Spices

Definition:

- Aromatic vegetables and are used for seasoning or garnishing foods and beverages
- Condiments: are spices or other flavourings and are usually added to food after cooking
- Culinary herb: aromatic vegetable product comes from a temperate plant

bay leaves

তেজপাতা

coriander

ধনে

cumin

জিরা

fennel

মৌরি

fenugreek

মেথি

Characterization:

- They are pungent: strong odour and sweet/bitter taste.
- They are hard or hardened parts of plants

Black pepper

cinnamon

cloves

cardamom

Use:

- Ancient time: preservatives, ointments, perfumes, antidotes against poison, cosmetics and medicines and were little used in food.
- Middle ages, spices were considered important medicines.
- Today: a few are used in the official drug lists, and these are used for imparting a pleasant taste.
- A few spices have antiseptic and carminative properties too.

- In our daily diet
  - To give an agreeable flavor and aroma
  - To stimulate and increase the flow of the gastric juices
  - To camouflage or disguise the slightly unpleasant taste of many dried meats and
  - To increase the rate of perspiration, thus having a cooling effect on the body.

Ginger (আদা)

- *Zingiber officinale* Rosc. (n = 11)
  Family: Zingiberaceae
- Dried and branched rhizomes
- South-East Asia: used by the Chinese
- India is the primary producer, consumer and exporter of ginger in the world
- Karnataka, Assam, Arunachal Pradesh, West Bengal, Sikkim and Madhya Pradesh
- Two popular varieties: Cochin ginger and Calicut ginger

Parts Used

- The rhizomes are pale yellow or yellow-orange in colour and greenish yellow inside.
- It requires curing (preserve by drying) after harvesting.
- Rhizomes appear on the market in the following two forms:
- Dried or cured ginger:
  - scraped or peeled ginger (also known as uncoated ginger) and
  - unscraped or coated ginger
- Preserved or green ginger:
  - It is prepared by boiling the tender, peeled rhizomes in water
  - They are boiled and sold in sugar syrup
  - Crystallized ginger is produced which is dried and dusted with sugar

Active Constituents

- The characteristic aroma: volatile oil (**ginger oil**),
- The pungent taste: a non-volatile **oleoresin**, **gingerin**.
- Minute sacs containing essential oil and resin are distributed throughout the rhizome
- Mainly in the epidermal tissue: excessive scraping of the rhizome should be avoided.
- Unpeeled ginger constitutes the best source for extracting the essential oil and oleoresin.
- The principal constituents:
  - zingiberent,
  - zingiberol,
  - chavicol,
  - cineole,
  - geraniol,
  - d-camphene and d-β-phellandrene.
- The non-volatile fraction of ginger:
  - the oleoresin,
  - Gingerin contains: gingerol, zingerone and shagaol

Use of Ginger

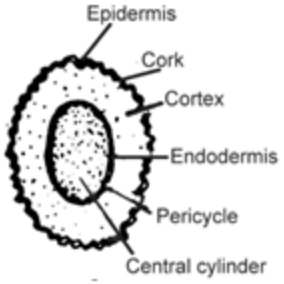
- Ground, cracked (broken bits) or whole
  - cookery mainly as a flavouring agent.
- Powdered dry ginger
  - component of curry powder.
  - pickled in salt
- Dry ginger
  - several by-products, such as ginger oil, ginger essence, ginger oleoresin, tinctures
- Vitaminised effervescent ginger powder
  - soft drinks: ginger ale (the US) and ginger wine.
- In medicinal and veterinary preparations
  - a stimulant and carminative.
- Ginger oil (steam distillation)
  - food flavouring and
  - perfumery,
  - Men's toilet lotions
- Oleoresin
  - flavour soft drinks

Turmeric (হলুদ)

- *Curcuma longa* L. (2n = 62, 63, 64)
- Syn. *C. domestica* Val.
- Family: Zingiberaceae
- Dried and processed rhizomes
- Indigenous to southern Asia
  - condiment
  - Dye stuff and
  - medicine
- Most important and ancient Indian spices
  - Andhra Pradesh (60%), Tamil Nadu (13 %) and Odisha (12 %).
  - West Bengal, Karnataka, Maharashtra, Assam and Kerala
- Indian turmeric best in the world
  - High “curcumin” content
  - antitumor, antioxidant, anti-amyloid and anti-inflammatory

Parts Used

- The plant is propagated vegetatively
- Both bulbs and projection like-fingers: used as “seed” (planting) material
  - Dug out by hand
  - the fibrous roots are cut off.
- Green turmeric has to be cured and processed
- Curing:
  - boiling the rhizome in water over a slow fire (until they become soft).
  - A few leaves of turmeric are usually added to the water in a cooking vessel.
  - A little cow dung is known to intensify the colour of the product.
  - Drying: Cooked rhizomes are spread out in thin layer in the sun (5 to 7 days)
- Cured and finished turmeric
  - deep yellow to orange yellow in colour
  - a distinctive pungent flavour
  - Rhizomes are rough, hard and possess numerous encircling ridges (annulations)
  - In a cross section, the endodermis is clearly visible separating the cortex from the central cylinder
  - The cut surface is waxy, rough and resinous in appearance.



