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Distribution and Seed Description of the Genus *Acacia* (Mimosoideae-Leguminosae) in Saudi Arabia

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ABSTRACT. The genus *Acacia* constitutes an important component of Thorn Woodlands in Saudi Arabia. Some comments on its distribution are made; the seeds are described for 14 species and two subspecies, and a key is developed for their discrimination.

The study has covered twelve *Acacia* species and two subspecies distributed in Saudi Arabia. As far as the general distribution, the study has reveiled the need for detailed investigations on the biological aspects of this genus and its geographical and ecological distribution. The study mentions some good examples of such approaches and concludes that such analysis will be more fruitful if carried out within small areas.

The study has concentrated on the description of the seeds for the various species and the two subspecies of *Acacia*. Important differences have been disclosed and can be observed by use of simple magnifying glasses. About twelve characters have been recorded, *viz.*, seed-size, areole features, presence or absence of a white spot near the funicle, or its scar, base, surface texture, etc. The importance of this can be seen in the fact that seeds could be collected from under their mother trees while the trees are not in flower. The study has provided a simple key based on seed characters for species and subspecies determination of *Acacia* occurring in Saudi Arabia. This confirms the taxonomic and descriptive value of *Acacia* seeds.

Migahid (1978) recorded some 12 *Acacia* species within the eight phytogeographical regions of the Kingdom of Saudi Arabia (Map 1). According to Migahid, *A. albida* and *A. asak* occur in southern Hijaz, SH: *A. laeta, A. cyanophylla* and *A. nubica* all grow in southern Hijaz, as well as in the southern region, S: *A. etabica* and *A. mellifera* are found in northern Hijaz, NH as well as the southern region; *A. seyal* grows in southern Hijaz, the southern region, and in Najd, NJ: *Acacia tortilis* subsp. *raddiana* covers northern Hijaz, the southern region, Najd, and extends into the northern region, N: *A. arabica* is found only in Najd, while

A. farnesiana is reported in southern Hijaz, Najd, and the eastern region, E. None of the species is, as expected, reported from Rub-al-Khali (Empty Quarter) R. From the above it is very clear that Migahid provides only a general distribution of the species.

Contrary to Migahid, Collenette (1985) gives the exact location of the species samples. In several, if not all cases, the longitude and latitude are given. As far as *Acacia* species are concerned, she determines the exact location. For example: *A. tortillis:* Jabal Fayfa, 100 km N.E. of Jizan on steep rocky hillside 5,300 ft. The danger with such an approach is the ever changing distribution induced by distribances caused by many possible factors including Man. However, for herbarium records such an approach is welcomed in order to understand the geographical distribution of a species.

Chaudhary (1983) surveyed the Mimosoideae in Saudi Arabia and treated the genus *Acacia* in detail as to the distribution of each species including the ecological requirements where these are known.

The most comprehensive study of distribution, however, is that presented by Baierle *et al.* (1985) whose general sketch map is reproduced (Map 2).

As far as the genus *Acacia* is concerned the Baierle's map gives a very comprehensive analysis and mentions that one or more of its representative species are seen in one of more of the following regions:

Plant Communities:

Although much of Saudi Arabia is generally believed to be a desert, the following vegetation types were reported (Baierle *et al.* 1985).

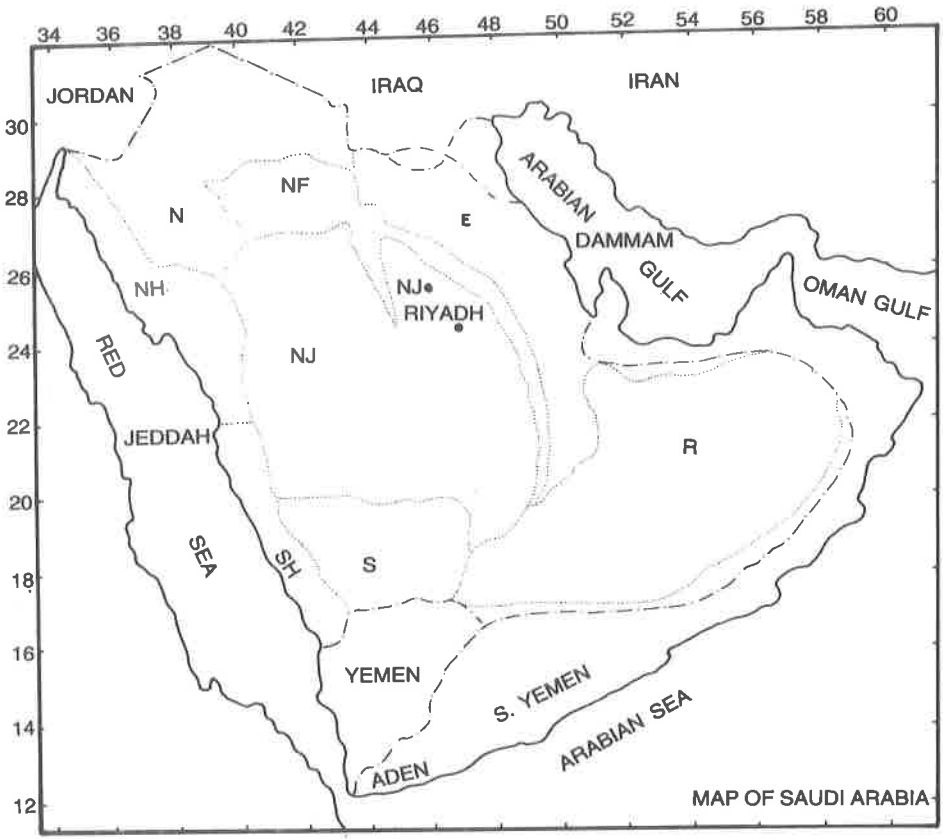
a) Mixed Formation of Evergreen Broad - Leaved Woodlands and Evergreen open Xeromorphic scrub:

This occurs on the northeastern slopes of the Hijaz and Asir mountains (1750-2000 2500)m. Here *A. gerrardii* grows together with *Barberya olioides, Olea africana, Pistacia falcutta* and *Rhus reinorrhea.*

b) Predominantly Evergreen Needle-Leaved Woodlands and Drought Deciduous trees:

These occupy locations on the northeastern slopes of the southern Hijaz mountains and the Asir highlands (2000-2500)m where *A. gerrardii, A. origana, A. negrii* occur with *Juniperus excelsa.*

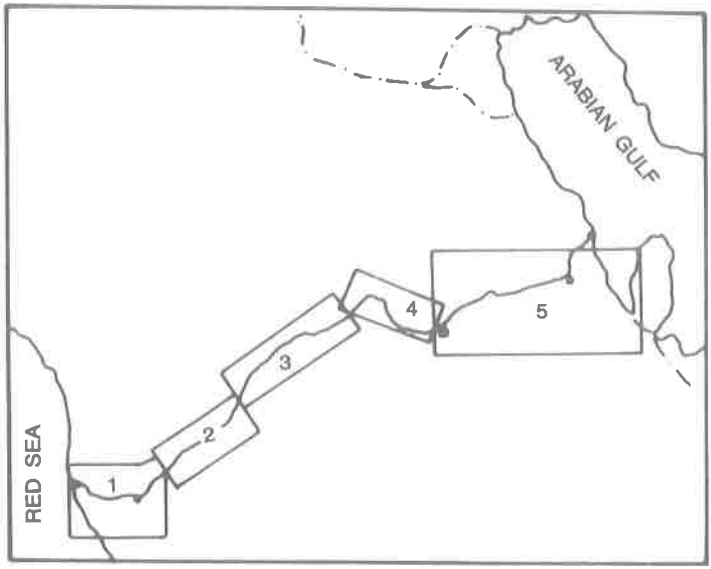
c) Sclerophyllous-rich Extremely Xeromorphic Woodlands:



Map 1 Phytogeographical Regions of the Kingdom of Saudi Arabia (Migahid, 1978).

N. Northern region, including Tabuk, Al Jawf and Sakakah area.
NF. Nefud region, including the great northern Nefud area, Dahna' and Al-Qassim area.
NH. North Hijaz, representing the western part of Saudi Arabia that extends along the Red Sea coast north of Jeddah.
SH. South Hijaz, representing the southern part of the western region extending south of Jeddah to the Yemen boundaries.
S. Southern region, lying to the east of South Hijaz, to the south of Najd and to the north of Yemen. It includes Abha, Bisha and Najran areas.
NJw. Western Najd.
NJe. Eastern Najd.
E. Eastern region, between Dahina' and the Arabian Gulf.
R. Al Rub' Al Khali, representing most of the southern and south-eastern parts of Saudi Arabia.

Map 2 Sketch map of Baierle *et al.* (1985) TAVO AVI 9 - Vegetation of Central Saudi Arabia (Taif-Riyadh-Dammam).



Map 2 Sketch map of Baierle *et al.* (1985) TAVO AVI 9 - Vegetation of Central Saudi Arabia (Taif-Riyadh-Dammam).

These are found on the western slopes of the Hijaz mountains near Taif (1250-1500)m and are dominated by *A. asak, A. etbaica, Dodonaea viscosa, Ficus salicifolia, Olea africana* and *Psiadia punctata.*

d) Thorn-Woodlands:

These vary in form and species composition in response to the edaphic, climatic, and orographic factors prevailing in Saudi Arabia. They generally characterize the lower hill ranges of Tihama, Hijaz and Asir mountains, extending inwards into Taif and Riyadh especially along drainage systems. Within this broader range of Thorn Woodlands occur *A. asak, A. ehrenbergiana, A. etbaica, A. gerrardii, A. hamulosa, A. mellifera, A. raddiana, A. tortilis, Adenium obescum, Anisotes trisulcus, Commiphora opobalsamum, Delonix alata, Euphorbia cuneata, Grewia tenax, Premna resinosa* and *Ziziphus spina-christi.*

Seed Morphology:

Acacia seeds have been fully studied by only a few authors (Vassal 1971, Brenan 1970). In several other works (Al-Kinany 1981, Bebawi and Mohamed

1982, Mahmoud *et al.* 1981 and Singh 1982), authors have not described the seeds. In still other works seeds are mentioned but data are only given on their number per pod, or their arrangement on the placenta (Andrews 1965, Chaudhary 1983, Hutchinson and Dlaziel 1954, Migahid 1978, Oliver 1971, Sharma and Tiagi 1973, Tackholm 1974, and White 1962). In few cases (Gunn 1984, Martin and Williams 1973) *Acacia* seeds were generally described. Martin and Williams say that seeds are "rather diverse, compressed, and oval to elliptic, black to greenish brown, 4-12 mm long. All species have the faces marked by an oval or elliptic line more or less concentric with the outline of the seed. Endosperm lacking".

