Phytochemical and pharmacological review of *Andrographis echiodies*

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ABSTRACT

*Andrographis echiodies* belongs to Acanthaceae family, used for various medicinal purposes in South Asia particularly India and China. This medicinal plant was extracted by different solvents and its medicinal properties were identified by various technique. Based on the literature, this plant possess pharmacological properties include antimicrobial activity, anti-inflammatory, diuretic, anthelmintic, analgesic, antipyretic, hepato-protective activities and antioxidant effect. It contains plenty of phytochemical constituents such as flavonoids, flavones, steroids, tannins, carbohydrate, glycosides and alkaloids.

**Keywords:** *Andrographis echiodies, Acanthaceae, Medicinal properties, phytochemical Analysis*

1. INTRODUCTION

Plants are containing more number of medicinal properties and it should be used to treat many diseases in humans. It contains plenty of medicinally bio-active compounds which are used to cure many diseases across the world. India is one of the countries contains more than 45,000 plant species, out of that 15,000-20,000 plants are showing good medicinal properties, but currently 7,000-7500 plants only used for medicinal purposes [1]. Herbal drug companies are growing very fast in international market because modern medicine causes some health hazards problem [2]. *Andrographis echiodies* plant is located in dry land of south Asian countries. The leaf juice of *A. echiodies* is used to cure fevers. Genus of *Andrographis* family plants are used to cure various diseases like goiter, liver diseases, fertility problems, bacterial, malarial and fungal disorders [3,4].

*Andrographis echiodies* boiled with coconut oil is used to decrease the falling and graying of hair [5].

**Taxonomical Classification**

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae, Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subkingdom</td>
<td>Tracheobionta - Vascular plants</td>
</tr>
<tr>
<td>Superdivision</td>
<td>Spermatophyta - Seed plants</td>
</tr>
<tr>
<td>Division</td>
<td>Magnoliophyta - Flowering plants</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida - Dicotyledons</td>
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<tr>
<td>Subclass</td>
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<tr>
<td>Order</td>
<td>Scrophulariales</td>
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<tr>
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<td>Acanthaceae - Acanthus family</td>
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<tr>
<td>Genus</td>
<td><em>Andrographis</em> Wall. ex Nees - false water willow</td>
</tr>
<tr>
<td>Species</td>
<td><em>Andrographis echiodes</em> (L.) Nees - false waterwillow [6]</td>
</tr>
</tbody>
</table>
Vernacular names

Common name : False Waterwillow
Tamil : Gopuram tangi
Gujarati : Kalukariyatuum
Malayalam : Pitumba
Marathi : Ranchimani
Oriya : Lavalata

Habitat

Andrographis echiodies is an herbaceous plant widely located in dry area of southern Asian countries [7]. The flowering season of Andrographis echiodies is March-June and October-December [8].

Morphology

Andrographis echiodies plant contains more number of branchlets to 50 cm long. Leaves are elongated form with approximately parallel sides to broad rounded apex and a tapering base and are sub-sessile with glandular hairs on both abaxial and adaxial surface. The stem is slightly quadrangular with hairs on its surface. The plant shows Raceme type of inflorescence not exceeding the leaves and is scarcely branched. The calyx of the flower is with sub equal lobes, lanceolate with glandular hairs. Corolla is white with brown tinge. It is tubular, showing the 2+3 lipped condition, which are unequal. Stamens-2, exserted and straight, style slender, with capitate stigma. The capsules are ovoid, sparsely hairy, pointed above and narrowed below. The average number of the capsule per plant is 38, seed are yellow in colour and ovoid. Four seeds per capsule. 1.5mm across and glabrous. By The free hand sections, the anatomical characters of root stem and leaf were observed [9].

LEAF: The transverse section of leaf shows the upper and lower epidermis with glandular hairs. The mesophyll, in between the epidermis is made of palisade cells and spongy cells. The palisade parenchyma cells compactly arranged without any intercellular spaces. The spongy cells are loosely arranged with intercellular space and air cavities for gaseous exchange. In the midrib region the stele is surrounded a layer of compactly arranged parenchymatous cells. The stele is limited by the boarded parenchyma cells. The xylem is facing the upper epidermis where the phloem is towards the lower epidermis [9].

STEM: T.S of the stem shows the well-defined epidermis with epidermal hairs. It is followed by the hypodermis and the chlorenchymatous cortex.

The xylem elements are spherical in shape. The xylem is endarch. The phloem is encircling the xylem. Prominent pith is present in the centre. The pith cells are polygonal and are compactly arranged [9].

ROOT: The outermost covering of the root is the epidermis which is composed of single layer of barrel shaped epidermal cells. It lacks stomata and cuticle. The epidermis is followed by the compactly arranged parenchymatous cortex. Secondary growth is present. The phloem is towards the epidermis and the xylem are at the centre [9].

Part used from Andrographis echiodies

Whole plant, leaves and stem.

