

Lesson no. 28 Sweet Flag



Sweet flag has been since long an item of trade in many cultures for centuries. It has been used medicinally for a wide variety of ailments, such as gastrointestinal diseases and treating pain, and its aroma makes calamus essential oil valued in the perfume industry. The essence from the rhizome is used as a flavor for foods, alcoholic beverages, and bitters in Europe. It was also once used to make candy. Sweet flag has a very long history of medicinal use in Chinese and Indian herbal traditions. The leaves, stems, and roots are used in various Siddha and Ayurvedic medicine and by the Sikkim of Northeastern India. Sweet flag is one of the most widely and frequently used herbal medicines among the Chipewyan people. In Latin it is called as *Acorus calamus* (botanical name) & belongs to Acoraceae family; sweet flag grows in India, central Asia, southern Russia and Siberia, and Europe. Habitats include edges of small lakes, ponds and rivers, marshes, swamps, and wetlands.

Sweet flag and products of it (such as its oil) were banned from use as human food or as a food additive in 1968 by the United States Food and Drug Administration. Although limits on consumption in food or alcoholic beverages (115 micrograms per day) were recommended in a 2001 ruling by the European Commission, the degree of safe exposure remained undefined. Although calamus has been used for its fragrance and ingested, it has not been studied by rigorous clinical research. Individual medical reports of toxicity mention severe nausea and prolonged vomiting over many hours following oral uses. Laboratory studies of its extracts indicate other forms of toxicity, due mainly to the emetic compound β -asarone.

It is mentioned in Hadith that it was applied on bread & Ihraam by Prophet Muhammad ﷺ & also applied on His blister & did Dua to Allah saying " Who makes big things smaller & makes small things bigger" "Make

small that what I have" (means the blister) after applying it on blister Please read my English Tibb e Nabawi book lesson no. 49 page 142 onwards; or visit my website www.tib-e-nabi-for-you-com or direct link on website <http://www.tib-e-nabi-for-you.com/zarira.html>

- **NAMES:**

1. In Hadees it is called as Zarirah (ذريرة)
2. In Arabic it is called as Tharirah.
3. In Sanskrit it is called as Vacha.
4. In Urdu & Hindi it is called as Bahi.
5. In English it is called as Sweet flag, Bitter pepper root, Calamus.
6. In Latin it is called as Calamus aromaticus.
7. It belongs to Acoraceae family.
8. Its botanical name is Acorus calamus.

It is mentioned in following books of Hadith (names of book of Hadith & reference are also given) are Bukhari : 5930; Mustadrak Al-Hakim : 7463 & Majma Al-Zawaid 8350.

Two very famous Islamic scholars of medical science of their time said 1. Ibn Al-Qayyim says that sweet flag (ذريرة) (Zarirah) is an Indian medicine, which is made from the reeds of sweet flag (ذريرة) (Zarirah). It is beneficial for swelling in stomach, liver, hydrocephalus, it strengthens the heart & it has pleasant fragrance. 2. Ibn Sina says that there is nothing better for burns than sweet flag (ذريرة) (Zarirah) mixed with rose water and vinegar. The reeds of it are gentle, slightly astringent, and pungent & remove swelling.

- **Basic encyclopedia of Sweet flag: -**

There are three cytotypic forms distinguished by chromosome number: 1) a diploid form ($2n=24$), 2) infertile triploid form ($2n=36$), and 3) tetraploid form (we will learn this). The triploid form is the most common and is thought to have arisen relatively recently in the Himalayan region through hybridisation of the diploid with the tetraploid means hydride from 2nd & 3rd cytotypic form.

Botanical name of diploid is Acorus americanus also called Acorus calamus var. americanus; it is found in northern subarctic North America and scattered disjunct areas throughout the Mississippi Valley and in Mongolia, central Siberia (Buryatia), Gilgit–Baltistan in Pakistan (claimed by India) and northern Himachal Pradesh in India. It contains only traces of β -asarone in its rhizome essential oil.

The triploid form is botanically called as Acorus calamus var. calamus (also known as var. vulgaris or var. verus) has now been introduced across Europe, Australia, New Guinea, South Africa and North America. The triploid cytotype (var. calamus, $3n = 36$), present in Central Europe and Kashmir, contains 9–13% of β -asarone.

The tetraploid form botanically is called as Acorus calamus var. angustatus & is native throughout Asia, from India to Japan and the Philippines and from Indonesia to Siberia. It contains 70–96% of β -asarone (Röst 1979; Hanelt et al. 2001). Taste is astringent, bitter, pungent.

- **Sweet flag plant: -**



Sweet flag is herbaceous perennial (Herbaceous plants in botany, frequently shortened to herbs, are vascular plants that have no persistent woody stems above ground. Herb has other meanings in cooking, medicine, and other fields) 2 m (79 in) tall plant; the sweet flag plant can be distinguished from iris family plants and other similar plants by the crimped edges of the leaves, the fragrant odor it emits when crushed, and the presence of a spadix (as shown in the above picture) (In botany, a spadix is a type of spike inflorescence having small flowers borne on a fleshy stem). It is a semi aquatic plant and is

cultivated in damp and marshy places. It is found in Holland, North America, most of the European countries, Central Asia, India and Burma. In India it is found in Manipur, Himalayas and Naga hills and on the edges of lakes and streams. The rhizomes of the plant is used to cure various diseases such as sedative, stomachic, aromatic, insecticidal, anti-inflammatory, aphrodisiac, antipyretic, insecticidal, carminative and many other diseases. It grows when grown in sandy, clayey and alluvial soil of river banks. It requires the pH ranging from 5 to 7. For sweet flag plantation, it requires water logged soil. To bring soil to fine tilth, first fields are watered well with mixture of FYM (Farm Yard Manure) and green leaf manure. Then ploughing is done two to three times. The land should be prepared before the onset of monsoon. The best time for planting the crop is March-April. The planting should be done in the month of July-August but the best time to plant the crop is second fortnight of June. Propagation is mainly done through rhizomes. The rhizomes are first cut into smaller pieces and then sprouted rhizomes are planted. For planting, use seed rate of 44400 per acre. When propagation is done through seeds then it is sown in greenhouse. First fill a tray with organic soil and then firmly press the seeds in soil. Moist the soil until it starts germinating. The germination takes place in around 2 weeks. Plant starts yielding by 6-8 months after sowing. Harvesting is done when the lower leaves dry and turns yellow in color as it indicates its maturity. Before harvesting the field should be partially dried so that digging will be easier. After harvesting, cleaning is done. After cleaning rhizomes are cut unto 5-7.5 cm of size. Then rhizomes are air dried and are beaten and rubbed. The rubbing is done 2-3 times. After rubbing, packing is done for transportation. The useful products are made by processing such as extract, oil, powder etc.

- **Sweet flag leaves: -**



Its leaves resemble leaves of the iris family. Sweet flag consists of tufts of basal leaves that rise from a spreading rhizome; leaves are erect yellowish-brown, radical, with pink sheathing at their bases, sword-shaped, flat and narrow, tapering into a long, acute point, and have parallel veins. The leaves have smooth edges, which can be wavy or crimped. Only plants that grow in water bear flowers. The solid, triangular flower-stems rise from the axils of the outer leaves. A semi-erect spadix emerges from one side of the flower stem. The spadix is solid, cylindrical, tapers at each end, and is 5 to 10 cm in length. The spadix is densely crowded with tiny greenish-yellow flowers. Sweet flag found in Eurasia & North America leaves grow to 5 feet long & have elliptical spadix of 4 inches; this species are evergreen & have slow spreading underground rhizomes.

- **Sweet flag inflorescence: -**



It grows on outer leaves in the form of a spadix without a spathe; this leaf is triangular in cross-section at the approximate mid-point of the leaf, and at that point a solitary dense 2 to 4 inch long pointed spadix angles outward and the remainder of the leaf then partially encircles this spadix, then flattens and extends upward like the other leaves. The spadix is solid, cylindrical, tapers at each end, and is 5 to 10 cm in length. A covering spathe, as is usual with Araceae, is absent. The spadix is densely crowded with tiny greenish-yellow flowers.

