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SEED CHARACTERS OF GRAMINECIOUS WEEDS IN DAMIETTA, NILE DELTA

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ABSTRACT

Seed characters of 29 plant species belonging to 27 genera of the family poaceae in Damietta district were studied. Qualitative traits such as seed dispersal, seed shape, seed outline and seed texture have been examined. Also, quantitative traits had been measured such as seed mass, seed width and seed length using vernier caliper in mm. Seeds of 15 species were germinated without special pre-treatments, 14 species germinated with special pre-treatments such as KNO_3, boiling water & H_2SO_4. Results indicated that small seeded species were generally wind dispersed and more widely distributed. The relationships between seed mass, dispersal mode and plant distribution in different habitats were significant. The findings of this study support the strategy for control of weeds by understanding seed characters of graminecious weeds in the study area.

Keywords: dispersal mode, grasses, seed germination , seed mass, weed distribution

INTRODUCTION

The Poaceae (known as the Graminae) is a large and nearly ubiquitous family of flowering plants. Members of this family are commonly called grasses. Plant communities dominated by Poaceae are called grasslands; grasslands are estimated to comprise 20% of the vegetation cover of the Earth (Piperno and Sues, 2005). Poaceae have hollow stems called culms, which are plugged (solid) at intervals called nodes, the points along the culm at which leaves arise. Grass leaves are alternate, distichous (in one plane) or rarely spiral, and parallel-veined. Seeds of this family are very light and provided with structures that adapted them for wind dispersal such as wings, long hairs, pappus, plumose appendages or persistent membranous or scabrous parts.

Seed mass and shape are functionally important (Campbell *et al*., 1999; Kleyer, 1999; Weiher *et al*., 1999). They are associated with the probability of seed predation (Gomez, 2004), persistence in the seed bank (Thompson *et al*., 1993, 1998; Moles and Westoby, 2003), dispersal ability (Grime, 2001), seed production (Henery and Westoby, 2001), and establishment success (Thompson, 1987; Lloret *et al.,* 1999; Guo *et al*., 2000). Numerous empirical studies have been conducted with regard to seed mass and shape (e.g.Thompson *et al*., 1993; Weiher *et al*., 1999; Leishman, 2001). Plant abundance is restrained by seed mass (Guo *et al*., 2000). It is reported that small-seeded species tend to have a greater abundance than large-seeded species (Guo *et al*., 2000). Seed mass is also associated with other physical factors such as landform characteristics (Csontos *et al*., 2004). Seed shape is a major plant functional trait (Weiher *et al*., 1999). The relationship between seed shape and germination is closer than that between seed mass and germination (Liu *et al*., 2007). Grime et al. (1981) showed that many small- and elongated- or conical-seeded species are able to germinate immediately after collection.

The major objectives of this study are (1) Collection of plant samples representing family Poaceae in Damietta area and make herbarium specimens, (2) Collection of seeds for each species, seed dryness, (3) Study the bio- characteristics of the collected seeds, (4) Testing the relationship between seed characters and their plant distribution (5) Testing germination of seeds of each species. To achieve these points, we examined how seed mass associated with seed dispersal, seed germination and plant distribution in different habitats. We hypothesized that seed quantitative traits indicated no significant correlations to germination. To test these, we collected seeds of 29 plant species represent family Poaceae in Damietta district to conduct germination experiments under laboratory conditions.

MATERIALS AND METHODS

Study area

Damietta Province is a part of the Nile Delta. It lies between 31° and 31^{o} $30^{\backslash}$ N and between 31°, $30^{\backslash}$ and 32° E. It is bordered by Dakahlia Governorate from south and west, by Mediterranean Sea from north and Lake Manzala from east. Damietta governorate is divided into marine and coastal habitat, wetland habitat, cultivated habitat and urban landscape. The climate of this region was reported as a typically Mediterranean almost semi-arid with a short rainy winter season and along dry summer season. The study area is dependent on five water sources: River Nile water (through the Damietta branch), rainfall, seawater, water from the northern lakes and ground water. The study area is undergoing rapid changes in vegetation, and is experiencing large-scale human disturbances in the form of building, exploitation by the cement industry, etc.

