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Comprehensive Overview of the Phytochemical Constituents and Pharmacological Potential of *Malva sylvestris L.*

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Abstract: ***Malva sylvestris L.*** **is a medicinal plant from the Malvaceae family that is found across different regions, including parts of Europe, North Africa, and Asia. It has been traditionally used for managing conditions related to inflammation, digestion, and the respiratory system, mainly due to its soothing and protective nature. Studies on this plant indicate the presence of several important compounds such as flavonoids, phenolic substances, anthocyanins, mucilage polysaccharides, tannins, and sterols, which contribute to its therapeutic effects. Experimental findings suggest that *Malva sylvestris* shows multiple biological effects, including antioxidant, anti-inflammatory, antimicrobial, and wound healing properties, along with hepatoprotective, nephroprotective, laxative, antiviral actions. These effects are largely linked to its phenolic and flavonoid components, as well as mucilage that supports tissue protection and recovery. This review summarizes the chemical composition and biological effects of *Malva sylvestris*, focusing on its importance in traditional use and its possible applications in modern therapy.**

Keywords: *Malva sylvestris L., Phytochemistry, Antioxidant Activity, Anti-Inflammatory Activity, Antimicrobial Activity, Malvaceae.*

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I. INTRODUCTION

Malva sylvestris L., often referred to as common mallow, is a herbaceous species from the Malvaceae family that can grow either as an annual plant or persist for a short period as a perennial. The leaves and flowers of this plant have long been utilized in various regions as both a dietary component and a traditional remedy. Its use in traditional practices mainly relates to conditions affecting the respiratory and digestive systems, as well as certain inflammatory skin issues. These applications are generally associated with its mild soothing effect, which helps in protecting and calming irritated tissues [(1)].

The genus Malva comprises several herbaceous species distributed across temperate and subtropical regions. *Malva sylvestris* is especially valued in ethnomedicine due to its mucilage-rich aerial parts, which are traditionally used to relieve cough, sore throat, digestive irritation, and urinary disorders. Its long-standing use across multiple cultures highlights its importance as a medicinal plant with broad therapeutic relevance [(2)].

Studies on *Malva sylvestris* indicate that the plant is rich in several biologically active compounds such as flavonoids, phenolic substances, tannins, mucilage, sterols, along with minor components like coumarins and terpenoid derivatives. These constituents are mainly found in higher amounts in the leaves and flowers and contribute to its protective effects against cellular damage[(3)].

Experimental findings suggest that extracts of this plant are associated with multiple therapeutic effects, including protection against oxidative stress, reduction of

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inflammation, inhibition of microbial growth, support in liver protection, and promotion of wound repair. Some studies have also indicated cytotoxic potential under specific conditions. These effects are largely linked to phenolic and flavonoid compounds, which are known to neutralize reactive species, influence inflammatory responses, and limit the growth of microorganisms [4].

This review aims to provide a comprehensive overview of the phytochemical composition and pharmacological activities of *Malva sylvestris L.* based exclusively on evidence from Scopus-indexed literature, emphasizing its relevance in traditional medicine and modern pharmacological research.

II. PLANT PROFILE

Malva sylvestris L., often referred to as common mallow, is a medicinal herb from the Malvaceae family that occurs naturally across several regions, particularly in Mediterranean areas as well as parts of Western Asia and Europe. The plant has a long history of use in traditional practices, where it has been applied in conditions related to inflammation, digestion, respiration, and certain skin disorders. These uses are mainly linked to its mild soothing and protective effects on tissues. Morphologically, the plant is easily recognized by its characteristic purple flowers and the presence of mucilage-rich aerial parts, especially in the leaves and stems [5].

Chemical and nutritional studies indicate that *Malva sylvestris* is rich in several active compounds such as flavonoids, phenolic substances, anthocyanins, mucilage polysaccharides, tannins, and vitamins. These constituents are associated with its protective effects, particularly in reducing oxidative stress, controlling inflammation, limiting microbial growth, and supporting the healing process, which explains its continued use in traditional and therapeutic applications [6].

