

Primary Pharmacological and Other Important Findings on the Medicinal Plant “*Aconitum Heterophyllum*” (Aruna)

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Key Words

aconitum heterophyllum, diterpene alkaloids, ranunculaceae

Abstract

Aconitum Heterophyllum (*A. Heterophyllum*) is an indigenous medicinal plant of India and belongs to the family Ranunculaceae. *A. Heterophyllum* is known to possess a number of therapeutic effects. For very ancient times, this plant has been used in some formulations in the traditional healing system of India, i.e., Ayurveda. It is reported to have use in treating patients with urinary infections, diarrhea, and inflammation. It also has been used as an expectorant and for the promotion of hepatoprotective activity. The chemical studies of the plant have revealed that various parts of the plant contain alkaloids, carbohydrates, proteins and amino acids, saponins, glycosides, quinones, flavonoids, terpenoids, etc. In the present study, a comprehensive phytochemistry and pharmacognosy, as well as the medicinal properties, of *A. Heterophyllum* are discussed. Scientific information on the plant was collected from various sources, such as electronic sources (Google scholar, Pubmed) and some old classical text books of Ayurveda and Ethnopharmacology. The study also presents a review of the literature on *A. Heterophyllum*, as well as the primary pharmacological and other important findings on this medicine. This review article should provide

useful information to and be a valuable tool for new researchers who are initiating studies on the plant *A. Heterophyllum*.

1. Introduction

India has an ancient and rich heritage of traditional medicine. Ayurveda is accepted as an ancient medicinal system that originated in Indian. Ayurveda is accepted to be an upaveda (part) of Atharavaveda (1000 B.C.). All the formulations mentioned in the Ayurvedic Formulary of India are still used in India, and recently, those formulations have begun to spread worldwide [1].

Aconitum Heterophyllum (*A. Heterophyllum*) is an ayurvedic medicinal plant used as the main ingredient in many formulations mentioned in the Ayurvedic formulary of India. *Aconitum* species are also used as major components in Chinese and Bhutanese herbal medicines. This plant is also known in Indian English as atees and atis root, in Sanskrit as ativisha, shuklakanda, aruna, and vishada, in Urdu as atees, in Hindi as atis and atvika, in Bengali as ataish, in Telugu as ati vasa, in Gujarati as ativakhani, in Marathi as ati vish, in Kannada as ati-vishsa, in Malayalam as ati-vidayam, and in Panjabi as atis [2].

A. Heterophyllum falls under the plant Kingdom, ‘Magnoliophyta’ division, and belongs to the Ranunculaceae family and the *Aconitum* genus [3]. About 300 species of *Aconitum* are found worldwide, of which 24 species are found in India. Medicinal *A. Heterophyllum*

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consists of dried, tuberous roots of *A. Heterophyllum* Wall. ex. Royle, a perennial herb native to the western Himalayas and found in Kashmir, Uttarakhand Sikkim, and Nepal at altitudes between 2,500 and 4,000 m. Most of the species are highly toxic in nature, being known as the Queen of all poisons, with several species having been used, and still being used, on the tips of hunting spike. Thus, this plant must be handled carefully [4, 5].

The plant *A. Heterophyllum* is reported to have antidiarrheal, expectorant, diuretic, hepatoprotective, antipyretic and analgesic, antioxidant, alexipharmic, anodyne, anti-atrabilious, anti-flatulent, anti-periodic, anti-phlegmatic, and carminative properties; furthermore, it can be used to treat patients with reproductive disorders [6-8]. Figs. 1, 2 show pictures of the plant and its root. Table 1 presents its scientific classification.



Figure 1 Plant of *Aconitum Heterophyllum*.



Figure 2 Root of *Aconitum Heterophyllum*.

2. Description

The roots of *A. Heterophyllum* appear whitish grey in color and are 2.0 - 7.5 cm long and 0.4 - 1.6 cm or more thick at

Table 1 Scientific classification of *Aconitum Heterophyllum* [2]

Botanical name	<i>Aconitum Heterophyllum</i>
Family	Ranunculaceae
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Ranunculales
Genus	Aconitum

their upper extremities, decreasing in thickness towards a tapered end (Fig. 2). Stems are simple and branched, 15 - 20 cm in height, and green in color. *A. Heterophyllum* is a small plant with a straight stem, but sometimes occurs with branches. It is a tree that has blue or yellow flowers from August to September (Fig. 1). The leaves of this herb are a heteromorphous dark green in color. The upper parts of the leaves are amplexicaul, and the lowest parts of the leaves are long petioles. The plant has a spiral (alternate) arrangement [9]. The macroscopic and the microscopic characteristics of the plant are presented in Tables 2 and 3, respectively.

