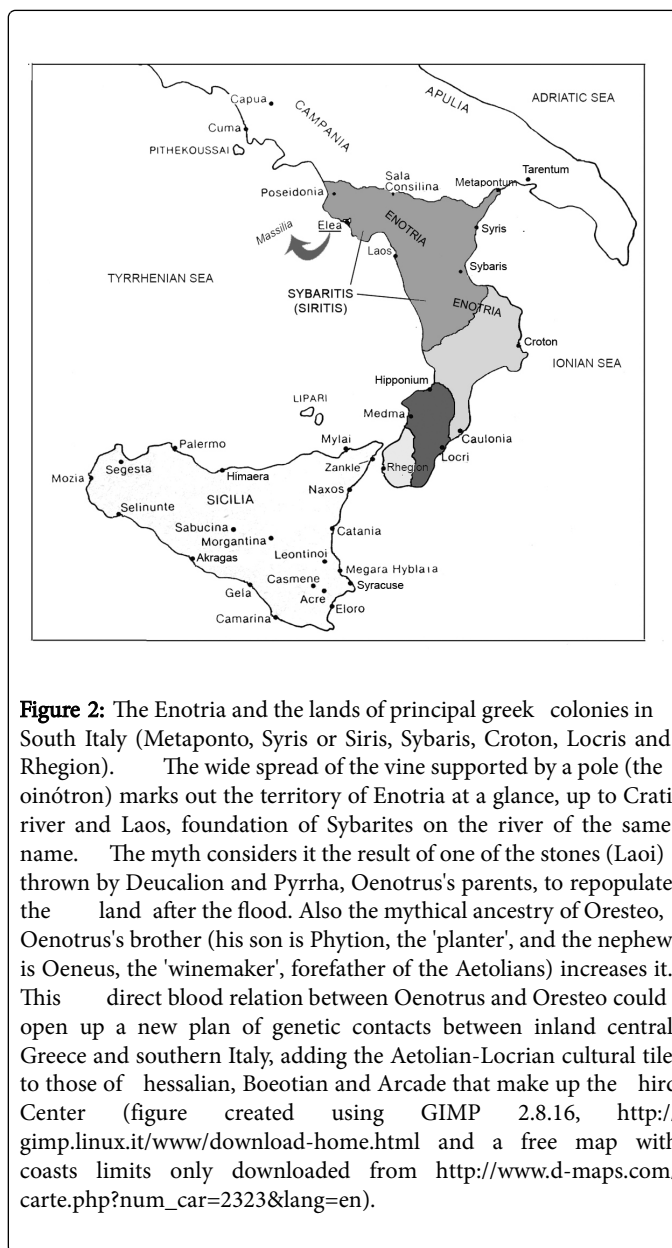


Figure 2: The Enotria and the lands of principal greek colonies in South Italy (Metaponto, Syris or Siris, Sybaris, Croton, Locris and Rhegion). The wide spread of the vine supported by a pole (the oinótron) marks out the territory of Enotria at a glance, up to Crati river and Laos, foundation of Sybarites on the river of the same name. The myth considers it the result of one of the stones (Laoi) thrown by Deucalion and Pyrrha, Oenotrus's parents, to repopulate the land after the flood. Also the mythical ancestry of Oresteo, Oenotrus's brother (his son is Phytion, the 'planter', and the nephew is Oeneus, the 'winemaker', forefather of the Aetolians) increases it. This direct blood relation between Oenotrus and Oresteo could open up a new plan of genetic contacts between inland central Greece and southern Italy, adding the Aetolian-Locrian cultural tile to those of hessalian, Boeotian and Arcade that make up the hird Center (figure created using GIMP 2.8.16, <http://gimp.linux.it/www/download-home.html> and a free map with coasts limits only downloaded from http://www.d-maps.com/carte.php?num_car=2323&lang=en).

