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# Mycorrhiza! A potential natural booster to the phytoconstituent (β-asarone) of *Acorus calamus*

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**Abstract**
*Acorus calamus* commonly called Vekhand or Sweet flag is an aromatic plant belonging to family Acoraceae. It has many useful phytoconstituents used for various ailments like fever, constipation, etc. One of them is β-asarone which is a volatile oil present in upmost amount in the rhizome of *Acorus* which has many pharmacological effects like neuroprotective, analgesic, anti-depression, anti-cancer etc. Arbuscular mycorrhizal fungi (AMF) have shown evidence that it can enhance the phytoconstituents quantitively without having side effects on the plants. Our article tries to suggest whether mycorrhiza can play a vital role on the phytoconstituent (β-asarone) of *Acorus calamus*.

**Keywords:** *Acorus calamus*, β-asarone, mycorrhiza

## 1. Introduction
Systematic Position
Division- Spermatophyta
Class- Monocotyledonae
Orde- Acorales
Family- Acoraceae
Genus- *Acorus*
Species- *Calamus*

*Acorus calamus* is a perennial plant native to Central Asia and Eastern Europe, and is indigenous to the marshes of the mountains of India. In India, it is mostly found in the states of Himachal Pradesh, Manipur, and Tamil Nadu etc. [1].
It is a hairless herb that is up to 2 metres in length and mainly used parts are leaves, and a creeping rhizome. Leaves are bright green in colour having wavy margins and thickening in the middle. Rhizome (Root) is pale yellow to pinkish brown in colour with large leaf scars on it. Both leaves and rhizome have been used in Ayurveda for the treatment of various skin diseases and also as anti-diabetic, anti-pyretic etc. [2].
These contain a range of phytoconstituents such as β-asarone, α-asarone, monoterpenoids, tannins, saponins, sugars such as fructose and glucose, methylisoeugenol, flavonoids etc. [3].

## 1. β-asarone
β-asarone is a volatile oil present abundantly in the leaves and the dried rhizome of the *Acorus* plant. It is a yellow-coloured liquid with a boiling point of around 260-270 ºC with various pharmacological properties like anti-cancer, anti-fungal etc.

### 1.1 Anti-cancer [4]
β-asarone oil was tested on the human glioblastoma U251 cells, a type of malignant brain tumor. Glioblastoma is characterized by rapid growth, increased formation of blood vessels and the test carried showed that the cells treated by β-asarone underwent apoptotic and necrotic death.
This concluded that β-asarone can act as an anti-cancer agent.

### 1.2 Anti-fungal [5]

Another experiment was done on different fungal pathogens (*in vitro*) using β-asarone oil. This oil was tested in the form of BMCDEP (β-methyl cyclodextrin encapsulated powder). The results showed that at 30 ppm, BMCDEP showed antifungal activity against *P. capsici* while at 200 ppm it was able to 50% inhibit *S. rolfsii*. Several other fungi were also 60% inhibited at 300 ppm.

This proved that β-asarone can act as an anti-fungal agent.

## 2. Experimental methods of extraction of beta-asarone

Many methods have been used to extract beta-asarone from *Acorus calamus* but one of the convenient methods employed was by [6] from Uttar Pradesh, India. They used the rhizomes of *Acorus calamus* which were air dried. Oil extraction was carried using hydro-distillation method. This was then subjected to dehydration over anhydrous sodium sulphate and was stored at 4 ℃. The collected oil was then run on a glass column containing silica gel. Solvent used were Petroleum ether: Chloroform and the oil was run till a spot of maximum intensity was formed on the column. The spot was then forwarded for spectral analysis.

## 3. Mycorrhiza

Mycorrhiza has been one of the most useful fungi present in this world found in about 80 percent of plants which helps plants by symbiosis [7].

The term 'mycorrhiza' was first used by Professor A.B. Frank in the 1880's. He was the first person to describe the mutual relationship between trees and fungi, which he named 'mykorhiza'.

They are found in a wide range of habitats that include deserts, lowland tropical rainforests, high latitudes and altitudes.

There are usually 2 types of mycorrhizas found i.e., ectomycorrhiza and endomycorrhiza. The former refers to the fungi present on outside of the plant while the latter means the fungi present inside the plant [8].

As it forms a symbiotic association with the plant, the fungal partner gets benefitted generally by the net movement of carbon and phosphorus from the plant and in return the associated plant receives protection from pathogenic attack, drought resistance and increased nutrient supply.

Also, mycorrhiza have shown proof that it can enhance certain important properties of the plant naturally.

### 3.1 Some experiments on mycorrhiza

[9] From University of Delhi experimented on plants like *Bacopa monieri*, *Centella asiatica*, and many more and inoculated them with mycorrhiza and were allowed to grow for few months. Afterwards on calculating the amount of phytoconstituent, it showed that every phytoconstituent of each plant under consideration showed increase in quantity by a significant margin.

The control for phytoconstituent Bacoside A3 of *Bacopa monnieri* was 0.24% which on applying mycorrhiza increased to 0.65%.

Similarly, control for phytoconstituent Brahmic acid of *Centella asiatica* was 0.59% which increased to 1.49%.

This showed that mycorrhiza can act as a quantitative enhancer for plants.

### 3.2 Mycorrhiza as a qualitative booster

Mycorrhiza also helps in enhancing the quality of plants. For example, AMF-colonized strawberries showed increased levels of secondary metabolites which resulted in enhanced antioxidant property [10] have reported that this association of mycorrhiza with plants enduring drought condition enhance their osmosis process and also increased stomatal regulation.

AMF also helped in extreme salinity for *Antirrhinum majus* plants by increasing water potential and growth rate.

Another experiment was conducted by [11] to examine the impact of arbuscular mycorrhizal fungi on quality and yield of two genotypes of durum wheat (*Triticum durum* L.). They concluded that not only the root colonization of arbuscular mycorrhizal fungi increased but also enhanced lipids and seed quality.

Arbuscular mycorrhizal fungi also enhance quality of certain minerals like zinc and phosphorus.

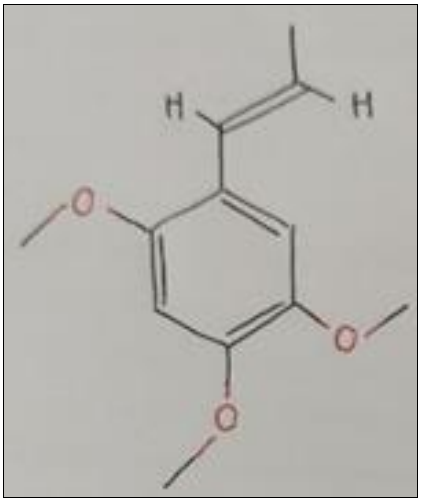


**Fig 1:** Chemical structure of β-asarone

## Conclusion and Discussion

We know that beta-asarone is very useful due to presence of their anti-fungal, anti-cancer properties etc. But the amount produced by the *Acorus* plant is very low. If we somehow use natural quantitative boosters like arbuscular mycorrhiza fungi (AMF) which can aid in increasing this valuable oil significantly, then it can prove vital in treating various ailments without having any side effect on the plant. Also, there is a much bigger scope in research if mycorrhiza can somehow enhance the quality of beta-asarone.

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