

## LAVANGA (*SYZYGIUM AROMATICUM* LINN.) - A SPICY BOON

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### ABSTRACT

Clove indicates the symbol of dignity in actual sense. It is a very precious spice of the world. The health benefits of clove have been known for centuries. It is beneficial as a home remedy in curing several ailments or diseases. In addition to its culinary uses, it has got abundant medicinal and commercial applications. The practice of adulteration of clove to meet the increased market demand is the issue of present scenario. The specificity of Lavanga with respect to habitat, irrigation and environmental conditions, exclusive cultivation and collection methods need to be discussed in order to procure the best quality Lavanga. Various tests adopted to evaluate the purity of Lavanga is required to affirm its genuinity. Thus in this article an overall review of Lavanga is made comprising of botanical description, cultivation and collection methods, qualitative and quantitative standards including its adulteration and tests for purity.

**KEYWORDS:** *Lavanga, Cultivation, Extraction, Genuinity*

### INTRODUCTION

Clove is one of the most ancient spices of the orient. Though there is very less explanation of clove in Veda and Samhitas, in the later Ayurvedic treatises, it is explained in detail. Acharya Dalhana has given a synonym shreechandana pushpa for Lavanga owing to the shape of the flower.<sup>1</sup> Health benefits from the use of clove has been known from centuries. However, commercial use of clove is for the production of clove oil which has many pharmacological activities like, anti-oxidant, anti-inflammatory, anti-viral etc. Other than medicine, clove is also used in perfume industries, bio-fuelling, insect repellents etc. Hence due to increased demand for clove in the global market, its quality is being compromised. So there is a need to know the

properties of good quality of clove in terms of its habitat, collection, cultivation, extraction etc. In the light of above, an attempt is made to compile an up-to-date review article on clove covering its habitat, cultivation, collection, tests for purity, extraction methods etc.

### REVIEW FROM AYURVEDIC LITERATURE:

Detailed explanation about the drug Lavanga is not available in the Samhitas and Vedas. In nighantukala the drug was explored more. The properties of Lavanga include Katu tikta rasa, Laghu teekshna guna, Sheeta veerya, Katu vipaka. The karmas attributed to Lavanga are Chakshushya, Bhaktarochana, Deepana, Pachana, etc. It is indicated in

diseases like Shoola, Kshaya, Shwasakasa, etc.<sup>2</sup>

### **BOTANICAL DESCRIPTION:**<sup>3</sup>

**Habit:** the clove tree is a small, handsome, evergreen tree reading 12-15 meter in height, conical in shape when young, later becoming roughly cylindrical in a mature plant. **Stem:** the trunk is up to 30 cm in diameter, is composed of very hard wood. The bark is grey and rough, and slash on a healthy tree is white to rose-pink in colour. **Leaf:** - these are simple, opposite, coriaceous, extipulate, glabrous and aromatic. The petiole is slender, 2-3 cm long, somewhat swollen and pinkish at the base and the lamina is lanceolate or narrowly elliptic dotted with glands, the new leaves appear in flakes and are bright pink. Later the upper surface becomes glossy and dark green, and the lower surface dull and paler. **Inflorescence:** terminal, shortly pedunculate and branched from the base, from 3 flowers as many as 50 or more The angled peduncles and shorter pedicels, about 5 mm long, constitute the clove stems of commerce. **Flower:** hermaphrodite with fleshy hypanthium which is surrounded by the sepals. **Calyx:** four lobed, 3-4 mm long, easily observed in the spice. **Corolla:** 4, imbricate, tinged red, rounded, about 6mm in diameter. Anthers are pale yellow, ovate, opening longitudinally. The style is very stout, swollen at the base, pale green, gland dotted. The stamens fall soon after the flowers open. The two celled, multi ovate inferior ovary is embedded in the top of the hypanthium.



