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Ethanopharmacology of *Myrica esculenta*: A Systemic Review

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ABSTRACT

This systematic review focuses on *Myrica Esculenta*, a medicinal plant with a rich history in traditional medicine. The aim of the review is to provide a comprehensive overview of the ethnopharmacology of the plant, including its traditional uses, phytochemistry and pharmacological benefits. Common uses of *M. Esculenta* include treating respiratory diseases such as asthma and bronchitis, as well as gastrointestinal problems such as diarrhea and ulcers. The plant is also used to treat fever, anemia and various ear, nose and throat diseases. With its recognition in the Ayurvedic Pharmacopoeia and its widespread use in folk medicine, *M. Esculenta* has significant ethnopharmacological value. Through phytochemical analysis, flavonoids, tannins, steroids and terpenes have been identified as the plant's main components, which are believed to contribute to its medicinal properties such as analgesic, anti-inflammatory, antioxidant and anti-cancer effects. Pharmacological studies have confirmed the therapeutic potential of *M. Esculenta* and demonstrated its antiasthmatic, antiulcerative, anxiolytic, hepatoprotective and wound healing properties. Conservation measures are crucial to protect the plant from over-exploitation and habitat loss. Suggestions such as micropropagation, germplasm preservation and synthetic seed production make sense for sustainable use.

Keywords- Ethanopharmacology, *Myrica Esculenta*, Traditional Medicine, Phytochemistry, Conservation.

I. INTRODUCTION

Myrica Esculenta also called kaphal or box myrtle, is a deciduous shrub or small tree in the family ***Myricaceae***. It is native to the Himalayas in subtropical and temperate regions, especially India, Nepal and Bhutan [1]. This plant is known for its small, dark red fruits, which are not only edible but also have medicinal properties in traditional medicine. Indigenous communities have long used various parts of *Myrica Esculenta* for therapeutic purposes. The fruits, leaves and bark are used in folk medicine to treat various diseases. For example, the fruits are taken to help with respiratory diseases such as asthma and chronic bronchitis [2]. The bark is valued for its astringent properties and is used to treat problems such as diarrhea and dysentery. In addition, the leaves are applied topically to wounds and used to treat fever [3].

(a)

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(b)

(c)

(d)

Fig. *Myrica Esculenta:* (a) Whole plant (b) leaves and fruits (c) Bark (d) Fruits [2, 3]

The phytochemical analysis of *Myrica Esculenta* has revealed a diverse array of bioactive compounds, including flavonoids, tannins, triterpenoids, and essential oils. Key constituents such as myricetin and quercetin possess strong antioxidant and anti-inflammatory properties, supporting the plant's traditional medicinal applications [4]. Research has shown that *Myrica Esculenta* also exhibits antimicrobial activity against bacteria such as Staphylococcus aureus and Escherichia coli, and can reduce inflammation by inhibiting inflammatory mediators. The plant's antioxidant capabilities make it effective in neutralizing harmful free radicals, which can help prevent chronic diseases. Studies have suggested that *Myrica Esculenta* may have analgesic and liver-protective effects, but further research is needed to ensure its safety for consumption. In addition to its medicinal uses, *Myrica Esculenta* is also utilized in food products and shows promise in pharmaceuticals and cosmetics due to its beneficial bioactive compounds, underscoring its economic and cultural significance [1, 5,40].

II. BOTANICAL CLASSIFICATION [5-10]

Myrica Esculenta, also known as Box Myrtle or Kaphal, is a member of the Myricaceae family. It is recognized for its deciduous shrub or small tree form and is native to the Himalayan region. Here is a detailed botanical classification of *Myrica Esculenta*, along with references for further reading:

Kingdom: Plantae - encompasses all plants.

Subkingdom: Tracheobionta - includes vascular plants with specialized tissue for conducting water and nutrients.

Superdivision: Spermatophyta - plants that reproduce by seeds.

Division: Magnoliophyta (Angiosperms) - flowering plants with seeds enclosed in fruit;

Class: Magnoliopsida (Dicotyledons) - plants with two embryonic leaves.

Subclass: Hamamelididae - includes various orders of flowering plants.

Order: Myricales - contains the Myricaceae family.

Family: Myricaceae - also called the bayberry family, consists of aromatic shrubs and trees. Genus: Myrica - includes approximately 35 species of small trees and shrubs.

