

# A Review on Plant: Kalmegh (Andrographis Paniculata)

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**Abstract:** *Andrographis paniculata*, commonly known as Kalmegh or “King of Bitters,” is a well-known medicinal plant belonging to the family Acanthaceae. It has been traditionally used in Ayurveda and other systems of medicine for treating various ailments such as fever, liver disorders, respiratory infections, and digestive problems. The major bioactive compound present in this plant is andrographolide, which is mainly responsible for its therapeutic potential. The plant exhibits a wide range of pharmacological properties including antiinflammatory, antiviral, antioxidant, hepatoprotective, and immunomodulatory effects. Recent studies have also highlighted its possible role in enhancing immune response and reducing symptoms of viral infections. Due to its broad medicinal value and safety profile, *Andrographis paniculata* is considered a promising source for the development of modern herbal formulations. Due to its high medicinal value, relatively low toxicity, and availability in nature, *Andrographis paniculata* is considered a promising candidate for the development of standardized herbal formulations and phytopharmaceutical products. Further clinical studies and pharmacokinetic evaluations are required to fully establish its therapeutic efficacy and safety profile for wider clinical application. The pharmacological efficacy of *Andrographis paniculata* is mainly attributed to its active phytochemical constituents, especially andrographolide and its derivatives. These bioactive compounds exhibit a wide range of biological activities, including potent anti-inflammatory, antiviral, antibacterial, antioxidant, hepatoprotective, antipyretic, and immunomodulatory effects. Because of these properties, the plant has gained significant attention in modern pharmacological research and herbal drug development.

**Keywords:** *Andrographis paniculata*, Kalmegh, Acanthaceae, Andrographolide, Hepatoprotective activity, Anti-inflammatory activity, Antimicrobial activity, Phytochemistry

## I. INTRODUCTION

*Andrographis paniculata* has been used for centuries because of its wide range of health benefits (1). It is a well-known medicinal plant in traditional systems of medicine, especially Ayurveda and Siddha.

Different parts of this plant such as roots, stems, and leaves are used medicinally. These plant parts are utilized separately depending on the therapeutic purpose. Traditionally, it is used for the treatment of leprosy, respiratory tract infections, liver disorders, and loss of appetite.

The plant is commonly prepared in traditional medicine either as a powdered form or as a decoction obtained by boiling the plant material in water.

This plant exhibits a broad spectrum of pharmacological activities including anti-inflammatory, antiviral, antioxidant, immunomodulatory, and anticancer properties. It was also widely used during the COVID-19 pandemic, where it helped in reducing symptoms in mild to moderate cases (2).



Due to its diverse pharmacological potential and advantages in formulation development, *Andrographis paniculata* is considered a promising candidate for the development of novel therapeutic agents.

It enhances immune response by modulating cytokine production and lymphocyte proliferation

It has great effectiveness against diabetes, peptic ulcer, snake bites, diarrhoea, hypertension etc (3)

## II. TAXONOMY (4)

**Kingdom** Plantae

**Subkingdom** Tracheobionta (Vascular plants)

**Superdivision** Spermatophyta (Seed plants)

**Division** Magnoliophyta / Angiosperms (Flowering plants)

**Class** Magnoliopsida (Dicotyledons)

**Subclass** Asteridae

**Order** Lamiales

**Family** Acanthaceae

**Genus** *Andrographis*

**Species** *Andrographis paniculata*

## III. DISTRIBUTION

*Andrographis paniculata* is widely distributed across South and Southeast Asia. It is found in countries such as India, Sri Lanka, Java, Malaysia, and Indonesia. In India, the plant occurs naturally and is also cultivated in several states including Maharashtra, Kerala, Karnataka, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, and Madhya Pradesh. In addition, its cultivation has been reported in parts of Assam and West Bengal (5).

