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RESIN TRAILS: THE HISTORY AND UTILIZATION OF RESIN IN POLAND

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ABSTRACT

The history of resin tapping in Poland reflects the dynamic development of a traditional forest use practice that played an important economic role, particularly in supplying raw materials to the chemical industry. Natural resin, extracted mainly from Scots pine, was used for producing turpentine, rosin, varnishes, and adhesives. However, the rise of petrochemicals, synthetic substitutes, and increasing labour costs led to the gradual decline and eventual discontinuation of resin tapping by the end of the 20th century. Today, while industrial-scale resin production has ceased, there is growing interest in its artisanal revival. Resin tapping is being re-evaluated for its educational and cultural value. Resin now finds niche applications in cosmetics, natural medicine, art conservation, and historical reenactment. The paper provides a review of scientific studies on resin tapping in Poland, including book publications issued by the leading research institutions dealing with this subject in the country. It explores the potential for limited revitalization of resin tapping in Poland through local, craft-based, and educational initiatives. Although a return to industrial-scale production is unlikely, resin tapping may re-emerge as a practice that supports cultural heritage preservation and sustainable forest use.

Keywords: resin tapping, natural resin, Scots pine, traditional practices, forest history

INTRODUCTION

Resins are natural, viscous secretions of a semi-liquid consistency produced by selected plant species, mainly coniferous trees. They are found in special intercellular spaces or resin ducts. Chemically, resins are complex mixtures of organic compounds, among which terpenes and their derivatives predominate. Their primary role is to protect tree wounds. When a plant is injured, the resin begins to ooze out, forming a viscous, thick barrier that floods the wound, preventing pathogens from entering the wound. Mankind has been using resin since prehistoric times. In crafts, it was valued for its adhesive and sealing properties. In medicine, it was used for its antiseptic properties. However, the dynamic development of industry has brought an intensification of the commercial extraction of resins, which have become a valuable raw material for the chemical industry. The greatest interest in the use of resins in various industries came at the turn of the 20th century. Until the development of synthetic, petroleum-based substitutes, resins were a basic raw material in the production of varnishes, solvents, paints and also an important ingredient in some medicines and perfumes. As a result of technological advances and economic changes, industrial

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resin production in Central Europe disappeared in the 1990s. Today, resin extraction in Poland is a historical issue, which, although it has gone out of economic practice, is a valuable part of cultural heritage

The aim of this paper is to present the history of pine resin tapping and its use with the development of this industry in Poland. It discusses the factors that led to the end of resin tapping in Polish forest, as well as providing a historical overview of the work devoted to this issue.

METHODOLOGY

This article is a review-based study and relies on the analysis of written sources concerning the history, technology, and contemporary perspectives of resin tapping in Poland. The literature search included scientific publications and monographs, with particular emphasis on works issued by key research institutions. The collected material was organized both chronologically and thematically, which enabled the identification of the major stages in the development of resin tapping in Poland, as well as an assessment of its potential revitalization in the context of current trends and practices in sustainable forest use.

THE ORIGINS OF RESIN TAPPING IN POLAND

In Poland, resins were initially harvested in a primitive way, mainly by extracting them from natural seeps on tree trunks. In the 18th century, attempts were made to resin tap spruce (*Picea abies*), but this practice was abandoned due to low yield and technical difficulties. Common spruce is a species that is particularly sensitive to mechanical damage to the bark and phloem, which led to a reduction in the technical quality of the wood and an increased risk of fungal infections. For this reason, spruce tapping never became a large-scale practice and further efforts were concentrated on the common pine (*Pinus Silvestris*). This species was and still remains the most important forest-forming species in Poland. Due to its wide distribution and high abundance, Scots pine could provide a stable and accessible source of resinous material. This species is also more resistant to mechanical damage, which minimised the risks associated with the depreciation of raw material in resinous stands and limited the potential threat from the development of fungal diseases. Scots pine has the lowest resin yield of all members of the *Pinus* genus that have been used in the resin industry. However, due to the high market value of the resin and its strategic importance as a chemical raw material, especially at the turn of the 20th century, when synthetic equivalents did not yet exist, attempts were made to intensify its extraction. Despite natural biological limitations and lower profitability compared to resin stands in western Europe, experimental tapping of pine stands began. The first attempts at organised tapping of pine stands in Poland were based on the French method, the so-called patch method, which was distinguished by its relatively low labour intensity. This method involved making wide, flat incisions on the tree trunk and allowing the resin to flow into special containers. While this technique worked well for other pine species, such as *Pinus pinaster* in France, it was not optimal for Scots pine (*Pinus sylvestris*). The problem was the short time of intense resin leakage, which translated into the low efficiency of the whole process. In the following years, as a result of research and practical experience, methods adapted to the biology of Scots pine were developed that allowed more efficient resin harvesting. The changes ranged from incision techniques and selection of the right timing to the use of chemicals to stimulate resin secretion. Thanks to these improvements, resin harvesting became more cost-effective and efficient, which contributed to the development of this branch of secondary forest use in Poland (Antkowiak, 1996).

