

Supplementary Materials

S1 – Pollen morphology of plants of the Dhofari coast.

S2 – Statistical-comparative analysis of the Amaranthaceae pollen grains.

S3 – Relevés from the estuaries.

S1 – Pollen morphology of plants of the Dhofari coast

Pollen morphology is a taxonomic character of high relevance. In pollen analysis, its knowledge represents the necessary information for the attribution of the grains to the plants, the first step in pollen analysis. Here we present a brief description of the pollen morphology of the main species growing in the estuarine habitats of Dhofar. The pollen morphology of other common plants in Dhofar is available in Mariotti Lippi et al. [11].

ACANTHACEAE

Avicennia marina (Forssk.) Vierh. (Figure S1a-f)

Pollen shape: prolate-spheroidal P/E ratio 1.06

Outline in polar view: trilobate

Outline in equatorial view: circular/elliptic

Pollen size (μm):

	Mean value	Min	Max	Mode
P	30	25	37.5	30
E	28.5	22.5	36.3	25

Pollen class: tricolporate or syncolporate.

Apertures: colpi, about 22 μm long, with a granular membrane tapering at the ends or, less frequently, anastomosed at the poles; ora circular, frequently elongate with main axis about 4 μm

Exine: tectate perforate to reticulate with small irregularly shaped lumina, larger at the poles and smaller at the equator; about 3 μm in thickness

AIZOACEAE

Aizoon canariense L. (Figure S1g-i)

Pollen shape: prolate-spheroidal P/E ratio about 1.09

Outline in polar view: circular

Outline in equatorial view: circular to slightly elliptic

Pollen size (μm):

	Mean value	Min	Max	Mode
P	27.5	22.5	29	27
E	25.5	20	27	24.5

Pollen class: tricolporate

Apertures: colpori, about 22.5 μm long; membrane covered by spinulae; ora minute

Exine: tectate perforate bearing sparse, minute spinulae irregularly scattered; about 2 μm in thickness

AMARANTHACEAE

Aerva javanica (Burm. f.) Juss. ex Schult. (Figure S1 j-l)

Pollen shape: spheroidal to slightly polyhedral with obtuse angles

Pollen size (μm):

	Mean value	Min	Max	Mode
D	17.5	14	20	17

Pollen class: pantoporate

Apertures: pores quite circular, about 1.5 μm in diameter; mean distance from the center of adjacent pores 4.5 μm

Exine: tectate perforate microechinate; exine thickness about 1.5 µm. Pore membranes covered by dense spinules

Amaranthus viridis L. (Figure S1m-o)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	23.5	18.5	26.5	23.5

Pollen class: pantoporate

Apertures: pores circular less than 2 µm in diameter; distance from the center of adjacent pores about 3.5 µm

Exine: tectate perforate microechinate for the presence of sparse short spinules; exine thickness about 1.5 µm. Pore membranes covered by spinules larger than those of the exine

Arthrocnemum macrostachyum (Moric.) Piirainen & G. Kadereit (Figure S1p-r)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	22.5	17.5	25	23

Pollen class: pantoporate

Apertures: pores circular about 2.5 µm in diameter; distance from the center of adjacent pores about 5 µm

Exine: tectate perforate microechinate for the presence of sparse short spinules; exine thickness about 1.5 µm. Pore membranes covered by dense spinules

Sevada schimperi Moq. (Figure S1s-t)

Pollen shape: spheroidal to slightly polyhedral with obtuse angles

Pollen size (µm):

	Mean value	Min	Max	Mode
D	16	13	20	16

Pollen class: pantoporate

Apertures: pores circular 2-2.5 µm in diameter; distance from the center of adjacent pores about 3 µm

Exine: tectate perforate microechinate for the presence of sparse short spinules; exine thickness about 1.5 µm. Pore membranes covered by dense spinules

Suaeda aegyptiaca (Hasselq.) Zohary (Figure S1u-x)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	25.5	22	28	25

Pollen class: pantoporate

Apertures: pores circular about 1.5 µm in diameter; distance from the center of adjacent pores about 3 µm

Exine: tectate perforate microechinate for the presence of sparse short spinules; exine thickness about 1.5 µm. Pore membranes covered by spinules larger than those of the exine and inclined towards the edge of the pore

Suaeda vermiculata Forssk. ex J.F. Gmel (Figure S1w-z)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	24	20	28	25

Pollen class: pantoporate

Apertures: pores circular about 1.5 µm in diameter; distance from the center of adjacent pores about 3 µm

Exine: tectate perforate microechinate for the presence of sparse short spinules; exine thickness about 1.5 µm. Pore membranes covered by spinules larger than those of the exine and inclined towards the edge of the pore

Wadithamnus artemisioides subsp. *batharitica* (A.G. Mill. & J.A. Nyberg) T. Hammer & R.W. Davis (≡ *Aerva artemisioides* subsp. *batharitica* A.G. Mill. & J.A. Nyberg) (Figure S2 a-b)

Pollen shape: spheroidal to slightly polyhedral with obtuse angles

Pollen size (µm):

	Mean value	Min	Max	Mode
D	15	14.5	16	16

Pollen class: pantoporate

Apertures: pores circular to elliptic, about 1.5 µm in diameter/2 µm main axis; distance from the center of adjacent pores about 4 µm

Exine: tectate perforate microechinate for the presence of sparse spinules; exine thickness about 1.5 µm. Pore membranes covered by dense spinules

ASTERACEAE

Pluchea arabica (Boiss.) Qaiser & Lack (Figure S2 c-e)

Pollen shape: spheroidal

Outline in polar view: circular to slightly trilobate

Outline in equatorial view: circular

Pollen size including spines (µm):

	Mean value	Min	Max	Mode
D	16	14.5	17.5	16

Pollen class: tricolporate

Apertures: colpori about 11 µm long, tapering at the ends; colpus membrane granulate; ora slightly lalongate

Exine: tectate perforate echinate, about 1.6 µm in thickness; spinae about 4 µm long gradually tapering towards the apices, broad and perforate at the basis

Pulicaria glutinosa (Boiss.) Jaub. & Spach (Figure S2 f-h)

Pollen shape: prolate-spheroidal P/E ratio about 1.1

Outline in polar view: circular

Outline in equatorial view: circular to elliptic

Pollen size including spines (µm):

	Mean value	Min	Max	Mode
P	24	21	29	25.5
E	22.5	17.5	29	22.5

Pollen class: tricolporate.

Apertures: colpori about 10 µm long, tapering at the ends; colpus membrane granulate; ora slightly lalongate

Exine: tectate perforate echinate, about 3 µm in thickness; spinae about 5 µm long with triangular profile, with broad perforations and a pointed smooth tip

BORAGINACEAE

Heliotropium bacciferum Forssk. (Figure S2 i-l)

Pollen shape: prolate P/E ratio 1.48

Outline in polar view: esalobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	26	24.5	27	24.5
E	17.5	15.5	20	18

Pollen class: heterocolpate with alternance of colpi and colpori (3+3)

Apertures: colpi, about 23.5 µm long, and colpori with similar lenght and circular ora about 2.5 µm in diameter. Sexine margins often protruding over ora

Exine: tectate perforate, uneven with irregularly spaced perforations, about 1 µm in thickness

***Nogalia drepanophylla* (Baker) Verdc.** (Figure S2 m-p)

Pollen shape: prolate-spheroidal P/E ratio about 1.05

Outline in polar view: circular

Outline in equatorial view: circular to slightly elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	23.5	20	29.5	23.5
E	22.5	18.5	26.5	23.5

Pollen class: heterocolpate with alternance of colpi and colpori (3+3)

Apertures: colpi, about 16 µm long, and colpori with similar lenght and circular ora about 2 µm in diameter

Exine: tectate perforate, about 1.5 µm in thickness

CAPPARACEAE

***Cleome droserifolia* (Forssk.) Delile** (Figure S2 q-v)

Pollen shape: subprolate. P/E ratio about 1.2

Outline in polar view: slightly trilobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	31	26	37	29
E	25	22	29	26

Pollen class: tricolporate

Apertures: colpori about 23 µm long, tapering at the ends; colpus membrane granulate in the middle part; ora slightly lolongate

Exine: tectate perforate suprareticulate, about 3 µm in thickness. Reticulum with lumina generally elongate, up to 2 µm long, with 1, rarely 2 perforations. Longitudinal muri slightly more pronounced than the transversal ones

CARYOPHYLLACEAE

***Petroana montana* (Balf. f.) Madhani & Zarre** (\equiv *Gypsophila montana* Balf. f.) (Figure S2 x-y)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	24	21	27	24

Pollen class: pantoporate

Apertures: pores circular, operculate, about 1.5 µm in diameter; distance from the center of adjacent pores about 9.5 µm.

