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A LITERARY REVIEW ON KALMEGH AND BHUMYAMLAKI AS HEPATOPROTECTIVE MEDICINAL PLANTS

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ABSTRACT

India is rich in flora of various kinds having several medicinal properties which are already known to us while some are yet to be discovered and used for the betterment of the human mankind. The practice of using indigenous plants for the treatment of various health ailments has been an age-old practice. With the advancement in technology and lifestyle modification people are suffering from liver diseases and it is a worldwide problem now. Liver is a vital organ which plays a major role in the metabolism and excretion of xenobiotics from the body. The currently available synthetic drugs cause damage to the liver so it is imperative to find new drugs with least side effects. In Ayurveda, various medicinal plants are mentioned which are efficient in protecting liver from various harmful agents or toxins causing diseases. *Kalmegha* and *Bhumyamlaki* mentioned in various Ayurvedic texts has hepatoprotective activity. Ayurveda has a holistic approach. It believes in organic way of treatment by eliminating the toxins and balancing the *Tridosha*. The review has been done based on both *Ayurvedic* text and modern experimental studies. In this regard, their morphology, phytochemistry, Ayurvedic pharmacology, effects and trial studies and dosages are focused on. The introduced medicinal plants can be used for production of new drugs via antioxidant related properties, hepatoprotective activities for the prevention and treatment of liver disorders.

Keywords: *Ayurveda, Kalmegha, Bhumyamlaki, Hepatoprotective.*

INTRODUCTION

Liver diseases of various origin remains a serious health problem and a major cause of mortality.In the absence of reliable hepatoprotective drugs in modern medicine, herbs and plants play a vital role in managing several liver disorders.The prevalence of liver diseases have been increasing day by day due to change in lifestyle and use of synthetic drugs.The liver is one of the human body's key organs that regulates metabolism and has secretion, storage and detoxification functions. It is an accessory digestive organ that produces bile, an alkaline fluid containing cholesterol and bile acids, which helps in breakdown of fat. The liver is the first destination of toxins from the intestinal tract. The liver's highly specialized tissue,consisting of mostly hepatocytes, regulates a wide variety of high volume biochemical reactions, including the synthesis and breakdown of small and complex molecules, many of which are necessary for normal vital function[1].The damage to the hepatocytes can be both reversible and irreversible. The impairment in liver function leads to deranged liver enzymes and over a long period of time may lead to fibrosis and eventually to cirrhosis. Patients with abnormal liver function who develop ascites, variceal hemorrhage, hepatic encephalopathy or renal impairment are considered to have end-stage-liver disease. The traditional systems of medical practice in several parts of the world constitute several hepato-protective herbs among which *Kalmegha* and *Bhumyamlaki* has its role. Liver can be referred as *Yakrit*as per Ayurvedic classics. *Yakritvikara* (liver disorders) are dealt with *Udararoga.* Ayurveda has a holistic approach in destroying the disease from the root. It was seen that both *Kalmegha* and *Bhumyamlaki* hepatoprotective, antioxidant, Anti-diabetic, Anti-inflammatory, Anti-Cancer, Anti-Viral actions.

Aim: To study drug review of *Kalmegha* and *Bhumyamlaki* based on Ayurvedic classical texts and other experimental studies.

Objectives:

1. Collection of various references from the available Ayurvedic classical texts.
2. Highlighting the effects, benefits and dose of the same.
3. Collection of a few classical formulations containing *Kalmegh* and *Bhumyamlaki* and their indications as described in the texts.

