

Seed Morphology of *Acacia* in Egypt and its Taxonomic Significance

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ABSTRACT

Seed shape and dimensions, surface texture and sculpture, areole form and hilum shape and position were recorded comparatively for 12 taxa representing *Acacia* in Egypt by light and electron microscopy. The data were used in the construction of an indented key to the species and infra-specific taxa.

Key Words: *Acacia*; Areole form; Identification; Seed shape; Surface sculpture

INTRODUCTION

Acacia (Mill.) is the largest genus in the Leguminosae-Mimosoideae with approximately 1200 species distributed mainly in tropical and subtropical regions Mabberley (1997). It is represented in Egypt by ten species, of which two [*A. tortilis* (Forssk.) Hayne and (*A. nilotica* L.) Delile] are represented by two subspecies each Boulou (1999). They are widely distributed in various phytogeographical regions of Egypt, where they are immensely useful as sources of food, fodder, fire-wood and a variety of natural products such as gum exudates (Springuel & Mekki, 1993).

The trees of *Acacia albida* Delile are a prominent feature in the flora of Nile valley and the Eastern Desert. However, the universally accepted concept of *Acacia* is based on the absence of conspicuous glands on leaf-rachis and the presence of apical stalked glands on anthers. This concept led Chevalier (1934) to segregate *A. albida* Delile (with the contrasting distribution of glands) into a new mono-specific genus *Faidherbia* A. Chev. This view was later supported by differences in pollen morphology (Guinet, 1969; Robbertse, 1974a; Tantawy *et al.*, 2005), seed and seedling morphology (Robbertse & Van der Schijff, 1971; Vassal, 1972), flower and inflorescence structure (Robbertse, 1974b), leaf and stipule features (Robbertse, 1975a; 1975b) and isoenzyme profile Joly (1991). The taxonomic implications of this assortment of correlated characters were discussed in detail by Brenan (1983) and prompted Boulou (1999) to uphold the isolation of *A. albida* in *Faidherbia* in the latest floristic treatment of the Leguminosae in Egypt.

Despite the plethora of publications on various morphological, anatomical, palynological and biochemical attributes of *Acacia* species, no attempt seems to have been made to study surface sculpture of their seed coats. The present study was aimed at to abridge this gap and to apply the results to the identification of the species.

MATERIALS AND METHODS

The present study included seed collections from all the species and infra-specific taxa representing the genus *Acacia* in Egypt Table I. For seed morphology, five to seven seeds were investigated to record their dimensions, shape, color and surface texture. Details of seed sculpture were examined by a JEOL JSM – 100 scanning electron microscope operated at an accelerated voltage of 25 kV and photographed.

The terminology of Barthlott (1981 & 1990) and Stearn (1992) was adopted to describe the SEM aspects of the seed coat.

Observations

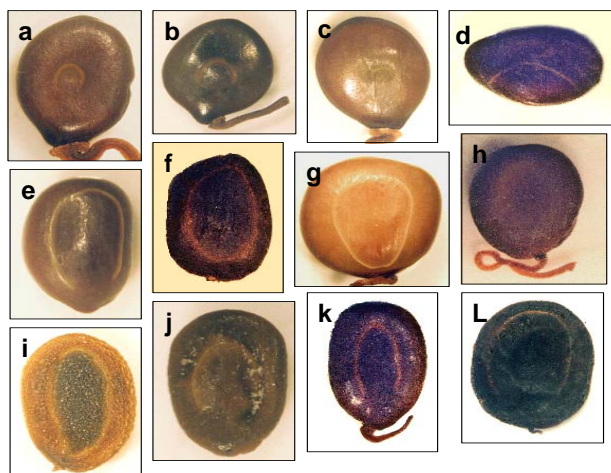
1. Seed size: 10 - 12 mm large/6 - 9 medium/< 5 small.
 2. Seed shape: obovate/globose/oblong/obovate-rectangle.
 3. Seed colour: dark brown/brown/yellowish brown.
 4. Seed texture: smooth/pitted/undulate.
 5. Areole shape: horseshoe (Fig. 1a)/obovate (Fig. 1f).
 6. Hilum position: terminal (Fig. 1a)/subterminal (Fig. 1b)/lateral (Fig. 1c).
 7. Hilum shape: slit-like/round/sunken.
 8. Seed sculpture: undulate reticulate (Fig. 2a)/reticulate granulate (Fig. 2f)/microverrucate (Fig. 2h)/reticulate (Fig. 2i)/ruminate (Fig. 2k).
 9. Cell shape: polygonal (Fig. 2c)/angular (Fig. 2e)/angular-round (Fig. 2d)/round (Fig. 2f)/variable (Fig. 2g)/irregular (Fig. 2k).
 10. Anticlinal walls shape: undulate (Fig. 2b)/wavy (Fig. 2L).
 11. Anticlinal walls thickness: thin (Fig. 2b)/thick (Fig. 2i).
 12. Anticlinal walls level: raised (Fig. 2i)/grooved (Fig. 2e).
 13. Periclinal walls level: convex (Fig. 2c)/concave (Fig. 2j)/flat (Fig. 2b)/undulate (Fig. 2h).
 14. Periclinal walls texture: striate/tuberculate/smooth/wavy.
- The key.** The recorded data Table II and III were used to

