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CC BY 4.0**A Bibliographic Analysis of the Traces of Viticulture in  
Archaeobotanical Literature**Ertan Şehit<sup>1</sup>, Aysun Şehit<sup>2</sup><sup>1</sup>Dr. Öğr. Görevlisi, Yozgat Bozok Üni., Boğazlıyan MYO, Mimarlık ve Şehir Planlama Böl., Yozgat; ORCID: 0000-0002-1759-1295<sup>2</sup>Dr. Öğr. Üyesi, Yozgat Bozok Üni., Boğazlıyan MYO, Ziraat Fak., Bahçe Bitkileri Böl., Bahçe Bitkileri Pr., Yozgat; ORCID: 0000-0002-1968-9325

Viticulture has played a central role in the economic, cultural, and social structures of ancient societies, as clearly demonstrated by archaeological and archaeobotanical data. This study aimed to evaluate the development of scientific literature at the intersection of viticulture and archaeology, its thematic orientations, and its collaborative structure using a bibliometric approach. A total of 263 studies published in the Scopus database between 1987 and 2025 were analyzed using the Bibliometrix package in the VOSviewer and R environments. The analyses focused on author collaborations, institutions, country contributions and keyword trends. Bibliometric analysis shows that Montpellier University-centered research networks have played a decisive role in ancient viticulture studies focused on Southern Europe, the Mediterranean, and the Caucasus through archaeobotany, geometric morphometry, and ancient DNA-based approaches. France, Italy, Spain, and the United States stand out as leading countries in the field, with the University of Montpellier occupying a position as a major research center. Keyword and co-authorship analyses indicated a shift in the research focus from traditional descriptive studies to interdisciplinary, genetic, and climate-based approaches. Consequently, ancient viticulture research is being addressed within a more comprehensive framework owing to increasing international collaboration and methodological diversity.

**Arkeobotanik Literatürde Bağcılığın İzlerinin Bibliyometrik  
Analizi**

Bağcılık, antik toplumların ekonomik, kültürel ve sosyal yapılarında merkezi bir rol oynamış olup, bu durum arkeolojik ve arkeobotanik verilerle açıkça ortaya konulmaktadır. Bu çalışma, bağcılık ve arkeolojinin kesişiminde yer alan bilimsel literatürün gelişimini, tematik yönelimlerini ve iş birliği yapısını bibliyometrik bir yaklaşımla değerlendirmeyi amaçlamaktadır. Scopus veri tabanında 1987–2025 yılları arasında yayımlanan toplam 263 çalışma, VOSviewer ve R ortamında kullanılan Bibliometrix paketi aracılığıyla analiz edilmiştir. Analizler; yazar iş birlikleri, kurumlar, ülke katkıları ve anahtar kelime eğilimleri üzerine odaklanmıştır. Bibliyometrik analiz, Montpellier Üniversitesi merkezli araştırma ağlarının arkeobotanik, geometrik morfometri ve antik DNA temelli yaklaşımlar aracılığıyla Güney Avrupa, Akdeniz ve Kafkasya odaklı antik bağcılık çalışmalarında belirleyici bir rol üstlendiğini göstermektedir. Fransa, İtalya, İspanya ve Amerika Birleşik Devletleri, alanın önde gelen ülkeleri olarak öne çıkarken, Montpellier Üniversitesi önemli bir araştırma merkezi konumundadır. Anahtar kelime ve ortak yazarlık analizleri, araştırma odağının, geleneksel tanımlayıcı çalışmalardan, disiplinlerarası, genetik ve iklim temelli yaklaşımlara doğru kaydığını göstermektedir. Sonuç olarak, antik bağcılık araştırmaları, giderek artan uluslararası iş birliği ve metodolojik çeşitlilik ile daha bütüncül bir çerçevede ele alınmaktadır.

