5-Field bean *Vicia faba* L.

Prepared

By

Prof. Dr. Ali E. M. Sharief

Agronomy Dept., Mansoura University, Egypt

Common Names

Broad bean, Faba bean, Horse bean, Windsor bean, Tick beans (small types), Bakela (Ethopia), Boby kurmouvje (Russia), Faveira (Portugal) Ful masri (Sudan) Feve (French) and Yeshil Bakla (Turkey). Protein percentage 27-30 % include essential amino acids of Methionine and Cysteine.

Taxonomy

Based on seed size, two subspecies were recognized, *paucijuga* and *faba*. The latter was subdivided into:

Types of faba bean:

1-**Faba bean var. minor** with small rounded seeds (1 cm long).

2-**Faba bean var. *equina*** with medium sized seeds (1.5 cm) and

3-**Faba bean var. *major*** with large broad flat seeds (2.5 cm).

There are four subspecies, namely: *minor*, *equina*, *major*, and *paucijuga*. Taxonomically the crop belongs to Section Faba of the Genus *Vicia.*

Germination

Germination is the process by which the embryo grows and develops, eventually becoming a fully mature plant. The pattern of germination is similar in most dicotyledonous seeds.

When the seed is shed, it is usually dry and hard, containing very little water. In this dehydrated state it is best suited to withstand drought and extreme temperatures.

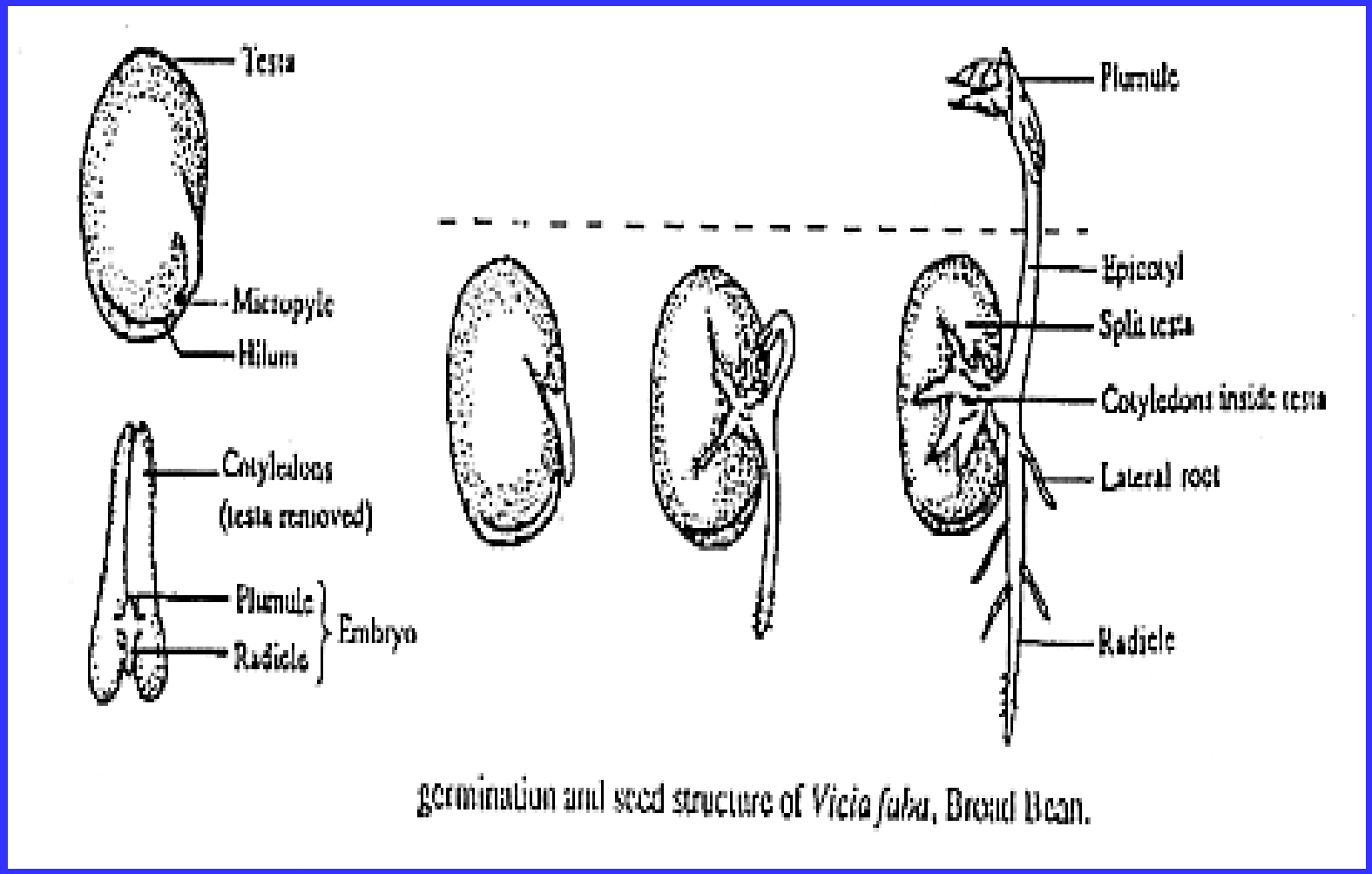
When conditions become suitable for germination, the seed takes in water through its micropyle. The tissues absorb water and swell and the testa becomes soft.

