

# MINOR SPICES



# Tree spices

- **Nutmeg**
- **Cinnamon**
- **Cassia**
- **Tejpat**
- **Clove**
- **Kokam**
- **Tamarind**
- **Pimento**
- **Star anise**
- **Curry leaves**



# Seed Spices

Coriander

Cumin

Fennel

Fenugreek

Ansie

Celery

Dill

Mustard

Poppy

Caraway

Ajowan or Bishop's weed

Pomogranate

# Herbal Spices

- Marjoram
- Savory
- Tarragon
- Thyme
- Origanum
- Sage
- Basil
- Pepper Mint
- Parsley
- Rosemary
- Lovage

# Other Spices

- **Garlic**
- **Asafoetida**
- **Greater Galanga**
- **Saffron**
- **Sweet Flag**
- **Long Pepper**
- **Horse Radish**
- **Hyssop**

# CLOVE



*Syzygium aromaticum*(L.)

family - Myrtaceae

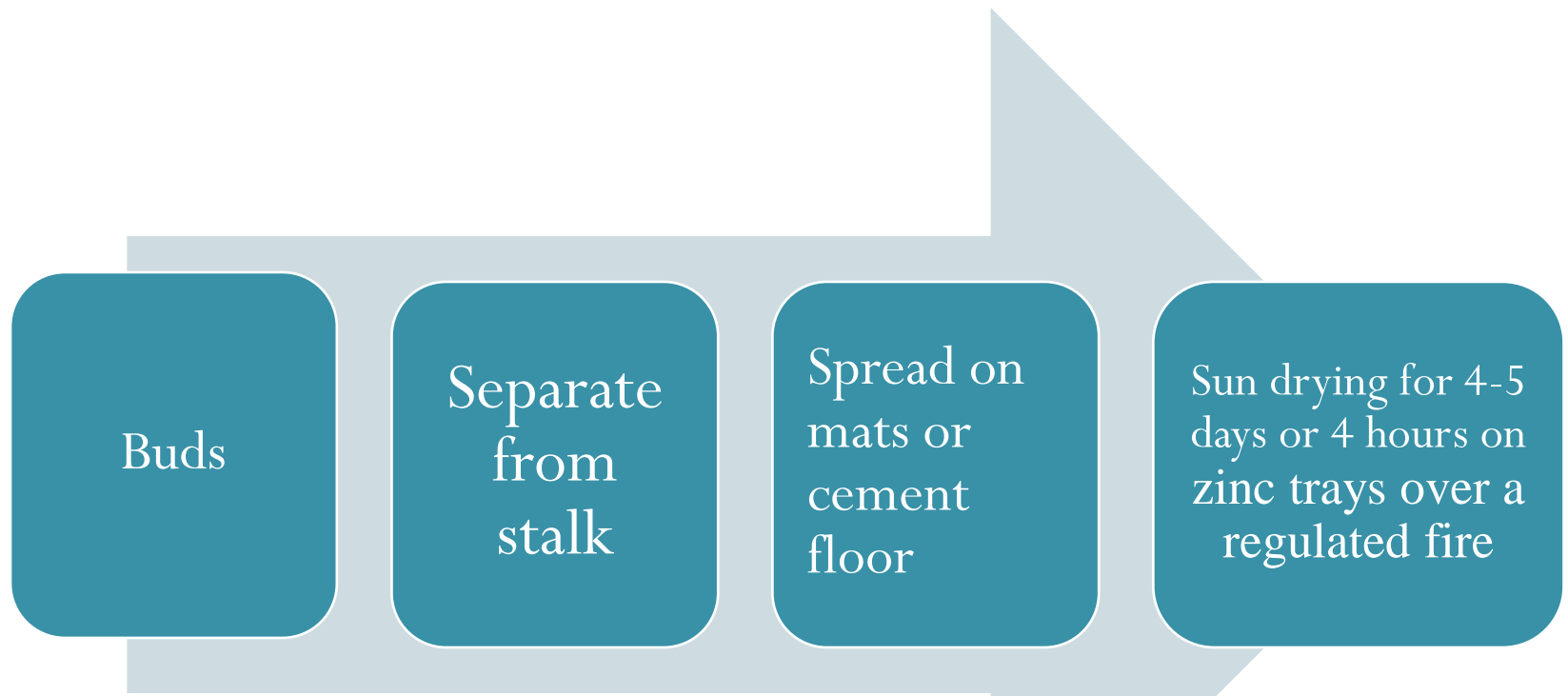
# Clove

- Indigenous : volcanic islands of north molucca, indonesia
- Cloves : Indonesia, India, Madagascar, Zanzibar, Pakistan and Sri Lanka
- India: Tamil nadu, Kerala, Karnataka
- Tree: *Syzigium aromaticum*
- First introduced to India around 1800 AD by the East India company
- Tropical plant and requires warm humid climate, tree is of medium size, evergreen, reaching up to 20m in height and varies in its canopy shape from cylindrical to pyramidal
- Temp: 20-30°C, rainfall: 1500-2000 mm
- Soil: deep red loam, sandy soil, black soil and deep gravelly soil are suitable but water logged conditions are undesirable.
- Fully grown but unopened dried flower buds- whole buds range from ½ to ¾ inch in length and have spike like shape. Popular for flavor.
- *Clove flavor is also available in Clove oil, clove leaf oil and clove stem oil*