## INTRODUCTION

The crucial role of viticulture in antiquity is well attested in archaeological and historical records. Originating during the Neolithic period in the South Caucasus, wine has played an important role for at least 8,000 years in various cultures, including those of the Greeks and Romans. It was integrated into the social and religious structures of ancient societies. Wine is not only a highly valued agricultural product but also a marker of wealth and social status. It was also used in religious rites, social festivities, and medical procedures. This importance in history, archaeology, culture, and tourism continues to shape regional identities and economies today (McGovern, 2013; Estreicher, 2017; Harutyunyan & Malfeito-Ferreira, 2022). Viticulture and the wine industry occupy a prominent position in economic development, cultural heritage transmission, and gastronomic tourism. Countries where enotourism is practiced include France, Italy, Spain, Portugal, Greece, and Türkiye, in addition to other wine-producing nations such as the USA, Canada, Argentina (particularly along the foothills of the Andes), Chile, and Australia. These regions support agricultural ecosystems by enhancing biodiversity and resilience while promoting sustainable viticulture practices (Estreicher, 2017; Kasaroğlu et al., 2021; Petelca et al., 2022). Archaeological excavations and historical sources have demonstrated that vineyards were cultivated and wine was produced. The commercial correspondence of Assyrian merchants preserved in the Kültepe texts indicates that the cities of Tegarapa and Zalpa, located in Anatolia, were significant wine-producing centres (Öz, 2011; Laflı, 2017). Commercial inscriptions and archaeological evidence indicate that viticulture was central to the Anatolian economy. In the 2021-2022 archaeological works in Tatarlı Höyük, grape seeds were discovered in a storage unit (Kavak, 2024). Similarly, archaeologically recovered remains of *Vitis sylvestris* (wild grape) were uncovered at Kanlıtaş Höyük (Kavak et al., 2024). This indicates that grapes were not only cultivated but also consumed through the gathering of wild grape resources in the region. This is further supported by textual evidence that shows that wine functioned as both a social and medicinal agent. The ancient writer Strabon wrote that Knidos, Smyrna, and some other places produced wine for pleasure and medicinal purposes (Strabon, 2009). Hippocrates described wine as a remedy for various ailments and noted its therapeutic applications (Hippocrates, 2018). Archaeological findings show that viticulture and wine were not only economic activities for societies but also important elements in

social relations and health. Accordingly, advances in archaeobotanical methodologies are essential to develop an understanding of viticulture in societies within their historical context and its evolution. To this end, it is necessary to examine viticulture in the archaeological literature to understand the cultural importance of wine, its production methods, and its economic impact on these societies, thus bridging the gap between archaeology and modern viticultural practices and grape varieties (Harutyunyan & Malfeito-Ferreira, 2022; Sarpaki, 2012; Di Cecco et al., 2024; Prados Martínez, 2011). Bibliometric analysis of evolution and convergence trends in archaeobotany and vine growing/viticulture research can be a valuable tool for understanding discipline growth, tracing key players and their related sub practices, and creating a map. This method presents a structured view of scientific production, focusing on the best studies, institutions, and geographical trends. Bibliometric analysis is particularly valuable for understanding how viticulture intersects with other fields, such as tourism, archaeology, and economic value creation (Karabulut & Akyürek, 2022; Sanchez-Garcia et al., 2024). This research fills a void in the scientific output by summarizing all archaeological research in which archaeobotany and viticulture overlap, representing a useful tool for tracing the formation of this field and its current trends.

## MATERIALS AND METHODS

This study evaluates the trend in the location and relevance of viticulture in archaeology through bibliometric screening and analysis. The analysis was based on data retrieved from the Scopus database, selected for its extensive and continuously expanding coverage, as it provides more flexible information than other databases with a growing source structure (Pranckutė, 2021). Research published in Scopus between 1987 and 2025 was accessed on 8 June, 2025, and the keywords used as search criteria were as follows: “viticulture” OR “grape cultivation” OR “vineyard management” OR “grapevine” OR “grape” OR “vitis” OR “*Vitis vinifera*” OR “origin of viticulture” OR “ancient viticulture” OR “historical viticulture” OR “grape domestication” OR “wine archaeology” OR “grape seeds” OR “ampelography” AND “archaeology” OR “archaeological sites” OR “archaeobotany” OR “agricultural archaeology” OR “paleoethnobotany” OR “landscape archaeology” OR “food archaeology” OR “environmental archaeology” OR “ethnoarchaeology” OR “aDNA”.

Based on these criteria, 263 publications, including research articles, review articles, book chapters, conference proceedings, and books, were included in the analysis. For each record, detailed bibliographic information was extracted, including authorship, document type, keywords, year of publication, publishing sources, institutional affiliations, country or region, and indexing categories. VOSviewer (accessed on June 8, 2025; <https://www.vosviewer.com>) and the Bibliometrix package implemented in the R statistical environment (accessed on June 8, 2025; <http://www.bibliometrix.org>) were used to visualize the results and construct bibliographic networks. These tools have been widely demonstrated to be effective for mapping scientific knowledge structures, identifying thematic clusters, and analyzing collaboration patterns within bibliometric datasets (Arruda et al., 2022; Stefanis et al., 2023).

