Acta Scientific AGRICULTURE (ISSN: 2581-365X)

Volume 9 Issue 9 September 2025

Research Article

Mediterranean Native Aromatic Plants Harnessing Ecosystem Resilience and Wildfire Risk Mitigation: Bioactive and Ecological Properties of *Lavandula stoechas* and *Pistacia lentiscus* as a Nature-Based Tool for Flora and Fona Resilient

Omayma Abidi[1,2]*, Ameni Smaoui[3], Foued Hasnaoui[4] and Houcine Selmi[4]

[1]*Faculty of Sciences of Tunis, University Tunis El Manar, Tunisia*

[2]*Laboratory of Physiology and Pharmacology, National School of Veterinary Medicine, University of Manouba, Tunisia*

[3]*Laboratory of Plant Productivity and Environmental Constraints, Department of Biological Sciences, Faculty of Sciences of Tunis, University of Tunis El Manar, Tunis, Tunisia*

[4]*Laboratory of Sylvo-Pastorales Ressources, Sylvo-Pastoral Institut of Tabarka, University of Jendouba, Tunisia*

***Corresponding Author:** Omayma Abidi, Faculty of Sciences of Tunis, University Tunis El Manar and Laboratory of Physiology and Pharmacology, National School of Veterinary Medicine, University of Manouba, Tunisia.

Received: August 06, 2025

Published: August 18, 2025

Abstract

The Mediterranean basin is increasingly affected by the intensification of wildfires, driven by climate change and land degradation. In this context, native aromatic and medicinal plants (AMPs) such as *Lavandula stoechas* and *Pistacia lentiscus* represent valuable ecological and economic assets. This review aims to assess their chemical composition, biological potential, and relevance as Nature-based Solutions (NbS) for wildfire risk mitigation and post-fire ecosystem restoration.

Drawing on fieldwork conducted in Northwestern Tunisia, this paper highlights the richness of their essential oils rich particularly abundant in monoterpenes and phenolic compounds and their proven antioxidant, anti-inflammatory, antimicrobial, and anticancer activities. These bioactivities, especially well-studied in *L. stoechas* and *P. lentiscus*, position both species as promising candidates for therapeutic, cosmetic, and agro-industrial applications.

Ecologically, *L. stoechas* is characterized by low flammability, high pollinator value, and ground-covering abilities, while P. lentiscus is distinguished by its evergreen foliage, post-fire natural regeneration, and role in stabilizing Mediterranean scrublands. Collectively, they play a significant role in soil conservation, biodiversity maintenance, and the preservation of landscape structure. Their integration into sustainable land-use strategies could strengthen territorial resilience and foster fire-adapted vegetation mosaics.

This review also discusses successful case studies from Tunisia (Tabarka, Cap Bon), where these species are locally harvested, distilled, and embedded in cultural heritage. Finally, the paper proposes recommendations for integrating *L. stoechas* and *P. lentiscus* into regional programs of fire resilience, emphasizing their strategic importance in prevention, community-based reforestation, and the design of multifunctional landscapes adapted to climate-related risks.

Keywords: Bioactive and Ecological Properties; Ecosystem Resilience; Flora and Fona Resilient; Lavandula Stoechas; Mediterranean Native Aromatic Plants; Pistacia Lentiscus

Abbreviations

AMPs: Aromatic and Medicinal Plants; EOs: The Essential Oils; *L. stoechas: Lavendula Stoechas;* NbS: Nature-based Solutions; *P. lentiscus: Pistacia Lentiscus;* WUI: Wildland-Urban Interfaces

Introduction

The Mediterranean basin is facing increasing environmental pressures driven by climate change, including rising temperatures, declining precipitation, and the intensification of both the frequency and severity of wildfires [1]. These disturbances have profound impacts on forest ecosystems, biodiversity (both flora and fauna), water resources, and rural populations whose livelihoods depend on these fragile environments. In this context, wildfires represent not only an ecological hazard but also a socio-economic challenge, undermining the resilience and long-term sustainability of Mediterranean landscapes [2,3].

