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A REVIEW ON *MYRICA NAGI*: APPROACH IN RECOGNIZING THE OVERALL POTENTIAL OF THE PLANT

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ABSTRACT: *Myrica nagi* also known as *Myrica esculenta* (Myricaceae) with common names such as, katphala, boxberry, *kaphal* is widely used medicinal plant. It's the tastiest wild fruit of sub-Himalayan region. The fruit is very attractive with a distinct flavour. It is a rich source of various flavanoids specially myrecetin which was found to be effective in various metabolic and CNS disorders. Recent studies have shown the presence of new compound myresculoside from methanolic leaf extract which had potent ACE-I inhibitory property. The objective of the present review article is to compile all the relevant published information regarding traditional uses, phytochemistry and therapeutic potential of *M. nagi*. For this purpose various databases and books were examined. The review clearly demonstrates the importance of this plant in ethno medicine and its immense potential in modern medicine. The present review is an effort to gather and consolidate the most recent information available on *Myrica nagi*. This will further help in explaining the efficacy and potency of the herb and to incorporating this knowledge into modern medicine.

KEYWORDS: *Myrica nagi*, Phenolics, Flavonoids, Anti-oxidants, DPPH.

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1. INTRODUCTION

Usage of medicinal plant for treatment has increased considering their minimal side effects, the remedies are in total sync with one's natural self, considering this as one of the greatest advantages. The medical industry is promoting usage of plant products. As per some studies conducted, world population is relying on plants extracts for their health care needs. Around 21,000 plant species have the potential, of being used as medicine, according to WHO. *Myrica nagi* is used in both ayurvedic and unani system of medicines for curing various diseases [1]. *Myrica nagi* belongs to the family Myricaceae and is also known as *Myrica esculenta* with common names such as, Box myrtle, katphala, boxberry, *kaphal* is an important, widely used medicinal plant [2]. The fruit looks somewhat like deep-red coloured raspberries. They have little pulp and have a big round seed in the center. The bark dark yellow bark contains chemical substances myricetin, myricitrin and glycosides [3]. It's primarily sourced for its fruits. The size of the tree varies from medium to large. It can easily be classified into small tree or a large shrub. It's woody in appearance, evergreen tree, 12 to 15 metres high; trunk girth, ranges from 55-95 cm. It's a dioecious tree meaning the male and female tree are separate but they have almost similar appearance [4]. Seeds stem cuttings, and suckers of *Myrica nagi* are used in propagation of the plant. Also Seeds of *Myrica nagi*, fully ripened fruit can be used for germination in the spring season. Saplings of around 10-15 cm height are planted in the late spring. Ayurveda literatures have reported bark to be acrid, bitter, and pungent. It is stated to be beneficial in fever, asthma, bronchitis and other respiratory condition, infection, urinary discharges, piles, constipation, throat complaints, tumours, anaemia, depression, chronic dysentery and ulcers [5]. Fruit is edible and natives of the region use its fruits to prepare pickle, jam and refreshing drinks. Mash constitutes 75.4% of entire organic product with juice substance of 40 %. The juice has 3.68% acidity, 12.65 % add up to sugars, which are generally lessening sugars [6, 7]. The organic product tannin content was observed to be 1.05% on mash premise though vitamin C just 4.12 mg for every 100 ml. The mineral substance of the natural product mash is 0.387% by its slag. The organic product mash contains 0.97% protein, 0.007% phosphorus, 0.194 % potassium, 0.039% calcium, 0.013% magnesium and 0.004% iron. The bark found to constitute 10.5% dampness, 32.1% tannins, solvent nontannins 2.9% [8,9, 10]. The tree is a mainstream solution for various illnesses [10, 11]. The organic products might be potential hotspot for the detailing of nutraceuticals or normal sustenances[11].