The present study on *Acacia* seeds in Saudi Arabia indicates that at least some thirteen characters may be observed using a simple magnifying glass of X5—X10. In the 14 species examined, no two species were identical.

It is hoped that the key presented here will allow seed characters to be used in addition to the commonly employed floral and leaf features to facilitate the identification of *Acacia* species.

In forthcoming papers, more information on *Acacia* species will be given, probably on their soil preferences, water relations and seedling characteristics. In this and following issues, nomenclature follows Migahid, 1978, Chaudhary 1983, and Collenette 1985.

Materials and Methods

Map 1 illustrates the phytogeographical regions of Saudi Arabia according to Migahid (1978), while Map 2 shows the area covered by Baierle *et al.* (1985). The former indicates the general distribution, the latter indicates a more comprehensive analysis of a smaller area.

Fifty *Acacia* seeds were collected from mature pods from material deposited at the Botany Department Herbarium, Faculty of Science, King Saud University. In only two cases were seeds obtained from the Sudan (Table 1).

The method employed was simply the use of a pocket lens of X5—10 or more. Simple drawings were then made (Figs. 1-15).

The seeds were studied from both surfaces. The position of the funicle was noted. The 'left' side of a seed is that facing the observer when the basal part of the funicle faces left. Similarly, the 'right' side of a seed is that facing the observer when the basal part of the funicle faces right. When the funicle is apical, or almost so, either side could be 'left' or 'right'.

Table 1. Representative specimens used in this work with reference to localities, collectors, and dates. All material is deposited at the Herbarium of the Botany Department, King Saud University, Riyadh.

No.	Taxon	Locality	Collector	Specimen identified by
1	*Acacia abyssinica*	Taif	A.M. El-Sheikh and A.M. Migahid, 1981	S.A. Chaudhary, 1985
2	*A. albida*	17 Km E of Biljurshi Alt. 1930 m.	H.M. Hassan, P. König H. Kürshner, 1982	P. König, Berlin, 1982 H.M. Hassan, Riyadh, 1982.
3	*A. ehrenbergiana*	12 Km E of Al-Mudhaylif Alt. 120 m.	U. Baierle, P. König 1982	U. Baierle, P. König Berlin, 1982.
4	*A. etbaica*	30 Km E N of Taif Alt. 1400 m.	U. Baierle, W. Frey, P. König 1982.	P. König, Berlin, 1982.
5	*A. farnesiana*	15 Km N E of Ad Darb Alt. 180 m	U. Baierle, S.A. Chaudhary, P. König 1982.	A.G. Miller, Edinb. 1983.
6	*A. gerrardii*	15 Km S of Taif Alt. 1750 m.	A.M. El-Sheikh, W. Frey, H. Kürshner, A. Mahmoud, A.M. Migahid, 1981.	P. König, H. Kürshner Berlin, 1982.
7	*A. gerrardii* ssp. *negevensis*	Huraimla	A.M. Migahid 1973	S.A. Chaudhary, 1985.
8	*A. hamulosa*	25 Km E of Al-Jumum Alt. 420 m.	U. Baierle, W. Frey, P. König, 1982	P. König, Berlin, 1982

Table 1.–(*Contd.*)

No.	Taxon	Locality	Collector	Specimen identified by
9	*A. laeta* (seeds only)	Sudan	A/Sallam Mahmoud	A/Sallam Mahmoud
10	*A. mellifera*	15 Km N E of Ad Darb Alt. 180 m	S.A. Chaudhary, P. König, 1982	P. König, Berlin 1982
11	*A. negrii*	75 Km N of Abha	A.M. El-Sheikh, W. Frey, P. König, 1981	P. König, Berlin
12	*A. nilotica* (seeds)	Sudan	A/Sallam Mahmoud	A/Sallam Mahmoud
13	*A. oerfota*	40 Km E of Jizan Alt. 50 m.	U. Baierle, P. König, 1982	U. Baierle, P. König, 1982
14	*A. seyal*	Gebel Fayfa	S.A. Chaudhary Yahya Mekki, 1982	H.M. Hassan, 1983
15	*A. tortilis*	20 Km S E of Al Ma'aquas Alt. 480 m.	U. Baierle, P. König 1982	U. Baierle, P. König 1982

To prepare seeds for phography, 2 seeds were selected and a slide prepared containing two small drops of Elmer's School Glue (Borden Inc. Dept. CP, Columbia, Ohio, USA). The seeds are then placed one with the basal part of its funicle (or its scar) facing left and the other with the basal part of the funicle (or its scar) facing right. The preparation was then left to dry.

N.B.—Elmers Glue is water soluble and the seeds may be re-employed elsewhere.