3. Cultivation and Collection

For the cultivation of *A. Heterophyllum*, the suitable altitude is about 2,400 - 3,600 m above sea level. The plant is mostly found in sub-alpine and alpine region of the Himalayas. *A. Heterophyllum* is cultivated in moist soil, and the rain fall required for the cultivation of natural and transplanted populations of *A. Heterophyllum* is 664.2 to 1485.7 mm. *A. Heterophyllum* plants are grown from seeds and tuberous roots; seeds collect and germinate only in the beginning of the spring, March to April. Generally, one to two daughter tubers are produced by the end of the growing season. Daughter tubers are collected during autumn after the aerial shoots have senesced and are replanted in the spring. The new plants produce leafy shoots during the first year of the growth while the cultivated plants produce flowers during the second year of growth [4].

4. Medicinal Importance of *A. Heterophyllum*

A. Heterophyllum has various medicinal uses. It is reported to have antidiarrheal activity when taken with fine powder of dry ginger, Beel (Bellpetra in India) fruit, or Nutmeg (jaiphal in India). The juice of the root when taken with milk acts as an expectorant. The seeds are used as a diuretic. Furthermore, the plant is used to treat patients with reproductive disorders and is known to have hepatoprotective, antipyretic and analgesic, antioxidant, alexipharmic, anodyne, anti-atrabilious, anti-flatulent, anti-periodic, anti-phlegmatic, and carminative properties.

Table 2 Preliminary macroscopic characteristics of *Aconitum Heterophyllum* [3]

Stems	<ul style="list-style-type: none"> • Simple and branched • 15-20 cm in height • Green in color • Small plant with a straight stem • Sometime occurs in branches
Leaves	<ul style="list-style-type: none"> • Heteromorphous dark green in color • Upper parts are amplexicaul • Lowest parts are long petioles • Paired whitish grey in color
Roots	<ul style="list-style-type: none"> • 2.0 - 7.5 cm long • 0.4 - 1.6 cm or more thick at its upper extremity, decreasing in thickness towards tapering end.

Table 3 Preliminary microscopic characteristics of *Aconitum Heterophyllum* [9]

Roots	<p>Transverse section of the mature root shows</p> <ul style="list-style-type: none"> • Single layered epidermis consisting of light-brown tabular cells rupturing on formation of cork • 5 - 10 rows of tangentially elongated, thin-walled cells • Cork cambium single layer consisting of tangentially elongated, thin-walled cells • Much wider cortex consisting of tangentially elongated or rounded, thin-walled parenchymatous cells with intercellular spaces, cells
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Table 4 Chemical constituents of *Aconitum Heterophyllum* [6, 11]

Class	Chemical constituents		
	Leaf	Root	Stem
Alkaloids	+	+	+
Carbohydrates	+	+	+
Proteins & Amino acids	+	+	+
Saponins	+	+	+
Glycosides	+	+	+
Quinones	-	+	+
Flavonoids	+	+	+
Terpenoids	-	+	+

Table 5 Phytochemical structures present in *Aconitum Heterophyllum* [6]

Chemical constituents
12-secohetisan-2-ol
N-succinoylanthranilate
Atesinol 6-benzoylheterastine
N-diethyl-N-formylaconitine
Methyl aconitine
Aconitine
Anthorine

5. HPLC Analysis

Jabeen *et al* developed a fingerprinting method for iden-

tifying the bioactive compounds present in *A. Heterophyllum* by using a simple reversed-phase high-performance liquid chromatography - ultraviolet-photodiode array detector (HPLC-UV-DAD) method. Peak heights were linear in the aconitine concentration with a correlation coefficient > 0.999. The assay was rapid and reproducible. A reliable and accurate HPLC method coupled with DAD was developed for simultaneous quantitative determination of six aconitum alkaloids: aconitine, mesaconitine, hypaconitine, benzoylaconine, benzoylmesaconine, and benzoylhypaconine [10]. The identified chemical constituents found in *A. Heterophyllum* are presented in Table 4, and the corresponding structures of those constituents are presented in Table 5.

6. Conclusion

In the present review, we have made an attempt to assemble all available information on *A. Heterophyllum*, such as

its botanical, photochemical, pharmacological, and toxicological properties. *A. Heterophyllum* is a medicinal herb used in the traditional Indian medicine system known as the Ayurvedic system. It has many pharmacological properties, such as its alexipharmic, anodyne, anti-atrabilius, anti-flatulent, anti-periodic, anti-phlegmatic, carminative, anti-oxidative, anti-inflammatory, and expectorant properties, but in nature, most species of aconitum are extremely toxic due to the presence of certain phytoconstituents. *A. Heterophyllum* is the intoxicating source of the phytochemical constituents that are responsible for its pharmacological activities. This plant has medicinal value, as has been proven through the history of this ancient formulation.

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