Research and Applied Perspectives on the Socialization of the Natural Monument: Gradishteto – est. Nahodishte na Sinya Hvoyna“

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Abstract: *In the PubMed medical database, a search using the keywords “juniper oil”—with no restrictions on publication date and limited to open-access studies—yields 122 studies (Last accessed April 17, 2026). This report analyzes the areas of scientific research, the types of juniper, and the prospects for application in the fields of public health and healthcare—particularly health tourism—as part of the promotion of natural heritage, in particular Blue Juniper Site in the Gradishte Area, and its integration into various sectors of the recreational industry.*

Keywords: *Juniper oil; healthtourism; promotion of natural heritage; “Strandja” Geopark*

SCIENTIFIC RESEARCH WITH JUNIPER OIL

According to the European Environment Agency, there are 30 species names for juniper, 18 of which are classified as unique (Valid name) and 12 as synonyms (Synonym) (European Environment Agency, n.d.).

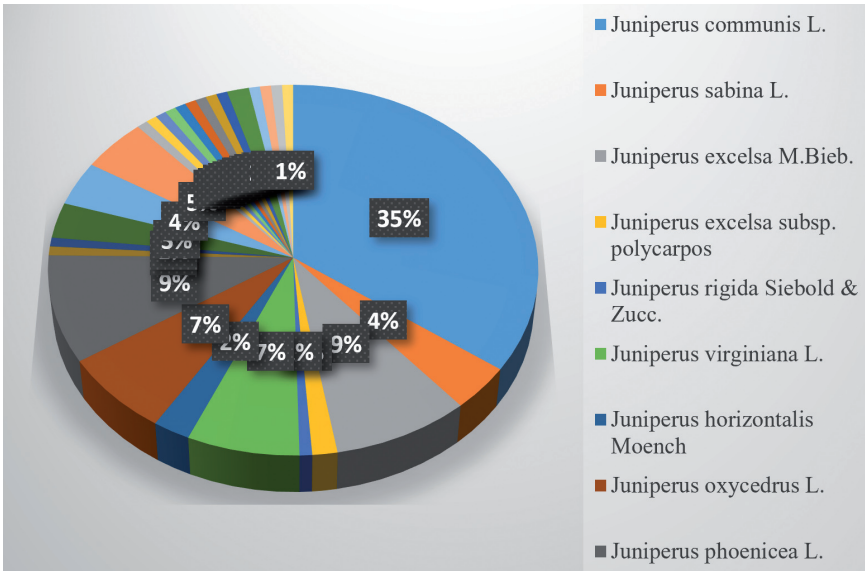

Figure 1. Juniper species (n = 28) included in the studies

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A search was conducted in PubMed using the keywords "juniper oil" with no restrictions on the publication period; free full text; the search yielded 124 studies (April 17, 2026), of which 122 were analyzed and two were irrelevant. Fig. 1 shows the juniper species included in this study. The largest percentage of the studies focused on Juniperus communis L. (35%), followed by Juniperus Phoenicia L. (9%); Juniperus excelsa M. Bieb. (9%); Juniperus excelsa M. Bieb. (9%); Juniperus oxycedrus L. and Juniperus virginiana L. (7% each); Juniperus chinensis L. (5%); Juniperus procera Hochst. ex Endl. and Juniperus sabina L. (3% each); Juniperus horizontalis Moench and Juniperus ashei J. Buchholz (2% each); and the following, each at 1%, namely: Juniperus excelsa subsp. polycarpos, Juniperus rigida Siebold & Zucc., Juniperus phoenicea subsp. turbinata (Guss.), Juniperus drupacea Labill., Juniperus formosana Hayata, Juniperus californica Carrière, Juniperus thurifera L., Juniperus seravschanica Kom., Juniperus pseudosabina Fisch. & C.A.Mey., Juniperus sibirica, Juniperus scopulorum Sarg., Juniperus recurva Buch.-Ham. ex D.Don, Juniperus brevifolia (Seub.) Antoine, Juniperus pinchotii Sudw., Juniperus turbinata Guss., Juniperus indica Bertol., Juniperus seravschanica Kom., Juniperus deppeana Steud. The data obtained identify Juniperus communis L. as the predominant juniper species of interest to researchers.