In light of the escalating wildfire regimes, expanding desertification, and degradation of ecosystems in the region, conventional environmental management approaches often prove limited in scope, financially burdensome, or ecologically unsustainable. Nature-Based Solutions (NbS) have thus emerged as a promising, integrative alternative. These approaches rely on the natural functions of ecosystems to address societal challenges such as climate risk mitigation, biodiversity conservation, and food and water security [1,2,4].

NbS strategies embedded the restoration, protection, and sustainable management of landscapes using resilient native plant species capable of contributing to ecological regeneration, supporting post-fire recovery, and reduction of landscape flammability. Among these strategies, the valorization of local, fire-adapted plant species that enhance soil structure and ecological functions has gained growing attention [4,5].

Mediterranean aromatic and medicinal plants (AMPs), rich in bioactive secondary metabolites and deeply embedded in local agro-pastoral traditions, offer a compelling avenue for sustainable NbS implementation [6]. These species play a multifunctional role within Mediterranean ecosystems: ecological, economic, and cultural. Well-adapted to harsh environmental conditions such as drought, nutrient-poor soils, and intense sunlight, they constitute integral components of the native flora. Thanks to their content in essential oils, flavonoids, and phenolic compounds, supports soil stabilization, erosion control, post-disturbance regeneration, and pollinator attraction thereby reinforcing ecosystem resilience [6-8].

Beyond their ecological value, AMPs represent a major socio-economic resource for rural communities. Their sustainable exploitation for pharmaceutical, cosmetic, agri-food, or natural crop protection purposes supports income diversification and the valorization of ecologically sensitive regions [9-11].

Among these, *Lavandula stoechas* and *Pistacia lentiscus* are of particular interest, not only for their well-documented pharmacological properties but also for their ecological potential in fire prevention strategies, maquis restoration, and landscape rehabilitation in Mediterranean areas prone to climate extremes. Their spontaneous growth, post-fire regeneration capacity, low flammability, and integration into local traditions make them ideal candidates for inclusion in NbS frameworks that aim to reconcile biodiversity conservation with rural development and wildfire risk mitigation.

Botanic and ecological presentations

Lavendula stoechas identification

Lavandula stoechas holds a distinctive place in the history of Mediterranean medicinal plants. It was the first species of the *Lavandula* genus described during the Roman era, and has since been widely cited in both botanical literature and pharmacopoeias. Although the genus was frequently mentioned over the centuries, the first formal monograph, *"De Lavandula"*, was not published until 1780. The genus *Lavandula* is native to the Old World, with a natural distribution range extending from Macaronesia (including the Cape Verde Islands, the Canary Islands, and Madeira), across North and tropical Africa, the Mediterranean regions of Europe, the Middle East, the Arabian Peninsula, western Iran, and as far east as southeastern India [7,11].

Figure 1: *Lavendula stoechas* real image in the flowering season from Dweydiya in the region of Tabarka-Jendouba, Tunisia.

Thus, *Lavandula* is distributed across three continents Africa, Europe, and Asia…making it a widely distributed Mediterranean endemic species. In Tunisia, *Lavandula* species are primarily found in high-altitude regions, up to 1800 meters above sea level, in well-aerated and sun-exposed habitats. They are particularly concentrated in the northwestern and central-western parts of the country, notably in the Kroumirie, Saïdjane, and Mogods regions. In certain areas, these plants grow abundantly and may dominate large stretches of landscape.

Pistacia lentiscus Identification

Pistacia lentiscus L. is a slow-growing aromatic shrub that thrives in the wild, particularly in Mediterranean scrublands (garrigue) [12]. It is widespread throughout the Mediterranean basin [13-15], including Mediterranean Europe (Albania, Croatia, Spain, France, Greece, Italy, Portugal), North Africa (Morocco, Algeria, Tunisia, Libya, Egypt), and parts of Asia (Lebanon, Iran, Iraq, Palestine, Syria, Turkey).

