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Taxonomic Implications of Seed Morphology and Seed Protein Electrophoresis of Some Egyptian Taxa of the Mimosoideae-Leguminosae.

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THE SEED macro-morphological features including seed shape, colour, size, areole shape as well as the testa sculpturing patterns examined by scanning electron microscopy (SEM) and SDS-PAGE profiles of seed proteins of 14 species and one subspecies; representing eight genera of Mimosoideae were investigated. A key to the taxa studied was provided based on the recorded macro-morphological features and the testa sculpturing patterns as viewed under SEM. The phenogram generated from the numerical analysis of the scored characters from SDS-PAGE profiles of seed proteins was beneficial to discuss some of the fore-mentioned opinions concerning the taxonomic status of members of Mimosoideae.

Keywords: Mimosoideae; SEM; Seed Morphology; Testa Sculpture; SDS-PAGE.

Mimosoideae is one of the three widely recognized subfamilies of Leguminosae (Elias, 1981). The Mimosoideae (treated as family Mimosaceae by Hutchinson, 1964) comprises 82 genera and 3335 species distributed throughout tropical and warm temperate regions of the world (Stevens, 2001). Mimosoideae is represented in the Egyptian flora by 5 genera, 10 species, 4 subspecies and two varieties (Boulos, 1999).

Bentham (1875), in his revision, established six tribes namely; Acacieae, Adenanthereae, Eumimoseae, Ingeae, Parkieae and Piptadenieae containing 46 genera of the Mimosoideae. Later on, Bentham's classification of Mimosoideae into tribes had been subjected to some modifications by Burkart (1939), Hutchinson (1964) and Lewis & Elias (1981). Furthermore, Elias (1981) distinguished between the following five tribes: Acacieae, Ingeae, Mimoseae, Mimozygantheae and Parkieae as constituents of the Mimosoideae depending upon the following characters: calyx either imbricate or valvate in bud; sepals either joined or free; stamens more than 10 or either 10 or fewer free or joined.

The use of SEM in studying the morphology of seeds has revealed new finer details on their surface which, in turn, yielded valuable taxonomic information adopted in solving many taxonomic problems (Chaung & Heckard, 1983; Hussein *et al*., 2002 a, b; Abou-El-Enain *et al*., 2007 and Gunes, 2012).

Morphology of seeds of many mimosoid taxa has been treated variously in many studies among them: Manning & Van Staden (1987), Al-Gohary & Mohamed (2007) and Karakish *et al*. (2013). Electrophoresis has become an additional tool applied in resolving taxonomic and phylogenetic problems (George *et al*., 2013 and Burghardt & Espert, 2007). Most applications of electrophoretic techniques in plant classifications use gel medium supports. This has resulted from the reliability of data produced by gel electrophoresis, which have been accepted widely, particularly in studies of plant population genetics (Omonhinmin & Ogunbodede, 2013 and Atoyebi *et al*., 2014). The use of seed protein electrophoretic profiles in addressing taxonomic relationships among some Leguminosae taxa has been highlighted by many researchers namely: Badr (1995); Ghareeb *et al.* (1999) and Arslan & Ertugrul (2010). Thus, the present study aims to characterize the seed morphological features including the testa

sculpturing patterns as viewed under SEM and to evaluate the genetic diversity and taxonomic relationships among 12 species and 3 subspecies of Egyptian Mimosoideae using SDS-PAGE analysis of seed storage proteins. The main objective of this study is to collect additional criteria which can be of more taxonomic interest in delimitation and differentiation among the taxa studied.

Material and Methods

Material

Specimens containing mature dry pods of 14 species and one subspecies of Mimosoideae were collected from June, 2001 to August 2004. Some of them were gained only as mature dry pods (Table 1). The collected specimens include both wild and horticultural ones. The identification of both of them was achieved by the morphological comparison against authentic herbarium specimens kept at the herbarium of Orman Botanical Garden, Giza, Egypt. The scientific names, synonyms and the author citations were rechecked and updated according the website: www.theplantlist.org.

Methods

A. Seed Morphological Features

The seed dimensions; length (L) and breadth (B) of each specimen, were measured as average of 10 seeds by using the vernier caliper. The general macro-morphological features of the seeds; including the shape, colour and the areole shape were directly recorded from the specimens examined. For SEM-observations of the testa surface patterns, at least two seeds for each specimen were mounted on stubs, coated with a thin layer of gold and examined at different positions using JEOL-JSM-5400 scanning electron microscope at Electron Microscope Unit, Assiut University since 2003-2004. The characters were recorded and SEM-micrographs, exhibiting the testa sculpturing were taken towards the mid-seed involving the pleurogram and part of the areole with a range of magnification between (500x-1500x). The terminology listed by Stearn (1983) and also that of Lersten (1981), with some modifications by the authors, were adopted for description of the seed surface sculpturing patterns. In addition, Polhill *et al.* (1981) defined that the hard seeds of Mimosoideae generally have an area on each face (the areole) bounded by a crack in the testa (the pleurogram). Gunn (1981) added that the fracture lines, on the seed surface, are cracks formed during seed maturation and appear to be in the thick cuticle layer.

