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THE TRADITION OF LARCH RESIN EXTRACTION IN AUSTRIA

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ABSTRACT

Larch balm (larch resin) is used in natural and porcelain paints as a binder for paint production, as a plasticiser in elastic varnishes, and as an active ingredient in pharmaceutical and cosmetic products. Due to its optical properties, *Venetian turpentine* extracted from larch was of great importance for a long time in the past as a putty and sealant in optics. Larch resin is considered particularly valuable in folk medicine because of its preserving and healing properties. Larch resin (local name *Lörget*, *Loriet*) is extracted by drilling the trunks into the resin canal. Drilling to harvest larch resin is one of the oldest uses of the Austrian mountain forests. Written reports about this form of forest use date back to the 14th century. Larch resin was originally extracted by shepherds. They used an axe to make deep holes in the trunk until the resin cracks were opened and the resin running out could be collected. This tree-damaging procedure was forbidden several times by law already in the 16th century but was gradually permitted from the second half of the 18th century through an imperial privilege under improved technical requirements. This was often practised at that time by woodworkers, who either paid the forest owners an annual rent or leased certain forest plots for a flat rate. Due to the rising prices for larch wood, the extracting of larch balsam declined from the 1860s onwards. Today, larch resin is only turpentined in some mountain forests. For the farmers who cultivate their larch forests between 1,000 and 1,300 m above sea level, drilling to gain resin from larch is still an interesting additional income today. The study focuses on traditional forest-related knowledge and its applications. Learning about the diverse production concepts of the past will not only point to the safeguarding of cultural heritage today in important ways but also to future strategies towards sustainable raw material supply.

Keywords: larch, resin, history, intangible cultural heritage

INTRODUCTION

The knowledge, innovations, and practices of local communities have greatly contributed to the world's natural and cultural heritage by helping to sustain production of multiple goods and services that enhance livelihood, security, and quality of life. The resulting biocultural diversity is increasingly known and valued by decision-makers, conservation and development organisations, and the scientific community. In this sense, sustainable forest management is also being recognised as a cultural heritage and a component of regional development. Research initiatives are increasingly focusing on traditional forest-related knowledge and its application for safeguarding livelihoods in rural communities in a world grappling with ecological, cultural, social, and economic change.

Innovative ideas for assessing the tangible and intangible values of forest management can be guided by traditional practices. For example, forests with little or no economic value for timber production can acquire new functions through the use of secondary forest products. Understanding these traditions is an important prerequisite for understanding current

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challenges and assessing future prospects. Many of these products are important resources in the context of renewable raw materials and the bioeconomy.

In recent years, research in the field of wood chemistry has attracted increasing interest, and sustainable industrial solutions based on the traditional and promising raw material wood are being developed. Certain ingredients have already been used in the past, including the wood extracts wood oil, turpentine, and tar, as well as resins.

In this chapter, we focus on resin, particularly larch resin, which is extracted in the Alpine region, and its applications in local communities and beyond. Examining the diverse production concepts of the past not only provides important clues for safeguarding cultural heritage today but also for future strategies for a sustainable supply of raw materials. An acknowledged history and an upgrading of the importance of the cultural heritage of the forest can be an act of contributing to a regional sustainable development.

MATERIAL AND METHOD

Apart from the study of Lagoni (2012), contemporary papers with regard to the former collection of larch resin are very sparse. The paper relies on primary and secondary sources. Information concerning the ancient techniques of larch resin harvesting was gathered by the comprehensive study about the Austrian Alps and their forests published by Wessely (1853). He described the method practised by shepherds and also the methods used till the beginning of the 19th century. Wessely also highlighted some of the negative aspects of inadequate practices. Hafner also provides wide-ranging information related to the location of collection and the techniques that were applied and improved. General information about the history of larch drilling in the alpine regions is additionally provided by Bürgi and Stuber (2003), Lagoni (2012) and Koller (1975). Johann (1968, 2004), Koller (1975), and Hafner (1979) contribute to the knowledge related to technical regulations for resin extraction. The dispute concerning the environmental impact caused by drilling and the legal framework to avoid damaging impact can be gathered by studying the primary documents which are stored in the Carinthian State Archive (KLA) and published by Johann (1968 and 2004). These documents also give notice about the interrelationship between humans and forests.

The study also relies on the research papers by Schmied (1942, 1947, 1949a, 1950, 1956), who was based in the Austrian Forest Research Institute at Mariabrunn, Vienna, in the first half of the 20th century. His studies focused on larch resin extraction from different perspectives, including the appropriate tools. These research papers document the high importance of larch resin even after World War II and the efforts to improve the technology for avoiding negative impacts on the trees drilled. These improvements are also documented in the application form referring to the admission in the UNESCO National List by Schuster (2018).