1-The radicle grows first, pushing though the testa and entering the soil.

2-Next, either the hypocotyl or the epicotyl, depending on the species, starts to elongate and carry the plumule upwards through the soil.

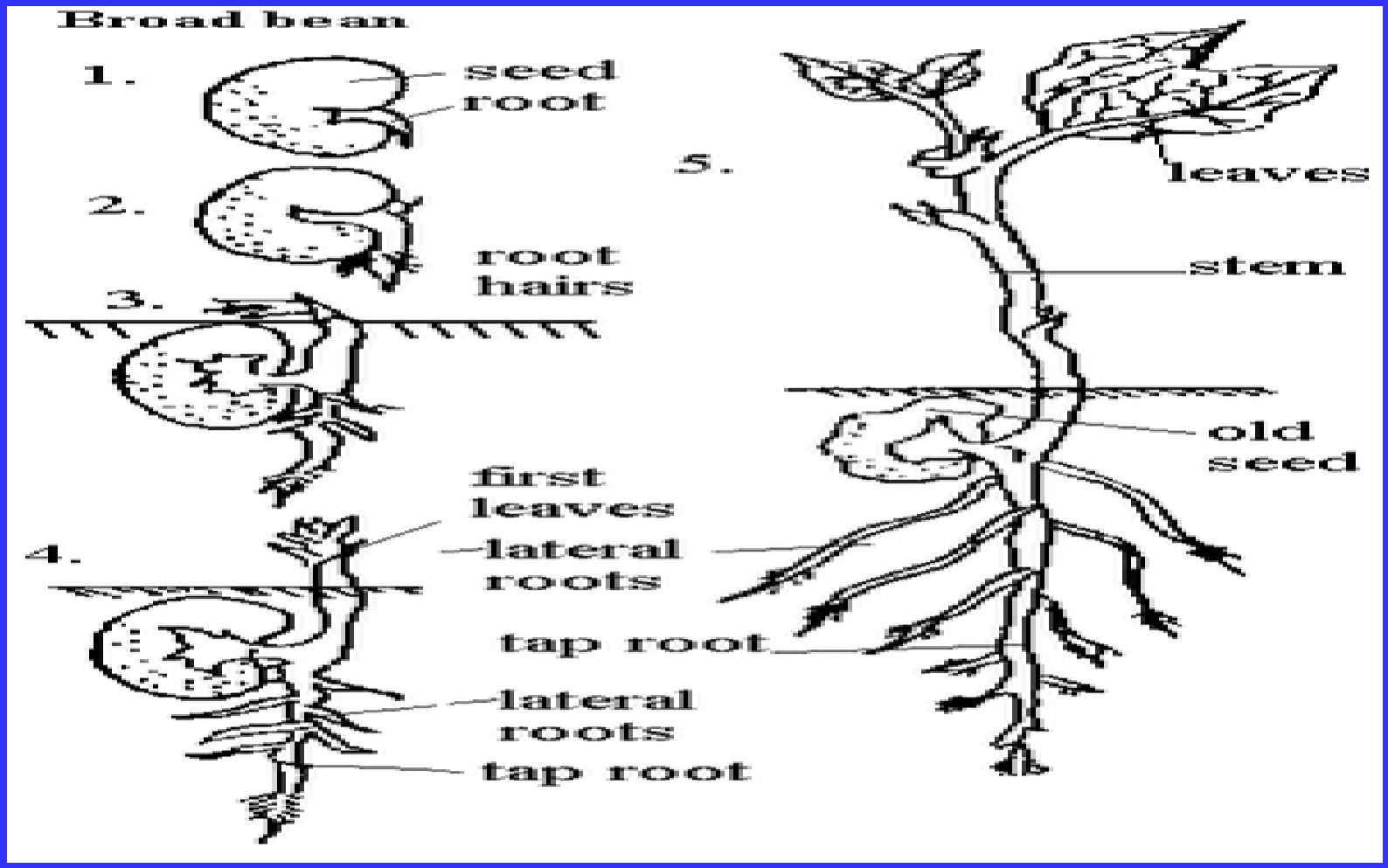
3-Elongation of the epicotyl brings the embryo out from between the cotyledons and through the soil, leaving the cotyledons below ground. Elongation of the hypocotyl brings the cotyledons and the plumule above ground.

