

ANDROGRAPHIS PANICULATA: A REVIEW ON ETHNOMEDICINAL POTENTIAL AND BIOLOGICAL ACTIVITIES

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Abstract: *Andrographis paniculata* Nees (Acanthaceae) the 'Kalmegh' of Ayurveda is an erect annual herb extremely bitter in taste. It is also known as 'BhuiNeem', since the plant though much smaller in size shows similar appearance and has bitter taste as that of Neem. Present review reflects its ethnomedicinal uses. Since ancient times, *A. paniculata* is used as a wonder drug in traditional Siddha, ayurvedic systems of medicine as well as in tribal medicine in India. The plant extract exhibits antityphoid and antifungal activities. Kalmegh is also reported to possess antihepatotoxic, antibiotic, antimalarial, antithrombogenic, anti-inflammatory, antsnakevenom and antipyretic, anti HIV activity. As the dependence on herbal medication is increasing day by day, this review may be helpful for further research on this wonderful medicinal plant.

Keywords: *Andrographis*, Kalmegh, Antihepatotoxic, Antithrombogenic, Antiinflammatory

INTRODUCTION

Andrographis paniculata Nees, the kalmegh of Ayurveda belongs to family Acanthaceae is also known as king of bitters. It is also known as Bhui Neem since the plant shows similar appearance and has bitter taste as that of neem (*Azadirachta indica*). *Andrographis paniculata* is an erect annual herb extremely bitter in taste in each and every part of plant body. *Andrographis paniculata* plant extract is known to possess a variety of pharmacological activities it has been used in no. of disease as herbal ailment. The herb is well known for drugs as 'green chiretta' and forms the principle ingredient of a reputed house hold medicine 'alui'. *Andrographis paniculata* has immense potential for treating various diseases. This review present information about botanical description, distribution ethnomedicinal and pharmacological aspects of *Andrographis paniculata* which may be used as wonder full herbal drug. Since ancient time *A. paniculata* is used as wonder drug in traditional siddha in ayurvedic system as well as in tribal medicine in India and some other countries for multiple clinical applications. The therapeutic value of kalmegh is due to its mechanism of action which is by enzyme induction. The plant extract exhibit antityphoid, antifungal, antihepatotoxic, antibiotic, antimalarial, antithrombogenic, anti-inflammatory, anti snake venom, anti-HIV activity. Recent studies confirm anti HIV activity of andrographolide, the main alkaloid found in *Andrographis paniculata*.

Distribution

Andrographis paniculata is distributed in tropical Asian countries in isolated patches it can be found in a variety of habitats viz plains, hills slope, waste land, farms, dry or wets lands, sea shore and even roads sides. Native populations of *A. paniculata* are spread throughout South India. It prefers a sunny location the seeds are sown during May to June. The seedlings are transplanted at a distance of 60 cm X 30 cm. (Zhou *et al.*, 1987)

Botanical Description

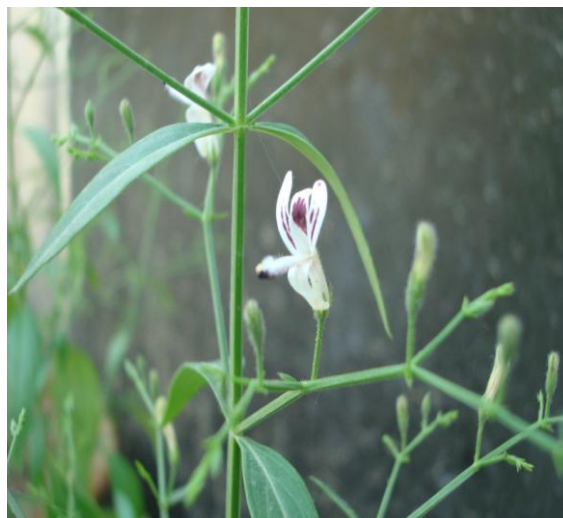
Andrographis paniculata grows erect to a height of 32 to 100 cm in moist shady places with glabrous leaves and white flowers with rose-purple spots on the petals. Stem is dark green 0.3 to 1.0 m in height, 2 to 6mm in diameter, quadrangular with longitudinal furrows and wings on the angle younger parts, slightly enlarged at the nodes: Leaves glabrous up to 8.0 cm long and 2.5 cm broad lanceolate, pinnate. Flowers are small, possess calyx with five sepals which are small and linear, corolla tubes are narrow, about 6mm long, bilabiate upper lip oblong, lower tips are broad, three lobed, white with violet markings. Stamens 2, inserted in the throat. Flower is hypogynous. Fruit is a capsule, compressed longitudinally furrowed with thin glandular hairs. Seeds are very small.

According to karyomorphological studies chromosome number is $2n = 50$ (Govindarajan *et al.*, 1983).

