

## CLOVE: A CHAMPION SPICE

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Received on: 12/11/2010 Revised on: 04/01/2011 Accepted on: 23/01/2011

### ABSTRACT

Clove may be looked upon as a champion of all the antioxidants known till date. The Oxygen Radical Absorption Capacity (ORAC) test is a scale developed by U.S. Department of Agriculture for comparing anti-oxidant activity. The ORAC score, of clove is over 10 million. A drop of clove oil is 400 times more powerful as an anti-oxidant than wolf berries or blueberries. Health benefits from the use of clove have been known over the centuries. It is beneficial as a home remedy in curing several ailments / diseases. In addition to its culinary uses, the clove buds have an abundance of medicinal and recreational uses. The major part of the world's consumption of the clove spice is in the home kitchens. However, commercial use of the clove is for the production of clove oil that contain active constituents, which possess antioxidant, anti-fungal, anti-viral, anti-microbial, anti-diabetic, anti-inflammatory, antithrombotic, anesthetic, pain relieving and insect repellent properties. Eugenol is the main constituent responsible for the medicinal properties of the clove bud. In the light of above, we thought it worthwhile to compile an up-to-date review article on clove covering its, synonyms, chemical constituents, phytopharmacology and medicinal uses.

**KEY WORDS:** Cloves, *Syzygium aromaticum*, Laung, Lavang.

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### INTRODUCTION

The symbol of dignity that is what "Clove" actually means. It is a precious and valuable spice of the world. It is an unopened flower bud growing on a tree belonging to the family *Myrtaceae* which is same as that of guavas. Cloves (*Syzygium aromaticum*, *Eugenia aromaticum* or *Eugenia caryophyllata*) are the aromatic dried flower buds, which are commonly used in biryanis, pickles, salads and garam masala. The tree that creates the miracle of nature originated from the Moluccas Islands, actually known as Spice Island. It is the common product found in the spice rack around the world. Clove buds possess intense fragrance and burning taste. They have deep brown color, powerful fragrant odour which is warm, pungent, strongly sweet and slightly astringent. In India it is used in almost all spicy rich dishes. Indonesia uses half the world production of cloves to make kretek cigarettes in the proportion of one part of clove mixed with two parts of tobacco. In 2009 clove cigarettes were banned in the U.S. however they are still marketed with the new label as filtered clove cigars.