Active Constituents

- The characteristic odour
  - Essential oils (5-6%): d-α-phellandrene, d-sabinene, borneol, zingiberene and sesquiterpenes.
  - Its bright yellow colour is due to a group of compounds called curcuminoids (polyphenols), which include "**curcumin**" (diferulomylmethane),
  - The other two constituents: demethoxy-curcumin and bisdemethoxy-curcumin.
  - It contains sugars, proteins, resins and volatile oils (tumerone, atlantone and zingiberone)
  - Turmeric is an excellent source of minerals (manganese and iron)

Use of turmeric

- In India
  - Mainly as **spice**.
  - A fine yellow powder: yellow **dye stuff**, vegetable dye (silk, cotton and wool).
  - Constituent of **curry powders** (a blend of numerous spices and herbs).
  - Turmeric is used as a **colouring matter** in pharmacy, confectionery and **food technology** (alcoholic solution: is used for colouring and flavouring margarine, butter, cheese, fruit drinks and beverages).
  - **Rice**, coloured **yellow** with turmeric, is used on ceremonial **occasions**.
  - of **minerals** like **manganese** and **iron** and also a good source of **vitamin B6**– all the three nutrients are essential for the **formation of red blood corpuscles (RBC)**.
  - **Curcumin** is implicated
    - to lessen the chance of **Alzheimer**'s disease (a degenerative brain disorder causing senility).
    - powerful **antioxidant** (scavenges free radicals from our body).
    - It may help combat different kinds of **cancers** (skin and colon etc.).
    - Anti-inflammatory, anti-diabetic, antibacterial, antifungal and anti-viral activities.

Use of turmeric **contd..**

- The protective effects of turmeric on the **cardiovascular diseases** include
  a. Lowering of LDL or bad cholesterol total cholesterol and triglyceride levels in the bold stream.
  b. Stops platelets from clumping together
  c. Prevents blood clots or plaque from building up along the arteries walls that cause **atherosclerosis** (hardening or blocking of arteries), which leads to heart attacks and strokes.
- Curcuminoids stimulate the **immune system**
- It stimulates **bile production**, thus increasing the body's ability to **digest fats** (improving digestion and also eliminating toxins from the liver, like alcohol)
- Medicinally: tonic and as a **blood purifier**
- **Boiled with milk** and sugar, it is taken as a remedy for the common **cold**.
- Turmeric powder and water are used in **cosmetics** in India and elsewhere in south-eastern Asia.
- It is still used on **auspicious occasions** in Hindu religious rituals or observances.

Other economically important of the genus

- Mango ginger (*C. amada* Roxb.),
- East Indian arrowroot (*C. angustifolia* Roxb.)
- Wild turmeric (*C. aromatica* Salisb.)


Mango Ginger


C. angustifolia


C. aromatica

Cinnamon (দারুচিনি)

- *Cinnamomum verum* J. S. Presl. (n = 12)
- Syn. *C. zeylanicum* Garc.ex Blume
- Family: Lauraceae
- Cinnamon represents the **dried inner bark** : indigenous to Sri Lanka and South India
- Breath-sweetener and a general tonic
- Sri Lanka is the largest producer of “True” or **Ceylon cinnamon**
- In India- hilly pockets of Kerala, Karnataka and Tamil Nadu

Parts Used

- The plants are cut close to the ground following the monsoon rainfall
- It facilitates the peeling of the bark.
- Each coppicing (cut periodically to stimulate growth) produces new shoots, which in turn are ready for cutting in three years' time.
- Two longitudinal slits are made and the bark is peeled off
- The bark is then firmly tied together in bundles and left for 24 hrs.
- The corky outer layer of the bark is then carefully scraped off, allowed to dry
- It makes it contract and curl inward in the form of hollow tube-like structures '**the quills of commerce**'.
- After final drying, the smaller quills are inserted into the larger quills, forming compound quills.
- The chips and refuse (the waste) left after the collection of quills are used for the extraction of an essential oil