Exine: tectate perforate, microechinate for the presence of few sparse spinules; exine thickness about 3 µm.

Opercula with dense spinules up to 2 µm long, larger than those of the exine surface

***Polycarpaea spicata* Wight ex Arn.** (Figure S3 a-d)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	17.5	15.5	20	18

Pollen class: tricolpate

Apertures: colpi, about 13 µm long; colpus membrane granulate

Exine: tectate perforate, microechinate for the presence of sparse spinules; exine thickness about 2 µm

CONVOLVULACEAE

Cressa cretica L. (Figure S3 e-g)

Pollen shape: subprolate. P/E ratio 1.27

Outline in polar view: trilobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	32.5	27	36	33.5
E	26	20	31.5	27

Pollen class: tricolporate

Apertures: colpi about 24.5 µm long; colpus membrane granulate

Exine: tectate perforate microechinate for the presence of sparse minute spinules; exine thickness about 2 µm

CYPERACEAE

Cyperus conglomeratus Rottb. (Figure S3 h)

Pollen shape: truncated conical P (main axis)/D (shorter axis) ratio 1.48

Outline in polar view: circular

Outline in lateral view: trapezoidal

Pollen size (µm):

	Mean value	Min	Max	Mode
P	32	27	36	31.5
D	21.5	18	24.5	20

Apertures: 4-5 poroid: a circular poroid measuring about 7,5 µm at the distal pole; 3-4 elliptic lateral poroids about 13.5 µm long and 4 µm wide. Poroid areas with exine elements bearing granulate and punctate ornamentations.

Exine: tectate perforate scabrate for the presence of minute granules; exine thickness <1 µm.

Cyperus laevigatus L. (Figure S3 i-j)

Pollen shape: conical P/D ratio 1.25

Outline in polar view: circular

Outline in lateral view: roughly triangular

Pollen size (µm):

	Mean value	Min	Max	Mode
P	38	36	40.5	36
D	30.5	27	36	29

Apertures: 5 poroid: a circular poroid measuring about 8,5 µm at the distal pole; 3-4 elliptic lateral poroids about 13 µm long and 4 µm wide. Poroid areas with exine elements bearing granulate ornamentations

Exine: tectate perforate scabrate for the presence of minute granules; exine thickness <1 µm

Eleocharis geniculata (L.) Roem. & Schult. (Figure S3 k-l)

Pollen shape: quite spheroidal to slightly conical, mean P/D ratio 1,02

Outline in polar view: circular (often irregular for the presence of foldings)

Outline in lateral view: circular to roughly triangular (often irregular)

Pollen size (µm):

	Mean value	Min	Max	Mode
P	27	21	32	28.5
D	27	19.5	31	24

Apertures: (4)-5 poroid, circular to elliptic. Poroid areas with sexine elements bearing granulate ornamentations, which are distinctly separated from each other

Exine: tectate perforate scabrate with minute granules; exine thickness about 1 µm

Schoenoplectus subulatus (Vahl) Lye (= *Schoenoplectus litoralis* (Schrad.) Palla) (Figure S3 m)

Pollen shape: conical P/D ratio 1.67

Outline in polar view: circular

Outline in lateral view: roughly triangular

Pollen size (µm):

	Mean value	Min	Max	Mode
P	42	36	49.5	40.5
D	25.5	22.5	29	24.5

Apertures: 5 poroid: a circular poroid measuring about 8 µm in diameter at the distal pole; 3-4 elliptic lateral poroids about 16.5 µm long and 5 µm wide. Poroid areas with exine elements bearing granulate ornamentations

Exine: tectate perforate scabrate with minute granules; exine thickness <1 µm

FABACEAE

Indigofera obongifolia Forssk. (Figure S3 n-p)

Pollen shape: prolate-spheroidal P/E ratio 1.1

Outline in polar view: trilobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	27.5	24	30.5	29
E	25	21	27	25.5

Pollen class tricolporate.

Apertures: colpi, about 19 µm long; ora minute, sometime hardly visible

Exine: tectate perforate, about 1,5 µm in thickness

Indigofera volkensii Taub. (Figure S3 q-s)

Pollen shape: prolate-spheroidal P/E ratio 1.2

Outline in polar view: trilobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	19.5	17	23.5	18.5
E	16	14	20.5	15.5

Pollen class tricolporate.

Apertures: colpi, about 13 µm long; ora circular to lalongate

Exine: tectate perforate, about 1,5 µm in thickness

Prosopis juliflora (Sw.) DC. (Figure S3 t-w)

Pollen shape: subprolate P/E ratio 1.23

Outline in polar view: trilobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	32.5	25	37.5	31
E	26.5	22	31	25

Pollen class tricolporate.

Apertures: colpi, about 27 µm long; ora about 1.5 µm in diameter

Exine: tectate scabrate about 1,6 µm in thickness

Tephrosia purpurea subsp. *apollinea* (Delile) Hosni & El Karemy (Figure S3 y-ac)

Pollen shape: prolate-spheroidal P/E ratio 1,16

Outline in polar view: slightly trilobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	27	24	29.5	27
E	23	21	26	22.5

Pollen class tricolporate.

Apertures: colpi, about 20 µm long; ora circular to lalongate

Exine: tectate perforate, smooth at the colpore margin and protruding over the ora, about 1,5 µm in thickness

NYCTAGINACEAE

Boerhavia diffusa L. (Figure S4 a-b)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	71	62.5	78	73.5

Pollen class: pantoporate

Apertures: pores circular, about 5 µm in diameter

Exine: tectate echinate, with spinules 1.5 µm long; exine thickness about 2 µm

Commicarpus helenae (Schult.) Meikle (Figure S4 c-e)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	72	62.5	90.5	70

Pollen class: pantoporate

Apertures: pores circular, about 4.5 µm in diameter

Exine: tectate echinate, with spinules 1.5-3 µm long; exine thickness about 3.6 µm

PLANTAGINACEAE

Bacopa monnieri (L.) Pennell (Figure S4 f-h)

Pollen shape: prolate-spheroidal P/E ratio 1.1

Outline in polar view: trilobate

Outline in equatorial view: circular/elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	26.5	22.5	32	25,5
E	25	18	32	26

Pollen class tricolporate.

Apertures: colpori, about 21 µm long, tapering at the ends, with smooth membrane; ora circular, about 5 µm in diameter

Exine: tectate reticulate with irregular lumina decreasing in size from the middle of the mesocolpium towards the margins; exine about 2 µm in thickness

POACEAE

Aeluropus lagopoides (L.) Trin. ex Thwaites (Figure S4 i-k)

Pollen shape: spheroidal

Outline in polar view: circular

Outline in equatorial view: circular

Pollen size (µm):

	Mean value	Min	Max	Mode
D	30.5	27	36	30.5

Pollen class: monoporate

Apertures: pore circular about 3.7 µm in diameter with annulus and a small operculum; annulus diameter about 7.6 µm

Exine: tectate areolate-scabrate, about 1.5 µm in thickness

***Cenchrus pennisetiformis* Steud.** (Figure S4 l-m)

Pollen shape: spheroidal

Outline in polar view: circular

Outline in equatorial view: circular

Pollen size (µm):

	Mean value	Min	Max	Mode
D	35	27.5	42.5	35

Pollen class: monoporate

Apertures: pore circular about 2.5 µm in diameter with annulus and operculum; annulus diameter about 7.5 µm

