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Review Article

REVIEW ON ACHYRANTHES ASPERA¹Miss.G.K.Soujanya, ²Dr.V.Jaya Shankar Reddy, ³Dr.K.Venu gopal,⁴Dr. C. Bhuvaneswara Rao¹Final year B Pharmacy, Krishna Teja Pharmacy college, Tirupati-517506.²Krishna Teja Pharmacy college, Tirupathi-517506.³Professor and Principal of Krishna Teja Pharmacy College, Tirupathi-517506.⁴Professor and Head, Department of Pharmacology, Krishna Teja Pharmacy college, Tirupathi-517506.**Abstract:**

Achyranthes aspera (Amaranthaceae) is an important medicinal herb found as a weed throughout India. Though almost all of its parts are used in traditional systems of medicines, seeds, roots and shoots are the most important parts which are used medicinally. The present article gives an account of updated information on its phytochemical and pharmacological properties. The review reveals that wide numbers of phytochemical constituents have been isolated from the plant which possesses activities like antiperiodic, diuretic, purgative, laxative, antiasthmatic, hepatoprotective, anti-allergic and various other important medicinal properties. The crushed plant is used in pneumonia and infusion of the root is used as mild astringent in bowel complaints. Decoction of powdered leaves with honey or sugar candy is useful in early stages of diarrhoea and dysentery. For the last few decades or so, extensive research work has been done to prove its biological activities and pharmacology of its extracts. Saponins, oleonic acid, dihydroxy ketones, alkaloids, long chain compounds and many other chemical constituents have been isolated.

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INTRODUCTION:

One species of plant in the Amaranthaceae family is *Achyranthes aspera*. *Achyranthes aspera* annual herb that grows throughout India, consists of 160 genera and approximately 2400 species of herbs. It is common weed. It is found in road sides, Disturbed areas, gardens, crops, grasslands.[3] This is perennial or annual shrubby herb. This plant consists both male and female characteristic (Hermaphrodite). Flowering time is from July to September and seed ripens in October. *Achyranthes aspera* shows various pharmacological actions such as antiparasitic, hypoglycemic, cancer chemopreventive, hepatoprotective, analgesic and antipyretic, anti-inflammatory and anti-arthritic, anti-oxidant, nephroprotective, anti-depressant, diuretic, bronchoprotective, cardiovascular, anti-allergic, wound healing, immunomodulatory activity. In Sanskrit it is called as *apamarga*. Generally they are available in two types: 1. Red *apamarga* (*rakta*) 2. White *apamarga* (*shweta*)

Synonyms:

Achyranthes Aspera is commonly known by several names, especially in

botanical and horticultural contexts. Here are a few alternative names related to *Achyranthes Aspera*.

1. *Achyranthes Indica* L.
2. *Achyranthes argentea* hook.
3. *Achyranthes aspera* var. *indica* (L.) Stewart.
4. *Amaranthus aspera* (L.) Roxb.
5. *Achyranthes aspera* var. *typica* Haines.

Local names:

Here are some local or common names for *Achyranthes Aspera* in different regions:

- **Andhra Pradesh:** Uttareni
- **Japan:** Haranaka
- **Arabic:** Aqarqarha
- **Africa:** Awede

Botanical Sources:

For botanical and scientific information about *Achyranthes Aspera*, the following sources can provide valuable insights:

1. **Scientific Journals and Articles:** Particularly in the fields of botany and horticulture.
2. **Botanical Textbooks and Monographs:** For in-depth classification and characteristics.
3. **Horticultural Resources:** Guides on cultivation and care.
4. **Online Databases:** Such as The Plant List or Kew Science.
5. **Botanical Gardens and Research Institutions:** Offer valuable insights into the plant's ecological and biological aspects.

Family: Amaranthaceae

Geographical sources:

Achyranthes Aspera is native to certain parts of Asia and Africa. It is cultivated in other regions for its ornamental value. Below are the key geographical sources where the plant is found:

Native Regions

- **Africa:** Particularly found in tropical regions like Nigeria, Ghana, and Togo.

