A REVIEW ON MEDICINAL PROSPECTIVES OF ANDROGRAPHIS PANICULATA NEES

A. paniculata Nees (Acanthaceae) is a widely used medicinal plant in China, India, and South Asia. It contains andrographolide as major constituent which impart bitter taste of this herb. Other constituents include 14-deoxy-12-methoxyandrographolide, 14-deoxy-11,12-didehydroandrographolide, 14-deoxyandrographolide. It is used in various ailments like throat infections, dysentery, cancer, hepatotoxicity, cough, cold, headache, edema, pain conditions, inflammation and muscular pain, arthritis, rheumatism, fibro myalgia, multiple sclerosis, depression, diarrhoea, dysentery, choler a, candida, lupus, diabetes, piles, fevers, fatigue, hepatitis, herpes, leprosy, loss of appetite, swollen lymph nodes and other lymphatic conditions, jaundice, malaria, dyspepsia, dermatitis, eczema, burns, pneumonic, bronchitis, tuberculosis, chicken pox, mumps, sluggish liver, spleen, kidneys and adrenal glands, sleeplessness, vaginitis, & constipation. The present review is an attempt to provide recent update on phytochemical and pharmacological profile of A. paniculata along with its toxicity and contraindications status.

**Keywords:** Andrographis paniculata, andrographolide, evaluation, medicinal uses.

**ABSTRACT**

**Andrographis paniculata** Nees (Acanthaceae) is a widely used medicinal plant in China, India, and South Asia. It contains andrographolide as major constituent which impart bitter taste of this herb. Other constituents include 14-deoxy-12-methoxyandrographolide, 14-deoxy-11,12-didehydroandrographolide, 14-deoxyandrographolide. Andrographis paniculata is a perineal herb widely cultivated in China, India, and South Asia. It contains andrographolide as major constituent which impart bitter taste of this herb. Other constituents include 14-deoxy-12-methoxyandrographolide, 14-deoxy-11,12-didehydroandrographolide, 14-deoxyandrographolide. It is used in various ailments like throat infections, dysentery, cancer, hepatotoxicity, cough, cold, headache, edema, pain conditions, inflammation and muscular pain, arthritis, rheumatism, fibro myalgia, multiple sclerosis, depression, diarrhoea, dysentery, choler a, candida, lupus, diabetes, piles, fevers, fatigue, hepatitis, herpes, leprosy, loss of appetite, swollen lymph nodes and other lymphatic conditions, jaundice, malaria, dyspepsia, dermatitis, eczema, burns, pneumonic, bronchitis, tuberculosis, chicken pox, mumps, sluggish liver, spleen, kidneys and adrenal glands, sleeplessness, vaginitis, & constipation. The present review is an attempt to provide recent update on phytochemical and pharmacological profile of A. paniculata along with its toxicity and contraindications status.

**Keywords:** Andrographis paniculata, andrographolide, evaluation, medicinal uses.

**INTRODUCTION**

**Andrographis paniculata** Nees (Acanthaceae) commonly known as king of bitters, is a perineal herb widely cultivated in China, India, and South Asia. It contains andrographolide as major constituent which impart bitter taste of this herb. Other constituents include 14-deoxy-12-methoxyandrographolide, 14-deoxy-11,12-didehydroandrographolide, 14-deoxyandrographolide. It is used in various ailments like throat infections, dysentery, cancer, hepatotoxicity, cough, cold, headache, edema, pain conditions, inflammation and muscular pain, arthritis, rheumatism, fibro myalgia, multiple sclerosis, depression, diarrhoea, dysentery, choler a, candida, lupus, diabetes, piles, fevers, fatigue, hepatitis, herpes, leprosy, loss of appetite, swollen lymph nodes and other lymphatic conditions, jaundice, malaria, dyspepsia, dermatitis, eczema, burns, pneumonic, bronchitis, tuberculosis, chicken pox, mumps, sluggish liver, spleen, kidneys and adrenal glands, sleeplessness, vaginitis, & constipation. The present review is an attempt to provide recent update on phytochemical and pharmacological profile of A. paniculata along with its toxicity and contraindications status.

**Keywords:** Andrographis paniculata, andrographolide, evaluation, medicinal uses.

**Morphology of leaves of A. paniculata**: The leaves of A. paniculata are dark in color, simple, opposite, lanceolate, glabrous, 2–12 cm long, 1–3 cm wide; acute apex, entire margin. Flower consists of small, linear 5-particle Calyx; tube narrows, about 6 mm long white corolla with violet markings. Two stamens, inserted in the throat and two celled superior ovary. 1–2 cm long, 2–5 mm wide, linear-oblong, compressed, erected capsule. The photograph of whole plant of A. paniculata and its leaf can be seen in Plate 1 and Plate 2 respectively.

**Microscopy of A. paniculata**: The leaves of A. paniculata have diacytic stomata at leaf’s lower epidermis, glandular and non-glandular trichomes, fairly large cystoliths, columnar palisade cells, columnar parenchyma cells; vascular bundles of lignified spiral, scalariform and reticulate xylem vessels in the upper part and lignified phloem in the lower part, small acicular calcium oxalate crystals, a layer of wavy-walled lower epidermis cells, dense collenchyma at the corners of stems, a layer of thick-walled endodermis cells and parenchyma contains chloroplastid.