Exine: tectate scabrate, about 2 µm in thickness

***Paspalum vaginatum* Sw.** (Figure S4 n-p)

Pollen shape: spheroidal

Outline in polar view: quite circular

Outline in equatorial view: quite circular

Pollen size (µm):

	Mean value	Min	Max	Mode
D	29.5	22.5	35	32.5

Pollen class: monoporate

Apertures: pore circular about 2 µm in diameter with annulus strongly protruding and operculum; annulus diameter about 6.5 µm

Exine: tectate areolate-scabrate, 1-1.5 µm in thickness

***Sporobolus ioclados* (Nees ex Trin.) Nees** (Figure S4 q-s)

Pollen shape: spheroidal

Outline in polar view: quite circular

Outline in equatorial view: quite circular

Pollen size (µm):

	Mean value	Min	Max	Mode
D	26.5	22.5	31.5	27

Pollen class: monoporate

Apertures: pore circular about 2.5 µm in diameter with annulus and a small operculum; annulus diameter about 6.5 µm

Exine: tectate areolate-scabrate, about 1.5 µm in thickness

***Sporobolus spicatus* (Vahl) Kunth** (Figure S4 t-v)

Pollen shape: prolate-spheroidal P/E ratio 1.07

Outline in polar view: circular

Outline in equatorial view: circular to elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode

P	24.5	22.5	29	24.5
E	23	20	27	22.5

Pollen class: monoporate

Apertures: pore circular about 2 µm in diameter with annulus and a small operculum; annulus diameter about 6.5 µm

Exine: tectate areolate-scabrate, about 1.5 µm in thickness

Sporobolus virginicus (L.) Kunth (Figure S4 x-w)

Pollen shape: spheroidal

Outline in polar view: circular

Outline in equatorial view: circular

Pollen size (µm):

	Mean value	Min	Max	Mode
D	23.5	20	27	22.5

Pollen class: monoporate

Apertures: pore circular about 2 µm in diameter with a very thin annulus and a small operculum; annulus diameter about 3.5 µm

Exine: tectate areolate-scabrate, about 1.5 µm in thickness

Urochondra setulosa (Trin.) C.E.Hubb. (Figure S5 a-c)

Pollen shape: spheroidal

Outline in polar view: circular

Outline in equatorial view: circular

Pollen size (µm):

	Mean value	Min	Max	Mode
D	24	20	29	24.5

Pollen class: monoporate

Apertures: pore circular about 2 µm in diameter with annulus and operculum; annulus diameter about 6 µm

Exine: tectate scabrate

POLYGALACEAE

Polygala mascatensis Boiss. (Figure S5 d-e)

Pollen shape: sub-prolate P/E ratio 1.1

Outline in polar view: circular

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	28.5	25.5	32	29
E	27	24	30.5	27

Pollen class: stephanocolporate

Apertures: 16-17 colpi about 23 µm long; ora lalongate

Exine: tectate psilate, about 1.6 µm in thickness

PORFULACEAE

Portulaca dhofarica M.G. Gilbert (Figure S5 f-g)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	64.5	36.5	78	65.5

Pollen class: pantocolpate

Apertures: colpi about 16.5 µm long

Exine: tectate with distinct perforations and short supratectal spinulae; exine thickness about 2 µm

TAMARICACEAE

Tamarix mascatensis Bunge (Figure S5 h-k)

Pollen shape: prolate spheroidal to oblate spheroidal P/E ratio 0.97

Outline in polar view: trilobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	25	22.5	30	25
E	26	22.5	27.5	25

Pollen class: tricolporate

Apertures: colpi, about 17 µm long

Exine: reticulate, reticulum homobrochate, about 2.5 µm in thickness

TYPHACEAE

Typha domingensis Pers. (Figure S5 l-n)

Pollen shape: oblate-spheroidal P/E ratio 0.9

Outline in polar view: circular

Outline in equatorial view: circular to slightly elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	23	21	27	22.5
E	27.5	24	32	29

Pollen class: porate

Apertures: pore circular operculate, about 3 µm in diameter

Exine: reticulate, about 2.5 µm in thickness

VERBENACEAE

Phyla nodiflora (L.) Greene (Figure S5 o-r)

Pollen shape: prolate-spheroidal P/E ratio 1.08

Outline in polar view: roughly triangular

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	28	25	31	26.5
E	26	20.5	28	25

Pollen class: tricolpororate

Apertures: colpi about 15 µm long, with a granular membrane; ora lalongate, forming long equatorial slits

Exine: tectate perforate, sometimes the perforations situated in slit-like depressions; about 1.5 µm in thickness

ZYGOPHYLLACEAE

Tetraena simplex (L.) Beier & Thulin (Figure S5 s-v)

Pollen shape: sub-prolate P/E ratio 1.31

Outline in polar view: trilobate

Outline in equatorial view: elliptic

Pollen size (µm):

	Mean value	Min	Max	Mode
P	11	9	13.5	11
E	8.5	6.5	9	9

Pollen class: tricolporate

Apertures: colpi about 9 µm long; ora covered by genicula.

Exine: tectate perforate microreticulate, about 1 µm in thickness

Tribulus terrestris L. (Figure S5 x-z)

Pollen shape: spheroidal

Pollen size (µm):

	Mean value	Min	Max	Mode
D	40.5	34	45	40.5

Pollen class: pantoporate

Apertures: pores circular, about 2-2.5 µm in diameter, at the center of the lumina

Exine: reticulate simplibaculate with mostly exagonal brochi; exine thickness about 6 µm