RESEARCH TRENDS

After analyzing the 122 studies published in PubMed, we categorized them into the following areas: therapeutic applications, n=52 (42%); composition and properties of oils, n=22 (18%); food industry n=17 (14%); insecticides/repellents n=16 (13%); plan cultivation n=17 (14%); livestock farming n=4 (3%); biotechnology n=2 (2%); bioenergy n=2 (2%).

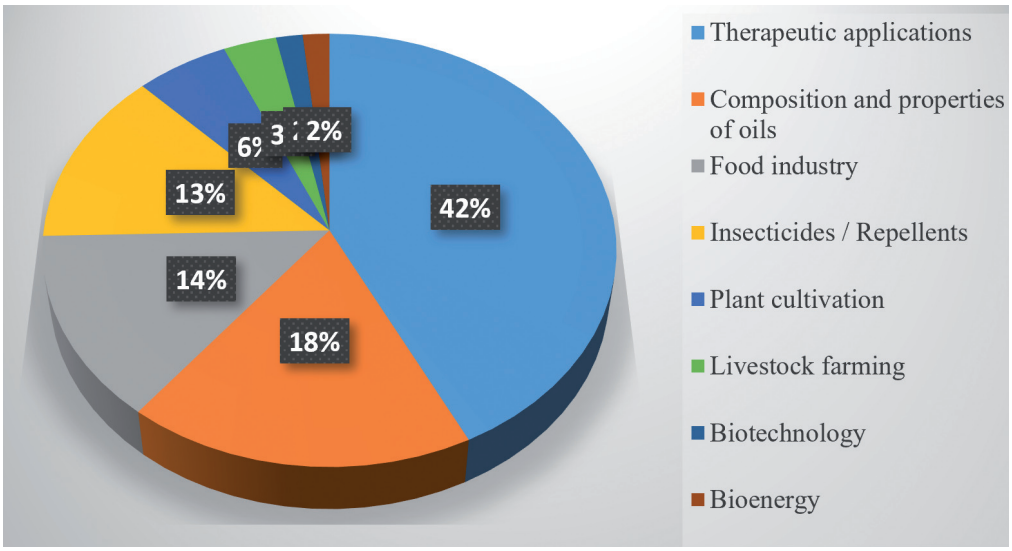

Figure 2. Research trends

Figure 2 shows that the largest number of studies focus on the therapeutic potential of juniper (n=52, 42%). Next in terms of representation are studies on the composition and properties of oils (n=22, 18%), some of which are again related to therapeutic applications and the food industry (n=17, 14%), where potential health benefits are also discussed. The text below presents the research areas and illustrative studies within each area.

Therapeutic applications

Most of the research on therapeutic applications has focused on the juniper species found in the "Gradishte" area of the Strandja Mountains. Other species studied include Juniperus rigida Siebold & Zucc., Juniperus virginiana L., Juniperus phoenicea, Juniperus oxycedrus L., Juniperus virginiana L., Juniperus excelsa subsp. polycarpos; Juniperus camphor; Juniperus procera Hochst. ex Endl.;

Juniperus chinensis L.; Juniperus morrisonicola Hayata; Juniperus sabina L.; Juniperus excelsa M. Bieb; Juniperus procera;Juniperus thurifera L.; Juniperus phoenicea; Juniperus excelsa; Juniperus seravschanica.

The effect of juniper on urinary tract function is empirically well-known, which explains the interest shown by Frydrysiak, E. et al. (2021). The authors highlight the fact that lower urinary tract inflammation is a very common problem, particularly among women. The study presents a concept for a system of preventive and supportive treatment for lower urinary tract infections. It was found that the essential oil of Juniperus communis L. inhibits the growth of S. epidermidis and E. faecalis, with no effect on E. coli. The results not only demonstrate the potential therapeutic effect of juniper in urinary tract infections but also identify the specific pathogens against which a positive therapeutic effect can be expected.

Cancer in today's world is not only widespread but is also one of the leading causes of death worldwide. It is no coincidence that the fight against cancer is a top priority for both the World Health Organization and the European Commission. Any research related to prevention and treatment is of great medical and social significance. The number of studies on the use of aromas for cancer prevention is growing; these studies focus on identifying essential oils with anticancer effects, as well as those in which aromatherapy is used to improve patients' quality of life.