### Common Names

Cloves, Carophyllus, Clovos, Caryophyllus

### Botanical Names

*Eugenia caryophyllus*, *Syzygium aromaticum*

### Names in Indian languages

**Sanskrit:** Bhadrasriya, Devakusuma, Devapuspa, Haricandana, Karampu, Lavanga, Lavangaka, Lavangam, Varala.

**Hindi:** Laung, Laung, Lavang.

**Malayalam:** Grampu, Karampu, Karayampu.

**Marathi:** Luvang

**Kannada:** Lavanga, Daevakusuma, Krambu

**Tamil:** Kirampu, Ilavankam, Kiraambu, Kirambu, Grambu.

**Telgu:** Devakusumamu, Lavangamu, Lavangalu, Kaaravallu

**Bengali:** Lavanga.

**Gujarati:** Lavang

**Punjabi:** Laung

**Oriya:** Labanga

**Urdu:** Laung, Loung

## INTERNATIONAL NAMES

**Arabic:** Kabsh qarunfil, Kabsh qaranful

**Bulgarian:** Karamfil

**Chinese:** Ding xiang

**Dutch:** Kruidnagel

**Danish:** Nellike

**French:** Giroflier, Cloude girofle

**German:** Gewürznelke, Nelke

**Greek:** Garifalo

**Georgian:** Mikhaki, Mixaki

**Hungarian:** Szegfu

**Indonesian:** Cengke, Cengkeh

**Italian:** Chiodo di garofano

**Japanese:** Girofla, Choji, Kurobu

**Korean:** Jeonghyang

**Latvian:** Krustnaglinas

**Nepalese:** Lwaang

**Norwegian:** Nellik

**Portuguese:** Cravo de India

**Persian:** Mikhak

**Pashto:** Kala

**Russian:** Gvosdika, Pazhitnik grecheski, Shambala,

Pazhitnik cennoj

**Spanish:** Clavo, Clavo de olor

**Swedish:** Kryddnejlika, Kryddnejlikor, Nejlikor

**Turkish:** Carenfil

**Thai:** Khan plu, Garn ploo

**Vietnamese:** Dhing huong

## HISTORY

Clove is one of the most ancient and valuable spices of the Orient, with its origin as old as the first century, before Christ. The ancient Chinese Han dynasty lasting from 207 B.C. to 220 A.D. gives us our first clue to the use of fragrant clove. Chinese physician of that era wrote that the court visitors to the Emperor were required to hold clove in their mouth. This was done to save the ruler from the bad breath of the visitors. The use of clove as a spice reached Europe around the 4th century A.D., when commercial trading really started with the Arabs, who in turn acquired these dried and fragrant buds from the cultures to the East in Asia. Its source and place of origin were shrouded in mystery until the Portuguese discovered the Moluccas Island or Indonesia in the 16<sup>th</sup> century. Parents planted a clove tree, when a child was born, believing if the tree flourished, so will the child. Roughly, half the commercial supply of cloves in the world is consumed by the Indonesians. Cloves are mixed with tobacco to produce a special cigarette, which is a ubiquitous sight in Indonesia.

Two major naval European powers in the 17th and 18th centuries, namely the Dutch and the Portuguese were involved in a long tussle over competition for cloves. One

of the ways in which the Dutch eventually gained a complete monopoly on the trade in cloves was by the destruction of every viable clove tree in all the islands, saving only the Dutch colonized island of Ambon on which vast acreage was devoted to clove plantations. The Dutch benefited from controlling much of the South East Asian islands. This monopoly of the Dutch lasted till the 19th century, when the plant was cultivated in different parts of the world having a tropical climate. The Dutch monopoly of the spice was broken, when the French managed to cultivate the tree on their colonized islands in Asia. The islands of Zanzibar, which belong to present day Tanzania, in eastern Africa has been a major producer of cloves for many decades. This exported plant grows so well in Zanzibar that the moniker given to the island of Zanzibar is "Island of Cloves". Clove was established in Sri Lanka in 1796 A.D., before the arrival of the British. In Britain, cloves were worth at least their weight in gold, due to their high importing price in 17<sup>th</sup> and 18<sup>th</sup> centuries. In India East India Company introduced clove in 1800 A.D. During Christmas, there is a tradition in some European countries to make pomanders (studding of a thin-skinned orange with clove buds) which are hung around the house. This helps to spread a nice scent throughout the house and serves as festival decoration.

## DESCRIPTION

Cloves are the aromatic dried buds of a tree (*Eugenia caryophyllata* also sometimes *Syzygium aromaticum*) used as a spice in virtually all the world's cuisine. The term 'Clove' is derived from the French word 'Clou' and the English word 'Clout', both meaning 'nail' - from the likeliness of the flower bud of the Clove tree to a broad-headed nail. The Clove tree is an evergreen tree, which grows to a height ranging from 8-12m, having large square leaves and sanguine flowers in numerous groups of terminal clusters. The flower buds are at first of a pale color and gradually become green, after which they develop into a bright red, when they are ready for collecting. Cloves are harvested when 1.5-2 cm long, and consist of a long calyx, terminating in four spreading sepals, and four unopened petals, which form a small ball in the center.