Species: *Myrica Esculenta* - the specific epithet "esculenta" indicates edible parts, referring to it.

III. GEOGRAPHICAL DISTRIBUTION AND HABITAT [6, 13,15].

Myrica Esculenta, also called box myrtle or kaphal, is a deciduous shrub or small tree native to the Himalayas and particularly found in India, Nepal, Bhutan and parts of China. It thrives at altitudes of 900 to 2,100 meters in well-drained, acidic soils of mixed forests. This species plays a crucial ecological role, providing food for wildlife and indigenous communities through its fruits and also contributing to soil fertility through nitrogen fixation. However, *Myrica Esculenta* faces threats such as deforestation, habitat fragmentation and overexploitation. Conservation efforts are essential to preserve its habitat and ensure its survival.

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IV. TRADITIONAL USES [4, 16-20].

Myrica Esculenta, also known as bay berry, has long been used as a natural remedy in traditional medicine. The fruits of this plant are consumed to treat respiratory diseases such as asthma and chronic bronchitis, whether consumed fresh or made into powders and decoctions. The bark of *Myrica Esculenta* is known for its astringent properties and is often used to treat gastrointestinal disorders such as diarrhea and dysentery [4]. It can be dried, powdered, and mixed with water or other herbal extracts to create remedies that help tighten mucous membranes and reduce intestinal inflammation. The leaves of *Myrica Esculenta* are used by traditional healers not only to heal wounds, but also to treat fever by making infusions that can reduce high body temperatures and relieve fever-related symptoms [16]. In addition to their medicinal uses, the fruits can be incorporated into local culinary practices due to their nutritional value and health benefits. *Myrica Esculenta* is also valuable in treating oral health problems as the bark and leaves are used to make mouthwashes that can help with gum disease and mouth ulcers due to their antibacterial and anti-inflammatory effects [17, 18, 31].

Additionally, the plant is used to treat skin conditions by applying leaf extracts to relieve rashes and itching, thereby promoting overall skin health. Overall, *Myrica Esculenta*'s diverse uses in traditional medicine highlight its importance to the local community as a natural remedy for various health conditions. Despite advances in modern medicine, these traditional practices continue to be valued, highlighting the cultural and medicinal significance of *Myrica Esculenta* [19,20].

V. PHYTOCHEMISTRY

Myrica Esculenta, also known as Box Myrtle or Kaphal, is a plant renowned for its traditional medicinal uses due to its diverse array of chemical compounds [20]. . The key compounds found in *Myrica Esculenta* include flavonoids, tannins, triterpenoids, essential oils, phenolic acids, alkaloids, and glycosides, each playing a unique role in the plant's therapeutic properties. Among the most important compounds are flavonoids like myricetin, quercetin, and kaempferol, known for their potent antioxidant effects which combat free radicals and oxidative stress. Myricetin exhibits anti-inflammatory, anticancer, and neuroprotective properties, while quercetin is valued for its antihistamine and anti-inflammatory effects, and kaempferol reduces the risk of chronic diseases through its antioxidant and anti-inflammatory mechanisms [21, 24]. Tannins, such as ellagitannins and gallotannins, give the plant its astringent properties and possess antimicrobial, anti-inflammatory, and anticancer activities useful in treating gastrointestinal disorders. Triterpenoids like betulinic acid and ursolic acid offer a wide range of biological benefits, such as inducing apoptosis in cancer cells and inhibiting viral replication [22, 23, and 31]. The essential oils from *Myrica Esculenta* contain volatile compounds like eugenol and limonene with antimicrobial and antioxidant properties, beneficial for respiratory and skin infections. Phenolic acids like caffeic acid and gallic acid also contribute to the plant's antioxidant and anti-inflammatory effects, further enhancing its medicinal value [25]. *Myrica Esculenta* is a valuable plant with a wide range of therapeutic compounds that make it beneficial for various health conditions [26].

VI. PHARMACOLOGICAL ACTIVITIES

The pharmacological activities of *Myrica Esculenta* have been extensively studied, and the plant has been found to possess a wide range of bioactivities. These activities include:

Antiasthmatic Activity: Extensive research has shown that *Myrica Esculenta* has significant anti-asthmatic properties. A study on ScienceDirect found that the plant's crude stem bark extract inhibited the accumulation of eosinophils in mice, a key predictor of allergic reactions. In addition, the extract reduced plasma excretion caused by acetic acid, another indicator of allergic reactions. The ethanol extract of *M. Esculenta* bark was also found to have antiasthmatic effects through antianaphylactic, antispasmodic and bronchodilatory mechanisms [27, 32].

