

# A PHARMACOGNOSTICAL STUDY OF THE SEEDS OF A SPECIES OF THE GENUS *PAPAVER* GROWN IN EGYPT

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THE cultivation and possession of plants or seeds of certain *Papaver* species is strictly forbidden in Egypt, and to aid identification a comparison of the seeds of some species of *Papaver* was made. Winton<sup>1</sup> reported on the histology of seeds of *Papaver somniferum* var. *nigrum*. Fedde<sup>2</sup> discussed the taxonomy and morphology of the flowering and fruiting plants of the genus *Papaver*. Muschler<sup>3</sup> similarly studied *Papaver* species which grow in Egypt, and Aleksandrov and Vislaukh<sup>4</sup> reported on the histology of the flowering and fruiting plants of *P. somniferum*.

## MATERIAL

The seeds were obtained from the following: Chelsea Physic Garden, London; Kew Gardens, London; The Medicinal Plant Garden, University of Washington, Seattle, U.S.A., The Pharmacognosy Department, University of Southern California, U.S.A.; The Botanical Garden, Graz University, Austria; The Pharmacognosy Department, Faculty of Pharmacy, Cairo University and Zuhria Garden, Gizerah, Cairo.

The seeds of each species were separately cultivated in the Medicinal Plants Garden, Faculty of Pharmacy, Cairo University, as an additional means of authentication.

## SEEDS: MORPHOLOGY

The seeds of the different *Papaver* species (Fig. 1) are minute, varying in colour and size, being somewhat laterally compressed, more or less reniform in shape and with a narrow, pointed end. They are thicker towards the convex edge which is mostly rounded, while the concave edge shows in the centre a pale depression, the hilum. The microphyle is hardly seen. The seeds are hard, but can be easily crushed. They are odourless with an oily taste when crushed.

Externally, the seeds are reticulated, the reticulations being polygonal, isodiametric or somewhat elongated with nearly straight or wavy sides, surrounding shallow depressions. The number of the reticulations lengthwise and across the flat lateral side of the seed varies in the different species.

Internally, the seeds consist of a thin testa, enclosing a fleshy endosperm in which is embedded a curved embryo; the cotyledons being slightly longer than the radicle which is pointed towards the hilum.

The seeds as well as an alcoholic extract (1 in 10) when examined in filtered ultra-violet light, emit a bluish fluorescence.

The morphology of the seeds is given in Table I.

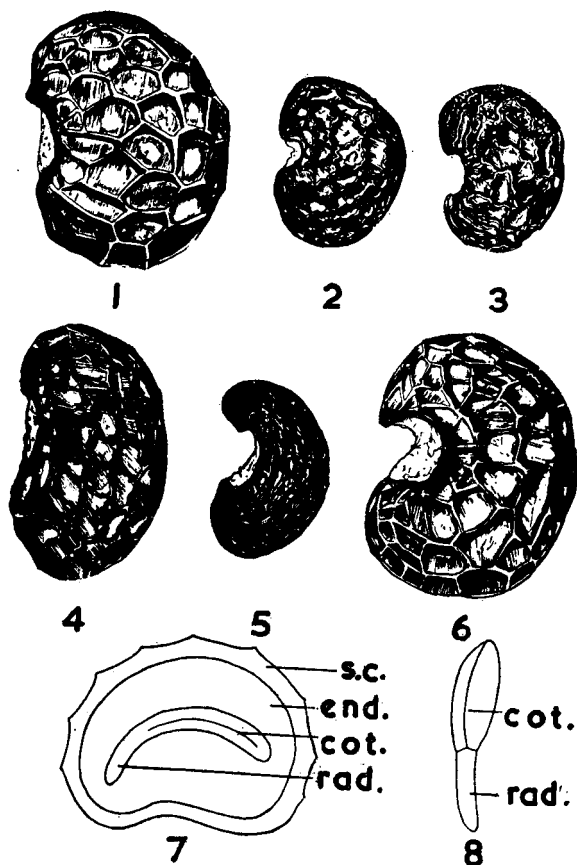


FIG. 1. Seeds (all  $\times 25$ ); 1, *Papaver somniferum* var. *nigrum*; 2, *P. rhoeas*; 3, *P. dubium*; 4, *P. argemone*; 5, *P. nudicaule*; 6, *P. orientale*; 7, longitudinal cut surface in the seed of *P. somniferum* (var. *nigrum*); 8, embryo; *cot.*, cotyledons; *end.*, endosperm; *rad.*, radicle; *sc.*, seed-coat.