Chemical constituents from Andrographis echiodies

From the leaves extract of A.echiodies, various chemical constituents were isolated dihydroechioidinin, skullcap avone 1’2’-methyl ether, echioidinin, echioidin, skullcap avone 1 and 2’-O-b-D-glucopyranoside [10]. Some of the other chemical constituents present in the A. echiodies are more than 17 compounds such as borneol (2.6%), cyclohexanol 2,4 dimethyl phenol (1.89%), 3,4 altrason (3.5%), n-deconoicacid (15.29%), Squalene (22.57%), vitamin E (7.40%), Methoprene (1.53%), 2-nonenol Oxirane,octyl-, 2, 2-cyclopentene-1-undecanoic acid, ketone, 1,5-methylbicyclo [2.1.0] pent-5-ymethyl (10.61%) and 2,5-cyclohexadiene-1,4- diene, 2, 5-dihydroxy-3-methyl -6 -(1-methylethyl) bicycle heptan -3- one, 2,6,6-trimethyl (1à,2à,5a) (1.60%), (- )-3-á-Acetoxy-5-etienic acid(3.0%). The medicinal propiities of these compounds needs further research which can pave way to further applications and utility of A. echiodies in pharmaceutical field [11].

Pharmacological Activity of Andrographis echiodies

Diuretic Activity

Diuretic activity of petroleum ether and chloroform extract of Andrographis echiodies leaves was studied by Raama Murthy et al (2012). Chloroform extract of A.echiodies exhibited significant diuretic activity as evidenced by increased total urine volume and the urine concentration of Na⁺, K⁺ and Cl⁻. The result of the work indicates that plant can be used for future work and its effective against free radical mediated diseases [12].
**Antimicrobial Activity**

Petroleum ether, chloroform, acetone and methanol extract of *A. echioides* leaves and stems were screened for its preliminary phytochemical analysis. The antimicrobial activity of the crude extract was evaluated by Sermakkani *et al.*, (2011) against *Candida albicans* [13].

**Anthelmintic Activity**

Padma *et al.*, (2012) evaluated the anthelmintic activity of ethyl acetate, methanol and aqueous extract of whole plant of *Andrographis echioides* against *Pheretima posthuma*. The results revealed that the test extracts of *A. echioides* exhibited significant anthelmintic activity at concentration of 50 mg/ml. The use of *A. echioides* as an anthelmintic has been confirmed and further studies are suggested to isolate the active principles responsible for the promising activity [14].

**Hepatoprotective and antioxidant effect**

In this study the methanolic extract of *A. echioides* was investigated for its hepato protective and antioxidant effects against acetaminophen induced hepatotoxicity in wistar albino rats was studied by Basu *et al.*, (2009) [15].

**Anti-inflammatory, analgesic and antipyretic activity**

Basu *et al.*, (2009) evaluated the anti-inflammatory, analgesic and antipyretic activity of ether, chloroform, and ethyl acetate extract of *Andrographis echioides* in rats and mice. The results suggest that different extracts of *A. echioides* produce antinociceptive, anti-inflammatory and anti-pyretic activities that could be due to the effect of one or a combination of the bio-active components in each extract [16].

**Anti-ulcer activity**

Anti-ulcer activity of ethanol extract of *Andrographis echioides* was evaluated by Ramasubramania Raja *et al.*, (2014). The extracts have shown potential anti-ulcer activity in all tested models [17].

**Synergistic effect**

Sankaran Rajkumar *et al.*, (2012) studied the synergistic effect of leaves of *Andrographis echioides*. It is subjected to Soxhlet extraction using ethanol as solvent. The plant alcoholic extract was examined against 4th instar larvae of *A. aegypti* with gradually increasing concentration from 50 to 250mg/L using WHO protocol. From the results it can be concluded that synergistic effect of *A. echioides* as a more powerful arsenal for control of *A. aegypti* [18].

**Phytochemical Analysis of Andrographis echiodies**

The whole plant of *Andrographis echiodies* contains more number of phyto-constituents that are extracted using various solvents depending upon the polarity of these compounds. The isolated compounds are listed below in Table 1.


**Conclusion**

Review on *Andrographis echiodies* showed that it contains enormous amount of phytochemical constituents. In addition, it possesses wide range of pharmacological activities. Hence the plant can be used to treat many diseases, and also it could be used in various pharmaceutical formulation and drug development studies.
Table 1. Works reported on *Andrographis echioides*

<table>
<thead>
<tr>
<th>S.No</th>
<th>Parts used</th>
<th>Activity</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leaves</td>
<td>against dengue</td>
<td>Rajkumar et al (2012)</td>
</tr>
<tr>
<td>2</td>
<td>Leaves</td>
<td>Anti-microbial activity</td>
<td>Nirubama et al (2014)</td>
</tr>
<tr>
<td>4</td>
<td>Whole plant</td>
<td>Phytochemical screening and Antimicrobial activity</td>
<td>Kanchana et al (2014)</td>
</tr>
<tr>
<td>5</td>
<td>Whole plant</td>
<td>Preliminary phytochemical and Antimicrobial activity</td>
<td>Radha et al</td>
</tr>
<tr>
<td>6</td>
<td>Whole plant</td>
<td>Anti-Inflammatory Activity</td>
<td>Yang Shen et al (2013)</td>
</tr>
<tr>
<td>7</td>
<td>Whole plant</td>
<td>Anthelmintic Activity</td>
<td>Padma et al (2012)</td>
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<tr>
<td>8</td>
<td>Leaves</td>
<td>Hepatoprotective and antioxidant effect</td>
<td>Basu et al (2009)</td>
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<tr>
<td>10</td>
<td>Whole plant</td>
<td>Anti-inflammatory, Analgesic and Antipyretic activities and Antiulcer activity</td>
<td>Ashok Kumar, 2011</td>
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</tbody>
</table>

References

service united state department of Agriculture.