Whichever pattern of germination occurs, the energy and raw materials required for growth come from the food (usually starch) stored in the cotyledon (Fig.1).



germination and seed structure of *Vicia faba*, Broad Bean.

Germination Stage



Germination Stage

Roots

There is a robust tap root with profusely branched secondary roots" (Bond et al., 1985). The taproot well-developed, with strong lateral roots.

Faba bean roots need to be inoculated with the appropriate strains of rhizobia (*Rhizobium leguminsarium*), which will infect the plants root and stimulates root nodule development. This occurs when the faba beans are being grown in the field for the first time or where they have not been grown for along time (Fig. 2).

Fig.2 Faba bean tap root and bacterial nodules

Stem

Stem is a stiffly erect, branched annual plant; 1 to 1.5 m tall, additional branches emerge from the base of the main stem.

Stems are square, with vertical ridges defining the sides of the square and appear to be very robust, 10-13 mm wide, However, they are relatively weak and easily damaged.

Stems may be red-tinged towards the top.

Stem of faba bean

Faba bean plant flowering

Leaves

The Leafe is compound alternate, paripinnate, with 2–6 leaflets. The seedling leaves emerge from the seed and soil as an erect shoot (the cotyledons remain in the soil). The seedling leaves unfurl from this shoot. The first true leaves are in pairs, each leaflet 30 – 40 mm long and 25 – 35 mm wide. Leaflets are a rounded diamond shape, glossy green on top and paler underneath and are borne on a short leaf stem, 5 – 10 mm long. Central and lateral veins are apparent on the bottom side of the leaflets. Two scale leaves clasp the stem at the junction of the leaf.