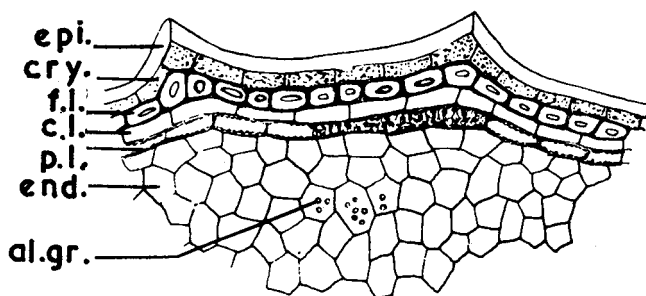


FIG. 2. T.S. in the seed of *P. somniferum* var. *nigrum* (by 160); *epi.*, epidermis; *cry.*, crystal layer; *f.l.*, fibrous layer; *c.l.*, cross layer; *p.l.*, pigment layer; *end.*, endosperm; *al.gr.*, aleurone grains.

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HISTOLOGY

The seed-coat (Fig. 2, 3, 4) consists of five layers, the epidermis, the crystal layer, the fibrous layer, the cross layer and the pigment layer. The first three layers correspond to the outer integument, while the inner two correspond to the inner integument. Each layer of the seed-coat consists of a single row of cells.

The epidermal cells appear tabular and tangentially elongated in transverse section and usually polygonal, isodiametric or somewhat elongated in surface view with slightly thickened almost straight or wavy anticlinal walls. The epidermal cells on the convex edge towards the

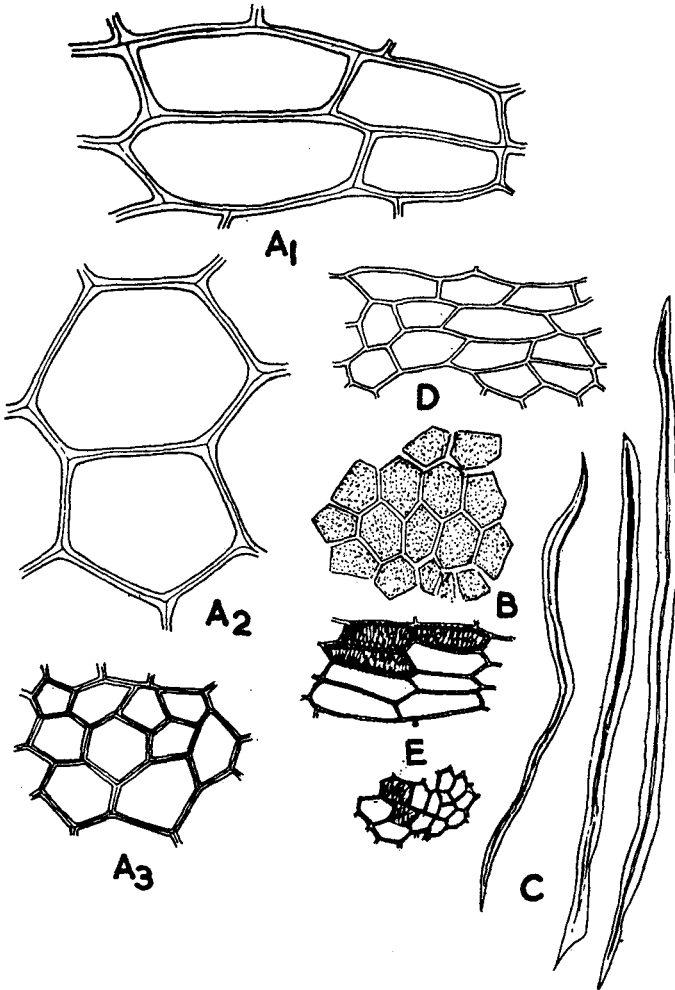


FIG. 3. Elements of the seed-coat of *P. somniferum* var. *nigrum* ( $\times 120$ ); A<sub>1</sub>, epidermal cells on the convex edge towards the narrow end; A<sub>2</sub>, epidermal cells; A<sub>3</sub>, epidermal cells in the neighbourhood of hilum; B, cells of crystal layer; C, cells of fibrous layer; D, cells of cross layer; E, cells of pigment layer.