## Planting material

The seeds should be collected from fully ripe fruits for raising seedlings. Fruits for seed collection known commonly as "mother of clove" are allowed to ripe on the tree and drop down naturally. Such fruits are collected and sown directly in the nursery or soaked in water overnight and the pericarp removed before sowing. The second method gives quicker and higher percentage of germination. Only fully developed and uniform sized seeds, which show the signs of germination by the

presence of pink radicle, are used for sowing. It is advisable to sow the seeds immediately after harvest. Heaping the fruits or keeping them tied up in air tight bags hastens the death of the seeds. Beds of 15-20 cm height, 1m width and conventional length are prepared for sowing seeds. The fertilizers must be applied in two equal split doses during the months of May-June and September-October in shallow drenches dug around the plant about 1-11/m away from the base.

### Harvesting and processing

The trees begin to flower in 6 years. Full bearing is achieved by about 20 years and the production continues for 80 years or more. Bearing between years shows much variation. Clove clusters are handpicked, when the buds reach full size and turn pink but before they open. At this stage, they are less than 2 cm long. They are spread thinly on mats and stirred frequently for uniform drying. Well dried cloves will snap cleanly with a sharp click across the thumb nail and weigh about one third of the green weight. The opened flowers are not valued as a spice. Harvesting has to be done without damaging the branches, as it adversely affects the subsequent growth of the trees. On an average, a clove tree yields 3.5-7.0 kg/year, depending upon the age, size and condition of the tree.

### Climate and soil

Clove trees grow well in rich loamy soils of the humid tropics and can be grown successfully in the red soils of the midlands of Kerala as well as in the hilly terrain of Western Ghats at higher elevations in Tamil Nadu and Karnataka. A cooler climate with well distributed rainfall is ideal for flowering; it thrives well in areas receiving an annual rainfall of 150-300 cm. The site selected for cultivation of clove needs good drainage, since crop cannot withstand water logging.

### NUTRIENT CONTENT OF CLOVE

The composition of the clove varies according to the agro climatic conditions under which it is grown, processed and stored. The dried clove bud contains carbohydrates, fixed oil, steam-volatile oil, resins, tannins, proteins, cellulose, pentosans and mineral elements. Carbohydrates comprise about two-thirds of the weight of the spice. The dried dark and flower buds also contain nutrients like proteins, minerals, vitamins, etc. Nutrient composition of clove is depicted in Table 2.

### CHEMICAL CONSTITUENTS

Clove comprises of volatile as well as non-volatile constituents.

#### Volatile Constituents

Clove yields different types of volatile oil [oil extracted from i. leaves, ii. the stem, iii. the buds and iv. the fruit.] These oils differ considerably in yield and quality. The

yield and composition of the oil obtained are influenced by its origin, season, variety and quality of raw material, maturity at harvest, pre- and post-distillation treatments and method of distillation. The chief component of all the types of oil is eugenol.

#### Bud Oil

Good-quality clove buds contain 15–20% essential oil<sup>1,2</sup>. The oil is dominated by Eugenol (70–85%), eugenyl acetate (15%) and  $\beta$ -caryophyllene (5–12%), which together make up 99% of the oil. The constituents of the oil also include methylamylketone, methyl salicylate,  $\alpha$ - and  $\beta$ -humulene, benzaldehyde,  $\beta$ -ylangene and chavicol. The minor constituents like methylamylketone, methylsalicylate etc., are responsible for the characteristic pleasant odour of cloves. The clove bud and stem oils from Madagascar were also dominated by eugenol, eugenyl acetate and  $\beta$ -caryophyllene. The stem oil contained a higher level of eugenol, whereas the eugenyl acetate content was higher in the bud oil. The oil from clove bud contained 73.5–79.7% eugenol and 4.5–10.7% eugenyl acetate, while the stem oil contained 76.4–84.8% eugenol and 1.5–8.0% eugenyl acetate. Both contained 7.3–12.4%  $\beta$ -caryophyllene and 1.0–1.4%  $\alpha$ -humulene<sup>3</sup>. Pino *et al.* identified 36 compounds from the volatile oil of clove buds. Clove buds from India contained 12.9–18.5% oil, of which 44–55% was eugenol, whereas the pedicels contained 3.0–7.7% oil with 60.0–72.4% eugenol<sup>2</sup>.