This species is typically propagated through seeds and thrives well in its native habitats. It commonly grows in pine forests, evergreen forests, and deciduous forest regions, and is also frequently observed along village roadsides and wastelands. In India, cultivation of *Andrographis paniculata* is mainly carried out during the monsoon (rainy) season, as the warm and humid climatic conditions during this period support optimal germination and plant growth (6).

## IV. MORPHOLOGY

*Andrographis paniculata* is commonly found in moist and shady habitats. It is a small herbaceous plant attaining a height of about 30–110 cm.

### 1. Stem

The stem is branched, sharply quadrangular, fragile, and easily breakable in nature.

### 2. Leaves

Leaves are green in color, lanceolate, and glabrous (hairless). Their size ranges from 2–12 cm in length and 1–3 cm in width.

### 3. Root

The plant has a slender tap root system, which helps in anchoring and absorption.

### 4. Flower

The flowers are small and consist of:

Calyx: Small, linear in shape

Corolla: Narrow, white in color with a yellowish upper portion

Stamens: Two in number, inserted at the throat of the corolla

Anther: Bearded



Ovary: Superior, bilocular (two-celled)

#### **5. Fruit (Capsule)**

The fruit is a capsule, erect and linear, measuring about 1–2 cm in length, compressed and acute at both ends.

#### **6. Seeds**

Seeds are small in size and sub-quadrate in shape.

### **CHEMICAL CONSTITUENTS**

This plant contains many diterpenoids, lactones and flavanoids, The concentration and composition of its photochemicals varies according to the geography, different parts of the plant, season and phenological growth stage. The main active compound of this plant is Andrographolide, it is found in the whole plant. The characteristics of this compound are a colourless and bitter ent-labdane diterpene lactone substance. This substance was first isolated by Boorsma, who named it Andrographolide. It can be extracted from the whole plant but it is highly concentrated in the leaves. (8)

The areal parts contain alkanes, ketones, aldehydes. Although it was initially believed that only Andrographolide was the bitter compound found in this plant but later on more investigations showed that the leaves contained two compounds Andrographolide and Kalmeghin. This plant contains four lactones- Chunaxilian A (deoxyandrographolide),

B (andrographolide), C (neoandrographolide), D (14-deoxy-11, 12-didehydroandrographolide). They were isolated from aerial parts in China. A diterpene glucoside (deoxyandrographolide-19 $\beta$ -D-glucoside) has been detected in the leaves and six diterpenoids of the ent-labdane type, two diterpene glucosides and four diterpenedimers (bis-andrographolides A, B, C, and D) have been isolated from aerial parts.

Two flavanoids identified as 5,7,2',3'-tetramethoxyflavanone and-hydroxy-7,2',3'-trimethoxyflavone were isolated from the whole plant while 12 new flavonoids and 14 diterpenoids have been reported from the aerial parts. Two new flavonoid glycosides and a new diterpenoid (andrographic acid) were recently reported and two new ent-labdane diterpenoid glycosides were isolated from the aerial parts. (9)

### **V. PHARMACOLOGICAL ACTIVITIES**

#### **5.1 Anti hyperglycemia activity**

Hyperglycemia is known as the elevation of blood glucose level which results in diabetes. Diabetes is the one of rapidly increasing disease worldwide. Globally more than 1 in 10 adults are suffering with diabetes. This shows that there are need of affordable and effective cure for this with less adverse effects. 'Andrographolide' the active component of *Andrographis Paniculata*, is known to have antihyperglycemic effects when tested on rats fed with high amount of fat and fructose. The anti hyperglycaemic activity of 90% ethanol extract of *andrographis paniculata* was compared with antidiabetic drug glimiperide both in glucose loaded and alloxan induced diabetic rats. The results showed that the ethanol leaves extract of this plant reduced the blood sugar levels by 40.65% in glucose loaded rats and 32.18% in alloxan induced diabetic rats. This study strongly showed that the ethanol leaves extract of this plant has antidiabetic properties and could be a cure for treating diabetes. (10)

#### **5.2 Anti oxidant property**

Andrographolide and an aqueous extract of *Andrographis Paniculata* herbs were tested for their antioxidant activity against nicotine induced male wistar rats. The results showed that it reduced the level of lipid peroxidation and also increased the antioxidant enzyme status in the organs tested when compared with the group that was treated with nicotine alone.