1. Plant Profile



Figure 1: *Myrica nagi*: Whole plant and *Myrica nagi* stem bark



Figure 2: *Myrica nagi*: Whole Fruit

2. Distribution

Myrica nagi comprehensively found between 900– 2100 m in the Indian Himalaya from Ravi eastward to Assam, Khasi, Jantia, Naga, and the Lushi Slants and extending to Malaya, Singapore, China, and Japan. In India *Myrica nagi* is found in Punjab, Meghalaya, Nagaland, Manipur and Mizoram, Himachal Pradesh, Bengal and Naga. It is acknowledged to be comprehensively scattered across finished Indo-Malesian zone [8, 12, 13]. Leaves are of lanceolate shape with evaluated length of 9.2 cm, width of 3.2cm. The Lower surface is light green and upper surface is light green. Sprout is Pistillate, little, sessile, solitary and bracteates; Inflorescence: a catkin, 4.2 cm long, axillary bearing around 25 blooms. Each staminate sprout has around 12 stamens, each with a short fiber. Seed measure around 9 mm long, 5 mm in broadness and weighs around 165 mg [13].

3. Traditional Uses

a) Powdered Bark

The bark powder is traditionally used in Cardiac debility and oedema. Also its used in Chronic gonorrhoea, Cough, bronchitis, Dental ache, Diarrhoea, Diuresis, Dysentery, Epilepsy [14]

b) Fruits

The fruit is helpful in Bleeding piles, Body ache, Toothache and Ulcer healing. In addition to it the fruit is helpful in regulation of menstrual cycle [15, 16, 17]

c) **Ayurvedic depiction of Myrica nagi:** Maharsi Charaka has sorted katphala as

Vedanasthapaka	:Pain executioner
Sandhaniya	: Restores the strength of joints
Sita prasamana	:Relieves cool sensation on the skin
Kanthya	:Beneficial for the throat
Sandhaniya	: A recuperating herb

Maharsi Susruta has specified it as visaghna: detoxifier and stambhana astringent. It is one of the herbs said in every single old sacred of writing of Ayurveda and has different equivalent words like ramapatri, somavalka, kaitarya, sriparnika, bhadra, kumudika and so forth [18].

Ayurvedic Preparations

Katphala curna, Katphala kvatha, Katphala taila [19, 20].

4. Traditional Uses Overview

According to ayurvedic and unani arrangements *Myrica nagi* is used for bark, bloom and leafy food. According to various citations made by ayurveda the bark quotes with unpleasant, sharp, warming properties, and have potential applications in preventing exasperation. This tree is widely used to cure of various diseases like weakness, respiratory illness (asthma, bronchitis), unending looseness of the bowels, fever, liver problems, rhinitis (nasal catarrh), injuries, throat problems, tumors, ulcers, urinary releases [21-24]. It was mentioned in ayurvedic Samhita that *Myrica esculenta* is runious to liver and spleen. In spite of this, oil extricated from the blossoms act as a tonic, and has been utilized in prophylaxis ear infection, migraine, loose bowels and paralysis [8, 9, 22-24]. In addition to this, the organic constituents show recuperating properties in ulcers, and also supports application in maintenance of placenta and bone fracture [15, 25, 26].

5.0 Phytochemistry of Fruits, Bark and Leaves

The products of *Myrica nagi* have been accounted for lessening sugars, tannins and Vitamin C [27]. The details of constituent's analysis done by HPLC, GC-Mass [28] are in Table no. 1.

Table 1: Details of Phyto-constituents analysis done by HPLC, GC-Mass

Sr. No	Plant Part	Extract	Phytoconstituents	References
1.	Fruit	Ethanollic	Gallic acid, catechin, chlorogenic acid and ρ -coumaric acid	28
2.	Bark	Ethanollic	Gallic acid, myricanol, myricanone, epigallocatechin 3-O-gallate, two prodelphinidin dimmers, castalagin. Gallic acid, lupeol, oleanolic acid and stigmasterol, myricitrin, diarylheptanoid glycosides and myricanol	29-33
3.	Leaves	Ethanollic	4-hydroxy-1,8-cineole 4-O- β -Dapiofuranosyl-(1 \rightarrow 6)- β -D-glucopyranosie, (1S,2S,4R)- 2-hydroxy-1,8-cineole β -D-glucopyranoside, corchoionoside C, (6S,9R)- roseoside, myricanol, 5-O- β -D-glucopyranosyl myricanol, arjunolic destructive, arjunglucoside, 3-epi-ursonic destructive, 3-O-(E)-caffeoylursonic destructive, myricetin, myricitrin, flavone 4'- hydroxy-3',5,5'- trimethoxy-7-O- β -D-glucopyranosyl (1 \rightarrow 4)- α -L-rhamnopyranoside and 3', 4'- dihydroxy-6-methoxy-7-O- α -L-rhamnopyranoside, β -Sitosterol, β -Sitosterol- β -D-glucopyranoside and quercetin, Nerolidol (13.46%), α -pinene (13.46%), α -Selinene (12.28), β -Caryophyllene (11.66%), β -Selinen (9.71%), α -Caryophyllene (8.94%), α -cadinol (5.32%), Linalool (4.06%)	34-36
	Bark Root bark	Acetone fraction	Proanthocyanidin while the constitutes 13-oxomyricanol. Constituents like flavonol glycosides myricetin-3-O-(3"-Ogalloyl)- α -L- rhamnoside, myricitrin-3-O-(2"-Ogalloyl)- α -Lgalactoside, myricetin, 3-O-(2"-O-galloyl)- α -Lrhamnoside, myricitrin, diarylheptanoid glycosides characterized as myricanol-5-O- β -Dglucopyranosyl(1 \rightarrow 3)- β -D-glucopyranoside	42-44