#### Leaf Oil

Clove leaves yield 3.0–4.8% essential oil. The essential oil content during the different stages of leaf growth revealed that the eugenol content in the leaves increased from 38.3 to 95.2% with maturity, while the contents of eugenyl acetate (51.2 to 1.5%) and caryophyllene (6.3 to 0.2%) decreased<sup>4</sup>. Clove bud and leaf oil contain various classes of compounds, e.g. monoterpenes, sesquiterpenes, aldehydes and ketones.

#### Clove Stem Oil

Clove stem yields 6% volatile oil<sup>1</sup>. The oil is a pale to light yellow liquid containing 80.2% eugenol and 6.6%  $\beta$ -caryophyllene, besides several minor components.

#### Fruit Oil

Ripe fruits yield 2% of oil, which is comprised of 50–55% eugenol.

#### Non-volatile Constituents

A few non-volatiles have been isolated from clove, which include tannins, sterols, triterpenes and flavonoids.

#### Tannins

Cloves contain 10–13% tannins, which have the same chemical composition as gallotannic acid. Eugenin and ellagitannin<sup>5</sup> were isolated from cloves. Eugenol glucoside gallate, a chromone C-glycoside, galloyl and

hexahydroxy diphenyl esters of 2, 4, 6-trihydroxy acetophenone-3-glucopyranoside were isolated from clove leaves<sup>6</sup>. Further, two ellagitannins, namely, syzyginin A (1, 2, 3-tri-*O*-galloyl-4, 6-(*S*) - tergalloyl- $\beta$ -D-glucoside) and syzyginin B, were also isolated from the leaves.

### **Triterpenes**

Cloves contain about 2% of the triterpene, oleanolic acid. Narayanan and Natu (1974) isolated maslinic acid from clove buds<sup>7</sup>. From clove, 2 $\alpha$ -hydroxyoleanolic acid was also isolated<sup>8</sup>.

### **Sterols**

Sterols isolated from clove include sitosterol, stigmasterol and campesterol<sup>8</sup>.

### **Flavonoids**

A chromone C-glucoside, isobiflorin (5, 7-dihydroxy-2-methoxychromone-8-C- $\beta$ -D-glucopyranoside) and biflorin were isolated from the ethanolic extract of cloves<sup>9</sup>. From the ethanol extract of the seeds, apigenin 6-C-[ $\beta$ -D-xylopyranosyl-(1 $\rightarrow$ 2'')- $\beta$ -D-galactopyranoside]-7-O- $\beta$ -D-glucopyranoside and apigenin-6-C-[ $\beta$ -D-xylopyranosyl-(1 $\rightarrow$ 2'')- $\beta$ -D-galactopyranoside]-7-O- $\beta$ -D-(6-O-p-coumarylglucopyranoside) were isolated<sup>10</sup>.

### **MEDICINAL USES**

Clove is known to possess antibacterial properties and is used in various dental creams, tooth pastes, mouth washes, and throat sprays to cleanse bacteria. It is also used to relieve pain from sore gums and improves overall dental health.

In dentistry, eugenol in combination with zinc oxide is used for temporary filling of cavities.

Clove is an anodyne (an agent that soothes or relieves pain) for dental emergencies<sup>11</sup>.

Cloves are aphrodisiac (an agent for arousing or increasing sexual desire or potency).

Clove is used as an anti-inflammatory agent, due to its high content of flavonoids. Aroma therapists use pure clove oil to cure the symptoms of rheumatism and arthritis.

Clove is used as a carminative, to increase hydrochloric acid in the stomach and to improve peristalsis.

Apply the paste of clove powder in honey to treat acne.

Paste of clove powder in water promotes faster healing of cuts and bites.

Cloves can effectively cure many digestive problems. It is having medicinal qualities to cure flatulence, loose motions, indigestion and nausea. Cloves are useful in relieving the symptoms of diarrhea, gastric irritability and vomiting.

Clove and clove oil boost the immune system by purifying the blood and help to fight against various diseases.