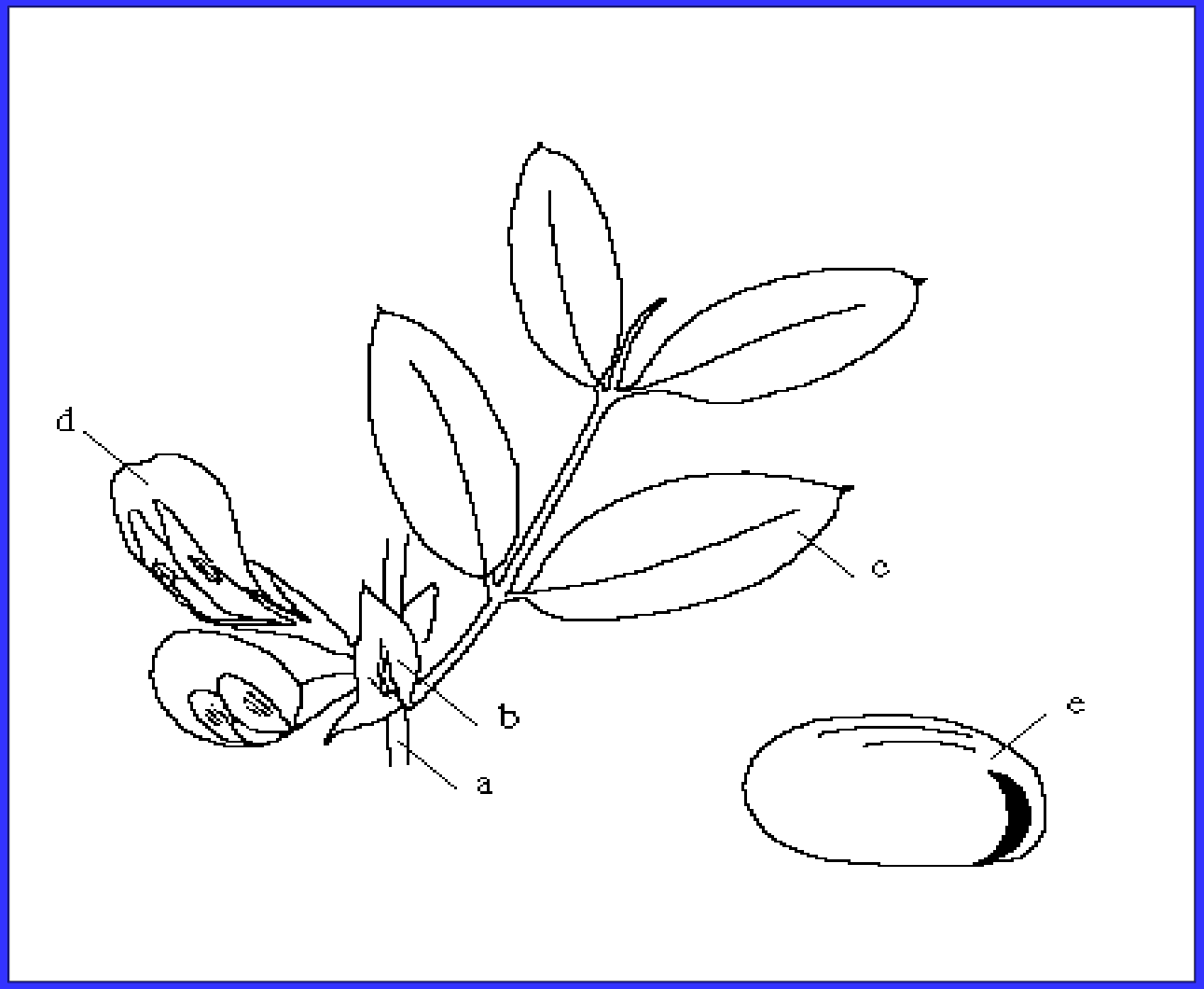