TABLE 1. The collection data with their sources of collection.

No.	Taxa	Source of collection in Egypt
1.	*Acacia saligna* (Labill.) Wendl. (=*Acacia cyanophylla* Lindl.)	Parks at Zagazig Univ., Zagazig.
2.	*Acacia farnesiana* (L.) Willd.(*)	Canal banks, Beni Swif.
3.	*Acacia nilotica* (L.) Delile (=*Acacia nilotica* (L.) Delile subsp. *nilotica*)	Canal banks, Zagazig.
4.	*Acacia tortilis* (Forssk.) Hayne(*) (=*Acacia tortilis* (Forssk.) Hayne subsp. *tortilis*)	El Tur, South Sinai.
5.	*Acacia tortilis* (Forssk.) Hayne subsp. *raddiana* (Savi) Brenan(*)	El Tur, South Sinai.
6.	*Albizia julibrissin* Durazz.	Orman Botanical Garden, Giza.
7.	*Albizia lebbeck* (L.) Benth.	Salah Salem road, Cairo.
8.	*Dichrostachys cinerea* (L.) Wight & Arn.	Orman Botanical Garden, Giza.
9.	*Enterolobium contortisiliquum* (Vell.) Morong	The Zoo, Giza.
10.	*Enterolobium cyclocarpum* (Jacq.) Griseb.	The Zoo, Giza.
11.	*Faidherbia albida* (Delile) A. Chev. (= *Acacia albida* Delile)	Agricultural Museum, Giza.
12	*Leucaena leucocephala* (Lam.) de Wit (=*Leucaena glauca* (L.) Benth.)	The Zoo, Giza
13.	*Pithecellobium dulce* (Roxb.) Benth. (=*Inga dulcis* (Roxb.) Willd.)	The Zoo, Giza.
14.	*Prosopis farcta* (Banks & Sol.) Macbr.(**)	Bahariya Oasis.
15.	*Prosopis juliflora* (Sw.) DC.	The Zoo, Giza.

(*) Specimens collected from the herbarium of Cairo University.
(**) Specimen collected from herbarium of Orman Botanical Garden.

B. Seed protein electrophoresis

Total protein from 0.2 gm of milled seeds, of each of the collected specimens, were extracted overnight using 0.2 M Tris-HCl buffer, PH 6.8 containing 2% SDS and 10% glycerol. Centrifugation was carried out at 9000 rpm for 6 min. Then 30 µl supernatant were loaded in 12.5% acrylamide slab gels containing 10% SDS. Run power was 15 mA for about 30 min. Then raised up to 25 mA for 6-7 hr. The molecular weights of separated protein bands were compared with standards protein ladder ranging from 27 to 116 KDa. Gel was then stained in Comassie blue for 16 hr at room temperature, destained and photographed. The bands produced by each sample were directly scored as 0 for absent and 1 for present bands.

The data were treated by numerical analysis using the program NTSYS-pc. (Rholf, 1988). The similarity between each two taxa; based on comparisons of their SDS-PAGE profiles, was calculated using Jaccard's coefficient of similarity.

Results and Discussion

A. Seed Morphological Features

Variation in macro-morphological features of the seed including seed shape, colour, size and the areole shape as well as the testa sculpturing patterns as seen by SEM were outlined in Table 2. In addition, the testa surface, in the taxa studied, as viewed under SEM exhibited the pleurogram as a break in the testa surrounding the areole. Cracks or fracture lines were, also, commonly observed at different parts of the seed especially near the hilum or towards the mid-seed (Fig. 1A-Q).

The seed was either compressed (11 taxa) or not compressed in *Acacia farnesiana*, *Enterolobium contortisiliquum*, *E. cyclocarpum* and *Prosopis juliflora*. The shape of seed was oval, broad oval, oval-oblong or oblong. The colour of seed varied from pale brown to glossy dark brown and only brown mottled with yellowish white streaks and spots in *Acacia nilotica*. The mean length of seeds ranged from 4.9 mm to 11.9 mm. The smallest seeds were recorded in *Acacia saligna* and *Dichrostachys cinerea* whereas seeds of *Enterolobium cyclocarpum* are the longest ones. The areole shape was linear oblong in *Acacia saligna*, oblong in *Albizia julibrissin* and *A. lebbeck,* oval-oblong in *Acacia tortilis*, *Enterolobium contortisiliquum* and *E. cyclocarpum*; broad oval in *Acacia nilotica* and *Dichrostachys cinerea* and oval in the remaining seven taxa (Table 2). The testa sculpturing patterns observed under SEM were clearly variable among the taxa investigated (Table 2 and Fig. 1A-Q).