5.1 Fruits and Bark Analysis with TLC and HPTLC

5.1.1 Fruits

HPLC analysis examined presence of Gallic acid, catechin, chlorogenic acid, and p-coumaric acid in the ethanolic extract of the *Myrica nagi* fruit which contains reducing sugars, tannins and vitamin C [38,39,41]. Gallic acid and myricetin compound responsible for sourness of fruit was studied for effective matrix metalloproteinase [41]. The analysis of the alcoholic content of fruit was done with TLC using silica gel plate with N-butanol: acetic acid : water (4:1:5) . The result of which being a mobile phase is shown in Table no.2 [41,42].

Table 2: TLC and HPTC Profile of Fruit

Fraction Of Extract Used	Solvent system used (mobile phase)	Rf value Obtained	Reference Compounds	Reagent used for detection	Reference
Alcoholic plant extract	n-Butanol : Acetic acid : water (4:1:5)	0.25, 0.43, 0.57, 0.75, 0.88	Myricetin, Vitexin, Aureubidin , Lutolin, Apigenin	Visible light	42
Alcoholic plant extract	nButanol : Acetic acid : water (4:1:5)	0.09, 0.18, 0.30, 0.49 0.65, 0.731	Cysteine Atropine, Glycine, Orientin, Azaleatin, Quercetin, chlorogenic acid Rhamnoside, Tricin	363 nm (U.V)	42
Alcoholic plant extract	nButanol : Acetic acid : water (4:1:5)	0.07, 0.09, 0.12, 0.25, 0.30, 0.35, 0.14,	Berberine, Cysteine, Proline, Alanine, Glutamic acid, Gossypetin, Morphine, Glutamine, Aesculin, Cichorin, Scopolin, Quinine, Malvidin,	Iodine Vapours	42
Alcoholic plant extract	nButanol : Acetic acid : water (4:1:5)	0.09, 0.30, 0.51, 0.71, 0.82, 0.88	Cysteine, Valine, Caffeoylglucose,, Asperulin, cellobiose Peonidin, Pelargonidin Isoferulic, umbelliferone		42

5.1.2 Bark

Gallic acid, myricanol, myricanone, epigallocatechin 3-*O*-gallate and hydrolysable tannin castalagin are the various bioactive constituents present in the bark of *Myrica nagi*. Ultrasound assisted technique was used to extract proanthocyanidins present in *Myrica nagi* with water as

solvent for extraction [28]. Epigallocatechin 3-O-gallate is present as terminal unit of the polymer where as the extender units were also known to have galloyl group at C-3 [44, 45]. The details of HPTLC of Bark of *Myrica nagi* are given in Table:3.