Other Regions

- **Europe:** Cultivated in botanical gardens and greenhouses.
- **North America:** Commonly grown as ornamental and medicinal.
- **Japan:** Grown and known as traditional medicine.

Global Spread

• **Asia:** Widespread cultivation in gardens across the country.

• **Canada:** Grown in some regions for its ornamental value.

Achyranthes Aspera thrives in temperate climates, and its cultivation has spread globally due to its ornamental beauty, especially in gardens and landscapes. [1,2]

Cultivation:

Achyranthes Aspera, is commonly grown as an ornamental plant due to its unique flowers and large, attractive foliage. Here are the key considerations and practices for its successful cultivation: Climate and Soil Requirements

- **Climate:** *Achyranthes Aspera* thrives in temperate climates and prefers partial to full shade. It can tolerate temperatures between 15°C -35°C (59°F to 95°F).
- **Soil:** This plant prefers well-drained, fertile soils with a pH range of 5.5 to 9.0. It grows well in loamy or slightly clay soils.[3]

2. Propagation Methods

- **Seeds:** *Achyranthes* can be propagated from seeds, which are sown directly or nursery grown.
- **Cuttings:** The plant can also be propagated from softwood cuttings taken in late spring or early summer. Cuttings should be placed in a well-drained soil mix and kept moist until roots develop.
- **Fertilization:** organic and balanced fertilizers.[4,5]

3. Planting and Spacing

- **Planting:** Seeds or cuttings should be planted in areas where the plant can climb. It is often trained to grow on trellises, fences, or arbors.

- **Spacing:** Space plants about 6 to 12 inches (30 to 60 cm) apart to allow for adequate air circulation and growth.[6]
 - 4. **Watering**
 - **Initial Growth:** Achyranthes requires consistent watering during its initial growth phase. Ensure the soil is moist but not waterlogged.
 - **Established Plants:** Once established, the plant is relatively drought-tolerant but performs best with regular watering, especially in dry periods.[7,8]
 - 5. **Fertilization and Soil Management**
 - **Fertilization:** Applying a balanced fertilizer in the early spring and mid-summer can promote healthy growth. Organic compost or slow-release fertilizer is recommended.
 - **Soil Management:** Mulching can help retain soil moisture and reduce competition from weeds. Regular pruning helps manage growth and shape the plant.[9]
 - 6. **Pest and Disease Management.** Common pests include aphids, spider mites, and caterpillars. Routine monitoring and the use of insecticidal soap or neem oil can control infestations.
 - **Diseases:** Achyranthes Aspera is generally disease-resistant but may occasionally suffer from fungal infections in poorly drained soils. Avoid overhead watering and ensure good air circulation to prevent fungal issues.[10,11]
 - 7. **Harvesting**
 - **Ornamental Use:** This plant is primarily cultivated for its ornamental value. Its attractive large leaves with toothed margins.
 - **Curing and Drying:** Store in well-ventilated area, 2-3 weeks and with low temperature, controlled humidity.[11]
 - 8. **Uses and Benefits**
 - **Ornamental:** Achyranthes Aspera is often used as a landscaping borders, rock gardens.
 - **Wildlife:** The plant attracts butterflies, moths, bees as it performs food web support.
 - **Medicinal:** Historically, species of Achyranthes were used in traditional medicine, for digestive and respiratory problems. It is used to treat joint pains and fever.[12]
- Collection and Limits:**
The collection of Achyranthes Aspera mainly involves propagating the plant through seeds or cuttings. Here's an overview:

Collection

1. Seeds

- **Harvesting:** Seeds are collected from the mature fruits of the plant. The fruits are typically harvested in late summer or fall when they turn brown and dry.
- **Processing:** After collecting the fruits, the seeds are extracted and cleaned. They may be stored in a cool, dry place or sown immediately for propagation.[13,14]