Active Constituents

- The bark contains essential oil: **cinnamon bark oil** (0.5 to 1.5%).
- Its chief constituent is **cinnamic aldehyde** (60-75%).
- Cinnamon leaf oil contains **eugenol** (70-95%)
- Ceylon cinnamon has a negligible amount of coumarin (0.04 %)
- Cassia cinnamon has high coumarin content (5%)

Use of Cinnamon

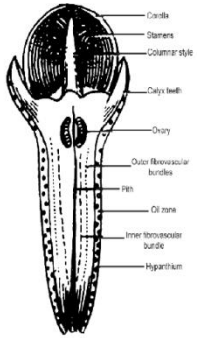
- It has a pleasing, fragrant odour and a warm, sweet, aromatic taste.
- The use as a spice has **declined**: owing to the synthesis of **cinnamic aldehyde**.
- It is still used for **flavouring** cakes and pastries, in beverages and as a constituent of curry powder.
- Stick cinnamon used to add **flavour** to **stewed** prunes.
- Cinnamon powder is effective for the treatment of **diarrhoea**.
- Cinnamic aldehyde: used for flavouring :
  - pharmaceuticals,
  - soaps and
  - dental preparations.
- Eugenol is preferred to clove oil for the synthesis of vanillin ($C_8H_8O_3$)
- Coumarin in Ceylon cinnamon is known to be a **blood thinner**.

- Cinnamon consumed in the US today comes from
  - Saigon cinnamon (*Cinnamomum loureirii* Nees),
  - Chinese cassia (*Cinnamomum cassia* Nees ex Blume): highest percentage of the essential oil (1-2.5%)
  - Indonesia cassia or Padang cassia (*C. burmannii* Nees ex Blume).
  - Cassia bark **resembles** true cinnamon but is coarser, thicker and has a more intense aroma.
  - Unlike cinnamon, it has a higher essential oil content and is not so delicately flavoured.
  - Cassia is actually the whole bark (the outer bark is not removed).
  - The US annually imports substantial amounts of cassia from Indonesia.
- Indian cassia
  - Obtained from *Cinnamomum tamala* (Buch.-Ham.) Nees and Eberm.
  - Its leaves (tejpata) are also used extensively in North India as a spice.
  - The leaves of *C. obtusifolium* Nees (known as tezputa) are used for flavouring purposes, especially cooked rice

Clove

- *Eugenia caryophyllus* (Spreng.) Bullock and Harrison (2n = 22)
- Syn. *Caryophyllus aromaticus* L.;
- *Eugenia caryophyllata* Thunb.;
- *Syzygium aromaticum* (L.) Merr. and Perr.
- Family: Myrtaeeae
- The clove tree is believed to be indigenous to the Moluccas or Spice Island- a group of volcanic islands in Eastern Indonesia.
- Cloves were considered a remedy for nausea, colic flatulence and diarrhoea.

Parts Used



- Cloves are dried, highly aromatic, unexpanded flower buds
- Crimson red flowers are produced in clusters of three
- Under cultivation the trees are not allowed to bloom.
- The flower buds are handpicked (dull red in colour), sun dried on a mat.
- Dried cloves have a very strong aromatic odour and a hot pungent taste.
- The shape of the bud is like a nail (“clove” = French word, nail “**le clou**”)
- Each flower bud consists
  - A peduncle (hypanthium)–receptacle,
  - Four distinct triangular calyx lobes,
  - Four crimson unopened petals investing numerous stamens and a central columnar style.
  - The bicarpellary inferior ovary is enclosed by receptacle.
  - The peduncle is well supplied with **oil glands** that impart a characteristic aromatic odour.

Active Constituents:

- Clove oil contains **Eugenol (**80 - 92 %)

Use of Clove

- Flavouring pickles, curries and ketchup.
- **In Java**, tobacco leaves are mixed with cloves (**clove cigarettes**) for smoking.
- **In India**, cloves are popular ingredients in **spice mixtures**.
- In the **West**, they are used **cooking** and for **flavouring puddings, fruit cakes** and other desserts.
- The clove tree is a rich source of essential oil
  - 16 %: clove buds,
  - 2 %: leaves and
  - 4-6 %: stem.
- The essential oil is used in **perfumes**, in scenting **soaps** and as an ingredient of **toothpaste** and **mouthwashes**.
- Clove oil is used in **biology** as a **histological clearing agent**.
- Medicinally it is important for **relieving toothache**.
- When taken internally, it has **carminative** and **antispasmodic** properties.
- Eugenol: for the manufacture of vanillin (another important flavouring substance)

