THE ORIGIN OF GRAPEVINE CULTIVATION IN ITALY: THE ARCHAEOBOTANICAL EVIDENCE

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Abstract – Grapevine remains show that this plant has been important for humans since ancient times. This paper presents a synthesis of archaeobotanical studies on grapevine remains (pollen, wood, charcoal, seed/fruit and other botanical remains) from Epigravettian to Bronze Age sites. Carpological remains are the most important ones, because they often allow to distinguish cultivated and wild grapevines. Grapevine findings are rare in Mesolithic sites, they increase during Neolithic period and become frequent in Bronze Age. Archaeobotanical data show that during Neolithic and in the Early Bronze Age a good level of knowledge concerning grapevine utilization was already acquired; during Middle and Late Bronze Age the grapevine diffusion increases. Based on archaeobotanical data, the wild grapevine evolution by indigenous people was probably accompanied by an input of allochthonous vines from Mycenaean world, and then from Hellenic world. Therefore, the critical period of grapevine domestication can be placed between Bronze Age and Early Iron Age.

Keywords: Archaeobotanical grapevine remains, Vitis vinifera L. ssp. sylvestris, Vitis vinifera L. ssp. vinifera, Domestication, Cultivation, Italy

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Notes

INTRODUCTION

In spite of the abundance of archaeological, archaeobotanical, historical and genetic data, the origins, historical biogeography, identity of ancient grapevine cultivars and mechanisms of domestication are still largely discussed. Archaeobotanical remains seem to confirm the complexity of human contacts, exchanges and migrations which spread cultivation in Europe and in the Mediterranean areas.

Particularly, archaeobotanical researches on the origin of grapevine cultivation have shown that the fruits of this plant have always been harvested by humans even during periods preceding its domestication and before the development of grapevine cultivation systems. It is likely that something similar to the wine has been produced, consumed and exchanged since 8000 years ago, according to the analysis performed on residual traces found in a vase discovered south of Tbilisi – Georgia, in the hills of Shulaveris-Gora (Lordkipanidze, 2010).

Fossils of grapevine ancestors were found in the Bolca basin (Verona, Northern Italy) and assigned to the Middle Eocene (around 50 million years ago). Similar remains of the same age were discovered in the Chiavon basin (Vicenza, Northern Italy) (Paronetto, 1996).

In Italy grapevine - Vitis vinifera L. - is present with two subspecies: Vitis vinifera L. ssp. sylvestris (C.C. Gmelin) Hegi (wild grapevine) and Vitis vinifera L. ssp. vinifera (cultivated grapevine). As a synonymous of the cultivated form, the name Vitis vinifera L. ssp. sativa Hegi is commonly used (Webb, 1968; Pignatti, 1982).

The wild grapevine is a heliophilous liana growing generally along river banks and in deciduous and semi-deciduous forest. It is distributed in a wide area from Western Europe to the Trans-Caucasian zone and around the Mediterranean...
Basin, except the southernmost infra-Mediterranean and non-Mediterranean zones (Arnold et al., 1998). The cultivation and domestication of grapevine appears to have occurred between the 7th and the 4th millennium BC, in a geographical area between the Black Sea and Iran. Specifically, its origin is recognized by most authors in the hygrophilous forests located between the Southern coast of the Caspian Sea and the Eastern coast of the Black Sea (McGovern & Rudolph, 1996; Zohary & Hopf, 2000).

From this area, cultivated forms would have been spread by humans in the Near East, Middle East and Central Europe. Grapevine is cultivated in the sub-Mediterranean region, where the average annual temperatures and the average winter temperatures do not go, respectively, below 10°C and 0°C.

The discrimination between the two subspecies is based on the fact that *Vitis vinifera* ssp. *sylvestris* is dioecious and dimorphic and the presence of hermaphrodite individuals is rare, generally below 5%; on the contrary, *Vitis vinifera* ssp. *vinifera* (the cultivated subspecies) is monoecious with hermaphrodite flowers (Scossiroli, 1988). The hermaphroditism, recognized and selected since the very beginning of the domestication process, represents the botanical trait of main interest from the agronomical point of view. According to the traditional interpretation, the first domestication occurred in the region between Caucasus and Mesopotamia, and resulted in the selection of the more productive subspecies, *V. vinifera* ssp. *vinifera* (Fig. 1).