Seed collection, cleaning and storage

Collecting seeds at the correct time is crucial for propagation to be successful. Gather fruits from the ground only if they have recently dropped. We reject fruits or seeds that have been on moist ground for some time, or any seed that may have begun to decay, mold, or become infested with insects.

The drying of seed is done by spreading seeds on the ground for days. The main advantage of this way of drying is that it requires no additional expenditure, or special requirements, but the disadvantage is consuming time.

Store seeds in the refrigerator, not the freezer, until they were ready to plant. Low temperatures, humidity, and darkness protect seed longevity. If it is not practical to store seeds in your refrigerator, store them in any place that is cool, dark, and dry, protecting them from insects as much as possible.

Germination Test

A germination test is a simple gardening technique that involves nothing more than the seeds, some absorbent paper towels, a spray bottle, water, a zip lock bag and a warm spot. To begin testing for germination, spread a paper towel on a water proof surface and wet down with warm water, by using a spray bottle. The germination test was carried out under the light and temperature conditions suitable for most weeds annuals and perennials which were recommended by Baskin and Baskin (1998) (21.6 ± 1.3 ^{o}C).

Seed characters

Collected seeds were morphologically described by the authors using magnifying lens and digital Microscope. The main characters include: seed length, width, mass, shape, outline and seed texture. Seed length and width of the 29 species were measured using digital vernier caliper in mm, and the recorded measure was a mean of 3 replicas of seeds per species. Seed mass was measured by using a mg scale and was counted by seed counter, For each species, 100 seed was weighted and the recorded measure is a mean of 10 replicas of seeds per species. In some cases, when seeds are so light that the scale cannot give accurate reading, they should be weighted in groups of 100 seeds weighted together to have suitable readings

Data analysis

Relationships between seed quantitative traits, dispersal mode and germination characteristics were tested using simple linear correlation coefficient (r). ANOVA one way was applied to test the effect of habitats on seed mass and seed dispersal using SPSS software (SPSS 13).

RESULTS

Habitat affinity

Eight grass species were recorded in waste land habitat, 7 species were recorded in canal banks, 5 species in gardens, 7 species in field edge, 7 species in cultivated fields, 7 species in orchards, 5 species in salt marshes, 3 species along road sides, and 3 species in sand flats (Table1).

Seed dispersal

Determination of the dispersal types of the studied species, indicated that the anemochores-light gliders is the most represented dispersal type. All species adapted for wind dispersal as a result of presence of structures such as wings, long hairs and pappus except *Cenchrus echinatus* adapted for animal dispersal (Table 1).

Seed shape

The seeds of the studied species exhibit 8 shapes. The oval shape (12 species) is the most represented, while rounded (1species), cylindrical (1species), and triangular (1 species) were the lowest represented seed shapes Table (2), Fig. (1a).

Table (1). Habitat type and dispersal type of poaceae species in the Damietta district. habitats are abbreviated as follows: Canal Bank (CB) , Garden(G), Field edge (Fe), Cultivated field(Cf), Waste land(Wl) ,Orchards(Or), Salt marsh(Sm), Road side(Rs),Open sand sheets(Ss).