Antiulcer Activity: Researchers have discovered that the plant contains bioactive compounds like flavonoids and phenolic acids, which contribute to its antiulcer properties. In studies conducted on rats using an ethanolic extract from the bark of *Myrica Esculenta*, significant antiulcer effects were observed in a pyloric ligation ulcer model [28]. The extract was able to enhance the antioxidant status of the gastric tissue by boosting levels of enzymes such as SOD, catalase, and glutathione peroxidase. These findings showed that the antiulcer potential of the extract was comparable to that of the standard antiulcer medication, omeprazole, in the same animal model [30, 31].

Anxiolytic Activity: The plant has been found to have anxiolytic effects, which is attributed to the presence of bioactive compounds such as flavonoids and phenolic acids. *Myrica Esculenta*, a plant known for its traditional use in Ayurvedic medicine, has been shown to possess anti-anxiety properties. In various studies, the ethanolic extract of the bark of *M. Esculenta* has been shown to have anxiolytic effects. The extract significantly reduced anxiety-like behavior in mice, indicating its potential as a natural anxiolytic [29, 31].

Hepatoprotective Activity*:* The plant was found to possess hepatoprotective activity, which is attributed to the presence of bioactive compounds such as flavonoids and phenolic acids. The ethanolic extract of *Myrica Esculenta* leaves was found to have a significant hepatoprotective effect against liver damage caused by

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carbon tetrachloride (CCl_4) in rats [32]. The study showed that the extract, when administered at doses of 200 and 400 mg/kg body weight, significantly reduced the elevated levels of serum biochemical markers such as serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT) and alkaline phosphatase (ALP) in the animals treated with CCl_4. In addition, the extract was able to restore the reduced total protein and albumin levels in the liver [33, 34].

Wound Healing Activity: The plant has been found to have wound-healing effects, which is attributed to the presence of bioactive compounds such as flavonoids and phenolic acids. The wound healing activity of *M. Esculenta* is attributed to the presence of bioactive compounds such as flavonoids, phenolic acids and terpenes, which have been shown to possess anti-inflammatory, antioxidant and antibacterial properties. These compounds are believed to play a critical role in reducing inflammation, promoting tissue repair, and improving the overall wound healing process [29, 35].

Antioxidant Activity: The plant was found to possess antioxidant activity, which is attributed to the presence of bioactive compounds such as flavonoids and phenolic acids. The antioxidant activity of *M. Esculenta* has been attributed to the presence of bioactive compounds such as flavonoids, phenolic acids and terpenes, which have been shown to possess antioxidant properties. These compounds are believed to play a critical role in reducing oxidative stress and inflammation, as well as protecting against cell damage [29, 36].

Anti-inflammatory Activity: The plant has been found to have anti-inflammatory effects, which is attributed to the presence of bioactive compounds such as flavonoids and phenolic acids. The anti-inflammatory activity of the aqueous extract of *M. Esculenta* using in vitro and in silico approaches [15, 37]. The study found that the extract has a strong inhibitory effect against the enzyme 15-lipoxygenase (15-LOX), which plays a crucial role in the inflammatory process. In silico docking analysis revealed that the bioactive compounds present in the extract, such as myricetin, arjunolic acid and myricanone, have high binding affinity with key inflammatory proteins including cyclooxygenase-1 (COX-1), cyclooxygenase-2 (COX-1), and exhibit. 2) And tumor necrosis factor-alpha (TNF-α) [29, 31].

Anticancer Activity: The plant's anti-cancer properties are believed to be due to the presence of bioactive compounds like flavonoids and phenolic acids. In addition, *M. Esculenta* has been shown to be able to regulate the production of pro-inflammatory mediators, such as cytokines and chemokines, which also contribute to its anti-cancer effects. The ethanolic extract of *M. Esculenta* bark effectively reduced the accumulation of eosinophils and plasma exudation in experimental models of allergic pleurisy and vascular permeability in mice [31, 38].