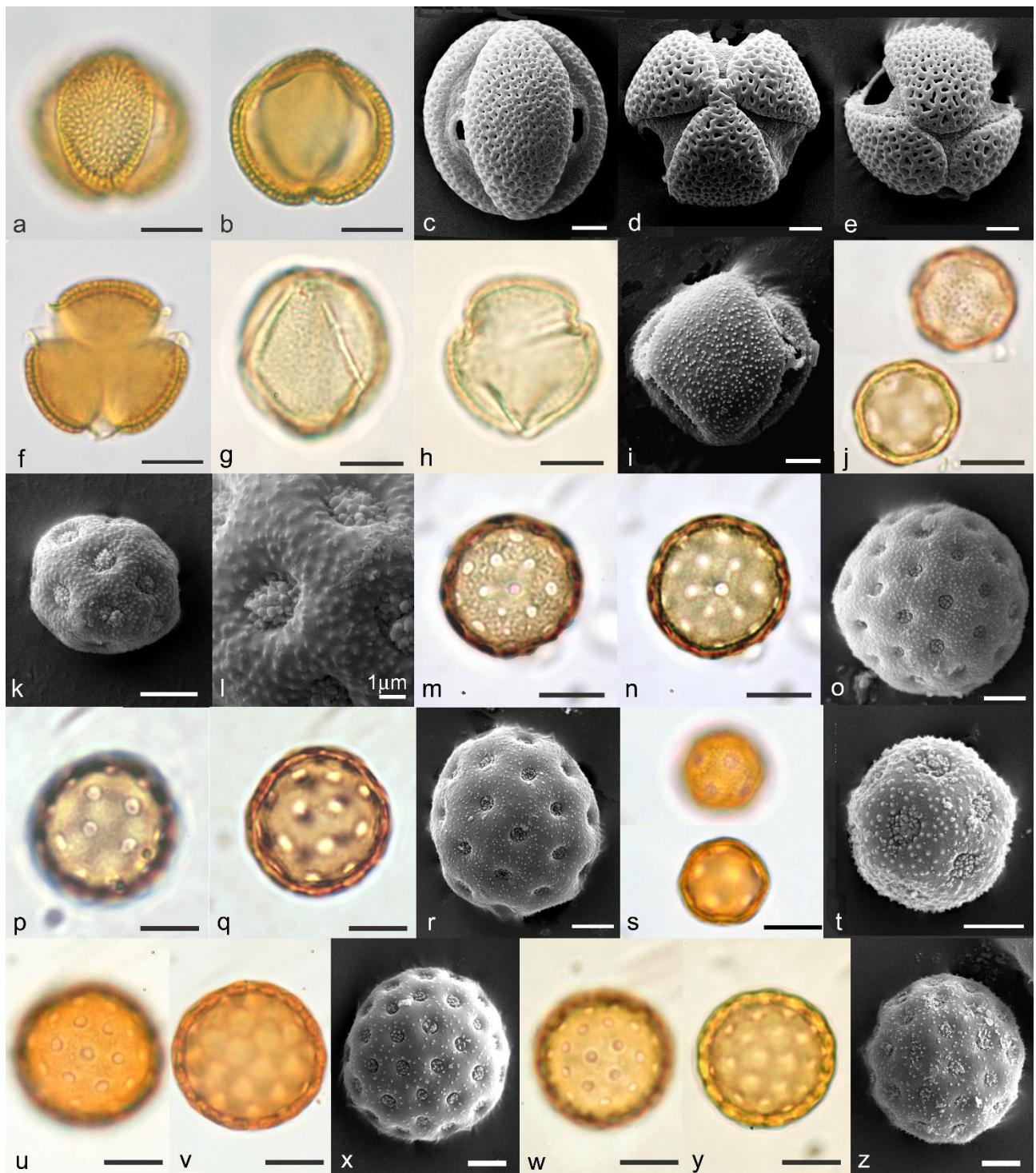


Figure S1 - a-f) *Avicennia marina*: a-b LM equatorial view; c SEM equatorial view; d-e SEM polar view; f LM polar view. g-i) *Aizoon canariense*: g LM equatorial view; h LM polar view; i SEM equatorial view. j-l) *Aerva javanica*: j LM high focus and optical cross-section; k SEM; l SEM detail of the exine. m-o) *Amaranthus viridis*: m LM high focus; n LM optical cross-section; o SEM. p-r) *Arthrocnemum macrostachyum*: p LM high focus; q LM optical cross-section; r SEM. s-t) *Sevada schimperi*: s LM high focus and optical cross-section; t SEM. u-x) *Suaeda aegyptiaca*: u LM high focus; v LM optical cross-section; x SEM. w-z) *Suaeda vermiculata*: w LM high focus; y LM optical cross-section; z SEM. LM bar = 10 μm; SEM bar = 5 μm.

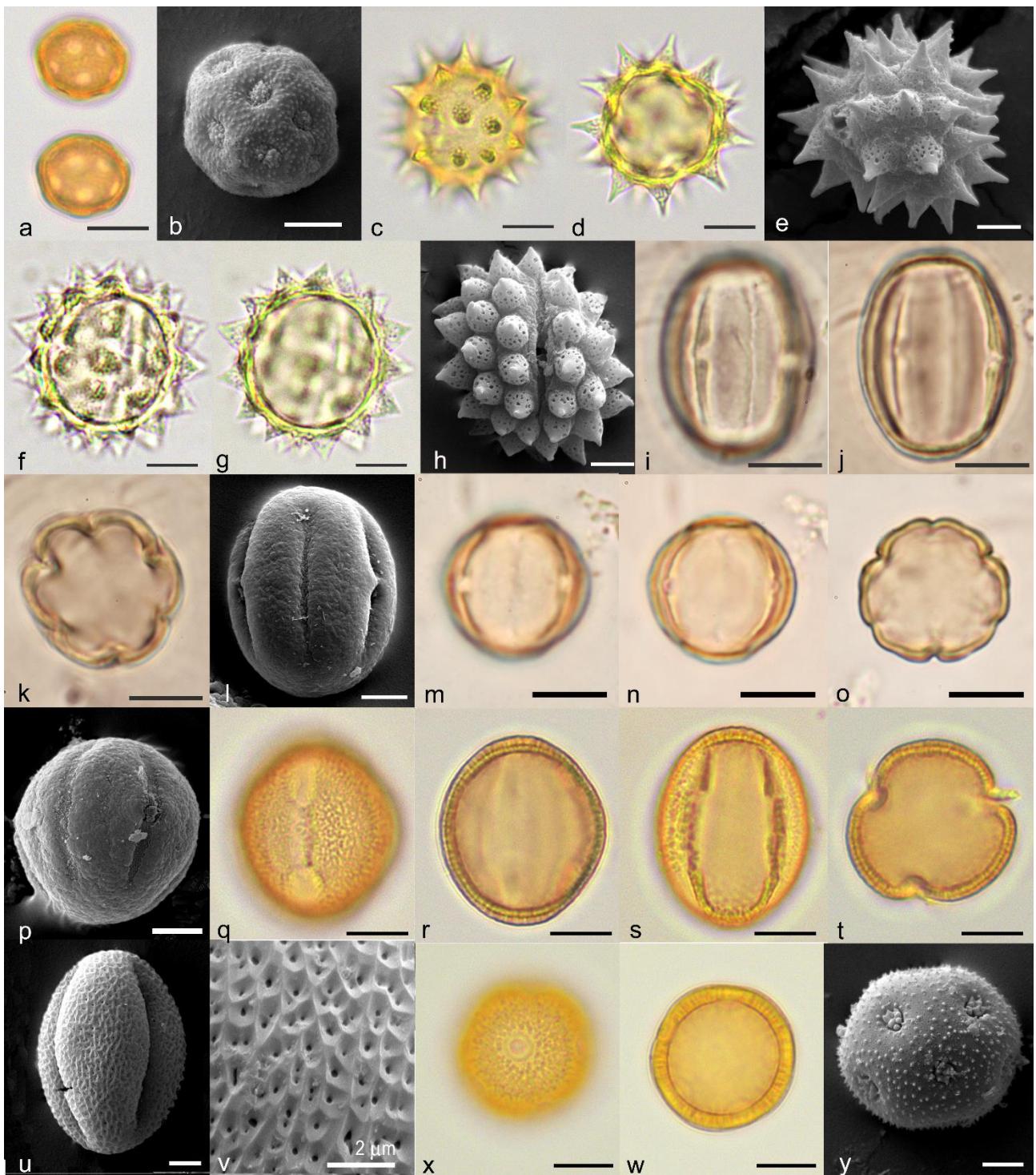


Figure S2 - a-b) *Wadithamnus artemisioides* subsp. *batharitica*: a LM high focus and optical cross-section; b SEM. c-e) *Pluchea arabica*: c LM high focus; d LM optical cross-section; e SEM. f-h) *Pulicaria glutinosa*: f LM high focus; g LM optical cross-section; h SEM. i-l) *Heliotropium bacciferum*: i-j LM equatorial view; k LM polar view; l SEM. m-p) *Nogalia drepanophylla*: m-n LM equatorial view; o LM polar view; p SEM. q-v) *Cleome droserifolia*: q-s LM equatorial view; t LM polar view; u SEM; v SEM detail of the exine. x-y) *Petroana montana*: x LM high focus; w LM optical cross-section; y SEM. LM bar = 10 μm; SEM bar = 5 μm.