In 2022 and 2024, visits to two enterprises in Carinthia still processing larch balm, along with interviews with the owners, gave an overview of current activities. An excursion to a mountain forest where larch resin is still extracted by a resin worker on behalf of a forest owner provided additional information with regard to the probable impact on the health of drilled larch trees. Knowledge concerning the contemporary market of ointments and other healing products containing larch turpentine was acquired from the publications by Unterhofer (2010) and Lagoni (2012).

Geographically, the study covers the Alpine countries with a high proportion of larch, where the traditional use of larch for resin production was widespread, such as Carinthia, Styria, and Tyrol (Austria), and South Tyrol (Italy) (see Fig. 1).

THE EXTRACTION AND PROCESSING OF LARCH RESIN IN THE AUSTRIAN ALPINE COUNTRIES AND THE NEIGHBOURING REGIONS

Occurrence and location

Larch (*Larix decidua*) is a conifer native to Europe and can be found in the Alps up to an altitude of 2,400 to 2,500 m. Especially in subcontinental climates, it forms forests together with spruce and grows particularly on steep slopes (see Fig. 2). It also occurs mixed in mountain pine (*Pinus mugo*) forests in the central and eastern Alps. It can reach the upper tree line together with stone pine (*Pinus cembra*). Outside its natural range, the European larch often occurs in mixed stands with common beech (*Fagus sylvatica*).

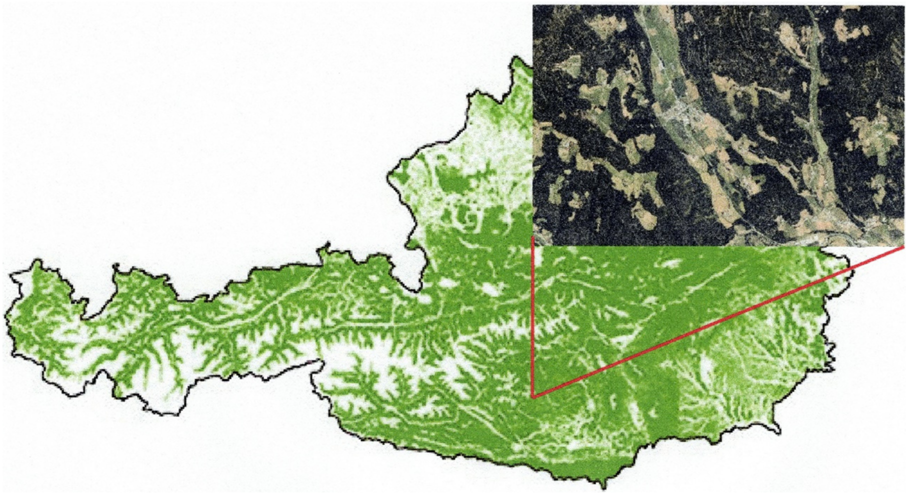

Fig. 1. Map of the forest cover in Austria and map section of the region where larch trees are still drilled (source: Bauerhansl et al., 2008)
Ryc. 1. Mapa pokrywy leśnej w Austrii oraz fragment mapy przedstawiający region, w którym nadal wykonuje się nawiercenia modrzewi (źródło: Bauerhansl i in., 2008).

Fig. 2. Mountain Forest Nockberge, Carinthia, Austria (Phot. Elisabeth Johann)
Ryc. 2. Górski las Nockberge, Karyntia, Austria (fot. Elisabeth Johann)

Today, its main habitat is in the high altitudes of the Austrian Alps (Tyrol, Vorarlberg, Salzburg, Carinthia, Styria), the Sudeten Mountains and the Carpathians, in Switzerland, in the French Alps and in northern Italy (South Tyrol). In Switzerland, apart from plantations in the Central Plateau, the occurrence of the larch is now mainly limited to the Valais, the Ticino Mountain valleys and Graubünden (Eidgenössische Forschungsanstalt).

Mountain forests consisting of pure larch stands are now found mainly at the foot of the slopes and on easily accessible slopes exposed to solar radiation. The current distribution of pure larch stands is largely due to the centuries-long impact of humans on mountain forests. Without human intervention, the more shade-tolerant Swiss stone pine would have gradually displaced the light-hungry larch through natural forest succession. However, where mountain areas were suitable for grazing, humans deliberately cut down the Swiss stone pine and spruce. This resulted in light-flooded forests that were suitable for grazing. This species shift in the mountain forest in favour of larch was also supported by the fact that Swiss stone pine trees are much more damaged by browsing and trampling. Due to their thick, cork-like bark, larches were more resistant to forest fires that used to be very common. Larch trees with a breast height of 35 cm or more growing on sunny south- or west-facing not-too-steep slopes and at altitudes of up to 1,300 m are well suited for resin extraction (Schusser, 2018).

In the past, European larch (*Larix decidua*) was highly valued as a resin-producing tree. In areas with a correspondingly high larch stand density, one of the secondary forestry uses was the extraction of larch resin, which in earlier times sometimes exceeded the main use. The extraction of larch resin has a long tradition in the resin-producing areas of Carinthia, South Tyrol and the southwest of Switzerland, as well as of Styria and Salzburg. Historically, Venice was the centre of the resin trade. Until the late 19th century, the entire Mediterranean region was supplied from this area.