## RESULTS AND DISCUSSION

The bibliometric data obtained in the study were evaluated at the author, country, journal and keyword levels; they were interpreted using network analysis, total link strength, co-occurrence, centrality and density criteria. The top 10 authors with the highest number of publications are presented in Table 1. Bouby L. has 86 publications indexed in Scopus, 20 of which are directly related to the thematic area, making him the author with the most publications in this field. Ivorra S., who ranks second, has 12 publications matching the keywords and 53 publications. Similarly, Bonhomme V. focused directly on viticulture and archaeology in 10 of his 63 publications. Most of the top 10 authors were affiliated with the University of Montpellier and collaborated with other institutions. Furthermore, the University of Montpellier ranked first among institutions producing the most publications. Researchers appear to specialize in archaeobotany, the domestication of grapevines, and agriculture in ancient times, and their work is generally based on the analysis of ancient plant parts using modern analytical techniques (geometric morphometry and ancient DNA). Furthermore, research has been conducted in regions of significance for the origins of viticulture, such as Southern Europe, the Mediterranean Basin, and the Caucasus. The data indicate that researchers have contributed not only to the quantitative productivity of the field but also to its qualitative aspects through interdisciplinary approaches. Bouby and Marinval (2001) contributed substantially to discussions on the origins and early

development of viticulture by demonstrating clear morphological differences between wild grape seeds (*Vitis sylvestris*) recovered from 6th-century BC Marseille, currently regarded as the earliest archaeological evidence of viticulture and seeds from modern cultivated grapevine (*Vitis vinifera*). Institutional researchers play a significant role in developing internationally applicable analysis protocols at both morphometric and molecular levels. Consequently, France has led the way in understanding viticulture and archaeobotany, both as a methodological framework and as a cultural-historical interpretative field (Terral & Bouby, 2013; Bouby et al., 2022). This concentration of archaeobotanical and morphometric expertise has resulted in ongoing institutional partnerships and interdisciplinary research plans. Research on early viticulture is not confined to France. There is further evidence from Italy, Spain and Greece that both wild and domesticated vines were used concurrently. These conclusions primarily rely on pollen analysis and charred seeds of *Vitis vinifera* L. found in archaeological sites, which provide specific insights into ancient cultivation methods and horticultural strategies (Brion & Castiñeira, 2021; Valera et al., 2023; Ucchesu et al., 2025; Beukers & Hondelink, 2025). Taken together, such regionally grounded approaches contribute to a more nuanced and comparative understanding of viticulture and archaeobotany on a broader geographical scale.

In the author co-authorship analysis performed in VOSviewer, we chose authors who had published at least three times, and seven clusters, including a total of 43 authors, were detected (Figure 1). The groups are organized according to their areas of methodological expertise. Cluster 2 (green cluster) represents the core themes or most prevalent authors (Bouby L, Ivorra S., Bonhomme V, Pastor T, Pérez-Jordà G) of interest of the present study. This cluster contributes to the continuity and cohesion of the research network regarding publication output, interdisciplinarity, and cooperation intensity. Studies in this theme cluster tend to concentrate on themes such as the domestication process of grapevines (*Vitis vinifera*), geometric morphometric approaches, and analyses of archaeological grape seeds, with a special emphasis on Southern France, Spain, and the wider Mediterranean. Based on edge thickness, number of connections, and node centrality, cluster 2 exhibited the highest network intensity. The strongest clusters were retrieved: Cluster 6 (light blue), Cluster 3 (blue), and the red cluster. Cluster 6 (light blue) is concerned with the archaeobotany applications, carbonised seed analysis and ecological diversity in the western Mediterranean; here Cluster 2's unique methodology

approaches are applied on site. Cluster 3 (blue) shows a geographical concentration of studies in Europe, Georgia and Israel, including research focusing on molecular approaches to interpret the genetic variation and historical spread of the vine. Cluster 1, depicted in red, deals with Italy and features palaeoecology, pollen analyses, and agricultural systems in a Paleoclimatic framework. This cluster showed partial collaboration with Cluster 2 which was dominated by plant palynology. Except for this, Cluster 4 (light green) is unrelated to viticulture, however it belongs to the early phases of agricultural changes. The purple cluster (5) authors investigated ancient agriculture by studying excavated materials in Israel and its environs. Cluster 7 (orange) consists of studies on the detection and analysis of wine residues