Marković et al. (2024) investigated the antitumor potential of Juniperus communis fruit essential oil on cervical cancer cells. The results show that the essential oil from the berries of J. communis interferes with the molecular mechanisms of cancer cells. The authors identify the essential oil from the berries of J. communis as a promising natural agent with anticancer potential.

Acute inflammatory processes are the focus of the study by Bolunduț et al. (2026). Their study investigates the antioxidant and anti-inflammatory potential of an ethanol extract from J. communis needles, using in vitro analyses and an in vivo model of acute inflammation induced by turpentine oil in rats.

The results show that an ethanol-based extract of Juniperus communis needles is capable of modulating the redox-inflammatory response in an experimental model of acute inflammation. The observed effects suggest that simultaneously targeting oxidative stress and inflammatory signaling may represent an effective strategy for limiting acute inflammatory damage.

Of particular interest is a study conducted by Höferl et al. (2014). Essential oil from juniper berries (Juniperus communis L., Cupressaceae) is traditionally used for medicinal and aromatic purposes. As determined by gas chromatography/flame ionization detector (GC/FID) and gas chromatography/mass spectrometry (GC/MS) methods, the juniper berry oil from Bulgaria consists primarily of monoterpene hydrocarbons such as α-pinene (51.4%), myrcene (8.3%), sabinene (5.8%), limonene (5.1%), and β-pinene (5.0%). The antioxidant activity of the oil, due to electron transfer, makes juniper essential oil a powerful antioxidant with potential benefits for the production of dietary supplements, providing an effective way to improve people's health and quality of life.

Composition and properties of oils

The composition and properties of juniper essential oil were examined in 18% of the studies in our sample. Of particular interest is a study by Petroianu et al. (2018), who conducted a historical retrospective review of available sources. Turpentine and juniper were widely used in ancient times for both ritual and medical purposes, including in Egyptian kiph. The authors discovered a text on pediatrics written by John Appley in the mid-1970s, which mentions the role of Cleopatra's urine in her amorous games. Taferieophrastus (c. 371–c. 287 BCE), the father of botany: in his book "De odoribus", he mentions that juniper berries make urine pleasantly fragrant. According to Plutarch, Alexander the Great's sweat smelled of violets (Monin, 1886). The author believes that when something or someone smells of violets, it is most likely due to the ingestion of turpentine and/or juniper.

Food industry

Fourteen percent of the studies focus on the potential applications of juniper in the food industry. A study conducted by Bhatia et al. (2025) found that the inclusion of juniper berry

essential oil significantly improves the thermal degradation resistance and antioxidant activity of food packaging films. Furthermore, the films exhibited remarkable antimicrobial properties, effectively inhibiting the tested pathogenic bacteria and fungi. These findings highlight the potential of these films to serve as sustainable alternatives to traditional synthetic packaging in food applications.

Insecticides/repellents

Unlike most of the studies analyzed above, which focus primarily on the juniper species Juniperus communis L., studies on their insecticidal and repellent effects also involve the following species: Juniperus virginiana L.; Juniperus chinensis; Juniperus recurva; Juniperus procera; Juniperus oxycedrus L.; Juniperus indica Bertol.; and Juniperus phoenicea. Chang et al. (2025) investigated the chemical constituents of the essential oil from the leaves of J. chinensis var. kaizuka. The composition of the juniper was analyzed by gas chromatography–mass spectrometry and consists primarily of monoterpenoids. Its main compounds are limonene (33.33%), bornyl acetate (23.71%), β-elemol (14.99%), β-myrcene (8.11%), and sabinene (3.54%). The results indicate that monoterpenoids with an isopropenyl group may exhibit superior larvicidal activity against mosquitoes.

Plan cultivation

Six percent of the studies are related to juniper cultivation. The species studied are Juniperus communis L.; Juniperus phoenicea L.; Juniperus drupacea Labill.; Juniperus excelsa M. Bieb.; Juniperus horizontalis Moench; Juniperus excelsa subsp. polycarpos; Juniperus phoenicea; Juniperus procera; and Juniperus brevifolia (Seub.) Antoine. The significance of fungal infections and certain challenges in their treatment have led to increased interest in finding new fungicides to replace chemical ones. The results of a study by Mehdizadeh et al. (2020) show that the essential oil from the leaves of J. polycarpos var. turcomanica is a suitable alternative to synthetic fungicides for use in the agro-industry. The phytotoxic activity of the essential oil from J. polycarpos var. turcomanica on various plants may aid in the production of new herbicides for weed control.