Saffron (জাফরান)

- *Crocus sativus* L. (n = 12)
- Family: Iridaceae
- Saffron is one of the oldest and certainly among the **world's most expensive spices**
- It takes 15,00,000 *Crocus* flowers to yield 1Kg of saffron
- **Iran** accounts maximum (90%)
- The other major producing countries are
  - Spain
  - India and
  - Greece

Parts Used

- **Stigmas** are handpicked every day as the flowers open.
- They are **dried** in the sun or by artificial heat.
- The saffron is **packed immediately** (tin containers)
- The finest quality of saffron (**shahi zafran)** is obtained from the **red tips** of the **stigmas**
- The remaining part of the stigma: saffron of inferior grade.
- About one and a half million (15,00,000) flowers are required to make 1 kg of true saffron.

Active Constituents

- Aromatic odour and a pungent, bitter taste.
- It is a rich source of **riboflavin** and
- Contains a reddish yellow pigment, **crocin**.
- **Saffron** is one the most popular ingredients for colouring and flavouring butter, cheese and confectionery;
- Characteristic odour is due to **safranal**

Use of Saffron

- Saffron is used in India
  - tonic and **stomachic** (assisting digestion)
  - A **strong** infusion (extract prepared by soaking) of saffron will kill a **small animal** (dog, in a few days slowly but **painlessly**)
  - It is also used by the **Hindus** on a number of **religious and ceremonial rituals**.
  - **Saffron oil** (distillation of dried stigmas): is the most expensive of the essences and the characteristic odour is due to **safranal**.
  - **Substitute** for genuine saffron: because of the cost of the spice, true saffron is often adulterated:
    - meadow saffron, *Colchicum autumnale* L. (family Liliaceae), or
    - safflower, *Carthamus tinctorius* L. (family Asteraceae)

Colchicum autumnale

Carthamus tinctorius

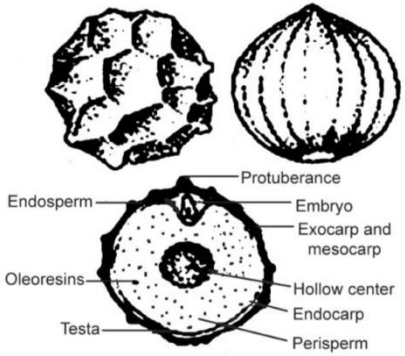
Black Pepper (গোল মরিচ)

- *Piper nigrum* L. (n = 26)

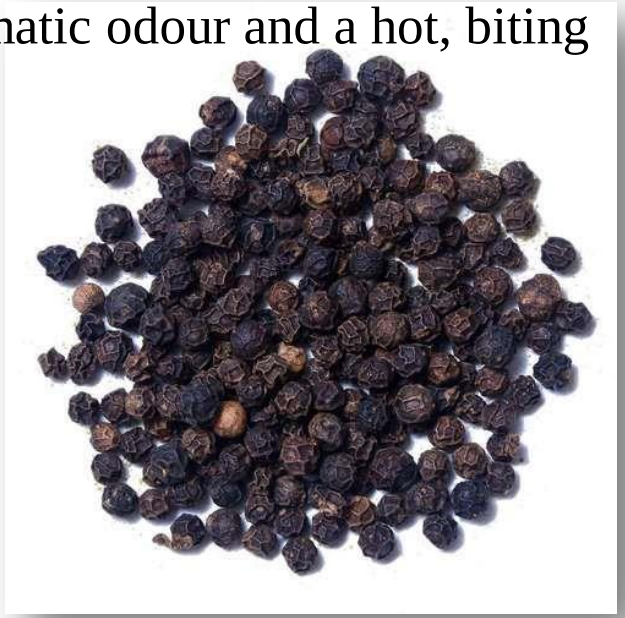
  Family: Piperaceae
- True pepper comes from the fruits of an **evergreen woody perennial vine**, *Piper nigrum*
- Indigenous to Malabar Coast of south-western India.
- It is now cultivated in the tropics of both the Eastern and Western Hemispheres
- **Vietnam** was the largest producer followed by **India** and **Indonesia**
- Indian: Kerala, Karnataka, Tamil Nadu and Maharashtra
- Andaman and Nicobar Islands

Parts Used

- Each spike may bear between 50 and 60 single-seeded indehiscent drupes (**peppercorns**)
- Roughly **spherical** in shape and 4-6 mm in diameter.
- At maturity, the colour of the ‘berries’ changes from dull green to bright red.
- The **thin pericarp** encloses a single seed with a hollow centre.
- The major portion of the seed consists of the **perisperm**, which is horny in the outer part and floury around the central cavity.
- The embryo is embedded in a small endosperm at the apex of the seed.