The seed morphological characteristics such as shape, colour, size and areole shape; if present, in combination with the testa sculpturing peculiarities observed under SEM had been found very useful in delimitation and identification of genera and species within family Leguminosae (Hussein *et al*., 2002 a, b; Taia, 2004; Abou-El-Enain *et al*., 2007 and Al-Gohary & Mohamed, 2007). Hussein *et al.* (2012) stated that diversity in the characteristics of the micropyle, hilum, and lens of seeds of Mimosoideae, when observed under SEM, offer indispensable criteria for separation primarily at the species level and sometimes at the subspecies level as well as very rarely at the rank of genus. In this work, the seed shape seems to be a reliable criterion for separating some of the taxa at the species level. *Albizia lebbeck* with compressed oval-oblong seeds could be distinguished from *A. julibrissin* with compressed oblong seeds. *Prosopis farcta* with compressed oval seeds could be differentiated from *Prosopis juliflora* with oval seeds. Also, the seed shape may represent a useful character for separation of *Acacia tortilis* subsp. *raddiana* with compressed broad oval seeds from *A. tortilis* having compressed oval seeds. However, *Enterolobium contortisiliquum* and *E. cyclocarpum* retained a similar seed shape which is oval-oblong. The seed colour appeared clearly distinctive to *Acacia nilotica*; where it is brown mottled with yellowish white streaks and spots. Gunn (1981) reported that the legume testa is usually monochrome brown to black, rarely red, cream or white or occasionally dichrome as mottling or two distinct coloured areas.

TABLE 2. The macro- and micro-morphological features of seeds of the studied Mimosoideae taxa.

Characters Taxa	Seed Comp•	Shape	Colour	Size(**) mm			Areole	Surface Pattern
				L	B	Grade		
Acacia saligna	+	oval-oblong	glossy dark brown	4.9	2.4	(S)	linear oblong	faint irregularly tuberculate (Fig. 1A&B)
Acacia farnesiana	-	oval	brown	7.2	5.1	(M)	oval	irregularly regulate (Fig. 1C)
Acacia nilotica	+	broad oval	brown(*)	7.8	5.7	(M)	broad oval	compact regulate (Fig. 1D)
Acacia tortilis	+	oval	brown	5.3	3.6	(M)	oval-oblong	ill-defined coupled with some variable pits (Fig. 1F)
Acacia tortilis subsp. *raddiana*	+	broad oval	brown	6.4	4.7	(M)	oval	ill-defined coupled with some variable pits (Fig. 1E)
Albizia julibrissin	+	oblong	brown	8.6	4.2	(M)	oblong	irregularly foveolate with variable foveolae (Fig. 1G)
Albizia lebbeck	+	oval-oblong	pale brown	10.8	7.6	(L)	oblong	compact coarse rugulate frequently with exaggerated thick rugae coupled with sparsely scattered variable pits (Fig. 1H)
Dichrostachys cinerea	+	broad oval	glossy brown	4.9	3.7	(S)	broad oval	inconspicuous rugulate to ill-defined coupled with variable pits (Fig. 1I)

TABLE 2 Cont. The macro- and micro-morphological features of seeds of the studied Mimosoideae taxa.

Characters Taxa	Seed Comp•	Shape	Colour	Size(**) mm			Areole	Surface Pattern
				L	B	Grade		
Enterolobium contortisiliquum	-	oval-oblong	dark brown	9.1	3.7	(M)	oval-oblong	irregularly reticulate-foveolate with thick anticlinal ridges (Fig. 1J)
Enterolobium cyclocarpum	-	oval-oblong	dark brown	11.9	6.9	(L)	oval-oblong	irregularly papillose (Fig. 1K)
Faidherbia albida	+	oval	glossy brown	7.8	4.6	(M)	oval	obsoletely tuberculate(Fig. 1L)
Leucaena leucocephala	+	oval	glossy brown	6.9	4.6	(M)	oval	faint polygonal-discoid plates covered with micro-striations (Fig. 1N& O)
Pithecellobium dulce	+	broad oval	dark brown-black	10.8	8.8	(L)	oval	prominent irregularly tuberculate (Fig. 1M)
Prosopis farcta	+	oval	brown	8.1	5.1	(M)	oval	irregularly reticulate-foveolate to ill-defined with ridges of the reticulae thick and micro-striated (Fig. 1P)
Prosopis juliflora	-	oval	glossy pale brown	5.2	3.8	(M)	oval	compact fine rugulate coupled with sparsely scattered variable pits (Fig. 1Q)

+Seed compressed; - Seed not compressed; L=Length; B= Breadth; Brown (*) = Brown mottled with yellowish white streaks and spots; Comp• = Seed compression; (**) Concerning seed size the following grades were taken into consideration: Small-sized seeds (S) *i.e*. less than 5 mm long; Medium-sized seeds (M) *i.e*. 5-10 mm long; Large-sized seeds (L) *i.e*. More than 10 mm long.