**Chemical Constituents**

Therapeutically active constituent of A. paniculata / Kalmegh plant is andrographolide which is generally extracted from leaves and aerial parts of A. paniculata. It is a colourless diterpene lactone, with bitter taste. Melting point of Andrographolide is 230°C-239°C. Andrographolide is 230°C-239°C. Andrographolide is 230°C-239°C.

**Taxonomic hierarchy**

**Kingdom:** Plantae  
**Division:** Angiospermae  
**Class:** Dicotyledoneae  
**Order:** Tubiflorae  
**Family:** Acanthaceae  
**Genus:** Andrographis  
**Species:** paniculata Nees

---

Dhiman Anju et al: A review on Andrographis paniculata Nees  
Journal of Pharmaceutical and Scientific Innovation  
www.jpsionline.com  
Review Article  

Received on: 17/12/11 Revised on: 20/01/12 Accepted on: 23/01/12
Pharmacological profile of *A. paniculata*

According to Chinese medicine theory, *A. paniculata* 'cools' and relieves internal heat, inflammation and pain and also used for detoxication. It is used as bitter tonic, antispasmodic, stomachic and also an antihelminthic. Modern pharmacological studies have demonstrated its hepatoprotective, antithrombotic, anti-inflammatory, immunostimulant, antimalarial, antihyperglycemic and cardioprotective properties. Research confirmed that if properly administered, *A. paniculata*, has a wide range of pharmacological actions, many of which are very beneficial. The pharmacological update of *A. paniculata* can be covered under the following headings:

**Anti-inflammatory**

*A. paniculata* acts as an anti-inflammation drug against histamine, adrenaline, di-methyl benzene etc. Chronic diseases such as cardiovascular disease, cancer and diabetes cause burst release of inflammatory molecules like macrophage and T lymphocyte production and activation and release of pro inflammatory mediators like tumour necrosis factor (TNF)-α, interleukin (IL)-1, IL-6, interferon (IFN)-γ, nitric oxide (NO) causes inflammation. Effective drug or any inhibitor may reduce the production of these inflammatory molecules which may further reduce inflammation. A study demonstrated that intraperitoneal (i.p) administration of *A. paniculata* methanol extract 50 mg/day for five consecutive days inhibited 65% NO production by peritoneal macrophage and significantly inhibited carageenan induced paw oedema formation in mice. Andrographolide inhibits nitric oxide (NO) production and the expression and stability of inducible synthase (iNOS) protein in lipopolysaccharide (LPS) - stimulated RAW264.7 (RAW) cells. Andrographolide acts as antioxidant, thereby inhibits the production of neutrophils, macrophage migration, as well as TNF-α and IL-12.

**Hepatoprotective**

Andrographolide is extensively used as a stimulating agent for liver enzymes and hepatoprotective agent. Andrographolide increases the bile flow and bile salt production. Studies showed that Andrographolide is a potent hepatoprotective agent when compared with silymarin.

**Anti-oxidant activity**

Hydro alcoholic extract of *A. paniculata* prevented isoproterenol induced elevated lipid per oxidation and antioxidant enzymes activity viz. super oxide dismutase, catalase, glutathione peroxidase and the levels of reduced glutathione level in heart. In addition, the extract also prevented leakage of lactate dehydrogenase from heart and salvaged it from isoproterenol induced myocardial ischemic injury. The study indicated the antioxidant, antilipid peroxidative and antischismic activity of *A. paniculata* and justified its use in ischemic heart diseases.

**Common cold**

A randomized double-blinded placebo- controlled clinical trial to study the preventive effect of *A. paniculata* on common cold was conducted on 107 children. They received either andrographis extract tablet or placebo for 3 months during winter season. By the third month, there was found a significant decrease in the incidence of cold in the group taking andrographis compared to those taking placebo. *A. paniculata* prevented and reduced the risk of getting cold by 2.1 times as compared to the placebo.

**Anti-cancer activity**

Methanolic extract of *A. paniculata* was found to have significant toxicity against KB (human epidermoid leukemia) and P388 (lymphocytic leukemia) cell lines. Bioactivity guided chromatographic fractionation led to the isolation of pure andrographolide from *A. paniculata*, which was proved to be highly toxic to the above-mentioned cell lines. This was the first significant demonstrations of cytotoxic potential of andrographolide. Andrographolide effectively induced cellcycle arrest in cancer cells at G0/G1 stage. Andrographolide also activated the extrinsic death receptor pathway (including caspase-3 and caspase-8) and induced apoptotic cell death in certain human cancer cell types. It has been observed that the alcohol extract of the plant as well as isolated andrographolide were able to induce significant stimulation of both “antigen specific” and “antigen nonspecific” types of immune responses in mice.