METHOD OF EXTRACTING RESIN FROM SCOTS PINE TRUNKS

Stands close to the cutting age, i.e. those that were soon to be felled as part of planned forest management, were selected for incision. In this way, the tapping process was able to proceed without damaging the further development of the forest, and once the exploitation was completed, the wood harvested from these trees still had a high industrial value and was used in various branches of the wood sector, including construction and the paper industry. The work of preparing the trees for tapping began between 15 February and 15 April. The early spring timing allowed the trees to be prepared properly before sap setting off

and the active flow of nutrients began. Using axes, so-called resin spikes were made on selected trees, i.e. special exposures of the bark, which were regularly incised during the growing season to stimulate the flow of resin. The dormers covered up to 70% of the trunk circumference, while the remaining 30% was the 'life belt', which played a key role in maintaining the tree's basic physiological functions. This reduced the risk of trees dying prematurely and ensured their ability to continue producing resin for several consecutive seasons. The number of resin incision per tree depended on the circumference of the tree: up to four incisions could be established in the thickest specimens. The rib method was used to carry out the tapping. A hard layer of bark was removed from the section of trunk to be used for the tapping, leaving a thin layer about 3 mm thick to protect the inner layers. It was crucial to avoid exposing the endosperm, as premature disturbance of the deeper layers would result in a premature, intense resin flow before harvesting could begin. Once the tree had been properly prepared, it was left for a period ranging from several days to even several weeks until the sap had been fully set off. Only then did the regular incision of the trunk begin. The key stage was to make precise incisions that allowed the resin to flow into the collecting vessels in a controlled manner. The central part of the previously debarked surface was incised vertically, creating a 'drip groove'. This main incision acted as the main channel for draining the resin from the incision surface. In its lower end, a special drip pan was mounted to direct the flowing resin into a collecting vessel below. Different types of vessels (ceramic, glass, metal or plastic) were used, depending on the region and period. In order to prevent excessive evaporation of the volatile compounds contained in the resin and to limit the entry of contaminants, the vessels were covered. Over the course of the growing season, gradual, 45-degree-angled side incisions were made to the main incision which stimulated the flow of resin and directed its runoff to the main incision and the collection container. The single groove incision should have been 4 mm deep. Between the individual grooves, a "rib" was left, i.e. an unbroken strip of wood including the bark. The main, most intensive leakage of resin occurred during the first 12 hours after the incision was made. This is when the greatest amount of raw material was obtained. Every few days, the resin container was emptied and the side incisions on the trunk were repeated to maintain the intense resin flow. With favourable conditions, resin tapping could be carried out until October. In the following years, the tree could be tapped again. In this case, in the following year, the new incision was made above the previous year's one. Trees could be tapped from 1 to 6 years. The literature even advocated extending this period to nine years. Despite the fact that near-forest and clear-felled stands were selected for resin use, many of them were not eventually harvested according to the planned clear-felling after resin harvesting had ceased. As a result, trees with resin bark can still be found in Polish forests (e.g. in forests in National Parks) (Fig. 1).