Many genetic researches are currently in progress in order to examine in depth the evolution of grapevine in Italy (Grassi et al., 2003, Zecca et al., 2012). This paper presents a synthesis of archaeobotanical data on grapevine remains from Epigravettian to Bronze Age in Italy.

**Fig. 1 - Grapevine domestication centers with relative diffusion phases (I-VI) (Forni 2012, modified).**

**MATERIALS AND METHODS**

In total 112 sites were examined: Epigravettian: 1, Mesolithic: 1, Neolithic: 41, Eneolithic: 7, Bronze Age: 62 (Fig. 2, 3, 4). A detailed list is reported elsewhere (De’ Siena et al., in press).

All branches of archaeobotany were involved. Particularly, palynological, carpological and xylo-anthracological analyses were considered in this paper.

Grapevine subspecies identification using pollen is difficult, and single flowers produce small amounts of pollen, whose dispersal is limited to a restricted area around the plant. In general, xylo-anthracological remains are not abundant,

**Fig. 2 - Sites with grapevine remains at different ages.**
and only rarely, based on the type of assemblage and on the archaeological context, it is possible to advance hypothesis on the belonging subspecies. Among the macroremains, seeds are the most abundant, while the finding of skins, pedicels, grapes is quite rare. They can be found among charred materials together with seeds. Seeds are the only remains which can ensure the discrimination between wild and cultivated subspecies thanks to their morpho-biometric characteristics. However, in many cases, grape seeds show intermediate features between the differential parameters necessary for subspecies recognition. The seeds of wild species are small, robust and with a rounded outline or cordate, with short stalks and a flat ventral side with sharp angles and a strongly developed chalaza, while those of the cultivated species appear large, elongated, oval or pyriform with an elongated stalk (Orrù et al., 2013).

The use of biometric indices for seed studies has often proved
to be of great importance in the understanding of the domestication processes, in taxonomic studies of modern *Vitis*, as well as for the classification of archaeobotanical remains (Rivera et al., 2007). As regards to the dimensional rate between maximum width and height, the discrimination of grape seeds can be based on the intervals described by the Stummer’s Index (Stummer, 1911). Unfortunately, the intervals of the two subspecies widely overlap, and it is not always possible to determine them. Since the ’90s, other systems of morpho-biometric characterization to identify the seeds of *Vitis* have been proposed, which are based on more complex parameters (biometric variables, different algebraic formulae) and on the computerized visual analysis (Mangafa & Kotsakis, 1996; Perret, 1997; Castelletti et al., 1998; Terral et al., 2010).
RESULTS AND DISCUSSION

The most ancient evidence of wild grapevine in Italy are the findings of the Epigravettian site of Grotta del Romito (Nuppolarara near Papasidero, Cosenza, Calabria), where 12 grape seeds of wild grapevine were identified (Cattani et al., 2004). Remains of wild grapevine were found in the Mesolithic site of Grotta dell’Uzzo (Trapani, Sicilia), where one grape seed was identified (Costantini, 1982).

The sites of the Neolithic period, where the remains of grapevine were found, are more than 40. Grape seeds were recognized in the Ancient Neolithic sites of San Sebastiano di Pertì - Savona, Liguria (Arobbà & Vicino, 2003), Lugo di Romagna - Ravenna, Emilia Romagna (Castelletti & Rottoli, 1996), Sammardenchia - Udine, Friuli Venezia Giulia (Rottoli, 1999), in the Ancient/Middle Neolithic sites of Biancade di Roncade - Treviso, Veneto (Balista et al., 1996), Arene Candide - Savona, Liguria (Arobbà et al., 1997), San Marco - Gubbio, Perugia, Umbria (Costantini & Giorgi, 1992), Grotta dell’Uzzo - Trapani, Sicilia (Costantini, 1982), La Marmotta - Roma, Lazio (Rottoli, 1993). In particular, at La Marmotta, the abundance of wild grape seeds allows us to hypothesize a use of this material for the production of a fermented drink, even if its characteristics would be very different from those of what today we refer to as “wine”. In the Middle/Late Neolithic grapevine remains were found in about 20 sites: wild grape seeds were collected in all sites, in 2 sites they were found with charred woods (charcoals) and pollen grains, as in Spilamberto - Modena, Emilia Romagna (Marchesini, pers. comm.), Terragne - Taranto, Puglia (Accorsi et al., 1995) and only at Quadrato di Torre Spaccata-Roma both grape seeds and charcoals were identified (Celant, 1995). In Casalnoceto (Alessandria, Piemonte) inside a well, carbonized remains of wild grape seeds were found (Castelletti & Motella De Carlo, 1998). These findings confirm the intense search for this plant during the harvest activity and its role in the land use by the Neolithic populations.

