Acta Sci. Pol.
Silv. Colendar. Ratio Ind. Lignar. 24(2) 2025, 61–67
ACTA FORESTRY

www.forestry.actapol.net pISSN 1644-0722 eISSN 2450-7997 https://doi.org/10.17306/J.AFW.2025.2.3

ORIGINAL PAPER

Received: 18.09.2025
Accepted: 30.09.2025

RESIN AND PITCH PRODUCTION IN ITALY: HISTORICAL OVERVIEW AND REGIONAL PRACTICES

Irene Bertelli[1,2]✉, Jeannette Lucejko[2], Erika Ribechini[2]

[1]Department of Sciences of Antiquity, Sapienza University of Rome
Rome, **Italy**
[2]Department of Chemistry and Industrial Chemistry, University of Pisa
Pisa, **Italy**

ABSTRACT

This review presents a historical and technological overview of resin and pitch production in Italy, tracing their development from prehistory to the present. Archaeological evidence attests to the early use of birch tar and conifer resins in the manufacture of composite tools, while historical sources underscore the industrial scale and strategic value of Brettian pitch during the Roman era. In the Middle Ages and early modern period, pitch production became institutionalized through guild systems and regional economies. Although industrial output declined in the twentieth century, traditional practices persist in parts of the Italian peninsula. The review situates the Italian experience within broader European contexts, highlighting its technological, economic, cultural, and ecological significance. By integrating chemical, archaeological, historical, and ethnographic perspectives, this study elucidates the long-term continuity and transformation of resin and pitch production and use in Italy over millennia.

Keywords: resin, pitch, Italy, traditional forestry, archaeological adhesives, Brettian pitch, larch turpentine

INTRODUCTION

Natural resins and their derivatives – tars and pitches – have long served as versatile materials in human societies. Their distinctive adhesive, hydrophobic, preservative, and antimicrobial properties made them indispensable from Prehistory onwards (Langejans et al., 2022). These attributes stem from their terpene-rich chemical composition, characterized by molecules formed through the condensation of isoprene units that are abundant in resins. The specific composition of these terpenes varies among plant families and, often, among species (Colombini and Modugno, 2009).

Across Europe, the use of resinous substances developed into diverse regional traditions that reflected both ecological adaptation and cultural knowledge. Within this wider context, Italy presents a particularly rich and complex case. Owing to its climatic and environmental diversity, the peninsula has long exhibited pronounced regional variation in culture and raw-material availability. In prehistoric northern Italy, birch bark tar was predominantly employed, whereas southern regions relied largely on resins and derivatives from the Pinaceae, reflecting the biogeographical distribution of these species in Europe (Rageot et al., 2021). However, this represents only a general trend, as it is impossible to draw a dividing line given the continuous trade and technological exchanges that occurred over time.

✉irene.bertelli@phd.unipi.it, https://orcid.org/0000-0003-2057-1540

Resin was commonly obtained by tapping or wounding trees to induce the exudation of oleoresin, which was then collected manually. In Alpine regions, the *Loriet drilling* or *Lörget* technique was widely used on larch trees (Schmied, 1956); this involved boring into vertical resin canals and sealing the openings with wooden plugs to maintain productivity and tree health.

Pitch (wood tar), by contrast, was produced through the pyrolysis of resinous wood – typically pine – under low-oxygen conditions. Traditional methods entailed stacking logs in earth-covered kilns or pits and igniting them to initiate controlled thermal decomposition. The resulting tar condensed in subterranean channels and was collected in earthen vessels or drainage troughs (Brózdowski et al., 2025; Osipowicz, 2005).

These two fundamental processes – resin tapping and wood pyrolysis – formed the technological foundation of a wide spectrum of regional practices. Over time, they became codified crafts shaped by ecological constraints, forest regulation, and artisanal innovation. Understanding these techniques is essential for identifying their archaeological signatures and assessing their socio-economic relevance within Italian forest history.

Recent advances in chemical characterisation, particularly spectroscopic and mass-spectrometry analyses, have provided new insights into these materials. Such approaches now permit detailed reconstructions of production methods and applications in archaeological contexts (Davara et al., 2023; Lebedev et al., 2021; Modugno et al., 2006; Orsingher et al., 2025).

This paper examines the long-term trajectory of resin and pitch production in Italy and situates it within a broader European framework. It synthesizes archaeological discoveries, historical developments, regional diversity, and contemporary efforts in conservation and valorization.