No	Species	Habitat	Dispersal type
1	*Oryza sativa*	WL	Anemochores, rollers
2	*Poa annua*	Sm	Anemochores, rollers Anemochores,
3	*Lolium tomulentum*	CB	rollers
4	*Avena fatua*	CB,WL	Anemochores, heavy gliders
5	*Polypogon monspeliensis*	WL,G	Anemochores, Light gliders
6	*Elymus farctus*	Ss	Anemochores, rollers Anemochores,
7	*Arundo donax*	WL,CB,Fe	Light gliders Anemochores, Light
8	*Phragmites australis*	All habitats	gliders Anemochores, Light gliders
9	*Stipagrostis lanata*	Ss	Anemochores, Light gliders
10	*Leptochloa fusca*	WL,Or	Anemochores, Light gliders
11	*Dinebra retroflexa*	WL	Anemochores, heavy gliders
12	*Eleusine indica*	Cf	Anemochores, heavy gliders
13	*Dactyloctenium aegyptium*	Or	Anemochores, Light gliders
14	*Sporobolus pungens*	G,WL	Anemochores, Light gliders
15	*Cynodon dactylon*	All habitats	Anemochores, rollers
16	*Paspalum disticum*	Cf	Zoochores,epizoochorechores
17	*Cenchrus echinatus*	Or	Anemochores, Light gliders
18	*Imperata cylindrical*	WL	Anemochores, Light gliders
19	*Setaria pumila*	Or,Fe	Anemochores, Light gliders
20	*Digitaria sanguinalis*	Cf,Fe,Or	Anemochores, heavy gliders
21	*Echinochloa crus-galli*	Cf	Anemochores, heavy gliders
22	*Echinochloa colona*	Or	Anemochores, heavy gliders
23	*Echinochloa stagnina*	CB	Anemochores, Light gliders
24	*Pennisetum divisum*	Fe	Anemochores, Light gliders
25	*Saccharum spontaneum .v. aegyptuim*	Fe	Anemochores, Lightgliders
26	*Paspalidium geminatum*	CB,Fe,G	Anemochores, Lightgliders
27	*Aleuropus lagopoides*	Sm	Anemochores, Lightgliders
28	*Cutandia dichotoma*	Sm	Anemochores,rollers
29	*Phalaris minor*	Ca,Dr,Cf,Or,Rs	

Seed outline

Variation in seed outline indicated the presence of 6 outlines .The elongated outline is the most represented (14species), followed by the curved one (10 species). On the other hand, triangular (2 species), the flat, wavy and rounded (1 species) outlines are the less represented (Table 2 and Fig. 1b).

Seed texture

Studying variation in seed texture indicated that presence of 4 types of seed textures. The smooth (17species) and hairy (9 species) are the most represented textures. On the other hand, rough (2 species)and warty texture (1 species) were the less represented (Table 2 and Fig. 1c).

Seed length

The length of the studied species ranged between a minimum of 0.6 mm seed^{-1} in *Saccharum spontaneum* and a maximum of 10 mm seed^{-1} in *Elymus farctus*. The lengths of 5 species are within the first length class of 0 - 1 mm, and 6 species within the second length class of 1.1-2 mm. The third class of 2.1-3 (5species.), the fourth class of 3.1-4 (4 species) and the fifth class of 4.1-8 (8species=15%). The less represented length class of >8 mm (1 species) *Elymus farctus* (Table 3 and Fig. 1d)

Table (2): Qualitative characters of the seeds of the species collected from Damietta.

Species	Shape	Texture	Outline
Oryza sativa	Oval	Smooth	Elongated
Poa annua	Oval	Rough	Curved
Lolium tomulentum	Oval	Smooth	Elongated
Avena fatua	Boat	Hairy	Elongated
Polypogon monospeliensis	Oval	Smooth	Curved
Elymus farctus	Long Oval	Smooth	Elongated
Arundo donax	Long Oval	Hairy	Elongated
Phragmites australis	Oval	Hairy	Curved
Stipagrostis lanata	Cylindrical	Hairy	Elongated
Leptochloa fusca	Oval	Smooth	Curved
Dinebra retroflexa	Oval	Smooth	Curved
Eleusine indica	Triangular	Hairy	Triangular
Dactyloctenium aegyptium	Rounded	Warty	Wavy
Sporobolus virginicus	Lenticular	Smooth	Elongated
Cynodon dactylon	Lenticular	Smooth	Flat
Paspalum disticum	Pointed Oval	Rough	Elongated
Cenchrus echinatus	Oval	smooth	Curved
Imperata cylindrical	Oval	Hairy	Curved
Setaria pumila	Oval	Smooth	Curved
Digitaria sanguinalis	Pointed Oval	Hairy	Elongated
Echinochloa crus-galli	Oval	Smooth	Curved
Echinochloa colona	Oval	Smooth	Curved
Echinochloa stagnina	Boat	Smooth	Elongated
Pennisetum divisum	Lenticular	Hairy	Elongated
Saccharum spontaneum .v. aegyptuim	Long Oval	Smooth	Elongated
Paspalidium geminatum	Pointed Oval	Smooth	Triangular
Aleuropus massuanesis	Boat	Smooth	Elongated
Cutandia dichotoma	Long Oval	Smooth	Elongated
Phalaris minor	Pointed Oval	Hairy	Angular