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A Plant



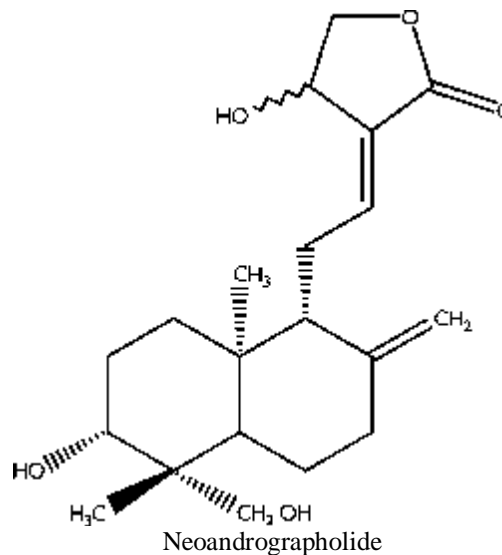
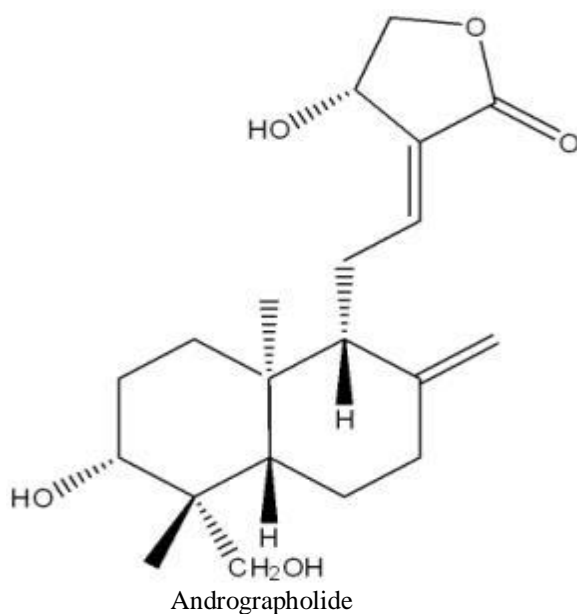
Flowering Twig

Andrographis paniculata

Chemical Composition of *Andrographis Paniculata*

It contains bitter diterpenoid lactones such as 14deoxyandrographolide (Sangalunkarn *et al.* and Garcia *et al.*), andrographolide. Neoandrographolide (a non bitter derivative 14-deoxy11,12didehydroandrographolide identified by Dhammaupakorn *et al.* Du *et al.*, separated andrographolide and neoandrographolide from the

leaves of *Andrographis paniculata* using HPLC. Andrographolide content depends on collection time and growing region. Leaves of *A.paniculata* may contain more than 2% andrographolide before the plant blooms and less than 0.5% after blooming. The stem contains 0.1% to 0.4% of andrographolide. The best harvesting time is early autumn (Zhu *et al.*). The other active chemical constituents include diterpene (Sharma *et al.*) and flavonoids



Pharmacognosy

Andrographolide, chief constituent extracted from the leaves of the plant exhibited protective effects in carbon tetrachloride induced hepatopathy in rats (Handa and, 1990). This bitter principle was isolated in pure form by Gorter, 1911. Sharma, 1992. Andrographolide is also attributed with such other activities like liver protection under various conditions of treatment with galactosamine (Saraswati *et al.*), paracetamol (Visen *et al.* 1993) etc.

The hepatoprotective action of andrographolide is related to activity of certain metabolic enzymes (Choudhury and Poddar 1984, 1985 ; Choudhury *et al.*, 1987)

Several studies have been conducted on cellular processes and targets modulated by andrographolide treatment in human cancer and immune cells. andrographolide treatment inhibited the in vitro proliferation of different tumor cell lines representing various types of cancers. The compound exerts direct

anti cancer activity on cancer cells by cell cycle arrest at G0/G1 phase through induction of cell cycle inhibitory protein and decreased expression of cyclin dependent kinase 4 (CDK 4). Immunostimulatory activity of andrographolide is evidenced by increased proliferation of lymphocytes and production of interleukin 2. Andrographolide also enhance the tumor necrosis factor production resulting increased cytotoxic activity of lymphocytes against cancer cells which may contribute for its indirect anti cancer activity. These results suggest that andrographolide is an interesting phytochemical constituent with anti cancer and immunomodulator activity and hence has the potential for being developed as a cancer therapeutic agent. (Rajagopal *et al* 2003).