Recent studies suggest that fermentation using lactic acid bacteria can improve the chemical profile and overall effectiveness of *Malva sylvestris* extracts. This process has been associated with an increase in phenolic compounds, better free radical scavenging ability, and an overall enhancement in functional properties, which may support its use in the development of functional foods and nutraceutical products [7].

Fig 1 *Malva sylvestris*

- *Taxonomy*

Table 1 Taxonomic Classification of *Malva sylvestris L.*

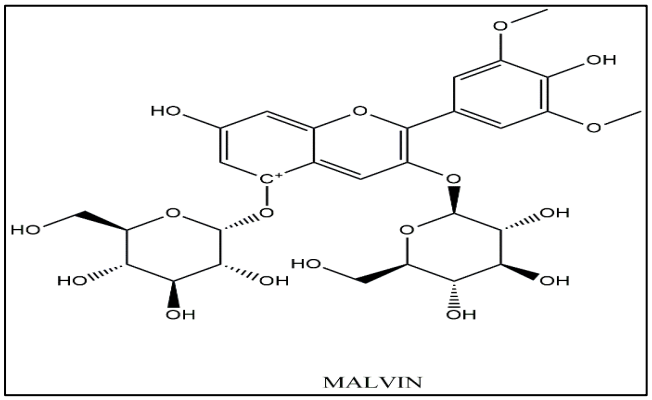
Kingdom	**Plantae (Angiosperms)**
Family	Malvaceae
Sub family	Malvoideae
Genus	*Malva*
Tribe	Malveae
Order	Malvales
Species	*Malva sylvestris* L.

- *Chemical Constituents Found in the Whole Plant of the Malva Sylvestris [1]*

Table 2 Biochemical Constituents of *Malva sylvestris L.*

Plant parts	**Chemical constituents**
Leaves	Flavonoids (quercetin, kaempferol, rutin), mucilage (polysaccharides), phenolic acids (gallic, caffeic, ferulic acids), tannins, chlorophyll, ascorbic acid.
Flowers	Anthocyanins (malvidin, delphinidin), flavonoids, mucilage, tannins, sugars, essential oils.
Seeds	Fatty oils, mucilage, proteins, sterols (β-sitosterol)
Roots	Mucilage, Starch, Pectins , Tannins

- *Chemical Structures of Major Phytoconstituents of Malva sylvestris*



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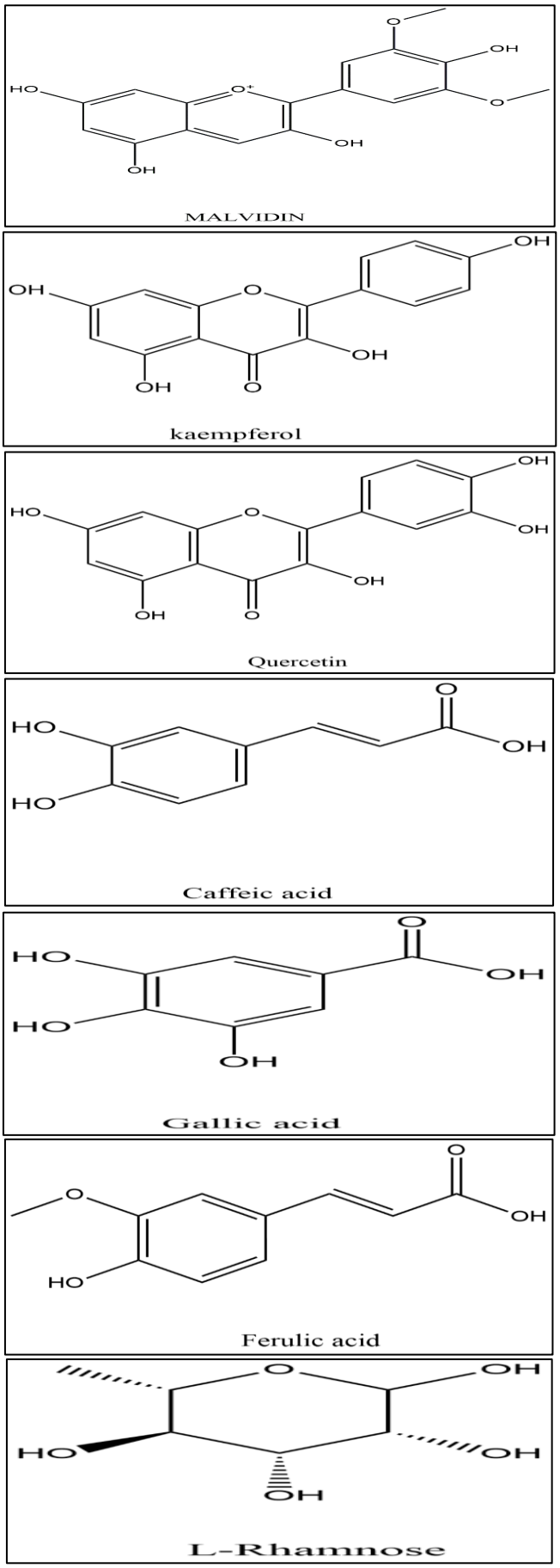