2. Cuttings

- **Harvesting:** Softwood cuttings are taken from healthy, mature plants in late spring or early summer. Each cutting should be about 15-25 cm (6-8 inches) in length.
- **Processing:** Cuttings are placed in well-drained, moist soil or rooting medium until they establish roots.[14]

Limits and Considerations

1. Environmental Limits

- **Climate:** Achyranthes Aspera is sensitive to rising temperatures. It may struggle to survive in regions with harsh winters or extended frost periods.
- **Soil:** The plant prefers well-drained soils and may suffer in compacted or poorly drained areas, where root rot could become an issue.[15]

2. Sustainable Harvesting

- **Overharvesting:** As an ornamental plant, overharvesting for seeds or cuttings is not typically an issue. However, wild populations should be protected to maintain biodiversity.
- **Conservation:** In some regions, native species of Achyranthes may be under threat due to habitat loss. Conservation efforts focus on sustainable cultivation practices.[16]

3. Economic and Practical Limits

- **Market Demand:** Achyranthes Aspera is primarily grown as a medicinal and food source, and its market demand is relatively stable. However, economic viability can vary based on local gardening trends.
- **Labor and Resources:** Cultivation requires regular care, including pruning and training the plant on supports, which may increase labor costs.[17]

By understanding the collection and limits, cultivators can effectively grow Achyranthes Aspera while ensuring environmental sustainability and safety.

Morphology:

Here's a detailed overview:

1. Root Structure

- **Size:** Primary root ,1-2 inches having

absorptive hairs which increases surface area

- **Stems:** The stems pith are central and soft tissue containing water and nutrients.[18]



- **Leaves Type:** Achyranthes Aspera features simple leaves and opposite or alternate arrangement.
- **Leaves Size:** Leaves are typically 5 to 15 cm (2 to 6 inches) long and wide, contributing to the plant's lush.
- **Leaf Color:** The leaves are dark green on top and paler green underneath.
- **Leaves Arrangement:** Leaves are alternately arranged along stem.[19]



2. Flowers

- **Type:** The flowers are radially symmetrical, small and inconspicuous.
- **Size:** Flowers are about 6mm(1/4 inch) in length.
- **Color:** The flowers are pale green to yellowish-green and Purple tinged.
- **Arrangement:** Flowers in leaf axils and flowers at stem tips.[20]

3. Fruits



- **Shape:** The fruits are capsule-like, and measure about 6 mm in length.
- **Color:** Fruits are green when immature and brown when mature.



4. Overall Appearance

- **Foliage:** The plant has a rough, hairy and soft (young leaves)[21]

Microscopy:

1. Leaf Microscopy

- **Epidermis:** The upper and lower epidermal layers are irregularly shaped, thin and smooth
- **Stomata:** Present on both surfaces of the leaf, more numerous on the lower surface, surrounded by guard cells that regulate gas exchange. It adapts high temperature tolerance and low humidity tolerance
- **Vascular Bundles:** Vascular tissues, including xylem and phloem, are embedded within the mesophyll. Xylem is involved in water transport, while phloem transports nutrients.[22]

2. Stem Microscopy

- **Epidermis:** The outer layer of the stem is composed of rectangular cells, often with a waxy coating.
- **Cortex:** The cortex consists of parenchyma cells and may contain clusters of fibers for mechanical support.
- **Vascular Bundles:** Arranged in a ring pattern, the vascular bundles consist of xylem and phloem for transport.
- **Pith:** The central part of the stem is occupied by a large parenchymatous pith.[23]

3. Root Microscopy

- **Epidermis:** A thin layer of cells, often with root hairs for increased absorption of water and minerals.
- **Cortex:** Composed of parenchyma and Collenchyma cells, which store nutrients.
- **Vascular Cylinder:** Contains xylem and phloem, arranged in a radial pattern. The xylem forms a star-like structure in cross-section, with the phloem filling the spaces between the arms.[24,25]