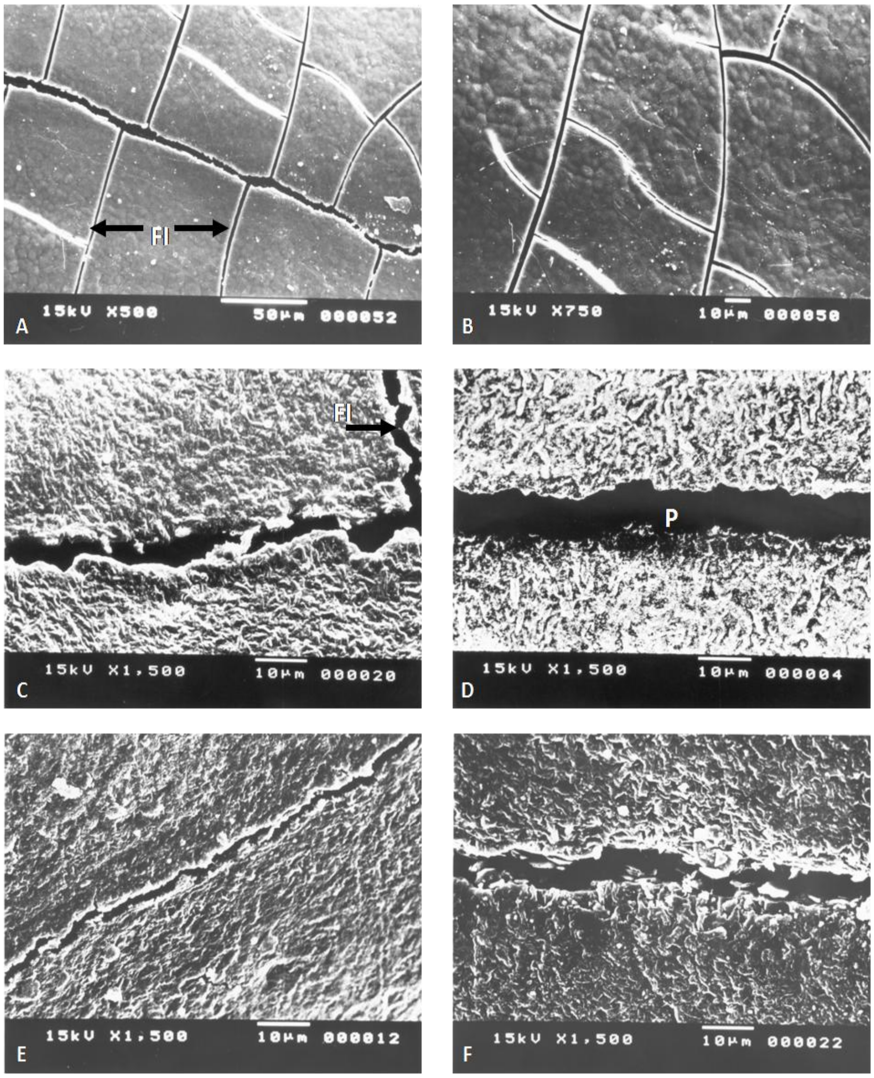

Fig 1 (A-F). SEM-Photomicrographs showing variation in the testa sculpturing patterns. A&B. *Acacia saligna*, x = 500, 750, respectively; C. *Acacia farnesiana,* x = 1500; D. *Acacia nilotica*, x = 1500; E. *Acacia tortilis* subsp. *raddiana*, x = 1500; F. *Acacia tortilis,* x = 1500; Fl = Fracture lines; P = Pleurogram.