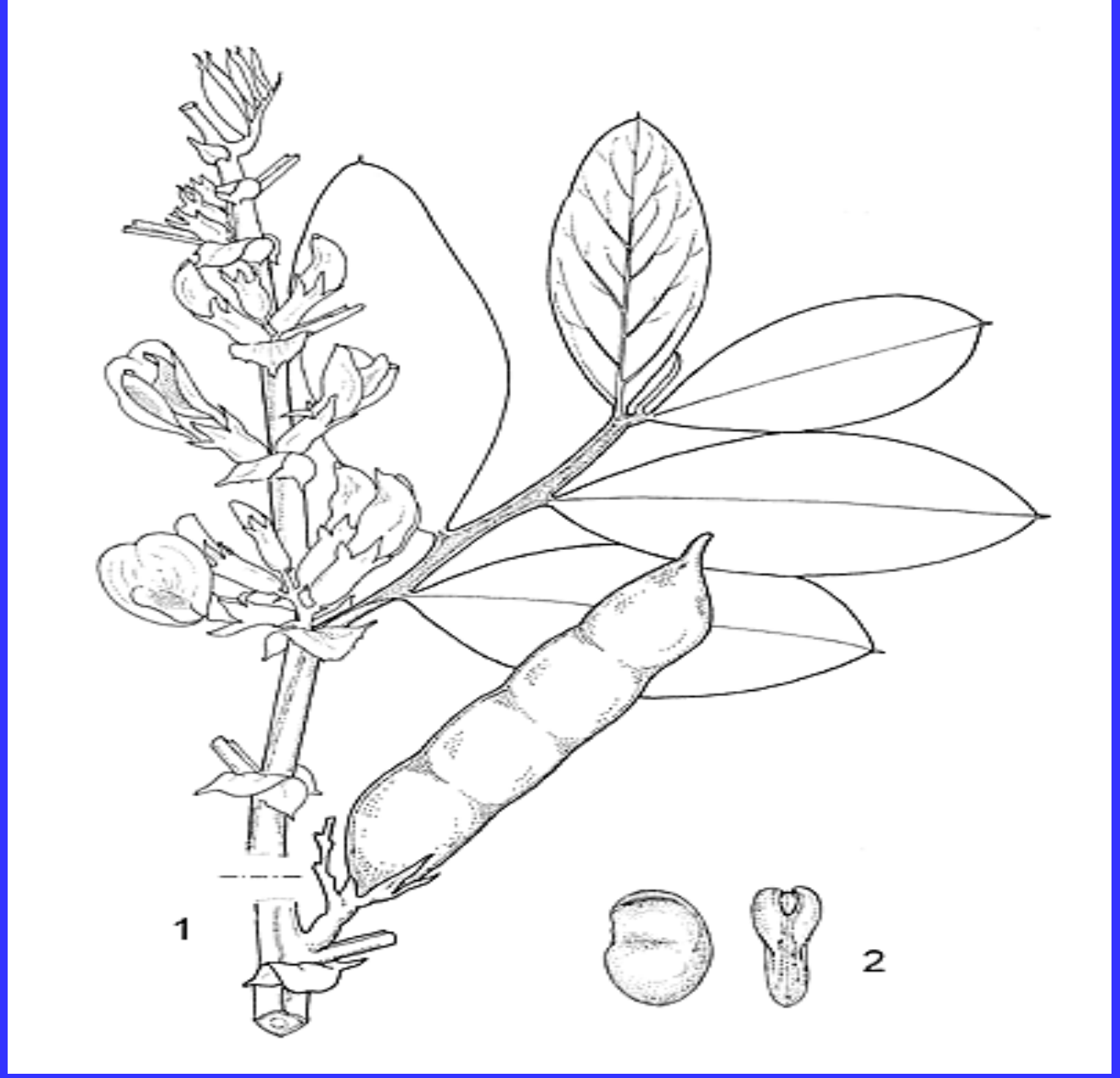