Antimicrobial Activity: The plant was found to possess antimicrobial activity, which is attributed to the presence of bioactive compounds such as flavonoids and phenolic acids. The antimicrobial activity of *M. Esculenta* has been attributed to the presence of bioactive compounds such as flavonoids, phenolic acids and terpenes [16]. These compounds have been found to have antimicrobial activity against various microorganisms, including bacteria and fungi. The antimicrobial activity of *M. Esculenta* was evaluated using various in vitro and in vivo models, including the agar well diffusion method and the broth microdilution method. [16, 31, 39].

Antidiabetic Activity: The antidiabetic activity of *M. Esculenta* has also been shown to be effective against various types of diabetes, including type 2 diabetes (T2D). The methanolic extract of *M. Esculenta* leaves showed a significant hypoglycemic effect in rats fed high fat and in rats with a single, low-dose streptozotocin-induced T2D. The study also found that the extract improved glucose uptake by skeletal muscle by activating IRS-1/PI3K/Akt/GLUT4 signaling in vitro and in vivo. The plant has been found to have antidiabetic effects, which is attributed to the presence of bioactive compounds such as flavonoids and phenolic acids [32, 34].

VII. CONSERVATION STATUS

Myrica Esculenta is a valuable medicinal plant that must be preserved for long-term sustainability. It is widely used in traditional medicine, but its high demand has caused overexploitation and habitat loss, putting it at risk of extinction. Illegal harvesting by the horticultural trade has further depleted the plant's natural populations and genetic diversity. To safeguard the future of *M. Esculenta*, conservation efforts are needed. Proposed strategies include [29, 32].

- **Micropropagation**: This involves propagating plants through tissue culture techniques in a controlled environment. This method can increase the plant's population while reducing pressure on its natural habitats.
- **Germplasm Preservation:** Preserving the plant's genetic material, such as seeds, leaves, and stems, in a controlled environment is essential. This technique can aid in safeguarding the plant's genetic diversity and securing its existence, particularly when its natural habitats are at risk of depletion.
- **Synthetic Seed Production:** In this process, artificial seeds are created through tissue culture methods. This innovative technique can increase the number of plants and relieve stress in their natural environment.
- **Hairy Root Technologies:** Using hairy root crops to produce the plant's bioactive compounds can reduce stress on natural

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populations and ensure long-term plant sustainability.

VIII. FUTURE PROSPECTS

Efforts to conserve the plant are necessary due to threats from overexploitation and habitat loss. Methods such as micropropagation, germplasm preservation, and synthetic seed production are essential for its long-term sustainability. There is a need for further research into the pharmacological properties of the plant's bioactive compounds to explore potential therapeutic applications [22]. *Myrica Esculenta* fruits have high nutritional content, suggesting potential for use as functional food or dietary supplement. Biotechnological applications of the plant's bioactive compounds, such as the synthesis of nanoparticles with various activities, could lead to more efficient production methods [40]. Mapping the plant's ecological distribution is important for conservation efforts. Traditional medicine has used *Myrica Esculenta* for ailments such as asthma and diabetes, indicating potential for new medicines. Sustainable harvesting practices are crucial for the plant's survival and should be promoted [18, 29].

IX. CONCLUSION

Myrica Esculenta, a medicinal plant with a long history of traditional use and extensive pharmacological research, is considered a valuable candidate for further study and possible applications in modern medicine. This plant is used in traditional medicine to treat respiratory diseases, gastrointestinal problems, skin diseases and anemia. Flavonoids, tannins, steroids and terpenes are the main components responsible for its medicinal properties, as confirmed by phytochemical analysis. Studies have shown that extracts and compounds from *M. Esculenta* have significant bioactivities, making them a promising option for therapeutic use in diseases such as inflammation, oxidation and cancer. The conservation status of the plant is worrying due to overexploitation and habitat loss. Efforts are required to ensure its long-term sustainability through strategies such as micropropagation, germplasm preservation and sustainable harvesting practices. Promoting the use of the plant in traditional medicine may also contribute to its survival. Future research should focus on isolating and characterizing the active ingredients responsible for its medicinal properties, as well as exploring possible applications in modern medicine. Conservation efforts are critical to the plant's future prospects, and the development of new drugs using its bioactive compounds is an important area of research. With its rich history and pharmacological potential, *M. Esculenta* is a valuable candidate for further studies and applications in modern medicine.

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