Clove oil is effective in curing Athlete's foot and nail fungus.

Cloves are good expectorants that promote the discharge of mucous and secretions in the respiratory passage.

The aromatic clove oil, when inhaled can help soothe certain respiratory conditions like cold, cough, asthma, bronchitis, and sinusitis. It also helps in clearing the nasal tract.

Cloves can effectively prevent the lung cancer as well as the skin cancer. Eugenol helps in minimizing the harmful effects of environmental wastes that can cause cancer of digestive system.

Clove oil stimulates blood flow and circulation making it useful for the people having cold extremities.

Cloves benefit the diabetic patients by controlling the blood glucose levels. Eugenol is powerful enough for preventing blood clots.

Sucking of a clove bud reduces desire for alcohol.

Muscular cramps are often relieved, when the oil of clove is applied as a poultice near the affected area.

Cloves also help prevent the breakdown in retina of the eye, which slows down macular degeneration and aids vision in the old age. The underlying mechanism is through the prevention of the breakdown of docosahexaenoic acid, which preserves vision in elderly people.

Researchers found that sniffing the spicy aroma of cloves reduces drowsiness, irritability and headaches.

One drop of clove oil applied to the roof of the mouth can instantly relieve many headaches.

Clove enhances memory retention. It is recommended for relieving brain fog, lethargy and depressive state of mind. Research has shown that clove oil is an effective mosquito repellent<sup>12</sup>.

Clove may be looked upon as the champion of all the anti-oxidants known till date. The Oxygen Radical Absorption Capacity test (ORAC) is a scale developed by U.S. Department of Agriculture for comparing anti-oxidant activity. The ORAC score, of clove is over 10 million. A drop of clove oil is 400 times more powerful as an anti-oxidant than wolf berries or blueberries.

### **VETERINARY USES**

Cloves are used as part of a larger herbal formula to treat bitches that are retaining pups.

The clove oil has been used to treat foreign matter in dog and cat ears and as a painkiller to treat tooth pain.

Peppermint tea with a sprinkle of cloves and ginger has been used to treat vomiting in dogs; 1 tbsp or more,

according to the size of the animal, being given 3 times daily.

### **CULINARY USES**

Dried cloves are the key ingredient in Indian masala tea. Clove is often used to flavor meat products, pastries, cookies, candies, chewing gum, spiced fruits, hot spiced drinks, chocolate drinks, wines and liqueurs, puddings, sandwiches, cakes, curries, and pickles.

It is a common kitchen spice used for studding particularly tomatoes, onions, sausage, soups, salads and herbal teas.

It is an important spice used in cuisines of Russia, Scandinavia, Greece, India, and China.

### **MISCELLANEOUS USES**

Clove is used to flavor Pharmaceuticals.

Clove oil is used to flavor tooth pastes.

The leaf oil is used to impart fragrance to perfumes and soaps.

In Indonesia, cloves are mixed with tobacco in the proportion of 1: 2 to make a cigarette called Kretrek.

Clove is used to make pomanders (thin skinned oranges, lemon and apples are pierced with a large needle to make holes for studding clove inside the concentric holes).

### **PHARMACOLOGICAL ACTIVITIES**

#### **Anti-microbial activity**

Cloves represent one of the Mother Nature's premier antiseptic. Clove oil was found to be more effective than sodium propionate (standard food preservative) against some food borne microbes. Clove oil was found to be very effective against *Staphylococcus species*. Amongst the fungi, *Aspergillus niger* was found to be highly sensitive to the clove oil. Essential oil of clove, dispersed (0.4% v/v) in a concentrated sugar solution, had a germicidal effect against various bacteria (*S. Aureus*, *Klebsiella Pneumoniae*, *Pseudomonas aeruginosa*, *Clostridium perfringens*, *E.coli*) and *Candida albicans*<sup>13</sup>. Clove is also included in Dr Huda Clark's protocol for elimination of parasites from the digestive system. It has been found that a 0.05% solution of eugenol is sufficient to kill bacillus tuberculosis. Clove oil showed antimicrobial activity against some human pathogenic bacteria resistant to certain antibiotics<sup>14</sup>. Clove oil and its main component eugenol show considerable antifungal activity against *Candida Aspergillus* and dermatophyte species. It also shows activity against clinically relevant fungi including fluconazole- resistant strains<sup>15</sup>.