Fig. 3 a Faba bean parts a: stem hollow, quadrangular; b: stipule; c: leaf glaucous, made up of 2-6 leaflets and ending in a dendril; d: flower; e: seed.



Faba bean inflorescence, leaf, pod and seed.

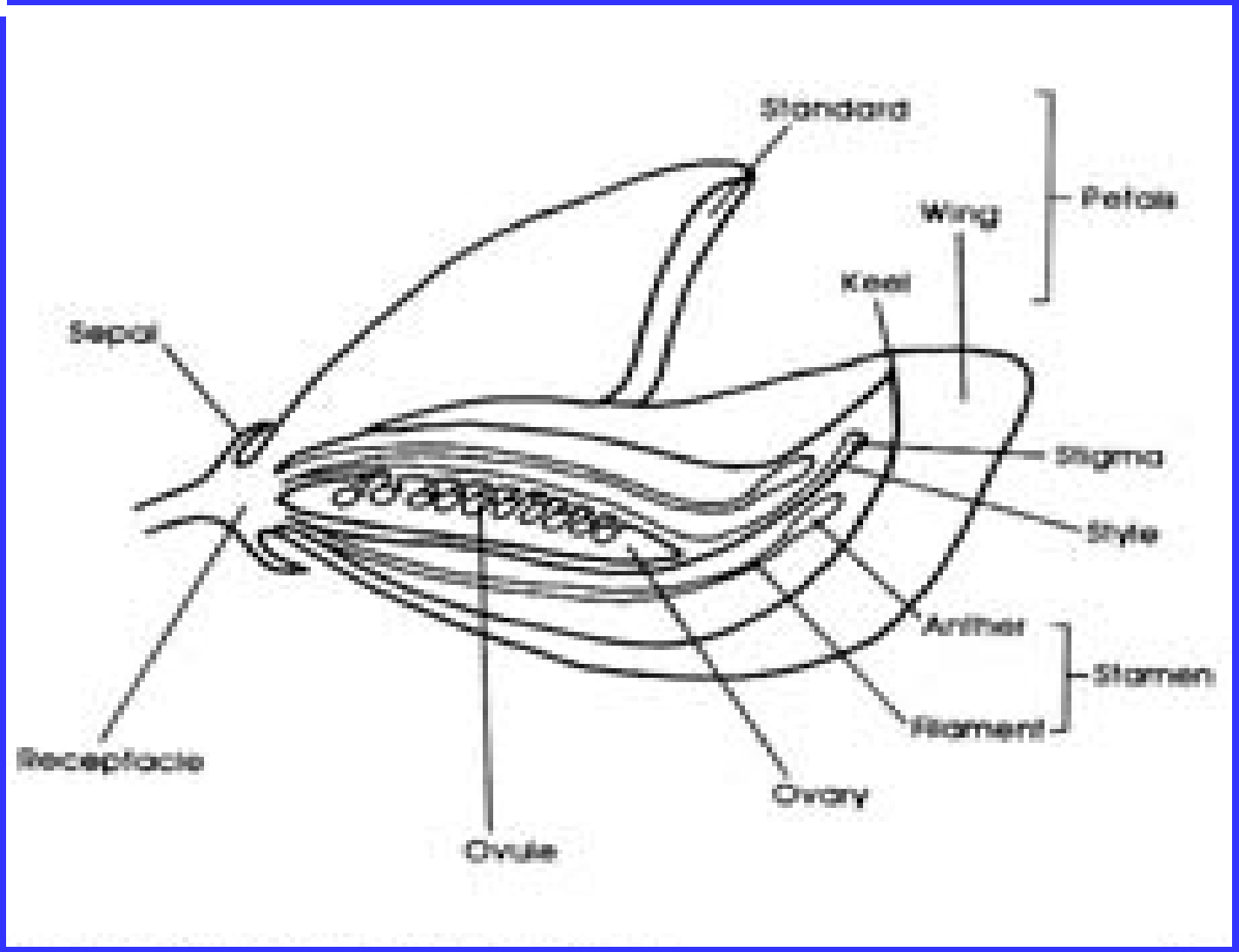
Flowers

Flowers are large, white with dark purple markings, borne on short pedicels in clusters of 1-5 on each axillary raceme usually between the 5 and 10th node; 1-4 pods develop from each flower cluster, and growth is indeterminate though determinate mutants are available (Fig. 3).

Flower stricture

Flowers bisexual, papilionaceous, almost sessile; calyx campanulate, 5-lobed, tube c. 7 mm long, lobes almost equal, narrowly triangular, 2–8 mm long; corolla white, marked by a dark brown blotch, fragrant, standard broadly ovate, c. 2.5 cm × 1.5 cm, approaching the keel, wings oblong-ovate, c. 2.5 cm × 0.5 cm, keel c. 1.5 × 0.5 cm; stamens 10, 9 united and 1 free, c. 15 mm long, anthers ellipsoid to ovoid, about 1 mm long, dark brown; ovary superior, sessile or nearly so, very slender, compressed, c. 1.5 cm long, style abruptly upturned, c. 3 mm long, with a tuft of hairs near the glandular-papillate stigma.

Faba bean flowers



Flower stricture

Population and Fertilization

There is a significant body of research to indicate that honey bees (*Apis mellifera* L.) play an important role in the pollination of faba beans.

Honey bee activity has been recognized as contributing to pollination in faba bean crops in Australia (Somerville 1999).

About 30 % of the plants in a population are cross-fertilized and the main insect pollinators are bumblebees.

Honey bees on flowers

The fruit (pods)

Fruit a narrowly oblong, cylindrical to flattened pod. The fruit is a broad leathery pod which is green and matures blackish-brown. It has a densely downy surface and large seeded beans have 1- 2 pods at each node, while small seeded varieties produce 2-5 pods per node. Pods are up to 18 inches long and contain 3-12 large beans. There are about 15 pods per stalk on large types and 60 pods on the small varieties. Pods vary in shape, size but should be picked when they are thick, green and have a glossy sheen. Seed pods develop in the leaf terminals from the flowers, initially green and fleshy, 60 – 100 mm long, depending on variety. Pods are furry and have a sharp point on the end. Pods blacken and shrivel as they mature.

Pods with seeds

Pods on Plants

Seeds

Seeds are 8 – 15 mm long or more, depending on variety. Seeds are light to dark brown and flattened, with a black strip running around the outside edge from the embryo to the end (Fig. 25b).