Seed width

The seed width of the studied species ranged between a minimum of 0.2 mm seed^{-1} in *Poa annua*, *Leptochloa fusca* and a maximum of 4.5 mm seed^{-1} in *Lolium tomulentum*. Seed widths of most species were within width classes of 0 - 1 mm seed^{-1} (13 species) and 1.1 - 2 mm seed^{-1} (14 species). The less width class > 4 was represented by 2 species. (Table3 and Fig. 1e)

Seed mass

The seed mass of the studied species ranged between a minimum of 0.0016 gm 100 seed^{-1} in *Aeluropus lagopoides* and a maximum of 2.52 gm100 seed^{-1} in *Cenchrus echinatus*. According to seed mass there are 4 Seed Weight Classes (SWC) of plant species (SWC- I) of 0.1×10^{-2}- 0. 9×10^{-2} gm100 seed^{-1} (3 species), (SWC-II) of 1×10^{-2}- 9 ×10^{-2}gm100 seed^{-1} (14 species), (SWC-III) of 0.1- 0.9 gm 100 seed^{-1} (7 species) and (SWC- IV) of >1 gm 100 seed^{-1} was represented by 5 species (Table3 and Fig. 1f). Within SWC-I, SWC-II and SWC-III 96.5% were adapted for wind-dispersal and only *Cenchrus echinatus* showed animal dispersal. The correlation between seed mass and dispersal mode was significant (P>0.05).