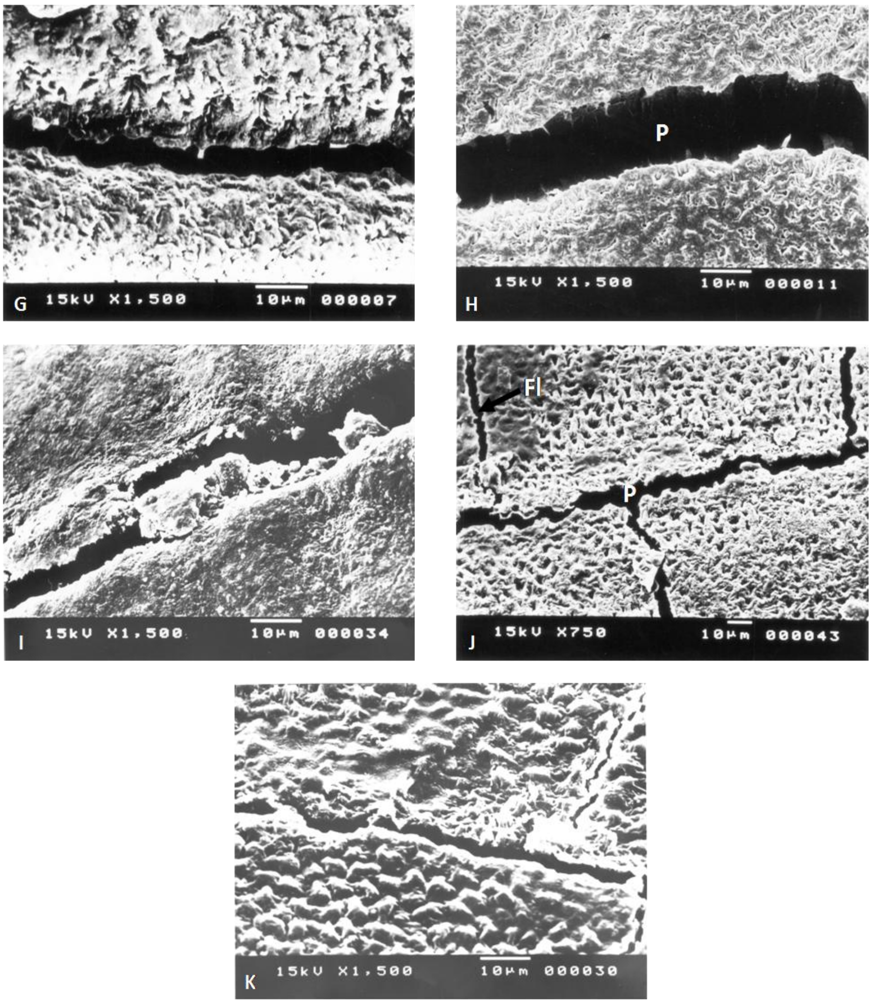

Fig. 1. "continued" (G-K): SEM-Photomicrographs showing variation in the testa sculpturing patterns. G. *Albizia julibrissin*, x = 1500; H. *Albizia*. *lebbeck,* x = 1500; I. *Dichrostachys cinerea,* x = 1500; J. *Enterolobium contortisiliquum*, x = 750; K. *Enterolobium cyclocarpum*, x = 1500; Fl = Fracture lines; P = Pleurogram.

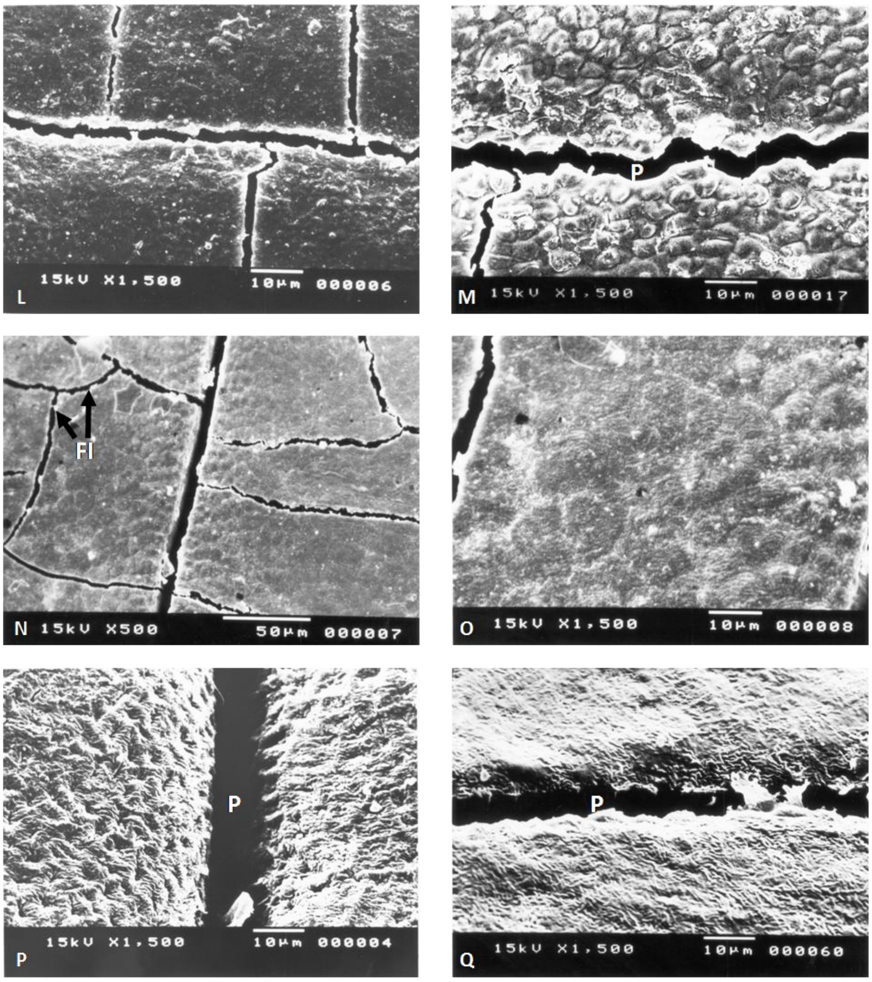

Fig. 1. "continued" (L-Q): SEM-Photomicrographs showing variation in the testa sculpturing patterns. L. *Faidherbia albida*, x = 1500; M. *Pithecellobium dulce*, x = 1500; N&O. *Leucaena leucocephala*, x = 500, 1500, respectively; P. *Prosopis farcta*, x = 1500; Q. *Prosopis juliflora*, x= 1500; Fl = Fracture lines; P