Livestock farming

The research in the livestock section focuses on the species Juniperus communis L. At the request of the European Commission, a scientific opinion was prepared regarding the safety and efficacy of juniper oil and juniper tincture derived from the berries of Juniperus communis L., which are used as feed additives for animals. It was concluded that juniper tincture is safe up to the maximum proposed level of use in feed of 45 mg/kg of feed or drinking water (Bampidis et al., 2023)

Biotechnology

Peruč et al. (2018) investigated the effects of essential oils from juniper (Juniperus communis) and Italian immortelle (Helichrysum italicum) against Mycobacterium avium, M. intracellulare, and M. gordonae in tap water and against their adhesion to Acanthamoeba castellanii. The results show that the essential oils or their components weaken the interaction between nontuberculous mycobacteria from the environment and free-living amoebae and indirectly reduce their pathogenic potential, which could be valuable in developing strategies for maintaining water supply systems.

Bioenergy

The study conducted by Ahmouda (2026) highlights the novel relationship between the hydrophobicity of the extract, the surface chemistry of the nanoparticles, and the quality of the biodiesel, providing a green strategy for designing plant-based nanocatalysts capable of producing biodiesel compliant with EN 14214 (≤1.91 mM glycerol). The economic assessment highlights the commercial potential of this method. The production cost of biodiesel was calculated at $1.12 per kg, a figure that is highly competitive and is partly due to the use of a hydrophobic ROS-FeNP catalyst. The juniper species used in the study is Juniperus phoenicea.

The promotion of natural heritage and its integration into various sectors of the recreational industry is an area with established best practices, as demonstrated by studies by Bulgarian researchers such as Angelcheva and Petkova (2019); Dimitrova and Nesheva (2021), Dimitrova and Tomova (2024); Dimitrova (2017); Dimitrova et al. (2021), among others. The present study takes a different approach in this field. In the following text, we examine possible perspectives for the socialization of a specific natural feature

THE NATURAL MONUMENT: "GRADISHTETO - EST. NAHODISHTE NA SINYA HVOYNA" — CHARACTERISTICS AND PROSPECTS FOR PUBLIC ACCESS

The Natural Monument: Gradishteto - est. nahodishte na sinya hvoyna" falls within the jurisdiction of the Regional Inspectorates for Environment and Water/National Parks Directorates in Burgas.

The total area of the site is 2.0 hectares. It was designated as a protected area by Order No. 1427 of May 13, 1974, published in Issue No. 44/1974 of the State Gazette (1427-1974). The purpose of the designation is to preserve the only natural habitat of the blue juniper. The following activities are prohibited in the area: cutting down or pruning trees, as well as picking or uprooting any plants; grazing of livestock; the hunting of wild animals, birds, and their young, and the destruction of their nests and dens; the opening of quarries for stone, sand, and soil, which alters the natural appearance of the area, including watercourses and other features. There is an overlap (partial or complete) with the Strandja Nature Park and the Special Protection Area under the Birds Directive: Strandja (Register of Protected Areas in Bulgaria, n.d.).

A Trans-European tourism perspective on the socialization of the natural monument: "Gradishteto - est. Nahodishte na sinya hvoyna"

According to Resolution CM/Res(2023)2 on the revision of the rules for awarding the "Council of Europe Cultural Route" certification, one of the priority areas of action is "Enhancing Memory, History, and European Heritage," the essence of which is "… identifying and enhancing European heritage sites and areas other than the monuments and sites typically used for tourism, particularly in rural areas, but also in industrial zones undergoing economic restructuring" (Council of Europe, 2023).

One of the certified cultural routes is the European Route of Historic Pharmacies and Medicinal Gardens. It consists of a network of routes called "Aromas Itinerarium Salutis" which "... reflects the richness and diversity of Europe's pharmaceutical heritage and medicinal gardens." Bulgaria has an established representative in this network, namely the Botanical Garden of the Bulgarian Academy of Sciences (BAS) in Sofia, Bulgaria[20].