Characters used include:

(a) The position of funicle *i.e.* whether lateral or apical.
(b) The presence or absence of a white spot on the seed-shoulder close to one side of the funicle, and whether this is flat or elevated.
(c) The central areole: this is a ring-shaped structure on the seed surface. The central areole is described as 'open' when it does not form a complete circle and as 'closed' when it forms a complete circle.
(d) The gap seen in an open central areole; this is called the "areole aperture".
(e) The lines that flange the areole aperture; these are called the 'areole arms'.
(f) The shape and size of the central areole.
(g) The presence of any radiating lines from the central areole.
(h) The presence of any crest-like extension of the seed-wall.
(i) The colour of the area inside the central areole and whether it is flat or concave.
(j) The colour of the seed-coat.
(k) Whether the seed surface is rough, wrinkled or smooth.
(l) The seed shape *i.e.* whether elliptic or rounded.

Based on these characters, the following key was constructed to permit identification of 14 species of *Acacia* and also to distinguish the two subspecies of *A. gerrardii*.

1. Seeds wrinkled	13. *Acacia oerfota* (Fig. 13; Plate 5-1)
1. Seed smooth	2
2. Central areole closed	3
2. Central areole open	6
3. White spot present on seed shoulder near funicle	1. *A. abyssinica* (Fig. 1; Plate 1-1)
3. White spot absent	4
4. Central areole obtuse at apex	11. *A. negrii* (Fig. 11; Plate 4-2)

4. Central areole acute at apex — 5
5. Central areole mucronate towards the funicle — 9. *A. laeta* (Fig. 9; Plate 3-3)

5. Central areole tapering towards the funicle — 12. *A. nilotica* (Fig. 12; Plate 4-3)

6. Seed circular — 7
6. Seed enlongated — 10
7. White spot absent, length of areole arms different — 7. *A. gerrardii* subsp. *regevensis* (Fig 7; Plate 3-1)

7. White spot present on seed shoulder near the funicle — 8
8. White spot elevated — 8. *A. hamulosa* (Fig. 8; Plate 3-2)

8. White spot flat — 9
9. Central areole on both sides large and similar. — 15. *A. tortilis* subsp. *raddiara* (Fig. 15; Plate 5-3)

9. Central areole on both sides small and dissimilar. — 10. *A. mellifera* (Fig. 10; Plate 4-1)

10. White spot present on seed shoulder near the funicle — 11
10. White spot absent — 12
11. Longitudinal groove present — 5. *A. farnesian* (Fig. 5; Plate 2-2)

11. No longitudinal groove — 4. *A. etabaica* (Fig. 4; Plate 2-1)

12. Funicle apical — 2. *A. albida* (Fig. 2; Plate 1-2)

12. Funicle lateral — 13
13. Central areole distinct, thick — 6. *A. gerrardii* subsp. *gerrardii* (Fig. 6; Plate 2-3)

13. Central areole ill-defined, thin — 14
14. Areole arms divergent at apex — 14. *A. seyal* (Fig. 14; Plate 5-2)

14. Areole arms convergent at apex — 3. *A. ehrenbergiana* (Fig. 3; Plate 1-3)

Seed Description:

1. *A. abyssinica* Hochst. ex Benth. (Fig. 1; Plate 1-1)

Seeds up to 8×5 mm; smooth, compressed, thick, pointed at both ends, elongated. Funicle subterminal, reddish brown, twisted, shining. A white elevated spot lies on the seed-shoulder to one side of funicle. Central areole closed on the left side (Fig. 1, right) and slightly open on the right side (Fig. 1, left). Central areole almost equidistant from the seed periphery and occupies one third the seed

surface. Area inside the areole darker, smooth and flat on the left side, spotted with white dots and somewhat rough on the right side.

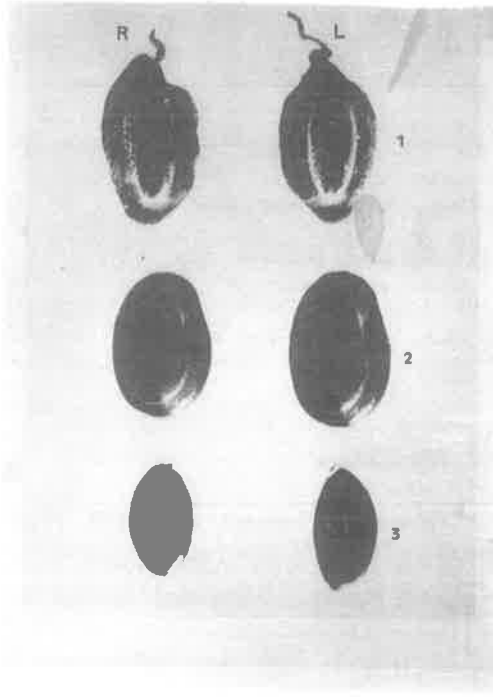
2. *A. albida* Del. (Fig. 2; Plate 1-2)

Seeds up to 7.5×5 mm, smooth, compressed, thick, rounded at both ends, reddish brown. Funicle apical, deciduous. Central areole similar on both surfaces, equidistant from the seed periphery and occupying half the seed surface. Areole-aperture 1.5 mm wide. Both sides similar.