The destruction of Siris in 530 BC marks the expansion of Sybaris (symbolised by the hero Philoctetes and so 'thessalyc' par excellence) in Siritide, extending its territory (Sybarite) and expanding the network of alliances with Enotrian populations up to the Cilento headland [24]. The effectiveness of this new penetration has reflected in the persistence of Sybarite even after the destruction of the colony in 510 BC. The Sybarites survivors are welcomed in the cities of their previous foundation (*Poseidonia*, from the second half of the seventh century BC; Capaccio, Salerno) [3] and in the allied populations (the *Serdaioi*). They open to trade and development areas until then which remained on the fringes (Vallo di Diano and high Val d'Agri) [25].

direct heir, marks the insertion of Attic element in Magna Grecia, near the Ionian and the Achaean [3], and it is celebrated for its vineyards Capnios, Buconiates and Tharrupia within a production soon called Lucana, no longer oenotrian. These varieties are known for the late harvest, constant productivity, resistance to adversities and a variable colour of the grapes from black to white (Capnios, 'Smoky', for the Athenians in the second half of the fifth century BC), like the Bombino and the same Pinot, 'grey' and 'white'. Pliny the Elder, misunderstanding this character, would say that in Massilia and the rest of Gaul Narbonne wine is made by 'smoking' it. But it will be only because it is produced with grapes from variable colour ('smoky' indeed) and then, among others, Pinot [27].

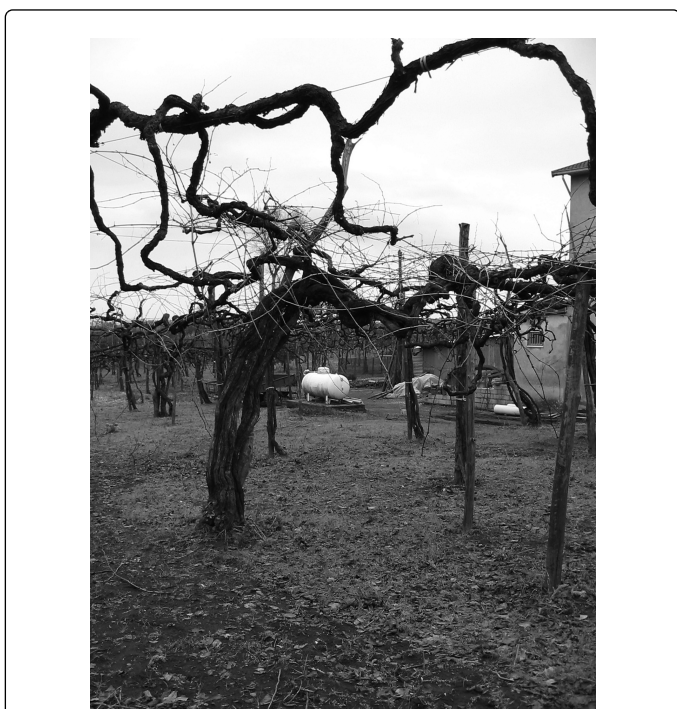


Figure 4: A great and old grapevine of Chiriaco or Siriac in the small farm of Mr. Sabatino Di Jorio (Atripalda, Avellino, Campania) with a curious history. It has been discovered and noticed with a tag put around its trunk in 2005, November, by the research group of Vitivin-Valut project (CRA-UTV, Turi, Bari). They have published it a year after in the national congress of Villa Gualino (Torino) about autochthonous grapevines. Then in 2007 other research group went there, found the same plant and added its target over and published their "discover" in a daily newspaper.

These, together with *Dureza, *Mondeuse and even more so *Syrah, also called *Sirica, can be identified with the Siriche for their origin and common provenance from Siris and strong similarities of ampelographic type [42]. The change of the adjective from Sirinos, in the sense of 'relevant to Siris', to Sirikos ('red' or 'red colour pigment') [43] dates from the late fifth century BC, with the introduction of the Attic suffix *-ikos*, adopted in the words to indicate the belonging of an element to a homogeneous group [44]. The homophony of 'Syric' with 'Syriac' would result in a semantic transformation ('originating from Syria') in Latin sources. There begins the widespread idea of Syrah as a "clear" product from Syracuse or Eastern (from Persian Shiraz, in Iran) (Figure 4). In the meantime the equating of Syriacae to Amineae,

recognised in the Picentini area and with an Etruscan settlement (Amina) [45] in relation with Poseidonia is declared by Pliny and confirms their Italic origin [27].