Figure 3. Common juniper (Juniperus communis L.), the "Gradishte" area (Dnevnik, 2014)



Figure 4. The European Route of Historic Pharmacies and Medicinal Gardens (Aroma Itinerarium Salutis, n.d.)

The European Route of Historic Pharmacies and Medicinal Gardens is managed by AIS NETWORK, which, as of April 17, 2026, has ten municipalities; nine associative and cultural stakeholders; twenty-six museums/heritage sites; thirteen universities and research centers—including the Bulgarian Academy of Sciences (BAS) in Sofia, Bulgaria; eight SMEs; five individuals; four other entities; three cooperation partners; and one cross-sectoral network. There are 48 AIS member destinations (Aroma Itinerarium Salutis, 2026).

The European Route of Historical Pharmacies and Medicinal Gardens has been a "Cultural Route of the Council of Europe" since 2024 The procedure for membership and joining the network is clearly described on the organization's website (Aroma Itinerarium Salutis, n.d.). To meet the selection criteria, an organization must engage in at least one of the following activities: Investigation and development; Cultural heritage; Education; Artistic and contemporary practices; Sustainable tourism (Dnevnik, 2014).

The call for membership in AIS is the official annual procedure with specific deadlines for selection; for 2026, it proceeded through the following phases: (Submission: October 6–December 5, 2025; Correction: December 5–31, 2025); Virtual meeting with applicants and the Scientific Committee (January 15, 2026); Evaluation (January 16–February 15, 2026); Results (March 3–10, 2026) (Dnevnik, 2014).

The rationale for including the "Natural Monument: Gradishteto - Est. Nahodishte Na Sinya Hvoyna" is that it fits within the concept of showcasing "…places of memory or symbolic significance that contribute to the broader narrative of health, care, and botanical knowledge in European history… in line with "…the Cultural Route's mission to preserve and promote a multifaceted and interdisciplinary interpretation of European cultural heritage" (Aroma Itinerarium Salutis, n.d.).

An example of such a destination is "The Scents of Turia."



Figure 5. Les Aromes del Túria (Les aromes del Turia, Riba-roja de Turia, Spain, n.d.)

The Municipal Council of Ribarroja de Turia initiated the creation of the "Aromas of Turia" destination and is also participating in the development of the "European Route of Historic Pharmacies and Medicinal Gardens". The idea is to showcase the unique diversity of aromas and medicinal plants along the Turia River. In essence, this is indeed exactly as promoted: "…a unique cultural and ecological initiative…" that "…connects the local landscape with the traditions of health and well-being." It offers "…an educational and immersive experience." (Les aromes del Turia, Riba-roja de Turia, Spain, n.d.).

Unique experiences—precisely—are the new tourism trend set by millennials and followed by subsequent generations. The "Strandja" Nature Park, and in particular the "Natural Monument: Gradishteto - Est. Nahodishte Na Sinya Hvoyna" protected zone, has great potential for the development of wellness tourism in the region.

A local tourism perspective on the socialization of the natural monument: "Gradishteto – est. Nahodishte na sinya hvoyna"

A prerequisite for the development of sustainable tourism is the existence and management of the Strandja Nature Park. A hiking trail has been built and is maintained leading to the blue juniper site in the Gradishte area. According to information available online, organized hikes to the site are rare (Hike to Golyamo Gradishte Peak with a visit to the blue juniper site, organized by the "Green Strandja" Tourist Association (Zelena Strandja, n.d.).



Figure 6. Cleanup of the "Blue Juniper" Trail (Gramofona, n.d.)



Figure 7. Strandja mountain
Photo: Dilyana Dobreva

The local perspective on promoting the destination involves publicizing it and incorporating it into wellness packages offered by major seaside hotels, in line with efforts to extend the tourist season beyond the busy summer months.