- Two main grades of pepper are recognized
  - Black pepper
    - Berries are **picked** while still **immature** i.e. green,
    - piled in heaps and
    - left in the sun for several days to dry
    - the pericarp becomes tough and wrinkled and
    - develops a dark brown colour owing to natural fermentation
    - Black pepper has a characteristic aromatic odour and a hot, biting and pungent taste



– white pepper

- produced from **fully-ripened** berries (red)
- the berries are packed in sacks and soaked in running water (8 to 10 days) to loosen the skin.
- They are then trodden with bare feet to rub off the outer hull.
- The white fruits left are thoroughly washed with water and
- Dried in the sun (several days)
- They turn creamy white in colour

– Nowadays

- white pepper is mostly prepared from: decorticating machines
- It is less pungent.

Active Constituents

- Aroma: volatile oil (**pericarp**), **Piperine** ($C_{17}H_{19}NO_3$)- 4.5 to 8.0 %.
- Pungency is caused by the non-volatile **oleoresin** fraction and various alkaloids.
- Other alkaloids,
  - chavicine,
  - piperidine and
  - piperettine

Use of Black Pepper

- In the preparation of sauces, soups, curry powder and pickles.
- **Black** pepper is preferred in the **US**
- **Mild-flavoured** white pepper is generally consumed in **Europe**.
- Black pepper: preparation of processed meat of all kinds.
- The **oleoresin** of pepper has **bacteriostatic** and **fungistatic** properties.
- Medicine as an aromatic stimulant for enhancing salivary and gastric secretions and also as a **stomachic**.
- Its **cooling effect**: ingredient for the preparation of refreshing drinks in India
- **Oil of pepper** (steam distillation of crushed black pepper): is used in the flavouring of sausages, canned meat, soups and beverages.
- Pepper hull (recovered after the preparation of white pepper): flavouring tinned foods.

Cardamom (এলাচ)

- *Elettaria cardamomum* (L.) Maton (n = 24)
- Family: Zingiberaceae
- It is the dried **aromatic fruits and seeds**
- Indigenous to South India and Sri Lanka
- In India:
  - Western Ghats (**Cardamom Hills**),
  - Kerala
  - Karnataka and
  - Tamil Nadu
- Two important varieties:
  - *E. cardamomum* var. ***major*** Thw:
    - '**wild**' cardamom,
    - the seeds are **larger**, more **numerous** and **less aromatic**
  - *E. cardamomum* var. *cardamomum* syn. var. ***minor*** Watt; var minuscula Burkill: **Cultivated variety** cardamomum:
    - Cultivated races
    - The fruits are sub-globose, yellowish when dried and **smaller** than the variety major.
    - The seeds are also **more** aromatic.

Parts Used

- The capsular **fruits** are harvested in the **under-ripe** stage to **prevent their dehiscence** during drying.
- The fruits are either dried in the sun or in drying sheds.
- Sometimes the fruits are **bleached** with **sulphur fumes** to improve the colour of the outer skin.
- **Husked** fruits retain their aromatic odour for a **longer** time.
- The seeds have a pleasing aroma and a characteristic warm, slightly pungent taste.
- The pleasant aroma of cardamom is due to the presence of volatile oil (3-8%) contained in the seeds that are held together by a loosely attached papery structure–the **aril**.

Active Constituents

- The chief components of the essential oil (**cardamom oil**) are
  - cineol,
  - terpineol,
  - turpinene,
  - sabinene and
  - limonene.

Use of Cardamom

- Cardamom seeds: **whole** or **powdered**
- In the preparation of curry powder, pickles, sausages, cakes and confectionery.
- Cardamom pods are **chewed after meals** or are often included in '**pan**' preparations.
- In Saudi Arabia
  - It is also used for flavouring **coffee, liqueurs** and **tobacco**.
- Cardamom oil (distillation of the whole fruit) is used as a condiment and for **flavouring beverages**.
- **Medicinally**: stimulant and carminative.

Cheaper substitutes for the true cardamom

- Seeds of some species of *Amomum* (Zingiberaceae) বড়ো এলাচ,
  - Bengal cardamom (*A. aromaticum* Roxb.),
  - Nepal cardamom (*A. subulatum* Roxb.) and
  - Malabar cardamom (*A. xanthioides* Wall.)
- The large cardamom (*Amomum subulatum* Roxb.):
  - is the India's main **cash crop**
  - Cultivated in the Sikkim and Darjeeling district of West Bengal.
  - In parts of Uttrakhand and some north-eastern hill states
  - The fruits are dark brown, obovoid (ovoid with the broad end toward the apex) and three-valved with numerous large seeds in each
- The properties of seeds are similar to those of the true cardamom.