3. *A. ehrenbergiana* Hayne (Fig. 3; Plate 1-3)

Seeds up to 6 × 3 mm, smooth, compressed, thick, dull-green, elliptic. Funicle subterminal reddish, twisted. Central areole distinct, thin and open. Areole mouth 1 mm wide. Area inside the areole darker. Areole arms unequal.

Plate 1



1-1 *Acacia abyssinica*

1-2 *A. albida*

1-3 *A. ehrenbergiana*

R = right side
L = left side

4. *A. etabaica* Schweinf. (Fig. 4; Plate 2-1)

Seeds up to 6×5 mm, smooth, compressed, thick, light-green, elongated. Funicle lateral. Seed-apex pointed, base rounded. A white spot lies on seed-shoulder to one side of the funicle. Central areole sharp, equidistant from seed periphery except towards seed apex. Areole-aperture 2 mm wide. Area inside the areole flat and darker. Both sides similar.

5. *A. farnesiana* (L.) Willd. (Fig. 5; Plate 2-2)

Seeds up to 8.5×6 mm, smooth, thick compressed, reddish brown, elongated. Funicle sub-terminal, deciduous. A white elevated spot lies on seed shoulder to one side of the funicle and a groove runs below this spot to nearly 5/6th, the seed length. Central areole sharp and contrinues over seed apex (saddle-like) and appears shifted to the side (Fig. 5, left). Area inside the areole darker and flat. Both sides similar.

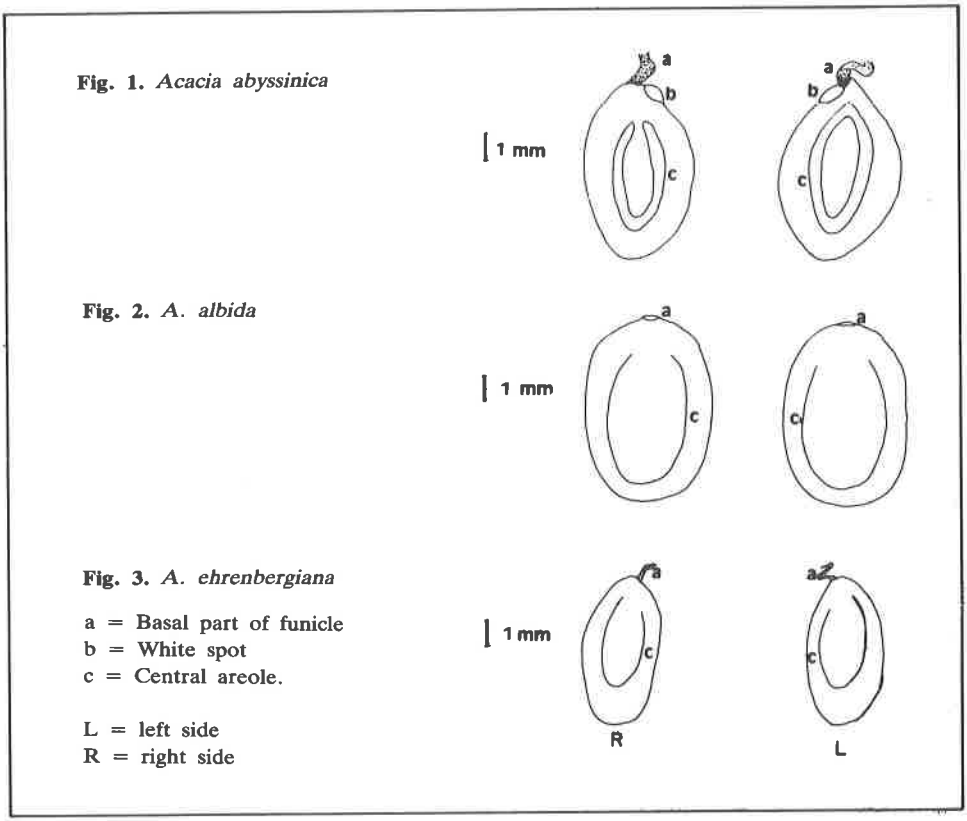


Plate 2:

2-1. *Acacia etbaica*

2-2. *A. farnesiana*

2-3. *A. gerrardii* subsp. *gerrardii*

R = right side
L = left side

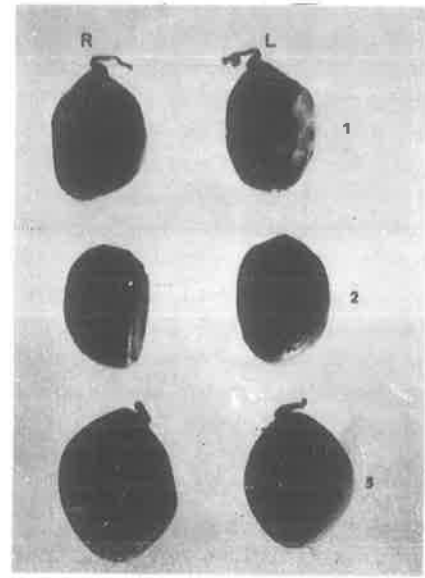


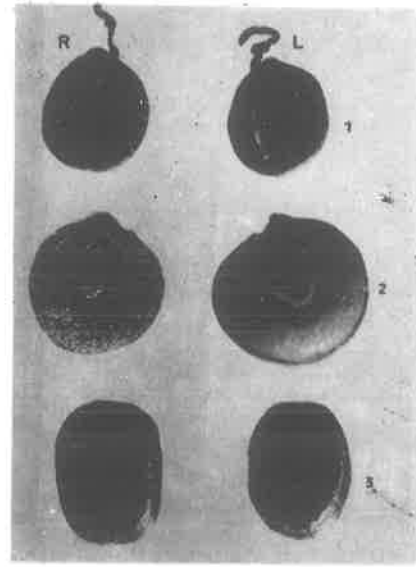
Plate 3:

3-1. *Acacia gerrardii* subsp. *negevensis*

3-2. *A. hamulosa*

3-3. *A. laeta*

R = right side
L = left side



6. *A. gerrardii* Benth. subsp. *gerrardii* (Fig. 6; Plate 2-3)

Seeds up to 7×5 mm, smooth, thick, compressed, yellowish-green, elongated. Funcile lateral, twisted and reddish. Central areole distinct, whitish and open, almost equidistant from the seed periphery and occupies half the area of the seed surface. Both sides similar.

7. *A. gerrardii* Benth. subsp. *negevenesis* Zoh. (Fig. 7; Plate 3-1)

Seeds up to 6×6 mm, smooth, thick, compressed circular, dull-green. Funicle lateral, twisted reddish. Central areole sharp, open, large, with one arm longer than the other. Areole aperture 1.5 mm wide. Area inside the areole concave or flat; area outside the rings and towards seed base mottled with white dots. Both sides similar.

8. *A. hamulosa* Benth., (Fig. 8; Plate 3-2)

Seeds up to 9×9 mm, smooth, thick, compressed reddish-brown, circular. Funicle lateral deciduous. Seed apex pointed. An elevated white spot lies on seed-shoulder to one side of the funcile. Central areole distinctly small, open and occupying one third the central area of the seed surface. Areoles are dissimlar,

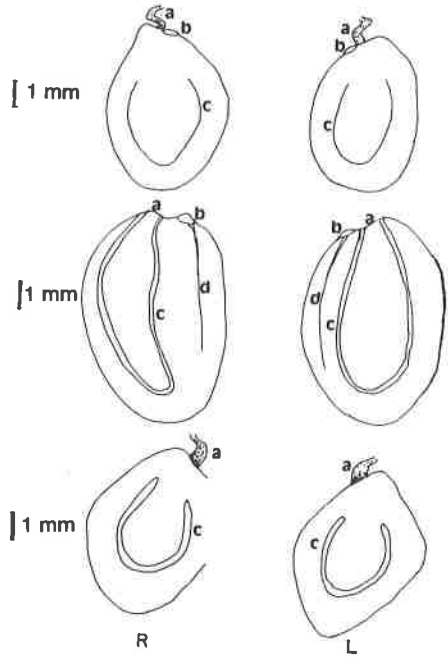
Fig. 4. *Acacia etbaica*

Fig. 5. *A. farnesiana*

Fig. 6. *A. gerrardii* subsp. *gerrardii*

a = Basal part of funicle
b = White spot
c = Central areole.
d = groove

R = right side
L = left side



basin-like, with a 3 mm opening on the left side and thicker, U-shaped with a 2 mm opening on the right side. The seed periphery appears crested, particularly on the left side.

9. *A. laeta* R. Br. ex Benth. (Fig. 9; Plate 3-3)

Seeds up to 7×5 mm, smooth, thick, compressed, obtuse at both ends, almost quadrangular, dark-brown, lustrous. Funicle apical and deciduous. Central areole closed, large, approaching the periphery of seed and occupying 3/4th the seed surface. Apex of areole mucronate, base rounded, area inside flat. Both sides similar.

10. *A. mellifera* (Vahl.) Benth. (Fig. 10; Plate 4-1)

Seeds up to 7×7 mm, smooth, thick, compressed, reddish brown, shining and circular. Funicle lateral, twisted. Seed apex pointed. A flat white spot lies on the seed-shoulder to one side of funicle. Central areole open, distinctly small and dissimilar. On the left side the areole is basin-like with an opening 1.5 mm wide, while on the right side the ring is thinner, U-shaped and with an opening 1 mm wide. The seed periphery is crested.

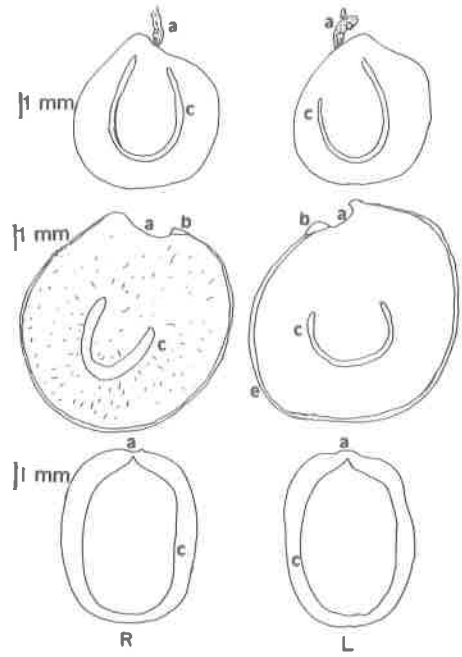


Fig. 7. *Acacia gerrardii* subsp. *negevensis*

Fig. 8. *A. hamulosa*

Fig. 9. *A. laeta*

a = Basal part of funicle
b = White spot
c = Central areole.
e = Crest like extension.
R = right side
L = left side

11. *A. negrii* Pichi-Sermolli (Fig. 11; Plate 4-2)

Seeds up to 7×5 mm, smooth, compressed, thick elongated, greenish. Funicle almost terminal and twisted. Central areole closed, elliptic, ends obtuse. Whitish strands raddiate from both sides of the areole lines. Area inside the areole flat and darker. Both sides similar.