Table 3: HPTLC Details of Bark of Myrica Nagi

Method of screening	Extract used	Solvent System Used (Mobile Phase)	Rf Value Obtained	Reference Compounds	References
HPTLC	Bark extract	toluene-ethyl acetate-formic acid (5:5:1)	0.56	Gallic acid	29,42,43,44
HPTLC	Bark extract	toluene-ethyl acetate (8:2)	0.38, 0.49, 0.62	Oleanolic acid, Stigmasterol, Lupeol	29,42,43

6.0 Myricetin: An Important Phytoconstituent

Myricetin (3,5,7-Trihydroxy-2-(3,4,5-trihydroxyphenyl)-4-chromenone) is a bioactive flavone and is generally a yellow-beige crystalline powder. Myricetin consist the backbone of 3-hydroxyflavone and 6 hydroxyl groups that hold a lot of benefits in the prophylaxis of many diseases and possess an enormous diversity of physiological effects that includes potent antioxidant and free radical scavenging properties. In- vitro study of myricetin on epidermal growth factor-activated mouse epidermal cells found to directly inhibit Janus kinase 1 (JAK1) thereby inhibiting cell transformation, along with this it is widely known for its anti-cancer, anti-mutagenic, anti-inflammatory, anti-diabetic properties [45]. Expression of tumor necrosis factor-alpha, which is a cytokine responsible for stimulating the inflammatory response was impeded by myricetin and thus manifesting its anti-inflammatory potential. In addition to this myricetin also inhibited the increase in capillary permeability induced by acetic acid in human body. On the other hand, it significantly decreased the serum levels of Malonyldialdehyde (MDA) which in turn, increased the serum levels of increased superoxide dismutase (SOD) in the carrageenan-induced paw edema model. This study proves the potency of myricetin as anti-inflammatory function on acute and chronic inflammation [46,47].

6.1 Role Of Myricetin In Various Health Issues

Myricetin block uptake of LDL by macrophages through reducing gene expression on macrophages. In addition to that myricetin also prevent oxidation of LDL and thus can boost heart

health by minimizing uptake of oxidized LDL [48]. In a study on diabetic rats, myricetin was found inhibiting the uptake of methylglucose by adipocytes, along with that myricetin also reduced the oxidative injury in diabetic related bone diseases. Another founding of study was the reduction in glucose plasma level in diabetic rats. In animals with Parkinson disease, myricetin restored the dopamine level. It also inhibits beta-amyloid fibril formation in Alzheimer patients [49,50].

7.0. Pharmacological Employments of *Myrica nagi*

7.1. Anti- Allergic Action

Sensitivity is an extremely touchy reaction of body to any outside body; it is intervened by arrival of histamine like operators. In ayurvedic written works and a few investigations directed on the plant it was reasoned that *Myrica nagi* is viable against sensitivity. It is trusted it has anti histaminic properties and represses the arrival of histamine [51,52].

7.2. Mitigating/ Anti-inflammatory Action

Aggravation can be characterized as tissue reaction to contamination, disturbance. It is viewed as a basic instrument of body barrier components. There are four cardinal indications of fiery condition and they are Calor, dolor, rubor, and tumor, i.e. Warmth, agony, redness, and swelling. Provocative reaction is exceptionally basic for the upkeep of ordinary tissue homeostasis. Studies bolster the way that the plant concentrates might be compelling as calming operator, it hinders the arrival of prostaglandins and histamine in middle people which causes bodily fluid emission and mucosal oedema. This specific reaction might be a direct result of essence of flavonoids and steroids [53].

7.3. Cell reinforcement Movement/Antioxidant Activity

The products of the tree were examined for the Anti-Oxidant prevention agent exercises and it was discovered that they can be used as normal cell reinforcements. Studies have discovered confirmations that propose unrefined concentrate of *Myrica esculenta* organic products help in lessening of free radicals [40, 60, 61].

7.4. Antihelmintic Action

Numerous references bolster the way that watery ethanolic concentrate of bark demonstrated hostile to helmintic movement. The concentrate caused loss of motion took after by the death of the worms at all tried measurement levels [38].

7.5. Anti-microbial Action

The plant has anti microbial action Against different micro organisms with normal zone of hindrance as 17.9mm, 17.6mm, 19.5mm, 26.9mm, 9.5mm and 15.9 mm, the basic oil of the stem

bark was observed to be a strong antimicrobial specialist. It was also found that aqueous concentrate of *Myrica nagi* have strong action against salt water shrimp (*Artemia salina*) while natural concentrate don't exhibit such action [53, 54].

7.6. Anxiolytic Impact

The positive outcomes were acquired when ethanolic concentrate of the bark was subjected for anxiolytic examination. The ethanolic remove have measurements subordinate anxiolytic action was demonstrated in the result, when the oral organisation of the ethanol exricate at dose of 100,200, and 400 mg/kg was directed [55].