The Greeks, surprised by the quality, however, attribute such origin to their ancestors. The claim came from an unknown town in Thessaly [46] which refers back to the Achaean colonies founded by Philoctetes (Sybaris in particular) and establishes the belonging of these vines to a specific group of varieties evolved in Italy, well distinct from the truly Greek wines (*Graeca vina*), imported at different times from the Aegean-Anatolian world [27,47].

Aglianico's possible "authors"

Cato superimposed the *Duracinae* (a group of vines where *Dureza* is in) to *Aminium maius*, because their grapes can be preserved drying them under the sun or near the forge of a blacksmith [47]. So in the early second century BC he proposes again the protohistoric binomial of Poggiomarino and the Cyclops, that is viticulture/metallurgy, and suggests a continuity of *syric* varieties well represented by [**Aglianico*], well-known and appreciated but not yet named as that. This name is comparable to a strand of DNA. Indeed it contains the identity of a family of entrepreneurs (the gens *Allia*) from Aquileia (first century BC) [48].

Allianicus, which has a counterpart in the Italic and Gallic names of places, the suffixes *-anus*, 'belonging to', and *-icus* (*-ikos* of Ionic-Attic origin) are welded to roots of the vine variety. The family *Allia* have probably invested capital in the improvement of this vine and they vindicate this supremacy in its name. Literally it means 'the product coming from', 'the property belonging to' (i.e. the farm, the village or the plot), and 'the person belonging' to gens *Allia*, from which the forms *Allianus* (or *Alianus*), *Allianicus* and in the later phase *Alliaticus*. In the Early Middle Age there is the additional meaning 'curtis' of a family group called the *Allianici*, because residents in a fundus *Allianus*, which allows the *Aglianico*, name to survive until today [49].



Figure 5: Bunches of black and white Aglianico (photo allowed by Basivin_SUD project) and the grave stone of *Allia Danais Grumentina* (CIL, IX, 231, from S. Gregorio Magno, Salerno; photo of the author).

Archaeologically (epigraphies) the family has been found in the territory of *Massilia* (at the mouth of the Rhone), in Rome, in Campania and Lucania, entering the area of Naples and Vesuvius (Miseno, Pozzuoli, Pompeii, Herculaneum, Nocera), particularly suited to viticulture. The eruption of 79 AD and the destruction of much of the vineyards [50] shifts the economic interest and the wine production onto Benevento and Irpinia, where gens is settled in the

immediate vicinity of the existing areas of Taurasi and Mount Taburno, for centuries suited and reserved to *Aglianico*. The Appian way in the two branches, *vetus* and *nova*, leads the *Allii* in the territory of Venosa, the eastern edge of Mount Vulture and the second area suited to this vine. Then they are in Lucera, Canosa and Taranto. Finally, across the *Annia-Popilia* way they move into the Vallo di Diano and penetrate the upper Val d'Agri (*Grumentum* near Grumento Nova), where the white *Aglianico* variety was discovered [51] (Figure 5). The area is crossed by the river Alli (a *rivus Allii*, 'of the family *Allia*') and here the best of local wine production would concentrate.

Conclusion

Now the Third Center begins to have a geographic, historic and cultural consistency in Central and Southern Italy. The voyage of discovery is just beginning. Genetics and archaeological research have just embarked on it. New ways can introduce to explain the genetic outcomes by sciences of antiquities and insert in amphoras not only "wine" but something of concrete about type of wine. Historical news is normally over imposed on grapevine varieties and many stories written "on wine" do not mention them. Now genetics, archaeology and history speak the same language and tell their history, beginning from Pinot and *Aglianico*, for example.

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Conflict of Interest

The author declares that he has no conflict of interest.

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