Materials and Methods: The review has been done based on Brihattrayee, Bhavprakash Nighantu, Adarsh Nighantu and other experimental and evidence-based research papers on *Kalmegha* and *Bhumyamlaki.*

Kalmegha

Botanical Name: *Andrographis panniculata* (Burm f.) Wall ex Nees

Family: Acanthaceae

Synonyms: *Bhunimba, Yavatikta, Yavakaraphala, Shankhini.*

Vernacular Names:

Hindi: Kalamegha, Kalpanath, Bengali: Kalamegh, Malayalam: Nelavepu, Nelavemu, Nilavaepu, Telugu: Nelavemu, Kannada: Nelabevu, English: Create

Morphology[5]

Kalmegh is a small terrestrial, annual, erect herb, attaining 1-3 feet of height. The Stem is dark green, much branched, sharply quadrangular, smooth from the lower part with longitudinal furrows, and wooly haired at upper young parts. Leaves are smooth, opposite, linear to lanceolate, short petioled, with narrowed ends, 1.5-2.5 inches in length and 0.5-0.75 inches wide. Flowers are small, petiolate, white, light purplish or with purple patches; inflorescence is spreading (terminal and axillary) panicled racemes of 2-4 inches long. Calyx is 5, linear, lanceolate and wooly haired. Corolla tube is narrow and about 6 mm long; limb longer than the tube and is bilabiate. Two stamens inserted in the throat and far exerted; anther basically bearded. Fruits are the erect capsules of linear-oblong shape, 1 - 2 cms long and 2-5 mm wide and acute at both ends. The unripe fruit is wooly haired whereas the ripe one is smooth. Seeds are small, numerous, sub-quadrate and yellowish brown in color. The plants bear flowers and fruits during the months of April-May (*Grishma Ritu*) and September-October (*Sharad Ritu*).

Distribution: Widely distributed throughout plains of India from Uttar Pradesh to Assam, Madhya Pradesh, Tamil Nadu and Kerala.

Fig. 1

Phytochemistry

Whole plant contains lactones-andrographolide,14-deoxy,11-oxoandrographolide, 14-deoxy11,12-didehydro-andrographolide,14-deoxy andrographolide and meandrographolide, iridoid glucoside, 5-hydroxyl7, 8-dinecthoxyflavone glucoside. The roots contain andrographin, panicolin, apigenin, andrographolide, flavones andrographone, flavonoid glucoside 2'5 dihydroxy-7,8-dimethoxy flavones-2-0 B glucoside and 3 B hydroxyl-5-stignuasa-9 (11)22(23)-diene. The aerial parts contain alkenes, ketones and aldehydes. The bitter principles in the leaves are due to the presence of andrographoloide named Kalmegin, dioxyandrographolide, neoandrographolide and dihydroandrographolide isolated form the aerial parts. The leaves and stems are rich in flavonoids, gums, mucilages and tannins[22]. The leaves of the herb were found to contain the highest amount (2.39% w/w) of Andrographolide and the seed to contain the lowest[23].

Ayurvedic Pharmacology

*Rasa – Tikta***,** *Guna – Laghu, Ruksha***,** *Virya – Sheeta***,** *Vipaka – Katu***,** *Dosha karma – Kapha-pitta shamaka, Dipana, Pachaka, Yakrituttejaka, Jwaraghna, Krimighna, Raktashodhaka, Sothahara, Swedajanana*

1. In *Adarsh Nighantu*[2], Bapala G. Vaidya has mentioned *Kalmegha* in *VasadiVarga* with synonyms *Kalpantha, Yavatikta a*nd *Shankhini.*
2. Prof. Priyavrat Sharma has mentioned it in *Shatapushpadi Varga* with synonyms *Bhunimba*[3].

Parts used: Whole plant[4].

Dose: *Churna (*Powder):1-3gm, *Swaras* (Fresh juice)*:* 5-10ml, *Kwatha* (Decoction): 20-40ml[4].

Pharmacological Activities of *Kalmegha:*

1. Hepatoprotective Action

The effect of *Andrographis panniculata* extract was studied on CCl_4 induced hepatic damage in rats. The degree of protection was measured by physical, biochemical changes. Pre-treatment with extract significantly prevented the physical, biochemical, changes induced by CCl_4 in the liver. The effects of it could be useful in preventing chemically induced acute liver injury. It can be concluded that the aqueous extract of *Andrographis panniculata* almost significant effective in the standard drug[6]. A recent study showed that andrographolide attenuated concanavalin A-induced liver injury and inhibited hepatocyte apoptosis[7]. The effect of andrographolide was found to be more potent than silymarin against acetaminophen-induced reduction of the volume and contents of bile. Andrographolide was also shown to protect against ethanol-induced hepatotoxicity in mice with an equivalent efficacy of silymarin[21]. Hepatoprotective effects of the crude alcohol extract of leaves against CCl4-induced liver damage; these effects have had also been established against paracetamol-induced toxicity in an ex vivo rat model of isolated hepatocytes [13].

