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Economic Botany

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Origin, Morphology and Uses of Gram (Chick Pea)

The **chickpea** or **chick pea** (*Cicer arietinum*) is an annual legume of the family Fabaceae, subfamily Faboideae.

Its different types are variously known as **gram** or **Bengal gram**, **garbanzo** or **garbanzo bean**, **Egyptian pea**, **chana**, and **chole**.

The chickpea is important in Indian, Mediterranean and Middle Eastern cuisine. In 2017, India produced 67% of the world total for chickpeas.

Origin of Chick Pea:

Chickpea is probably originated from South East Turkey. Four centers of diversity were identified in the Mediterranean, Central Asia, the Near East and India as well as a secondary center of origin in Ethiopia (Vavilov, 1951).

Chickpea spread with human movement toward the West and South via the Silk Route (Singh *et al*., 1997).

Proof of chickpea cultivation dates back as far as the early Bronze Age in Jericho (Hopf, 1969).

The chickpea most probably originated in an area of present-day south-eastern Turkey and adjoining Syria. Three wild annual species of ***Cicer***, closely related to the chickpea, are found there: **C. bijugum** K.H. Rech., **C. echinospermum** P.H. Davis and ***C. reticulatum*** Lad. The

De Candolle (1883) traced the origin of chickpea to an area south of the Caucasus and northern Persia.

Vavilov (1926, 1949-50) designated two primary centres of origin (now centres of diversity), south-west Asia and the Mediterranean, and a secondary one, Ethiopia. He noticed that, like other grain legumes, large-seeded cultivars abounded around the Mediterranean basin, whereas small-seeded cultivars predominated eastwards.

There are linguistic indications that the large-seeded, cream-coloured chickpea reached India only two centuries ago, apparently through Afghanistan, as its Hindi name is **Kabuli chana (chana = chickpea),** an allusion to the Afghanistan capital Kabul. The small-seeded, dark-coloured chickpea is called **Desi (local),** and these denominations are now quite widely used to distinguish the two main groups of cultivars.

Morphology:

Cicer arietinum is a short annual herb, attaining a height of less than a metre. Depending on the angle of the branches and the soil surface, the plant assumes 'erect, semi-erect, spreading, semi-spreading and prostrate' growth habit

The plant surface including roots, stem, leaves and pods are pubescent, covered with glandular and non-glandular hairs.

Root: The root system is characterized by a thick tap root with several side roots developing into a robust system.

Stem: The stem is firm due to hypodermal collenchyma, angular with ribs, straight or flexuous and pubescent. The plant produces three types of branches—primary, secondary and tertiary. The lowest nodes of the plant produce 1–8 primary branches.

Leaf: The compound leaves contain 5–7 pairs of hairy leaflets per leaf, opposite or alternate, and the rachis ends in a leaflet (imparipinnate).

The leaflets are oval or elliptic in shape with serrated margins. Simple leaf types also exist.

Inflorescence: The inflorescence is an axillary raceme with generally a single papilionaceous flower though two to three flowers were also reported to occur rarely at the same node.

Flower: The flower can be described as regular, bisexual, with five fused hairy sepals in a single whorl which form a calyx tube, five petals (pink, white, purple or blue in colour) in a typical papilionaceous arrangement.

Pod: Pods start appearing about six days after fertilization and may take up to four weeks for completing seed development. Initially, the pod wall starts to grow followed by the seed. The pod size is generally in the range of 15–20 mm and may go up to 30 mm depending on the genotype, especially in kabuli types.

Seed: The shape of the seed generally resembles a ram's (Aries) head, hence the name 'arietinum', while other shapes do exist such as globular or quasi-spheric with a characteristic beak. The surface of the seed coat may be smooth or tuberculate. Endosperm is absent.

Desi type: The seeds are generally small (around 0.2 g per seed); seed coat is thick with varying colours such as cream, yellow, brown, black and green.

Kabuli type: The seeds are generally large (around 0.3–0.5 g per seed) to extra large (more than 0.5 g per seed); seed coat is thin and mainly cream or beige coloured, sometimes white.

Fig. 3.7 (a and b) Immature chickpea pod

Uses:

- Chickpeas are used for human consumption, and for animal feed.
- Research has shown that chickpeas have no adverse effects on livestock, allowing animals to grow and produce milk equally as well as soy or cereal.
- For human consumption, chickpeas are nutrient dense, providing more than 20% Daily Value of protein, dietary fiber, folate, and minerals like iron and phosphorous. They also provide a moderate amount of zinc, thiamin, vitamin B6, and magnesium. Cooked chickpeas are high in amino acids.
- Chickpeas can also be consumed raw, most frequently being used in salad.
- Chickpeas might also be popped and eaten like popcorn, or ground into flour.

Origin, Morphology and Uses of Mung (mung bean)

The **mung bean** (***Vigna radiata*),** alternatively known as the **green gram** or **moong** is a plant species in the legume family Fabaceae, subfamily Faboideae..