Table I. List of *Acacia* taxa and their collections data from Egyptian deserts

Taxa	Localities	Date
1- <i>Acacia mellifera</i> (Vahl) Benth.	Wadi Acow, Gebel Elba.	23-6-1998
2- <i>A. laeta</i> R.Br ex Benth.	Wadi Acow, Gebel Elba.	11-6-1999
3- <i>A. asak</i> (Forssk.) Willd.	Wadi Aeideib, Gebel Elba.	29-5-2001
4- <i>A. tortilis</i> (Forssk.) Hayne ssp. <i>tortilis</i>	Wadi Aeideib, Gebel Elba.	29-5-2001
5- <i>A. tortilis</i> (Forssk.) Hayne ssp. <i>raddiana</i> (Savi) Brenan	Abu - Ramad - Halaeib Road, Gebel Elba.	13-6-1999
6- <i>A. nilotica</i> (L.) Delile ssp. <i>nilotica</i>	Ain Dakhakhin, Kharga Oasis.	15-9-1998
7- <i>A. nilotica</i> (L.) Delile ssp. <i>tomentosa</i> (Benth.) Brenan	Orman Botanic Garden, Giza.	27-7-1999
8- <i>A. pachyceras</i> O. Schwartz var. <i>najdensis</i> (Chaudhary) Boulos.	Wadi El-Arish, Gebel El- Halal, Sinai.	20-7-2003
9- <i>A. oerfota</i> (Forssk.) Schweinf var. <i>oerfota</i> .	Wadi Tetuila, Gebel Elba.	17-6-2000
10- <i>A. seyal</i> Delile	Wadi Aeideib, Gebel Elba.	17-6-2000
11- <i>A. ehrenbergiana</i> Hayne	El- Kattamia- El- Suez, Desert Road.	8-7-2001
12- <i>A. etbaica</i> Schweinf.	Wadi Acow, Gebel Elba.	23-6-1998

Fig. 1. Light microscope of *Acacia* seeds

a, *Acacia mellifera*; b, *A. laeta*; c, *A. asak*; d, *A. tortilis* ssp. *tortilis*; e, *A. tortilis* ssp. *raddiana*; f, *A. nilotica* ssp. *Nilotica*; g, *A. nilotica* ssp. *Tomentosa*; h, *A. pachyceras* var. *najdensis*; i, *A. oerfota* var. *aoerfota*; j, *A. seyal*; k, *A. ehrenbergiana*; l, *A. etbaica*

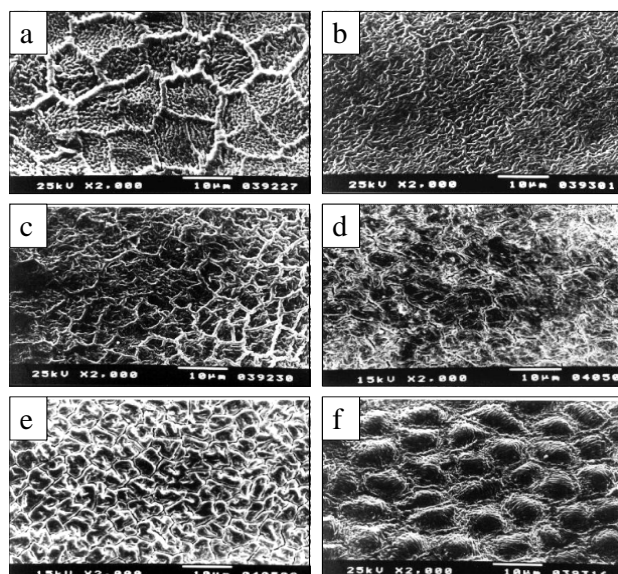


construct the following indented key to the 12 taxa representing *Acacia* in Egypt, so that it might help in the confirmation of their identification:

- A- Seed 10 - 12 mm long
- B- Hilum subterminal, sunken, seed obovate, dark brown, with pitted texture.....*A. laeta*
- BB- Hilum lateral, round, seed oblong, yellowish brown with smooth texture.....*A. etbaica*
- AA- Seed 7 – 9 mm long
- C- Hilum terminal, sunken.....*A. mellifera*
- CC- Hilum subterminal, slit- like
- D- Seeds oblong, yellowish brown
- I- Texture smooth, areole horseshoe, anticlinal walls grooved.....*A. tortilis* ssp. *raddiana*
- II- Texture undulate, areole obovate, anticlinal walls raised.....*A. nilotica* ssp. *tomentosa*
- DD- Seeds obovate –rectangular, dark brown.....*A. nilotica* ssp. *nilotica*
- CCC- Hilum lateral, round

Fig. 2a-f. SEM micrographs of seed coat sculpture

a, *Acacia mellifera*; b, *A. laeta*; c, *A. asak*; d, *A. tortilis* ssp. *tortilis*; e, *A. tortilis* ssp. *raddiana*; f, *A. nilotica* ssp. *nilotica*

**Fig. 2g-l. SEM micrographs of seed coat sculpture**

g, *Acacia nilotica* ssp. *tomentosa*; h, *A. pachyceras* var. *najdensis*; i, *A. oerfota* var. *oerfota*; j, *A. ehrenbergiana*; k, *A. seyal*; l, *A. etbaica*

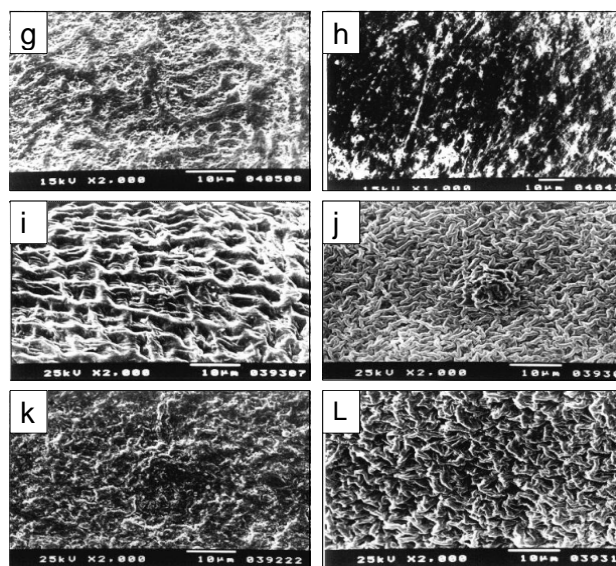


Table II. Seed morphology of the species and infra-specific taxa representing *Acacia* in Egypt

Characters taxa	Mean Length (mm)	Mean Width (mm)	Shape	Color	Texture	Areole shape	Areole (mm)	L x W	Hilum Position	Hilum Shape
<i>A. mellifera</i>	8-9	5-6	O	YB	S-Sh	H	2.5 x 2.5	T		SK
<i>A. laeta</i>	10-11	8-9	O	DB	P-Sh	H	1.5x2.0	St		SK
<i>A. asak</i>	7-8	5-6	O	DB	P-Sh	H	2.5x3	L		RO
<i>A. tortilis</i> ssp. <i>tortilis</i>	4-5	4-4.5	G	B	S	H	3.5x2.3	T		SL
<i>A. tortilis</i> ssp. <i>raddiana</i>	7-8	4-5	Ob	YB	S	H	5.7x2.3	St		SL
<i>A. nilotica</i> ssp. <i>nilotica</i>	7-9	5-7	O- R	DB	P	O	5-6.5x4-6	St		SL
<i>A. nitotica</i> ssp. <i>tomentosa</i>	7-8	6-7	Ob	YB	U	O	5-6x3-3.5	St		SL
<i>A. pachyceras</i> var. <i>najdensis</i>	7-8	6-7	O - Ob	B	S-Sh	O	4-6 x 3-4	L		RO
<i>A. oerfota</i> var. <i>oerfota</i>	7-8	5-6	Ob	B	U	O	4-6 x 3-4	L		RO
<i>A. seyal</i>	5-6	4-5	O	YB	S	H	4-4.5x 2.5-3	L		RO
<i>A. ehrenbergiana</i>	6.5-7	4.5-5	Ob - O	B	S	H	3-4 x 2-3	L		RO
<i>A. etbaica</i>	11-12	5-7	Ob	YB	S	H	4-5 x 3	L		RO