Chilli or Red Pepper

- *Capsicum* spp. (x = 12)
- Family: Solanaceae
- The dried ripe fruits of *Capsicum* species, **indigenous** to the **American** tropics
- 5 cultivated species of Capsicum,
  - ***C. annuum*** L.,
  - ***C. frutescens*** L.,
  - *C. chinense* Jacq.,
  - *C. pendulum* Willd. and
  - *C. pubescens* Ruiz and Pavon.
- The last three are of lesser economic importance
- **India** is the world **leader** in chilli production

- *C. annuum* are
  - The fruits are less pungent, large
  - sweet bell peppers as well as small-fruited stronger tasting types
  - produce ‘paprika’ (ground spice made from dried red fruits of sweeter varieties of the plant)

- *C. frutescens*
  - Much more pungent than *C. annuum* (Tabasco peppers)
  - some of the types being extremely fiery.

Active Constituents

- The pungency or spicy taste : **crystalline** substance known as **capsaicin** ($C_{18}H_{27}NO_3$),
- Concentrated mainly in the **placental region** where the seeds are attached
- The small thin-skinned peppers of *C. frutescens* have the highest capsaicin content (0.2 to 1.0% of **capsaicin**)
- Chillies are good source of **vitamin C**
- Vitamine A and vitamin E (tocopherol) have been also reported
- The colouring matter of the ripe fruit consists of several compounds
  - capsanthin ($C_{40}H_{58}O_3$),
  - capsorubin,
  - zeaxanthin,
  - cryptoxanthin,
  - lutein and
  - carotenes and
  - few unidentified xanthophylls.
- Capsaicin is **hydrophobic** in nature
  - drinking water will not cool the mouth from the pungency caused by the pepper
  - The fat in cheese, butter and milk will absorb the capsaicin and give relief to some extent

Use of Chilli

- **Capsaicin**
  - **lowers** the **cholesterol** level in the body by reducing its build-up and **increasing** its **breakdown** and excretion.
  - They **block action** of a gene that makes **arteries contract** and restricts the blood flow.
  - Spicy diet **rich** in hot chilli peppers can help in **controlling** high **blood pressure**.
  - It **relaxes the blood vessels**, burn fat and boost the overall calorie-burning rate (they speed up the body's overall metabolism).
- **Popular condiment**, being used to add zest and flavour to foods.

- Eaten **raw** as **salads**.
- The hollow, often being **stuffed** with meat or potatoes and then cooked.
- The small-fruited, stronger flavoured types of *C. annuum* yield '**paprika**' (flavouring and colouring material).
- Large quantities of paprika are used in the manufacture of **sausages** and other **meat** products
- **Red pepper** (fruits of *C. frutescens)* is used in the manufacture of **sauces and curry powders** and also in the preparation of **pickles**.
- **Tabasco sauce** is prepared by pickling the pulp of chilli fruits in salted water or strong vinegar.

- **Capsaicin** is used in the manufacture of **ginger ale** and **ginger beer**.
- **Medicinally** Capsicum peppers have been used
  - Internally stimulant and carminative,
  - but externally as a counter-irritant to cure rheumatism.
- **Capsicum** is now found in legitimate **medications** for **arthritis** and **herpes zosters** (also called shingles).

Vanilla

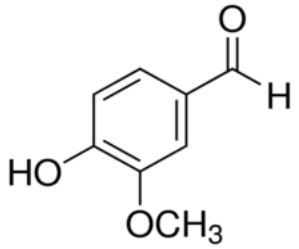
- *Vanilla planifolia* Andrews (n = 16)
- Syn. *V. fragrans* (Salisb.) Ames
- Family: Orchidaceae (Monocots)
- Vanilla
  - flavouring, a source of perfume and
  - as an herbal tonic
- Dried, cured, full sized but **unripe fruits**
- Indigenous to Central and South America and the West Indies
- The **Madagascar vanilla** beans are simply the **best** in the world
- Bean is also known as '**Bourbon vanilla**': originally grown on the **Bourbon Island**, off the coast of Madagascar
- In India, : Kerala and the Nilgiris (Tamil Nadu)

Parts Used


- The **vanilla fruit** is an elongated, **tricarpellate capsule** with numerous tiny black seeds.
- When ripe, the pod looks like a hefty dark brown string bean, with seeds packed in an aromatic oily pulp
- The **fruits are picked before** they are **fully-ripe**, just as their colour starts changing from green to yellow.
- The flavour and aroma develop slowly during fermentation.
- The pods are **spread** on **woollen blankets**, placed in the sun until mid-day and are then folded in the blankets.
- The beans are kept **overnight** in **airtight** containers.
- This **sweating process** is continued until the fruits become
  - pliable (flexible),
  - coffee-coloured and
  - develop a definite odour.