- **Sweet flag flower: -**



The spadix is packed with tiny 6-parted yellowish-green flowers. These are arranged in a diamond pattern and each flower has a perianth of 6 divisions with 6 tepals (petal and sepal combined) enclosing a large green 3-celled ovary. Around the ovary are 6 stamens. The tepals can be a light brown in color, are very small with squarish tips; anthers of the stamens are yellow. In North America *A. calamus* is sterile and *A. americanus* is fertile. A test is that the pollen grains of the latter will stain deeply in aniline blue whereas those of the former do not. In England *A. calamus* does fruit. Only plants that grow in water bear flowers. The solid, triangular flower-stems rise from the axils of the outer leaves. In Europe, it flowers for about a month in late spring or early summer, but does not bear fruit.

- **Sweet flag fruit & seeds: -**



The fruit of the *Acorus americanus* species is a brown to reddish berry, full of mucus, with, usually, 6 embedded seeds; which when ripe falls into the water and disperses by floating. In Asia, it also fruits sparingly, and propagates itself mainly by growth of its rhizome, forming colonies.

- **Sweet flag rhizome: -**



The branched, cylindrical, knobby rhizome is the thickness of a human finger and has numerous coarse fibrous roots below it. The exterior is brown and the interior white. The rhizome is used to cure various diseases & conditions as has properties as anti-inflammatory, anti-bacterial, aphrodisiac, antipyretic, carminative, aromatic, insecticidal, sedative, stomachic etc.

pH, calories, glycemic index & glycemic load does not matters a lot because sweet flag is used as medicinal dose & never taken in bulk quantity.

- **Gross health benefits of rhizome & leaves & other parts: -**

It is helpful in Stomach disorders, it stimulates blood circulation, combats tobacco addiction, helpful in mouth disorders, insomnia, helps in increasing appetite, reduces cough & fever, reliefs skin disorders, asthma, impotency, prevent infections, enhances memory, relief respiratory disorders, intestinal worms, arthritis, epilepsy; sweet flag is useful against the treatment for cough and cold. It can also have positive effects against respiratory disorders like bronchitis; It can be a body coolant and used against dyspepsia, and vomiting. The rhizome of Sweet flag has sedative properties; it can have a depressing effect on the central nervous system.

Hence, it is an essential ingredient in Ayurvedic medicines used for the treatment of psychosomatic disorders like epilepsy. Acorus calamus roots are one of the main components of pills used against snake bites. Sweet flag plants are used externally for the treatment of inflammation in rheumatoid arthritis, osteoarthritis and paralysis.

- **Clinical pharmacology of it: -**

In India, Acorus Calamus is extensively used as a home remedy for baby colic, diarrhea and stomach pain. It can have a positive influence on children suffering from diarrhea and stomach ache. It helps to cool the stomach and promotes healing. A paste made of sweet flag roots and honey is also given to children suffering from stomach pain and intestinal worms. Root of sweet flag is an excellent remedy for many of the digestive disorders. It can have a soothing influence in the stomach and reduces the formation of gas and intestinal worms. A mixture of sweet flag roots and honey is good for stomach pain caused due to gas and indigestion. This mixture is given to children for body heat and better bowel movements.

Sweet flag has been screened for various pharmacological activities. It has significant action on CNS as it is a potent CNS active botanical 653 anti-convulsant, sedative, hypnotic, tranquilizing, and memory enhancing; it also has effective acetylcholinesterase inhibitory, antispasmodic, antimicrobial, anti-inflammatory, anti-helmintic, and insecticidal effects. The various pharmacological activities of it are sedative and hypnotic effect; the volatile oils showed potentiation of the sedative activity of pentobarbitone in mice. The active principle responsible for the activity resided in the hydrocarbon fraction of the oil or in an oxygenated component out of various fractions of the oil (Dandiya et al., 1959a). The steam volatile fractions prolonged the sleeping time in mice with pentobarbital, hexobarbital, and ethanol. The sedative potentiating activity was highest in the volatile fraction of the petroleum ether extract (Dandiya & Cullumbine, 1959). Pretreatment of mice with lysergic acid diethylamide (LSD) partly prevented the hypnotic potentiating action of the volatile oil (Dandiya et al., 1959b).

- **When not to use sweet flag/ contraindication: -**

Pregnancy: -

Avoid using this herb when a woman is pregnant or she is breast-feeding her baby. It might not be safe for the child in womb or the infant

Before or after Surgery: -

Sweet Flag acts on the central nervous system and promotes sleep. This could act negatively if taken after surgery with other medications which have similar effects. It is best to avoid this herb 2 week before and 2 week after surgery.

Depression Medications: -

Do not take this herb with medication for depression. Most of the depression medicines do not go well with it.

Sedatives: -

Do not take it if you are taking any medication which causes drowsiness or makes you sleep (sedatives). This herb causes sleepiness and taking it along with other drugs which also have similar effects might not be good.

Acidity: -

Bach or Calamus might increase stomach acid. If you are suffering from G.e.r.d or acidity problem then it is best to avoid this herb.

- **Modern uses of it:**

Headache: Prepare a paste of the roots mixed in olive oil & apply it on the affected area.

Rheumatoid arthritis: Apply paste of the roots mixed in olive oil on the affected areas.

Cholera: Crush the roots. Boil one teaspoon of it in one liter water. Filter it. Drink 4 times a day. Alternate drink should be taken after a gap of 15 minutes.

Cough: Roast sweet flag root and make a powder out of it. Take a pinch of this powder and mix it with honey. Consume it 2 times a day or cut the roots into small pieces. Lick it. (Attention: Helps in increasing salivary functioning).

Indigestion: Make a decoction (tea) of the root powder. Let it stand. Drink 4 times a day or burn the root till it gets char. Grind to make powder. Take half teaspoon a day with lukewarm water.

Anorexia: Drink decoction (tea) of the root powder 4 times a day or consume half a pinch of the sweet flag root powder with 1 cup of warm water. It works well to cure anorexia.

Stomach upset: Drink decoction (tea) of root powder, 4 times a day.

Infection: Chew or lick small pieces of root.

Ulcer: Make fine powder of the roots. Sprinkle them over the affected area.

Wounds: take fine powder of the roots mix in olive oil & apply on wounds. It would heal the wound fast.

Whooping Cough: Take one tablespoon of sweet flag powder with honey twice a day.

Stomach Problems: Chew some small pieces of the sweet Flag root and swallow the nectar. It gives prompt relief. In chronic conditions the root can be chewed 3-4 times a day. Do not swallow the pulp.

Smoking addiction: Chew the dried root. It may cause mild Nausea.

Insomnia: Take 1lb. dried rootstock and add to 20 cups of water. Boil and then steep for 5-7 minutes. Strain and add to your bath water. It is good for a sound sleep.

Wounds, burns and Ulcers: Take one tablespoon rootstock of sweet Flag. Put into half cup of boiling water and steep for 5 minutes. Use externally for burns, wounds and ulcers.

Flatulence: Burn sweet flag root & mix it in coconut oil & apply & massage the abdomen for half an hour.

Asthma: Prepare a decoction of sweet flag root & take one teaspoon after every 4 hours.

Whooping Cough: Burn sweet Flag & collect the ash, take a pinch with honey daily.

Aphthous Ulcers: Take a small piece of sweet flag & rub it on affected area of mouth for 10 minutes.

Fitz Hugh Curtis: Add 3 g root powder in 1 tsp honey & have this mixture with a cup of warm milk.

Epilepsy: Tie the rhizome of sweet flag around waist in the form of an amulet.

Nervine: Consume 1 mg rhizome powder of sweet flag daily. It helps in strengthening our nervous system. (**Note:** More than 1 g consumption leads to Vomiting.)

Antimicrobial: Extract the sap of sweet flag root or purchase from market. Apply it on affected parts twice a day.

Ascaris: Take 5 ml extract of sweet flag root with lukewarm water.