Mung beans are one of many species moved from the genus *Phaseolus* to *Vigna* in the 1970s. The previous names were ***Phaseolus aureus*** or ***P. radiatus***.

Origin:

The mung bean is thought to have originated from the Indian subcontinent where it was domesticated as early as 1500 BC. The crop is said to have originated from India and must have been derived from var. sublobata which occurs wild throughout India and Burma (Aykroyd and Doughty, 1964; Purseglove, 1977).

From there it has spread to South and East Asia, East and Central Africa, the West Indies and the United States.

Mung bean is a low altitude crop grown from sea level to approximately 2000 m, usually as a dry land crop. It thrives best on a good loam soil with well distributed rainfall of 70-90 cm year. It is drought resistant and is susceptible to water-logging.

It grows well between latitudes 0° and 30° north or south. The temperature range for optimum performance is between 20° and 45°C. In India, yields of mung bean ranging from 100 to 200 kg/ha have been reported (Duke, 1983),

Morphology:

The mung bean (*Vigna radiata* (L.) R. Wilczek) is a legume cultivated for its edible seeds and sprouts across Asia. There are 3 subgroups of *Vigna radiata*: one is cultivated (*Vigna radiata* subsp. *radiata*), and two are wild (*Vigna radiata* subsp. *sublobata*and *Vigna radiata* subsp. *glabra*).

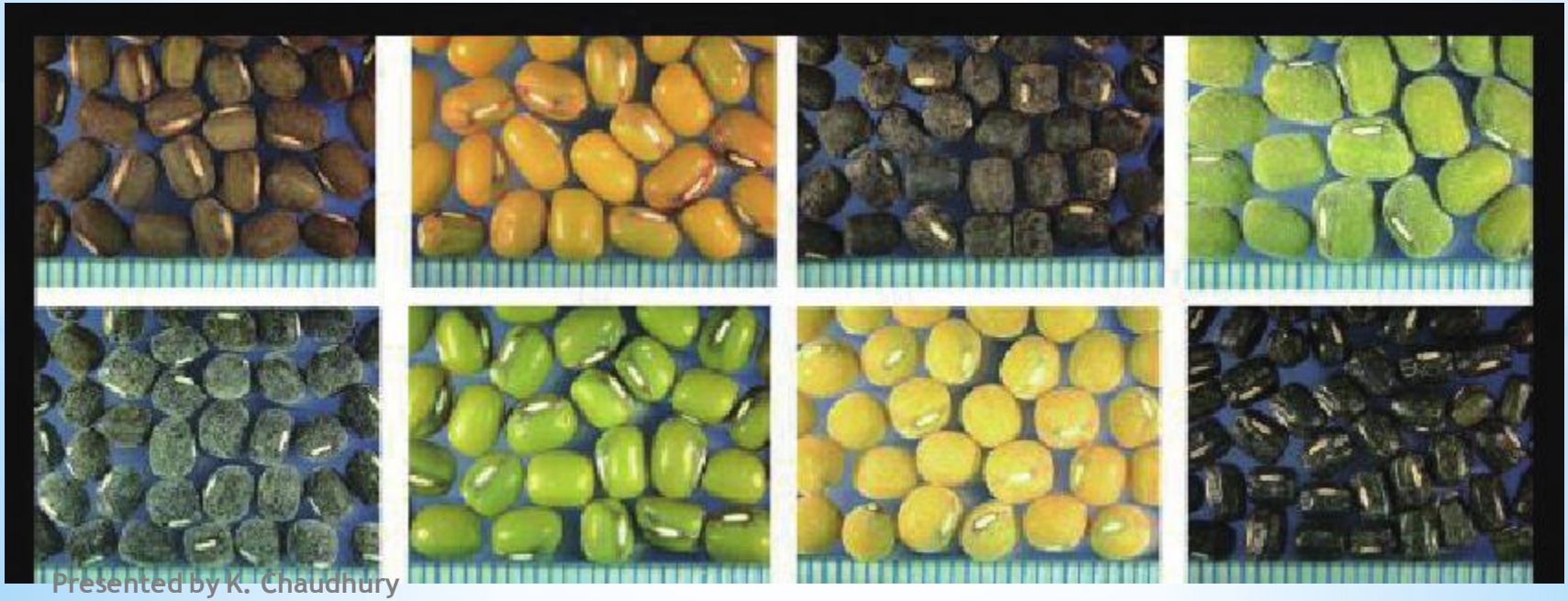
The mung bean plant is an annual, erect or semi-erect, reaching a height of 0.15-1.25 m (FAO, 2012; Lambrides et al., 2006; Mogotsi, 2006). It is slightly hairy with a well-developed root system. Wild types tend to be prostrate while cultivated types are more erect (Lambrides et al., 2006).