Historical development

The resin of larch (local names Loriet, Lörget; in South Tyrol also Lerget or Largá) was historically extracted through various techniques and was a sought-after natural remedy and versatile raw material for the production of ointments, fragrances, glue, and varnishes. The origin of the extraction methods for larch resin is shrouded in historical obscurity. One of the oldest known references can be found in the scientific collection of the Roman historian and writer Pliny the Elder. There he describes a larch resin ointment for treating skin diseases. The collecting and drilling of resin are among the oldest forms of utilisation of the Austrian mountain forests. In fact, larch resin was delivered to the Roman Empire from the Alpine region early in history – along with other goods. There it was used for caulking (sealing ship planks). A customs agreement between the bishops of Trentino and Brixen from the year 1202 provides documentary evidence of this activity (Johann, 2004).

There is a significant difference between the extraction of resin from living and dead wood. When extracting resin from living wood, a distinction can be made between scratched resin and flowing resin. Scratched resin is collected as resin that has dried on the tree and is scraped off with a knife or by hand. By contrast, flowing resin refers to the freshly exuding liquid that flows like honey from the trunk into a collecting vessel. Resin extraction from larch trunks yields predominantly flowing resin, the so-called Loriet, also known as *Venetian turpentine* (Bürgi and Stuber, 2003).

One of the earliest written reports of Loriet drilling comes from the Obdach Saddle on the border between Carinthia and Styria and concerns the forests that belonged to the Admont Abbey. According to the Obdach decree of 1391, no one was allowed to “let any resin be drilled” without the knowledge of the provost. Loriet drilling was usually mentioned in connection with the use of resin and was therefore frequently prohibited for the local people. The reason for these restrictions lay in the applied harvesting method, which was originally carried out by shepherds and later also by woodworkers from Tyrol and Italy, as well as farmers or non-locals from the south (the so-called “Vallians”). The practice had the reputation of damaging the forest and impacting the trees’ health (Johann, 2004). People would use an axe to cut deep holes in the trunk at about 1 to 2 m above ground until the resin cracks opened, and the resin would flow out and could be collected. In Tyrol, bans on this practice existed as early as the 15th century, but most notably in the forest regulations of Sterzing from 1528. In the mining regulations of Emperor Maximilian I for the Lower Austrian lands (Tyrol, Carinthia, Styria, Upper and Lower Austria) of 1517, measures against drilling larch trees were taken in article 121. According to the draft forest regulations of 1567 and 1668, resin drilling required special permission. In the forest regulations of Lienz from 1598, the harvesting of resin was similarly prohibited. Johann (2004) reported that the first known ban for Carinthia in this regard dates back to 1567. After Archduke Charles became aware of the disadvantage and damage to his forests caused by resin drilling, he prohibited the practice altogether. Subsequent attempts to regulate forest use and protect the forest stocks, including “resin tapping and turpentining”, can be found in the Carinthian forest regulations project in 1702. According to article 9 of Maria Theresa's interim forest regulations for Carinthia in 1745, authorised people were permitted to drill larch trees in those state-owned forests that could not be used to produce charcoal, firewood, or boards. From 1787 onwards, forest owners were permitted to extract Loriet in their own forests, but in compliance with the provisions set out in the forest law (Johann, 2004).

From 1860 onwards, the drilling of larch trees decreased due to the rising value of larch wood. However, as Hafner (1979) reported, it was still practised in areas around Neumarkt, Oberwölz and Murau by Italians and Tyroleans, who often worked as woodcutters in Upper Styria. As noted by Johann (2004), in 1888 a law was finally passed in Carinthia that dealt with the authorisation to "pick pitch and drill for turpentine". Thus, the extraction of resin was now everywhere subject to the approval of the political authorities. In 1913, 14 entrepreneurs in the districts of Judenburg, Voitsberg and Deutschlandsberg, were granted permission to extract resin and turpentine. During World War I, resin was a highly valued raw material again. In remote regions in Carinthia, resin was drilled until the middle of the 20th century, before gradually declining due to the import of cheaper products from overseas. A few companies still exist; their origins go back to Nikolaus Schusser, who began collecting this valuable natural material commercially in the Carinthian Nockberge in 1919, following the example of South Tyrol. Today, resin is collected on a small but economically viable scale in Carinthia (Nockberge), Austria (Johann, 2018), South Tyrol (Sarntal, Ultental), Italy, and Valais (Switzerland) (Unterhofer, 2010).