In France, *P. lentiscus* is restricted to the Mediterranean zone, rarely venturing far from the coastline except in a few warm valleys. It is especially abundant in Corsica, along the Mediterranean rim, and in Charente-Maritime [13,14]. A particularly old shrub in Ghisonaccia, Corsica, is estimated to be between 700 and 1000 years old. In November 2011, it was named "Tree of the Year 2011" in France, and was later classified as a remarkable tree of France [16]. A young seedling of the same species was ceremonially planted at the Élysée Palace. Together with wild olive (*Olea europaea* var. *sylvestris*), myrtle (*Myrtus communis*), and smilax (*Smilax aspera*), *P. lentiscus* forms a dense, almost impenetrable thicket typical of Mediterranean vegetation, though it is also highly flammable [13-15].

In Tunisia, *P. lentiscus* has been part of the native flora since Antiquity. It is believed that the Carthaginians introduced the species from Turkey or Syria, later reinforced by Roman and Arab influence. Forests containing *P. lentiscus* extend from north to south, both in coastal areas and inland, and they host a variety of pheno-

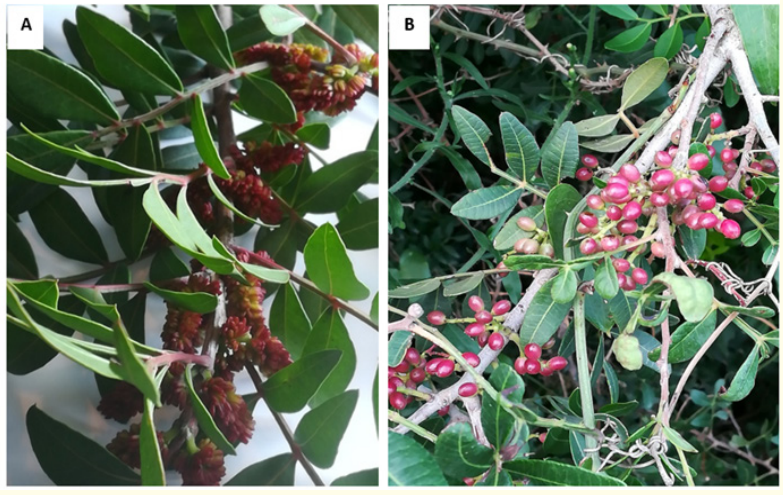

Figure 2: *Pistacia lentiscus* real image from the region of Tabarka-Jendouba, Tunisia. A: Mâle flowering season and B: female fruiting season.

types whose morphological similarities often complicate identification [17]. In particular, Djebel Boukornine is characterized by a homogenous stand of degraded *P. lentiscus*-dominated vegetation. The coastal limestone chains (Raoued Mountains) and stabilized dune complexes (Gammarth Mountains) are also home to artificial stands of *P. lentiscus*. Natural populations are found in forested areas throughout the northwest (Tabarka, Ain Draham, Nefza, and Fayja National Park), and in the central-western regions (Siliana, Kasserine), making the species' distribution nearly nationwide across a wide range of Tunisian landscapes.

Element	Lavandula stoechas	Pistacia lentiscus
Family	Lamiaceae	Anacardiaceae
Class	Magnoliopsida	Dicotyledones
Habitat	Garrigue, maquis, calcareous soils	Dense maquis, poor soils, forest edges
Adaptation	Drought resistance, poor soils	Drought tolerance, natural regeneration, fire resilience
Distribution	Mediterranean region (e.g., Tabarka – Tunisia)	Mediterranean region (e.g., Cap Bon, Northwestern Tunisia)

Table 1: Botanic and ecological comparison of *lavendulan stoechas* and *Pistacia lentiscus* L.