METHODOLOGY

This review adopts an interdisciplinary approach that integrates archaeology, chemistry, historical, and ethnographic evidence. Archaeological and chemical analyses provide insights into the earliest uses and material properties of resins, tars, and pitches. Written sources elucidate their economic and cultural roles across different historical periods, while ethnographic research documents the persistence and adaptation of traditional practices in the present day. By synthesizing these complementary lines of evidence, the study constructs a comprehensive account of resin and pitch production and use through time.

DISCUSSION

Prehistoric and protohistoric periods

The use of resinous substances by prehistoric humans represented a major technological advance, marking the emergence of adhesive technologies that enabled the production of more complex composite tools (Fig. 1). This innovation was pivotal in the transition from simple, single-component implements to multi-component tools designed for specific functions (Rageot et al., 2021; Wilson et al., 2021). In Italy, the earliest evidence of resin use as an adhesive dates to the Paleolithic site of Campitello (Mazza et al., 2006; Modugno et al., 2006). A notable example of this

Fig. 1. Graphic representation of Neolithic sickles
Ryc. 1. Graficzne przedstawienie neolitycznych sierpów

technological development is the Neolithic sickle—an agricultural implement made by attaching sharp flint blades to a wooden handle using a resin-based adhesive (Mazzucco et al., 2022).

During the Neolithic period in Italy, both birch-bark tar and resins from the Pinaceae were employed in manufacture. Chemical analyses of Neolithic artifacts from across the peninsula reveal clear regional preferences in material selection. Broadly, birch-bark tar predominated in the northern regions, correlating with the cooler alpine environment, whereas Pinaceae resins were more typical of central and southern areas. These trends, however, were not absolute. Archaeological evidence from La Marmotta – an archaeological site located on Lake Bracciano in the Lazio region of central Italy – demonstrates the co-existence of birch tar and Pinaceae resin (Bertelli et al., 2025). In some cases, where naturally occurring deposits were available, the use of bitumen has also been documented (Nardella et al., 2019; 2021).

Ancient period

Before the rise of the Roman Empire, several populations coexisted in the Italian peninsula (Fraschetti, 2002). Among these, the Etruscans were the most advanced. They had already established true city-states with complex urban and political systems and had developed a highly sophisticated writing system as well as rich artistic and religious traditions. Characteristic of Etruscan craftsmanship are ceramics decorated with geometric patterns in the Villanovan style, as well as vessels featuring more elaborate ornamentation using metal stripes (Fig. 2). This latter type of decoration is mainly found in the principal centers of southern Etruria and in sites such as Vetulonia and Populonia (Iaia, 2017). The metal stripes were affixed to the ceramic surface by employing an adhesive substance, probably resin-based (Morandi et al., 2018). Unfortunately, only limited characterization analyses of these artifacts have been conducted, and these have largely focused on their inorganic components (Mazzeo, 1989; Stjernqist, 1960).

During the Roman period, one of the most prized pitches in the empire was produced in Brettian territory, corresponding to modern Calabria (Vivacqua, 2004). The significance of this resource and the regions in which it was produced is attested by classical authors such as Pliny the Elder, Cicero, and Strabo (Agnoletti, 2018). Strabo records that "there is that forest called Sila (Σίλαν), which produces the best pitch known, called Brettian pitch (πίτταν Βρεττίαν)" [Strabone VI, 1, 9]. Brettian pitch – *pece bruzia* – was so renowned and valuable that it was marketed under a distinctive trademark (Fig. 3).

Fig. 2. Graphical representation of ceramic with "lamelle" decoration
Ryc. 2. Graficzne przedstawienie ceramiki z dekoracją typu lamelle

Although the Brettians were initially enemies of Rome, the Romans soon recognized the importance of their natural resources. After taking control of the region, they established *societas picariae* – organized associations dedicated to pitch production. These

Fig. 3. Graphical representation of a trademark for Brettian pitch
Ryc. 3. Graficzne przedstawienie znaku towarowego smoły breckiej (Brettian pitch)

operated primarily in forest areas near the coast, often bringing them into conflict with local landowners, the *boni homines* mentioned by Cicero (Vivacqua, 2004).

Medieval period

During the Middle Ages, forests remained an important source of materials, even as the growth of cities and the expansion of agriculture gradually reduced woodland areas. Feudal nobility often held control over forest resources, alongside communes and the Church. For example, during this period, the Sila territory – then, as now, an important forested region – was part of the *Demanio regio*, meaning that it belonged directly to the sovereign. Those who exploited its resources, including the *mastri piciari* (masters of pitch), were required to pay taxes.