The herb is the well known drug kalmegh 'green chiretta', and forms the principal ingredient of a reputed house hold medicine (alui) used as a bitter tonic and febrifuge. The herb is reported to possess astringent, and is helpful in arresting dysentery, cholera, diabetes, influenza, bronchitis, swellings and

itches, piles and gonorrhoea. A decoction of the plant is a blood purifier. It is used as a cure for jaundice. It forms the major constituents of the Ayurvedic drug SG-1 Switradilepa which is effective for treating vitiligo- a dermatological disease. The macerated leaves and juice together with certain spices, such as cardamom, clove and cinnamon, are made into pills and prescribed for relief from stomach ache other stomach ailments in infants. A decoction or infusion of the leaves is useful in general debility and dyspepsia. The leaves and roots are also used as febrifuge, tonic, stomachic, cholagogue and anthelmintic.

Andrographis improves non specific immune response. The immune response maybe specific, directed at a microbial invader already present in the body or strengthening the immune system in preparation against future infections. *Andrographis* strongly stimulates phagocytosis and the production of specific antibodies. Following list shows various biological activities of *A. paniculata* Nees

Biological activities of *A. paniculata*

No	Biological Activity	References
1.	Anti allergic activity	Gupta <i>et al.</i> , 1994
2.	Antibiotic activity	Gupta <i>et al.</i> , 1993
3.	Anti fertility effects	Akbarsha <i>et.</i> , 1990; Akbarsha and Murugan 2000
4.	Anti filarial activity	Dutta and Sukul, 1982
5.	Antifungal activity	Anonymous, 1982
6.	Anti hepatitis activity	Jayaram <i>et al.</i> , 1989; Ramfi <i>et al.</i> , 1992
7.	Antihepatotoxic activity	Rana and Avadhoot, 1991, Honda <i>et al</i> , 1990
8.	Anti HIV activity	Shukla <i>et al.</i> , 1992; Otake <i>et al.</i> , 1995; Calabrese <i>et al.</i> , 2000, S. Rajagopal, 2003
9.	Antiinflammatory activity	Tajuddin <i>et al.</i> , 1983; Shen <i>et al.</i> , 2000
10.	Antimalarial activity	Misra <i>et al.</i> , 1992
11.	Antisnakevenom effects	Selvanayagam <i>et al.</i> , 1994, Samy <i>et al</i> , 2008
12.	Antityphoid activity	Anonymous, 1985, Mishra <i>et al</i> , 2009
13.	Antiulcer activity	Viswanathan <i>et al.</i> , 1981
14.	Asthma	Rao, 1914
15.	Blood purification effects	Vohora, 1985
16.	Colic	Rao, 1914
17.	Diabetes	Ahmad and Asmawi, 1992; Zhag and Tan, 2000
18.	Diarrhea	Gupta <i>et al.</i> , 1990
19.	Fever	Ahmed and Asmawi, 1992
20.	Gonorrhoea	Rao, 1914
21.	Hepatostimulation effect	Tripathi and Tripathi, 1991
22.	Immunostimulation effects	Sutarjadi <i>et al.</i> , 1991; Puri <i>et al.</i> , 1993
23.	Influenza	Dey, 1983
24.	Jaundice	Tomar <i>et al.</i> , 1983
25.	Loss of scalp hair	Home <i>et al.</i> , 1992
26.	Piles	Rao, 1914
27.	Stomachic effect	Chaudhury and Poddar, 1985
28.	Leshmaniasis	Sinha <i>et al.</i> , 2000

List of ethnomedicinal uses of *A. paniculata* nees

No.	Ethnonobotanical use	Reference
1.	Blood purification	Rao, 1914
2.	Cancer	Mathew and Unnithan, 1992
3.	Colic	Jain <i>et al.</i> , 1973
4.	Diarrhoea	Aminuddin and Girach, 1991
5.	Dysentery and Dyspepsia	Sudhakar and Rao, 1985 Bhalla <i>et al.</i> , 1982
6.	Fever	Gupta, 1990; Jain 1963; Bhalla <i>et al.</i> , 1982
7.	Filariasis	Sudhakar and Rao, 1985
8.	Gastric complaints	Gupta, 1990
9.	Jaundice	Hemadri and Rao, 1984; Hemadri and Rao. 1989
10.	Malaria	Reddy, 1988; Aminuddin <i>et al.</i> , 1993
11.	Snake bite	Gupta and Srivastava, 1994, Samy <i>et al</i> , 2008
12.	Stomach complaints	Kiritikar and Basu, 1918; Goel and Mudgal, 1988
13.	Vermifuge	Gupta and Srivastava, 1994
14.	Whooping cough	Goel and Mudgal, 1988
15.	Wounds and itches	Jain, 1963; Jain <i>et al.</i> , 1973

CONCLUSION

After reviewing the available literature it can be concluded that *A. Paniculata* has great potential as anti-allergic, antimicrobial, anti-hepatotoxic, antifever remedy. The plant may be a constituent in various immunological applications for cancer. It is also beneficial for treating snake bites, abdominal problems. *Andrographis paniculata* can be advocated as herbal remedy for different human diseases. Further research would be helpful in assessment of more medicinal uses and possible adverse effects on human health

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