- Dried bulbs yield 14-21% oil: eugenol (70-90%), eugenol acetate (5-12)
- Water distillation- 81 % eugenol(suitable for perfumery)
- Dry distillation- strong oil with 95% eugenol
- Volatile oil at low Maturity stages- high eugenol acetate and less eugenol, Fully mature clove – eugenol conc increases and eugenol acetate conc decreases.
- Yield: 4<sup>th</sup> year of planting and full bearing:after 15 years.
- Flower buds are formed on young flush. It takes about 4-6 months for the buds to become ready for harvest (3-4 kg, hand picking)
- Harvesting: colour of unopened buds at the young stage is usually green, turning to flushed pink (before opening of the bud) maturity index. (78-91 days after fruit set –optimum harvesting time)
- At that stage the stamens are still inside and covered by the petals which form the head of the dried cloves.





- **Characteristic dark brown colour and are crisp, full and plump crown (12% mc)**
- **About 8000 to 10,000 good quality clove buds would weigh one kg**
- **Khoker cloves- which have undergone fermentation due to improper drying. Pale brown color and whitish mealy appearance**

## NUTRITIONAL COMPOSITION

Cloves Dry	
Parameters	Value
Moisture	25.2 gm
Protein	5.2 gm
Fat	8.9 gm
Minerals	5.2 gm
Fibre	9.5 gm
Carbohydrates	46.0 gm
Energy	286.0 K cal
Calcium	740.0 mg
Phosphorus	100.0 mg
Iron	11.7 mg
Vitamins	
Carotene	253.0 µg
Thiamine	0.08 mg
Riboflavin	0.13 mg
Minerals & Trace Elements	
Magnesium	130.0 mg
Copper	1.01 mg
Manganese	4.75 mg
Zinc	1.47 mg
Chromium	0.056 mg

Cloves Green	
Parameters	Value
Moisture	65.5 gm
Protein	2.3 gm
Fat	5.9 gm
Minerals	2.2 gm
Carbohydrates	24.1 gm
Energy	159.0 K cal
Calcium	310.0 mg
Phosphorus	40.0 mg
Iron	2.1 mg
Vitamins	
Carotene	72.0 µg

## Chemical composition of volatile oil (15-20%)

compound	Whole or ground clove
eugenol	70-95
eugenol acetate	17
$\beta$ -caryophyllene	12-15

- ❑ Clove bud oil (16%), Clove leaf oil (1-2%),
- ❑ Clove stem oil (4-5%), Oil of mother clove (6.5%), and clove root oil (6%)

## 1. Dried clove bud

- After being harvested, the buds are separated from the stems (hand or thresher machine). Buds are dried under the sun or using an artificial dryer. The colour and oil content of artificially dried cloves are not significantly different from sun dried.
- **Storage:** gunny bags and should be stored in a clean, dry room with good ventilation

## 2. Ground clove

- Ground clove is produced by milling and/or grinding of the dried clove buds at low temperature (25°–35°C) to prevent the loss of valuable volatile constituents during processing
- pre-chilling, water cooling or refrigeration of the grinding chambers have been developed to minimize the heat formed during processing
- For extraction and distillation-coarsely- ground material direct use- finer product is required.
- Very fine clove powder : two step procedure is usually conducted
- Reduce to coarse powder by slow speed breaker or cutter mill then ground to the desired fineness.

## Clove oil

Clove buds and stem are comminuted, leaf

Water or steam distillation (8-24 hours)

subcritical condition  
50–80 bar pressure and  
0 to 10°C

17% oil  
85-90% eugenol

## Clove oleoresin

Extraction using suitable solvent (ethanol, benzene, alcohol) and then evaporated or distilled

18-30% oleoresin with 90-92% volatile compounds

supercritical CO<sub>2</sub> extraction: 200–300 bar pressure at 50–80°C

Clove bulbs

passing between rubber rolls

Individual cloves are obtained

Screening or aspirating to remove paper shell

Washing in flood of water

Slicing (designed high-speed cutter )

spread on drying trays- tunnel type dehydrators 10–15 hours at 60–65°C  
(10% moisture content)

place in large bins

Force warm air (30 hours)

Powder(6.5 % moisture content)

powdered, minced, coarse, granulated, chopped, diced



## Use

- Aid in digestion, cure stomach disorders and helps in pain relief
- Eugenol has antiseptic & antioxidant properties(1.4-1.8%)
- Clove oil- inflamed oral and pharyngeal mucous and for topical anesthesia in dentistry, potent bactericide, nematocide and fungicide
- Balm with clove oil soothing pain caused by rheumatism

# Cinnamon (*Cinnamomum verum*) Family - Lauraceae)



- A native of south western tropical India and Sri Lanka
- 250 species—distributed in South East Asia, China, Australia, Seychellus and Malagasy Republic
- Sri Lanka – Largest producer and exporter
- In India- Kerala, TN and Karnataka
- It is precious not only as a flavoring agent, but was esteemed as a medicine, perfume and as one of the aromatics burned as incense.