The testa surface, among the taxa studied, exhibited seven basic sculpturing patterns namely: regulate, reticulate-foveolate, foveolate, faint polygonal-discoid plates, tuberculate, papillose and ill-defined coupled with variable pits. Furthermore, intergraded forms within some of the basic patterns were also observed. Manning and Van Staden (1987) reported the common occurrence of cuticular sculpturing in seeds of Mimosoideae which is usually rugose but sometimes it also exhibits modifications. Furthermore, Lersten & Gunn (1982) stated that the papillose pattern of the testa in many members of Leguminosae results from the protrusion of the tips of the epidermal cells.

The variation in the testa sculpturing patterns has been found very useful in the differentiation of the taxa studied The combination of the salient macro-morphological features with the testa surface sculpturing patterns have ascertained the differentiation and segregation of the taxa investigated as illustrated in the following key:

I. Seeds compressed
A. Seeds oval-oblong or oblong
B1. Testa faint irregularly tuberculate…………………………*Acacia saligna*
B2. Testa irregularly foveolate with variable foveolae…......*Albizia julibrissin*
B3. Testa compact coarse rugulate frequently with exaggerated thick rugae coupled with sparsely scattered variable pits………*Albizia lebbeck*
AA. Seeds oval or broad oval
C1. Testa ill-defined coupled with some variable pits; seeds brown
D1. Areole oval…………………………*Acacia tortilis* subsp. *raddiana*
D2. Areole oval-oblong…………………*Acacia tortilis*
C2. Testa compact regulate; seeds brown mottled with yellowish white streaks and spots…………………………*Acacia nilotica*
C3. Testa inconspicuous rugulate to ill-defined coupled with variable pits; seeds glossy brown ………………..*Dichrostachys cinerea*
C4. Testa tuberculate
E1. Testa obsoletely tuberculate; seeds glossy brown ………*Faidherbia albida*
E2.Testa prominent irregularly tuberculate; seeds dark brown-black *Pithecellobium dulce*
C5. Testa with faint polygonal-discoid plates covered with micro-striations *Leucaena leucocephala*
C6. Testa irregularly reticulate-foveolate to ill-defined with ridges of the reticulae thick and micro-striated…………*Prosopis farcta*

II. Seeds not compressed
F1. Seeds oval
G1. Testa irregularly regulate………………………*Acacia farnesiana*
G2. Testa compact fine rugulate coupled with sparsely scattered variable pits ……… *Prosopis juliflora*
F2. Seeds oval-oblong
H1. Testa irregularly reticulate-foveolate with thick anticlinal ridges ………………….*Enterolobium contortisiliquum*
H2. Testa irregularly papillose…………………*Enterolobium cyclocarpum*

B. Seed protein electrophoresis

The banding patterns of the investigated taxa are shown in Fig. 2A. A total of 88 bands were scored in the electrophoretic profiles of seed proteins of these taxa. The similarity matrix among the taxa was given in Table 3. The highest similarity (55.26 %) was recorded between the two *Enterolobium* species namely: *E. contortisiliquum* and *E. cyclocarpum*, followed by (53.49 %)

similarity observed between *Acacia tortilis* and *A. tortilis* subsp. *raddiana*. However, the lowest similarity (7.14 %) was recorded between *Acacia saligna* and *Albizia lebbeck* followed by (8.11 %) similarity recorded between *Acacia tortilis* and *Albizia lebbeck* and also between *Albizia lebbeck* and *Enterolobium cyclocarpum*. The phenogram (Fig. 2B) resulted from the hierarchical cluster analysis of the seed protein profiles of the examined taxa illustrated that these taxa are splitting into six clusters including two groups (Fig. 2 B & C).

Cluster 1, II, and VI representing one species each namely: *Albizia julibrissin*, *Pithecellobium dulce* and *Acacia saligna* respectively. Cluster III comprises *Acacia tortilis*, *A. tortilis* subsp. *raddiana* and *A. nilotica*. Cluster IV includes *Faidherbia albida* (= *Acacia albida*), *Enterolobium contortisiliquum*, and *E. cyclocarpum*. Cluster V involves two groups: group 1, including *Prosopis farcta* and *P. juliflora*, and group 2, including *Albizia lebbeck*, *Leucaena leucocephala*, *Dichrostachys cinerea* and *Acacia farnesiana*.