Evidence of the presence of grapevine in the Eneolithic period was found mainly in Northern Italy, where macroremains with seeds and charcoals were identified in Balm’Chanto - Roure, Torino, Piemonte (Rottoli & Castiglioni, 2009), Bressanone - Bolzano, Trentino Alto Adige (Rottoli & Castiglioni, 2009) and Sant’Ilario d’Enza - Reggio Emilia, Emilia Romagna (Barfield et al., 1975). Grapevine pollen grains were found in the site of Stanghella - Padova, Veneto (Marchesini & Marvelli, pers. comm.). The increased presence of grapevine in Bronze Age remains testifies the importance of this plant, which is present in at least 60 sites in a time slot of 1300 years. In the Early Bronze Age the wild species was still prevailing, as confirmed by the presence of 21,600 grape seeds in the pile-dwelling site of Canâr (San Pietro Polesine, Rovigo, Veneto). The seeds show morphological characteristics typical of the wild grapevine (Castiglioni et al., 1998). The presence of pollen grains can be interpreted at least as a preliminary human activity consisting of taking care of spontaneous plants, if not as a true cultivation. In particular, the increase of its pollen in the central part of the diagram could be related to some biological transformations or increase of the number of plants (Accorsi et al., 1998).

Also in the Filo Braccio site of Ancient Bronze Age, in Filicudi island (Sicilia), 111 fruit fragments, mainly seeds of *Vitis vinifera* (Martinelli et al., 2010) were found. This kind of remains are more common at the beginning of the Middle Bronze Age, when some seeds with intermediate characteristics between the two subspecies *sylvestris* and *vinifera* were found. Grape seeds were found in the settlement of Castello di Annone - Asti, Piemonte (Castelletti & Motella De Carlo, 1998).

In the early Middle Bronze Age, in the site of San Lorenzo a Greve (Firenze, Toscana), 929 seeds were found and more than 300 fragments combined with 324 remains of *Cornus mas*. Morpho-biometrical analysis showed the presence of both the wild and the cultivated grapevine, together with relevant number of seeds with an intermediate length/width rate (Aranguren et al., 2007).

Similar are the findings of the Portella site (Salina island, Sicilia), referring to the Middle Bronze Age (Fiorentino et al., 2011). In the Streparo and Cento Moggie sites (Capua, Caserta, Campania) of the Middle Bronze, 21 grapevine branches with a diameter of 4-10 mm were found; the abundance of this kind of remains suggests the presence of a developed cultivation system (Castiglioni & Rottoli, 2001). The identified seeds in Terramara of Montale (Castelnuovo Rangone, Modena, Emilia Romagna), dating to the Recent Bronze Age, testifies the increasing use of the grapevine to produce alcoholic drinks that progressively substituted those prepared with *Cornus mas*, whose presence at the same time dramatically decreased (Accorsi et al., 2004; Mercuri et al., 2006). In Borgo Moretta (Alba, Piemonte) the remarkable pollen percentage of grapevine documents the presence of plants near houses, in a marshy environment probably unsuitable for wild grapevine (Arobbà & Caramiello, 1998). During the Final Bronze Age, fragments of grape seeds and a whole wild grape seed were found in fires of Morano necropolis, in Casale Monferrato – Alessandria, Piemonte (Motella De Carlo, 1999).