### **Climate & Soil**

A hardy plant which tolerates a wide range of climate

- Altitude: 300-1000 m from MSL
- Avg temp: 27 °C
- Rainfall: 150-250 cm
- Hot and moist climate – highly suited

## **Chemical Composition and Uses**

- **Dried inner bark of C.verum– commercially imp.**
- **Bark, oil and oleoresin– economically imp products**
- **Small piece of bark or powder form- used as spice**  
**Domestic culinary flavoring and industrially manufactured sauces, candy, pickles and some beverages.**
- **Ground form – used in curry powders and to flavor baked foods like bun and cakes and in preparation of various preserves**
- **Used in the manufacture of soaps, dental preparations and perfumes.**
- **Cinnamon bark –used in indigenous medicinal preparations**
- **Bark has carminative, astringent, stimulative and antiseptic properties**
- **It checks vomiting and relieves flatulence**

# HARVESTING

- Starts from 4<sup>th</sup> of 5<sup>th</sup> year after planting (depending on the availability of peeler shoots)
- Coppicing is required from 2<sup>nd</sup> year or 3<sup>rd</sup> year onwards, to maintain a height from the ground level
- Stems are cut during rainy season to facilitate peeling. Best time for peeling is when new flushes and leaves are hardened after a rainy season
- Harvesting interval: 12-18 months
- Cut stems are collected, tied and bundled and carried to the peeling shed. (cutting is followed by scraping and peeling). After scraping the peeling is done carefully by piercing the bark with a sharp knife.
- Tube like barks (20-28cm in length) are placed one inside the other to form a tube of 90 cm known as Quill. These are then piled up within enclosures of sticks and wrapped up in mats and kept overnight . Light softening of the bark, peels become more pliable

**Sun drying on a mat for 3 days- shade drying for the next 3 days (During drying hand pressing of quills to prevent it from opening up )**

**Quillings—Barks which can not be taken out as tubes**

**Featherings— scraped pieces**

**Yield : about 70-100 kg of quills and 30 kg of quillings and featherings from 0.4 ha of cinnamon after 4 years, full yield -200 to 300 kg of quill.**

**Aromatic oil** – by distillation of leaves, yield : 1.8-2.6 % in fresh leaves and 3.75% in dried leaves. (drying under shade is recommended to avoid the loss of oil), almost equals clove oil in its eugenol content. Used for flavoring of sweets and confectionery and is a common adulterant for bark oil. Good for rheumatic patients

- **Bark oil , root bark oil and seed oil** : also available.
- Yield –bark oil – 0.95 to 3.55%(main constituent – cinnamaldehyde (65%))
- Root bark oil and seed oil – not imp commercially
- From unripe fruits a medicinal oil can be extracted
- Cinnamon bark oil- substitute for the spice, used as flavoring agent, also used in perfumery and pharmaceutical applications. As a powerful local stimulant, prescribed in flatulence and gastric disabilities. Also has high germicidal and fungicidal activity , but due to the irritant nature prevents its use as such.



# Oleoresins

- From bark – oleoresins recovery 10-12% , dark brown oil containing 50% of volatile oil, has to be diluted before using it as a flavoring agent.
- Other minor products- buds and wood
- Buds- used for flavoring and spicing
- Wood- soft timber for low grade board wood

# Seed spices

Coriander, cumin, fennel, fenugreek, anise, celery, dill, mustard, poppy, caraway, ajowan, pomegranate

Coriander

Cumin

Fenugreek



# *CORIANDER- Coriandrum sativum* L., family Umbelliferae

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- ❑ pleasant aromatic odour: stem, leaves and fruits (due to essential oil)
- ❑ India: prime position
- ❑ Besides seeds, fresh leaves (Chinese parsley) are used for garnishing of food
- ❑ A thin stemmed, small bushy herb, 25-50 cm in height with many branches
- ❑ Coriander green leaves contain
  - 87.9% moisture
  - 3.3% protein
  - 0.6% fat
  - 6.5% carbohydrates, 1.7% : mineral matter
  - Vit C 25-250 mg/100 g, Vit A- 5200 IU/100g



# CORIANDER SEEDS

Mature dry seeds are tan to brownish-yellow and have

6.3–8.0%	moisture,
1.3%	protein,
0.3–1.7%	volatile oil,
19.6%	non-volatile oil,
31.5%	ether extract,
24.0%	carbohydrates,
5.3%	mineral matter and
vitamin A	175 IU per 100 g



- Coriander : A tropical crop – requires cool and comparatively dry frost free climate
- Cultivated either as a pure crop. or as mixed crop under irrigated or rain fed condition

Unripe: aliphatic aldehydes imparts fetid-like aroma

Ripened: more pleasant and sweet odour- linalool

Dried ripe coriander seeds: steam-volatile oil and fixed oil (clear, colourless to light yellow liquid)

Aroma: warm, spicy-aromatic, sweet and fruity



# HARVESTING

Ripens in 90-115 days (even 125 days) depending on the variety and agro-climate.