TABLE 3. Similarity matrix of seed protein profiles among the studied Mimosoideae taxa.

Taxa*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	100														
2	29.27	100													
3	33.33	28.95	100												
4	37.21	23.08	37.50	100											
5	42.86	34.09	51.16	53.49	100										
6	25.49	23.26	20.00	18.00	20.69	100									
7	7.14	9.68	13.89	8.11	8.51	18.42	100								
8	17.07	19.35	15.79	13.16	17.39	20.00	16.00	100							
9	23.08	20.45	30.43	22.92	29.63	30.61	12.50	17.07	100						
10	22.92	29.73	25.00	28.57	27.45	22.92	8.11	16.22	55.26	100					
11	26.00	18.18	28.26	20.83	32.69	26.00	10.00	27.03	36.96	31.82	100				
12	24.53	17.02	26.53	22.00	24.14	22.22	27.03	19.05	24.53	27.08	36.84	100			
13	19.57	25.72	21.43	19.05	24.49	14.58	9.09	30.00	37.50	42.86	28.57	26.67	100		
14	24.49	21.95	29.55	30.23	24.07	27.08	20.00	15.38	22.00	27.27	30.43	36.96	23.81	100	
15	21.28	24.32	35.90	20.93	31.25	16.33	15.15	17.14	14.00	23.81	24.44	25.53	23.08	31.71	100

Taxa* are numbered as in Table (1).

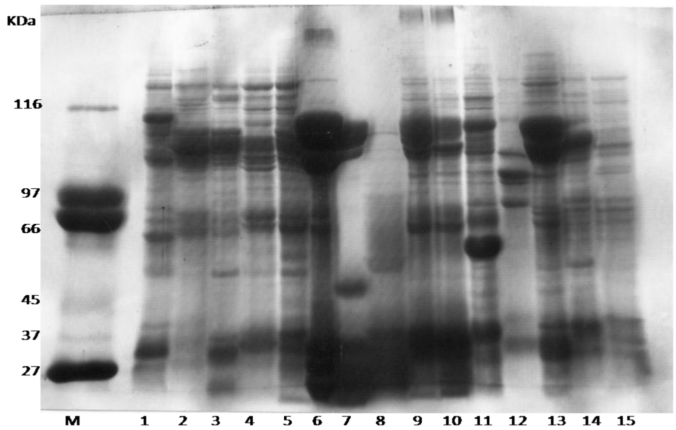

Fig. 2A. Variation in SDS-PAGE profile of seed proteins among the taxa studied. 1. *Acacia saligna*; 2. *A. farnesiana*; 3. *A. nilotica*; 4. *A. tortilis* subsp. *raddiana*; 5. *A. tortilis*; 6. *Albizia julibrissin*; 7. *A. lebbeck*; 8. *Dichrostachys cinerea*; 9. *Enterolobium contortisiliquum*; 10. *E. cyclocarpum*; 11. *Faidherbia albida*; 12. *Pithecellobium dulce*; 13. *Leucaena leucocephala*; 14. *Prosopis farcta*; 15. *P. juliflora*; M = Protein marker.

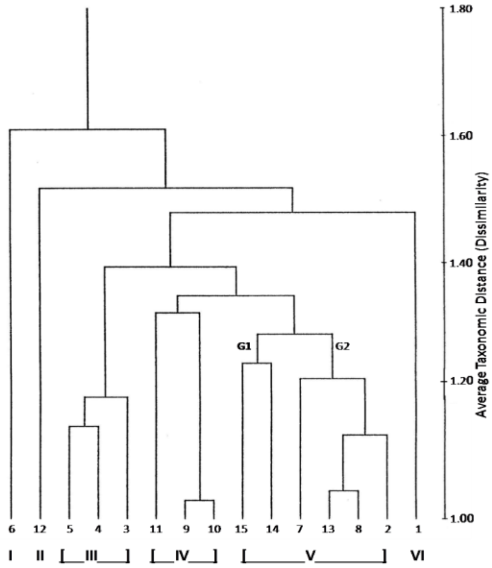

Fig. 2B. Phenogram based on the SDS-PAGE of seed protein characters illustrating average taxonomic distance (Dissimilarity) among the taxa studied. 1. *Acacia saligna*; 2. *A. farnesiana*; 3. *A. nilotica*; 4. *A. tortilis* subsp. *raddiana*; 5. *A. tortilis*; 6. *Albizia julibrissin*; 7. *A. lebbeck*; 8. *Dichrostachys cinerea*; 9. *Enterolobium contortisiliquum*; 10. *E. cyclocarpum*; 11. *Faidherbia albida*; 12. *Pithecellobium dulce*; 13. *Leucaena leucocephala*; 14. *Prosopis farcta*; 15. *P. juliflora*; G1=Group1; G2=Group2.