With the professionalization of crafts, the figure of the pitch worker gained formal recognition and prestige through the title *mastri piciari*. This designation reflected the increasing importance of skilled trades within the socio-economic fabric of the time. As crafts (or *artes*) began to organize into corporations (Pratesi, 2016), professions such as the *mastri piciari* acquired both dignity and official status, underscoring the connection between craftsmanship and social identity.

However, this period also witnessed intense exploitation of forests – not only for pitch production but also for heating and other purposes. The cleric Ermanegildo Pini, writing in 1785, described the problem vividly:

"L'introduzione di molte Arti, che ne fanno un grande consumo, la riduzione di molti boschi in terreni coltivi, o in pascoli, ę prati, la negligenza de' possessori nel mantenere i boschi in buono stato, e nel pensare alla loro riproduzione dopo il taglio periodico degli alberi sono le principali cagioni dell'accennata scarsezza" [The introduction of many crafts that consume large quantities of wood, the conversion of forests into farmland, pastures, and meadows, and the negligence of landowners in maintaining forests properly and ensuring their regeneration after periodic cutting are the main causes of the aforementioned scarcity] (Agnoletti, 2018; Dattero, 2022).

Modern and contemporary periods

Deforestation intensified over time, yet the forest economy continued to play an important role in Italy until the early twentieth century. A notable example is found in the Gargano region, where the *peciaoli* produced pitch and other derivatives of the Aleppo pine (*Pinus halepensis*), including turpentine, pine oil, tar, and *teda* (resinous bark), as well as manna extracted from ash trees.

From the 1830s onwards, however, deforestation for timber production increased, while the demand for pitch declined – particularly after the Unification of

Table 1. Summary of resin and pitch production in Italy by region and historical period as described in this review
Tabela 1. Zestawienie produkcji żywicy i smoły w poszczególnych regionach Włoch w różnych okresach historycznych omówionych w artykule

Historical period	Region	Main product	Application domains	Notes
Prehistoric (Neolithic)	Northern & Central Italy	Birch bark tar	Adhesives for tools, waterproofing	Found at several aracheological sites across the Italy
Roman period	Calabria (Sila), Campania	Brettian pitch	Shipbuilding, waterproofing, construction	Highly valued and regulated (Pliny the Elder, Cicero and Strabo)
Middle ages	Gargano, Sila	Wood pitch	Agriculture, crafts, tool maintenance	*Mastri piciari* and guild systems documented
19th–20th century	Southern & Central Italy	Pitch & turpentine	Industrial applications (e.g., soap, paint)	Decline due to synthetic alternatives
Contemporary period	Trentino, South Tyrol	Larch turpentine	Traditional medicine, cosmetics, heritage revival	Considered intangible heritage; still practiced today

Italy – due to growing competition from other European producers. Pitch production in the Gargano region persisted until the 1960s, often integrated with agricultural and artisanal activities (Agnoletti, 2018; Dattero, 2022). In the same area, ash-tapping disappeared completely after the Second World War as industrial manna production became dominant. Pine tapping, by contrast, survived for a few more decades, continuing locally until the 1960s (Palmieri, 2001).

With the advent of synthetic materials, the economic importance of resin and pitch production has progressively declined in recent decades. Nonetheless, several traditional practices have endured. In certain Alpine areas of Trentino, such as the Val di Ledro, traditional resin extraction continues – particularly the collection of *larix* turpentine, which is used for the preparation of medicinal and artisanal products (Ilary, n.d.; Melchiori, n.d.; Torreggiani, n.d.).

CONCLUSION

From prehistoric times onward, the use of resins and other forest by-products has played a central role in Italian technology and economy, reaching significant levels of industrialization and regulation as early as the Roman era. These materials were vital to a range of industries – including shipbuilding, food storage, and even military applications. However, as with many natural materials, these traditional practices gradually declined, particularly with the rapid advent of synthetic products, which were cheaper and more durable. These synthetic alternatives soon replaced their natural counterparts, rendering the ancient art of resin tapping economically unviable on a large scale.

Although large-scale industrial resin production has long ceased, a few communities still maintain these traditional practices today, primarily with the goal of preserving them as part of Italy's living cultural heritage. For these practitioners, production is not merely economic – it is an act of continuity and conservation.

This review has sought to reconstruct the historical trajectory of resin and pitch use in Italy, highlighting their technological, economic, and cultural significance. Recognizing this legacy as a vital component of national heritage may support its preservation and appreciation for future generations.

REFERENCES

Agnoletti, M. (2018). Storia del bosco, il paesaggio forestale italiano. Gius. Laterza & Figli Spa.

