

where E. caffra stands close by.

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A Plate of Beans

R.O. Gardner

"Beans ... are hard of digestion, and make troblesum dreames"
-- William Turner "A New Herball: the seconde parte" 1562

But 400 years later:

"The hardness and impermeability of the dried testa is caused mainly by the contraction of the walls of the palisade-cells as the seed ripens. When dried, the palisade may be almost impossible to section, but a trace of water on a fractured surface enables the razor to glide through". (Corner 1951)

The conception of a single family (Fabaceae) for this group of about 16000 species is supported by a remarkably uniform seed coat anatomy. This coat is derived entirely from the outermost of the ovule's two integuments. With few exceptions, it has: a palisade of Malpighian cells -- prismatic in shape, thick-walled, usually unligified cells; a layer of thick-walled hourglass-shaped cells; an inner layer of parenchyma or aerenchyma. A curious feature hardly known outside the legumes is the occurrence of a "light line" in the palisade. This appears to be caused usually by a sudden narrowing of the lumen, but sometimes differences in the chemistry of the wall, or anomalous structures, are present too.

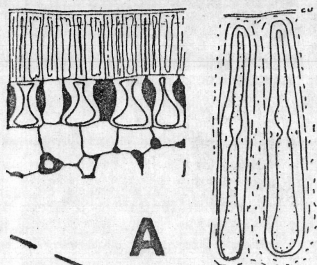
ILLUSTRATIONS

- A. Cross section of typical leguminous seed coat x 200; detail of palisade cells (in different species) x 240. cu cuticle l.l light-line. After Corner.

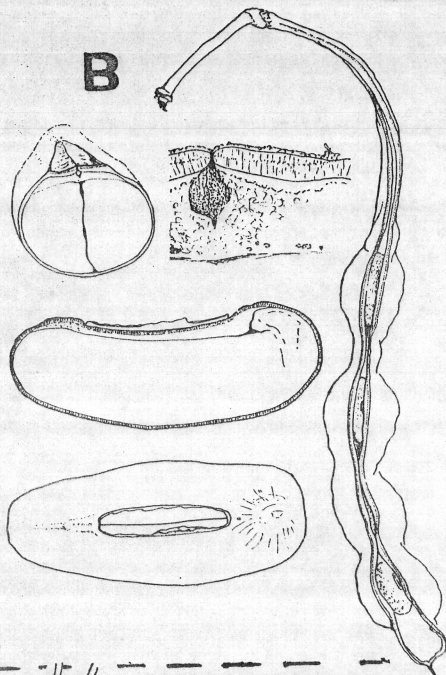
The family is divided into 3 subfamilies, and the seeds of each have a characteristic appearance and anatomy:

Faboideae

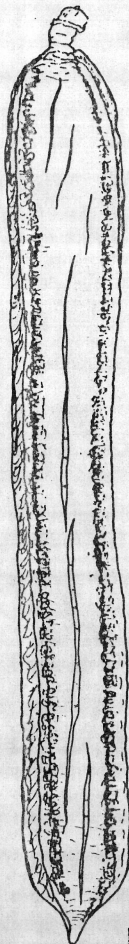
- B. Erythrina crista-galli Pod x 0.8; seeds x 4; cross-section of seed coat x c. 30.



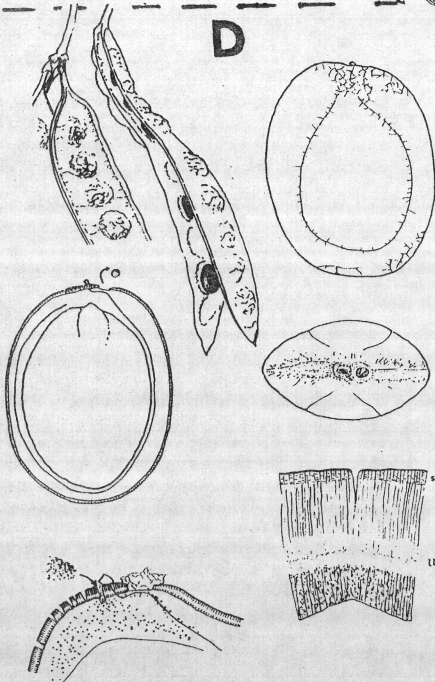
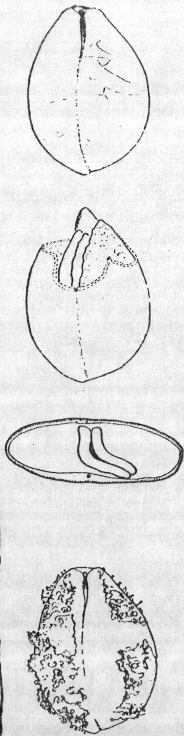
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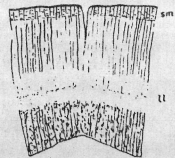
B



C



D



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The seed in Faboideae usually has a conspicuous abscission scar, called the hilum. The micropyle (shown as a dark dot) lies on one side of the hilum, above the tip of the characteristically curved radicle. There is a narrow groove centrally along the hilum, which the detail illustration shows as leading down into an air-space (dark) above a rod of vascular tissue, the tracheid bar. In this seed the palisade has a light-line only beneath the hilum.

