Asian Journal of Pharmaceutical Technology & Innovation
ISSN: 2347-8810

Review Article

Received on: 21-11-2015
Accepted on: 07-12-2015
Published on: 15-12-2015

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A Review on King of Bitters: *Andrographis paniculata*

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ABSTRACT

Kalmegh, The King of Bitter is traditionally used plants in ayurvedic system of medicine.Its biological name is *Andrographis paniculata* (Nees) belonging to the family Acanthaceae. From the beginning, it has been used in ayurveda as anti-inflammatory, Antioxidant, Antibacterial, Antidaibetic, Antispasmodic, anti-carcinogenic, antipyretic, antidiarrhoeal, hepatoprotective, nematocidal, anti-HIV and in many infectious diseases rangning from malaria to dysentery. Medicinal value of this plan is due to the presence a diterpenoid derivative Angrapholide and Neoandrographolide.Traditionally, its decoction has been used as hepatoprotective in treatment of jaundice.The roots of the plant was used to prepare decoction and thus the chemical acting as hepatoprotective must be present in roots of the plant.

Key-words: Kalmegh, Bitter, Acanthaceae, Hepatoprotective.

Cite this article as:
Chawla Payal, Kaur Sukhmandeep, Chawla Payal, Dhawan R.K., Review on King of Bitters: Andrographis paniculata, Asian Journal of Pharmaceutical Technology & Innovation, 03 (15); 2015. www.asianpharmtech.com

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Introduction

Kalmegh is annualto aborescent herb with intense medicinal uses. Plants is upto 1m high and with liner to lanceolate leaves.stem of plants is woody to semi woody with several cross armed branches. The stem also bears slender hard adventitious roots at nodes. Leaves are simple , opposite and exstipulate, thin memberanous, lanceolate and somewhat undilated, glabrous and dark green. The plants is zygomorphic bracteated, pedicellated with pink to purple coulred withing purple dotes.Fruit of plant is capsulated narrow from both ends, slightly flattened.

Distribution

Andrographis paniculata is widely distributed herb in tropical Asian countries. Plant being gregarious grows abundantly throughout moist shady topical regions in waste grounds. However it can be seen in a variety of habitats, such as plains, hillsides, coastlines. Native populations of *Andrographis paniculata* are found to be present throughout south India and Sri Lanka .This represents the centre of origin and species diversity . the distribution of 28 species of small annual herb belonging to the genus *Andrographis* Wall. Was founf in tropical Asia.Only few species of kalmegh were found to possess medicinal uses. Use of kalmegh as medicinal herb has been for centuries in several Ayurvedic traditional systems of medicine. It is also extensively used in Unani and Siddha medicines as home remedy for various diseases like jaundice, hepatitis, fever in tribal medicine in India and some other countries for multiple clinical applications.