Comparative chemical composition and bioactivity of *Lavandula stoechas* and *Pistacia lentiscus*

Essential Oils: Composition and Extraction

The essential oils (EOs) extracted from *L. stoechas* and *P. lentiscus* are rich in volatile bioactive compounds. Their chemical profiles vary significantly according to geographic origin, harvest season, and extraction method. Steam hydro-distillation is the most widely employed method for their extraction. EO of *L. stoechas* is characterized by high levels of camphor, fenchone, 1,8-cineole, borneol, and α-pinene. These compounds confer potent respiratory, neurotonic, and antiseptic properties [7]. EO of *P. lentiscus* (mainly from leaves or twigs) is dominated by α-pinene, terpinene-4-ol, myrcene, limonene, and caryophyllene. The profile varies depending on the plant organ (leaves vs. resin) [9,10].

Major biological activities

Both species display significant pharmacological potential, with sometimes complementary effects.

Antioxidant Activity: Both EOs show significant antioxidant activity (via DPPH and ABTS assays), attributed to their richness in monoterpenes and phenolic compounds. *P. lentiscus* demonstrates better oxidative stability, which is valuable for pharmaceutical preservation and formulation [9-11].

Anti-inflammatory Activity: Extracts of *P. lentiscus*, particularly triterpene-rich fractions (mastic), inhibit the production of pro-inflammatory mediators (IL-6, TNF-α, NO), as shown by several *in vitro* and *in vivo* studies. *L. stoechas* has a milder anti-inflammatory effect but is well known for its calming effects on the nervous system [9-11].

Antimicrobial Activity: Both EOs exhibit broad-spectrum antibacterial and antifungal properties, notably against *Staphylococcus aureus*, *E. coli*, and *Candida albicans*. *L. stoechas* appears more effective against Gram-positive strains, while *P. lentiscus* shows a wider antimicrobial range, including environmental pathogens [7,10,11].

Anticancer Activity: *P. lentiscus* has shown promising anticancer potential. In your doctoral research, you demonstrated a synergistic effect between *P. lentiscus* extract and tamoxifen, with a significant inhibition of tumor cell proliferation in an *in vivo* murine breast cancer model. This was accompanied by reduced oxidative stress and modulation of apoptotic pathways. *L. stoechas* also exhibits moderate cytotoxicity against certain cancer cell lines (e.g., colorectal, hepatic), but the data remain less developed [9-11].

Ethnopharmacological and Industrial Relevance

L. stoechas is traditionally known for its neurotonic, expectorant, and wound-healing properties. It is commonly used in inhalations, infusions, or oil macerates [7,11].

P. lentiscus occupies a prominent place in the traditional medicine of the Maghreb and the Mediterranean basin. It is used to treat wounds, inflammation, digestive and respiratory disorders. Its mastic gum is also exploited in cosmetics, dentistry, and as a natural food additive [9,10].

From an industrial perspective, both species present significant potential in phytotherapy, aromatherapy, organic cosmetics, and ecological restoration strategies, particularly in post-wildfire forest recovery initiatives.

Ecological potential and role in nature-based solution

With the increasing frequency of wildfires in the Mediterranean region, post-fire ecological restoration strategies are progressively turning towards NbS. These approaches rely on the intrinsic capacity of certain plant species to stabilize soils, promote biodiversity, restore ecological cycles, while providing ecosystem services and sustainable socio-economic opportunities.

Fire resilience and natural regeneration

Both species exhibit remarkable adaptation strategies to environments exposed to thermal stress. *L. stoechas*, a heliophilous species typical of garrigues, features low-growing herbaceous structures that are minimally flammable. Although sensitive to intense direct fire, it displays good post-fire regeneration capacity via seed germination, supported by a significant dormant seed bank in the soil.

P. pistacia lentiscus is a perennial shrub with evergreen foliage and a major component of the maquis. It has excellent natural post-fire regeneration abilities through root suckers and seed germination. Its deep root system renders it particularly resilient to water and heat stress, playing a crucial stabilizing role in pioneering post-fire phases.

