INTRODUCTION

Mother earth has bestowed to the mankind and various plants with healing ability for curing the ailments of human being. This unique feature has been identified since pre historic times. The WHO has also estimated that 80% of the world population meets their primary health care needs through traditional medicine only. It is a most valuable plant in the medical science almost throughout the India. In Ayurvedic science the use of sweet flag is effective against wide varieties of illness. This plant showed anti-spasmodic, carminative and anthelmintic properties. The rhizomes of this plant is used in the number of ailments like epilepsy,
mental ailments, chronic diarrhea, dysentery, bronchial catarrh, intermittent, fevers and glandular, abdominal tumors, kidney and livers troubles, rheumatism, sinusitis and eczema. It is a highly valued herb because it acts as a rejuvenator for the brain and nervous system. In small doses it reduces the acidity in stomach and used in the treatment of anorexia nervosa while large doses causes nausea and vomiting. A number of active constituents form leaves, rhizomes and essential oils of A. calamus have been isolated and characterized, of the constituents, alpha and beta-asarone are the predominant bioactive components. Number of plant products with the useful bioactive properties is increasing rapidly as an outcome of several ongoing research programs on investigation of biological activities of a number of plants. Therefore, we report here the anti-bacterial and anti-fungal properties of this fraction which contain beta asarone assay major component according to proton nuclear magnetic resonance spectroscopy ($^1$H NMR).

**Plant Profile:**
*Acorus* is a genus of monocot flowering plants. This genus was once placed within the family Araceae (aroids).

**Scientific Classification:**
Kingdom…………………. Plantae  
Subkingdom………………Tracheobionta  
Super division……………..Spermatophyta  
Division.....................Magnoliophyta  
Class.........................Liliopsida  
Sub class....................Arecida  
Order..........................Arales  
Family..........................Araceae  
Species......................Calamus  
Genus..........................Acorus

**Vernacular Names:**
Tamil: matali, mattiri, mattirikam.  
Hindi: gorbacc, gorbach,  
Telugu: vadaja, vasa, wasa  
Marathi: Vekhand  
English: sweet flag, sweet grass, sweet rush, sweetroot

**Description:**
Sweet flag or buch plant is a grass-like, rhizome forming, perennial that can grow to 2 meters high, resembling an iris. This plant found in the wet areas like ponds, lakes and ditches. It consists of long creeping roots which spread out just below the surface of the soil. It is mostly common with the cat tail. The leaves are thick, erect and are very similar in appearance to the iris but edges are crimped. The flower is very rarely grown in this plant if grown than it is 3-8cm long, cylindrical in shape greenish brown in color and covered with the multitudes of rounded spikes. The fruits are small and berry-like containing few seeds. Flowers are grown from early to late summer depending on the latitude. The flowers are small, sessile and densely packed and 5-10 cm of spadix on all sides.
The leaves are free, alternate, green and wavy. 1-3 seeded having thin test which is cylindrical in shape and green in color. Flowering and fruiting occurs in July- August; fruiting very rare.
The dried rhizome of *Acorus calamus* contain the yellow aromatic volatile oils having asarone as a main constituent which contains the small quantity of sesquiterpenes and its alcohols; the rhizome also contains the choline, flavone, acoradin, galangin, acolamone, isocolamone and aerial parts of plant contains lutcolin-6,8-c-diglucoside; chemical constituents vary in ecotypes and polyploides. asarone is a genotoxic substance causing genetic mutation and tumors. Phenylpropanoid promotes defense mechanism in herbivores and ultra violet ray’s protection.
It is also active in inducing the liver tumors. Other constituents are alpha pinene, cineole, limonene, terpineol, azulene, eugenol, camphene, cadinene, menthol and camphor (Figure No.1). The Asia varieties contain the varying amounts of amounts of beta asarone which causes the more sedate feeling after ingestion while European varieties yield sesquiterpenoids which is psychoactive agent and having good medicinal properties.

**MATERIAL AND METHOD:**

**Plant material collection**

Plant material was collected from wild population around velimalai, kallakuruchi district and also available in other medicinal plants like *tinospora cordifolia*, *gotukola*, *ashwangandha* etc. Collected plant material was washed in running fresh water and dried under shad at room temperature and whole plant were size reduced to coarse granules.

**Requirements**

- Chemicals - Ethanol and water
- Instruments - 1000ml Beaker and stirrer.

**Preparation of extract:**

The extract were prepared by using maceration method, when the 100gm of powdered crud drug was macerate with alcohol 350ml for one week and finally extracting the crud drug. When the same process for the aqueous extract of the crud drug is prepared. The 100gm of crude powdered drug was soaked in a beaker by using 350ml distilled water for one week day by day shaking and finally prepared the extract. This maceration method is simple, easy to handle and economically chief, extraction process is easy and activity produced quickly.