- Pre-treatment of the fruits with nearly boiling water for a couple of minutes seems to accelerate the sweating process.

Active Constituents



- The characteristic flavour and aroma of vanilla is due to a crystalline substance **vanillin**, $C_8H_8O_3$ (2-3%)

- This crystallized out during curing within the cells of the placental tissues and the internal hairs of the fruit.

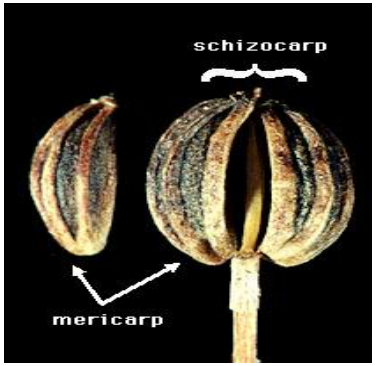
- These **tiny crystals** of vanillin may even **appear** on the **surface of the seeds** and the fruit wall.

Use of Vanilla

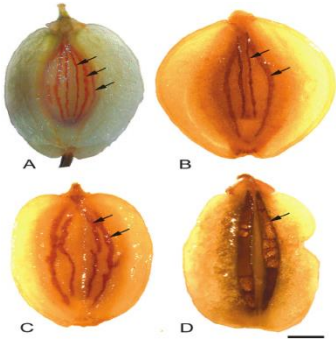
- Vanillin: synthesized from eugenol, coniferin, wood pulp, guaiacol and coal tar,
- Still: Great demand for the natural product.
- Synthetic vanillin lacks the subsidiary aromatic substances,
  - gums,
  - fixed oils and
  - resins present in the oily material from the seeds.
- The true Vanilla beans, possess
  - a gentle, rich spicy aroma and
  - are widely used as a **flavouring** for **ice creams**, soft drinks, **chocolate** confectionery, **candy**, baked goods, **puddings**, cookies, tobacco, liqueurs and
  - also in **perfumery**.

The Apiaceous or Umbelliferous Spices

- The family provides many **culinary herbs** that are prized mainly for their aromatic fruits.
- The fruit is typically a schizocarpic (fruits split at maturity into two, dry, indehiscent, one-seeded sections (mericarps)
- Which may be held together by a slender branched or unbranched structure–the **carpophore** (a modified extension of the pedicel).
- The outer wall of the mericarp is differentiated into
  - ridges (costae) and
  - grooves (valleculae).

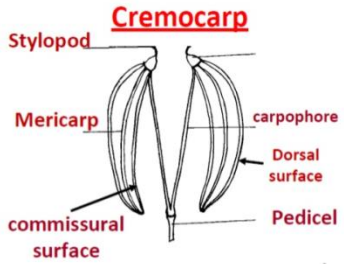


- The aroma of umbelliferous spice is due to the presence of **volatile oils** contained in the **vittae (an oil tube/cavities)**.
- Coriander, cumin and fennel- grow in the Mediterranean countries



Fennel (মৌরি)

- *Foeniculum vulgare* Mill. (n = 11)
- Syn. *Anethum foeniculum* L.; *F. officinale* Gaertn.
- Fennel, a tall, aromatic perennial herb
- **Native** of **Southern Europe** and **Mediterranean** region
- Two important varieties:
  - **bitter fennel**, *F. vulgare* var. *vulgare* and
  - **sweet**, *F. vulgare* var. ***dulce*** (Mill.) Thellung
- In India: Gujrat, Rajasthan and Uttar Pradesh.
- All parts of the plant are aromatic
- The fruits are
  - with a long pedicel and a short stylopodium.
  - The two mericarps are attached to a divided carpophore and the pericarp usually contains 4 dorsal and 2 commissural (line of union) vittae.



Active Constituents

- The essential oil content varies from 0.7- 6 %, being lowest in the fruits from
- India: lowest quantity of essential oil content (0.7 to 1.2 %)
- European cultivars: highest (4.0-6.0 %)
- Bitter fennel oil contains
  - **anethole (**50-60 %).
  - **fenchone** (reason of bitterness).
- The delicate sweet odour and flavour of the oil:
  - higher percentage of **anethole** (up to 90%) and **absence of fenchone**.