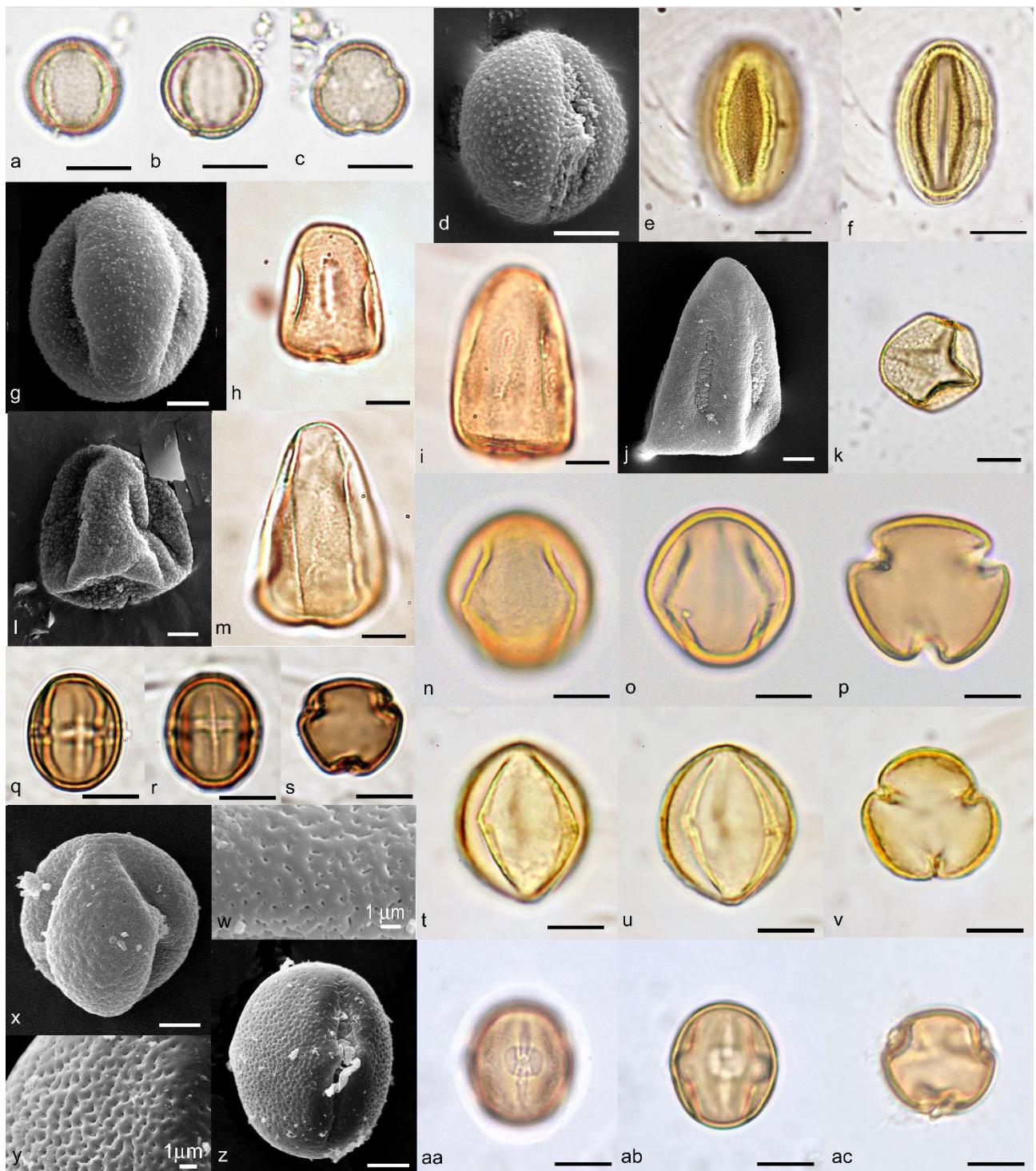


Figure S3 - a-d) *Polycarpea spicata*: a-b LM equatorial view; c LM polar view; d SEM. e-g) *Cressa cretica*: e-f LM equatorial view; g SEM. h) *Cyperus conglomeratus* at LM. i-j) *Cyperus laevigatus*: i LM; j SEM. k-l) *Eleocharis geniculata*: k LM; l SEM. m) *Schoenoplectus subulatus* at LM. n-p) *Indigofera obongifolia*: n-o LM equatorial view; p LM polar view. q-s) *Indigofera volkensii*: q-r LM equatorial view; s LM polar view. t-w) t-u LM equatorial view; v LM polar view; x SEM; w SEM detail of the exine. y-ac) *Tephrosia purpurea* subsp. *apollinea*: y- SEM detail of the exine; z SEM; aa-ab LM equatorial view; ac LM polar view. LM bar = 10 μm; SEM bar = 5 μm.

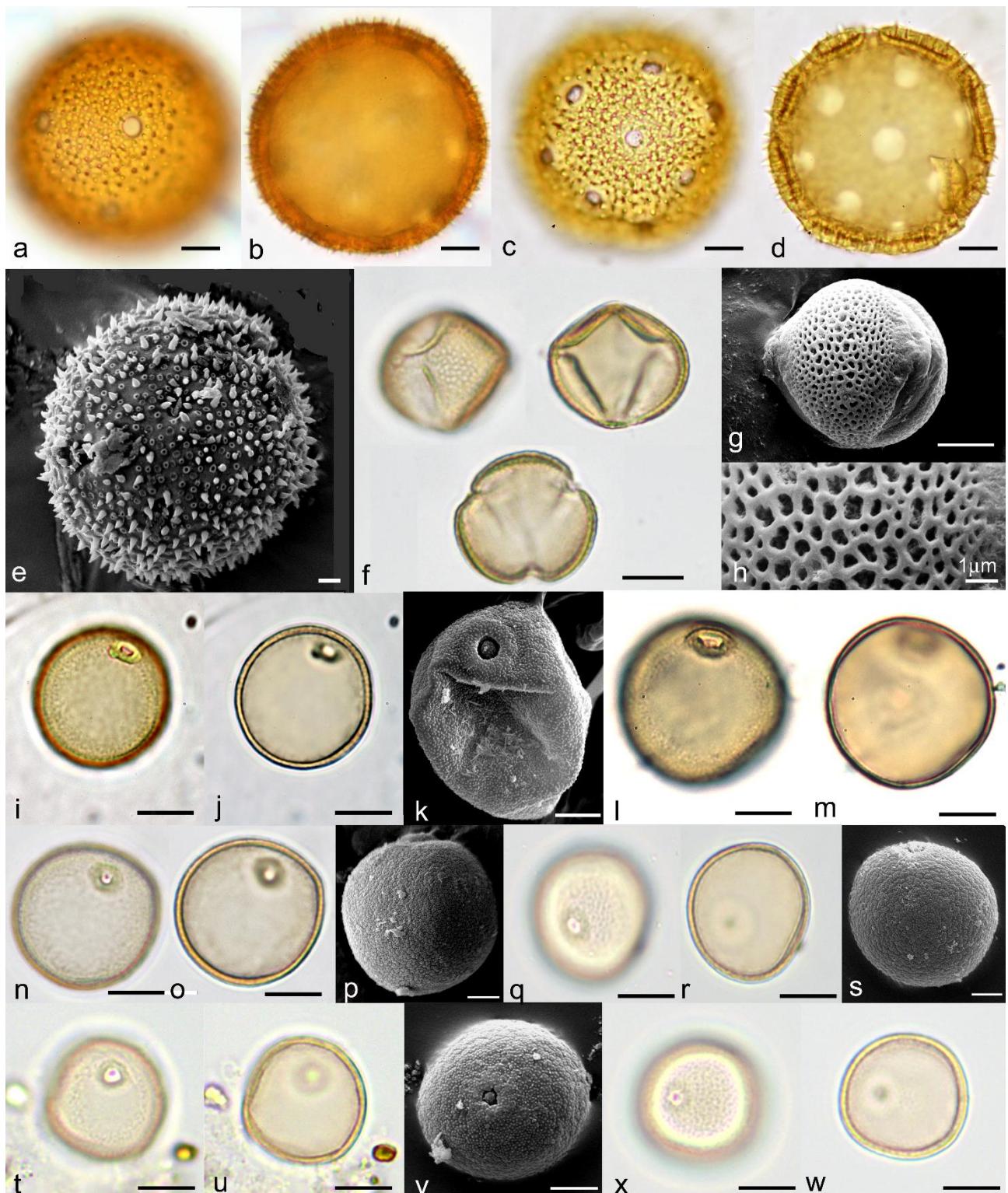


Figure S4 - a-b) *Boerhavia diffusa*: a LM high focus; c-e) *Commicarpus helenae*: b LM optical cross-section. c LM high focus; d LM optical cross-section; e SEM. f-h) *Bacopa monnieri*: f LM equatorial view above and polar view below; g SEM; h SEM detail of the exine. i-k) *Aeluropus lagopoides*: i LM high focus; j LM optical cross-section; k SEM. l-m) *Cenchrus pennisetiformis*: l LM high focus; m LM optical cross-section. n-p) *Paspalum vaginatum*: n LM high focus; o LM optical cross-section; p SEM. q-s) *Sporobolus ioclados*: q LM high focus; r LM optical cross-section; s SEM. t-v) *Sporobolus spicatus*: t LM high focus; u LM optical cross-section; v SEM. x-w) *Sporobolus virginicus*: x LM high focus; w LM optical cross-section.