- ❑ **when 60% of seeds in main umbels** starts turning from green to yellowish brown
- ❑ Uproot the plants or cut with sickles
- ❑ Tied in small bundles and stacked
- ❑ dry in the shade, keep the bundles upside down
- ❑ After drying ,seeds are separated by light beating with sticks on threshing floor.
- ❑ Grains cleaned by winnowing and stored in moisture free storage



**Dual Purpose varieties– the foliage is plucked when crop is 60 to 70 days old**

**Yield: 1.0 – 1.5 t/ha (irrigated condition)**

**0.4- 0.5 t/ha (rain fed condition)**

**0.15- 0.30 t/h (mixed crop)**

### **Processed Products**

**Whole coriander, ground coriander (powder)**

**Coriander seed oil, coriander herb oil**

**Coriander oleoresins**

**Fresh green plant – used as a flavorant in chutneys and soups.**

**Seeds extensively used as condiment with or without roasting**

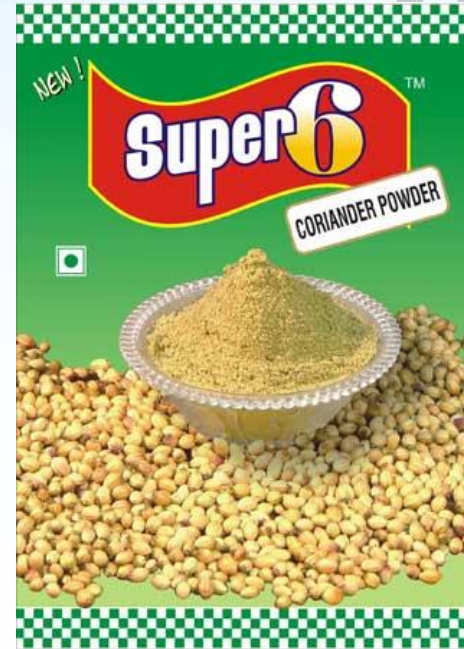
**☐In medicine** carminative, refrigerant, diuretic and aphrodisiac





# \* USES

- curry powder
- pickling spices
- sausages and seasonings,
- baked goods
- condiments
- chewing gums and
- alcoholic/non-alcoholic beverages



# Cumin *Cuminum cyminum* L. (Apiaceae)

- ❑ Commonly called as Safaid zeera
- ❑ Annual herb- native of Egypt and Syria
- ❑ Iran, India, China, Southern Russia, Europe, Turkey
- ❑ India – largest producer and consumer
- ❑ Rajasthan, Gujarath, MP, Karnataka,AP, UP, and TN
- ❑ Tropical annual plant , prefers mild climate. Well drained,medium to heavy textured soils are suitable.



# Physico chemical Composition

Moisture	:	6.2%
Protein	:	17.7%
Fat	:	23.8%
Crude Fibre	:	9.1%
Carbohydrate	:	35.5%
Mineral matter	:	7.7%
Calcium	:	0.9%
Phosphorus	:	0.45%
Iron	:	0.048
Sodium	:	0.16%
Potassium	:	2.1%
Vitamins	:	mg per 100 g
Vit B1	:	0.73 mg
Vit B2	:	0.38 mg
Niacin	:	2.5
Vit C	:	17.2 MG
Vit A	:	175 IU/100g
Food Energy	:	460 Calories/100g

- yellowish green or yellowish brown, elongated ovoid; 3–6 mm in length. The surface has five primary ridges alternating with four less distinct secondary ridges bearing numerous short hairs
- about 2–4.5% of volatile oil, 10% fixed oil, tannins, oleoresin, mucilage, gum, protein compounds and malates
- odour and flavour is due principally to the aldehydes (cumenic aldehyde) or cuminol, p-menth-3-en-7-ol and pmentha 1,3-dien-7-ol.

# HARVESTING

- ❑ Crop matures in 80-120 days depending upon the variety and agro-climatic conditions
- ❑ Uprooted plants stocked together in the sunlight for drying
- ❑ Separation of seeds manually by beating with sticks, cleaned by winnowing
- ❑ Clean dried seeds are stored in gunny bags.
- Healthy crop yield: 6-8 q/ha



# Processed products

Cumin powder

Cumin oleoresin

Volatile oil

Fixed oil

Seeds: aromatic odour and spicy and somewhat bitter taste

- Largely used as condiment
- Essential ingredient in all mixed spices and curry powder
- for flavoring soups, pickles and for seasoning bread and cakes
- They are also candied
- In medicine – cumin seeds are considered stimulant , carminative, stomachic, astringent and useful in diarrhea and dyspepsia. Also used in veterinary medicine.



## Cumin oil production (Volatile oil)

- Steam distillation of crushed dried seeds
- Volatile oil: colourless or pale-yellow oily liquid with a strong odour, yield: 2.5-4.5%
- Storage: well-sealed bottles or aluminium containers
- Chief constituent: cuminaldehyde (20-40%)



**Use:** instead of seeds- in many types of flavouring compounds

- lime or lemon-based marinades for chicken, turkey, lamb, and pork, or added to chilli, curries or spicy meat stews. It can be added to olive oil when stir-frying vegetables
- Used in perfumery and for flavoring liquors and cordials. Also used as carminative
- residue after extraction- rich in protein (17.2%, fat 3%- can be used for cattle feed



Fixed oil: 10% (non volatile oil)- greenish brown  
– strong aromatic flavor- used in fat, oil and  
soap industry