**Phytochemical Screening:**

The phytochemical test of whole plant extract of *Acorous calamus* was studied and reported in the following Table No.1.

**Pharmacological studies:**

- Methanolic extract of *Acorus calamus* showed analgesic effect on the rat in a study done through the Writhing response and rat caudal immersion method while the anticonvulsant effect was studied through the Pentylenetetrazol induced seizures method. The studies showed that *Acorus calamus* roots have significant anti-inflammatory and anti-convulsant activity.
  - The anti-spasmodic and anti-diarrhoal activity of *Acorus calamus* was studied. In the study, jejunum was isolated from the rabbit and further effect of crude extract was evaluated. It was found that plant extract causes the spontaneous inhibition of high K (+) induced contractions which resulted in spasmolytic activity which is mediated through the calcium channel blockade.
  - Peroxidase activity of leaves extract of *Acorus calamus* was evaluated. The leaf extract protein of *Acorus calamus* was purified through the chromatography and peak giving fractions were tested for the anti-fungal activity by gel filtration using Superose 12 10/300 GL column. Through leaves of the plant peroxidase enzyme activity was observed in the lumen of the xylem and vessels.
  - Study of *Acorus calamus* was done for inducing neurotoxicity against acrylamide for increasing the activity of corpus striatum while dopamine receptors decreased. These neurobehavioral changes are occurring by ACR (acrylamide) for the treatment of diseases with the *Acorus calamus* rhizome.
  - Effect of *Acorus calamus* on acetaminophen induced toxicity in rats for anti-hepatotoxic and anti-oxidant activities was studied. It was seen that the effect of ethanol extracted *Acorus calamus* confer the hepatoprotective and anti-oxidant activities by biochemical and pathological observations against acetaminophen induced liver injury in rats.
  - Anti-cancer activity of *Acorus calamus* rhizomes was evaluated. In this study, hydro alcoholic extract of *Terminalia chebula*, rhizome of *Acorus calamus* and root of *Glycyrrhiza glabra* was prepared and further their anti-proliferative activity on anti-cancer cell was studied. Results predict the fact that all of these plant materials have significant anti-proliferative activity.
  - Anti-cellular and immunosuppressive potential of ethanolic extract of *Acorus calamus* was evaluated. The ethanolic extract of *Acorus calamus* rhizome...
showed anti proliferative and immunosuppressive properties. This extract causes the tumor necrosis which inhibits the proliferation of mitogen, antigen stimulated peripheral blood mononuclear cells in humans, nitric oxide and interleukins-2.

- The methanol and acetone extract of *Acorus calamus* leaves was evaluated for their CNS activity in mice. They showed the spontaneous locomotors activity for immobility by time using through forced timed swim test, diazepam induced sleeping time and motor impairment assessment using Rota rod for CNS depression/ analytic activity of ACME and ACAE in mice.

- *In vitro* and *in vivo* releasing alpha glycosidase inhibitory activity of ethyl acetate fraction of *Acorus calamus* was studied. The effects of serum glucose were detected in the fasted and amylum challenged normal mice. They used *Acorus calamus* extract for *in vivo* studies and found suppression in blood glucose level after the 2g/kg glucose loading in the normal mice. *Acorus calamus* extract had the hypoglycemic effects and glycosidase inhibition and improves the postprandial hyperglycemia and CVS complications.

- The reversal neurotoxicity of *Acorus calamus* in mice was studied which is induced with the phenytoin and Phenobarbital. The administration of *Acorus calamus* at ED50 dose of phenytoin markedly potentiated the anti-convulsant activity of phenytoin. The main reason is that the combination of *Acorus calamus* with phenytoin does not show any significant effect on the PTZ (pentylentetrazole) induced convulsions.

- The effect of acetone extract of *Acorus calamus* in albino rat for their anti-inflammatory activity was studied. Anti-inflammatory activity was evaluated using paw edema model induced by formaldehyde injection in the male rat. The inflammatory effect was completely diminished and the normal status of paw was achieved when 25-75% acetone extract was tested against inflammation in male rat within 30 minutes.

- One study showed that *Acorus calamus* possesses the ability for preventing the development of FeCl induced epileptogenesis by modulating antioxidan

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**RESULTS:**

**Test microorganisms and methods:**

**Antibacterial activity study report:**

**Name of the organisms used for the study:**
- *Bacillus subtilis* - Gram positive
- *Klebsiella pneumonia* - Gram negative