#### **Anti-viral activity**

Clove is a potent antiviral agent. Eugenol isolated from clove buds showed antiviral activity against Herpes Simplex virus at a concentration of 10 µg /ml<sup>16</sup>.

### **Chemo- preventive**

Aqueous infusion of Clove effectively reduced benzo[a] pyrene (BP) induced lung carcinogenesis in strain A mice. Incidence of hyperplasia, dysplasia and carcinoma were effectively reduced and there was significant reduction in the number of proliferating cells and increased number of apoptotic cells in BP induced lung lesions with the clove infusion. It also down regulates the expression of some growth promoting proteins, viz, COX-2, cMyc, Hras<sup>17</sup>. Aqueous infusion of cloves showed chemo preventive action on 9, 10-dimethyl benz (a) anthracene (DMBA) and croton oil induced skin carcinogenesis in Swiss mice. Oral administration of aqueous infusions of clove at the dose of 100 µl /mouse /day not only delayed the formation of papilloma but also reduced the incidence of papilloma as well as the cumulative number of papillomas per mouse<sup>18</sup>.

### **Hepato-protective activity**

Ethanollic extract of Clove showed the hepatoprotective activity on the paracetamol- induced liver injury. The extent of hepatic damage is assessed by the level of increased cytoplasmic enzymes AST, ALT in circulation<sup>19</sup>. Clove extract restored the activity of enzymes AST, ALT and ALP in serum towards normal values. These enzymes assess the functional status of the liver in both clinical and experimental settings.

### **Anti-oxidant activity**

Clove and Eugenol possess strong antioxidant activity, which is comparable to the activities of the synthetic antioxidant, BHA (butylated hydroxyl anisole) and Pyrogallol<sup>20</sup>. Clove has the highest capacity to give off hydrogen and reduce lipid peroxidation. With respect to the lipid peroxidation, the inhibitory activity of clove oil determined using a linolenic acid emulsion system indicated a higher antioxidant activity than the standard BHT (Butylated hydroxyl toluene). It also showed a significant inhibitory effect against hydroxyl radicals and act as an iron chelator<sup>21</sup>. The metal chelating activity, bleomycin dependent DNA oxidation, diphenyl-p-picryl hydrazyl (DPPH) radical scavenging activity and the ferric reducing antioxidant power (FRAP) of different spices were measured in rat liver homogenate. Cloves showed the highest DPPH radical scavenging activity & highest FRAP values<sup>22</sup>. The antioxidant activity of clove bud extract and its major aroma components, eugenol and eugenol acetate were comparable to that of the natural antioxidant  $\alpha$ -tocopherol<sup>23</sup>. Eugenol inhibited 5-lipoxygenase activity and leukotriene C-4 in human PMNL cells<sup>24</sup>.

### **Anti-diabetic activity**

Clove extract acts like insulin in hepatocytes and hepatoma cells by reducing phosphoenolpyruvate

carboxykinase (PEPCK) and glucose 6-phosphatase (G6Pase) gene expression. Much like insulin, clove-mediated repression is reversed by PI3K inhibitors and N-acetylcysteine (NAC). A more global analysis of gene expression by DNA microarray analysis revealed that clove and insulin regulated the expression of many of the same genes in a similar manner<sup>25</sup>.