Fig. 1. A resin-tapping scar on an old-growth pine tree on the grounds of the Forest Experimental Station - Murowana Goślina in Zielonka

Ryc. 1. Spała żywiczarska na wiekowej sośnie rosnącej na terenie Leśnego Zakładu Doświadczalnego Murowana Goślina w Zielonce

DEVELOPMENTS IN RESIN RESEARCH

In 1937, a resin harvesting department was established at the State Forest Research Institute and a research centre was launched to study the resin harvesting process in the Leszczydół Forest District. The research focused primarily on the influence of natural and technological factors on resin yield (Kamiński and Głowacki, 1967; Kamiński and Szmit, 1958; Ostrowski, 1980, 1986), the influence of resin harvesting on the quality of wood (Spława-Neyman, 1965), resin quality, the anatomy of resin-forming tissues (Flotyński, 1967), the physiology of resin efflux, and attempts to increase it by the stimulating effect of chemicals (Flotyński, 1957, 1960; Kamiński, 1958, 1960; Pilarski and Flotyński, 1963; Marciniak, 1984). Much attention was paid to the possibility of using chemicals to increase the efficiency of the resin tapping process. At the same time, attention was drawn to the possibility of deterioration in the quality of the raw material as a result of the use of chemicals (Prosiński et al., 1965). Over time, sulphuric acid was introduced into industrial tapping as an agent to increase resin efflux efficiency. There has been a steady increase in scientific and professional literature on resin extraction (Zielicho and Wislawski, 1955; Ostrowski, 1959, 1964, 1967; Pejoski and Głowacki, 1969; Grochowski, 1984; Antkowiak, 1996). High hopes were placed on the use of chemical sprays applied to the resinous spit to increase the efficiency of resin flow. In Poland, six resin tapping instructions were issued. The first was developed in 1939 and the last in 1987.

HISTORY OF POST-WAR RESIN HARVESTING AND ITS SCALE

On the territory of modern Poland, resin extraction on a large scale was initiated by the Germans during the First World War. After the war, tapping was continued by the Poles. Data presented by Fijałkowski (1922) summarising the 1918–1921 harvest speaks of 711 tons of resin harvested on an area of 4062 ha. Władysław Barański in Las Polski from 1924 (r. 4 nr 9) summarises exports and imports of turpentine and rosin (Barański, 1924). The total exports of these two products were 1837 tons in 1922, and 4138 tons in 1923; in the same years, the imports were 4896 tons and 6001 tons, respectively. Post-war resin tapping began with the end of the Second World War in 1945. Domestic resin production increased from 1945 to 1961, where, thanks to improved chemical methods, it reached its peak of 24,500 tons (Fig. 3). Thereafter, throughout the 1960s until 1969, resin harvesting remained stable at 23,000 tons per year. The entire domestic resin harvest was

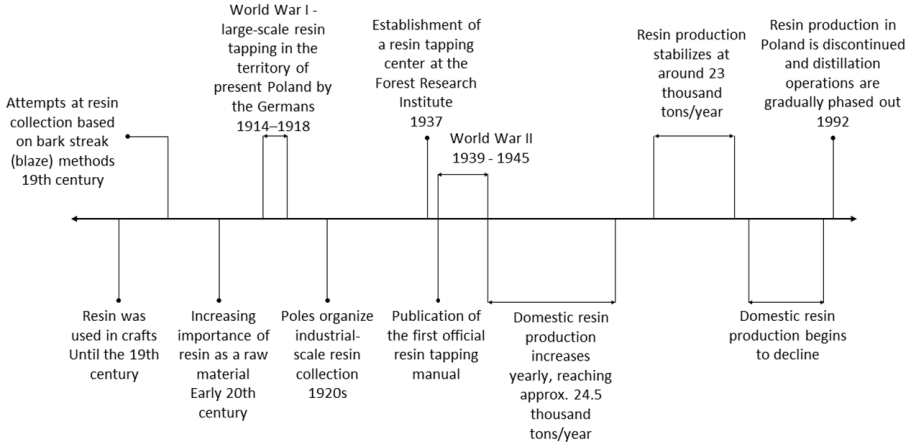

Fig. 2. Timeline presenting the most important events and periods related to resin harvesting in Poland
Ryc. 2. Oś czasu przedstawiająca najważniejsze wydarzenia i okresy związane z pozyskiwaniem żywicy w Polsce