2. Anti microbial

In vitro antibacterial activity of the crude powder of A. *paniculata* has been reported against Salmonella, Shigella, E. coli, gram A streptococci, and Staphylo-

coccus aureus, even at a concentration of 25mg/mL. Singha et al. [10] found significant antibacterial activity in an aqueous extract with andrographolide. Significant activity against enterohemorrhagic strains of E. coli was found in the ethanol extract of A. paniculata[14].

3. Anti-Inflammatory Effects

Andrographolide has been reported to significantly reduce the inflammation caused by histamine, dimethyl benzene, and adrenaline [11].

4. Antipyretic and Analgesic Effects

In Asian countries, *A. paniculata* has been widely used for its antipyretic, analgesic, protozoacidal, antihepatotoxic, anti-HIV, immunostimulant, anticancer effects [12]. It had been reported that andrographolide, with oral doses of 100 and 300mg/kg, produced a significant antipyretic effect after administration of brewer's yeast-induced fever in rats [15]. In addition, doses of 180 or 360mg/kg of andrographolide were also found to relieve fever in humans by the third day after administration [16].

5. Renoprotective effects

A study found that the aqueous extract of A. *paniculata* could considerably alleviate the nephrotoxic action of gentamicin in male albino rats, thus exhibiting marked renoprotective activity[18].

6. Effects on Cardiovascular Disease

A. *paniculata* has demonstrated an increase of blood-clotting time; hence, pre and post treatments of the extract of A. *paniculata* after surgery significantly prevent the constriction of blood vessels, thus decreasing the risk of the subsequent closing of blood vessels after angioplasty procedures[19].

7. Antidiarrheal Effects

Many Western medicines, such as kaolin-pectin, bismuth, and loperamide, have long been used to alleviate the symptoms but have included undesirable side effects. It was reported that the ethanol extract of *A. paniculata* cured 88.3% of acute bacillary dysentery and 91.3% of acute gastroenteritis cases [91]. Administering and rographolide was reported to cure 91% of acute bacillary dysentery cases. The same cure rate (91.1%) was also achieved by administering a compound tablet containing and rographolide and neoandrographolide (at a ratio of 7:3) in cases of bacillary dysentery. This was reported to be higher than cure rates obtained with furazolidene or chloramphenicol [17].The juice of fresh leaves of A.*paniculata*, which generally contains andrographolide, is used as a domestic remedy to treat colic pain, loss of appetite, irregular stool, and diarrhoea[20].

8. Anti diabetic effect

Andrographis paniculata (Burm.f.) Nees plant originates from India, and has been used for several purposes, primarily preventing diabetes mellitus[8]. Ethanolic extract of this plant can decrease thye blood glucose level in Type 1 DM rats[9]. However, its antidiabetic effect in type 2 DM has not been well reported.

Table 1: List of Classical Formulations of *Kalmegh* with Their Indication

Sl No.	Formulations	Indications	Reference
1	*Bhunimbadi Churna*	*Jwara, Pandu, Atisara*	C.Chi.15/132-133 *Grahanidosha chikitsa adhyaya*
2	*Chandraprabha Vati*	*Anaha, Shoola, Kushta, Kandu, Kamala, Bhagandara*	*Sharangadhara Madhyama Khanda* 7/40-49
3	*Tiktaka Ghrita*	*Trishna, Bhrama, Daha, Pandu*	*A.H/Chi*/19/2-7
4	*Nimbadi Kwatha*	*Kaphaja Jwara*	*Chakradatta, Jwara chikitsa,* 101
5	*Mahatiktaka Ghrita*	*Kustha, Visamajwara, Raktapitta, Hridroga*	*Su.Chi.*9/8 *Kustha chikitsa*

Bhumyamlaki

Botanical Name: *Phyllanthus niruri* Sensu Hook. f.