Stakeholders

From the 16th century onwards, resin harvesting was under the control of the authorities. It was regarded as a sovereign privilege, permitted only upon approval and payment of certain fees. Moreover, technical regulations for resin extraction had to be observed (Johann, 1968; Koller, 1975; Hafner, 1979). Harvesting was permitted exclusively in forests that could not be used for other purposes. Johann (2004) reports that in state forests a resin collection fee had to be paid for the right to drill into larch trees. Resin workers either paid an annual rent per tree or leased certain forest plots for a fixed fee, which in Carinthia, for example, amounted to two to four guilders per year at the beginning of the 19th century and later increased to six to ten guilders as the value of wood rose. Lease contracts generally lasted for 10 years. In the 18th century, arbitrary resin extraction was punishable by severe penalties (Koller, 1975). However, collecting these fees often proved difficult for the forestry staff, as resin collectors were hard to locate in the forest and frequently either lacked the means to pay or refused payment. Cases were also reported in which resin collectors disappeared without having paid the recognition.

Nevertheless, by granting a number of contracts, the forest tax fund received a certain sum of money in the first half of the 19th century. The immediate profit that could be made from the lease of a forest by-product seemed more important to the state than any potentially higher profit that could be expected in the future from the sale of quality timber. As long as appropriate precautions were taken, Loriet drilling was not considered to be in conflict with orderly forestry, as at least the quality of firewood did not suffer from the extraction of resin – especially if the age of the tree, the season and an appropriate drilling technique were considered.

Thus, under certain conditions lease contracts between private resin entrepreneurs or resin workers and the state forestry administration were concluded (Johann, 2004): (1) The contract extended to specified forest districts. (2) The permission to drill resin was only granted for an indefinite period of time and could be revoked and immediately stopped by the Imperial Authority at any time if the conditions set were not fully met. (3) The resin workers were only allowed to drill into trunks that had to be cut within five to eight years at the most. This did not tackle forests that could not be used otherwise. The forester had to decide on this beforehand. Since the time of tree cutting could not be known to the resin contractor, the forester had to indicate these trees or the area where larch tree drilling was allowed to take place every year. (4) Only trunks suitable for firewood and charcoal and those unusable as construction timber were allowed to be drilled. (5) The disadvantages to the forest stocks caused by drilling were to be prevented as carefully as possible. (6) Each tree trunk had not to be drilled higher or deeper than one and a half to two feet (50 to 70 cm) above the ground and only down to the sapwood. A gutter was to be put into the drilled hole in order to catch the resin that oozed out. (7) Drilling was to stop at the end of August of each year. (8) For this purpose, all drill holes had to be well blocked with stakes after the gutters had been removed. (9) Finally, the resin drillers had to pay a yearly recognition fee of 10 guilders at the beginning of each year in which they were granted permission to drill resin.

The state privilege of drilling larch trees was only abolished under Emperor Joseph II. From 1787 onwards, every forest owner was permitted to extract larch resin in his own forests, but in compliance with the provisions laid down in the forest regulations. In the first half of the 19th century, it frequently happened that locals or foreigners, who were usually among the poorest in the population, collected resin or drilled larch trees in the state forests without having previously applied for the relevant permit. The "silent, hidden activity" of the resin collectors made monitoring extremely difficult. In the second half of the 19th century, many communities, but also private forest owners, leased the right to harvest resin in order to increase their income. For the first time, these lease contracts defined in more detail how the resin could be extracted without damaging the trees or forest stand. As a freely available forest product, resin was one of the secondary forest uses. The state forestry staff was obliged, according to their service instructions from 1847, to assist the resin workers with regard to extraction and at the same time to generate revenue for the forest administration (Österreiche…, 1884).

METHODS USED THROUGHOUT HISTORY

In contrast to other resin-producing trees (black pine, spruce), where the bark is always damaged to extract resin, larch has a remarkable peculiarity. A larch forms vertical cracks in the trunk due to tension during growth, which are filled with the wound secretion larch resin. Therefore, the extraction of this deposit can only be achieved by drilling into these resin pockets (Johann, 2004). Only the resin of the European larch (*Larix decidua*) is suitable for further processing in pharmaceuticals and cosmetics. That of the Siberian larch (*Larix sibirica*) is not suitable due to its higher resin acid concentration. The capacity of a larch tree to produce resin is also influenced by the soil, as primary rock substrates are better suited than limestone sites. Rotten trunks of alpine larches produce hardly any resin, as do those grown above 1,300 m and below 800 m above sea level. Larches for resin extraction must be vital, have a large crown and have a diameter at breast height of at least 35 cm (Wedenig, 2022).

Extraction of resin

In ancient times, shepherds usually injured the trunks with an axe up to the resin cracks and harvested the resin while it was flowing. As this technique is harmful to the trees, it was one of the reasons the resin use was banned, as declared in many of the laws and regulations mentioned previously. It can be assumed that these early attempts at extraction had a negative impact on the health of the larch stands and, in the worst case, led to the trees dying. However, the method has been refined over the centuries, and the negative effects have been eliminated so that the method used today can be practised safely (see Table 1). This has been confirmed by years of detailed research by Herbert Schmied at the Federal Forestry Research Institute in Mariabrunn, Austria, which gave a positive report on the harmlessness of the method (Schmied, 1950; Schusser, 2018).