Autism: Prepare a root decoction of sweet flag & have two tablespoon two times a day.

Cold: Add the powder of the roots in boiling water & Inhale the vapors for 3 to 5 minutes for fast relief.

Mouth Ulcers: Rub the root on the ulcer 2 to 3 times a day.

Speech Disorders: Mix powdered root of the sweet flag with honey. Apply this mixture on the tongue or prepare a decoction by adding 1 tablespoon of dried rootstock to 2 cups of water and boil for 5 minutes. Take 1 cup daily.

Aphrodisiac: Prepare a tea, made of sweet flag roots and one cup of water. Strain and drink it. It will increase your sexual potency.

Sore Throat: Take a piece of sweet flag root and break it into small pieces by pounding it in a mortar and pestle. Now, take a small piece and suck on it for 3 to 5 minutes. As the extract from the root enters our throat you will feel a good relief from sore throat.

Stammering: Powder the roots of sweet flag. Take a pinch of this powder and mix it with honey & consume it regularly; it will help in treating stammering disorders.

Throat Disorder: Consume regularly the root powder of sweet flag mixed with honey. It treats all throat related disorders.

Amnesia: Take the small pieces of roots of sweet flag and dry it in shade. Then grind them to make powder & consume this powder with warm milk daily in the morning and evening.

Tonsillitis: Apply the paste of ground sweet flag roots on the throat for 10-12 hours. It relieves inflammation.

Flatulence: Take black caraway, chamomile and sweet flag. Prepare a decoction & drink it two or three times a day.

Colic: A decoction of black caraway, chamomile and sweet flag is worth in case of colic.

Body ache: Take equal quantities of the roots of punarnava, bitter gourd, apamarga, utaran, wood apple, black pepper, garlic, harad, long pepper, sweet flag and cat Tail Plant. Add neem bark. Grind them & then boil them properly with sesame oil. Apply it on the affected part.

Blood Impurity: Take the roots of sweet flag & coat it with thick layer of turmeric. Dry under the sun. Roast it over flame until the surface gets blackened. Remove from the fire. Grind it to make fine powder. Store it. Take one gram twice a day. Use it for 21 days.

Colic: Burn the roots of sweet flag. Mix the ash with castor oil. Apply it over the lower Abdomen. (**Note:** You can also use coconut oil instead of castor oil.)

Flatulence: Mix the ash formed by burning roots of sweet flag with castor oil. Apply it over the lower Abdomen. (**Note:** coconut oil can be used instead of castor oil).

Stomach problems: Apply the paste formed by mixing the ash obtained by burning roots of sweet flag with castor oil, over the lower abdomen. Apply it regularly until the symptoms go away. (**Note:** You may also use coconut oil in the absence of castor oil.)

Cough: Grind the roots of sweet flag to form powder. Mix quarter teaspoon of it with same quantity of Licorice powder. Add the mixture in 2 glass of water. Boil it. Cool it down. Take 4 teaspoon thrice a day. (**Note:** You may also add honey for taste.)

Fever: Mix the root powder of both sweet flag and licorice in equal ratio. Boil this mixture in 2 glass of water. Cool it. Have it 4 times a day. (**Note:** You may add honey for taste.)

Stomach ache: Take quarter teaspoon root powder of each sweet flag and licorice. Boil it in 2 glasses of water. Cool it. Drink 20 ml thrice a day. (**Note:** Add honey as taste booster.)

Cough: Take the rootstock of sweet flag. Coat it with a layer of castor oil. Roast over the flame until it chars. Mix half teaspoon of ash obtained in same quantity of honey. Take thrice a day. (Attention: Best remedy for Cough in children.)

Diarrhea: Take half teaspoon root powder of sweet flag. Mix it with honey. Take it every morning on an empty stomach.

Fever: Mix honey with 2 pinches of sweet Flag root powder & lick it every morning on an empty stomach drink little water to clear the mouth.

Flatulence: Grind the dried roots of Sweet Flag to make a fine powder. Take a pinch of it and mix it with Honey. Take it every morning.

Indigestion: Take the paste formed by mixing root powder of sweet flag and honey in the morning.

Dysentery: Take equal amount of sweet Flag root, long pepper, black pepper, dried ginger, rind of chebulic myrobalan and rock salt. Grind them all to make fine powder. Take quarter teaspoon of the powder with lukewarm water or honey.

Indigestion: Grind equal amount of Sweet Flag's root, Long Pepper, Black Pepper, dried Ginger, rind of chebulic myrobalan and rock salt. Crush them all to make powder. Take a pinch of the powder with lukewarm water or Honey.

Rheumatism: Mix equal amount of sweet Flag root, long pepper, black pepper, dried ginger, rind of chebulic myrobalan and rock salt. Grind them to make powder. Take a pinch of the powder with lukewarm water or honey.

Stomach Rumble: Take equal quantity of sweet flag root, long pepper, black pepper, dried ginger and rind of chebulic myrobalan. Add rock salt in it. Grind it. Take 10 gram of the powder with honey.

Ear Discharge: Grind the roots of drumstick tree, sweet flag and garlic. Warm them in sesame oil. Use it as ear drop with a cotton bud.

Flatulence: Coat the rootstock of sweet flag with the layer of castor oil. Roast it over the flame until it gets black. Take half teaspoon of ash obtained with some hot water.

Ascariis: Roast the rootstock of sweet flag with the layer of castor oil over the flame until it gets black. Take half teaspoon of ash obtained with some hot water.

Flatulence: Take the castor oil coated rootstock of sweet flag. Roast it over the flame until it chars. Mix half teaspoon of obtained ash with dried ginger powder. Add some sugar in it. Take with a little water once in a day.

Baldness: Take 5 g root powder of sweet flag. Mix it with 10 g coconut milk. Apply this paste on the affected part. Let it dry for half an hour. Rinse it off.

Stomach Upset: Burn the roots of sweet flag. Mix a pinch of the ash obtained with honey. Have it once a day.

Syphilis: Take equal quantity of snow lotus, withania somnifera and sweet flag. Grind them to make powder. Mix it in some butter to make paste. Apply over the affected area. (Note: Use butter obtained from buffalo milk.)

Earache: Extract the juice of ripe yellow leaves of sodom. Take quarter teaspoon of it and add same amount of sesame Oil. Now, add quarter teaspoon of sweet flag powder, cinnamon, garlic and 2 teaspoon of asafoetida powder. Boil the mixture until it gets thick. Filter it through a piece of cloth. Cool it and use as ear drops.

Ear Discharge: Mix 3 g of each of sodom leaves juice, sesame oil, powder of sweet flag, cinnamon and garlic. Add 12 g asafoetida powder in it. Boil until it gets thick. Filter through a piece of cloth. Cool it and use as an ear drop.

Tonsillitis: Take equal quantity of licorice, sweet flag and zamzam water. Grind them together. Have a teaspoon with Honey once a day.

Toothache: Take equal quantity of black caraway and sweet flag. Powder them together. Keep one pinch on the affected tooth and press. Repeat every night and throw out in the morning.

Abdominal Diseases: Add 50 g root of sweet flag in 30 g licorice powder. Make its decoction. Drink 10 ml thrice a day.

Indigestion: Take equal quantity of sweet flag, asafoetida, aconitum heterophyllum, ginger, black pepper and long pepper. Grind them to make powder. Take 2 g of it with lukewarm water once a day.

Hysteria: Take 3 to 4 tablespoons spikenard root powder, 2 to 3 tablespoons sweet flag powder and 1 tablespoon Black Salt. Mix all the herbs together. Take half tablespoon of this mixture with 1 teaspoon honey three times a day. Repeat for 2 week to stabilize the nervous system and cure hysteria.

Throat Disorder: Take each and equal amount of 5 to 6 grams of powdered roots of asparagus racemosus, sweet flag and sida cordifolia. Consume it orally thrice a day.

Insanity: Take 1 to 2 grams of each liquorice, ginger dried powder, sweet flag, ashwagandha, and albizia lebbeck. Grind them to make powder. Consume 1 teaspoon of it with a glass of water. Repeat it daily for two times a day.