Family: Euphorbiaceae

Synonyms: *Bahupatra, Bahuphala, Bahuvirya, Siva, Tamalaki, Ajata, Bhudhatri*

Vernacular Names:

- Hindi: *Bhuyiavla*

- Bengali: Noar
- Malayalam: *Arinelli, Kizhanelli,*
- Telugu: *Nela Usiri*
- Kannada: Kirunelli, Nela Nelli.
- English: Gale of the wind, Stonebreaker

Morphology[24]

Phyllanthus niruri is an erect annual herb, growing 40 - 70cm height having ascended herbaceous branching; it is quite glabrous and branching at the base. The genus Phyllanthus means "leaf and flower" because the flower and fruit can be associated with the leaf. It is a plumose leaf that carries flower and fruit.

Leaves are numerous, small, green, sub sessile, closely arranged, elliptic oblong shaped, obtuse, having short petiole and stipules present, they are arranged alternatively on each side of the stem.

The flowers are yellowish, small, numerous, axillary. These are unisexual, monoecious flowers, male flowers having 1-3 sessile stamens and female flowers were solitary in nature.

Fruit is a capsule, very small, depressed globose and more over capsule is smooth, 2-3mm in diameter.

Stem is having horizontal branches and height of 30-60cm, 1-2.5mm width.

Rootis somewhat branched and large.

Distribution: Widely available in Assam, Uttar Pradesh, Haryana, Punjab, Tamil Nadu, Maharashtra, Kerala, Andhra Pradesh, Karnataka, Bihar, Odisha and Bengal.

Fig. 2

Phytochemistry[24]

It contains active ligans, glycosides, flavanoids, alkaloids, ellagitans found in leaves, stem and roots. Common lipids, sterols and flavanoids also occur in the plant. Niranthinnirtetralinphyltetralin is isolated from leaves. Kaemferol-4 rhamnopyranocyte and criodictiol-7 rhamnopyranoside, lup 20 (29)-en-3 beta-ol and its acetates are extracted from roots.

Ayurvedic Pharmacology

Rasa – Tikta, Kasaya, Madhura

Guna – Laghu, Ruksha

Virya – Sheeta

Vipaka – Madhura

Dosha karma – Kapha-pitta shamaka, Rochaka, Pipasahara, Kasahara, Kanduhara, Raktapittahara, Kamalahara.

1. *Acharya Charaka* and *Acharya Vagbhata* categorized it as *Kasahara* and *Swasahara.*
2. *Bhav Prakash Nighantu* mentioned it as *Pipasahara, Kasahara, Kanduhara, Raktapittahara, Kamalahara.*

Parts used: Whole plant[4].

Dose: *Churna (*Powder):3-6gm, *Swaras* (Fesh juice)*:* 10-20ml,[4].

Pharmacological Activities

1. Hepato protective& antioxidant activity

The carbon tetrachloride and galactosamine induced cytotoxicity in rat hepatocytes can be decreased by the *P. niruri* hexane extract. Phyllanthin and hypophyllanthin protects against the CCl4 induced cell lesions and GalN induced Hepatotoxicity[32]. *Phyllanthusniruri* can reduce nimesulide induced hepatic damage. By measuring the levels of glutamate oxalo-

acetate transaminase (GOT), glutamate pyruvate transaminase (GPT) and alkaline phosphatase (ALP) in serum it was concluded that the levels of three enzymes are decreased in the extract treated group. By these observations intra peritoneal treatment was found to be more effective than oral administration and by combining this data we can conclude that P.niruri protects the liver from nimesulide induced liver toxicity [26]& Oxidative stress [29]. The ethanol extract and hexane extract were administered and the serum parameters (serum bilirubin, serum alkaline phosphatase, serum aspartate (AST), serum alanine transferase (ALT), hepatic reduced glutathione (GSH) were analysed and these parameters were controlled after the treatment with hexane extract and .hence, it was stated that *P.niruri* can control the paracetamol induced hepatotoxicity[27].