12. *A. nilotica* (L.) Willd. (Fig. 12; Plate 4-3)

Seeds up to 7×7 mm, smooth, thick, compressed, apex pointed, base rounded, lustrous, brownish. Funicle apical and deciduous. Central areole closed, ovate, lower and upper parts close to seed periphery. Area inside areole appears pitted, more so on the right side.

13. *A. oerfota* (Forssk.) Schweinf. (Fig. 13; Plate 5-1)

Seed up to 7×5 mm, wrinkled, thick, ovate, whitish-green. Funicle lateral, twisted, shining. A faint white spot lies on the seed-shoulder to one side of funicle. Central areole open, elevated, opening 0.5 mm wide. Both sides similar.

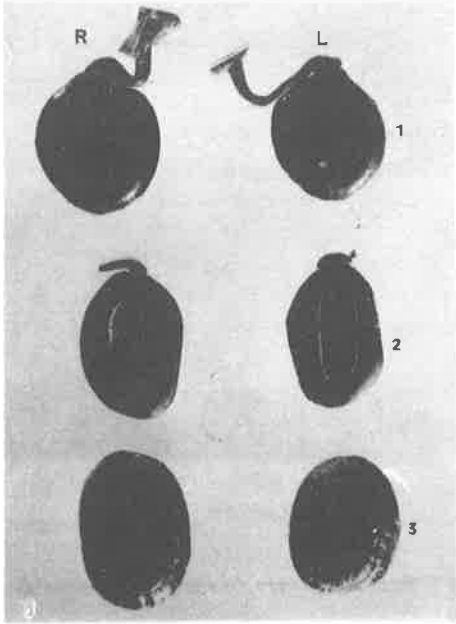
Plate 4:

4-1. *Acacia mellifera*

4-2. *A. negrii*

4-3. *A. nilotica*

R = right side
L = left side



14. *A. seyal* Del. (Fig. 14; Plate 5-2)

Seeds up to 7×5 mm, smooth, thick, elongatd, greenish. Seed apex pointed. Funicle lateral, twisted. Central areole open with the ends of arms divergent, opening 1.2 mm wide. Area inside areole darker. Both sides similar.

15. *A. tortilis* (Forssk.) Hayne subsp. *raddiana* (Savi) Brenan (Fig. 15; Plate 5-3)

Seeds up to 7.5×6.5 mm, smooth, thick compressed, reddish-brown, circular. Funicle subterminal, twisted. Seed apex pointed. A white spot lies on seed-shoulder to one side of funicle. Central areole open, large, equidistant from seed periphery. Areole aperture 2 mm wide. On the right side the areole is surrounded by a darker periphery.

Fig. 10. *Acacia mellifera*

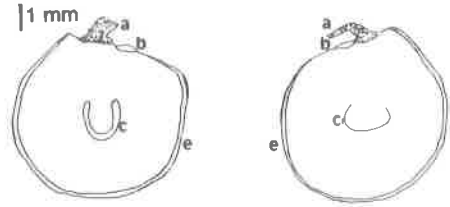


Fig. 11. *A. negrii*

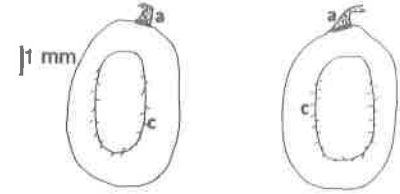


Fig. 12.. *A. nilotica*

a = Basal part of funicle
b = White spot
c = Central areole.

R = right side
L = left side

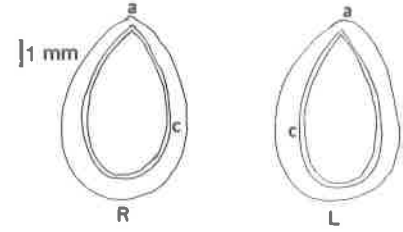


Plate 5:

5-1. *Acacia oerfota*

5-2. *A. seyal*

5-3. *A. tortilis* subsp. *raddiana*

R = right side
L = left side

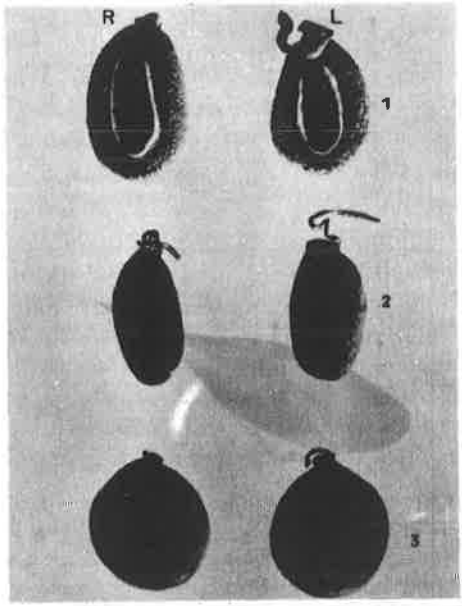
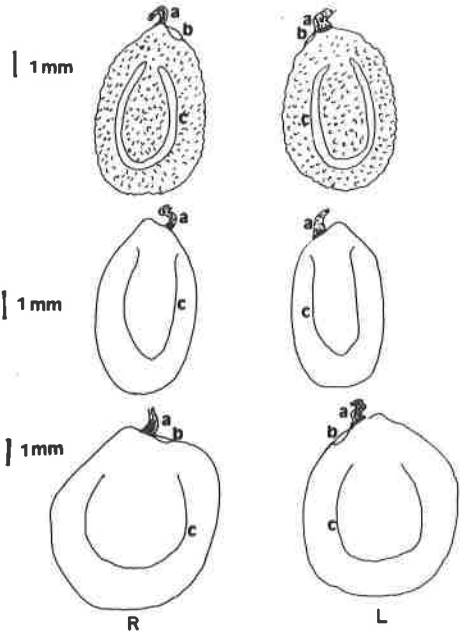


Fig. 13. *Acacia oerfota*

Fig. 14. *A. seyal*

Fig. 15. *A. tortilis* subsp. *raddiana*
a = Basal part of funicle
b = White spot
c = Central areole

R = right side
L = left side



Discussion

The genus *Acacia,* which is the largest in the sub-family, Mimosoideae, includes a number of characteristic tree species of Thorn Woodlands in Saudi Arabia. The distribution of such species was either reported in a generalized way (Migahid 1978) or not specified at all in other vegetation surveys which include some species (Vesey-Fitzgerald 1955 and 1959, Mahmoud 1977, Mitchell and Brardvijk 1962). Chaudhary (1983), gives a comprehensive survey of the Mimosoideae in Saudi Arabia and provides details for the distribution and ecology of some dominant species of *Acacia.* However, the most detailed analysis of the vegetation of Central Saudi Arabia is shown in a recent map (Baierle *et al.* 1985). The significance of this map lies in the fact that important differences in edaphic, climatic, or orographic factors are reflected in the vegetation of a rather small sector of the country, and a better understanding of the floristic composition is brought about. It is hoped that their approach will be extended to cover the whole area of the Kingdom.

As regards seed characters, Brenan (1970) usefully employed them in his species descriptions. Vassal (1971) has studied the seeds of *Acacia* both morphologically and anatomically and has classified the species on these bases. In both cases only a few of the species described occur in Saudi Arabia.

Nevertheless, comparisons of the seed descriptions given here with those given by the above authors, show many similarities. However, the few differences between our results and those of Vassal and Brenan are as follows:

a) Vassal observed the *white spot* near the funicle, as we also did, while Brenan did not include this character in his work.

b) In the present study the areole is described as open or closed with divergent, straight, equal or unequal arms. These features are not included by Brenan (1970) or Vassal (1971) in their descriptions.

In conclusion, *Acacia* species are traditionally classified on the basis of vegetative and floral characters. The present work, together with that of Brenan (1970) and of Vassal (1971), draws attention to the value of seed characters in the identification of *Acacia* species.

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توزيع ووصف البذور لجنس الأكاسيا (تحت الفصيلة السنطية ـ القرنيات) في المملكة العربية السعودية

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المملكة العربية السعودية

شملت الدراسة اثنى عشر نوعا ونويعين لجنس الأكاسيا المنتشرة في مناطق المملكة العربية السعودية المختلفة من حيث التوزيع العام للجنس وقد أوضحت الدراسة أنه لاتزال هنالك حاجة ماسة لدراسات متأنية ومفصلة تبحث في بيولوجية هذا الجنس وتوزيعه الجغرافي والبيئي وتشير الدراسة إلى نماذج جيدة لمثل هذا المسح الدقيق المطلوب القيام به وتخلص إلى الاشارة بأنه من المفيد أن تتم الدراسات داخل مساحات صغيرة محدده ليتم تغطيتها بدقة. ولقد ركزت الدراسة على وصف البذور للأنواع والنويعات المختلفة حيث أبرزت اختلافات واضحة يمكن ملاحظتها باستخدام أداة تكبير بسيطه، وأمكن استخلاص مايقارب الاثنتي عشر صفة يمكن رؤيتها بسهولة مثل مقاييس البذره، خصائص الحلقة البارزه في وسط السطح للبذره، وجود أو غياب بقعة بيضاء بالقرب من قاعدة الحبل السرى، ملمس سطح البذره إلى غير ذلك من الصفات. وتكمن الأهمية لذلك في أنه في حالات كثيرة يلاحظ وجود البذور تحت الأشجار وعن طريق هذه الصفات يمكن تعريف الشجرة الأم في غياب الأزهار. وقد أبرزت الدراسة إمكانية عمل كشاف مبسط مبنى على صفات البذور لتمييز الأنواع المتوفره في المملكة العربية السعودية مما يدعم أهمية البذور وقيمتها التصنيفية والوصفية.