# Herbal spices

Marjoram, savoury,  
tarragon, thyme,  
origanum, sage, basil,  
peppermint, parsley,  
rosemary, lovage



# Pepper mint

- ❖ *Genus- Mentha*, family Lamiaceae
- ❖ 25 species- Japanese mint (*M.arvensis*), Pepper mint (*M. piperita*)  
Spear mint (*M. spicata*) and Bergamot mint (*M.citrata*)
- ❖ Peppermint- fragrant volatile essential oil, sweet flavour
- ❖ *Mentha piperita* L.,

**Harvest:** herb is cut just before flowering with the sickle, spread in shade to reduce the bulk and increase the recovery of oil

- ❖ Peppermint oil: colourless, yellowish or greenish liquid, with a peculiar, highly penetrating odour and a burning, camphorescent taste.
- ❖ It thickens and becomes reddish with age, but improves in mellowness, even if kept as long as ten or fourteen years.

- large variety of aroma chemicals:  $\alpha$ ,  $\beta$  -pinene, Cineole, Jasmone, Isomenthol, Isomenthone, Ledol, Limonene, Menthofuran, Menthol, Menthone, Menthyl acetate, Neomenthol, Piperitone, Pulegone and Viridiflorol
- Peppermint oil: Menthol 29–55%, menthyl acetate and isovalerate
- On cooling: separation of menthol occurs, if a few crystals of that substance be added to start crystallization

### **Commercial uses:**

- Peppermint oil, peppermint extract and peppermint leaves
- Pharmaceutical industries
- Dental preparations, mouth washes, cough drops candies, confectionary
- Strong repellent action against adult mosquitoes, virucidal effect against herpes simplex virus

# Basil

family: Lamiaceae

bot name: *Ocimum basilicum*

Genus *Ocimum* is classified into *basilicum* and *sanctum*

Native: India

Spicy (fresh), sweet (dried)

Harvest: after 90-95 days of planting, cut 15-20 cm from ground level

Further processing before 8 hours of harvesting

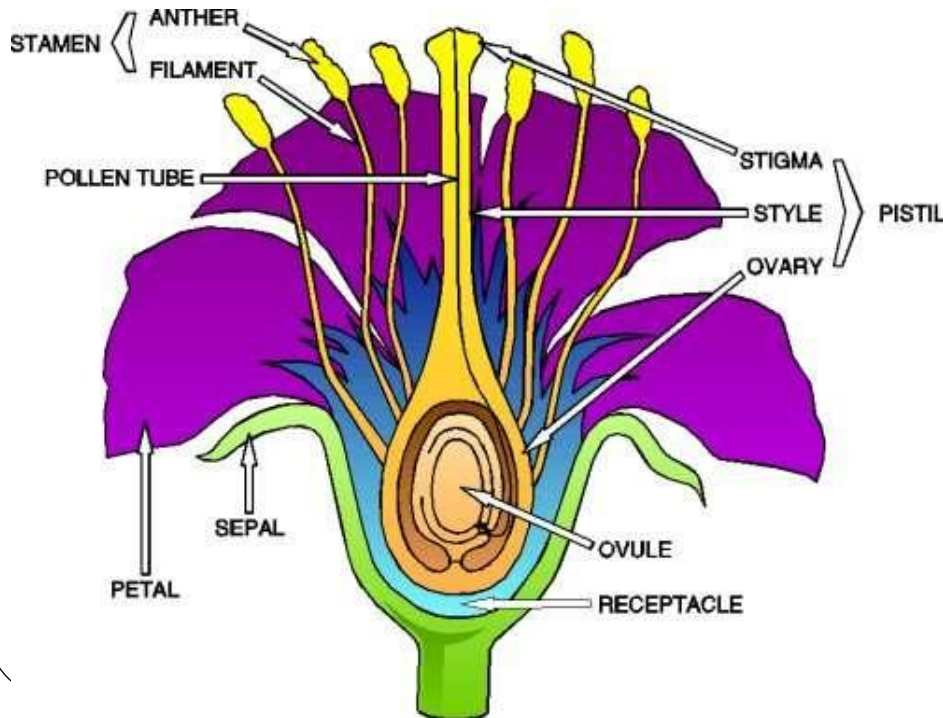
Essential oil: methyl chavicol(35%), linalool(40%), methyl cinnamate, eugenol