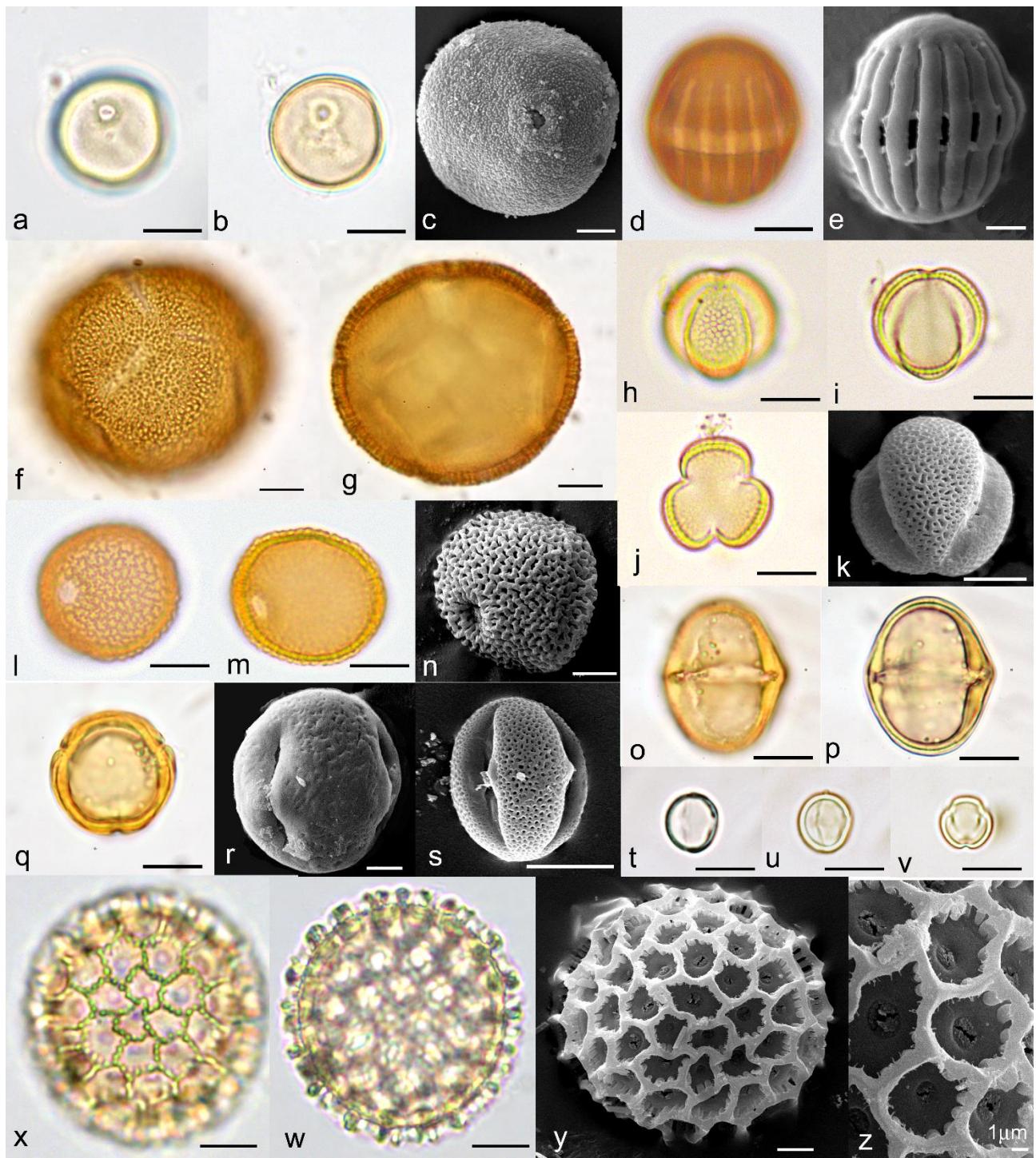


Figure S5 - a-c) *Urochondra setulosa*: a LM high focus; b LM optical cross-section; c SEM. d-e) *Polygala mascatensis*: d LM; e SEM. f-g) *Portulaca dhofarica*: f LM high focus; g LM optical cross-section. h-k) *Tamarix mascatensis*: h-i LM equatorial view; j LM polar view; k SEM. l-n) *Typha domingensis*: l LM high focus; m LM optical cross-section; n SEM. o-r) *Phyla nodiflora*: o-p LM equatorial view; q LM polar view; r SEM. s-v) *Tetraena simplex*: s SEM; t-u LM equatorial view; v LM polar view. x-z) *Tribulus terrestris*: x LM equatorial view; w LM polar view; y SEM; z SEM detail of the exine.

S2 – Statistical-comparative analysis of the Amaranthaceae pollen grains

The majority of the Amaranthaceae pollen grains found in the samples belong to seven species: *Aerva artemisioides* subsp. *batharitica* A.G. Mill. & J.A. Nyberg, *Aerva javanica* (Burm. f.) Juss. ex Schult, *Amaranthus viridis* L., *Arthroc nemum macrostachyum* (Moris) K. Koch, *Sevada schimperi* Moq., *Suaeda aegyptiaca* (Hasselq.) Zoh. and *Suaeda vermiculata* Forssk. ex J.F. Gmel.

The pollen grains showed a diameter ranging between a minimum of 15 μm (*A. artemisioides*) and a maximum of 26 μm (*S. aegyptiaca*). Regarding the thickness of the exine and the pores' diameter, all the families displayed approximately the same length (ca. 2 μm), with the exception of *A. macrostachyum* (pores diameter 3 μm). The distance between the pores ranging from 3 μm (*A. viridis*, *S. schimperi*, *S. aegyptiaca* and *S. vermiculata*) and 5 μm (*A. javanica* and *A. macrostachyum*) (data not reported).

The dendrogram elaborated with average measures of the pollen grains morphometric features (Figure S6) shows a good correspondence between all the Amaranthaceae species, with a dissimilarity coefficient varies of ca. 0.45. Despite this, the seven species have been divided into two groups. The first one includes *S. schimperi*, *S. vermiculata*, and the two *Aerva* species (*A. artemisioides* and *A. javanica*); the second group contains *A. macrostachyum*, *S. aegyptiaca* and *A. viridis*. In the first group, no differences are shown by the two *Aerva* species (dissimilarity coefficient 0), while they differ from *S. schimperi*, *S. vermiculata*, respectively, by a coefficient of 0.25 and 0.15. In the second group, no differences emerge between *S. aegyptiaca* and *A. viridis*; on the contrary *A. macrostachyum* displays a dissimilarity coefficient of 0.4 from the latter two.

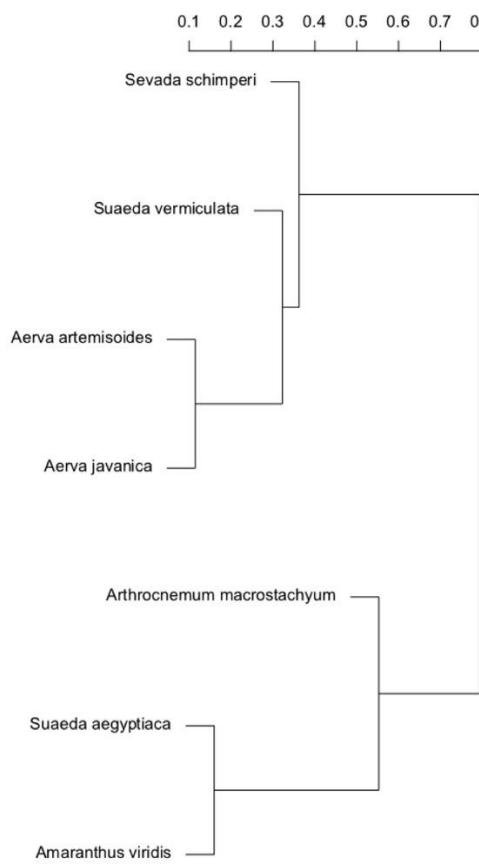


Figure S6 – Cluster dendrogram of the Amaranthaceae species recorded in the relevés. The scale at the top of the figure represents the similarities/dissimilarities coefficient among the species.