Ancient method. Until the 1850s, the only method used for commercial resin extraction in the Federal States of Styria and Carinthia was the "Styrian method". According to Wessely (1853), the trunk was drilled where the branches were most widespread, because these sides of the trunk were traditionally richer in resin. According to this method, a channel was drilled diagonally upwards into the resin crack or resin bubble of the trunk. Just below the mouth of the channel, a "drip board" was inserted into a notch in the bark, which was intended to facilitate the resin flowing down into a container placed underneath. As the resin gradually drained from the higher parts of the shaft into the drilled holes, a single drill hole was sufficient. Experience has shown that free-standing larch trees in sunny locations yielded the highest amount of resin. Wessely (1853) reported that until the middle of the 19th century, the drillholes were not plugged, but the resin was allowed to flow freely into notched tubs that were moulded into the wood at the base of the tree. The resin flow lasted for 6 to 10 years, and – apart from the loss of resin that often

Table 1. Comparison of the methods of larch extraction and its impact in the course of time
Tabela 1. Porównanie metod pozyskiwania żywicy modrzewiowej oraz ich wpływu w różnych okresach historycznych

Period	Tool	Method for opening the resin pocket and canal	Method of extraction	Collection vessel	Harvested quantity and quality	Expected impact on the tree	Legal regulations
14th /15th century	Axe	Pecking the resin gall 1 to 2 m above the ground	When the resin crack was opened, the resin flowing out could be collected	None	No report available	Weakening of the tree's health and even leading to the dieback of the larch stand	Administrative permission necessary (Local legislation)
16th /17th century	Hand drill	Drilling into the tree trunk	Resin flowed out by gravity and could be collected	Collecting notch at the root collar	Contaminated, yield reduction due to evaporation	Weakening of the tree's health	Forest legislation (sovereign privilege): Administrative permission necessary or completely prohibited
18th century	Hand drill	Drilling into tree trunks was permitted only 5 to 8 years before the planned felling	Resin flowed out by gravity and could be collected. Exudation of resin 6 to 10 years	Collection vessel at the borehole, no closure of the borehole	Contaminated, yield reduction due to evaporation	No expected damage to wood suitable for charcoal and firewood if the season, the appropriate drilling method, and the age of the trees were taken into account	Forest Law 1745 (Crownland Carinthia). Permission when no other use was possible
First half of the 19th century "Styrian Method"	Hand drill	Drilling into the trunk diagonally upwards (max. 50 to 70 cm above ground). Annual harvest	Resin flowed out by gravity. Collection until the end of August Expected exudation of resin 30 years	Collecting vessel directly below the borehole. Closing the borehole after removing the collecting vessel	Improved quality, yield reduction due to evaporation	Damage was expected because the resin channel remained open throughout the summer, risk of infection, and subsequent damage to the tree. Dying of the tree tops reported	1787 The state privilege of drilling larch trees was abolished under Emperor Joseph II. Permitted in the own forest according to the Forestry Act
1850 - 1918 "Tyrolian Method"	Hand drill	Drilling in spring, upwards at an angle of 15 to 20 degrees, 30 cm above ground, borehole length 80-90 cm, borehole immediately sealed	Harvest resin in autumn, using a resin spoon (60–80 cm long and 25–28 mm wide). Harvest twice within 5 years	Resin collection in the bore channel within the trunk	Good quality, 0.1 kg per trunk and year; 3 kg from each trunk within 25 to 30 years	No resin loss and no damage to the tree due to fungal infection	Imperial Forest Law 1852
20th /21st century "Improved Tyrolian Method" (developed by Schusser/ Schmied)	Motor drill	Drilling downward, drilled channel length 50 to 80 cm, diameter: 30 mm	Resin canal immediately hermetically sealed with a precisely fitted plug. Opening only for harvesting with a resin spoon. Harvest every two years for 30 years	Resin collection in the trunk. Extracting with a resin spoon immediately after removal of the plug	Very good quality, no contamination. From 200g to 300 g per harvest year (May till September)	No damage to the tree	Forest Law 1975

overflowed – the trunks visibly suffered. This method had the disadvantage that the channel remained open during the resin-producing period, so that the evaporation of turpentine oil not only reduced the quality and quantity of the resin but also damaged the tree, as the open borehole increased the risk of infection by fungal spores. In consequence, the drilled holes were later plugged with a wooden plug. The yield was now lower (up to half), but resin could now be extracted from one hole for around 30 years.