7.7. Chemopreventive Impact

Myrica nagi is a compelling chemopreventive operator in skin and equipped for enhancing cumene hydroperoxide initiated cutaneous oxidative pressure and harmfulness. It was discovered that the defensive impact was dosage subordinate [56].

7.8. Hypertension

Megastigmanes (a glycoside) isolated from *Myrica esculenta* showed potential role in the prophylaxis of hypertention. On administration of this compound against hypertension, uncovered that the compound corchoionoside C and (6S,9R)- roseoside detached from the leaves of the tree were intense Expert inhibitors with rates 29.97% and 25.63% at the grouping of 100 μ M, while bioactive compound myricanol, 5-O- β -D-glucopyranosyl myricanol and myricetin show feeble action with inhibitory rates of 0.07-1.41% at centralization of 100 μ M [34].

7.9. Mast cell Stabilizing Impact

Aqueous concentrate and ethyl acetic acid derivation of bark of *Myrica* at the dosage of 100mg/kg, 200mg/kg balance out movement of mast cells. At the end of treatment those broken peritoneal pole cells treated with compound, release better mast cell settling movement [52,57, 58].

8.0 Application In Nanosciences Field

Nanoparticles was prepared by *Myrica esculenta* Silver (Ag) with the aid of bio-reduction method. The nanoparticles obtained with this method were oval in shape and having an average size of 55 nm and were prepared by the aqueous extract of *Myrica esculenta* after the bio-reduction for six hours in aqueous solution of Ag⁺ ion [62,63].

9.0 Future Prospects

Through the literature survey, it was found that in nanoparticle field the nanoparticles from leaf extract and bark tannin of the tree was already prepared, but other parts of the tree like root, fruits are yet to be explored. The fruits of the tree have already been quoted for the antioxidant activity.

But myricetin the principal compound of fruit has only been investigated for effective matrix metalloproteinase inhibition activity in the prophylaxis of cancer. Myricetin (a naturally occurring compound) and its derivatives can be synthesized in vitro and further studied for diabetes, brain diseases. Thus the need of current time is the utilization of myricetin by conducting its further pharmacological studies because these medicinal herbs are the potential source of therapeutics and have attained a significant role in health system for both humans and animals. It is not only beneficial in the diseased conditions but also acts as a potential material for maintaining proper health. As *Myria nagi* is endangered, a prompt attention needs to be given to protect the tree from extinction [65,66].

2.CONCLUSION

Myrica nagi (bayberry) is an influential medicinal herb in Ayurvedic system of medicines and is safely and worthwhile it is used in the prophylaxis of diverse disorders [64]. Various bioactive constituent of the tree has several pharmacological actions such as; anti-inflammatory, antioxidant, antihelmintic, anti-microbial, anxiolytic, chemopreventive, mast cell stabilizing, hypertension which itself speaks about the wide scope for the utilization of this species i.e *Myrica nagi*. Commercially *Myrica nagi* have wide spectrum of applications and is having a strong prospect. Beside bark, fruits and flowers pharmacological potential for other parts of tree constitutes a potential area for research in future. Efforts should be made to standardize a technique for utilization of all the parts which will lead to wider its commercial applicability. The medicinal properties of *M. nagi* are well known. Mast cell stabilizing [52], anti-inflammatory [53], anti-helmintic [38], antimicrobial [53], anxiolytic [55] properties are possessed by bark whereas anti-oxidant properties and antimicrobial properties [53, 54] are possessed by fruits. Leaves of *M. nagi* are exported globally for its medicinal utilities. Traditionally, many Utrakhand tribal people utilize the bark and whole plant and are an effective chemopreventive agent in the skin. It is also efficacious in chronic cough earache and asthma. When applied externally powdered bark is used to heal ulcers and also intoxify fishes. Ayurveda documents of the plant showed for having antispasmodic, anti-inflammatory, analgesic properties [67, 68]. Through the literature survey, it was found that various activities of bark and leaves have been studied earlier, but not much work is done on physiochemical evaluation and phytochemical screening of leaves and fruits.

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CONFLICT OF INTEREST

The Author's declare that there is no conflict of Interest.

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