Synonyms

Kariyat, King of bitters

Classification of *Andrographis paniculata*

Kingdom:Plantae

Order:Lamiales

Family:Acanthaceae

Genus: Andrographis

Species:A.paniculata

Vernacular names

Beng. –kalmegh

Eng. – Creat, King of bitters

Guj.–Kariyattu,Kiriyati, Kirayata

Hind.– Charayetah, Mahatita ,Mahatela

Punj. – Korbutti

Tel. – Nelavemu

Kan. –Nelaberu

Mar. – OliKiriaat

Cultivation

It is cultivated in rainy season as Kharif crop in India .Hot and humid conditions are prerequisite as the climatic requirement for the plant with ample sunshine. *Kalmegh*does not require one particular soil and can be cultivated on ample number of soils from loam to lateritic soils with moderate fertility. Its culativation can also be carried out on shady wastelands. Flowering of the plants begins with the onset of monsoon.The plant grows luxuriantly with the moderation in temperature after end of monsoon. The propagation of plants is done by seeds . Vegetative propagation can also be carried out for certain special cases through layering as each node is capable of producing enough roots. Seeds are small and dormancy remains for 5-6 months. Liberal use of organic manure in nursery is suggested for cultivation of healthy seedlings. The seeds should be covered with thin layer of soil and compost mixture. Suitable mulch should be used to cover the bed properly and irrigated regularly with water fountain till seedlings emerge (6-7 days). The seedlings should be raised inshade in order to protect them from heat if possible. Irrigation of the beds should be done immediately after transplanting. It can be grown on poor to moderate fertile soil but application nitrogen fertilizers helps to increase the yield of the herb. Maximum herb yield can be obtained in 90-100 days after which leaves begins to shed. The crop keeps dormant in winter. At the time of flowering, the active principle andrographolide ismaximum in leaves. Since, the whole plant consists of active principals, plant material is dried in shade and powdered. A well protected crop grown during monsoon season yields 3.5 to 4 tonnes/ha of dried plant.

Chemical constituents

The principal Bitter compoundthat makes plant King of bitters is 'Kalmeghin' which is a bitter crystalline diterpene lactonevizandrographolideflavanoids which possess following structure. Two flavonoids identified as 5, 7, 2', 3'-tetramethoxyflavanone and 5-hydroxy-7, 2', 3'-trimethoxyflavone were identified from the whole plant, while 12 new flavonoids and 14diterpenoids have been isolated from the aerial parts. The recent reports showed 2 new flavonoid glycosides and a new diterpenoids (andrographic acid) and two new ent-labdanediterpenoids glycosides were isolated from the aerial parts.

Thus flavanoids occurs in plants mainly in roots but also in leaves in small quantity.[1] The main lactones derivative constituents present are Andrographalide(C_{20} H_{30} O_5, mp 230-239ºC). B, chuanxinlianA (deoxyandrographolide), C (neoandrographolide) and D (14-deoxy-11,12-didehydroandrographolide) .Other lactones isolated are Ninandrographolide, Isoandrographolide,Andropanolide etc. Moreover, other constituents present are oxygenated flavones, Volatile oils; Carvocrol, eugenol, myristic acid, caffeic acid and chlorogenic acid.

Traditional uses

*Andrographis paniculata*was reported to used in Ayurvedic system of medicine for decades and was found to have antibacterial, antifungal, antiviral, antioxidant, antiiflammatory, antihyperglycaemic, hypocholesterolemic, emollient , diuretic, carminative, astringent, hepatoprotective, antipyrectic and adaptogenic. It has "blood purifying" activity so it is recommended in treatment of leprosy, gonorrhea, scabies, boils, skin eruptions, and chronic and seasonal fevers. Juice or decoction of fresh leaves is adminstred to infants to confort griping, irregular bowel habits, and loss of appetite. It is represented as so called "bitter and cold" , is expressed tobe antipyretic, detoxicant, anti-inflammatory, and detumescent, and believed to mitigate "pathogenic heat" from the blood. *Andrographis paniculata*is used to treatpharyngolaryngitis, diarrhea, dysentery, cough with thick sputum,carbuncle, sores, and snake bites. Variousayurvedic and unanipreparations and compound formulas of the herb have been used for the treatment of infectious and non-infectious diseases,and there were significant effective rates described for conditions such asepidemic encephalitis B, suppurative otitismedia, neonatal subcutaneous annular ulcer,vaginitis, cervical erosion, pelvic inflammation, herpes zoster, chicken pox, mumps,neurodermatitis, eczema, and burns.

AntiInflammatory activity

It is reported that inflammation induced by histamine, dimethyl benzene and adrenaline was significantly reduced by dehydroandrographolide followed by neoandrographolide and andrographolide.[1]