through modern biochemistry. The results on the cluster structures match the regional methodological discrepancies described in the literature. In fact, the well-referenced article by Bouby et al. (2013), which documents the domestication of vine using geometric morphometric techniques, supports Cluster 2 (a central theme according to our results based on thematic and collaborative intensity). Similarly, the results obtained by Brión and Castiñeira (2021) describing the co-occurrence of wild and domesticated vines on the Iberian Peninsula, offer a valuable framework for interpreting how clusters within this region diverged over time. In this context, it can be said that clustering is based not only on geographical foundations but also on the continuity of specific methodological practices.

Table 1. Prominent authors in viticulture and archaeobotanical research and their publication metrics

| Authors       | Thematic Area Article | Total Article | Total Citation | h-index | Institutes                             | Country |
|---------------|-----------------------|---------------|----------------|---------|----------------------------------------|---------|
| Bouby, L.     | 20                    | 86            | 1987           | 23      | University of Montpellier              | France  |
| Ivorra, S.    | 12                    | 53            | 1390           | 21      | University of Montpellier              | France  |
| Bonhomme, V.  | 10                    | 63            | 1374           | 20      | University of Montpellier              | France  |
| Figueiral, I. | 9                     | 45            | 1701           | 20      | University of Montpellier              | France  |
| Baciliéri, R. | 8                     | 55            | 3102           | 25      | University of Montpellier              | France  |
| Lacombe, T.   | 8                     | 101           | 5488           | 36      | Institut Agro Montpellier              | France  |
| Mercuri, A.M. | 8                     | 156           | 5627           | 45      | University of Modena and Reggio Emilia | Italy   |
| Rovira, N.B.  | 8                     | 26            | 709            | 11      | University of Barcelona                | Spain   |
| Wales, N. A.  | 8                     | 61            | 3380           | 30      | University of York                     | UK      |
| Pastor, T.    | 7                     | 13            | 565            | 8       | University of Montpellier              | France  |

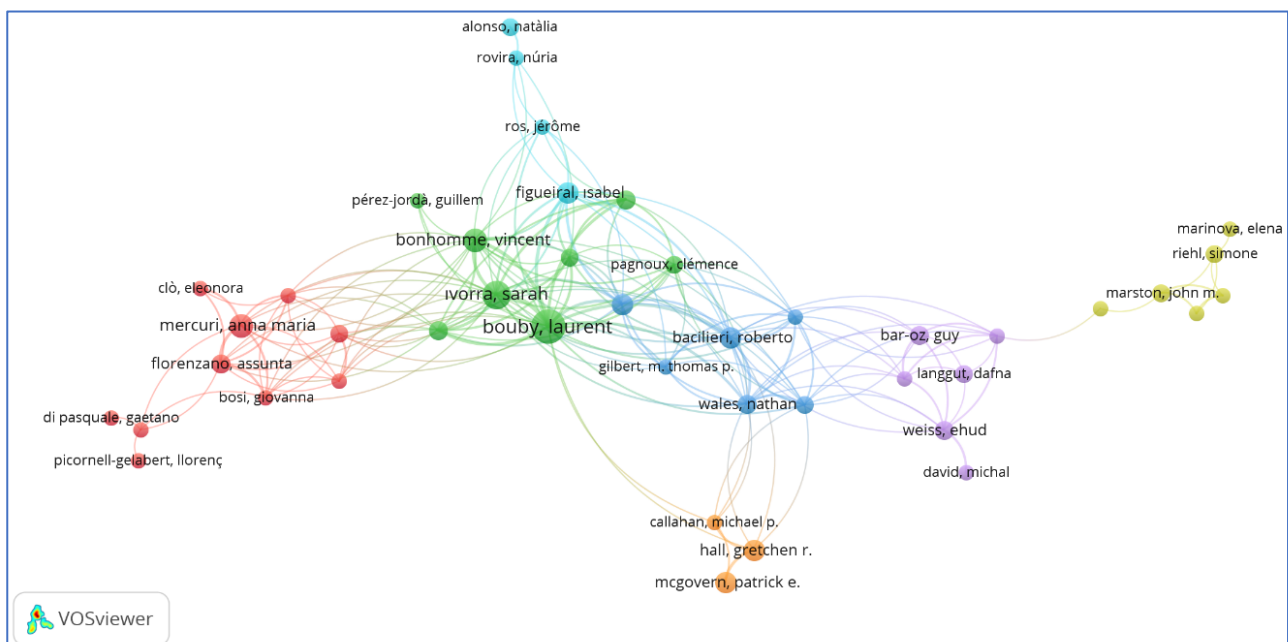


Figure 1. Author co-authorship network in viticulture and archaeobotanical research (VOSviewer analysis)