Epilepsy: Grind 1 to 2 grams of each licorice, ginger dried powder, sweet flag, ashwagandha, and albizia lebbeck to make a powder. Consume it with a glass of lukewarm water. Do this treatment twice a day to get best results.

- **Active components of it: -**

Calamus leaves and rhizomes contain a volatile oil that gives a characteristic odor and flavor. Major components of the oil are beta-asarone (as much as 75%) and alpha-asarone, saponin, lectin, sesquiterpenoids, lignans, and steroids. Beta-Asarone is the major constituent in the leaves (27.4 to 45.5%), whereas acorenone is dominant in the rhizomes (20.86%) Phyto-chemicals in the plant vary according to geographic location, plant age, climate, species variety, and plant component extracted. Diploids do not contain beta-asarone.

- **Contents/constituents of it: - each compound explained separately: -**

All contents may not present in all types of it, because there are many varieties of it according to geographical regions & content may differ a lot as per cultivation, soil, seed, climate etc.

Please note many compounds in sweet flag are present they are new compounds so detail may not be present in this article or very less detail is given due to less known & these compounds are under research.

According to Imam et al., 2013, photochemical studies have reported the presence of glycosides, flavonoids, saponins, tannins, polyphenolic compounds, mucilage, volatile oil and bitter principle. The plant has been reported for the presence of glucoside, alkaloid etc.

Its rhizome, leaves, root contents following: β - asarone, α - asarone, elemicine, cisoelemicine, cis and trans isoeugenol, camphene (2.27%), β - ocimene (3.28%), camphor (1.54%), calarene (1.42%), α - selinene (5.02%) and s- cadinol (2.00%), P- cymene, bgurjunene, β - cadinene, terpinen- 4- ol, aterpineol, calacorene, acorone, acorenone, acoragermacrone, 2- deca -4,7 dienol, shyobunones, linalool and preisocalamendiol, Acoradin, galangin, 2, 4, 5- trimethoxy benzaldehyde, 2, 5 dimethoxy benzoquinone, calamendiol, spathulenol, sitosterol, cadinane, guaiane, β -pinenes, myrcene, Para-cymene, α -terpinen, β -phellandrene, gammaterpinene, Terpinolene, Thujane and Limonene, Calamenone (a tricyclic sesquiterpene) as well as calamendiol and isocalamendiol (both sesquiterpenes) are occurs in the roots.

The other chemical components include α and γ -asarone, calamenene, asaronaldehyde, acorenone, calamenone, n-heptanic acid, calanendiol. The aromatic constituents namely asarylaldehyde in roots and asarone in leaves are responsible for the smell of volatile oil.

The other constituents are isoshyobunone (8.62%), bsesquiphellandrene (3.28%), preiso calamendiol (22.81%) and acorone (26.33%), Terpeneol, 2-Allyl-5-ethoxy-4- methoxyphenol, Epiudesmin, Lysidine, Spathulenol, Borneol, Furylethyl ketone, Nonanoic Acid, 2,2,5,5-Tetramethyl-3-hexanol, Bornyl acetate, Galgravin, Retusin, Octadecatrien-1- ol, Butyl Butanoate, Geranylacetate, Sakuranin, Acetic acid, Isoelemicin, a-Ursolic acid, Acetophenone, Dehydroabiatic acid, Isoeugenol methylether, Apigenin 4',7- dimethyl ether, dehydrodiisoeugenol, Linalool, Elemicin, Linolenic acid, isocalamendiol (12.75%). Monoterpene hydrocarbons, sequestrine ketones, (trans- or Alpha) Asarone (2,4,5-trimethoxy-1- propenylbenzene), and Beta asarone (cis- isomer) and eugenol.

The constituents of the essential oils in *Acorus calamus* are phenylpropanes, mono-terpenes, and thermolabile sesquiterpenoids other contents are calamen, clamenol, calameon, asarone; it also contains a bitter glycoside named acorine along with eugenol, pinene and camphene.

(Motley, 1994)-The volatile oil also has terpenoids calamine, calamenol, calamenone, eugenol, camphene, pinene and asaronaldehyde. Acorafuran is a new sesquiterpenoid found in Calamus oil Methyleugenol, cis-methylisoeugenol, β -asarone, geranylacetate, β -farnesene, shyobunone, epishyobunone and isoshyobunone are the most abundant chemical compounds which are present in 20% of the essential oil.

- **Asarone: -**

a-Asarone and b-asarone showed many pharmacodynamic actions similar to some well-established tranquilizers. a-Asarone and b-asarone significantly enhanced the anesthetic activity of pentobarbitone, hexobarbitol, and ethanol in mice. b-Asarone appeared to be more active (Sharma et al., 1961). The mechanism of tranquilizing action of a-asarone was also studied. a-Asarone was not found to cause any change in the noradrenaline content of whole brain of rat, and pretreatment of a-asarone failed to block the effect of reserpine on the spontaneous motor activity and ptosis of mice, as well as the conditioned avoidance response of trained rats. It was found that the sedative effect of a-asarone was dependent on the depression of the ergotropic division of the hypothalamus (Menon & Dandiya, 1967). b-Asarone administered in association with a cannabinomimetic drug was shown to potentiate some of the typical behavioral activities induced in animals by cannabinoids (Zanoli et al., 1998). a-Asarone reduced spontaneous motor activity and caused reduction in anxiety without dulling the perception in rats. It produced a prolonged calming effect in monkeys (Dandiya & Menon, 1964). a-Asarone also partially

antagonized tremorine-induced tremors in mice but was found to be inferior to atropine in this respect. The tranquilizing effect of α -asarone was responsible for its antagonism to mescaline and amphetamine, while the anticholinergic effect accounted for the partial protection offered to tremorine-treated mice (Dandiya & Menon, 1965).

- **Calacorene: -**

beta-Calacorene, also known as β -calacorene, belongs to the class of organic compounds known as sesquiterpenoids. These are terpenes with three consecutive isoprene units; beta-Calacorene is possibly neutral and 3,4-Dihydrocadalene, also known as (e)-calacorene or alpha-corocalen, belongs to the class of organic compounds known as sesquiterpenoids. These are terpenes with three consecutive isoprene units. 3,4-Dihydrocadalene is possibly neutral.

- **Saponin: -**

Saponins are glucosides with foaming characteristics. Saponins consist of a polycyclic aglycones attached to one or more sugar side chains. The aglycone part, which is also called sapogenin, is either steroid (C27) or a triterpene (C30). The foaming ability of saponins is caused by the combination of a hydrophobic (fat-soluble) sapogenin and a hydrophilic (water-soluble) sugar part. Saponins have a bitter taste. Some saponins are toxic and are known as saptotoxin.

Basic clinical pharmacology of saponin: -

It reduces cholesterol, LDL, increases testosterone, libido & muscle mass; it maintain balance between cellular proliferation & cell death the disturbances in the balance cause severe diseases like cancer etc; it is anti bacterial, anti oxidant, inhibit tumour growth.

- **Apigenin: -**

It is a natural flavonoid compound found in many fruits & vegetables serves multiple physiological functions.

Main sources of apigenin: -

It is present in onion, oranges, wheat, tea, grapes, parsley, thyme.

Basic pharmacokinetics of apigenin (based on human intake in natural food products): -

Its absorption, metabolism & excretion are yet not known & are under research.

Basic clinical pharmacology of apigenin: -

It calms the nerves, provides antioxidant effects, prevents & helps the body to fight cancer; it is anti-obesity; neuro-protective, help mood & brain function; reduces cortisol, blood sugar; improves bone, heart & skin health; promotes sleep. It is also anti bacterial, anti viral; reduces blood pressure.

- **Lignans: -**

It is among polyphenols, it is rich in omega 3 fatty acid (alpha linolenic acid). It has estrogenic activity in the process digestion, bacterias convert lignans into estrogenic like substance.

Main sources of lignans: -

It is present in cucumber, flax seeds, sesame seeds, cereals, soybean, broccoli, cabbage, apricot, strawberries.