### **ORIGIN AND DISTRIBUTION:**

The plant is indigenous to North Molocca Islands of Indonesia. It is cultivated in Zanzibar, Madagascar, Malaysia, Sri Lanka, and India. In India it is mainly grown in the Western ghats. The tree prefers well drained rich soil with sufficient soil moisture throughout the year. High atmospheric temperature (25-35 degree C) with heavy sunlight, good well distributed rainfall (above 150 cm) and high humidity (above 70%) are preferred.<sup>4</sup> The clove tree appears to be of one uniform type and no distinct varieties have been recognized. Differences have, however been observed in the shape of trees, bearing habit and cropping sessions; variation occurs in the yield, colors, shape, and dimension of cloves.<sup>5</sup>

### **CULTIVATION AND PROPAGATION:**

The clove tree thrives in all situations ranging from the sea level upto a altitude of 900m. It requires of warm humid climate with a well-distributed rainfall of 150-300 cm per annum. Deep and rich loams with high humus content are most suitable. The tree doesn't withstand water logging and drainage is essential. The plant is propagated from seeds sown during August – October. After harvest, the fruits (mother clove) are deskinning by soaking in water for 24 hours and rubbing with sand or ash. Deskinning fruits (seeds) should immediately be sown as their viability deteriorates rapidly. Germination is generally poor and hardly exceeds 70% under best conditions. Seeds are sown in rows, 12-15 cm. apart and 2.5 cm below the soil, in raised nursery beds, prepared under shade. Germination takes place in 4-5 weeks and seedlings are judiciously watered throughout the period in

the nursery. Seedlings are transplanted when they attain a height of 25 cm.<sup>6</sup>

In hilly and undulated lands of Andaman & Nicobar Islands, the tree is grown under multi-tier cropping system. Softwood grafting, a new method of vegetative propagation of clove, using 2 month-old seedlings was tried at Vellanikkara, Kerala and it gave better survival rate. Using scion shoots with leaves intact and providing a humid cap gave 33% success. In Trinidad, survival rate of first year seedlings during dry seasons was significantly improved by mulching the soil; coconut husk mulch was more effective than banana pseudo-stems. Seedling survival also improved by using banana or cassava as shade crops. In Zanzibar, effect of the growth regulator, Paclobutazol, on vegetative growth and flowering in clove was studied. Application of regulator as soil drench or foliar spray on 2 ½ year old trees resulted in early inflorescence, increased girth, height and canopy diameter. In 9 year old trees, the treatment reduced vegetative growth and resulted in 3-fold increase in clove yield.<sup>7</sup>

### **COLLECTION<sup>7</sup>**

In 7-8 years, the budding will start in the trees. The unopened buds are collected from the tree by climbing the tree and plucking it. At first the buds are pink, but as they grow, they acquire a deep red hue. This is the right time to pick up the clove. Harvesting is done manually and then dried in shade for 4-5 days. Work is carried out from November to February. For this, sticks to move the branches are used. This movement will make the cloves fall, if not, it will be plucked manually. Per collection, a tree will yield around 2 ½- 4 ½ kg of clove buds. After

collection, the stalk is separated and the buds are spread on a mat for 4-5 days in shade for drying. As they dry, they change to dark brown in color.

#### **CHARACTERISTIC FEATURES OF PURE CLOVE:**<sup>8</sup>

The dried floral bud has a nail-like shape, it is reddish brown, hammer shaped, heavy about 16-20 mm long. Hypanthium: stalk portion of clove but slightly flattened and tapering below 10-13 mm long 4 mm wide and 2 mm thick. Crown: consists of calyx, corolla, stamens and style. Calyx: Consists of 4 thick, spreading projecting sepals. Corolla: dome shaped (head)

#### **TEST FOR PURE CLOVE:**<sup>8</sup>

Clove when indented with finger nail, exudes volatile oil and when put into freshly boiled and cooled water it sinks. **Caryophyllene test:** when methanolic extract of clove is added with few drops of ferric chloride solution, it turns bluish black in color. When a thick section of Hypanthium of clove is treated with 50% potassium hydroxide solution, needle shaped crystals of potassium eugenate are seen. To the decoction of clove when few drops of ferric chloride solution is added, blue-black color is formed due to the presence of tannins.