#### **Anti-inflammatory activity**

Eugenol, the primary component of clove's volatile oils, functions as an anti-inflammatory agent. In animal studies, the addition of clove extract to diets already high in anti-inflammatory components (like cod liver oil, with its high  $\omega$ -3 fatty acid content) brings a synergistic effect. Clove also contains a variety of flavonoids, including kaempferol, rhamnetin and  $\beta$ -caryophyllene which also contributed to clove's anti-inflammatory and antioxidant properties<sup>26</sup>. The essential oil of *Eugenia caryophyllata* had an anti-inflammatory effect matching to that of etodolac at 0.025 and 0.1 ml/kg and to that of indomethacin at 0.05 and 0.2 ml/kg doses.

#### **Anti-platelet activity**

It was found that both eugenol and acetyl eugenol, (two active constituents of clove) were more potent than aspirin in inhibiting platelet aggregation induced by arachidonate, adrenaline and collagen. In arachidonate induced-aggregation eugenol was at par with indomethacin<sup>27</sup>.

#### **Anti-stress activity**

The clove extract reduced the development of cold restraint induced gastric ulcers and prevented the biochemical changes induced by sound stress such as elevated plasma levels of aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, glucose, cholesterol and corticosterone. Clove extract was also effective in increasing the latency of anoxic stress induced convulsions in mice<sup>28</sup>.

#### **Anti-pyretic effect**

Eugenol, the chief constituent of clove oil, showed marked antipyretic activity when given intravenously, intragastrically and centrally to rabbits made febrile by interleukin-1. Eugenol was more effective in reducing fever than acetaminophen. It reduced fever primarily through a central action similar to that of common antipyretic drugs, such as acetaminophen<sup>29</sup>.

#### **Anaesthetic effect**

Clove oil is found to be an alternative to Tricaine or MS-222 the only registered anaesthetic for several fish species. Exposure of channel catfish (*Ictalurus punctatus*) to clove oil at the concentration of 100mg/l induced anesthesia within 1min<sup>30</sup>. Clove oil and eugenol were reported to be acceptable anaesthetics for rabbit fish (*Saiganus lineatus*), coral reef fish (*Pomacentrus*

*amboinensis*) and rainbow trout (*Oncorhynchus mykiss*) for use in aqua culture and aquatic research<sup>31</sup>. It was found to be useful as a crab anaesthetic. Clove oil proved to be highly effective and easy to use on juvenile (*Valamaguil cunnesius* and *Monodactylus argenteus*) tropical marine fish at the dose of 0.05ml/l. This dose anaesthetized the fish in less than a minute.

#### **Aphrodisiac**

It has been found that ethanolic extract of clove (50%) produced a significant and sustained increase in the sexual activity of normal male rats, without any conspicuous gastric ulceration and adverse effects<sup>32</sup>.

#### **Mosquito repellent**

Clove oil gave the longest duration of 100% repellency (2-4 h) against three species of mosquitoes i.e. *Aedes aegypti*, *Culex quinquefasciatus* and *Anopheles dirus* under laboratory conditions using human subjects<sup>12</sup>.

#### **Insecticidal activity**

Eugenol, isoeugenol and methyl eugenol show insecticidal activity to the storage pathogens, *Sitophilus zeamidis* and *Tribolium costaneum*. The clove leaf and bud oils showed potent insecticidal activity against the human head louse (*Pediculus capitis*)<sup>33</sup>.

#### **CONCLUSION**

Clove may be looked upon as the champion of all the anti-oxidants known till date. A drop of clove oil is 400 times more powerful as an anti-oxidant than wolf berries or blueberries. Clove is a medicinally powerful herb with a solid traditional heritage and history. Clove has physical, mental and emotional health benefits. Clove possesses antioxidant, anti-fungal, anti-viral, anti-microbial, anti-diabetic, anti-inflammatory, antithrombotic, anesthetic, pain relieving and insect repellent properties. Cloves represent one of the Mother Nature's premier antiseptic. Eugenol is the main constituent responsible for the medicinal properties of the clove bud. Clove is the most important spice of the world, as judged from the world trade.

#### **Home Remedies Using Clove**

Pressing a clove bud between the jaws, at the site of aching tooth eases the pain.