Fig 2 Chemical Constituents Present in *Malva sylvestris L.*

III. AN OVERVIEW OF BIOLOGICAL ACTIVITY OF *MALVA SYLVESTRIS*

➢ *Antioxidant Effect*

Experimental evidence indicates that *Malva sylvestris* possesses notable antioxidant potential, which is mainly associated with the presence of phenolic substances and flavonoid compounds. Different in vitro studies using various solvent extracts have shown a strong ability to neutralize free radicals, particularly in commonly used assays such as DPPH and nitric oxide models. Among the tested extracts, fractions obtained using solvents like methanol and dichloromethane demonstrated comparatively higher activity, which was found to be linked with increased levels of phenolic and flavonoid constituents[8]. Additionally, the application of green extraction techniques revealed that ethanolic extracts possessed high total phenolic, flavonoid, and condensed tannin contents and exhibited considerable DPPH, ABTS, and ferric-reducing antioxidant power, indicating broad antioxidant potential across different assays[9]. Animal-based studies further indicate that supplementation with *Malva sylvestris* can enhance the body's antioxidant status. In infected lamb models, its administration was associated with improved antioxidant balance and a decrease in lipid peroxidation within abomasal tissues, reflecting a strengthening of internal defense mechanisms against oxidative stress[10]. In addition, polysaccharide fractions isolated from the leaves of *Malva sylvestris* have shown a notable ability to neutralize free radicals, particularly in assays involving DPPH and hydroxyl species. This observation suggests that high-molecular-weight components of the plant contribute significantly to its antioxidant behavior. Overall, these results indicate that *Malva sylvestris* can be considered a valuable natural source of antioxidant compounds with potential in reducing oxidative stress [11].

➢ *Anti-Inflammatory Effect*

Malva sylvestris exhibits significant anti-inflammatory effects in in vivo experimental models of inflammation. In a formalin-induced inflammation model in rats, hydroalcoholic extracts of M. sylvestris flowers significantly inhibited both acute and chronic paw edema, demonstrating notable reduction in inflammatory swelling when compared with controls, indicating pronounced anti-inflammatory potential under experimental conditions. This effect is thought to be mediated through the modulation of inflammatory mediator synthesis and reduction of edema formation in soft tissues [12]. In a mouse ear inflammation model induced by 12-O-tetradecanoylphorbol acetate (TPA), topical treatment with a hydroalcoholic extract of *Malva sylvestris* leaves significantly reduced ear edema, decreased leukocyte infiltration, and lowered interleukin-1β levels, supporting its traditional use in treating inflammatory skin conditions [13]. Furthermore, M. sylvestris leaf crude extracts have shown anti-inflammatory activity in macrophage cell culture models by reducing levels of proinflammatory prostanoids (e.g., PGE_2, PGD_2 and TXB_2) following lipopolysaccharide stimulation, suggesting that its anti-inflammatory mechanisms include inhibition of

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prostaglandin synthesis pathways implicated 11in inflammatory responses [14].

Hydroalcoholic extracts of M. sylvestris have also demonstrated anti-inflammatory efficacy in systemic injury models, where oral administration in rodents significantly attenuated cisplatin-induced inflammatory stress and organ functional disruption, indicating that M. sylvestris may modulate systemic inflammatory responses in addition to localized tissue inflammation [15].