S3 – Relevés from the estuaries.

Table S1 – Relevés from the estuary of Khwar Qurm Al Sagir (WS).

Rel. WS1-4 - Coastal sand-sabkhas

N. rel.	WS1	%	WS2	%	WS3	%	WS4	%
Date	03 Oct 2015		03 Oct 2015		03 Oct 2015		03 Oct 2015	
Coordinates	16°58'49.8"N 54°0'45.96"E		16°58'49.8"N 54°0'45.96"E		16°58'48.66"N 54°0'49.74"E		16°58'48.66"N 54°0'49.74"E	
Cover (%)	20		20		40		80	
Surface (mq.)	100		8		100		100	
Exposure	-		N		-		-	
Declivity (°)	-		1		-		-	
Altitude (m)	7,3		7,3		7		6,8	

<i>Sporobolus spicatus</i> (Vahl) Kunth	.	2	13,5	2	19,5	1	5
<i>Aeluropus lagopoides</i> (L.) Thwaites	.	+	0,5	.	.	.	.
<i>Urochondra setulosa</i> (Trin.) C.E. Hubb.	2	20	1	5	.	.	.
<i>Sevada schimperi</i> Moq.	.		+	0,5	.	.	.
<i>Suaeda aegyptiaca</i> (Hasselq.) Zoh.	.		+	0,5	+	0,5	.
<i>Arthrocnemum macrostachyum</i> (Moric.) K. Koch	.		.		2	20	4
							75

Rel. WS5 - Mangrove

N. rel.	WS5	%
Date	03 Oct 2015	
Coordinates	16°58'48"N 54°00'50"E	

Cover (%)	95
Surface (mq.)	25
Exposure	-
Declivity (°)	-
<u>Altitude (m)</u>	<u>3</u>

Avicennia marina (Forssk.) Vierh. 5 95

Table S2 – Relevés from the estuary of Khawr al Qurm (WR).

Rel. WR1-3 - Coastal sand-sabkhas

N. rel.	WR1	%	WR2	%	WR3	%
Date	29 Sept 2015		29 Sept 2015		29 Sept 2015	
Coordinates	17°1'43.02"N 54°17'13.74"E		17°1'43.02"N 54°17'13.74"E		17°1'54.36"N 54°17'8.63"E	
Cover (%)	5		100		20	
Surface (mq.)	400		12		100	
Exposure	-		-		-	
Declivity (°)	-		-		-	
Altitude (m)	2		2		2	

<i>Sporobolus spicatus</i> (Vahl) Kunth	r	0,1	r	0,1	.	.
<i>Aeluropus lagopoides</i> (L.) Thwaites	r	0,1	.	.	.	.
<i>Suaeda vermiculata</i> Forssk. ex J.F. Gmel.	r	0,1	.	.	.	.
<i>Cyperus conglomeratus</i> Rottb.	1	4,6	.	.	.	.
<i>Aizoon canariense</i> L.	r	0,1	.	.	.	.
<i>Prosopis juliflora</i> (Sw.) DC.	.		5	100	.	.
<i>Cressa cretica</i> L.	.		.	.	2	20

Rel. WR4 - Mangrove

N. rel.	WR4	%
Date	29 Sept 2015	
Coordinates	17°1'44"N 54°17'11"E	
Cover (%)	95	

Surface (mq.)	25
Exposure	-
Declivity (°)	-
<u>Altitude (m)</u>	3

Avicennia marina (Forssk.) Vierh. 5 95

Table S3a – Relevés from the estuary of Wadi Darbat (WD).

Rel. WD1-6 - Wet wadi vegetation+A1:O55

N. rel.	WD1	%	WD2	%	WD3	%	WD4	%	WD5	%	WD6	%
Date	30 Sept 2015		30 Sept 2015		30 Sept 2015		30 Sept 2015		02 Oct 2015		02 Oct 2015	
Coordinates	17°2'12.60"N 54°26'24.83"E		17°2'12.60"N 54°26'24.83"E		17°2'12.60"N 54°26'24.83"E		17°2'10.80"N 54°26'22.56"E		17°2'40.74"N 54°25'44.04"E		17°2'40.74"N 54°25'44.04"E	
Cover (%)	30		60		100		100		100		100	
Surface (mq.)	12		12		3		10		3		3	
Exposure	-		-		-		-		-		-	
Declivity (°)	-		-		-		-		-		-	
Altitude (m)	10		10		10		5		5		5	

<i>Sporobolus virginicus</i> (L.) Kunth	.		+	0,5	.	.	.	.	.	.	.	.
<i>Schoenoplectus subulatus</i> (Vahl) Lye	2	25	.		+	0,5	.		2	25	5	100
<i>Paspalum vaginatum</i> Sw.	1	4,5	2	9,5	+	0,5	.		.	.	.	.
<i>Najas marina</i> L.	+	0,5	.		5	98	.		4	75	.	.
<i>Cyperus laevigatus</i> L.	.		3	50	.		.		.	.	.	.
<i>Phragmites australis</i> (Cav.) Trin. ex Steud. subsp. <i>altissimus</i> (Benth.) D. Rivera & M.A. Carreras	.		.		.		5	90	.	.	.	.
<i>Salvadora persica</i> L.	.		.		.		2	10	.	.	.	.

Rel. WD7-12 Wet wadi vegetation

N. rel.	WD7	%	WD8	%	WD9	%	WD10	%	WD11	%	WD12	%
Date	02 Oct 2015											

	17°2'40.74"N 54°25'44.04"E	17°2'40.74"N 54°25'44.04"E	17°2'40.74"N 54°25'44.04"E	17°2'55.5"N 54°25'30.9"E	17°2'55.5"N 54°25'30.9"E	17°2'55.5"N 54°25'30.9"E
Coordinates						
Cover (%)	100	100	100	90	100	100
Surface (mq.)	2	2	2	3	6	2
Exposure	-	-	-	-	-	-
Declivity (°)	-	-	-	-	-	-
Altitude (m)	5	5	5	5,4	5,4	5,4

<i>Bacopa monnieri</i> (L.) Wettst.	3	50	+	0,5	+	0,5	2	25	.	.
<i>Cyperus laevigatus</i> L.	3	50	5	98	.	.	2	25	.	.
<i>Paspalum vaginatum</i> Sw.	.	.	.	.	5	99,5	3	39	.	.
<i>Sporobolus spicatus</i> (Vahl) Kunth	.	.	.	.	.	.	+	0,5	.	.
<i>Typha domingensis</i> Pers.	.	.	.	.	.	.	.	.	4	55
<i>Phragmites australis</i> (Cav.) Trin. ex Steud. subsp. <i>altissimus</i> (Benth.) D. Rivera & M.A. Carreras	.	.	.	.	.	.	.	.	4	45
<i>Schoenoplectus subulatus</i> (Vahl) Lye	.	.	+	0,5	.	.	+	0,5	.	5
										100

Table S3b – Relevés from the estuary of Wadi Darbat (WD).