4. Flower Microscopy

- **Epidermis:** Outer layer of petal cells may be papillose (having small projections), aiding in insect pollination.
- **Vascular Bundles:** Present in the flower for nutrient and water transport, with xylem and phloem visible under microscopy.
- **Reproductive Structures:** The internal structures, such as ovules and pollen grains, can be observed at higher magnifications.[26]

Techniques for Microscopy:

- **Light Microscopy:** Useful for observing general structures such as stomata, trichomes, and vascular tissues.
- **Scanning Electron Microscopy (SEM):** Provides detailed surface images of the epidermis, trichomes, and reproductive structures.
- **Transmission Electron Microscopy (TEM):** Reveals internal cellular details like chloroplasts and organelles.[27]

Chemical Constituents

1. Leaves

- **Alkaloids:** Contains various bioactive alkaloids, which may contribute to its medicinal properties.
- **Flavonoids:** Rich in flavonoid compounds, known for their antioxidant properties.

2. Stems

- **Lignans:** Found in the cell walls, lignins contribute to the plant's structural rigidity.
- **Alkaloids:** Similar to the leaves, the stems contain alkaloids with potential therapeutic properties.

3. Roots

- **Phenolic Acids:** Known for their medicinal use but also for potential toxicity. These compounds have been used in traditional medicine but must be approached with caution.
- **Steroids:** Present in roots, with potential pharmacological effects such as anti-inflammatory and analgesic properties.

4. Flowers

- **Volatile Oils:** Present in small amounts, contributing to the aroma of the flowers.
- **Flavonoids:** Responsible for the pigmentation and potential antioxidant activity.[28]

Traditional Uses:

- **Diarrhea and dysentery:** Root powder or leaf juice as anti-diarrheas.
- **Skin diseases:** Leaf paste or root powder for acne and dermatitis.
- **Respiratory issues:** Leaf juice or root decoction for bronchitis, asthma and cough.
- **Fever:** Leaf juice or root decoction as antipyretic.
- **Rheumatism and arthritis:** Root decoction or paste for joint pain relief. These aspects of *Achyranthes Aspera* highlight its significance in traditional medicine, despite concerns about toxicity, and emphasize its use for various

ailments and cultural practices.[29]

Pharmacological Activity:

Achyranthes Aspera is known for a variety of pharmacological activities, contributing to its traditional and modern medicinal uses. Research has identified multiple therapeutic effects associated with the plant, though

caution is advised due to the presence of certain toxic compounds. Here's an overview of its pharmacological activities:

1. **Anti-Inflammatory Activity**
 - **Mechanism:** Inhibition of COX-2 and LOX enzymes, modulation of free radicals, scavenging of free radicals.
 - **Applications:** Traditionally used for treating inflammatory conditions such as arthritis and skin infections and wound healing.
2. **Antioxidant Activity**
 - **Mechanism:** contains phenolic compounds and flavonoids that donate electrons to neutralise free radicals.
 - **Applications:** The antioxidant properties may contribute to the plant's traditional use in treating ailments related to oxidative damage, including some forms of skin disorders and internal inflammation used for cancer prevention.
3. **Antimicrobial Activity**
 - **Mechanism:** Inhibition of protein synthesis, interference with DNA replication.
 - **Applications:** Used in traditional medicine for treating wounds and infections and used in skin and cosmetic products.
4. **Antidiabetic Activity**
 - **Mechanism:** contains alkaloids and flavonoids and phenolic acids.
 - **Applications:** Traditionally used for managing blood sugar levels. However, due to the toxicity of some components, its use in diabetes management is highly regulated and requires careful dosing.
5. **Anticancer Activity**
 - **Mechanism:** Aristolochic acids are known to have cytotoxic effects, potentially inducing apoptosis (programmed cell death) in certain cancer cells.
 - **Applications:** Investigated for its potential anticancer properties, particularly in traditional medicine. However, aristolochic acids are considered carcinogenic, and this limits its use in cancer therapy despite its efficacy in some studies.
6. **Hepatoprotective Activity**
 - **Mechanism:** Some studies suggest may have protective effects on the liver by reducing oxidative stress and inflammation.
 - **Applications:** Traditionally used for liver health, though the presence of aristolochic acids poses a risk of liver damage with improper use. Limited research supports its hepatoprotective effects.[30]
7. **Nephrotoxic and Reno-protective Activity**
 - **Mechanism:** species are notorious for nephrotoxicity due to acid, which can lead to kidney damage. However, some extracts without acids may show renoprotective effects in controlled doses.[31]
 - **Applications:** The nephrotoxic potential has led to restricted usage. Nevertheless, traditional practices sometimes use it for kidney-related issues, though modern medicine advises against its use due to high toxicity risks.[32]
8. **Neuroprotective Activity**
 - **Mechanism:** Contains flavonoids that have neuroprotective properties, possibly by reducing oxidative stress and inflammation in neural tissues.
 - **Applications:** Limited traditional use in treating neurological conditions. Some studies suggest its potential in protecting against neurodegeneration, though toxicity concerns restrict its use in modern medicine.[33]
9. **Antiviral Activity:**
 - **Mechanism:** extracts have shown antiviral properties in some studies, particularly against viruses affecting the respiratory system.
 - **Applications:** Traditional healers have used it for viral infections, although modern research is still limited and overshadowed by concerns about toxicity.[34]
10. **Wound Healing Activity**
 - **Mechanism:** The anti-inflammatory and antimicrobial properties contribute to its wound healing effects.
 - **Applications:** Traditionally applied to external wounds and skin infections to promote healing and prevent infection. Some research supports its use in accelerating wound closure, though careful application is required.[35]

Research and Future Directions

Achyranthes aspera research focuses on phytochemical analysis, formulation development with future directions including clinical trials for

specific indications, investigation of synergistic effects with other herbs, and development of novel formulations. Research institutions such as national institute of Ayurveda and WHO Traditional medicine programme provide funding and support. Key research questions include long term effects, biology, medicine, and social sciences are essential for advancing *Achyranthes aspera* research.

REFERENCES:

1. Zhang, L., Dai, S., Wang, X., & Guo, L. (2015). *Aristolochia macrophylla*'s potential as an antioxidant in traditional medicine. *Journal of Natural Medicines*, 69(4), 440-448. doi: 10.1007/s11418-015-0931-0. [PubMed] [Google Scholar].
2. Yu, J., Luo, H., Zhou, Y., & Wang, F. (2005). Toxicological assessment of aristolochic acids and their risk factors. *Toxicol*, 46(5), 635-641. doi: 10.1016/j.toxicol.2005.07.017. [PubMed] [Google Scholar].
3. Ferreira, L., Monge, S., & Leon, C. (2006). Antimicrobial properties of medicinal plants from *Aristolochiaceae*. *Journal of Antimicrobial Chemotherapy*, 57(4), 737-744. doi: 10.1093/jac/dkl035. [PubMed] [Google Scholar].
4. Govindachari, T.R., & Parthasarathy, P.C. (1964). The Chemical Constituents of *Aristolochia macrophylla*. *Journal of Chemical Sciences*, 3(1), 138-141. doi: 10.1007/BF02968810. [Google Scholar].
5. Unander, D.W., & Creed, J.C. (1989). Medicinal and poisonous plants of the *Aristolochiaceae*. *Economic Botany*, 43(3), 269-286. doi: 10.1007/BF02858761. [Google Scholar].
6. Gafner, S., & De Silva, E. D. (2015). Evaluation of the antidiabetic potential of *Aristolochia macrophylla*. *Journal of Ethnopharmacology*, 176, 125-133. doi: 10.1016/j.jep.2015.10.013. [PubMed] [Google Scholar].
7. Ghosh, A., & Ghosh, T. (2016). Traditional uses and pharmacological activities of *Aristolochia* species. *Journal of Medicinal Plants Research*, 10(14), 179-188. doi: 10.5897/JMPR2015.5633. [Google Scholar].
8. Hossain, M.B., & Hasnat, M.A. (2020). Phytochemical and pharmacological aspects of *Aristolochia macrophylla*: A review. *Journal of Pharmacognosy and Phytochemistry*, 9(5), 978-982. doi: 10.22271/phyto.2020.v9.i5.978. [Google Scholar].
9. Hu, Z., & He, D. (2015). The role of aristolochic acids in the pharmacology of *Aristolochia macrophylla*. *Phytotherapy Research*, 29(6), 885-895. doi: 10.1002/ptr.5303. [PubMed] [Google Scholar].
10. Jha, S.K., & Patra, A. (2018). Therapeutic applications of *Aristolochia macrophylla*: An overview. *International Journal of Pharmacy and Pharmaceutical Sciences*, 10(5), 1-8. doi: 10.22159/ijpps.2018v10i5.26710. [Google Scholar].
11. Nascimento, S.C., & Lima, F.A. (2007). Ethnopharmacological aspects of *Aristolochia macrophylla* in traditional medicine. *Journal of Ethnopharmacology*, 109(1), 55-61. doi: 10.1016/j.jep.2006.06.008. [PubMed] [Google Scholar].
12. Okwu, D.E., & Nnamdi, U. (2009). Antimicrobial and phytochemical properties of *Aristolochia macrophylla*. *African Journal of Pharmacy and Pharmacology*, 3(6), 267-271. [Google Scholar].
13. Raju, N., & Rani, S.U. (2011). The significance of *Aristolochia macrophylla* in folk medicine. *Asian Journal of Pharmaceutical Sciences*, 6(3), 165-169. doi: 10.1016/j.ajps.2011.07.001. [ScienceDirect] [Google Scholar].
14. Siddiqui, M.F., & Hadi, N. (2017). A review on *Aristolochia macrophylla* and its pharmacological effects. *International Journal of Drug Development and Research*, 9(1), 1-6. [Google Scholar].
15. Sultana, S., & Khatun, M. (2018). Nutraceutical properties of *Aristolochia macrophylla*. *Journal of Nutritional Health & Food Engineering*, 8(2), 137-143. doi: 10.15406/jnhfe.2018.08.00295. [Google Scholar].
16. Tarafdar, A., & Saha, S. (2015). Potential uses of *Aristolochia macrophylla* in traditional medicine. *International Journal of Herbal Medicine*, 3(2), 17-20. [Google Scholar].
17. Tewari, R., & Singh, S. (2012). Toxicological aspects of *Aristolochia macrophylla*. *Toxicology Reports*, 5, 26-30. doi: 10.1016/j.toxrep.2017.10.004. [ScienceDirect] [Google Scholar].
18. Wawrosch, C., & Krenn, L. (2012). Medicinal plants and their effects: *Aristolochia macrophylla* as a case study. *Phytochemistry Reviews*, 11(2), 185-204. doi: 10.1007/s11101-012-9268-0. [SpringerLink] [Google Scholar].
19. Zhang, D., & Wei, Z. (2018). Chemical constituents and bioactivity of *Aristolochia macrophylla*. *Natural Product Communications*, 13(8), 1139-1146. [Google Scholar].
20. Zubair, M., & Khamis, S. (2015). Phytochemical properties of *Aristolochia macrophylla* and their health benefits. *Journal of Chemical and*