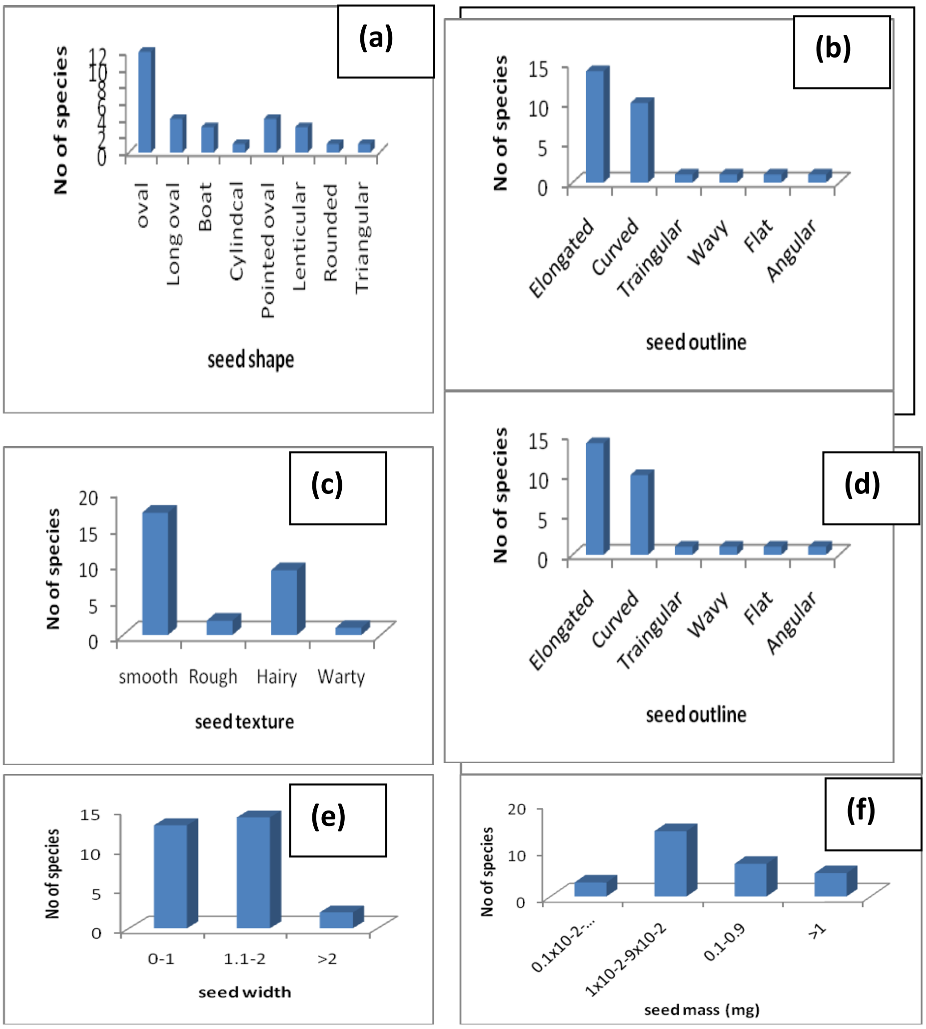

Figure 1. Relatioship between number of species and seed characters: (a) seed shape, (b) seed outlines, (c) seed texture, (d) seed length classes, (e) seed width classes, and (f) seed mass classes.

Table (3): Seed quantitative characters of 29 grasses collected from Damietta region.

Species	seed mass (gm/100seed)	seed length (mm)	seed width (mm)
Aeluropus lagopoides	0.0016	1.7	0.5
Arundo donax	0.028	4.8	1.7
Avena fatua	2.4979	6.9	2
Cynodon dactylon	0.00325	2.1	1.7
Cutandia dicotoma	0.2256	4.6	0.6
Cenchrus echinatus	2.52	4.7	2.5
Dactyloctinium aegyptium	0.2528	1	0.6
Digitaria sanguinalis	0.0477	3.4	1
Dinebra retroflexa	0.088	1.3	1.1
Echinochloa colona	0.01	4.2	1.7
Echinochloa crus-galli	0.016	3.9	1.4
Echinochloa stagnina	0.016	3.1	1.3
Eleusine indica	0.063	1.6	1
Elymus farctus	0.6491	10	2
Imperata cylindrical	0.128	1	1.2
Leptochloa fusca	1.225	1.9	0.2
Lolium tomulentum	0.206	6.2	4.5
Oryza sativa	0.1551	4.9	3
Paspalidium geminatum	0.0835	2.5	1.1
Paspalum disticum	0.1905	2	1.5
Pennisetum purpuremum	0.02351	4.5	1.5
Phalaris minor	0.017	3.1	1.5
Phragmites australis	0.028	4.6	1.3
Poa annua	0.07	1.2	0.2
Polypogon monospeliensis	0.02	0.7	0.3
Saccharum spontaneum	6.996	0.6	0.5
Setaria pumila	0.208	1.9	0.7
Stipagrostis lanata	0.1275	2.2	0.5
Sporobolus virginicus	0.0162	2.6	0.8

Seed Germination

Seeds of 15 species, out of the 29 studied species, germinated under the laboratory conditions (nearly at the mean temperature of 21.6 ± 1.3º C). On the other hand, 14 species failed to germinate under the same conditions and had been treated with special pre-treatments before germination (Table 4).

Impact of different habitats on quantitative traits and dispersal mode:

With reference to seed mass, there is a significant variation of seed mass in the different habitats ($P<0.05$), There is a highly significant variation between dispersal mode and different habitats ($P<0.001$). Seed length, width and seed germination showed no significant variation in the different habitats **(**Table 5).

Table(4): Percentage of species germination with special pre-treatment. a: soaking in boiling water, b: soaking in boiling water and H_2SO_4 for 5Min, c: soaking in KNO_3 for 5Min.

No	Species	Germination% (control)	Germination% after pretreatment	pretreatment
1	*Oryza sativa*	0%	100%	a
2	*Poa annua*	4%	50%	a
3	*Elymus farctus*	10%	100%	b
4	*Phragmites australis*	15%	90%	a
5	*Leptochloa fusca*	10%	70%	a
6	*Pennisetum divisum*	0%	50%	a
7	*Saccharum spontaneum .v. aegyptuim*	50%	100%	a
8	*Setaria pumila*		100%	a
9	*Paspalidium geminatum*	20%	70%	a
10	*Echinochloa cruss-galli*	12%	100%	a
11	*Cynodon dactylon*	15%	70%	c
12	*Phalaris minor*	20%	100%	c
13	*Cenchrus echinatus*	50%	100%	a
14	*Arundo donax*	40%	55%	a

Table (5): ANOVA-One Way of quantitative seed characteristics, dispersal mode, and the different habitats of Damietta region.