Rel. WD13-19 Coastal sand-sabkhas

N. rel.	WD13	%	WD14	%	WD15	%	WD16	%	WD17	%	WD18	%	WD19	%
Date	30 Sept 2015		30 Sept 2015		30 Sept 2015		30 Sept 2015		30 Sept 2015		02 Oct 2015		02 Oct 2015	
Coordinates	17°1'52.68"N 54°26'27.78"E		17°1'52.68"N 54°26'27.78"E		17°1'52.26"N 54°26'25.92"E		17°1'52.2588"N 54°26'25.92"E		17°2'15.12"N 54°26'26.82"E		17°2'21.42"N 54°26'0.66"E		17°2'40.74"N 54°25'44.04"E	
Cover (%)	20		30		30		40		20		30		80	
Surface (mq.)	25		18		25		9		9		9		2	
Exposure	-		E		-		-		-		-		-	
Declivity (°)	-		2		-		-		-		-		-	
Altitude (m)	5		5		5		5		10		17		5	
<i>Sporobolus spicatus</i> (Vahl) Kunth	+	0,5	+	0,8	2	15	1	4,5	2	10	2	10	5	80
<i>Cyperus conglomeratus</i> Rottb.	1	5	+	0,9	.	.	+	0,5	.	.	.	.	.	.
<i>Aizoon canariense</i> L.	.		r	0,1	.	.	.	.	.	.	.	.	.	.
<i>Cressa cretica</i> L.	.		.	.	2	15	.	.	2	10	2	10	.	.
<i>Urochondra setulosa</i> (Trin.) C.E. Hubb.	2	13	1	5	.	.	3	35	.	.	2	10	.	.
<i>Tetraena simplex</i> (L.) Beier & Thulin	+	0,5	+	0,9	.	.	.	.	.	.	.	.	.	.
<i>Heliotropium bacciferum</i> Forssk.	+	0,5	+	0,9	.	.	.	.	.	.	.	.	.	.
<i>Sporobolus ioclados</i> (Nees ex Trin.) Nees	.		2	18,6	.	.	.	.	.	.	.	.	.	.
<i>Tribulus terrestris</i> L.	.		+	0,9	.	.	.	.	.	.	.	.	.	.
<i>Polycarphaea spicata</i> Wight ex Arn.	.		r	0,1	.	.	.	.	.	.	.	.	.	.
<i>Cleome brachycarpa</i> Vahl ex DC.	+	0,5	+	0,9	.	.	.	.	.	.	.	.	.	.
<i>Sevada schimperi</i> Moq.	.		+	0,9	.	.	.	.	.	.	.	.	.	.

Table S4 – Relevés from the estuary of Wadi Ataq (WT).

Rel. WT1 - Marginal dry wadi vegetation

N. rel.	WT1	%
Date	28 Sept 2015	
Coordinates	17°5'44.76"N 55°7'11.22"E	
Cover (%)	90	
Surface (mq.)	25	
Exposure	-	
Declivity (°)	-	
Altitude (m)	8	

<i>Indigofera oblongifolia</i> Forssk.	2	15
<i>Sporobolus virginicus</i> (L.) Kunth	5	75
<i>Aeluropus lagopoides</i> (L.) Thwaites	2	7,5
<i>Cressa cretica</i> L.	+	0,5

Rel. WT2-5 - Wet wadi vegetation

N. rel.	WT2	%	WT3	%	WT4	%	WT5	%
Date	28 Sept 2015		28 Sept 2015		28 Sept 2015		28 Sept 2015	
Coordinates	17°5'46.98"N 55°7'5.22"E		17°5'46.98"N 55°7'5.22"E		17°5'46.56"N 55°7'4.50"E		17°5'46.56"N 55°7'4.50"E	
Cover (%)	100		100		80		70	
Surface (mq.)	6		10		6		6	
Exposure	-		-		-		-	
Declivity (°)	-		-		-		-	

Altitude (m)	12	12	8	8
<i>Sporobolus virginicus</i> (L.) Kunth	4	55	2	21
<i>Cyperus rotundus</i> L.	3	40	1	4
<i>Eleocharis geniculata</i> (L.) Roem. & Schult.	1	5	.	4
<i>Sporololus spicatus</i> (Vahl) Kunth	.		4	75
<i>Bacopa monnieri</i> (L.) Wettst.	.		.	.
			.	3
			.	50

Table S5– Relevés from the estuary of Wadi Attabarran (WH).

Rel. WH1-4 - Marginal dry wadi vegetation

N. rel.	WH1	%	WH2	%	WH3	%	WH4	%
Date	27 Sept 2015		27 Sept 2015		27 Sept 2015		27 Sept 2015	
Coordinates	17°26'41.64"N 55°15'4.26"E		17°26'42.12"N 55°15'4.74"E		17°26'41.52"N 55°15'4.68"E		17°26'42.24N 55°15'6.12E	
Cover (%)	100		45		40		35	
Surface (mq.)	40		100		25		21	
Exposure	W		-		-		-	
Declivity (°)	3		-		-		-	
Altitude (m)	4		4		4		2	
<i>Phoenix dactylifera</i> L.	2	25	.	.	.	.	.	.
<i>Vachellia tortilis</i> (Forssk.) Galasso & Banfi					2	19	.	.
<i>Indigofera oblongifolia</i> Forssk.	1	5	2	15	.	.	1	5
<i>Tamarix mascatensis</i> Bunge	1	5	2	10	2	20	2	22
<i>Tripidium ravennae</i> (L.) H. Scholz	2	25	1	5	.	.	.	.
<i>Phragmites australis</i> (Cav.) Trin. ex Steud. subsp. <i>altissimus</i> (Benth.) D. Rivera & M.A. Carreras	2	25	.	.	.	.	.	.
<i>Sporobolus virginicus</i> (L.) Kunth	2	15	2	6	.	.	.	.
<i>Pentatropis nivalis</i> (J.F. Gmel.) D.V. Field & J.R.I. Wood	+	1	.	.	.	.	.	.
<i>Phyla nodiflora</i> (L.) Greene	.		2	8	.	.	1	3
<i>Tephrosia purpurea</i> (L.) Pers. subsp. <i>apollinea</i> (Delile) Hosny & El-Karemy	.		+	0,9	+	1	1	3
<i>Chrozophora oblongifolia</i> (Delile) A. Juss. ex Spreng.	.		r	0,1	.	.	.	.
<i>Pluchea arabica</i> (Boiss.) Qaiser & Lack	.		.	.	.	.	1	1,5
<i>Heliotropium bacciferum</i> Forssk.	.		.	.	.	.	+	0,5

Rel. WH5 - Wet wady vegetation

N. rel.	WH5	%
Date	27 Sept 2015	
Coordinates	17°26'43.86"N 55°15'9.54"E	
Cover (%)	100	
Surface (mq.)	40	
Exposure	-	
Declivity (°)	-	
Altitude (m)	7	

Typha domingensis Pers. 5 100

Rel. WH6-7 - Low, flat calcareous (madreporic) shore vegetation

N. rel.	WH6	%	WH7	%
Date	27 Sept 2015		27 Sept 2015	
Coordinates	17°26'43.26"N 55°15'9.54"E		17°26'43.26"N 55°15'9.54"E	
Cover (%)	15		20	
Surface (mq.)	25		100	
Exposure	-		-	
Declivity (°)	-		-	
Altitude (m)	7		7	

Indigofera oblongifolia Forssk. . 2 7
Pluchea arabica (Boiss.) Qaiser & Lack 2 5 .
Pulicaria glutinosa (Boiss.) Jaub. & Spach 1 3 + 0,3

<i>Senra incana</i> Cav.	r	0,1	2	6
<i>Wadithamnus artemisioides</i> subsp. <i>batharitica</i> (A.G. Mill. & J.A. Davis) T. Hammer & R.W. Davis	1	2	.	
<i>Pulicaria omanensis</i> E. Gamal-Eldin	+	0,4	.	
<i>Cleome droserifolia</i> (Forssk.) Delile	+	0,5	+	0,5
<i>Salvadora persica</i> L.	1	4	1	4
<i>Aerva javanica</i> (Burm. f.) Juss. ex Schult.	.		+	0,5
<i>Pulicaria argyrophylla</i> subsp. <i>oligophylla</i> (E. Gamal-Eldin) K. Kilian & P. Hein	.		r	0,1
<i>Lavandula macra</i> Baker	.		1	0,3
<i>Heliotropium bacciferum</i> Forssk.	.		r	0,1
<i>Dichanthium foveolatum</i> (Delile) Roberty	.		r	0,1
<i>Cleome brachycarpa</i> L.	.		r	0,1
<i>Petroana montana</i> (Balf. f.) Madhani & Zarre	.		r	0,1
<i>Convolvulus glomeratus</i> Choisy	.		r	0,1
<i>Polygala mascatensis</i> Boiss.	.		+	0,5
<i>Vachellia tortilis</i> (Forssk.) Galasso & Banfi	.		r	0,1
<i>Fagonia luntii</i> Baker	.		r	0,1
<i>Barleria</i> sp.	.		r	0,1