Table 2 shows the countries whose researchers published within the research thematic area and the degree of international collaboration employed by these areas. Italy was the most productive country, with 40 articles (15.2%) in the total ratio of publication output. Despite Italy's strong national

research capacity through its high single country publication (SCP) rate, the United States (37.0%), France (52.2%), and Spain (44.4%) play a central role in interdisciplinary and multinational projects, as shown by their MCP rate. These countries also account for a high number of citations, with most of

the citations coming from the US (1,581 citations), France (637), and Spain (176). Despite the fact that only 8.3% of Israel also reflects a predominantly domestic-based publication, it has succeeded in obtaining high visibility in the literature with 640 citations. Based on archaeological and archaeobotanical evidence, the birthplace of viticulture was identified as the general area of the Caucasus, the Near East (particularly around Eastern Türkiye; Tzirani Sithon), and more specifically, The South Caucasus (Armenia) and Western Asia. The primary regions associated with the domestication of wild grapevines (*Vitis vinifera*) are the Caucasus and Near East. Recent research has shown how the culture of viticulture began to move west and evolved in transforming itself into local culture. Archaeological indications of viticulture in Greece during the Neolithic and Archaic periods have become apparent in recent years, particularly from findings at several sites over the past decades (McGovern, 2013; Harutyunyan & Malfeito-Ferreira, 2022; Valera et al., 2023; Pagnoux et al., 2021; Breglia et al., 2023). This is apparent in the data stratified by the country in which researchers were located; it can be observed that some of the top-mentioned geographical areas are set out under field location. However, it is noteworthy that for the United States, one of the countries with a higher number of publications in this kind of literature, their research is not confined to domestic study areas; 88.5% of these studies (Figure 1) are concentrated mainly around regions like Levant, Caucasus, and Mediterranean, where viticulture was developed. This finding highlights the expansion of scientific cooperation and global knowledge exchanges. These data suggest a growing decoupling between centers of knowledge production and the geographical locations where archaeological evidence was generated. If publication leadership is concentrated in institutions that are situated to do the technical work, research on historical centers of winemaking may lag behind site-based investigations. This state of affairs suggests that epistemic influence is increasingly shaped by what one knows about primary field data sources, but more by analytical potential and methodological advantage.

Table 2. Country-based distribution of publications and collaboration indicators in viticulture and archaeobotanical research

| Country        | Articles | Cited | SCP* | MCP* | MCP (%) |
|----------------|----------|-------|------|------|---------|
| Italy          | 40       | 601   | 32   | 8    | 20.0    |
| USA            | 27       | 1581  | 17   | 10   | 37.0    |
| France         | 23       | 637   | 11   | 12   | 52.2    |
| Spain          | 18       | 176   | 10   | 8    | 44.4    |
| Israel         | 12       | 640   | 11   | 1    | 8.3     |
| United Kingdom | 11       | 351   | 3    | 8    | 72.7    |
| Germany        | 10       | 162   | 1    | 9    | 90.0    |
| China          | 9        | 174   | 5    | 4    | 44.4    |
| Türkiye        | 6        | 34    | 5    | 1    | 16.7    |
| Portugal       | 4        | 16    | 2    | 2    | 50.0    |

\*SCP: Single Country Publications MCP: Multiple Country Publications

The most commonly referenced articles were reviewed. McGovern et al. (McGovern et al., 2004) for example, which carried out chemical analyses of archaeological vessels dating from China's Neolithic era, that chronicle the history of wine-like fermented beverages to around 7000 BCE, went on to become the most highly cited article in archaeological research in relation to the history of viticulture with 719 citations. Goren-Inbar et al. (2004) reported the presence of charred wild grape remnants dating to approximately 790 kya at the Gesher Benot Ya' aqov site, providing archaeobotanical documentation for plant exploitation alongside fire control among early hominins and documenting one of the earliest finds linked with viticulture.