#### **EXTRACTION:**

Clove extract or clove oil can be obtained from SFE, hydrodistillation, steam distillation and soxhlet extraction. Comparative studies on different extractions of clove have concluded SFE as the optimum process among the four processes for obtaining clove oil with high quality. Studies conducted to compare the extraction yield and the content of eugenol in extracts using three-level orthogonal array design keeping

different parameters such as temperature( 30<sup>0</sup> C,40<sup>0</sup> C, 50<sup>0</sup> C) and pressure ( 10 MPa, 20 Mpa, 30Mpa) and particle size (three degree index) show that the temperature has the largest effect on the eugenol content of the extracts, and particle size has the maximum effect on the oil yield. The essential oil of 19.56% yield, in which the maximum content of eugenol in extracts is 58.77%, can be extracted from clove buds at pressure of 10 Mpa and temperature of 50<sup>0</sup> C. general characteristics of the clove oils obtained by different methods were further compared and SFE is considered as the optimum process among the four processes for obtaining clove oil with high quality.<sup>9</sup>

#### **Supercritical Fluid Extraction**

Supercritical Fluid Extraction (S.C.F.E.) is the process of separating one component (the extractant) from another (the matrix) using supercritical fluids as the extracting solvent. Extraction is usually from a solid matrix. Carbon dioxide (CO<sub>2</sub>) is the most used supercritical fluid, sometimes modified by co-solvents such as ethanol or methanol. Extraction conditions for Supercritical carbon dioxide are above the critical temperature of 31°C and critical pressure of 74bar.<sup>10</sup>

#### **Procedure**

The system contains a pump for the CO<sub>2</sub>, a pressure cell to contain the sample, a means of maintaining pressure in the system and a collecting vessel. The liquid CO<sub>2</sub> is pumped to a heating zone, where it is heated to supercritical conditions. It then passes into the extraction vessel, where it rapidly diffuses into the solid matrix and dissolves the material to be extracted. The dissolved material is swept from the extraction cell into



a separator at lower pressure, and the extracted material settles out. The CO<sub>2</sub> can then be cooled, re-compressed and recycled, or discharged to atmosphere.<sup>10</sup>

### CHEMICAL CONSTITUENTS<sup>11</sup>

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

**Volatile constituents:** major oil component is eugenol. Bud oil: contains 15-20% essential oil. This oil is dominated with eugenol(70-85%), eugenyl acetate(15%) and beta-caryophyllene(5-12%). Leaf oil: yields 3-4.8% essential oil. This differs on the stages of leaf growth. Studies have revealed that the eugenol content in the leaves increased from 38.3-95.2% with maturity. Clove stem oil: yields 6% volatile oil containing 80.2% eugenol and 6.6% beta-caryophyllene. Fruit oil: ripe fruits yield 2% of oil which is composed of 50-55% eugenol.

**Nonvolatile constituents:** this includes tannins, sterols, triterpenes and flavonoids. Cloves contain 10-13% tannins which have the same chemical composition as galloannic acid Triterpenes: cloves contain about 2% of triterpene, oleanolic acid, maslinic acid and 2 alpha hydroxyoleanolic acid has also been isolated. Sterols: sterols isolated from clove include sitosterol, stigmasterol and campesterol. Flavonoids: a chromone C-glucoside, isobiflorin, and biflorin were isolated.

### PHARMACOLOGICAL ACTIVITIES WITH RESEARCH PROFILE

The ethanol extracts of *Syzygium aromaticum* flower bud were tested for anti-nociceptive and anti-inflammatory effects in mice and Wistar rats which were carried out using acetic acid-induced abdominal contractions in mice and formalin-induced

hind paw edema in Wistar rats. Three doses of the ethanol extract (50, 100, and 200mg/kg body weight i.p.) were used for both studies. The extract had an LD<sub>50</sub> of 565.7 mg/kg body weight intra-peritoneally in mice. The extracts produced significant effect (P<0.05) at all the three doses. Similarly, the anti-nociceptive activity produced significant effects (P<0.05) at all the three doses of the extract. The result supports the local use of the plant in painful and inflammatory conditions.<sup>12</sup> The work was undertaken in order to investigate the possible analgesic effect of clove oil in mice. The result showed that clove essential oil has analgesic effect in mice using hot plate test.<sup>13</sup> The antibacterial properties of "*Syzygium aromaticum*" commonly known as "Clove" tested against food borne pathogens (*S. aureus*, *P. aeruginosa*, *E. coli*). Agar diffusion susceptibility test revealed inhibition zone of clove sample. Compare to ethanolic extract, methanolic extract was showing best result against gram positive culture *Staphylococcus aureus* (MTCC 2940) and two gram negative cultures *Pseudomonas aeruginosa* (MTCC 2453) and *E. coli* (MTCC 739).<sup>14</sup>