Basic pharmacokinetics of lignans (based on human intake in natural food products): -

Its absorption, metabolism & excretion are yet not known & are under research.

Basic clinical pharmacology of lignans: -

It increases digestion, reduces high blood pressure, cholesterol, blood glucose; it is anti cancer, anti inflammatory, anti oxidant.

- **Calarene: -**

It is organic compound among tricyclic sesquiterpene; very less information regarding it is available now because it is under research.

- **Linolenic acid (ALA): -**

It is an omega 3 fatty acid, it essential fatty acid necessary for health & cannot be produced in human body, it is also called as ALA (alpha linolenic acid). It is the substrate for the synthesis of longer-chain, more unsaturated fatty acids eicosapentaenoic acid (EPA) & docosahexaenoic acid (DHA) required for tissue function.

Main sources of linolenic acid (ALA): -

Flax seed oil, rape seed oil, soybean, pea leaves, fish oil, evening primrose oil, vegetable oil, walnut, meat, grape seed oil.

Basic pharmacokinetic of ALA (based on human intake in natural food products): -

Same as omega 6

Basic clinical pharmacology of ALA: -

It is useful to prevent heart disease, control blood pressure, control cholesterol, prevents & reverse atherosclerosis, it is anti inflammatory, anti obesity, anti cancer, reduces fibro-adenoma, breast lumps, good & helpful for skin, nail, hair, brain, organs.

- **Ursolic acid (UA): -**

It is pentacyclic triterpenoid; it is widely present in peels of fruit, herbs like rosemary, thyme, vegetables, basil etc. It is anti inflammatory, anti oxidant, anti apoptotic, anticancer. UA-associated compounds include oleanolic acid, betulinic acid, uvaol and α - and β -amyrin; UA has the molecular formula $C_{30}H_{48}O_3$, a molecular weight of 456.70032 g/mol and a melting point of 283–285°C. UA can be dissolved in methanol, pyridine and acetone, but is insoluble in water and petroleum ether; UA and its derivatives exhibit potent biological and pharmaceutical effects. The anti-inflammatory effect of UA was linked to attenuation of production of pro-inflammatory cytokines including tumor necrosis factor α , interleukin; U A was associated with suppression of the nuclear factor- κ B (NF- κ B) pathway, inhibition of expression of cyclooxygenase-2 (COX-2) and nitric oxide synthase and the reduction of perhydrides including nitric oxide and hydrogen peroxide.

- **Heptanoic acid: -**

Heptanoic acid, also known as enanthic acid or heptylic acid, belongs to the class of organic compounds known as medium-chain fatty acids. These are fatty acids with an aliphatic tail that contains between 4 and 12 carbon atoms. It has a role as a plant metabolite. It is slightly soluble in water, but very soluble in ethanol and ether. It is under research.

- **Nonanoic acid: -**

Nonanoic Acid is a naturally-occurring saturated fatty acid with nine carbon atoms. Nonanoic acid is a C9 straight-chain saturated fatty acid which occurs naturally as esters of the oil of pelargonium. Has antifungal properties, and is also used as an herbicide.

- **Dehydroabietic acid: -**

Dehydroabietic acid (DAA) is a naturally occurring diterpene resin acid of conifers, such as pinus species (P. densiflora, P. sylvestris) and grand fir (Abies grandis), and it induces various biological actions including antimicrobial, antiulcer, and cardiovascular, anti-aging activities.

- **P-cymene: -**

It is a naturally occurring aromatic organic compound; it is insoluble in water, it has a mild pleasant odour; it floats on water; it is a hydrocarbon mono-terpene; it is present in many essential oils (mainly in cumin & thyme oil).

Main sources of p-cymene: -

Cumin oil, thyme oil, basil oil, carrot seed oil, clove bud oil, angelica root & seed oil, grape fruit oil, eucalyptus oil.

Basic pharmacokinetics of p-cymene (based on human intake in natural food products): -

It is well absorbed through skin; little excreted unchanged & remainder being oxidized to water-soluble metabolism.

Basic clinical pharmacology of p-cymene: -

It is anti inflammatory, reduces pulmonary oedema, it is used for flavouring cakes, beverages, confectionaries, fragrances etc; it is anti bacterial, anti fungal, analgesic, antioxidant, anxiolytic, anticancer, antinociceptive.

- **Cadinene:-**

Cadinene is the trivial chemical that occurs in a wide variety of essential oil-producing plants. The name is derived from that of the Cade juniper (Juniperus oxycedrus L.), the wood of which yields oil from which cadinene isomers were first isolated. Chemically, the cadinenes are bicyclic sesquiterpenes. It is anti-inflammatory & increase energy level; β -cadinene usually predominating, occur in several essential oils, species ylang-ylang, citronella and cade oil from Juniper subspecies Cadinene isomers are used as a

flavouring agent and/or flavour modifier; beta-cadinene is found in many foods, some of which are ginger, common oregano, sweet basil, and common thyme.

- **Farnesene:** -

The term farnesene refers to a set of six closely related chemical compounds which all are sesquiterpenes; it is found in alpha & beta form, both are similar with little difference but alpha is most common & found in apple coats, perilla oil; it is anti anxiety, anti spasmodic, calming, sedative, muscles relaxant, anti inflammatory, anti fungal, anti bacterial; it is used in cosmetics, perfumes etc. α -Farnesene and β -farnesene are isomers, differing by the location of one double bond. Beta-Farnesene, also known as (Z)- β -farnesene or β -cis-farnesene, belongs to the class of organic compounds known as sesquiterpenoids. These are terpenes with three consecutive isoprene units; beta-Farnesene is possibly neutral.

- **Selinene:** -

It is a group of isomeric chemical compounds amongst sesquiterpenes; it is found in 2 types alpha & beta; It is present in celery seed oil, marjoram oil etc; it is anti inflammatory, antioxidant, anti gout (increase uric acid). Alpha-selinene is an isomer of selinene where the double bond in the octahydronaphthalene ring system is endocyclic (2R,4aR,8aR)-configuration. It has a role as a plant metabolite. It is a selinene and a member of octahydronaphthalenes.

- **Ocimene:** -

It is a monoterpene & among group of isomeric hydrocarbons; it is often found naturally as mixture of various forms (in oil); it has pleasant odour sweet & herbaceous; it is used in perfumes making; it is insoluble in water, but soluble in common organic solvents; it is anti-fungal, anti bacterial, insecticidal; beta-ocimene that consists of octa-1,3,6-triene bearing two methyl substituent at positions 3 and 7 (the 3E-isomer). It has a role as a plant metabolite.

- **Pinene**

It is a bicyclic monoterpene chemical compound. There are two structural isomers of pinene found in nature: α -pinene and β -pinene. As the name suggests, both forms are important constituents of pine resin; they are also found in the resins of many other conifers, pine tree, maktur tree oil, lime fruit peel, as well as in non-coniferous plants such as camphorweed (*Heterotheca*) and big sagebrush (*Artemisia tridentata*). It is anti-inflammatory, bronchodilator, antianxiety, anti-pain etc.

- **Camphene:** -

It is a bicyclic mono-terpene, soluble in water; volatile in nature in room temperature; has a pungent smell. Please do not get confused with camphin & camphene, both are different; it has a role as a plant metabolite & a fragrance; it has structure as exactly 2 rings which fused to each other so called as bicyclic. It is present in dill, caraway, hyssop, fennel, camphor oil, citronella oil, thyme oil, ginger oil, cypress oil, thyme oil etc; it is used in medicine, fragrance, flavouring in food. It is absorbed through skin, inhalation & ingestion; it is anti fungal, anti microbial, antioxidant, analgesic, reduces lipids, anti viral, expectorant, anti septic, anti biotic, heals wounds, reduces swelling, headache, migraine etc. Its absorption, metabolism in under research & not known yet.

- **Limonene:** -

It is a chemical found in the peel of citrus fruits & other plants; it is used to make medicinal ointments, creams, to facilitate penetrate the skin, & also used in beverages, chewing gums, ready food & used as a flavouring agent.