*Vegetation History and Archaeobotany* (33), *Journal of Archaeological Science* (18), *Journal of Archaeological Science: Reports* (13) and *PLOS One* (13) are some of the journals that excel in the number of publications within the thematic area (Table 3). These journals are considered core and interdisciplinary journals. Prestigious journals, such as *Vegetation History and Archaeobotany* and *Journal of Archaeological Science*, are high-impact publications with CiteScore values of 4.9 and 5.6, respectively. Considering the number of citations, it is not behind PLOS ONE (341,421) and Proceedings of the National Academy of Sciences - PNAS (226,600), and its visibility is high at the international level. This table also shows that research on viticulture and archaeology is present in field-specific specialized journals as well as broad-access academic journals of different disciplines, providing methodological depth while allowing for interdisciplinary dialogue.

Table 3. Leading journals in viticulture and archaeobotanical research and their bibliometric indicators

| Journal                                                                      | Documents by Journal in the Thematic Area | Total Documents (2021-2024) | Citations (2021 - 2024) | CiteScore | SJR 2024 | Years Currently Covered | Research Area                                                             |
|------------------------------------------------------------------------------|-------------------------------------------|-----------------------------|-------------------------|-----------|----------|-------------------------|---------------------------------------------------------------------------|
| Vegetation History and Archaeobotany                                         | 33                                        | 192                         | 941                     | 4.9       | 0.864    | 1992                    | Archaeology, Paleontology, Plant Science                                  |
| Journal of Archaeological Science                                            | 18                                        | 469                         | 2.629                   | 5.6       | 1.242    | 1974                    | Archaeology                                                               |
| Journal of Archaeological Science: Reports                                   | 14                                        | 1.898                       | 5.546                   | 2.9       | 0.691    | 2015                    | Archaeology                                                               |
| PLOS One                                                                     | 13                                        | 62.774                      | 341.421                 | 5.4       | 0.83     | 2006                    | Multidisciplinary                                                         |
| Quaternary International                                                     | 11                                        | 1.126                       | 6.691                   | 5.9       | 0.682    | 1989                    | Earth-Surface Processes                                                   |
| Archaeological and Anthropological Sciences                                  | 8                                         | 833                         | 3.636                   | 4.4       | 0.888    | 2009                    | Archaeology, Anthropology                                                 |
| Methods in Ancient Wine Archaeology: Scientific Approaches in Roman Contexts | 8                                         |                             |                         |           |          |                         | Biomolecular Archaeology, Archaeobotany, Palynology, Vineyard Archaeology |
| Proceedings of The National Academy of Sciences (PNAS)                       | 8                                         | 13.719                      | 226.600                 | 16.5      | 3.414    | 1945                    | Multidisciplinary                                                         |
| Environmental Archaeology                                                    | 6                                         | 143                         | 677                     | 4.7       | 0.725    | 1981                    | Archaeology, Environmental Science                                        |
| Plant Biosystems                                                             | 4                                         | 479                         | 2.174                   | 4.5       | 0.409    | 1993                    | Ecology, Evolution, Behavior and Systematics, Plant Science               |

A clear upward trend is evident in the distribution of publication years for archaeobotanical studies pertinent to viticulture and archaeology as they reach out towards 2023. In particular, the number of publications that was average to the year ( $n = 18/\text{Yr}$ ) from 2018 to 2023 increased significantly up to ( $n = 44$ ) in 2024. This shows that there has been a remarkable increase in academic interest in the subject over the recent years, and it is being approached in a more comprehensive manner with the cooperation of various disciplines. Topics that were very prominent in the first phase (2003–2008) were archaeobotanical keywords such as “*fermentation*”, “*fruit*”, “*archaeological evidence*”, “*wine*” as well as “*Vitis vinifera*” that refer especially to grape varieties and fermentation methods. The appearance of “*Hordeum vulgare*” and “*Triticum aestivum*” in the trend topic words also suggests that it included studies on the geographical distribution of early agricultural systems and cereal analyses. It also contains terms that reflect the geographical area “*Eurasia*” including the Caucasus, Anatolia, Levant, and Southeast Europe, where agriculture and early viticulture were practiced. This indicates that early research primarily focused on agricultural products and the Neolithic period. This literature mainly focuses on the determination of archaeobotanical remains recovered from archaeological sites and early agricultural diversity. Variations in the number of keywords were observed from 2009 to 2017. Key words such as “*Vitis vinifera*”, “*ceramics*”, “*archaeology*”, “*grape*” and “*wine*” emerge which may be linked to the identification of grape varieties