**Method:**

The antibacterial activity of test sample was carried out by disc diffusion method. The target microorganism were cultured in Nutrient broth and incubated for 24 hrs. The Petri dishes containing Nutrient agar (NA) medium were cultured with diluted bacterial strain. The prepared discs were placed on the culture medium. Test sample (100, 150, 200, 250, 300, 350 µg) was injected to the sterile disc. Standard drug Streptomycin (20µg) was used as a positive reference standard to determine the sensitivity of microbial species tested. Then the inoculated plates were incubated at 37 °C for 24 h. The diameter of the clear zone around the disc was measured and expressed in millimetres as its antibacterial activity.
DISCUSSION:
Preliminary phytochemical screening of the extracts of *Acorus calamus* showed that presence of Flavonoids, Glycosides, and Tannins in ethanolic and aqueous extract. Flavonoids, steroids are present in ethanolic extract only, and protein, Amino acids present only in aqueous extract. The antibacterial studies shows, the ethanolic extract of *Acorus calamus* at 2000µg concentration exhibit mild activity against gram negative bacteria *K.pneumonia* same the 1000µg concentration exhibit the gram positive bacteria *Bacillus subtilis* and the aqueous extract of *Acorus calamus* does not show the any activity against gram positive and gram negative bacterial strains.

Table No.1: Phytochemical screening of whole plant extract of *Acorous calamus*

<table>
<thead>
<tr>
<th>S.No</th>
<th>Phytochemical test</th>
<th>Whole plant extract of <em>Acorous calamus</em></th>
<th>Ethanol</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Flavonoids</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Glycosides</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>Steroids</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>Saponins</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td>Tannins</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>Proteins</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>8</td>
<td>Amino acids</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

(+ indicate presence (-) indicate absence

Table No.2: Various Pharmacological properties of *Acorus calamus* and its active constituents were studied by many researchers given in the following

<table>
<thead>
<tr>
<th>S.No</th>
<th>Activity</th>
<th>Active compound or extract</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Antifungal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Epidermophyton floccosum, Microsporum gypseum,</em></td>
<td>Essential oil</td>
<td>Jatisatiener and Jatisatiener (1999)</td>
</tr>
<tr>
<td></td>
<td><em>Trichophyton mentagrophytes</em> and <em>T. rubrum,</em></td>
<td>Ethanol extract</td>
<td>Chantawannakul et al. (2005)</td>
</tr>
<tr>
<td></td>
<td><em>Ascosphaera apis,</em> <em>Aspergillus oryzae,</em> <em>A. nidulans,</em> <em>A. fumigates,</em> <em>Penicillium aculeatum,</em> <em>Phomopsis destuctum.</em></td>
<td>Ethanol oil</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>Antibacterial</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Aeromonas hydrophila</em></td>
<td>Essential oil, alpha_-asarone, beta_-asarone</td>
<td>Bhuvaneswari and Balasundaram (2006)</td>
</tr>
<tr>
<td>3</td>
<td><strong>Anti-inflammatory/immunomodulatory</strong></td>
<td>Leaf extract</td>
<td>Kim et al. (2009)</td>
</tr>
<tr>
<td></td>
<td>Anti-inflammatory effect in human HaCaT cells</td>
<td>Ethanolic extract</td>
<td>Mehrotra et al. (2003)</td>
</tr>
<tr>
<td></td>
<td>Immunomodulatory activity in human PBMCs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>Antioxidative/protective effect</strong></td>
<td>Ethanolic extract</td>
<td>Palani et al. (2010)</td>
</tr>
<tr>
<td></td>
<td>Antioxidant and nephroprotective effect in male albino rats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><strong>Antioxidant activity</strong></td>
<td>Ethyl acetate extract, Hydroalcoholic extract, _- and _-asarone</td>
<td>Acuna et al. (2002), Shukla et al. (2006)</td>
</tr>
</tbody>
</table>
BETA –ASARONE

ACORADIN

CHOLINE

CAMPHENE

AZALENE

CINEOLE

LIMONENE

GALANGIN

Figure No.1: Chemical Constituents
Figure No.2: Anti-bacterial activity of Ethanolic Extract

Figure No.3: Anti-bacterial activity for Aqueous Extract
### Table

<table>
<thead>
<tr>
<th>S.No</th>
<th>Sample</th>
<th>Zone of Inhibition (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B. subtilis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>250 µg</td>
</tr>
<tr>
<td>1</td>
<td>A.C ethanol extract</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>A.C aqueous extract</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Streptomycin (20 µg)</td>
<td>22</td>
</tr>
</tbody>
</table>

### CONCLUSION

*Acorus calamus* Linn., is a traditional plant used to cure many disease. We recommend that further studies are need about this plant to find out the various medicinal properties.

### ACKNOWLEDGEMENT

We gratefully acknowledged to our beloved Chairman Dr.K.Varadharajen., Vice chairman Mr.John Ashok Varadharajen and Our Principal, Professors, and others of Thanthai Roever College of Pharmacy who support to carry out this work successful.

### BIBLIOGRAPHY

12. Saxena *et al*. has reported repellency and feeding deterrent of neem oil to brown plant hooper Nilaparvata lugens, 1981.