Albizia julibrissin presented a considerable difference in its testa sculpture from *A. lebbeck*. This difference may support its clustering alone in Cluster I away from *A. lebbeck* based on its seed protein electrophoretic profile. According to Vassal (1972) and Pedley (1978) *Acacia saligna* has been placed in subgenus *Phyllodineae* (Syn. Subgenus *Heterophyllum*) while the other studied species of genus *Acacia* were classified in subgenus *Acacia*. *A. saligna* is actually with leaf-like petioles called phyllodes (Tiedeman and Johnson, 1992) while the other investigated *Acacia* species are with bipinnate leaves (Karakish, 2013). Moreover, Seeds of *Acacia saligna* exhibited a glossy dark brown colour and faint irregularly tuberculate testa which are not observed in any of the studied *Acacia* species. Hence, the separation of *A. saligna* in a separate cluster alone based on its seed protein profile can be justified.

According to Vassal (1972) both of *Acacia tortilis* and *A. nilotica* belong to the subgenus *Acacia*. Thus, the clustering of *A. tortilis* and *A. tortilis* subsp. *raddiana* with *A. nilotica* together, in Cluster III, may conform to this closeness**.** The degree of dissimilarity of *Faidherbia albida* (= *Acacia albida*) from the two studied *Enterolobium* species, Cluster IV, is insufficient for its further splitting but it is delimited as a different identity. Guinet (1969) referred that *Acacia albida* appeared sufficiently distinct in its pollen characters to warrant generic status. Vassal (1981) added that the unusual features of *Acacia albida* warrant the exclusion of the species from genus *Acacia* and its inclusion in the genus *Faidherbia.* Bentham (1875) was the first to restrict the tribe Acacieae to the genus *Acacia* but Vasal (1981) pointed out that it seems more appropriate to put the monotypic genus *Faidherbia* in the tribe Acacieae. However, Elias (1981) mentioned that *Faidherbia albida* (based on *Acacia albida*) is better transferred to tribe Ingeae and it may link the Ingeae with the Acacieae. Thus, the inclusion of *Faidherbia albida* with the two studied species of *Enterolobium* included in tribe Ingeae as listed by Nielsen (1981), in Cluster IV, may support the opinion of Elias (1981). In addition, the clustering of *Enterolobium contortisiliquum* and *E. cyclocarpum* at high degree of similarity may support the reliability of seed protein profiles for delimitation at the generic level. Similar observations were also recorded in members of Leguminosae by Hussein and George (2002) on some species representing genera of tribe Vicieae.

In Cluster V the three genera: *Prosopis*, *Leucaena* and *Dichrostachys* are included in the tribe Mimoseae (Lewis and Elias, 1981); but *Acacia* belongs to the tribe *Acacieae* (Vassal, 1981) and *Albizia* involved in tribe Ingeae (Nielsen, 1981). The inclusion of *Albizia lebbeck* with *Leucanea leucocephala*, *Dichrostachys cinerea* and *Acacia farnesiana* in Cluster V; group 2 may refer to the phyletic position of tribe Acacieae which is always considered a link between Mimoseae and Ingeae (Karakish *et al*., 2013).

Conclusion

In this study, the variation in some macro-morphological seed features viz. seed shape, areole shape and colour of seed as well as peculiarities of the testa sculpturing patterns can be useful in delimitation and identification of the taxa studied. In addition, the phenogram produced from the numerical analysis of the obtained characters from SDS-PAGE profiles of seed protein supported some of the taxonomic considerations of some members from the Mimosoideae-Leguminosae.

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المدلولات التصنيفية لمورفولوجية البذرة والتفريد الكهربى لبروتينات البذرة فى بعض الوحدات التصنيفية المصرية من تحت الفصيلة الطلحية ـ الفصيلة القرنية.

نيللى ميشيل جورج ـ حسين عبدالباسط حسين ـ أحمد غريب ـ مروة محسن الدمرداش
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يتناول البحث دراسة بذور أربعة عشرة نوعا ووحدة تصنيفية واحدة من تحت النوع من نباتات تحت الفصيلة الطلحية التابعة للفصيلة القرنية- والتى جمعت من مصر- باستخدام كلا من المجهر الإلكترونى الماسح، وكذلك التفريد الكهربى لبروتينات البذرة بُغّية إبراز الأهمية التصنيفية لصفاتها المورفولوجية وخصائص طرز البروتين بها.

وقد خلصت الدراسة إلى بناء مفتاح تصنيفى اصطناعى يميز بين الوحدات التصنيفية قيد الدراسة اعتمادا على الصفات المورفولوجية لبذورها، وكذلك أنماط زركشة سطح القصرة فى تلك البذور، كما أظهرت نتائج التحليل العددى لأنماط وخصائص بروتينات البذور للوحدات التصنيفية أهميتها كمعايير ودلائل تصنيفية أمكنت من مناقشة بعض الآراء التصنيفية التى تخص الحالة التصنيفية للوحدات محل الدراسة.