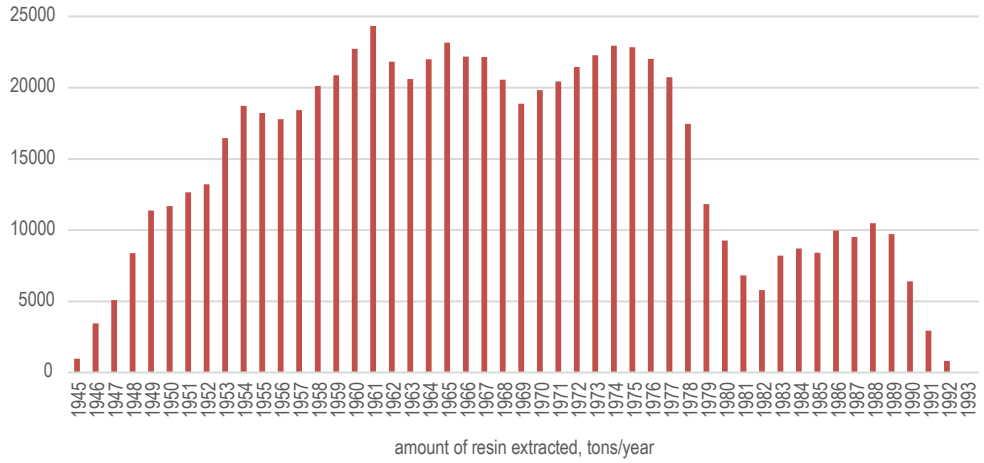

Fig. 3. Annual amount of resin harvested in Poland, tons per year
Ryc. 3. Roczna ilość pozyskiwanej żywicy w Polsce, tony na rok

processed in only two distilleries in Zagórz and Grabatka. Poland was then the sixth largest resin producer in Europe (Pejoski and Głowacki, 1969). In the 1990s, resin extraction from domestic sources was abandoned in favour of imports from tropical regions, where production was more efficient and cheaper due to lower labour costs. In 1992, two years before resin extraction was discontinued, 8,000 tons of resin were extracted in Poland with demand for its distillation products of 22,000-24,000 tons of rosin and 5,000 tons of turpentine (Antkowiak, 1993a, 1993b). The profession of the forest worker specialized in resin tapping disappeared along with the end of resin collection. Domestic resin distilleries were also shut down. The most important events related to resin tapping are presented in Fig. 2.

RESIN AS RAW MATERIAL

The resin extracted by tapping is called balsamic resin, and it was widely used in industry. However, before it could be used, it had to be separated, by means of steam distillation, into rosin and turpentine. Turpentine was used as a solvent in the manufacture of varnishes, floor polish and shoe polish. Alpha-pinene contained in turpentine was used to produce synthetic camphor, which was used in medicine and in the production of celluloid. Turpentine was also used to produce synthetic rubber, insecticides, fragrances and heat-resistant lubricants. Rosin, on the other hand, was used to seal paper and to make soaps. It was also used in the production of linoleum, oils, lubricants, synthetic varnish, brewer's tar, paints, varnishes, adhesives, putties, plastic masses, inks, and ointments, and for the production of insulating materials in the electrical industry (Zelicho, 1970).

RESIN PROCESSING METHODS

The resin collected from the trees was packed in wooden barrels. However, it was noticed that some of the resin leaked through these barrels; in addition, the wood of the barrel acted as a kind of filter, causing the leaked resin to have a higher turpentine content than the resin taken from the tree. Due to the loss of turpentine – the most valuable component of resin – work was carried out to improve transport packaging. One of the simplest solutions was to replace wooden barrels with metal ones, but this carried certain limitations. At the time, metal barrels were significantly more expensive than wooden ones and, in addition, inadequately protected, corroded, with iron oxides from corroded barrels contributing to the darkening of the stored resin and to an increase in the ash content – inorganic compounds – in the resin. Due to the limitations of using metal barrels, mainly due to their price, research was undertaken to optimise the storage of resin in wooden barrels, concluding the research recommended the use of high-quality barrels (pine or spruce) and the storage of resin barrels in concrete shelters

(Zajdler, 1954). The storage of resin in wooden barrels was greatly reduced already in 1958, metal barrels were stored, similarly to wooden barrels, in concrete shelters (Kwiatkowski, 1959). A scientific session organised by the Department of Wood and Peat Chemical Technology of the Technical University of Gdańsk on 14-15.02.1958 addressed the problem of limited resin processing in Poland. It was pointed out that the only industrial method of resin processing was to separate it into rosin and turpentine by distillation. The results of a study published in 1987 on the effect of the use of strip yeast and chemicals (Flordimex) on the quality of resin, indicated that the above-mentioned products did not affect the quality of resin distillation products obtained using them (Surmiński and Antkowiak, 1987). The processing of resin in Poland, which consisted in distilling resin with steam and obtaining two fractions of turpentine and rosin, did not undergo significant changes until it was discontinued in 1994. The most significant changes, as described above, changed the method of packaging and storing the resin from wooden barrels to steel barrels stored in concrete shelters.