The stems are many-branched, sometimes twining at the tips (Mogotsi, 2006). The leaves are alternate, trifoliolate with elliptical to ovate leaflets, 5-18 cm long x 3-15 cm broad.

- The flowers (4-30) are papillonaceous, pale yellow or greenish in colour.
- The pods are long, cylindrical, hairy and pending. They contain 7 to 20 small, ellipsoid or cube-shaped seeds.
- The seeds are variable in colour: they are usually green, but can also be yellow, olive, brown, purplish brown or black, mottled and/or ridged. Seed colours and presence or absence of a rough layer are used to distinguish different types of mung bean (Lambrides et al., 2006; Mogotsi, 2006).
- Cultivated types are generally green or golden and can be shiny or dull depending on the presence of a texture layer (Lambrides et al., 2006). Golden gram, which has yellow seeds, low seed yield and pods that shatter at maturity, is often grown for forage or green manure.

- Green gram has bright green seeds, is more prolific and ripens more uniformly, with a lower tendency for pods to shatter. In India, two other types of mung beans exist, one with black seeds and one with brown seeds (Mogotsi, 2006).

- The mung bean resembles the black gram (*Vigna mungo* (L.)) with two main differences: the corolla of *Vigna mungo* is bright yellow while that of *Vigna radiata* is pale yellow; mung bean pods are pendulous whereas they are erect in black gram. Mung bean is slightly less hairy than black gram. Mung bean is sown on lighter soils than black gram (Göhl, 1982).



Harvesting:

The olive-green mung beans should be harvested in the field after their pods have dried, typically in early to mid-September. Farmers use the same type of combine machinery used to harvest soybeans, but because mung beans are smaller than soybeans, they adjust the combine settings and screen size for the smaller bean size. Mung beans should be cleaned of debris before storage, and the beans should have no more than 12 percent moisture content for storage.

Uses:

- Mung beans are rich in vitamins and minerals. These beans are one of the best plant-based sources of protein. They're rich in essential amino acids, such as phenylalanine, leucine, isoleucine, valine, lysine, arginine and more
- Sprouted beans contain fewer calories and more free amino acids and antioxidants than unsprouted ones.
- Mung beans contain many healthy antioxidants, including phenolic acids, flavonoids, caffeic acid, cinnamic acid and more. sprouted mung beans appear to have a more impressive antioxidant profile and may contain as much as six times more antioxidants than regular mung beans.
- High cholesterol, especially "bad" LDL cholesterol, can raise your risk of heart disease. Interestingly, research shows that mung beans may have properties that can lower LDL cholesterol.
- They're a good source of potassium, magnesium and fiber. Studies have linked each of these nutrients to a significantly lower risk of high blood pressure.
- In particular, mung beans contain a type of soluble fiber called pectin, which can help keep your bowels regular by speeding up the movement of food through your gut.

❖ Mung beans possess several properties that help keep blood sugar levels low. They're high in fiber and protein, which helps slow the release of sugar into the bloodstream.

❖ Mung beans are high in fiber and protein, which can help you lose weight. Studies have shown that fiber and protein can suppress hunger hormones, such as ghrelin.

❖ Mung beans are delicious, versatile and easy to add to your diet. They can be used in place of most other beans in dishes like curries, salads and soups. These beans have a slightly sweet taste and are often made into a paste in Asian desserts.

Legumes are Important to Man and Environment

Many different kinds of plants are part of the leguminosae group. They are called legumes. These plants can produce their own nitrogen. Beans are legumes. Peanuts are legumes. Alfalfa is a legume. There are also many different kinds of trees that are legumes.

- As a food, beans are high in protein. Most beans also contain a lot of nutrients such as calcium, iron, phosphorus and niacin. Some beans contain amino acids and lysine.
- Many farmers around the world know the value of growing legumes along with their main crops, or between harvests. The legumes replace nitrogen used by crops. They also provide a cover for the soil to help protect it from heavy rains and strong winds.

- Legumes produce nitrogen through a process involving bacteria in the soil and nitrogen in the air. The bacteria form small growths on the plant roots. These growths are called nodules. They capture the atmospheric nitrogen that has entered the soil.
- The nodules change the nitrogen into ammonia, a form of nitrogen that plants can use. The process is called nitrogen fixation.

Many legumes contain symbiotic bacteria called *Rhizobia* within root nodules of their root systems (plants belonging to the genus *Styphnolobium* are one exception to this rule).These bacteria have the special ability of fixing nitrogen from atmospheric, molecular nitrogen (N_2) into ammonia (NH_3).The chemical reaction is:

$$N_2 + 8H^+ + 8e^- \rightarrow 2NH_3 + H_2$$

Ammonia is then converted to another form, ammonium (NH^+_4), usable by (some) plants by the following reaction: $NH_3 + H^+ \rightarrow NH^+_4$

This arrangement means that the root nodules are sources of nitrogen for legumes, making them relatively rich in plant proteins.