Wessely (1853) pointed out that the improved method of keeping the borehole blocked was already in use in South Tyrol around 1852. The trunks were drilled in spring at an angle of 15 to 20 degrees upwards about 30 cm above the ground, using a hollow drill with a length of 80 to 90 cm and a width of 26 to 27 mm. The drilled holes were plugged immediately. Twice over the course of five years the accumulated resin was extracted in autumn. A 60 to 80 cm long and 25 to 28 mm wide groove-shaped iron rod was used to empty the boreholes. Up to 3 kg of resin could be extracted per trunk over a period of 25 to 30 years, up to 0.1 kg per year. Traditional knowledge proved that the sides of the trunks that had many branches and that the outer sides of a curved trunk had a high content of resin. Towards the end of the 19th century, the "Tyrolean method" was also introduced in Carinthia and Styria. This system was able to reduce resin losses and prevent tree damage due to infection by storing the flowing resin within the tree and avoiding contact with the open air. To achieve this, the drilling was carried out from the outside downwards. Thus, the drilling channel also formed the collection space for the liquid resin. It was closed with a larch wood plug and only opened when the resin was being extracted. With this method, light larch resin with a higher content of turpentine oil could be obtained, and damage to larch trunks could be avoided.

Resin extraction today. In its current form, the method of extracting larch resin can be traced back to Nikolaus Schusser. His achievement was to refine the extraction method to such an extent that, as long as certain criteria are met, the tree is not harmed. Already in 1919 he wanted to scientifically study the resin utilisation project and asked for support at the Forest Research Institute in Vienna. Together with Schmied, they developed a method of extracting larch resin that avoids damage to the drilled larch trees (Schmied, 1956).

The so-called turpenting of larches is now carried out using the improved "Tyrolean drilling method". In spring, the resin worker drills the hole in the base of the trunk with a motor drilling set (weight: 10 kg) at the base of the trunk, preferably on the southern side. Resinous cracks in the bark on the trunk are an ideal starting point. The drill opens a channel diagonally downwards through the centre of the trunk towards the main root. This creates a hole about 50 to 80 cm long with a diameter of about 30 mm. An experienced resin extractor can drill up to 200 trunks a day under favourable conditions. The drilled canal is hermetically sealed with a conical plug, which is only removed before the resin is extracted. The goal of this drilling is to cut into the vertical resin-filled crack so that the resin can flow into the drill channel, which serves as a collection space for the flowing resin. Subsequently, the resin can be removed from the drill channel. Relying on his traditional knowledge and experience, the resin worker should be able to estimate the course of the resin crack and avoid drilling past the resin pocket.

Resin only flows when the trunk is warm. As soon as the temperature is above 10°C at night, the resin is liquid enough to flow and can be pulled out easily. In general, the first resin harvest can begin just a few months after drilling. In local terminology, this first yield is called "virgin resin". To extract the resin, firstly the wooden plug gets removed, and then the resin is taken out of the tree with a long, groove-shaped "resin spoon" and scraped into a resin bucket that is carried along (see Fig. 3 and 4).

The wooden plug is then carefully hammered back in, and the tree is marked. The drilled channel can be used throughout the entire resin-harvesting period. Further resin extractions generally take place at two-year intervals. About 200 to 370 g of resin can be extracted per harvest year from one donor tree (May to September), depending on the region. The resin yield is most productive in the first years after drilling. A healthy larch produces resin for around 30 years. When the resin flow dries up, the tree is usually cut. Schusser (2018) reports that the sawn boards of a resin-extracted tree show that the resin crack has closed. Thus, the quality of the board has improved, not declined.

Fig. 3. Resin extraction: After having removed the wooden plug, the resin is pulled out with a long, groove-shaped "resin spoon" (Phot. Elisabeth Johann)
Ryc. 3. Pozyskiwanie żywicy: po usunięciu drewnianego korka żywicę wyciąga się za pomocą długiej, rowkowanej „łyżki do żywicy" (fot. Elisabeth Johann)

Fig. 4. Resin collection: It is collected in a specially designed bucket (Phot. Elisabeth Johann)
Ryc. 4. Zbieranie żywicy: gromadzi się ją w specjalnie zaprojektowanym wiadrze (fot. Elisabeth Johann)

Processing of resin

Terebinthina laricina, also known as Venetian turpentine, is obtained from fresh larch resin. Larch resin is a multi-component mixture with special properties. The crystallisation of the resin acids under the influence of oxygen is low. The colour fastness is stable. Lagoni (2012) describes the process as follows: After the first cleaning through a sieve, the resin is filtered several times, slightly heated, and refined by steam distillation. Water, air bubbles, wood particles and other inclusions are removed by heating it up to 70–80°C as well as by filtering it through linen bags. The raw larch resin is converted into larch turpentine by decanting. The turpentine is a clear, yellowish-green, slightly viscous liquid with a fine aromatic smell. It smells finer than other resins and tastes spicy and slightly bitter.

Products

The usability of turpentine is based on the variety of its ingredients. Native turpentine oil contains 15 to 20% essential oils, 50 to 65% different resin acids, bitter and colouring agents and 8% water. Turpentine should be stored in a sealed container and well protected from light. Further processing is carried out by using steam distillation. This produces 17 to 20% turpentine oil (*Oleum terebinthinae*) and 75 to 83% rosin, an amber-like mass that is still used today for violin bows and in the paint industry. The extraction and use of larch resin in the mountain regions of Carinthia, South Tyrol and the southwest of Switzerland has a long tradition. Mediaeval documents (monastery recipes) testify to the importance of resin and its diverse use in folk medicine. Larch resin was one of the most sought-after remedies in the herbal pharmacy.