B = brown; DB = dark brown G = globose; H = horseshoe; L = lateral; O = obovate; Ob = oblong; O-R = obovate – rectangular; P = pitted; RO = round; R = rectangular; S = smooth; Sh = shiny; SK = sunken; SL = slit-like; St = subterminal; T = terminal; U = undulate, Y B = yellowish brown

Table III. Seed coat micromorphology of the species and infra-specific taxa representing *Acacia* in Egypt

Characters taxa	Seed coat pattern (Sculpture)	Cell shape	Shape	Anticlinal walls Thickness	Level	Periclinal walls Level	Periclinal walls Texture
<i>Acacia mellifera</i>	Ur	Py	U	K	Rs	Cv	St
<i>A. laeta</i>	Ur	An	U	Th	Rs	F	Tu
<i>A. asak</i>	Ur	Py	U	K	Rs	Cv	Tu
<i>A. tortilis</i> ssp. <i>tortilis</i>	Ur	An-Rd	U	K	G	Cv	Tu
<i>A. tortilis</i> ssp. <i>raddiana</i>	Ur	An	U	Th	G	Cv	S
<i>A. nitotica</i> ssp. <i>nitotica</i>	Rg	Rd	U	Th	Rs	Cv	St
<i>A. nilotica</i> ssp. <i>tomentosa</i>	Ur	V	W	K	Rs	Cv	S
<i>A. pachyceras</i> var. <i>najdensis</i>	M	V	W	Th	Rs	U	W
<i>A. oerfota</i> var. <i>oerfota</i>	R	An	U	K	Rs	F	Tu
<i>A. seyal</i>	Rm	Irr	W	K	Rs	Cc	S
<i>A. ehrenbergiana</i>	Ur	Irrr	U	Th	Rs	Cc	W
<i>A. etbaica</i>	Ur	An	W	Th	Rs	F	Tu

An = Angular; An-Rd = Angular- round; Cc = Concave; Cv = Convex; F = Flat; G = Grooved; Irr = Irregular; K = Thick; M = Microverrucate; Py = Polygonal; R = Reticulate; Rd = Round; Rg = Reticulate-granulate; Rm = Ruminant; Rs = Raised; S = Smooth; St = Striate; Th = Thin; Tu = Tuberculate; U = Undulate; Ur = Undulate-reticulate; V = Variable; W = wavy

I- Texture smooth

i- Areole obovate, seed coat pattern microverrucate, periclinal walls undulate and wavy.....*A. pachyceras* var. *najdensis*

ii- Areole horseshoe, seed coat pattern undulate- reticulate, periclinal walls concave and wavy.....*A. ehrenbergiana*

II- Texture undulate

Areole obovate, seed coat pattern reticulate, periclinal walls flat.....*A. oerfota* var. *oerfota*

III- Texture pitted

Areole horseshoe, seed coat pattern undulate-reticulate, periclinal walls convex.....*A. asak*

AAA- Seed 4 - 6 mm long

E- Hilum terminal, slit- like, seeds globose, brown, seed coat pattern undulate reticulate, anticlinal walls grooved, periclinal walls convex and tuberculate*A. tortilis* spp. *tortilis*

EE- Hilum lateral, round, seeds obovate, yellowish brown, seed coat pattern ruminant, anticlinal walls raised, periclinal walls concave and smooth.....*A. seyal*.

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