Apply clove oil in the cavity of decayed tooth. This would reduce the pain and help to ameliorate infection.

To remove bad breath chew clove buds.

Prepare a decoction by boiling 5-6 cloves in 30 ml of water. Take decoction of clove with honey, thrice a day as an expectorant. Chewing a clove with salt also relieves coughing.

Chewing roasted clove is a wonderful medicine in case of pharyngitis.

Suck a clove bud to obtain relief from hyperacidity.

Clove oil, when taken with sugar cures stomach ache.

Paste of clove and common salt, when taken with milk helps in reducing headache.

Licking the paste of clove powder in honey removes nausea.

Clove bud boiled in water acts as an anti-emetic, particularly when taken by pregnant ladies.

Application of the mixture of clove oil and mustard oil relieves joint pains and muscular cramps.

For treating spasmodic coughs during tuberculosis, bronchitis and asthma, mix a few drops of clove oil with garlic and honey.

Insert into the ear 2-3 drops of warm mixture of clove oil and sesame oil to relieve ear problems.

Apply the paste of clove powder in honey over the affected area to get rid of acne. The mixture of few drops of clove oil and coconut oil removes acne and leftover spots.

Rub a clove stub in water and apply the same over the affected area for treating sty (inflammation on the eye lashes).

Eating a clove in betel (piper betel) leaf is the best remedy for treating catarrh.

Spraying the solution of clove oil in water (1:10) keeps the insects at bay.

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**Table 1: Taxonomy**

<b>Domain</b>	Eukaryota	<b>Subclass</b>	Rosidae
<b>Kingdom</b>	Plantae	<b>Super order</b>	Myrtales
<b>Subkingdom</b>	Viridiplantae	<b>Order</b>	Myrtales
<b>Phylum</b>	Tracheophyta	<b>Suborder</b>	Myrteae
<b>Subphylum</b>	Euphyllophytina	<b>Family</b>	Myrtaceae
<b>Infraphylum</b>	Radiatopses	<b>Genus</b>	<i>Syzygium</i>
<b>Class</b>	Magnoliopsida	<b>Specific epithet</b>	<i>Aromaticum</i>

**Table 2: Nutrient Chart of Clove**

<b>Nutrient</b>	<b>Units</b>	<b>1 tsp = 2.10 g</b>	<b>Value per 100g</b>
Water	g	0.144	6.86
Energy	kcal	6.783	323
Energy	kJ	28.350	1350
Protein	g	0.126	5.98
Total lipid (fat)	g	0.421	20.07
Carbohydrate	g	1.285	61.21
Fiber, total dietary	g	0.718	34.2
Ash	g	0.123	5.88
Calcium, Ca	mg	13.566	646
Iron, Fe	mg	0.182	8.68
Magnesium, Mg	mg	5.544	264
Phosphorus, P	mg	2.205	105
Potassium, K	mg	23.142	1102
Sodium, Na	mg	5.103	243
Zinc, Zn	mg	0.023	1.09
Copper, Cu	mg	0.007	0.347
Manganese, Mn	mg	0.631	30.033
Selenium, Se	mcg	0.124	5.9
Vitamin C (Total ascorbic acid)	mg	1.697	80.8
Thiamin	mg	0.002	0.115
Riboflavin	mg	0.006	0.267
Niacin	mg	0.031	1.458
Vitamin B <sub>6</sub> , Vitamin B <sub>12</sub>	mg, mcg	0.027, 0.00	0.590, 0.00
Folate, total	mcg	1.953	93
Vitamin A, IU	IU	11.130	530
Vitamin E ( $\alpha$ -tocopherol)	mg	0.18	8.52
Vitamin K (phylloquinone)	mcg	3.0	141.8
Fatty acids, total saturated	g	0.114	5.438
Fatty acids, total monounsaturated	g	0.031	1.471
Fatty acids, total polyunsaturated	g	0.149	7.088
Phytosterols	mg	5.376	256
$\beta$ -carotene	mcg	2	84