Bertelli, I., Finocchiaro, C., Rageot, M., Ribechini, E., Mineo, M., Mengoli, D., Pannocchia, C. P., Starnini, E., Vassanelli, A., Gibaja, J. F., Mazzucco, N. (2025). What doesn't meet the eye: molecular insights into adhesive technologies of Neolithic harvesting tools from Central-North Italy. Archaeol. Anthropol. Sci., 17(8). https://doi.org/10.1007/s12520-025-02280-w

Brózdowski, J., Witczak, M., Sikorska, K., Ratajczak, I., Woźniak, M., Bartkowiak, M., Cofta, G., Dąbrowska, G. B., Zborowska, M. (2025). Valorization of forest biomass through pyrolysis: A study on the energy potential of wood tars. Energies, 18(5). https://doi.org/10.3390/en18051113

Colombini, M. P., Modugno, F. (2009). Organic Mass Spectrometry in Art and Archaeology. Wiley.

Dattero, A. (2022). Il bosco. Biodiversità, diritti e culture dal medioevo al nostro tempo. Roma: Viella. Retrieved from: https://www.viella.it/download/6881/7a477e2b4feb/il-bosco.pdf

Davara, J., Jambrina-Enríquez, M., Rodríguez de Vera, C., Herrera-Herrera, A. V., Mallol, C. (2023). Pyrotechnology and lipid biomarker variability in pine tar production. Archaeol. Anthropol. Sci., 15(9). https://doi.org/10.1007/s12520-023-01829-x

Fraschetti, A. (2002). Le popolazioni dell'Italia antica. In: Storia di Roma: dalle origini alla caduta dell'impero romano d'Occidente (pp. 1–7). Edizioni del Prisma.

Iaia, C. (2017). 40. Handicrafts, 10th cent.-730 BCE. In: A. Naso (Ed.), Etruscology (pp. 739–758). Boston: De Gruyter.

Ilary (n.d.). 16 modi per usare la Trementina di Larice. Retrieved from: https://tiamotrentino.it/i-6-modi-per-usare-la-trementina-di-larice/

Langejans, G., Aleo, A., Fajardo, S., Kozowyk, P. (2022). Archaeological adhesives. In: Oxford Research Encyclopedia of Anthropology. Oxford University Press. https://doi.org/10.1093/acrefore/9780190854584.013.198

Lebedev, A. T., Polyakova, O. V., Artaev, V. B., Mednikova, M. B., Anokhina, E. A. (2021). Comprehensive two-dimensional gas chromatography-high resolution mass spectrometry with complementary ionization methods in the study of 5000-year-old mummy. Rapid Comm. Mass Spectrom., 35(8). https://doi.org/10.1002/rcm.9058

Mazza, P. P. A., Martini, F., Sala, B., Magi, M., Colombini, M. P., Giachi, G., Landucci, F., Lemorini, C., Modugno, F., Ribechini, E. (2006). A new Palaeolithic discovery: tar-hafted stone tools in a European Mid-Pleistocene bone-bearing bed. J. Archaeol. Sci., 33(9), 1310–1318. https://doi.org/10.1016/j.jas.2006.01.006

Mazzeo, R. S. S. (1989). Indagini chimico-mineralogiche sulle decorazioni a lamelle metalliche. In: S. Tovoli (Ed.), Il sepolcreto villanoviano Benacci Caprara di Bologna (pp. 299–301). Grafis.

Mazzucco, N., Mineo, M., Arobba, D., Caramiello, R., Caruso Fermé, L., Gassin, B., ..., Gibaja, J. F. (2022). Multiproxy study of 7500-year-old wooden sickles from the Lakeshore Village of La Marmotta, Italy. Sci. Rep., 12(1). https://doi.org/10.1038/s41598-022-18597-8

Melchiori, G. (n.d.). La largaiola (raccoglitrice di resina) Chiara Iori.

Modugno, F., Ribechini, E., Colombini, M. P. (2006). Chemical study of triterpenoid resinous materials in archaeological findings by means of direct exposure electron ionisation mass spectrometry and gas chromatography/mass spectrometry. Rapid Comm. Mass Spectrom., 20(11), 1787–1800. https://doi.org/10.1002/rcm.2507

Morandi, L. F., Porta, S. N., Ribechini, E. (2018). Evidence for Birch Bark Tar Use as an Adhesive and Decorative Element in Early Iron Age Central Italy: Technological and Socio-Economic Implications. Archaeometry, 60(5), 1077–1087. https://doi.org/10.1111/arcm.12362