### **5.3 Anti cancer activity**

This plant has been shown to possess the anticancer activities in many studies. The main active compound which is responsible for this is Andrographolide, which has been shown to induce apoptosis in cancer cells and inhibit the growth and metastasis of tumours. Other compounds found in this plant such as neoandrographolide and andrographanin also has anticancer activity (11)

### **5.4 Wound healing property**

It has been reported that it has wound healing properties in various preclinical studies. This property of this plant is attributed to its various phytochemical properties such as andrographolide, neoandrographolide and deoxyandrographolide. This activity of this plant suggests its potential use in the management of various wound related disorders

### **5.5 Anti microbial activity**

Combination of Andrographolide and Arabinogalactan protein showed anti microbial activity against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Candida albicans*. (12)

### **5.6 Cytotoxic activity**

Additional insights were discovered by investigating the cytotoxic activity of Kalmegh extract and fractions in CACO-2 cell lines by using MTT assay. The assay is based on the reduction of MTT reagent by mitochondrial dehydrogenase from the introduction of active metabolic cells into the formazan. (13)

### **5.7 Anti venom activity**

In a test, the plant extracts and partially purified fractions were administered orally to mice induced with snake venom, showed neutralising effects against the venom. The isolated fractions effectively inhibited the toxic effects of snake venom in vitro than in vivo. (14)

### **5.8 Anti hiv activity**

Bis-andrographolide ether, andrographolide, 14-deoxy-11, 12- didehydroandrographolide, andrographanin, 14-deoxyandrographolide, 5-hydroxy-7,8-dimethoxyflavanone and 5-hydroxy-7,8-dimethoxyflavone were tested and found effective for anti-HIV and cytotoxic activity. Dehydroandrographolide succinic acid monoester (DASM) has been found to be an inhibitor against the HIV in vitro

### **5.9 Hepatoprotective activity**

The absence of hepatoprotective drugs in modern science, herbs and plants plays an important role in managing several liver diseases. This plant is used as hepatostimulant and hepatoprotective agent. This plant has also been reported to be effective against the chronic hepatitis B viral infection. This plant also showed hepatoprotective characters consistent with the folk use and pharmacology. (15)

### **5.10 Anti viral activity**

This plant has antiviral effects against several diseases. This plant exhibits a net utilising activity against the HIV virus. Andrographolide was investigated for anti viral activity against herpes simplex virus, HIV, flaviviruses, pestiviruses. This plant has good anti viral effects as compared to some other medicinal plants.



## VI. CONCLUSION

*Andrographis paniculata* is a highly valued medicinal plant that has been extensively used in traditional medicine systems such as Ayurveda, Siddha, and Unani for centuries. The present review highlights that this plant possesses a wide spectrum of pharmacological activities, which include anti-inflammatory, antimicrobial, antiviral, antioxidant, hepatoprotective, antidiabetic, immunomodulatory, and antipyretic effects. These diverse biological properties are mainly attributed to its rich phytochemical profile, especially the presence of bioactive diterpenoids such as andrographolide and its derivatives.

The plant has shown promising results in the management and treatment of various diseases, particularly respiratory tract infections, liver disorders, digestive problems, fever, and certain inflammatory conditions. Its traditional use is strongly supported by modern scientific studies, which validate many of its therapeutic claims. Moreover, different parts of the plant, especially the leaves, have been widely explored for both crude formulations and standardized extracts.

Despite its significant medicinal potential, there are still certain limitations that need to be addressed. These include variability in phytochemical content due to environmental factors, lack of large-scale clinical trials, and insufficient standardization of herbal preparations. Further research is required to isolate novel compounds, understand detailed mechanisms of action, evaluate long-term safety, and develop standardized dosage forms for consistent therapeutic outcomes.