➢ *Antimicrobial Effect*

Nanoparticles prepared using *Malva sylvestris* extract were found to inhibit the growth of both Gram-positive and Gram-negative bacteria. The minimum inhibitory concentrations were reported to be around 62.5 µg/mL for Corynebacterium, while approximately 125 µg/mL was required to suppress organisms such as Staphylococcus aureus, Pseudomonas aeruginosa, and Klebsiella pneumoniae[16] .

In traditional extract form, M. sylvestris leaves also possess antimicrobial properties as confirmed by phenolic-rich extracts exhibiting inhibitory activity in vitro. The phenolic compounds and flavonoids present in methanol, acetone, and other solvent extracts were shown to suppress the growth of multiple bacterial species, supporting the use of M. sylvestris extracts as natural antimicrobial agents in ethnomedicine and potential therapeutic formulations against bacterial pathogens [17]. Additionally, green synthesized silver nanoparticles (AgNPs) prepared from M. sylvestris hydroalcoholic flower extracts displayed broad antibacterial effectiveness against common human pathogens in disk diffusion and MIC assays. These AgNPs, acting through enhanced interaction with microbial cell walls and production of reactive species, inhibited growth of Escherichia coli, Staphylococcus aureus, and Streptococcus pyogenes, indicating that nanoparticle-mediated delivery of plant extract compounds can significantly augment innate antimicrobial effects [18].

➢ *Wound Healing Effect*

In an excisional wound model in BALB/c mice, topical application of *Malva sylvestris* 1% aqueous extract significantly improved the wound healing process compared with control. Treated mice showed reduced inflammatory cell infiltration and earlier keratinization at wound edges on days 4 and 7, and by day 10 demonstrated better histological healing features including less fibrosis, preserved hair follicles, and increased collagen synthesis relative to untreated controls, indicating that the extract accelerates cutaneous wound healing through enhanced tissue regeneration and reduced inflammation [19]. A controlled burn wound study in rats showed that topical creams containing 5% and 10% *Malva sylvestris* extract significantly increased the percentage of wound contraction and accelerated healing compared with silver sulfadiazine and control creams. Histological evaluation revealed well-formed collagen fibers and improved re-epithelialization in extract-treated groups, with wounds treated with 10% extract achieving over 90% wound closure by post-burn day 20, demonstrating the plant's ability to enhance dermal repair and reduce overall healing time[20]. Advanced dressing systems incorporating Malva sylvestris extract into polyurethane/carboxymethyl cellulose (PU/CMC) nanofiber matrices exhibited enhanced healing in diabetic wound models. The extract-loaded wound dressings showed superior fluid absorption and controlled release of bioactive compounds, leading to significantly higher wound healing rates compared with conventional gauze and polymer-only dressings, increased neovascularization, fibroblast proliferation, collagen deposition, and reduced chronic inflammation — indicating that M. sylvestris can be integrated into biomaterial scaffolds to improve tissue repair under impaired healing conditions [21]. Nanofiber scaffolds incorporating *Malva sylvestris* extract showed improved wound repair in experimental wound models, where sustained release of plant compounds from the dressing promoted enhanced tissue regeneration. These composite dressings exhibited antibacterial properties that helped protect the wound from infection while also facilitating fibroblast activity, extracellular matrix formation, and epithelial repair, which collectively contributed to accelerated closure and improved quality of healed tissue in preclinical evaluations [22] .

➢ *Nephroprotective Activity*

An experimental investigation in rats explored the ability of *Malva sylvestris* to protect against kidney damage induced by vanadium exposure. The assessment focused on markers such as lipid peroxidation and the activity of antioxidant enzymes in renal tissues. Treatment with the plant extract was associated with a reduction in oxidative stress, reflected by lower lipid peroxidation and improvement in antioxidant enzyme status, indicating a protective effect on kidney function.[23] The protective role of *Malva sylvestris* extract has also been examined in lithium-induced kidney toxicity models. The parameters evaluated included serum creatinine, urea levels, and antioxidant enzyme status. The findings demonstrated that treatment with the extract significantly restored biochemical parameters and reduced oxidative damage in renal tissues, confirming its nephroprotective potential [24]. Further investigation in ischemia–reperfusion-induced kidney injury models showed that *Malva sylvestris* extract reduced inflammatory markers, oxidative stress, and tissue damage, along with improvement in renal function parameters such as creatinine and urea levels [25].