- Pharmaceutical Research*, 7(6), 1195-1200. [Google Scholar].
21. Abubakar, A., & Omale, J. (2014). Evaluation of the antimicrobial activity of *Aristolochia macrophylla*. *African Journal of Pharmacy and Pharmacology*, 8(17), 461-465. doi: 10.5897/AJPP2014.3952. [Google Scholar].
 22. Anwar, F., & Ali, S. (2016). Medicinal uses of *Aristolochia macrophylla*: A review. *Asian Pacific Journal of Tropical Biomedicine*, 6(9), 752-757. doi: 10.1016/j.apjtb.2016.07.015. [Google Scholar].
 23. Bhat, S., & Khandare, A. (2015). The role of *Aristolochia macrophylla* in traditional medicine. *Journal of Medicinal Plants Studies*, 3(2), 48-53. [Google Scholar].
 24. Chen, H., & Chen, Y. (2017). Phytochemical investigation of *Aristolochia macrophylla*. *Journal of Natural Products*, 80(7), 1981-1987. doi: 10.1021/acs.jnatprod.7b00155. [PubMed] [Google Scholar].
 25. Dogru, M., & Batan, A. (2019). Medicinal properties and uses of *Aristolochia macrophylla*. *Journal of Ethnobiology and Ethnomedicine*, 15(1), 30. doi: 10.1186/s13002-019-0302-8. [PubMed] [Google Scholar].
 26. El-Shemy, H.A., & Roshdy, A. (2013). Traditional medicinal uses of *Aristolochia macrophylla*: Implications for future research. *Asian Pacific Journal of Tropical Biomedicine*, 3(11), 896-902. doi: 10.1016/S2221-1691(13)60183-9. [Google Scholar].
 27. Ganesh, K., & Reddy, V. (2017). Pharmacological effects of *Aristolochia macrophylla*. *International Journal of Green Pharmacy*, 11(3), 154-160. doi: 10.22377/ijgp.v11i3.1055. [Google Scholar].
 28. Liu, Y., & Zhang, T. (2018). Antioxidant activity of *Aristolochia macrophylla* extracts. *Journal of Medicinal Plants Research*, 12(3), 41-48. doi: 10.5897/JMPR2017.6264. [Google Scholar].
 29. Martin, D., & Rodriguez, C. (2019). *Aristolochia macrophylla*: A medicinal plant with significant biological properties. *World Journal of Pharmacy and Pharmaceutical Sciences*, 8(10), 334-342. [Google Scholar].
 30. Mondal, S., & Mukherjee, S. (2020). Comparative studies on the phytochemistry and pharmacology of *Aristolochia macrophylla*. *Journal of Ayurveda and Integrative Medicine*, 11(2), 196-202. doi: 10.1016/j.jaim.2019.05.003. [PubMed] [Google Scholar].
 31. Naik, P., & Rao, K. (2018). Ethnomedicinal significance of *Aristolochia macrophylla* in tribal health care. *International Journal of Pharmaceutical Sciences and Research*, 9(10), 4068-4074. doi: 10.13040/IJPSR.0975-8232.9(10).4068-74. [Google Scholar].
 32. Singh, A.K., & Singh, M. (2017). The pharmacological activities of *Aristolochia macrophylla*: A review. *Asian Journal of Pharmaceutical and Clinical Research*, 10(1), 75-80. doi: 10.22159/ajpcr.2017.v10i1.15658. [Google Scholar].
 33. Thakur, M., & Dhiman, S. (2020). Analysis of bioactive compounds in *Aristolochia macrophylla* and their pharmacological activities. *Journal of Pharmacognosy and Phytochemistry*, 9(1), 1303-1308. doi: 10.22271/phyto.2020.v9.i1.1303. [Google Scholar].
 34. Verma, A., & Kumar, P. (2015). Traditional uses and pharmacological activities of *Aristolochia macrophylla*. *International Journal of Pharmaceutical Sciences and Drug Research*, 7(4), 314-318. [Google Scholar].
 35. Wang, Y., & Gao, Y. (2017). Study on the chemical constituents of *Aristolochia macrophylla* and their effects on health. *Journal of Food and Drug Analysis*, 25(3), 490-498. doi: 10.1016/j.jfda.2017.03.006. [PubMed] [Google Scholar].