Different Seed Types

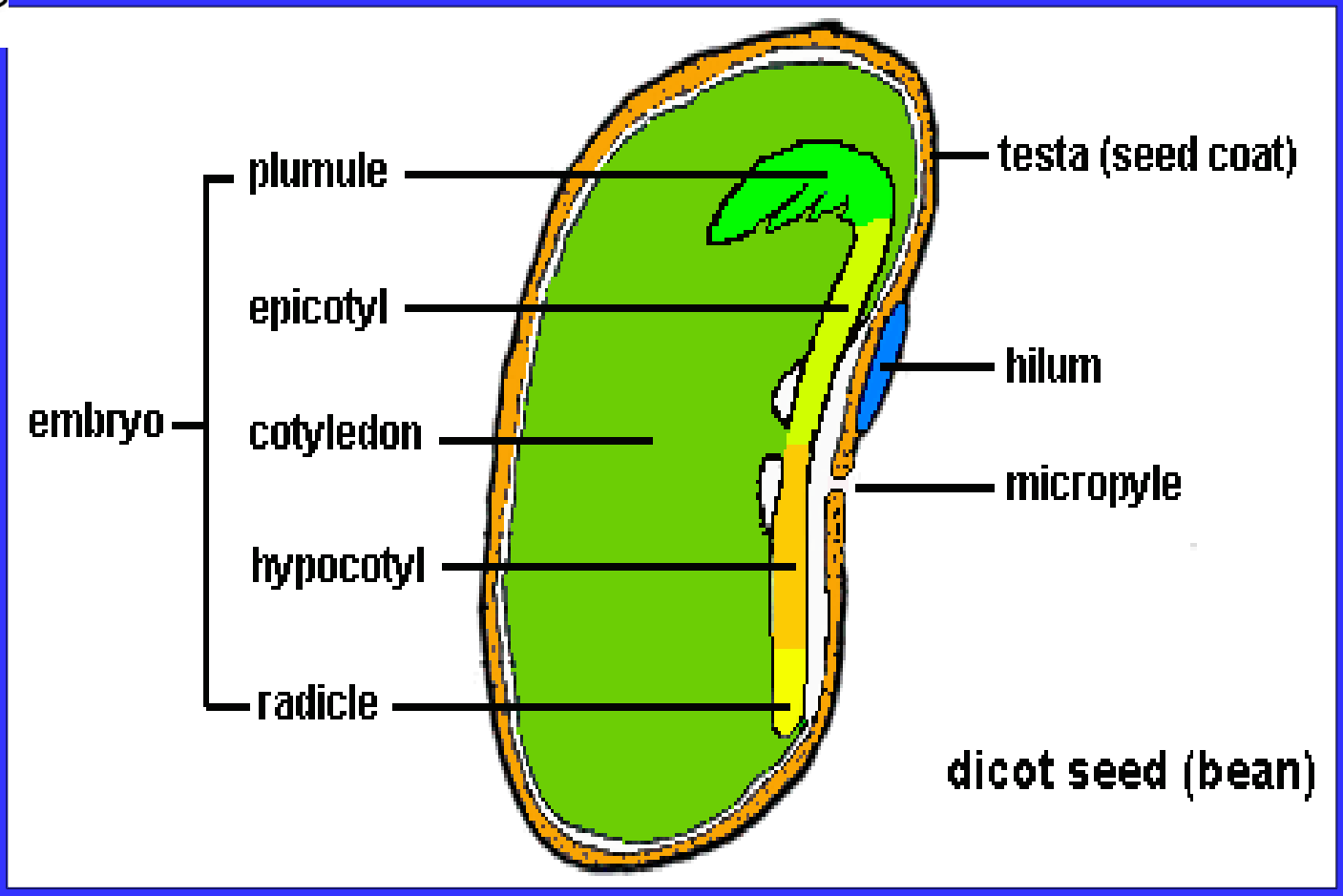
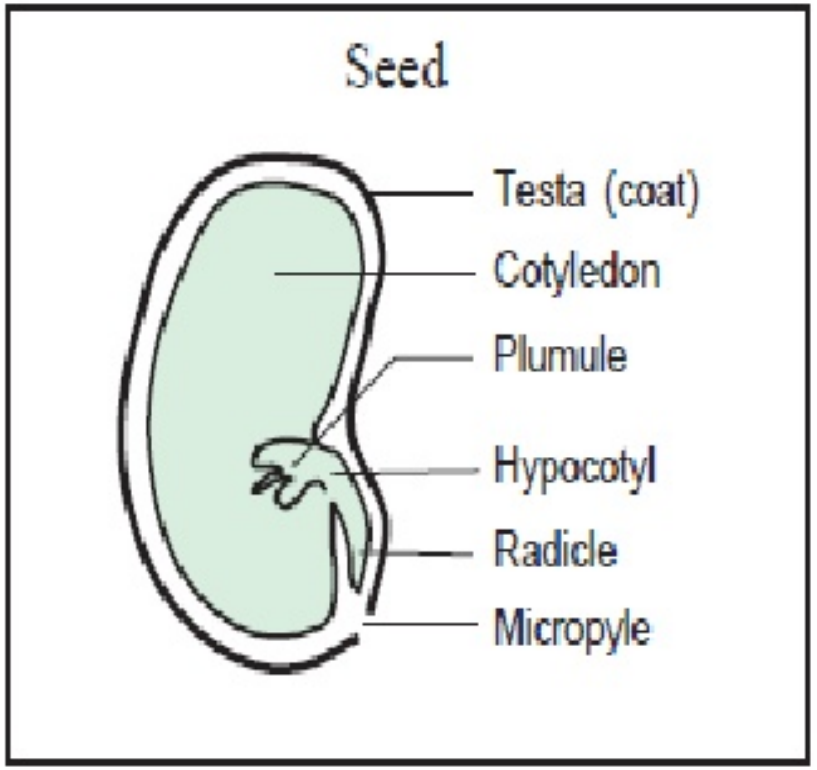