In the mature seed the hilar groove opens in dry air and water vapour is taken from the seed, with the tracheid bar presumably being important in some way. Though such seeds are viable they will not immediately imbibe water and germinate, and are said to be "hard".

At the other side of the hilum from the micropyle there is an area of tissue called the lens. This is sometimes visible externally as a raised or sunken differently-coloured area. In this subfamily the role of the lens in seed germination is not entirely certain but it does seem that water might first enter the seed via some sort of weakness in the palisade here.

In seeds of Faboideae endosperm is usually absent, food being stored in the fleshy cotyledons.

Mimosoideae

C. Paraserianthes lophantha brush wattle

Pods x 0.8; seeds in face view, longitudinal section, and from above x 7; section of seed apex after seed has imbibed dye x 15; cross section of seed coat at pleurogram x 150.

Seeds in this subfamily are usually regular and symmetrical. In c. 65% of the genera (according to Gunn 1971) the palisade is broken on the faces by a horseshoe-shaped mark, the pleurogram. The presumption must be that like the hilar groove in Faboideae, the pleurogram acts to maintain hardseededness, but this has not yet been demonstrated.

The cross-section of the seed coat shows the cuticle and then the palisade, which is differentiated from outside to inside as follows; i) the stratum mucilaginosum (s.m.), being the more or less gelatinous end walls of the palisade cells -- sometimes this feature extends down the sides of the cells as well (as shown in the right-hand illustration of Fig. A above); ii) an outer zone (cross-hatched) where the lumen is narrow, without cell contents, and where the walls are impregnated with a brown substance; iii) a pale zone, the light-line, where the cell is also narrow and without protoplasm, but where there is a central globule apparently of a fatty substance (Elford 1932); iv) an inner zone, where the lumen is wider and protoplasm is present.

The funicle (seed-stalk) in this subfamily is often relatively long and twisted, and the hilum merely a small more or less circular scar.

The radicle in Mimosoideae is almost always straight, and in about half the genera endosperm is more or less absent (as in brush wattle).

There is a single vascular bundle extending as a loop in the mesophyll of the testa right round the embryo. It deviates in its path to arch up close to the base of the lens.

If the seeds of this species are strongly heated, in boiling water for example, or, in natural circumstances, by a forest fire, the palisade of the lens detaches (as a slightly curved circular piece c. 0.4 mm diameter) and so provides the route for water to enter. Although there are stress cracks in the palisade, particularly at and around the micropyle (just in front of the funicle stump), and also the open-looking pleurograms, and even an apparent direct route down through the funicle's vascular bundle, simple experiments with dye and smears of grease show that water does not initially enter the seed in those places

(Dell 1980).

However, water can enter later through the micropyle, as the following experiment shows (see the illustration at bottom left). Seeds of the current season were obtained from the litter below the tree. They were boiled for a minute or so to remove the "lens cap", then placed in water. During the next 2-3 days some of the seeds began to swell (some were very much slower). These partially imbibed seeds were removed, their lens areas covered with a dab of petroleum jelly, and then placed into a dilute solution of aniline dye.

The illustration shows the dye entering through the micropyle and the spreading through a central zone in the mesophyll of the testa. There is also some concentration of dye in the upper part of the vascular bundle where it curves towards the lens, but further down the bundle dye is lacking. Even in seeds allowed to imbibe dye normally through the lens, the lower course of the bundle remains unstained. It seems then that the vascular bundle might be important only in the early stages on imbibition.

I have found no reference to the way in which water enters and swells the walls of the palisade layer.

Caesalpinioideae

D. Cassia leptophylla (cultivated in Auckland Domain). Pod x 0.5; seeds in face view, partially dissected at apical end, cross-section near middle, partially imbibed, x 2; cellular detail of palisade x c. 50.

The hilum and lens are almost always inconspicuous in this subfamily. A pleurogram occurs in only a few genera. It is absent in C. leptophylla, the dark furrow down the forward face just indicating the position of the vascular bundle.

Only if the cuticle is damaged can this seed imbibe -- the stratum mucilaginosum absorbs water and peels off in numerous short twists. A light line occurs throughout the palisade layer. About a third of the genera in this subfamily have obvious endosperm. In C. leptophylla it is present as a thick gelatinous layer.

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A Dictionary of Maori Plant Names

The second edition of James Beever's "A Dictionary of Maori Plant Names" is now available at the Society's meetings for \$10, or by mail from Auckland Botanical Society, Botany Department, Auckland Institute and Museum, Private Bag 92018, Auckland for \$11 (please make cheques payable to Auckland Botanical Society).

Most of the Maori plant names in the 75 pages of this bulletin have been found in the lists compiled by explorers, missionaries, botanists and others during their work among the Maori people in the 19th century and earlier. The names are mainly traditional but there are also more recent words that arose from the introduction of exotic plants, especially the food plants, potato, turnip, cabbage and better yielding forms of kumara.