Habitat	Seed mass	Seed length	Seed width	Seed germination	Dispersal mode
Canal banks	0.062±0.082	1.507±1.20	0.861± 0.52	1.536± 0.51	2.964± 0.69
Gardens	0.138± 0.165	1.981± 1.46	1.195± 1.02	1.500± 0.51	2.738± 0.76
Field edge	0.112±0.1553	1.692± 1.32	0.994± 0.67	1.400± 0.49	2.820± 0.59
Field crops	0.143±0.192	1.97± 1.292	0.944± 0.39	1.630± 0.49	2.88± 0.847
Waste lands	0.142± 0.188	2.06± 1.924	1.156± 0.89	1.480± 0.51	2.64± 0.810
Orchards	0.232± 0.277	2.492± 2.12	1.456± 1.34	1.440± 0.51	2.52± 1.046
Salt marshes	2.517± 8.968	2.246± 1.55	1.171± 0.76	1.417± 0.50	2.75± 0.944
Road sides	1.278± 2.377	2.981± 3.64	1.419± 1.28	1.519± 0.51	2.963± 0.58
Open water	0.22± 0.27	3.38± 3.81	1.680±0.781	1.57± 0.53	3.4± 0.55
Sand flats	0.25± 0.246	1.57± 1.21	1.214± 0.70	1.49± 0.501	4.14± 1.574
F-value	1.962	1.648	1.450	0.575	3.210
Sig.	0.044	0.102	0.167	0.818	0.001

(ns=not significant,*p<0.05,=p<0.01,***=p<0.001)**

DISCUSSION

Seed characteristics are important in species identification such as size, mass, shape, colour, and surface ornamentation (Salisbury 1986, Isely 1947, Baker 1972 and Van der Pijl 1972, Singh and Dathan 1969 and 1972). These characteristics were used by Mathews and Levins (1986) and Ness (1989) to explain the taxonomic relationships among species within the genus. Akhbari and Azizan (2006) reported that seed size and shape are variable within species, when they studied seed morphology and seed coat sculpturing. The previous authors agreed with Corner (1976) and Takhtajan (1991) in their conclusion that morphological characters of seeds provide valuable information on the evolutionary classification of flowering plants. Liu *et al*., (2007) reported that seed mass or/and shape associate with seed germination and plant distribution and hypothesized that (1) seed mass is negatively related to germination, (2) seed shape is positively related to germination. Plant abundance is restrained by seed mass (Guo *et al.* 2000). Small-seeded species tend to have a greater abundance than large-seeded species (Rees,1995); Guo *et al.*, 2000; Khurana *et al*. 2006). Seed mass is also associated with other physical factors such as landform characteristics (Csontos *et al*., 2004). In addition, although seed shape is a major plant functional trait (Weiher *et al.,* 1999). The relationship between seed shape and germination is closer than that between seed mass and germination Liu *et al*. (2007). Grime *et al.*, 1981; Liu *et al*., (2003) postulated that phylogeny may be responsible for this pattern, because seeds of Gramineae, likely to be elongated or flattened, tend to germinate easily.

In the present study, seed mass is negatively related to seed germination ($p > 0.05$), elongated and rounded seeded species have higher germination percentage ranging from (80%-100%). Grime *et al.* (1981) showed that many small- and elongated- or conical-seeded species are able to germinate immediately after collection.

Seed mass is a key ecological trait that influences many aspects of a species' regeneration strategy, including seedling survival rates, seed dispersal syndrome, and the number of seeds that can be produced for a given amount of energy (Leishman *et al*. 2000; Moles *et al.* 2007).

Khurana *et al*. (2006) indicated that small-seeded species, which were generally wind-dispersed, were more widely distributed, at this local scale, compared to large-seeded species. Individuals of small-seeded species were distributed more widely than those of large-seeded species. Similar results were obtained by Rees (1995); Guo *et al*. (2000). Several researchers (Leishman *et al*., 1995; Parciak, 2002) reported that small seeds are produced in greater numbers than the large seeds. Large crops of small seeds may be an adaptation to facilitate dispersal because of the greater mobility of small seeds and the larger numbers of offspring that can potentially disperse (Baker, 1972; Howe and Richter, 1982; Sallabanks 1992). Smaller seeds also enter into the soil more easily than large seeds, and thus have a greater probability of being found in persistent soil seed banks (Khurana and Singh, 2001).