# Saffron

The most expensive spice in the world

- dry stigmata of the saffron crocus

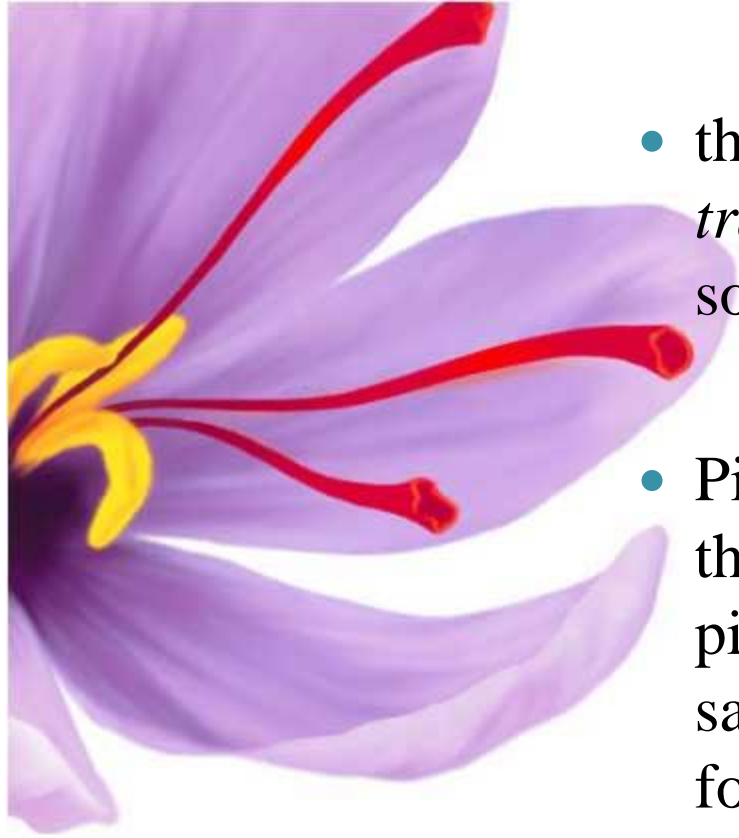
*Crocus sativus* L., family *Iridaceae*



ISNA

ISNA/PHOTO:AMIR HOSEIN HEIDARI





- the colouring strength of saffron are *cis* and *trans* crocins. Crocins are unusual water-soluble carotenoids.
- Picrocrocin or saffron bitter is responsible for the bitter taste of the spice. By submitting picrocrocin to hydrolysis and dehydration, safranal, the principal substance responsible for the aroma of saffron, is obtained
- The essential oil obtained by hydrodistillation of saffron contains safranal as main constituent and many other derivatives of cyclohexane

## Saffron is hand-harvested at the flowering season

- Saffron- gently toasting the stigmata in a silk sieve over the embers of a charcoal fire.
- Iran-removing the whole style with the stigmata binding them together in bunches and sun drying
- New Zealand, saffron is dried in an airflow oven at 30°C for 34 hours
- India-low yield
- Between 70 000 and 200 000 flowers are needed to produce 1 kg of dried saffron threads









- Use- as a culinary seasoning and to colour foods
- Cottage cheese, bouillabaise, chicken and meat, rice, mayonnaise, liquors and cordials.
- Health tonic
- Dyes and colouring matters, perfume and in cosmetics.



## MEDICINAL PROPERTIES

Cure for kidney, anodyne, antihysterical, antiseptic, antispasmodic, aphrodisiac, balsamic, cardiogenic, carminative, diaphoretic, ecbolic, emmenagogue, expectorant, nervine, sedative, stimulant, and stomachic



# Asafoetida

- 60 species: *Ferula asafetida*, *F. narthex*
- G:Ferula, Umbeliferaceae
- two major varieties are Hing and Hingra
- dried latex, oleogum or oleoresin exuded from the taproots (volatile oil, gum n resin)
- carrot-like taproots attain a diameter of 12 to 15 cm at the crown after four to five years of growth
- three forms, tears, mass and paste
- Tears- purest form of resin and are round and flattened, 5–30 mm in diameter and greyish or dull yellow in colour.
- Mass- is the common commercial form. It comprises tears agglutinated into a more or less uniform mass mixed with fragments of root, soil.
- Paste also contains extraneous matter

- white or pale variety and the dark or black variety. The former is soluble in water while the latter is soluble in oil
- two groups of compounds in the oil, one group belongs to the ferulic esters and the other, which is more important, is a volatile oil fraction consisting of different sulphur compounds
- volatile oil 3.5%, resin 46.6%, asaresinol ferulate 16.67%, free ferulic acid 1.33%,
- ether insoluble resin 1.0% and gum and impurities 31.0%.



Remove soil and stones surrounding foliage and base of foliage base of the foliage, including the top of the taproot, is exposed.

Pull out the foliage out leaving the base on the upper part of the taproot as a brush like mass.

brush-like mass is covered with loose earth and gravel(5 days)

Clean and remove brush-like mass is pulled out completely exposing the top of the taproot

Scrape and shade in a construction of twigs and stones

After 2-3 days first flow of sap is collected from the top of the taproot

Make a slightly deeper cut is made of about 0.5 cm from the top and collect sap(10-15 cycles)

- sap is stored in pits dug in the soil sides of the pit are plastered with mud and the top covered with stalks of male asafoetida plants, leaving an opening of about 0.3 m diameter, through which the daily collection of sap can be poured into the pit.
- very thick and sticky
- White asafoetida is packed first in cloth bags and then in jute bags. Dark red asafetida is generally packed in goat- or sheep-skin, where it matures further.