Use in folk medicine

Larch resin was and is still considered particularly valuable because of its preservative and healing properties. Records describing the various uses in both veterinary and human medicine date back to the 16th century. It was traditionally thought to have many effective properties. Larch resin ointment was an ancient household remedy that was once made by farmers themselves and used as a rub against pain. According to Johann (2018), Carinthian farmers used larch resin primarily to combat suppuration, inflammation, diseases of the internal organs, rheumatism, sprains and catarrhs with good results. There was a wide variety of recipes. For instance, in the 17th century, turpentine and resin were used in many ways to make plasters and ointments, to clean old and new wounds, to soften hard ulcers and to heal rashes on livestock and people. It was used both internally (cleansing the lungs, diuretic) and externally, especially by surgeons (Unterhofer, 2010). Lagoni (2012) describes that traditionally farmers and shepherds in remote Alpine regions collected dried larch resin from the trunk and, after slightly warming it, applied it locally to the inflamed, festering hooves of their sheep and goats. Thick resins were also used to seal wooden barrels and for caulking in boat and shipbuilding.

Today's industrial and therapeutical use of turpentine oils

Larch resin has special properties that make it a high-quality natural raw material for many technical fields. Due to its permanent elasticity and stickiness, it is particularly suitable for the production of elastic varnishes that must remain flexible and supple, for example, leather varnishes. Resin is used in the chemical industry and worldwide in semi-solid form as violin bow resin. In the optics industry, highly transparent turpentine oils are used to seal and glue lenses (Johann, 2018). Cosmetics and fragrance manufacturers like to use highly aromatic turpentine oils. For industrial usage, the first yield of resin is the most valuable: it is crystal clear and is specially collected and processed. This valuable resin is, for instance, used in artists' paints. In medicine, external use is based on the antiseptic and circulation-stimulating effect in the treated area of the body. Turpentine oil is now used exclusively for external use in the form of skin ointments, gels, lotions, turpentine plasters, bath additives and "resin soaps", which are enjoying increasing popularity. These preparations are used to relieve pain and stimulate local wound healing. Larch oils are also found in massage and fragrance lamp oils. Modern science also attributes healing effects to larch resin for rheumatic and neuralgic complaints, bronchial complaints, and boils. The highly aromatic turpentine oils are also used in the cosmetics industry and aromatherapy. In veterinary medicine, ointments and oils containing turpentine are often used for disinfection and to promote circulation in superficial injuries, as well as in hoof and claw care.

Intangible cultural heritage

Today's resin workers and farmers are still involved in the extraction of larch resin in Carinthia (the valleys of Gurk, Metnitz and Görtschitz) and in the area around Neumarkt in Styria. For the farmers and forest owners, who manage their larch forests at altitudes between 1,000 and 1,300 m above sea level, the drilling of larch trees is still a valuable source of additional income, as they can sell the extracted resin to the Schusser manufactory and the Greiler sawmill for further processing and marketing. In 2018, the Schusser manufactory applied for the inclusion of the craft of extracting and processing larch resin in the UNESCO National

Inventory of Intangible Cultural Heritage in Austria and was positively awarded. The technique and guidelines of collecting, which require a certain amount of experience with regard to wind direction, main axis, exposure, diameter of the tree, and depth of the borehole, have been passed down in families through the oral tradition for generations. In addition to the special technique, local farmers' and resin workers' own expressions ("Jungfernharz", "Pech ziachn", etc.) and specific tools used for extraction (e.g., resin spoons) are also part of the awarded element (Österreichische UNESCO Kommission, 2018). In recent years, there have also been increasing numbers of farmers who extract the resin of larch in their own forests and process it into ointments themselves. The Austrian resin companies supply their natural cosmetics to health resorts, thermal baths, and pharmacies in Austria on a small scale. However, the majority of sales are made directly from the company and via mail order. Colours made from natural substances are also a niche product that takes up a small share of the market.

DISCUSSION

Although larch resin has long been highly regarded as a valuable medicinal remedy in folk medicine and was also indispensable for sealing barrels and boats, its extraction was overshadowed for many centuries by charcoal as the sole source of energy for smelting metals. This brought the state the desired tax revenue, while little financial return could be expected from resin use. There is no doubt, and it has been documented many times, that resin extraction in its traditional form damaged the forest and could even cause the dieback of trees. Thus, concern related to a sustainable wood supply for iron-working companies influenced the forestry legislation, particularly of the 16th and 17th centuries. Thereby traditional resin harvesting was declared a secondary forest use and repeatedly prohibited or severely restricted. This ban extended not only to state forests but also to all private forests that could be used to supply furnaces and hammermills. If resin harvesting was permitted, the state also wanted to generate revenue from it and demanded a tax that the resin workers, often the poorest of the poor, could not or would not pay. It was not until the 18th and 19th centuries that a more differentiated approach was introduced. In addition to allowing forest owners more freedom in forest management, legislators also concluded that resin and timber harvesting would be possible side by side if appropriate framework conditions, such as the timing and technology of resin harvesting, were taken into account.