Variation in seed mass was associated with dispersal ability. The majority of small-seeded species were wind-dispersed, while those of large-seeded species were mammal-dispersed. The former should have greater dispersal ability and colonization and distribution success than the latter group of species. Ninety-seven percent of all species present were wind-dispersed. The association of wind dispersal and small seed size represents a general rule form the assembly of plant communities in which small-seeded species with greater dispersal ability exhibit a wider range of abundance and distribution (Guo *et al*., 2000). Non-animal dispersal (wind, explosive and gravity) was predominantly associated with smaller seed mass, whereas animal dispersal was predominantly associated with larger seed mass (Chazdon *et al*., 2003). Results revealed that the majority of SWC1, SWC2, SWC3, SWC4 species were wind-dispersed, while only species (*Cenchrus echinatus*) showed animal-dispersal.

REFERENCES

Akhbari, R. and Azizan, D. (2006). Seed morphology and seed coat sculpturing of *Epilobium* L. species (Onagraceae Juss.) from Iran. Turk J. Bot. 30: 435 - 440.

Baker, H.G. (1972). Seed weight in relation to environmental conditions in California. *Ecology* 53: 997–1010.

Baskin, C. and Baskin, J.M. (1998). Seeds: ecology, biogeography, and evolution of dormancy and germination - *Academic Press*, London,U.K.

Campbell, B.D., Stafford, D.M., Ash, A.J., 1999. A rule-based model for the functional analysis of vegetation change in Australasian grasslands. Journal of Vegetation Science 10, 723–730.

Corner, E. (1976). The seeds of the dicotyledons, Volume 2, Cambridge, University Press, Cambridge. pp. 558.

Csontos, P., Tama´s, J., Podani, J.(2004). Slope aspect affects the seed mass spectrum of grassland vegetation. Seed Science Research14: 379–385 .

Chazdon, R.L., Carega, S., Webb, C. and Vargas, O.(2003). Community and phylogenetic structures of reproductive traits of woody species in wet tropical forests. Ecol. Monogr. 73, 331–348.

Guo, Q., Brown, J.H., Valone, T.J.and Kachman, S.D., 2000. Constrains of seed size on plant distribution and abundance. Ecology 81, 2149–2155.

Grime, J.P., Mason, G., Curtis, A.V., Rodman, J., Band, S.R., Mowforth, M.A.G., Neal, A.M. and Shaw, S.(1981). A comparative study of germination characteristics in a local flora. Journal of Ecology, 69,1017–1059.

Grime, J.P.(2001). Plant strategies, vegetation processes, and ecosystem properties, 2 ed. John Wiley and Sons, Ltd., Chichester.

Gomez, J.M.(2004). Bigger is not always better: conflicting selective pressures on seed size in *Quercus ilex*. Evolution 58: 71–80.

Henery, M.L., Westoby, M., 2001. Seed mass and seed nutrient content as predictors of seed output variation between species. Oiko 92: 479–490.

Howe, H.F. and Richter, W.M., 1982. Effects of seed size on seedling size in *Virola surinamensis*: a within and between tree analysis. Oecologia 53: 347–351.

Isely, D. (1947). Investigations in seed classification by family characteristics. Iowa Agricultural Experimental Station Research Bulletin. pp. 351.

Kleyer, M. (1999). Distribution of plant functional types along gradients of disturbance intensity and resource supply in an agricultural landscape. J. Veg. Sci. 10: 697–708.

Khurana, E., Singh, J.S.(2001). Ecology of seed and seedling growth for conservation and restoration of tropical dry forest: a review. Environ. Conserv. 28, 39–52.

Khurana, E., Sagar, R. and Singh, J.S. (2006). Seed size: a key trait determining species distribution and diversity of dry tropical forest in northern, India. Acta Oecologia, 2 9:196-204.