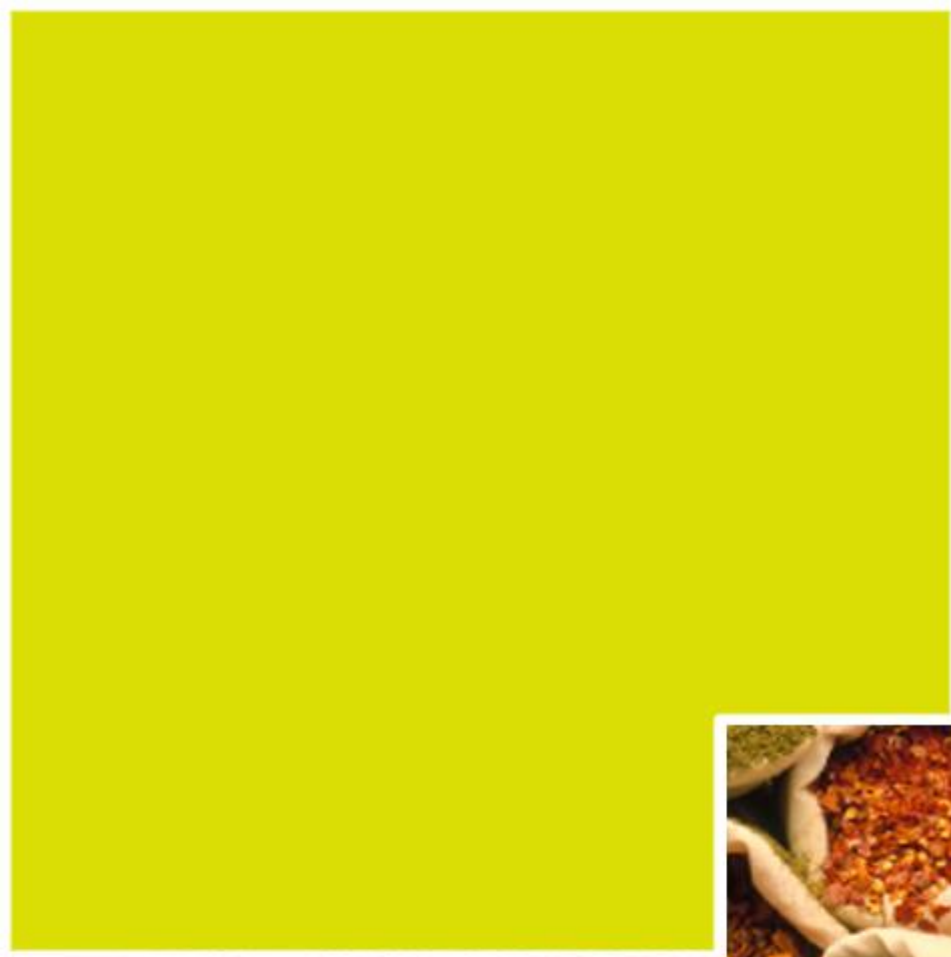
# USE

main processed products:

oil of asafetida (3.3 to 3.7%) and compounded asafetida

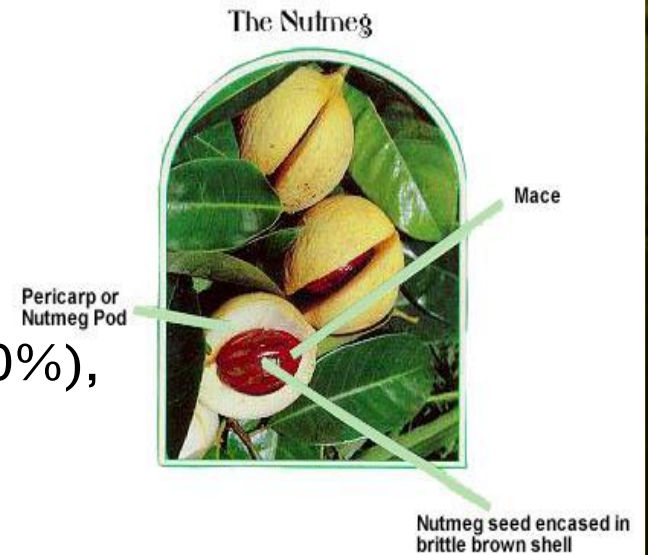
- **Compounded asafetida** is a ready-to-use preparation. composed of asafetida from one or more origins and gum arabic, with edible starch or edible cereal flour.
- Use: ingredients used in ointments for wounds, lesions and ulcers, nervous disorders





# Nutmeg and mace

- ❑ 2 different parts of same fruit
- ❑ *Myristica fragrans* houtt, family Myristiceae
- ❑ Indegenous: Banda islands of Moloccus
- ❑ Production: Indonesia(75%), West Indies (20%), Sri lanka, India, China.
- ❑ Tree in conical, height 4- 10 metres
- ❑ Nutmeg: dried kernel of seed  
mace: dried aril surrounding seed
- ❑ Fruting: 6<sup>th</sup> year, optimum- in about 15 years





# Composition

Content	Nutmeg	Mace
Moisture	14.3 g	15.9 g
Protein	7.5	6.5
Ether extraction	36.4 g	24.4
Carbohydrate	28.5	47.8
Fibre	11.6	3.8
Minerals	1.7	1.6
Calcium	120 mg	180 mg
Phosphorous	140 mg	100 mg
Iron	4.6 mg	12.6 mg
Vit B1	0.33 mg	0.35
Vit B2	0.01 mg	0.42 mg
Niacin	1.4 mg	1.4 mg
Volatile oil	6-16%	4-15%

Principal constituents of nutmeg are- fixed oil(fat), volatile oil and starch. Flavor and therapeutic action are due to volatile oil (6-16%)

Nutmeg butter – by pressing the ground and cooked or steamed kernels (24-30%)—solid yellowish red fat with nutmeg odour

Mace fat – similar to that from nutmeg but less quantity

Leaves – 0.41 to 0.62 % light brown volatile oil with a pleasing odour- obtained by water distillation.