### TRADE AND COMMERCE

Clove oil is used in incendiary material containing plant fragrance in match-heads. In Japan, it is used in water soluble lubricating compositions to prevent biofueling in metal working. In Japan, cloves are used to color the fabrics. It is also used to prevent the loss of flexibility embrittlement in palm leaves found in collection of manuscripts, miniature paintings etc. It is used in wood flooring to inhibit the growth of moulds and to repel insects. Ingredient in processing of boiled

beans to retain its colour and taste. It is also one of the ingredients in skin lightening cosmetics, anti-ageing, skin conditioners, toothpaste, dandruff control shampoos etc. Clove prices have soared in the domestic market as demand has outstripped supply. According to dealers and growers in the major growing and supply centre, Nagercoil in Tamil Nadu, the price of the good variety has crossed Rs. 800 a kg. The price has, of late, multiplied nearly four-fold on short supply as the last crop in India was less than half the normal output estimated at 2,500 tons. Indian demand is estimated at between 13,000 and 15,000 tons, market sources. There is a huge shortage of cloves in India as good quantities were exported to Singapore and Indonesia at \$12,000 to \$17,000 a ton. Prices in India for Colombo cloves was Rs. 750 a kg and that for Zanzibar Rs. 900. "The import costs are very high and given the current trend, cloves prices hit Rs. 1,000 to Rs. 1,200 a kg." The annual world cloves crop usually is at 1,41,000 ton, with Indonesia accounting for 1,10,000 ton. At the same time, it also consumes around 1,20,000 ton.<sup>14</sup>

#### **FOLKLORE PRACTICES OF CLOVE**

One of the medicinal benefits of cloves is that it is very effective against a variety of digestive problems. Thus cloves are used in the natural treatment for indigestion, loose stools, flatulence and nausea. In fact cloves are also effective in gaining relief from vomiting, gastric irritability and diarrhea. Additionally clove oil is also recommended to be used as part of skin care for those suffering from acne. The therapeutic uses of cloves also include it being used as a stress reliever. Clove oil is known to stimulate the

mind and thereby provide the individual with relief from mental fatigue and exhaustion. In fact clove oil is also used to treat mental ailments such as depression, loss of memory and anxiety. Another one of the medicinal uses of cloves is relief from headaches. The essential oil, Eugenol obtained from cloves, when mixed with salt and then applied on the person's forehead is known to have a cooling effect thereby providing immediate relief from the headache. Similarly a mixture of warm sesame oil and clove oil is also considered to be an excellent natural treatment for earaches.<sup>15</sup>

#### **ADULTERATION OF CLOVE:<sup>14</sup>**

Cloves are sometimes adulterated with mother cloves, clove stems, exhausted cloves, withered cloves, clove dust containing broken stamens and flowers, cereal starches.

**PARTS USED-** Flower bud<sup>3</sup>

**POSOLGY<sup>3</sup>**-Powder- 1-3g, Oil- 1-3 drops

#### **DISCUSSION AND CONCLUSION**

Lavanga is a very precious spice used since ages known for its high medicinal, culinary and commercial uses. In order to obtain the best quality of the drug, proper cultivation and collection methods must be adopted as Lavanga has specificity with respect to habitat, irrigation and environmental conditions. Since Lavanga is rich with volatile principles, to procure the maximum yield and active component in the extract, Super Critical Fluid (SCF) Extraction is the method to be adopted. Deliberate adulteration of Lavanga is in practice to meet the increasing market demand. Tests for its purity discussed above prove to be very efficient to ascertain the quality of Lavanga. By following all these methods and

techniques, the genuinity of the drug can be retained.

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