Nardella, F., Duce, C., Ribechini, E. (2021). Analytical pyrolysis and thermal analysis to chemically characterise bitumen from Italian geological deposits and Neolithic stone tools. J. Anal. Appl. Pyrol., 158. https://doi.org/10.1016/j.jaap.2021.105262

Nardella, F., Landi, N., Degano, I., Colombo, M., Serradimigni, M., Tozzi, C., Ribechini, E. (2019). Chemical investigations of bitumen from Neolithic archaeological excavations in Italy by GC/MS combined with principal component analysis. Anal. Method., 11(11), 1449–1459. https://doi.org/10.1039/c8ay02429d

Orsingher, A., Solard, B., Bertelli, I., Ribechini, E., Maritan, L., Badreshany, K., Amicone, S. (2025). Scents of home: Phoenician oil bottles from Motya. J. Archaeol. Method Theory, 32(4). https://doi.org/10.1007/s10816-025-09719-3

Osipowicz, G. (2005). A method of wood tar production, without the use of ceramics. euroREA, 2. Retrieved from: https://www.researchgate.net/publication/259583450_A_method_of_wood_tar_production_without_the_use_of_ceramics#full-text

Palmieri, N. (2001). Le pinete del Gargano: Aspetti naturalistici e vegetazionali. Claudio Grenzi Editori.

Pratesi, S. (2016). Il lavoro contrattato e la nascita delle professioni nel basso medioevo. Università degli Studi di Firenze.

Rageot, M., Lepère, C., Henry, A., Binder, D., Davtian, G., Filippi, J.-J., Fernandez, X., Guilaine, J., Jallet, F., Radi, G., Thirault, E., Terradas, X. X., Regert, M. (2021). Management systems of adhesive materials throughout the Neolithic in the north-west. Mediter. J. Archaeol. Sci., 126. https://doi.org/10.1016/j.jas.2020.105309

Schmied, H. (1956). Resin-tapping – its effect on the size of resin streaks in Larch. Mitteilungen Aus Der Forstlichen Bundesversuchsanstalt (52, pp. 44–73). Mariabrunn.

Stjernqist, B. (1960). La decorazione metallica delle ceramiche villanoviane in una nuova illustrazione. In: A. Forni (Ed.), Civiltà del Ferro. Studi Pubblicati nella ricorrenza centenaria della scoperta di Villanova, Documenti e Studi a cura della deputazione di Storia Patria per le Province di Romagna (pp. 432–442).

Torreggiani, L. (n.d.). Vi presento l'oro del bosco: la riscoperta della resinazione del larice in Valle dei Mòcheni, simbolo delle mille sfumature del legame tra uomo e foresta.

Vivacqua, P. (2004). La produzione della pece nel Bruttium: nuovi dati alla luce della ceramica da fuoco. Ann. Facolt. Lett. Filos. Univ. Siena, XXV. Edizioni Cadmo.

Wilson, M., Perrone, A., Smith, H., Norris, D., Pargeter, J., Eren, M. I. (2021). Modern thermoplastic (hot glue) versus organic-based adhesives and haft bond failure rate in experimental prehistoric ballistics. Int. J. Adhes. aAdhesiv., 104, 102717. https://doi.org/10.1016/j.ijadhadh.2020.102717

PRODUKCJA ŻYWICY I SMOŁY DRZEWNEJ WE WŁOSZECH: PRZEGLĄD HISTORYCZNY I PRAKTYKI REGIONALNE

ABSTRAKT

Niniejszy przegląd przedstawia historyczne i technologiczne ujęcie produkcji żywicy oraz smoły drzewnej we Włoszech, analizując rolę tych materiałów od czasów prehistorycznych po współczesność. Dowody archeologiczne potwierdzają wczesne wykorzystanie dziegciu oraz żywic iglastych do wytwarzania narzędzi kompozytowych, natomiast źródła historyczne podkreślają przemysłową skalę i strategiczne znaczenie smoły breckiej w czasach rzymskich. W średniowieczu i we wczesnej epoce nowożytnej rzemiosło produkcji smoły drzewnej zostało zinstytucjonalizowane poprzez cechy i gospodarki regionalne. Choć produkcja przemysłowa zaczęła zanikać w XX wieku, tradycyjne praktyki utrzymują się nadal w wybranych częściach Półwyspu Apenińskiego. Przegląd ten osadza przypadek włoski w szerszym kontekście praktyk europejskich, podkreślając jego znaczenie kulturowe i ekologiczne.

Słowa kluczowe: żywica, smoła drzewna, Włochy, tradycyjne leśnictwo, archeologiczne kleje, smoła brecka, terpentyna modrzewiowa