The following studies indicated *Malva sylvestris* L. to exhibit significant nephroprotective activity.

➢ *Anti-Covid (Antiviral) Activity*

The potential of *Malva sylvestris* against COVID-19 has been explored in recent investigations through phytochemical analysis and molecular docking approaches. The study focused on evaluating total phenolic and flavonoid levels, antioxidant potential, and the binding interactions of bioactive compounds with the SARS-CoV-2 main protease. The results showed that *Malva sylvestris* extract possessed significant antioxidant activity along with high phenolic content, and selected phytoconstituents

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demonstrated strong interactions with viral targets, indicating potential inhibitory activity against SARS-CoV-2. Further investigation revealed that these compounds exhibited favorable binding with key viral proteins, suggesting their possible role in interfering with viral replication mechanisms. The study indicates possible usefulness of *Malva sylvestris* as a natural source of compounds for antiviral drug development against COVID-19 [26].

The following study indicated *Malva sylvestris L.* to exhibit potential anti-COVID (antiviral) activity.

➢ *Laxative Activity*

Experimental studies have explored the laxative effect of *Malva Sylvestris* leaves using a loperamide-induced constipation model. The parameters taken into consideration were fecal output, stool water content, and gastrointestinal transit. The results showed that *Malva sylvestris* extract significantly increased defecation frequency, improved stool consistency, and enhanced intestinal motility, indicating effective laxative activity [27]. Clinical studies have examined the use of *Malva sylvestris* flower extract in managing functional constipation. The parameters evaluated included bowel movement frequency and severity of constipation symptoms. The results demonstrated a significant improvement in defecation frequency along with reduction in hard stool formation, confirming its therapeutic potential in human subjects[28].

The following studies indicated *Malva sylvestris L.* to exhibit significant laxative activity.

➢ *Hepatopretoctive Activity*

The protective influence of *Malva sylvestris* on liver tissue has been explored using experimental models involving systemic and oxidative injury. Evidence suggests that administration of the extract can help maintain tissue integrity and improve biochemical indicators associated with hepatic function.In ischemia–reperfusion models, treatment with *Malva sylvestris* extract was associated with a reduction in liver injury, along with improvement in oxidative stress markers and enzyme levels, indicating preservation of hepatic structure and function [25]. In addition, studies involving vanadium exposure have shown that *Malva sylvestris* reduces oxidative alterations such as lipid peroxidation and supports antioxidant defense mechanisms, thereby helping to prevent tissue damage [23].

Similarly, investigations using lithium-induced toxicity models have demonstrated that the extract contributes to restoration of biochemical balance and reduction of oxidative damage, reflecting its protective role in organ systems including the liver [29]. Overall, these findings indicate that *Malva sylvestris* possesses protective effects against toxicity-induced organ damage, including liver injury, primarily through modulation of oxidative stress and cellular defense pathways.

IV. CONCLUSION

Malva sylvestris L. continues to be an important medicinal plant with a strong background in traditional healthcare systems and growing scientific support. Its rich phytochemical composition, particularly the presence of flavonoids, phenolic acids, anthocyanins, and mucilage, plays a central role in its diverse pharmacological activities. A wide range of studies have demonstrated its antioxidant, anti-inflammatory, antimicrobial, wound healing, hepatoprotective, nephroprotective, laxative, and antiviral properties, supporting many of its traditional uses.

However, most of the current evidence is based on experimental studies, with limited clinical validation. Future research should therefore focus on well-designed clinical trials, standardized formulations, and detailed mechanism based studies to better understand its therapeutic potential. With further scientific validation, *Malva sylvestris* has the potential to be developed into effective and safe therapeutic agents for use in modern medicine.

➢ *Author Contributions*

All the authors contributed to the manuscript equally.

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➢ *Conflict of Interest*

The authors declare no conflict of interest.

➢ *Funding*

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