Main sources of limonene: -

Citrus fruit & its peels, grapes, black caraway seeds, soda drink, citrus peel oil.

Basic pharmacokinetics of limonene (based on human intake in natural food products): -

It is completely absorbed in intestines & there is rapid excretion in urine & little in stools; very less is known about its absorption & metabolism.

Basic clinical pharmacology of limonene: -

It prevents cancers, weight gain, helpful in bronchitis, boosts immunity; it is antioxidant, anti-inflammatory, anti-tumour, improves gall bladder health, cleans out the sludge in gall bladder; good for skin, boosts metabolism, reduces stress, anxiety.

- **Myrcene: -**

It is a monoterpene & is an olefinic natural organic hydrocarbon; its aroma is earthy, fruity & clove-like; it is pungent, it synergizes activity of terpenes & it has a role as a plant metabolite etc.

It is present in wild thyme leaves, cannabis, hops, lemongrass, mango, myrica, verbena, cardamom, West Indian bay tree, marjoram, houttuynia, basil etc.

It is useful in treating diabetes, diarrhea, dysentery, blood pressure, reduces pain, increases transdermal absorption, improves glucose tolerance, good for osteoarthritis, also used as a flavouring agent, perfume making etc; it crosses the blood-brain barrier & increases the transport of cannabinoids in the brain, it is a significant analgesic. It is under research & its absorption, metabolism is not known. It is anti-anxiety, anti-depressant, sedative, anti-inflammatory, anti-epileptic, increases immunity.

- **Calamene: -**

(E)-Calamene belongs to the class of organic compounds known as sesquiterpenoids. These are terpenes with three consecutive isoprene units (E)-Calamene is possibly neutral.

- **Eugenol: -**

Eugenol is an allyl chain-substituted guaiacol, a member of the allylbenzene class of chemical compounds. It is a colorless to pale yellow, aromatic oily liquid extracted from certain essential oils especially from clove oil, nutmeg, cinnamon, basil and bay leaf. It is present in concentrations of 80–90% in clove bud oil and at 82–88% in clove leaf oil. Eugenol has a pleasant, spicy, clove-like scent. The name is derived from *Eugenia caryophyllata*, the former Linnean nomenclature term for cloves. The current Linnean nomenclature term for cloves is *Syzygium aromaticum*. Isoeugenol acetate is a phenylpropanoid that is the acetate ester of trans-isoeugenol. It is a phenylpropanoid, a monomethoxybenzene and a member of phenyl acetates. It derives from a trans-isoeugenol.

Dehydrodiisoeugenol is isolated from *Myristica fragrans* Houtt, shows anti-inflammatory and anti-bacterial actions. Dehydrodiisoeugenol inhibits LPS-stimulated NF- κ B activation and cyclooxygenase (COX)-2 gene expression in murine macrophages.

Isoeugenol is a clear to pale yellow oily liquid extracted from certain essential oils especially from clove oil and cinnamon. It is very slightly soluble in water and soluble in organic solvents. It has a spicy odor and taste of clove. Isoeugenol is prepared from eugenol by heating. It may occur as either the cis (*Z*) or trans (*E*) isomer. Trans (*E*) isoeugenol is crystalline while cis (*Z*) isoeugenol is a liquid. Isoeugenol is one of several phenolic compounds responsible for the mold-inhibiting effect of smoke on meats and cheeses. Eugenol is used in perfumes, flavorings, and essential oils. It is also used as a local antiseptic and anaesthetic. Eugenol can be combined with zinc oxide to form zinc oxide eugenol which has restorative and prosthodontic applications in dentistry.

- **Spathulenol: -**

Spathulenol is a tricyclic sesquiterpenoid that is 4-methylidenedecahydro-1H-cyclopropa[e]azulene carrying three methyl substituents at positions 1, 1 and 7 as well as a hydroxy substituent at position 7. It has a role as a volatile oil component, a plant metabolite, an anaesthetic and a vasodilator agent. It is a sesquiterpenoid, a carbocyclic compound, a tertiary alcohol and an olefinic compound. It is anti-inflammatory, antioxidant, anti-proliferative, antimycobacterial.

- **Bornyl acetate: -**

(+)-Bornyl acetate is the acetate ester of (+)-borneol, a natural terpene derivative. The (–)-enantiomer is also found in nature. Both esters are found in oils extracted from the needles of conifers in the Pinaceae family. It is reported to have anti-inflammatory, analgesic, antibiotic, and sedative properties. The US Food and Drug Administration lists it as an active ingredient in over-the-counter cough and cold medications.

- **Geranyl acetate: -**

Geranyl acetate is a natural organic compound that is classified as a monoterpene. It is a colorless liquid with a pleasant floral or fruity rose aroma. Its condensed liquid has a slightly yellow color. It is insoluble in water, but soluble in some organic solvents such as alcohol and oil. It is a natural constituent of more than more than 60 types of oil including Ceylon citronella, palmarosa, lemon grass, petit grain, neroli, geranium, coriander, carrot, Camden woollybutt, and sassafras. It can be obtained by fractional distillation of essential oils.

Geranyl acetate is an ester that can be prepared semi-synthetically by the simple condensation of the more common natural terpene geraniol with acetic acid. It is used primarily as a component of perfumes for creams and soaps and as a flavoring ingredient. It is used particularly in rose, lavender and geranium formulations where a sweet fruity or citrus aroma is desired.

- **Phellandrene: -**

In Marjoram alpha & beta phellandrene are present; it is a pair of organic compound that have a similar molecular structure & similar chemical properties; both alpha & beta are cyclic monoterpenes & are double-bond isomer. In alpha both double bond are endocyclic & in beta one double bond is exocyclic; both are soluble in water; they have a pleasant aroma & peppery taste.

Alpha is potential immune stimulator, anti-fungal, anti-inflammatory, anti-cancer, anti pain, develop natural killer (NK) in the body, boost immune system; beta is anti microbial, anti-fungal, antioxidant; both are believed to be excreted in stools,

Beta is present in oil of following bitter fennel, elemi, ginger-grass, ridolfia segetum & alpha is present in oil of cinnamon, dill, turmeric, ceylon etc.

- **Beta-Sesquiphellandrene: -**

Beta-Sesquiphellandrene is found in common oregano; it is a constituent of ginger oil; it belongs to the class of organic compounds known as sesquiterpenoids

- **Cadinol: -**

Cadinol is also known as alpha-cadinol. Cadinol is practically insoluble (in water) and an extremely weak basic (essentially neutral) compound (based on its pKa). Cadinol can be found in spearmint, which makes cadinol a potential biomarker for the consumption of this food product. Cadinol is any of several organic compounds with formula C₁₅H₂₆O, especially: α -cadinol δ -cadinol (torreyol, sesquigoyol, pilgerol, albicaulol) T-cadinol.

- **Linalool: -**

It refers to 2 enantiomers (opposite or mirror image) of naturally occurring mono-terpene found in flowers & plants of many spices; it has a role plant metabolite, a volatile oil component, an anti microbial agent, a fragrance agent, it is present in sweet basil, lavender, laurel, citrus fruits, cinnamon, rosewood, birch tree, tea tree oil etc. It is anti anxiety, anti depressant, sedative, anti-inflammatory, anti epileptic, increase immunity. It is under research & its absorption, metabolism is not known.

- **Calamenone: -**

Trinor-7-calamenone belongs to the class of organic compounds known as tetralins. These are polycyclic aromatic compounds containing a tetralin moiety, which consists of a benzene fused to a cyclohexane (S)-11,12,13-Trinor-7-calamenone is an extremely weak basic (essentially neutral) compound (based on its pKa) (S)-11,12,13-Trinor-7-calamenone has been detected, but not quantified in, root vegetables. This could make (S)-11,12,13-trinor-7-calamenone a potential biomarker for the consumption of these foods.