Use of Fennel

- Dried fennel seeds:
  - curry powders
  - used for flavouring soups,
  - meat dishes, sauces, pastries, liqueurs, confectionery and
  - in the manufacture of pickles.
- The leaves
  - flavour fish sauces and
  - Garnishing (decorate)
- The thickened leaf stalks
  - Blanched (সাদা করা) and used as a vegetable.
- Pharmacologically
  - fennel oil is used as a **stimulant** and **carminative**,
  - infantile colic and flatulence and
  - good vermicide against hookworm.
- The oil
  - application in perfumes, soaps and
  - medicine.
- The residual mass (after the distillation) of fruits,
  - valuable cattle feed.

Coriander or Cilantro

- *Coriandrum sativum* L. (n = 11)
- Indigenous to the Mediterranean (grows wild or semi-wild)
- India contributed almost 80% of the total output: Rajasthan, Madhya Pradesh and Tamil Nadu.
- The plants have characteristic **dimorphic leaves**;
  - the **lower**: **broad** and deeply segmented
  - the **upper** leaves**: finely divided** with linear lobes.

Parts Used Coriander

- Compound umbel,
  - **peripheral** flowers are **large** and **zygomorphic**
  - **centrally** located ones are **small** and **actinomorphic**.
- The green **unripe fruits**
  - unpleasant smell
  - but the disagreeable odour **fades away**, becoming **pleasantly aromatic**.
- The dried coriander fruit
  - Globular and yellowish brown
  - The ridges of the fruit are indistinct and the fibro-vascular layer runs all along the dorsal surface.
  - The two mericarps are attached to an **undivided carpophore**.
  - The pericarp has **no vittae** on the dorsal side
  - but usually **a pair** of vittae on the **commissural side**.
  - fruits must be fumigated to eliminate any possible insect infestation.

Active Constituents

- The pleasant delicate aroma and taste
  - an essential oil.
  - European cultivars are usually rich in oil (1.4-1.7 %).
  - The chief constituent of coriander oil is **coriandrol** (45-70%).
- Of all volatile oils
  - coriander oil is **more stable** and
  - retains the sweet and agreeable odour longer.

Use of Coriander

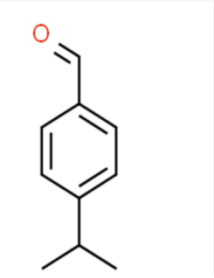
- The leaves are
  - strong smelling
  - garnishing meat preparations and sausages and
  - for making chutneys.
  - Often, they are used for flavouring curries, soups and curd.
- In a powdered form, the fruits
  - curry powders and other spice mixtures.
- The whole coriander seed
  - pickling spice mixture.
- In Western countries, liquors (gin) are often flavoured with coriander.
- Coriander oil:
  - flavouring perfumes, candy, cocoa, chocolate, tobacco, baked goods, canned soups, liqueurs, alcoholic beverages and
  - to mask offensive odours in pharmaceutical preparations.
- Medicinally, coriander oil is used as a carminative, tonic and diuretic.
- The residue (after the extraction of the volatile oil)
  - is used locally as a cattle feed

Cumin (জিরা)

- *Cuminum cyminum* L. (n = 7)
- The **monotypic genus**
- Native of **Upper Egypt**, Turkestan and the eastern Mediterranean
- India is one of the largest producer and consumer of cumin seeds
  - Gujrat and Rajasthan
- The fruits
  - ovoid-elongated (with a divided stylopodium),
  - greyish or yellowish-brown in colour.
  - The pericarp is characteristic in having papillose hairs;
  - The two mericarps are held together by a divided carpophore, branching beginning near the base.
  - The pericarp contains four dorsal and two commissural vittae (like fennel)

Active Constituents

- The dried fruit
  - has a strong distinctive pleasant odour and
  - The bitter taste is due to the presence of volatile '**oil of cumin**',
  - the main constituent of which is **cuminaldehyde**, varying from 35 to 62 %.
  - Besides the essential oil, the seeds contain around 10 % of the fixed oil.



Cuminaldehyde

Molecular Formula	$C_{10}H_{12}O$
Average mass	148.202 Da

Use of Cumin

- It is an important ingredient
  - curry powder
  - flavouring soups, sausages, pickles, cheese, meat dishes, bread and cakes.
- In India,
  - stimulant,
  - carminative and
  - stomachic.
- They are now chiefly used in veterinary medicine.
- The residue (after the extraction of volatile of oil)
  - used as cattle feed.