CONCLUSION

Resin yield depends essentially on the tree species, the location, the climatic and ecological conditions, the resin extraction process used and the duration of use. Significant amounts of resin can only be extracted from pine and larch. However, resin extraction is also strongly influenced by the health of the trees. Therefore, both abiotic hazards from fire and extreme weather conditions such as drought, wind, snow, heat, or frost, as well as biotic hazards from wild animals and rodents or fungal and insect infestation, play a major role. Therefore, the amounts of raw resin extracted vary both spatially and temporally. A prevailing belief exists that the use of resin damages the trees in principle, as the trees' resin is removed, resulting in a deterioration in their health. It is also said that the use of resin has a negative impact on trees that are already infected by root rot and honey fungus, and that the trees' protective effect against insect infestation is reduced. These arguments do not consider the improvements which have been introduced since the turn of the 19th/20th century. The fact that there may have been some regional overuse of larch stands is evident from the history of the Schusser resin refinery, where Schusser started to introduce a more environmentally friendly method in collaboration with scientists at the beginning of the 20th century. Due to this collaboration with the Mariabrunn Forestry Research Institute in Vienna, which is also documented by numerous publications by Schmied, a process was developed that demonstrably no longer causes damage to larch trunks that have been drilled into. On the contrary, a certain improvement in the quality of the wood can be perceived due to the natural closing of the resin canals after the resin source had been exhausted.

Learning about the diverse production concepts of the past will not only point to the safeguarding of cultural heritage today in important ways but also to future strategies towards sustainable raw material supply.

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TRADYCJA POZYSKIWANIA ŻYWICY MODRZEWIOWEJ W AUSTRII

ABSTRACT

Balsam modrzewiowy (żywica modrzewiowa) znajduje zastosowanie w naturalnych i porcelanowych farbach, jako spoiwo w produkcji farb, plastyfikator w elastycznych lakierach oraz składnik aktywny w farmacji i kosmetyce. Dzięki swoim właściwościom optycznym wenecka terpentyna przez długi czas odgrywała istotną rolę jako szpachlówka i uszczelniacz w optyce. Żywica modrzewiowa była również szczególnie ceniona w medycynie ludowej ze względu na swoje właściwości konserwujące i lecznicze. Żywica modrzewiowa (lokalnie nazywana *Lörget* lub *Loriet*) pozyskiwana jest poprzez wiercenie w pniach drzew w celu otwarcia kanałów żywicznych. Wiercenie to, mające na celu pozyskanie żywicy, należy do najstarszych sposobów użytkowania austriackich lasów górskich. Jedna z pierwszych pisemnych wzmianek o tej praktyce pochodzi z 1391 roku z przełęczy Obdach, na granicy Karyntii i Styrii. Początkowo żywicę pozyskiwali pasterze, którzy przy pomocy siekiery wykonywali głębokie otwory w pniu, aż do odsłonięcia kanałów żywicznych, z których wypływającą żywicę można było zebrać. Ta szkodliwa dla drzew metoda była wielokrotnie zakazywana już w XVI wieku, jednak w drugiej połowie XVIII wieku – po wprowadzeniu wymogów technicznych – została stopniowo dopuszczona na mocy przywileju cesarskiego. Od 1787 roku właściciele lasów mogli pozyskiwać żywicę modrzewiową we własnych lasach zgodnie z przepisami prawa leśnego. W drugiej połowie XIX wieku wiele wspólnot oraz prywatnych właścicieli lasów dzierżawiło prawa do pozyskiwania żywicy, aby zwiększyć swoje dochody. Zajmowali się tym często drwale, którzy – według ówczesnych relacji – mogli wywiercić od 60 do 80 pni dziennie. W zamian uiszczali właścicielom lasów roczny czynsz lub płacili ryczałt za wydzielone działki leśne. Uzyskana terpentyna modrzewiowa trafiała na sprzedaż. Jednak od lat 60. XIX wieku, w wyniku wzrostu cen drewna modrzewiowego, liczba umów dzierżawnych na pozyskiwanie żywicy zaczęła maleć. W okresie I wojny światowej (1914–1918) wydobycie żywicy i terpentyny ponownie stało się opłacalne, a w niektórych regionach praktykowano je aż do połowy XX wieku. Spadek znaczenia tej działalności nastąpił wraz z importem tańszych produktów z zagranicy. Obecnie w Austrii żywica modrzewiowa pozyskiwana jest jedynie w niektórych górskich lasach Karyntii. Dla rolników gospodarujących lasami modrzewiowymi na wysokości 1000–1300 m n.p.m. wiercenie pni w celu pozyskania żywicy nadal stanowi interesujące źródło dodatkowego dochodu.

Słowa kluczowe: modrzew, żywica, historia, niematerialne dziedzictwo kulturowe