2. Anti malarial activity

The herbal plants show antagonistic properties against malaria. *P.niruri* and *Mimosa pudica* showed antiplasmodial activity, when feeded with ethanol extracts in albino mice [30]. *P.niruri's* ethanolic extract of one month old in vitro grown callus showed higher antiplasmodial activity than extract prepared from fresh apical stem extract [31].

3. Lipid lowering activity

It has the capacity to reduce the serum lipid levels. The extract is fed orally (250 mg/kg b.w) in hyperlipidemic rats, results followed by reducing lipid levels [28].Methanol extract of P.*niruri* was tested against chlorpyrifos (CPF)- evoked erythrocyte fragility and lipoperoxidative changes in wister rats and observed lipid peroxidative changes and protection from the chlorpyrifos induced erythrocyte fragility [33].

4. Anti viral action (Hepatitis B)

Phyllanthus niruri has been used to inhibit the hepadna virus and it is extensively used to treat jaundice and hepatitis B virus [34]. The phyllanthus genus plants inhibit duck hepatitis B virus by inhibiting 50 % of DNA polymerase [25].

Table 2: List of Classical Formulations of *Bhumyamlaki* With Their Indication

Sl. No.	Formulation	Indication	Reference
1	*Chyawanprasha*	*Kasa, Swasa, Kshatakshina, Swarabheda. Hridroga. Vatarakta, Trishna,*	*Ch/Chi*/1-1/62-74
2	*Shatyadi, Churna*	*Tamaka Swasa, Hikka*	*Ch/Chi*/17/123-124
3	*Tejovatyadi Ghrita*	*Hikka, Swasa, Sotha, Vatajanya Arsha, Grahani, Hridroga*	*Ch/Chi*/17/141-144
4	*Pippalyadi Ghrita*	*Jirna jwara, Swasa, Kasa, Shirashoola*	*Chakradatta*, *Jwarachikitsa*, 240-242
5	*Vrihatkantakari Ghrita*	*Swasa, Kasa, Hikka*	*Chakradatta, Kasachikitsa,* 51-54

DISCUSSION

According to *Ayurveda, Yakrit Roga* occurs due to vitiation of *Pachak pitta, Ranjaka pitta, Samana vayu* and *Kledaka kapha.* The *dushita dosha* again vitiates the *agni* and *dhatu* resulting in *mandagni*, production of *ama* in turn producing *Apachit dhatu*. The *yakrit* gets *avrita* by *kapha* and there may be accumulation due to *kaphaavarana* causing *yakritvriddhi*, *agnimandya* and *balakshaya*. Excess consumption of *madya* due to its *agneya guna*, increases *pitta* and reduces *apadhatu* and vitiated *vata* to reduce the size of the liver mass (*yakritkshaya*).When the *usna guna* of *pachak pitta* is vitiated in stomach ,it disturbs the *ranjaka pitta* of the liver due to excess *pitta vriddhi ahara*. When *pitta* level is high in liver it causes the *kapha* to get reduced and damage the architecture of the liver, hence degeneration. The extract of *Kalmegha* and *Bhumyamlaki* independently has showed various activities which establishes its hepatoprotective activity. *Tikta rasa* present both in *Kalmegha* and *Bhumyamlaki* possess *guna* like *pitta shamak*, *agnivardhaka* thereby reducing the vitiated *kapha*. *Madhura vipaka* will also help in *pitta shaman*. *Ruksha* and *laghu guna* will help in clearing the *sroto avarodha* and thereby increasing the absorption.

CONCLUSION

Ayurveda has a holistic approach toward treatment of diseases. It has been shown both in Ayurvedic texts and modern research that *Kalmegh* and *Bhumyamlaki* has hepatoprotective activity. They also act as anti diabetic, anti oxidant, anti pyretic and other activities. This article helps in establishing that *Kalmegh a*nd *Bhumyamlaki* are potent hepatoprotective drugs and can be used in Liver diseases involving both *ama* and *nirama* condition.

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