Fig. 25 b Seed structure of faba bean

Structure of seeds

- Testa – coat
- Cotyledon – seed leaf
- Plumule – first shoot
- Radicle – first root
- Hypocotyl – first stem below the seed leaves
- Micropyle – small hole where seed joined plant.
- Dicots and monocot differences. Monocots have endosperm, dicots generally do not.



	Faba bean (*Vicia faba* L.) Leguminosae Fabaceae
Types	1-Vicia faba var. minor, seeds (1 cm long). 2-Vicia faba var. *equine,* seeds (1.5 cm). 3-Vicia faba var. major, seeds (2.5 cm).
Germination	Hypogeal: grains remains below the ground, Seed takes in water through its micropyle.
Root	Tap root 100 cm in the soil, branched included bacterial noodles. *Rhizobium leguminserum*.
Stem	Stem is stiffly erect, square, with vertical ridges, branched annual, 1 to 1.5 m tall, branches above the soil surface.
Leaf	Compound, paripinnate, with 2–6 leaflets, Leaves alternate. Seedling leaves emerge from the seed and the first true leaves are in pairs.
Inflorescence	Flowers on axillary raceme inflorescence.
Flowers	Flowers are large, white with dark purple, papilionaceous, calyx campanulate, 5-lobed, tube corolla white, approaching the keel, wings oblong-ovate, stamens 10, 9 united and 1 free, ovary superior, stigma.
Fruits	Seeds in pods, Kidney, are 8–15 mm long or more

1-Faba bean plant the root system consist of ..... with profusely branched secondary roots"

a- tap root

b-Seminal roots

c- brace roots

d-Answer both a and b

2-Faba bean roots need to be inoculated with the appropriate strains of *Rhizobium* ....which will infect the plants root and stimulates root nodule development

a-phaseoli

b-leguminsarium

c-trifoli

d- mliloti

3-Faba bean plant additional branches emerge from ……..of the main stem.

a- the base b-top

c-along the main stem d-the middle.

4- true or false:-

(true) Faba bean Stems are square, with vertical ridges defining the sides of the square and appear to be very robust.

5-(false) faba Flowers borne on short pedicels in clusters of 1-5 on each axillary raceme usually between the 5 and 10 node; 5-10 pods develop from each flower cluster.

6- in field bean about …….. of the plants in a population are cross-fertilized and the main insect pollinators are bumblebees.

a-30% b-40% c-50% 80%


Thank
You!