Ecosystem services: Soil, biodiversity, pollinators

These two species play a major role in maintaining the ecological balance of Mediterranean landscapes. *L. stoechas* attracts a

wide variety of pollinators (bees, butterflies, hoverflies), enhancing cross-pollination and floral diversity maintenance. In the other hand, *P. lentiscus* provides structural refuge for birds and small mammals. Its dense foliage limits soil erosion and protects young shoots of neighboring species. Together, they contribute to reducing soil erosion on slopes, progressive reconstitution of vegetation cover after fire, decreasing the risk of colonization by invasive species and strengthening local trophic networks, essential for ecosystem resilience.

Integration into NbS Post-Fire Restoration Strategies

Within nature-based post-fire recovery policies, these two plants present strong operational potential [4, 5]

- They are native, well-adapted to Mediterranean climatic conditions, drought-tolerant, and often already present in forest landscapes.
- Their valorization as economically valuable AMPs links ecological restoration with income-generating opportunities for rural communities.
- They can be integrated into participatory revegetation scenarios aligned with the objectives of the MedFireWise project: project enhancing territorial resilience, reducing woody fuel loads, and maintaining multifunctional ecological mosaics.

Criterion	Lavandula stoechas	Pistacia lentiscus
Biological type	Perennial herbaceous plant	Evergreen shrub
Fire resistance	Moderate (regenerate from dormant seeds, low flammability)	High (root suckers, root system resilience)
Role in biodiversity	High (support pollinators, and contributes to floral diversity)	High (provides habitat and food for birds, microfauna, companion species)
Post-fire ecological value	Good in early successional stages (colonizer)	Excellent for long-term landscape stabilization
Socio-economic interest	Aromatherapy, artisanal essential oil production	Traditional medicine, cosmetics, mastics, natural products

Table 2: Ecological Comparison of *lavendulan stoechas* and *Pistacia lentiscus* L.

Valorisation

Aromatic and medicinal plants represent a strategic asset for sustainable territorial development in Tunisia, particularly in rural areas affected by land degradation and forest fires. *L. stoechas* and *P. lentiscus*, two emblematic native species, offer concrete examples of successful valorization, combining biodiversity conservation, traditional uses, and the creation of high value-added economic activities [4,5].

Tabarka: Wild lavender and emerging local value Chain

The Tabarka region, located in northwestern Tunisia, is rich in aromatic maquis dominated by *L. stoechas*. This wild lavender is traditionally harvested by hand, mainly between April and June. Several local initiatives have developed around steam distillation to extract essential oil rich in camphor, 1,8-cineole, and fenchone, used in aromatherapy, dermatological care, and wellness products [7].

Beyond its therapeutic value, this species plays a key role in local floral diversity and attracts a wide range of pollinators. It is therefore a central element of the region's ecological mosaics, compatible with soft reforestation approaches or assisted natural regeneration after fire.

Northwest and Cap Bon: Pistacia lentiscus and Traditional Medicine

P. lentiscus is widespread across many regions and is particularly abundant in the forested areas of the Northwest and the maquis of Cap Bon. Its ancestral medicinal use makes it a cornerstone of Tunisian traditional pharmacopoeia: oil extracted from its fruits is used to treat burns, muscle pain, and skin conditions, while its resin "mastic" is valued for digestive and antimicrobial properties.

Artisanal distillation of its leaves produces an essential oil with anti-inflammatory and anticancer properties. Recent scientific studies, including our own research, confirm the anticancer potential of this species, notably against breast cancer cell lines, synergizing with therapeutic agents. Moreover, *P. lentiscus* has strong potential for post-fire ecological stabilization, thanks to its natural regeneration ability via root suckers, its role in structuring maquis landscapes, and its capacity to limit soil erosion on slopes.