## REFERENCES

- [1]. Hossain S, Urbi Z, Karuniawati H, Mohiuddin RB, Moh Qrimida A, Allzrag AM, Ming LC, Pagano E, Capasso R. *Andrographis paniculata* (burm. f.) wall. Ex nees: an updated review of phytochemistry, antimicrobial pharmacology, and clinical safety and efficacy. *Life*. 2021 Apr 16;11(4):348.
- [2]. Prabha YS, Rao TB. Therapeutic properties of *Andrographis paniculata* – A review. *Eur J Pharm Pharmacol Med Res*. 2025;12(6):24–30.
- [3]. Chowdhury A, Biswas SK, Raihan SZ, Das J, Paul S. Pharmacological potentials of *Andrographis paniculata*: an overview. *International Journal of Pharmacology*. 2012 Jan 1;8(1):6-9.
- [4]. Hossain MS, Urbi Z, Sule A, Rahman KH. *Andrographis paniculata* (Burm. f.) Wall. ex Nees: a review of ethnobotany, phytochemistry, and pharmacology. *The Scientific World Journal*. 2014;2014(1):274905.
- [5]. Devhare R, Kulkarni DV. *International Journal of Research in Indian Medicine*. *International Journal of Research*. 2020 Jun;4(3rd).
- [6]. Mishra SK, Sangwan NS, Sangwan RS. Phcog rev.: Plant review *Andrographis paniculata* (Kalmegh): A review. *Pharmacognosy Reviews*. 2007 Jul;1(2):283-98.
- [7]. Devi BS, Narkilli SN, Surabhi GS, Mohan MUJ. A review on ethnobotanical status of *Andrographis paniculata*. *Int J Pharm Res Appl*. 2022;7(2):84–89.
- [8]. Intharuksa A, Arunotayanun W, Yooon W, Sirisa-Ard P. A comprehensive review of *Andrographis paniculata* (Burm. f.) Nees and its constituents as potential lead compounds for COVID-19 drug discovery. *Molecules*. 2022 Jul 13;27(14):4479.
- [9]. Akbar S. *Andrographis paniculata*: a review of pharmacological activities and clinical effects. *Altern Med Rev*. 2011 Mar 1;16(1):66-77.
- [10]. Ayenitaju AO, Omokhuale FM. *Andrographis paniculata*: Review of its Curative Activities. *Journal of Pharmaceutical Development and Industrial Pharmacy*. 2023;5(2):2023.
- [11]. Patel S, Patel R, Shukla R. A review: Pharmacological and phytochemical screening of *Andrographis paniculata*. *J Pharm Sci Res*. 2023;22(6):26–32.
- [12]. Pandey G, Rao CH. Andrographolide: its pharmacology, natural bioavailability and current approaches to increase its content in *Andrographis paniculata*. *Int J Complement Alt Med*. 2018;11(6):355-60.



- [13]. Adiguna SB, Panggabean JA, Swasono RT, Rahmawati SI, Izzati F, Bayu A, Putra MY, Formisano C, Giuseppina C. Evaluations of andrographolide-rich fractions of *Andrographis paniculata* with enhanced potential antioxidant, anticancer, antihypertensive, and anti-inflammatory activities. *Plants*. 2023 Mar 7;12(6):1220.
- [14]. Niranjan A, Tewari SK, Lehri A. Biological activities of Kalmegh (*Andrographis paniculata* Nees) and its active principles-A review. *Indian Journal of Natural Products and Resources*. 2010 Jun;1(2):125-35.
- [15]. Jayakumar T, Hsieh CY, Lee JJ, Sheu JR. Experimental and clinical pharmacology of
- [16]. *Andrographis paniculata* and its major bioactive phytoconstituent andrographolide. *Evidence-Based Complementary and Alternative Medicine*. 2013;2013(1):846740.