TABLE I  
MORPHOLOGY OF SEEDS OF *Papaver* SPECIES

Name	Shape	Colour	Size	Weight of 100 seeds	Outline of reticulations	Number of reticulations
1a. <i>Papaver somniferum</i> var. <i>nigrum</i> var. <i>glacum</i>	Somewhat laterally compressed, reniform with a narrow and pointed end; convex edge mostly rounded; concave edge narrow containing the hilum and micropyle.	Greyish to greyish-brown to dark brown or even blackish.	1 to 1.2 mm. long 0.7 to 1.0 mm. wide 0.6 to 0.8 mm. thick	35 to 40 mg.	Polygonal, mostly isodiametric, with almost straight sides.	8 to 11 lengthwise, 6 to 8 across the flat lateral side.
1b. var. <i>album</i>	As for 1a	Whitish to pale yellowish white.	1 to 1.6 mm. long 0.7 to 1.2 mm. wide 0.6 to 0.8 mm. thick	40 to 50 mg.	As for 1a	As for 1a
2. <i>Papaver rhoeas</i>	As for 1	As for 1a	0.6 to 0.8 mm. long 0.5 to 0.6 mm. wide 0.4 to 0.5 mm. thick	12 to 17 mg.	Polygonal, mostly isodiametric with wavy sides.	8 to 11 lengthwise, 5 to 7 across, the flat lateral side.
3. <i>Papaver dubium</i>	As for 1	As for 1a	0.6 to 0.7 mm. long 0.4 to 0.5 mm. wide 0.4 to 0.5 mm. thick	10 to 15 mg.	As for 2	As for 2
4. <i>Papaver argemone</i>	As for 1, but usually narrow and elongated; the length about twice the width.	Dark reddish-brown to dark brown.	1 to 1.2 mm. long 0.5 to 0.6 mm. wide 0.4 to 0.5 mm. thick	17 to 20 mg.	Polygonal, somewhat elongated with slight wavy sides.	10 to 15 lengthwise, 5 to 7 across the flat lateral side.
5. <i>Papaver nudicaule</i>	As for 4	Pale brown to dark brown	0.7 to 0.9 mm. long 0.3 to 0.4 mm. wide 0.3 to 0.4 mm. thick	8 to 10 mg.	As for 4	10 to 15 lengthwise, 8 to 10 across, the flat lateral side.
6. <i>Papaver orientale</i>	As for 1, but the narrow ends are more acute and more elongated.	As for 1a	As for 1a	As for 1a	As for 1	As for 1

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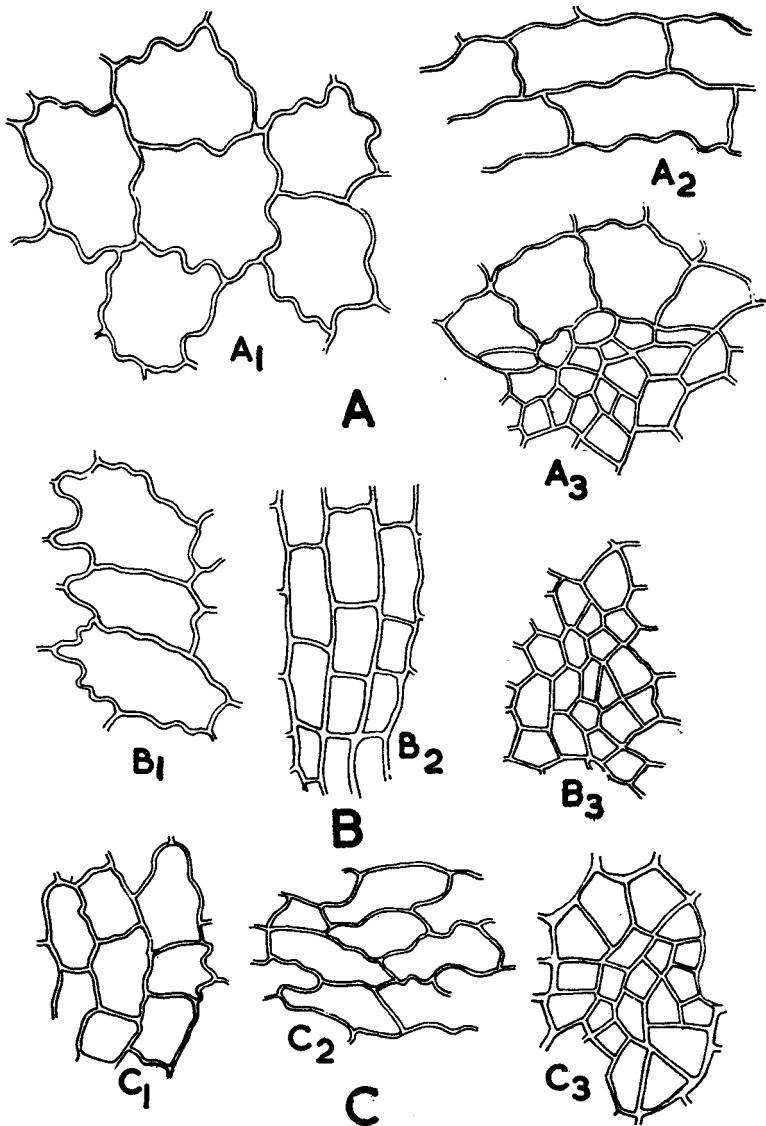