Towards sustainable local development

The valorization of AMPs, particularly *Lavandula stoechas* and *Pistacia lentiscus*, can serve as an innovation lever for sustainable territorial projects in Tunisia:

- Aromatic agrotourism: creation of sensory discovery circuits (harvesting, distillation, wellness products) integrated into ecotourism trails.
- Short supply chains and terroir labels: structuring micro-value chains with organic or PDO certification, linked to rural cooperatives.
- Smart and participatory reforestation: integrating these species into post-fire restoration programs by engaging local communities and fostering landscape resilience.

These approaches reconcile biodiversity conservation, rural economic revival, and adaptation to climate challenges, aligning fully with the spirit of NbS promoted by wildfire risk mitigation projects.

Perspective

The increasing recurrence of wildfires in Mediterranean regions calls for innovative, integrated, and nature-based approaches. *Lavandula stoechas* and *Pistacia lentiscus*, two emblematic native species of the North African maquis, prove to be strategic resources for wildfire prevention, mitigation, and post-fire restoration [4,5].

Ecological pillars for wildfire risk prevention

Thanks to their adaptation to extreme climatic conditions, multifunctional ecological value, and role in post-fire regeneration, these two plants can be leveraged in:

- Fire-resistant landscape designs that favor low-flammability species such as *Lavandula stoechas* along wildland-urban interfaces (WUI).
- Natural ground cover strategies limiting flame spread during dry seasons due to their low fuel load (*L. stoechas*) or resilient post-fire behavior (*P. lentiscus*).
- Smart reforestation systems combining their planting with agroecological practices and sustainable community forest management.

Recommendations for public and forestry policies

To maximize their impact in sustainable and integrated wildfire risk management, several concrete actions should be considered:

- Include *L. stoechas* and *P. lentiscus* among priority species in post-fire planting and adaptive reforestation programs at mid-altitude zones.
- Promote their local economic potential via AMP value chains supported by rural cooperatives to engage local populations in preventive landscape maintenance.
- Strengthen awareness among territorial stakeholders (farmers, foresters, policymakers) regarding their ecological and socio-economic benefits through training, field demonstrations, and pilot projects.

Proposals for future research

- Integrating these two species into wildfire management projects opens high-potential scientific avenues, including:
- Assessing their effectiveness as bioindicators of post-fire resilience linked to secondary vegetation dynamics.
- Conducting long-term ecophysiological studies on their responses to water stress, temperature, and natural regeneration after controlled burns.

- Experimenting with mixed strategic planting, including *L. stoechas*, *P. lentiscus*, and other local low-flammability species, to model their impact on fire spread.
- Performing cost-benefit analyses of their integrated agro-economic valorization within ecological restoration and climate adaptation projects.

Conclusion

Faced with the increasing frequency of wildfires and the growing vulnerability of Mediterranean ecosystems, integrating AMPs into territorial resilience strategies represents a pragmatic, ecologically and socio-economically promising approach. In this context, Lavandula stoechas and Pistacia lentiscus, two emblematic native species of the Mediterranean basin, embody plant models with multiple valuable traits that remain underutilized in sustainable land management policies.

Their rich chemical composition, exemplified by essential oils possessing antioxidant, anti-inflammatory, antimicrobial, and anticancer properties, as demonstrated by recent studies on P. lentiscusd confers significant pharmacological potential, for both traditional medicine and modern industry. Ecologically, their natural resilience to climatic and fire disturbances, their role in soil stabilization, their importance for pollinators, and their role in habitat restoration make these species key drivers for post-fire ecosystem recovery.

Beyond their scientific and environmental value, these two species offer a lever for sustainable local development, particularly in the forested regions of northwestern Tunisia, through artisanal distillation, agritourism, short supply chains, and community projects. Their inclusion in innovative frameworks such as the European MedFireWise project would illustrate the relevance of NbS at the territorial scale, harmonizing ecosystem preservation, risk prevention, and socio-economic inclusion.

Far from being mere plant resources, Lavandula stoechas and Pistacia lentiscus should be regarded as strategic allies in the ecological transition, carrying a dual promise: restoring natural balances and revitalizing rural dynamics. The thoughtful valorization of these species, supported by integrated forestry policies and transdisciplinary research, represents a promising pathway to building resilient, productive, and safe Mediterranean landscapes.