- **Guaiane: -**

Guaiane-type sesquiterpenes are present in approximately 70 genera of 30 plant families (e.g., Asteraceae, Lamiaceae, Thymelaeaceae, and Zingiberaceae); they can be classified into 12,6-guaianolides, 12,8-guaianolides, pseudoguaianolides, tricycle guaiane-type sesquiterpenes, dimers or trimers containing guaiane-type sesquiterpenes mother nuclei, variant guaiane-type sesquiterpenes, and other guaiane-type sesquiterpenes. Among them, 12,8-guaianolides exerted the broadest biological activity.

- **Lectin: -**

Lectins are carbohydrate-binding proteins that are highly specific for sugar groups of other molecules. Lectins have a role in recognition on the cellular and molecular level and play numerous roles in biological recognition phenomena involving cells, carbohydrates, and proteins.

- **Terpinene: -**

Terpinene are group of isomeric hydrocarbons & classified as monoterpenes; Alfa terpinene is isolated from cardamom & marjoram oil & from other natural sources, but beta terpinene is made artificially (compounding). Natural sources of it are cuminum cyminum, melalenca alternifolia, cannabis, apples, tea, cumin, nutmeg, rosemary etc. It has a pleasant aroma & flavour; it is used in manufacturing soaps, perfumes, lotions, insect repellent; it reduces anxiety because it is sedative, it is anticancer, antioxidant. Terpeneols are monocyclic monoterpene tertiary alcohols which are naturally present in plant species. There are five common isomers of terpeneols, alpha-, beta-, gamma-, delta- and terpinen-4-ol, of which α -terpeneol and its isomer terpinen-4-ol are the most common terpeneols found in nature. α -Terpeneol plays an important role in the industrial field. It has a pleasant odor similar to lilacs and it is a common ingredient in perfumes, cosmetics, and aromatic scents. In addition, α -terpeneol attracts a great interest as it has a wide range of biological applications as an antioxidant, anticancer, anticonvulsant, antiulcer, antihypertensive, anti-nociceptive compound. It is also used to enhance skin penetration, and also has insecticidal properties.

The difference between terpenes and terpenoids is that terpenes are hydrocarbons; whereas, terpenoids have been denatured by oxidation (drying and curing the flowers). The words terpene and terpenoid are increasingly used interchangeably, although they do have slightly different meanings.

- **Terpeneol: -**

It is a monoterpene alcohol that is isolated from a variety of sources like pine oil, petit-grain oil, marjoram oil, cajuput oil. Alpha terpeneol is most commonly present in trees, though there are 5 isomers of it, Alpha, beta, gamma, delta & terpinen-4-ol; it has pleasant odour & commonly used in perfumes, cosmetics, aromatics, scents etc; It is antioxidant, anticancer, anti-convulsant, anti-hypertensive, anti-nociceptive; it enhances skin penetration, it is insecticidal; it is also present in flowers, of narcissus, & freesia, & in herbs like marjoram, oregano, rosemary, lemon peel oil. Terpeneols are monocyclic monoterpene tertiary alcohols which are naturally present in plant species. There are five common isomers of terpeneols, alpha-, beta-, gamma-, delta- and terpinen-4-ol, of which α -terpeneol and its isomer terpinen-4-ol are the most common terpeneols found in nature. α -Terpeneol plays an important role in the industrial field. It has a pleasant odor similar to lilacs and it is a common ingredient in perfumes, cosmetics, and aromatic scents. In addition, α -terpeneol attracts a great interest as it has a wide range of biological applications as an antioxidant, anticancer, anticonvulsant, antiulcer, antihypertensive, anti-nociceptive compound. It is also used to enhance skin penetration, and also has insecticidal properties.

- **Terpinen: -**

It is an isomer of terpeneol a primary constitute of tea tree oil, also obtained from leaves, branches & bark of melalenca alternifolia. It is anti-inflammatory, antioxidant, reduces risk of colon cancer, pancreatic cancer, gastric cancer, prostate cancer & enhances the effects of chemotherapeutic agents. Terpeneols are monocyclic monoterpene tertiary alcohols which are naturally present in plant species. There are five common isomers of terpeneols, alpha-, beta-, gamma-, delta- and terpinen-4-ol, of which α -terpeneol and its isomer terpinen-4-ol are the most common terpeneols found in nature. α -Terpeneol plays an important role in the industrial field. It has a pleasant odor similar to lilacs and it is a common ingredient in perfumes, cosmetics, and aromatic scents. In addition, α -terpeneol attracts a great interest as it has a wide range of biological applications as an antioxidant, anticancer, anticonvulsant, antiulcer, antihypertensive, anti-nociceptive compound. It is also used to enhance skin penetration, and also has insecticidal properties.

- **Terpinolene: -**

It is among isomeric hydrocarbon group; it a monoterpene; it is a volatile oil component, not soluble in water; it is sedative, insect repellent; it is used in making plastics & resins; it is found in all spices; it is a flavouring agent. It is present in citrus, mentha, juniperus, myristica, parnip oil, pine oil, tea tree oil, orange, marjoram etc.

It is antioxidant, anticancer, sedative (when inhaled) reduces anxiety, helpful in insomnia, panic attack, anti-bacterial, anti-fungal; it is used in making of soap, perfumes, lotions, insect repellent.

- **Terpineol: -**

It is a monoterpene alcohol that is isolated from a variety of sources like pine oil, petit-grain oil, marjoram oil, cajuput oil. Alpha terpineol is most commonly present in trees, though there are 5 isomers of it, Alpha, beta, gamma, delta & terpinen-4-ol; it has pleasant odour & commonly used in perfumes, cosmetics, aromatics, scents etc; It is antioxidant, anticancer, anti-convulsant, anti-hypertensive, anti-nociceptive; it enhances skin penetration, it is insecticidal; it is also present in flowers, of narcissus, & freesia, & in herbs like marjoram, oregano, rosemary, lemon peel oil. Terpineols are monocyclic monoterpene tertiary alcohols which are naturally present in plant species. There are five common isomers of terpineols, alpha-, beta-, gamma-, delta- and terpinen-4-ol, of which α -terpineol and its isomer terpinen-4-ol are the most common terpineols found in nature. α -Terpineol plays an important role in the industrial field. It has a pleasant odor similar to lilacs and it is a common ingredient in perfumes, cosmetics, and aromatic scents. In addition, α -terpineol attracts a great interest as it has a wide range of biological applications as an antioxidant, anticancer, anticonvulsant, antiulcer, antihypertensive, anti-nociceptive compound. It is also used to enhance skin penetration, and also has insecticidal properties.

- **Beta-sitosterol: -**

It is among phytosterols & a main dietary phytosterol found in plants. It is anti cancer, anti inflammatory, it improves urine flow, reduces symptoms of heart diseases, reduces cholesterol, boost immune system, reliefs bronchitis, migraine, asthma, fatigue, rheumatoid arthritis, improve hair quality, reliefs prostate problems, improves erectile dysfunctioning, psoriasis, libido.

Main sources of beta-sitosterol: -

Canola oil, avocados, almond, soya bean oil, nuts, vegetable oil, dark chocolate, rice bran oil, wheat germ, corn oil, peanuts etc.

- **Elemicin & isoelemicin: -**

Elemicin is a constituent of the oleoresin and the many essential oils; Elemicin is also present in the oils of the spices nutmeg and mace; elemicin is similar to myristicin, differing only by myristicin's methyl group that joins the two oxygen atoms that make up its dioxymethy moiety, it may have anticholinergic action. Isoelemicin is found in herbs and spices. Isoelemicin is a constituent of oil; isoelemicin, also known as trans-isoelemicin, belongs to the class of organic compounds known as anisoles. These are organic compounds containing a methoxybenzene or a derivative thereof. Isoelemicin is an extremely weak basic (essentially neutral) compound (based on its pKa). Isoelemicin is a flower and spice tasting compound. Outside of the human body, Isoelemicin has been detected, but not quantified in, herbs and spices and ucuhuba. This could make isoelemicin a potential biomarker for the consumption of these foods.