**Infectious disease**

Andrographolide is found to be active against pulmonary type of tuberculosis, tuberculous meningitis and acute pyelonephritis. Intra-arterial or retrograde intravenous injections of the herb were reported to be effective in thromboangiitis obliterans, especially of “heat toxic type”. Ten cases of viper bites were reportedly cured in 3-5 days by a compound formula containing *A. paniculata* as the chief constituent. A phase I, dose-escalating clinical trial of andrographolide was conducted on 13 HIV-positive patients and five HIV-negative healthy volunteers. Andrographolide administration significantly improved the CD4+ lymphocyte count from a baseline mean of 405 cells/mm³ to 501 cells/mm³ in HIV- positive patients. There were no statistically significant changes in mean plasma HIV RNA levels. *A. paniculata* has also been used for uncomplicated upper respiratory tract infections (URTIs).

**Anthelmintic activity**

The methanol and aqueous extracts of *A. paniculata* were evaluated for its anthelmintic activity against adult earth worms (*Phertima prosthuma*). Three concentrations (25, 50, 75mg/ml) of each extract were studied, which involved the determination of time of paralysis and time of death of the test worms. It was found that both the extracts exhibited significant anthelmintic activity.

**Dysentery or Gastroenteritis**

Ethanol extract tablets of *A. paniculata* were reported to cure 88.3 percent of acute bacillary dysentery and 91.3 percent of acute gastroenteritis cases. Andrographolide administration was reported to cure 91 percent of acute bacillary dysentery cases.

**Anti-hyperglycaemic effects**

Ethanolic extract of *A. paniculata* increases insulin secretion from the β-cells of islets of langerhens, further mechanism of action of andrographolide is that it enhance the surface uptake of glucose by adipose tissues and inhibit glucose absorption from intestine and glucose production from liver. Oral administration of the ethanol extract of *A. paniculata* effectively reduced the fasting serum glucose level in human.

**Analgesic and anti-pyretic effects**

Oral administration of andrographolide isolated from *A. paniculata* leaves, (30, 100, and 300 mg/kg) was studied for its analgesic and antipyretic effect. Andrographolide did not showed any analgesic activity in hot plate test in mice while it showed significant analgesic activity in acetic acid-induced writhing in mice and Randall Selitto’s test in rats at 300 mg/kg dose. Andrographolide (100 and 300 mg/kg) produced significant (p<0.05) anti-pyretic effect after 3 hrs of administration in Brewer’s yeast-induced pyrexia in rats.
**Side effects**
Toxicity of andrographolide is not known. As it is called as “King of bitters”, it may cause emesis on over dosing. Gastric instability, loss of appetite and nausea were also observed due to over dosing of andrographolide extract.  

**Contraindications**
According to botanical safety handbook, this plant falls in class 2b “herb not to be taken during pregnancy.”

**CONCLUSION**
Andrographolide, main active constituent of *A. paniculata* is a diterpenoid lactone having a variety of pharmacological effects specified in ayurveda, unani, sidhha and traditional chinese medicine system. This herb has been revered for treating infectious diseases and highly regarded as having preventative effects against ailments as liver damage, hyperglycaemia, dysentery, cancer, pulmonary tuberculosis, AIDS, acute and common cold, flu, myocardial infarction, inflammation, blood clotting etc. It has no toxic effects but yet it found unsafe during the pregnancy. Besides a great number of pharmaceutical uses, andrographolide has some side effects like nausea, vomiting, loss of appetite which can only be seen upon over dosing. Therefore, research may further be undertaken to develop potent formulations consisting of *A. paniculata* and its isolated molecule, andrographolide by making use of novel herbal drug delivery systems like microparticles, vesicular systems or through complexation with lipid or other suitable novel carrier.

**REFERENCES**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Reported chemical constituent(s)</th>
<th>Pharmacological action(s)</th>
<th>Reference(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Andrographolide</td>
<td>Anticancer, hepatoprotective</td>
<td>11,16</td>
</tr>
<tr>
<td>2.</td>
<td>14-deoxyandrographolide</td>
<td>Enhanced proliferation and interleukin-2 induction in human peripheral blood lymphocytes</td>
<td>17</td>
</tr>
<tr>
<td>3.</td>
<td>14-deoxy-11,12-dihydroandrographolide</td>
<td>Anti-cancer</td>
<td>17</td>
</tr>
<tr>
<td>4.</td>
<td>14-deoxy-11-o xoandrographolide</td>
<td>Antileisemins and anti parasitic diseases</td>
<td>18</td>
</tr>
<tr>
<td>5.</td>
<td>Neoandrographolide</td>
<td>Anti-inflammatory</td>
<td>19</td>
</tr>
<tr>
<td>6.</td>
<td>Andrographide</td>
<td>Liver cleansing and Hepatitis</td>
<td>20</td>
</tr>
<tr>
<td>7.</td>
<td>Kalmeghin</td>
<td>Fever and Cold</td>
<td>21</td>
</tr>
<tr>
<td>8.</td>
<td>Andrographiside</td>
<td>Anti-oxidant, Anti- Liperoxidation, Carcinogenic Detoxification</td>
<td>22,23</td>
</tr>
</tbody>
</table>
Plate 1. Whole plant of *A. paniculata*

Plate 2. *A. paniculata* leaves