Bibliography

1. Granata F., *et al*. "Hydrological extremes in the Mediterranean basin: interactions, impacts, and adaptation in the face of climate change". *Regional Environmental Change* 25.3 (2025): 1-16.

2. Azzopardi B., *et al*. "Climate and environmental change in the Mediterranean basin–current situation and risks for the future. First Mediterranean assessment report (2020).

3. Diaz J., *et al*. "Climate and Environmental Change in the Mediterranean Basin-Current Situation and Risks for the Future. Climate and Environmental Change in the Mediterranean Basin–Current Situation and Risks for the Future". *First Mediterranean Assessment Report* (2020).

4. Seddon N., *et al*. "Understanding the value and limits of nature-based solutions to climate change and other global challenges". *Philosophical Transactions of the Royal Society B* 375.1794 (2020): 20190120.

5. Zanin GM., *et al*. "Nature-based solutions for coastal risk management in the Mediterranean basin: A literature review". *Journal of Environmental Management* 356 (2024): 120667.

6. Carrió E and J Vallès. "Ethnobotany of medicinal plants used in eastern Mallorca (Balearic Islands, Mediterranean Sea)". *Journal of Ethnopharmacology* 141.3 (2012): 1021-1040.

7. Batiha GES., *et al*. "A review of the bioactive components and pharmacological properties of Lavandula species". *Naunyn-schmiedeberg's Archives of Pharmacology* 396.5 (2023): 877-900.

8. Beghlal D., *et al*. "Phytochemical, organoleptic and ferric reducing properties of essential oil and ethanolic extract from Pistacia lentiscus (L.)". *Asian Pacific Journal of Tropical Disease* 6.4 (2016): 305-310.

9. Abidi O., *et al*. "Pistacia lentiscus L. revealed *in vitro* anti-proliferative activity on MCF-7 breast cancer cells and in vivo anti-mammary cancer effect on C57BL/6 mice through necrosis, anti-inflammatory and antioxidant enhancements". *Plos One* 19.4 (2024): e0301524.

10. Abidi O., *et al*. "Phytochemical analysis and biological activities of two oil-bearing extracts from fresh Pistacia lentiscus". *Bulletin of the Chemical Society of Ethiopia* 37.6 (2023): 1487-1501.

11. Ahamad R., *et al*. "A Comprehensive Review of Lavandula stoechas L.(Ustukhuddus) Plant: Phytochemistry, Pharmacology, and In Silico Studies". *Chemistry and Biodiversity* 22.4 (2025): e202401996.v

12. Beghlal D., *et al*. "Phytochemical, organoleptic and ferric reducing properties of essential oil and ethanolic extract from Pistacia lentiscus (L.)". *Asian Pacific Journal of Tropical Disease* 6.4 (2016): 305-310.

13. AL-Saghir MG and DM Porter. "Taxonomic revision of the genus Pistacia L.(Anacardiaceae)". *American Journal of Plant Sciences* 3.1 (2012): 12.

14. Yi T., *et al*. "Phylogenetics and reticulate evolution in Pistacia (Anacardiaceae)". *American Journal of Botany* 95.2 (2008): 241-251.

15. Nahida AS and A Siddiqui. "Pistacia lentiscus: A review on phytochemistry and pharmacological properties". *International Journal of Pharmacy and Pharmaceutical Sciences* 4.4 (2012): 16-20.

16. Nikolakopoulou V., *et al*. "Conveying intangible cultural heritage in museums with interactive storytelling and projection mapping: the case of the mastic villages". *Heritage* 5.2 (2022): 1024-1049.

17. Pottier-Alapetite G. "Flore de la Tunisie: angiospermes-dicotylédones. 1979: Ministère de l´Enseignement Supérieur et de la Recherche Scientifique (1979).