and study of ancient samples. This period might be described as a stage dominated by methodological progress, especially in the reconstruction of archaic viticulture grounded in solid evidence. When these terms are close to one another in the network, a tight cluster of the words viticulture, archaeobotany, and archaeology implies intensive cross-disciplinary activity. In the last few years (2018–2024), “*climate change*”, “*charcoal*”, “*genetics*”, “*diet*”, and “*domestication*” emerged, widening thematic perspectives and enhancing them technically thanks to an interdisciplinary influence. The large jump in the number of articles after 2024 is definitely connected to “*ancient DNA*”, “*domestication*”, “*climate change*”, “*plant seed*”, and the like. These developments mark a significant methodological shift, and their namesake is actually starting to make a difference by integrating archaeobotany with molecular biology and genetic studies.

Table 4. Temporal distribution of dominant keywords in viticulture and archaeobotanical research

| 2003 - 2008                   | 2009 - 2017              | 2018 - 2025          |
|-------------------------------|--------------------------|----------------------|
| <i>Hordeum vulgare</i> subsp. | archaeology              | diet                 |
| <i>Triticum dicoccon</i>      | archaeology              | charcoal             |
| <i>Linum usitatissimum</i>    | italy                    | ancient dna          |
| <i>lens culinaris</i>         | vitis                    | domestication        |
| eurasia                       | wine                     | genetics             |
| <i>Triticum monococcum</i>    | paleobotany              | climate change       |
| <i>corylus avellana</i>       | israel                   | human                |
| <i>corylus</i>                | mass spectrometry        | plant seed           |
| <i>vitis</i> sp.              | wood                     | mediterranean region |
| <i>Hordeum vulgare</i>        | archaeological evidence  | france               |
| fermentation                  | europa                   | ceramics             |
|                               | priority journal         | humans               |
|                               | juglans                  | article              |
|                               | <i>Panicum miliaceum</i> | grape                |
|                               | vitaceae                 | nonhuman             |
|                               | <i>Vitis vinifera</i>    |                      |
|                               | quercus                  |                      |
|                               | <i>Triticum aestivum</i> |                      |
|                               | hordeum                  |                      |
|                               | southern europe          |                      |

## CONCLUSION

This analysis has disclosed the types of products, collaboration and thematic focus of archaeobotanical research on viticulture and archaeology in the Scopus database. The bibliometric approach reveals that the disciplinary knowledge in this area is built as a result of methodological specialisation and interdisciplinarity. France, Italy, Spain and the USA are some of the countries with a high level of production of publications but also with authors exerting substantial academic and methodological influence. Indeed, the University of Montpellier in France was the most prolific research centre on this thematic during that period. These nations play a central role in scientific production due to their high research networks and sophisticated analysis facilities. Nevertheless, the historical geography of viticulture is clearly stubborn to appear as research and database production are conducted in situ (segment A) while knowledge production mainly find its place by centers with high technical skills. Journal analyses have indicated that the primary field journals (e.g., *Vegetation History and Archaeobotany*, *Journal of Archaeological Science*) provide methodological depth, whereas multidisciplinary journals such as *PLOS ONE* and *PNAS* increase global presence and citation impact. The trend of keyword suggests that grape morphology, wine fermentation and Archaeological material analysis are the research hotspots at beginning stage; while the research focus has been shifted to some comprehensive interdisciplinary contents on climate change, ancient DNA, winemaking processing

technology cultivation and genetic diversity in recent years. This transition suggests the emergence of novel research frontiers, science policy areas and paradigms based on the integration between molecular biology, climate science and archaeology. Annual performance of the publication between the years 1987 and 2000 were characterized by a very small number of publications. The average number of publishers increased between 2017 and 2023, but the most accelerated pace was observed in 2024 which recorded a rise of 133% when compared to the previous year. Here we see growing interest among the researchers in archaeobotanical investigations into viticulture and archeology. On the whole, the results suggest that in the future viticulture and archaeology at their intersection will be aimed by more methodological variety, intense data sharing, and international cooperation. Finally, such a hybridisation between genetic analysis, climate modelisation and cultural geography would enable a more globalising history of wine and viticulture. This strategy will not just extend academic expertise but it will contribute directly to safeguarding cultural heritage and sustainable policies for viticulture.

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