FIG. 4. Surface view of epidermal cells of seed coat ( $\times 140$ ); A, *P. rhoeas*; A<sub>1</sub>, epidermal cells in flat sides; A<sub>2</sub>, epidermal cells on the convex edge; A<sub>3</sub>, epidermal cells in the neighbourhood of hilum; B, *P. argemone*; B<sub>1</sub>, epidermal cells on flat sides; B<sub>2</sub>, epidermal cells on the convex edge; B<sub>3</sub>, epidermal cells in the neighbourhood of hilum; C, *P. nudicaule*; C<sub>1</sub>, epidermal cells on flat sides; C<sub>2</sub>, epidermal cells on the convex edge; C<sub>3</sub>, epidermal cells in the neighbourhood of hilum.

narrow end of the seed are usually narrow, elongated and nearly rectangular; while those in the neighbourhood of the hilum are usually smaller in size than those of other regions. In the crystal layer the cells are tabular and somewhat tangentially elongated in transverse section

TABLE II  
HISTOLOGY OF SEEDS OF *Papaver* SPECIES

Name	Epidermis	Crystal Layer	Fibrous layer	Cross layer	Pigment layer	Endosperm and embryo
<i>Papaver somniferum</i> 1a. var. <i>nigrum</i> var. <i>glaucom</i>	Epidermal cells, tabular, polygonal, isodiametric and slightly elongated, with straight walls; 18 to 337 $\mu$ long and 225 $\mu$ wide.	Cells tabular polygonal, isodiametric or somewhat elongated with nearly straight walls; contain minute shining microcrystals of calcium oxalate; 30 to 75 $\mu$ long and 20 to 60 $\mu$ wide.	Cells rounded or laterally compressed, elongated, somewhat twisted with pointed ends and thickened, non-lignified walls; 15 to 45 $\mu$ in diameter; and 300 to 750 $\mu$ long.	Cells tabular, polygonal, elongated, with straight fairly thickened brownish walls; 30 to 150 $\mu$ long; 20 to 60 $\mu$ wide.	Cells tabular, polygonal, isodiametric to elongated with straight reticulated thickened walls; contain amorphous dark brownish pigment; 15 to 130 $\mu$ long; 10 to 75 $\mu$ wide.	Endosperm cells polygonal, usually isodiametric with thin walls; embryo cells smaller, rounded, thin-walled. Endosperm and embryo cells contain fixed oil globules and aleurone grains; aleurone grains minute, rounded, containing one or more globoid and one crystalloid; 4 to 7 $\mu$ in diameter.
1b. var. <i>album</i>	As for 1a, but bigger; 18 to 375 $\mu$ long; 15 to 280 $\mu$ wide.	As for 1a	As for 1a	As for 1a, but the walls colourless.	As for 1a, but contain no pigment.	As for 1a
2. <i>Papaver rhoeas</i>	Epidermal cells, tabular, polygonal, isodiametric or slightly elongated, with wavy walls; 15 to 225 $\mu$ long; 15 to 150 $\mu$ wide.	As for 1a, but usually smaller; 15 to 37 $\mu$ long; 12 to 30 $\mu$ wide.	As for 1a in shape, but smaller; 10 to 30 $\mu$ in diameter; 300 to 600 $\mu$ long.	As for 1a, but usually smaller; 30 to 90 $\mu$ long; 10 to 45 $\mu$ wide.	As for 1a, but usually smaller; 15 to 110 $\mu$ long; 10 to 60 $\mu$ wide.	As for 1a, but aleurone grains, smaller; 2 to 5 $\mu$ in diameter.
3. <i>Papaver dubium</i>	As for 2	As for 2	As for 2	As for 2	As for 2	As for 2
4. <i>Papaver argemone</i>	Epidermal cells, tabular, elongated, polygonal with slightly wavy walls; 15 to 200 $\mu$ long; 15 to 95 $\mu$ wide.	As for 1, but smaller; 30 to 45 $\mu$ long; 20 to 37 $\mu$ wide.	As for 2	As for 2	As for 2	As for 2
5. <i>Papaver nudicaule</i>	Epidermal cells, smallest of species examined; remaining in shape those of 4. 15 to 150 $\mu$ long, 15 to 75 $\mu$ wide.	As for 1, but are the smallest of species examined; 10 to 30 $\mu$ long; 12 to 26 $\mu$ wide.	As for 1 in shape, but are the narrowest of species examined; 7 to 20 $\mu$ in diameter; 300 to 600 $\mu$ long.	As for 1 in shape, but are the smallest of species examined; 30 to 60 $\mu$ long; 10 to 30 $\mu$ wide.	As for 1 in shape, but are the smallest of species examined; 15 to 60 $\mu$ long; 10 to 37 $\mu$ wide.	As for 1
6. <i>Papaver orientale</i>	As for 1a	As for 1	As for 1	As for 1a	As for 1a	As for 2