- **Acetophenone: -**

Acetophenone is the simplest ketone derivative of benzene. It is naturally found in several fruits and chicory. It has a distinctive orange scent. Thus it is often used in scenting lotions and flavoring food. In humans, acetophenone is metabolized to benzoic acid, carbonic acid, and acetone.

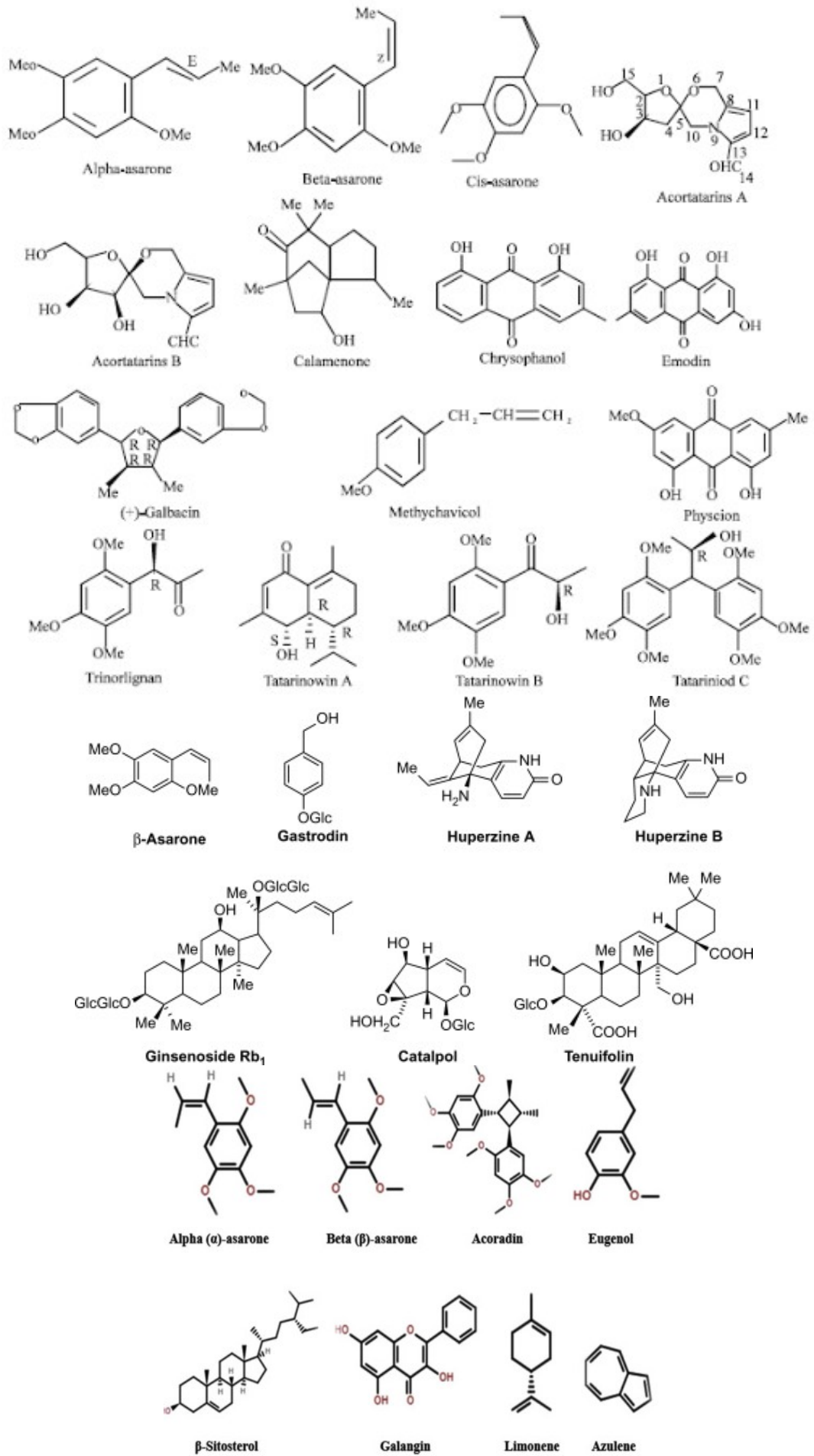
- **Dehydroabietic acid: -**

Dehydroabietic acid is an abietane diterpenoid that is abieta-8,11,13-triene substituted at position 18 by a carboxy group. It has a role as a metabolite and an allergen. It is an abietane diterpenoid, a monocarboxylic acid and a carbocyclic compound. It derives from an abietic acid. It is a conjugate acid of a dehydroabietate.

- **Calamendiol: -**

Calamendiol, also known as calameone, belongs to the class of organic compounds known as sesquiterpenoids. These are terpenes with three consecutive isoprene units. Calamendiol is an extremely weak basic (essentially neutral) compound (based on its pKa).

- **Main chemical structures of sweet flag: -**



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● **Research on sweet flag: -**

The aim of the present paper is to provide information regarding the ethnopharmacology, ethnobotany, therapeutic uses and scientific studies carried out on sweet flag (*Acorus calamus* Linn). The search was carried out

by examining the classical texts of Unani, Ayurveda and other traditional medical systems, as well as the ethnobotanical literature and Google scholar. The drug is popularly known as “Sweet flag” in traditional medicine and used to treat a number of diseases. The plant has a rich ethnobotanical history dating possibly back to the time of Moses in the Old Testament of the Bible and in early Greek and Roman medicine. Sweet flag has been valued for its rhizome and fragrant oils which have been used medicinally, in alcoholic beverages, as a fragrant essence in perfumes and oils, and for insecticidal properties. Chemical analysis of sweet flag shows that it contains sesquiterpenes, flavonoids, α - and β -asarone and various other constituents. Research studies have shown that it possesses various pharmacological activities. An extensive review of the ancient traditional literature and modern research revealed that the drug has numerous therapeutic actions, several of which have been established scientifically which may help the researchers to set their minds for approaching the utility, efficacy and potency of sweet flag.

Investigations on the LC50 values of sweet flag rhizome, evaluation of sweet flag rhizome formulation with different carriers against *Callasobruchus analis* L. on pigeonpea and *Sitophilus oryzae* on sorghum in storage condition, mode of action of sweet flag rhizome, persistence study and effect of packaging materials and sweet flag rhizome treatment against *C. analis* and *S. oryzae* was undertaken at the Department of Agricultural Entomology, college of Agriculture, Raichur, Karnataka during 2012-14. In the bioassay studies, LC50 values for adults of *C. analis* and *S. oryzae* was 21600, 22200 ppm and 18600 and 18700 ppm respectively for an exposure period of 24 hrs. In the evaluation of different carriers, sweet flag rhizome powder at two per cent with talc as carrier was found to be effective in restricting the oviposition, seed damage, weight loss and population buildup up to 120 days after storage in the laboratory condition. Sweet flag rhizome showed contact, fumigant and repellent action on *C. analis* and *S. oryzae*. The rate of response increased with increase in dose level and exposure period. It has the capacity to protect the seeds against *C. analis* and *S. oryzae* up to 10 months and 8 months respectively by preventing egg laying, population buildup, seed damage. Among the malathion and sweet flag rhizome evaluated impregnation treatment of cloth bag, gunny bag, mud container, polythene cover, glass and steel container, in which pigeon pea was stored for their efficacy, malathion was found to be most effective followed by sweet flag rhizome by recording minimum seed damage and adult survival. These two were superior over the untreated control. Seeds stored in cloth bag were worst affected compared to seeds stored in polythene cover, steel and glass containers which were found to be least affected.

- **Conclusion: -**

Conclusion A. calamus, the versatile medicinal plant is the unique source of various types of compounds having diverse biological activities. Its phytochemical constituents such as α -, β and γ asarone, sesquiterpenes and acorenone showed many biological activities. The compounds were found to be highly active in antimicrobial, anti-inflammatory, antioxidant, antidiarrheal, antiulcer, antispasmodic, immunosuppressant and mitogen inhibitor activity. Hence it has been proved from the different literature reviewed that *Acorus calamus* can be explored successfully for various marketed formulation.