Flowering –

Female plant – flowering confined to 7 months'

Male plant – throughout the year max in july and october

Flower development- female – 154 days, for male –half the time

Nutmeg- requires hot humid climate with no pronounced dry season.

Soil – rich in org matter and well drained , tree prefers partial shade

Fruiting- from 6<sup>th</sup> or 5<sup>th</sup> year, may also take 8<sup>th</sup> or 9<sup>th</sup> year

Delayed fruiting in 9<sup>th</sup> year is best. Optm productivity in 15 years

Fruit ripens in 6-9 months after flowering

In India- when the fruits split open on the tree and exposing crimson coloured aril are harvested

If the nutmeg and mace oils are intended for medicinal purpose, harvest the fruits at 6<sup>th</sup> month for extracting kernel oil and at 5<sup>th</sup> month for extracting mace oil.

Average yield of a full bearing tree-3000 fruits

Average weight of a single fruit is 60g, seed 6-7 g, mace 3-4 g and the rest is pericarp. Fruits are collected from the tree by hand or with hooked sticks or allowed to fall naturally on the ground and are gathered everyday.



Fruit: 3 parts- husk, mace, seed

Pericarp is removed, mace is peeled off and flattened by hand or between boards and then spread to dry in sun for 2-3 days

Nuts are left in shell and dried in sun or ovens

Seed rattles- end stage of drying( 1 week)

Crack shell by wooden hammers or mechanically by specially designed machines

Ratio of dried nutmeg to dried mace-20:3

Packaging: double layered linen, jute, sisal, PE bags



# Products

- ❖ Nutmeg oil: 5-15% colourless pale yellow- green
- ❖ Oil compound: hydrocarbons with smaller amounts of oxygenated monoterpenes and aromatic ethers
- ❖ Nutmeg oleoresin: by solvent extraction using benzene or cold ethanol (18-35%)
- ❖ Nutmeg butter : fixed oil of nutmeg obtained by expressing or extraction by solvents
- ❖ Fixed oil is semisolid, reddish, brown fat
- ❖ mace

Oil content: 20-35%

Clear red to amber red liquid

leaves: 0.34-0.65

Oleoresin with volatile oil: 10-55%



# Uses

Nutmeg is a stimulant, carminative, astringent, aphrodisiac, and hallucinogen.

Mace – used for flavoring cigarettes, and chewing to mask the foul breath.

Oil of nutmeg and mace – for flavoring food products and liquors, soaps, tobacco, dental cremas, perfumery products etc.

Volatile oil from leaves- weedicide activity

Nutmeg butter – used as stimulant in ointments, hair lotions, and is used in cases of rheumatism, paralysis and sprain.

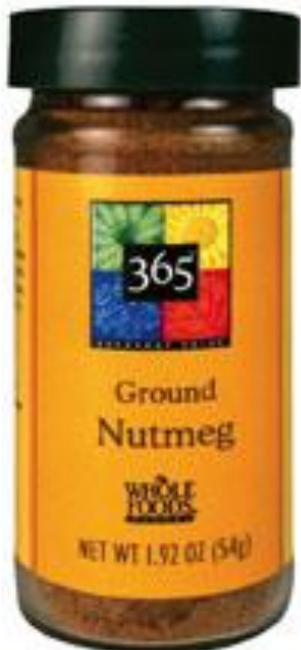
Fleshy pericarp – for pickles and jelly





## Uses

1. Ground form
2. Dutch dishes
3. Nutmeg: soup, sauce, baked foods, confectionary, pudding,
4. Mace: sausage, pickle, chutney, ketchup
5. Soft drinks, canned and meat products



## Curry leaf



- (*Murraya koenigii*, *Bergera koenigii* Koen *Chaleos koenigii*), family Rutaceae
- It has asparagine, glycine, serine, aspartic acid, glutamic acid, theonine, alanine, proline, tyrosine, tryptophan, amino butyric acid, phenylalanine, leucine, isoleucine, and traces of ornithine, lysine, arginine and histidine.
- Also contain a crystalline glucocide, koenigin and a resin.
- Fruit- 0.76% of a yellow volatile oil with neroli-like odour and pepper-like taste
- Plants should be pruned at the age if 8-10 months after planting at a height of 30 cm.





- leaves retain their flavour even after drying (fresh, dry)
- Drying in oven at 50°C
- Fresh leaves on steam distillation yield 2.6% of a volatile oil, hydrodistillation gave 0.5% essential oil(70 °C)

• moisture	66.3%
• protein	6.1%
• fat(ether extract)	1.0%
• carbohydrate	18.7%
• fibre	6.4%
• mineral matter	4.2%



# References

- [www.spiceindia.com](http://www.spiceindia.com)
- Spices: E. V. Nybe, N. Mini Raj, K.V. Peter
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