Hepatoprotectiveactivities

In Indian system of medicine *Andrographis paniculata*was exclusively used as hepatoprotective. Under Ayurvedic system of medicine, it is part of many ayurvedic formulations used to treat jaundice and hepatitis like Livokasayurvedic proprietary medicine. The main role of kalmegh in these preparations being a hepatoprotectant is well established in Ayurveda. Studies for kalmegh as hepatoprotective drug have been conducted.Camparative studies for hepatoprotective actions have been conducted between silymarin and andrographolide which indicates the significant chlorectic effects produced by andrographolide against acetaminophen- induced reduction in volume and contents of bile have been better than silymarin. Chowdhur*et al* shows the pre and post treatment of adult rat with kalmegh extract is found to be effective as protective against ethanol-induced increase in serum transaminase.Activity of the leaf extract on evaluation revealed the protection against carbon tetrachloride-induced microsomal lipid peroxidation which was in vitro inhibited completely by the extract but not by andrographolide which indicates the activity of hepatoprotection of the kalmegh was not solely due to the presence of andrographolide.2 flavonoids, acknowledged as 5,7,2',3'-tetramethoxyflavanone and 5-hydroxy-7,2',3'-trimethoxyflavone, as well as several other flavonoids, andrographolide diterpenoids, and polyphenolshave been acquired from the phytochemical investigation of the whole plant of kalmegh. With the aid of spectroscopic methods, the structures of these compounds have been established.[2]

Antimicribial and Antiparasitic Activities

The aqueosexract of the *Andrographis paniculata*has been found to have the antimicrobial and antiparasitic activity against bacteria, viruses etc.This activity of drug attributed to combined affect of andrograholides and arabinagalatan proteins.[3] Crude aqueous extract of leaves of the plant found to have similar antimicrobial activity against gram's positive S. aureus and methicillin resistant S. aureus and gram;s positive *Pseudomonas aeruginosa*. However it lack in activity againt E. coli and Klebsiella.[4] The ethanolic extract of plant found to inhibits adherence of *Streptococcus mutans*ATCC 25175 and *S. mutans* TPF-1 *in vitro* at an effective concentrations of about 0.5%.[5] The further investigations carried out for antibacterial activity of plant by filter plate disc-agar diffusion procedure against common bacterial pathogens such as *Pseudomonas aeruginosa, Clostridium perfringens, Serratiamarcescens, Bacillus subtilis, Enterobacter aerogenes, Shigellaflexneri, Staphylococcus aureusand, Salmonella typhi.*The hexane and chloroform extract was found to inhibit most of the pathogens but the activity was found to be highest against Methicllin resistant S. aureus . Presence of terpenoids , steroids and coumarins were found in the exatrct by phytochemical screening.[6]

Anti-inflammatory and Antioxidant activity

Various investigators reported the Anti-inflammatory activity of the plants, as the inflammation is caused by the release of histamine was found to significantly reduced by the dehydroandrographolide followed by neoandrographolide and andrographolide.This anti-inflammatory action of dehydrographolide was found due to its property to enhance the release of adrenocorticotrophic hormone (ACTH) form the pituitary gland which signals adrenal gland to release cortisol which in turn is potent endogenous anti-inflammatory agent.[7]

It was reported that the nicotine-induced suppression of mitochondrial electron chaincomplexes and theconclusive increase in nitricoxide (NO) in different parts of rats' brains was averted by concurrent treatment with thewater and ethanol extracts of *A. paniculata* or andrographolide; the water extract was found to exhibit higher antioxidant activity than the ethanolextract. Phytochemical analysis was found to reveal higherflavonoid but lower phenol contents in water extract than in ethanol extract.[8]

Anti-Hyperglycaemic Effects

It was reported that oral intake of Ilogen-Excel (an Ayurvedic formulation entrenched withthis plant, 50 mg/kg and 100 mg/kg) for 60 days results in significant reducing of blood glucose and raising levels of plasma insulin, hepatic glycogen and total hemoglobin. The ethanolic extract of whole plant was effective for antihyperglycaemic property and abates oxidative stress in diabetic rats.[9] Moreover, after *in vitro* experiments, its was concluded that the hypoglycemic effect of *Andrographis paniculata*is due to insulin release from pancreatic cells through ATPsensitivepotassium channels, similar to other insulin tropic antidiabatic agents.[10,11]

Acknowledgement:

Authors are thankful to Khalsa college of Pharmacy, Amritsar for their cooperation to do this work.

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