In Tuscany, at Forti (Chiusi) and Stagno (Livorno) sites, chronologically referring to the Final Bronze Age, several seeds of *Vitis vinifera* attributable either to the wild and cultivated subspecies were found, respectively, in the drainage channel of houses and in the pile-dwelling site (Aranguren et al., 2007).

In Sardinia, among findings of the Recent and Final Bronze Age period, charred seeds were discovered at Genna Maria Nuraghe (Villanovaforru-Cagliari) and Duos Nuraghes
(Borore-Nuoro) (Bakels, 2002) and some well conserved grapes were identified at Nuraghe Adoni (Villanova Tulo-Cagliari) within a layer dating back to the 12th century BC. At Ţelavè (Trici, Ogliastro, Sardegna), “askoide” pitcher showed wine residual traces, and pollen from a layer of the same period, dating to 1000 BC (with C\(^{14}\) method), confirmed the presence of *Vitis* pollen (Sanges, 2010). Finally, in the course of studies conducted at Sa Osa (Oristano, Sardegna), in a well built in the Recent and Final Bronze Age period, many seeds of cultivated grapevine were found (Orrù et al., 2013). In this case, the occurrence of the pollen grains in the filling up of the well can be considered a proof of its *in loco* cultivation (Marchesini, pers. comm.).

In the Iron Age the archaeobotanical evidence of grapevine cultivation becomes much more frequent, showing a progressive increasing trend from the 9th to the 7th century BC. Starting from the 8th century BC clear evidence of a semi-intensive grapevine production was known; it testifies the complete domestication of the plant. This process took much advantage from the frequent contacts and commercial activities with the Aegean region, well documented since the 2nd millennium BC (Gambari, 1994).

These findings seem to indicate that the knowledge of grapevine cultivation and wine production has already been a cultural acquisition since the time of Cuma and Pithecusa foundation and since the foundation of the first human settlements in Southern Italy.

As to Italy, natural remains show an interesting diachronism between the confirmation of the presence of domesticated grapevine in the Etruscan settlements in the surrounding area of Bologna (Via D’Azeglio, Bologna, Emilia Romagna, fig. 5) (Marchesini & Marvelli, 2010) and Verucchio - Rimini, Emilia Romagna (Marchesini & Marvelli, pers. comm.), where its cultivation has been demonstrated since the 8th and 7th century BC, while in the area around Verona clear proof of grapevine cultivation were found only one century later (Nisbet, 1987).

**Fig. 5 - Cultivated grapevine - *Vitis vinifera* L. subsp. *vinifera*, to the left grape seeds (5,8 mm), to the right pedicels (5 mm), via D’Azeglio (Bologna), Villanovian well.**

**CONCLUSIONS**

Finding the origins of wine-viticulture and the rigorous date of diffusion of the cultivated grapevine are very complicated problems, frantically debated, but substantially still open. Archaeobotanical data collected in Italian sites show that during Neolithic and in the Early Bronze Age the knowledge concerning collection and utilization of grapevine products had already been acquired (Forni, 2012). During Middle and Late Bronze Age the grapevine spread. It is not clear if this was due to new technologies directly acquired or partially imported from the Mycenaean world, and then from the Hellenic world (Sciensia, 2009). It is not clear, in the current state of the research, if these contributions had only facilitated the progress of technical knowledge, or if the external input was more radical, implying at some time of the Italic prehistory and protohistory the learning of very innovative techniques with the input of new selected varieties or even replacing the previous ones (Castiglioni & Rottoli, 2001). This hypothesis is also confirmed by genetic researches, which underline the presence of two domestication areas: Middle East and Western Europe (Failla, 2011). In particular, the greater variability of grapevine in Western Europe (Imazio et al., 2006) could be due to the strong contribution of the local wild flora, at least as important as the contribution from the Caucasian area (Imazio, 2007).

According to the data in our possession it is more likely to think that the Italian wild grapevine evolution carried out by indigenous people was accompanied by an input of allochtonous vines from areas in which there was a long-established viticulture, the eastern Mediterranean area where viticulture had already reached a high technological
level (Lentini, 2005; Solinas & Fiorentino, 2010).
What can be inferred from the current data is that there was a critical period between Bronze Age and Early Iron Age. Later on cultivation and wine making appear completely established.

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