SWOT ANALYSIS

Figure 7 presents the main aspects of the SWOT analysis. Strengths. The strengths are related to the existing, well-established hiking trail. The trail is a local attraction and is visited by organized groups of tourists. Weaknesses. An important factor is that the site is located in a border region. It is not suitable for independent travel. Opportunities. Incorporating the natural landmark into a cultural route, specifically the "European Route of Historic Pharmacies and Medicinal Gardens"; Another opportunity for promotion is organized group tourism and linking the destination to the overall concept of the "Strandja" Geopark. Threats. There are risks related to safety and the underestimation of wildlife and the specific characteristics of the border zone. The area is monitored by border police, but this does not negate the need for hikes to be organized by a specialist in orienteering tourism, a mountain guide, or a local guide.

CONCLUSION

Our study demonstrates the existence of research prospects and scientific evidence regarding the therapeutic potential and applicability of juniper in various economic sectors.

The positive example of the Municipal Council of Ribarroja de Turia, Valencia Province, Spain, and the "Aromas of Turia" route it has developed, provides a similar basis for applying to include the "Natural Monument: Gradishteto - Est. Nahodishte Na Sinya Hvoyna" in the "European Route of Historic Pharmacies and Medicinal Gardens".

The natural landmarks of the Strandja Mountains, combined with existing and prospective tourist routes that incorporate aesthetic and/or educational elements of archaeological, ecological, historical, or cultural value, are a prerequisite for sustainable economic development within the context of the overall vision for the creation of the "Strandja" Geopark.

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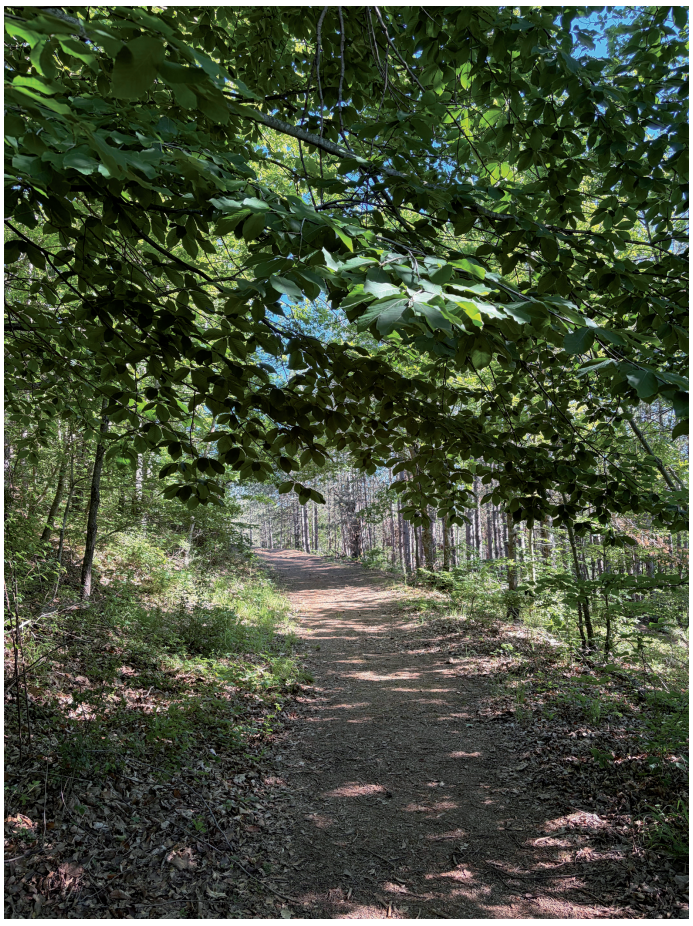
Изследователски и приложни перспективи за социализиране на ПЗ „находище на синя хвойна в м. Градището“

Дияна Добрева

Резюме: При търсене в медицинската база данни PubMed с ключовите думи „масло от хвойна“ — без ограничения по дата на публикуване и с ограничение до проучвания с отворен достъп — се получават 122 проучвания (последно посещение на 17 април 2026 г.). Настоящият доклад анализира областите на научните изследвания, видовете хвойна и перспективите за приложение в сферите на общественото здраве и здравеопазването – по-специално в здравния туризъм – като част от популяризирането на природното наследство, в частност “Находище на синя хвойна в м. Градището”, и неговата интеграция в различни сектори на развлекателната индустрия.

Ключови думи: масло от хвойна; здравен туризъм; популяризиране на природното наследство, Геопарк „Странджа“



Strandja mountain Автор: Дияна Добрева
Photo: Dilyana Dobreva