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and polygonal, nearly isodiametric or slightly elongated and with nearly straight, anticlinal walls in surface view. They contain minute, shining microcrystals of calcium oxalate.

The fibrous layer consists of fibrous cells which, in transverse section, appear nearly rounded or somewhat laterally compressed and in surface view are elongated, and twisted with fairly thickened non-lignified walls and acute apices.

The cells of the cross layer are tabular, almost rectangular in transverse section and polygonal, somewhat elongated in surface view with nearly straight, fairly thickened and brownish anticlinal walls excepting those of *P. somniferum* var. *album*, which are colourless.

In transverse section, the cells of the pigment layer appear tabular and nearly rectangular and in surface view, they are polygonal, either isodiametric or elongated, with usually straight and reticulately thickened walls. These cells contain amorphous, dark brownish pigment except those of *P. somniferum* var. *album* which do not contain pigment.

The endosperm is composed of numerous rows of polygonal, usually isodiametric, thin-walled cells, containing fixed oil globules and small aleurone grains. The radicle consists of small rounded, thin-walled cells and the cotyledons of a single row of short palisade-like cells and of several rows of small rounded, thin-walled cells. The cells of the radicle and cotyledons contain also fixed oil globules and small aleurone grains. The comparative histology is given in Table II.

### DIFFERENTIATION

The seeds are differentiated by the following:

1. The seeds of the species examined are dark in colour except those of *P. somniferum* var. *album* which are whitish to pale yellowish-white.

2. The seeds of the three varieties of *P. somniferum* and of *P. orientale* are nearly equal in size, being larger than those of the other species. The seeds of *P. orientale* differ from those of *P. somniferum* by having pointed and narrower ends.

3. The reticulations of the three varieties of *P. somniferum* seeds and those of *P. orientale* seeds have almost straight walls, while those of the other seeds have wavy walls. In *P. rhoeas* and *P. dubium* seeds the reticulations have more wavy walls than those of *P. argemone* and *P. nudicaule*.

4. The epidermal cells of the three varieties of *P. somniferum* and those of *P. orientale* are larger than those of the other seeds. They have almost straight anticlinal walls, differing from those of the other seeds which have wavy walls. The epidermal cells of *P. rhoeas* and *P. dubium* seeds are mostly isodiametric, while those of *P. argemone* and *P. nudicaule* are usually elongated and less wavy.

5. The cells of the other layers of the seed-coat of the three varieties of *P. somniferum* and of *P. orientale* seeds are larger than those of the other seeds, while those of *P. nudicaule* are the smallest in size. In *P. somniferum* var. *album* the cells of the cross layer and pigment layer differ from the other species in being colourless.

6. The aleurone grains of the three varieties of *P. somniferum* seeds are larger than those of the other seeds.

REFERENCES

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2. Fedde, *Pflanzenreich*, 1909, IV, 104.
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4. Aleksandrov and Visloukh, *Botanicheskii Zhurnal S.S.S.R.*, 1934, 19 (2), 141.