POTENTIAL FOR THE RESTORATION OF THE RESIN INDUSTRY

Is resin harvesting likely to make a comeback in Poland? According to the authors, organised resin harvesting for the chemical industry seems unlikely to return in its former, industrial form, understood as mass resin tapping. Technological changes, the availability of synthetic substitutes and high labour costs effectively limit the prospects for reactivating this form of forest side-use on an industrial scale. Nevertheless, some hope for a partial revival of this practice is provided by the craft production that has been developing in recent years. Observations of current consumer trends reveal growing interest in craft products – natural and based on traditional recipes. Increasingly, short-run products characterised by high quality, authenticity and a return to old production methods are appearing on the market. Such products could successfully include resinous preparations, such as rosin used by string musicians to rub the bristles of their bows, natural resin as an ingredient in soaps, ointments and cosmetics, as well as turpentine extracted by traditional methods for use in the conservation of works of art or in the production of historical varnishes and paints. Traditionally sourced resin can also have applications in specialised industries, such as the perfume industry, which seeks ingredients with unique aromas to create exclusive fragrances. In natural medicine and phytotherapy, which are gaining in popularity, resins can find specific applications thanks to their antiseptic properties. The cultural and educational dimension is also not without significance. As in the case of beekeeping or wickerwork, for example, resin harvesting can be reintroduced to a limited extent in order to popularise and preserve the cultural heritage associated with traditional forest use. Resin harvesting for demonstration, reconstruction or museum purposes could become a valuable element in the educational and cultural offer of institutions dealing with ethnobotany, the history of forestry and the popularisation of ancient crafts. Although the demand for these types of products and services will probably remain niche, and the process of their production seems to be costly due to its high labour intensity, their cultural and historical value may make local pine resin-making initiatives, carried out on a limited scale, both economically and socially justified.

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POZOSTAŁOŚCI ŻYWICY: HISTORIA I WYKORZYSTANIE ŻYWICY W POLSCE

ABSTRAKT

Historia pozyskiwania żywicy w Polsce to przykład dawnej dynamicznie rozwijającej się i ważnej tradycyjnej praktyki użytkowania lasu, która odgrywała istotną rolę gospodarczą, szczególnie w zakresie dostarczania surowców dla przemysłu chemicznego. Naturalna żywica, pozyskiwana głównie z sosny zwyczajnej, była wykorzystywana do produkcji terpentyny, kalafonii, lakierów i klejów. Rozwój przemysłu petrochemicznego, pojawienie się syntetycznych substytutów oraz rosnące koszty pracy doprowadziły do stopniowego spadku, a ostatecznie do całkowitego zaprzestania żywicowania drzew w Polsce na skalę przemysłową pod koniec XX w. Obecnie, mimo że produkcja żywicy na dużą skalę została zakończona, rośnie zainteresowanie jej rzemieślniczym pozyskiwaniem. Żywicowanie zyskuje nowe znaczenie edukacyjne i kulturowe. Żywica wciąż znajduje zastosowania w kosmetyce, medycynie naturalnej, konserwacji dzieł sztuki oraz rekonstrukcjach historycznych. W artykule przedstawiono przegląd badań naukowych dotyczących żywicowania w Polsce, w tym publikacji książkowych wydanych przez wiodące krajowe instytucje badawcze zajmujące się tą tematyką. Autorzy wskazują na potencjał ograniczonej rewitalizacji żywicowania w Polsce poprzez inicjatywy lokalne, rzemieślnicze i edukacyjne. Choć powrót do produkcji przemysłowej wydaje się mało prawdopodobny, żywicowanie może ponownie stać się praktyką wspierającą ochronę dziedzictwa kulturowego i zrównoważone użytkowanie lasów.

Słowa kluczowe: pozyskiwanie żywicy, żywica naturalna, sosna zwyczajna, praktyki tradycyjne, historia leśnictwa