Lloret, F., Casanovas, C., Penuelas, J.(1999). Seedling survival of Mediterranean shrubland species in relation to root: shoot ratio, seed size and water and nitrogen use. Functional Ecology 13, 210–216

Leishman, M.R., (2001). Seed size/number tradeoff model. Does the determine plant community structure? An assessment of the model mechanisms and their generality. Oikos 93, 294–302.

Liu, Z.M., Li, X.H., Li, R.P., (2003). A comparative study on seed shape of 70 species in Horqin Sandy Land. Acta Prataculturae *Sinica* 12 (5), 55–61.

Liu, Z., Yana,Q., Li ,X., Maa, J., Ling, J.(2007). Seed mass and shape, germination and plant abundance in a desertified grassland in north eastern Inner Mongolia, China. Journal of Arid Environments 69 :198–211.

Leishman, M.R., Westoby, M., Jurado, E.(1995). Correlates of seed size variation: a comparison among five temperate floras. J. Ecol 83, 517–530

Leishman, M.R., Wright, I.J., Moles, A.T. and Westoby, M. (2000). The evolutionary ecology of seed size. *Seeds: the ecology of regeneration in plant communities*, 2nd ed. (ed. by M. Fenner), pp. 31–57. CAB International, Wallingford, UK.

Mathews, J. and Levins, P. (1986). The systematic significance of seed morphology in *Portulaca* (Portulacaceae) under scanning electron microscopy. Syst. Bot. 11: 302- 308.

Moles, A.T., Ackerly,D.D. Tweddle, J.C., Dickie, J.B. Smith,R., Leishman, M.R., Mayfield, M.M., Pitman, A., Wood,J.T., and Westoby, M.(2007). Global patterns in seed size. Global Ecology and Biogeography, 16, 109– 116.

Moles, A.T. and Westoby, M. (2003) Latitude, seed predation and seed mass. *Journal of Biogeography*, 30, 105–128.

Ness, B. (1989). Seed morphology and taxonomic relationships in *Calochortus* (Liliaceae). Syst. Bot. 14: 495 - 505.

Parciak, W., 2002. Seed size, number and habitat of a fleshy fruited plant: consequences for seedling establishment. Ecology 83, 794–808.

Piperno, D.R. and Sues, H.D. (2005). Dinosaurs dined on grass. Science, 310:1126- 1128.

Rees, M., 1995. Community structure in sand dune annuals: is seed size weight a key? J. Ecol. 83, 857–863.

Salisbury, E. (1986). The reproductive capacity of plants. Studies in quantitative biology .University Microfilms International, Bell, London. pp.24

Sallabanks, R.S.(1992). Fruit fate, fugivory, and fruit characteristics: a study of the hawthorn, *Crataegus monogyna* (Rosaceae). Oecologia 91, 296–304

Singh, D. and Dathan, A. (1969). Structure and development of seed coat in Cucurbitaceae. 5-Seeds of *Melothria*. l. Proc. 65th. Indian Sci. Congr. 34: 393 - 400.

Singh, D. and Dathan, A. (1972). Structure and development of seed coat in Cucurbitaceae: 6-Seeds of *Cucurbita*. Phytomorphology 22: 29 - 45.
Takhtajan, A. (1991). Evolutionary trends in flowering plants. Columbia University Press, New York. pp.241.
Thompson, K. (1987). Seed and seed banks. New Phytologist 106 (Suppl. 1), 23–34.
Thompson, K., Band, S.R., Hodgson, J.G.(1993). Seed size and shape. Predict persistence in soil. Functional Ecology 7, 236–241
Thompson, K., Bakker, J., Bekker, R.M., Hodgson, J.(1998). Ecological correlates of seed persistence in soil in the north-west European flora. Journal of Ecology 86, 163–169.
Van der Pijl, P. (1972). Principles of dispersal in higher plants. 2 nd. Edition, Springer, Berlin. pp.161.
Weiher, E., van der Werf, A.,Thompson, K., Roderick, M., Garnier, E., Eriksson, O., 1999. Challenging Theophrastus: a common core list of plant traits for functional ecology. Journal of Vegetation Science 10, 609–620.

خصائص البذور للحشائش النجيلية في محافظة دمياط بدلتا النيل

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تناولت الدراسة بعض الخصائص المورفولوجية لبذور الفصيلة النجيلية في محافظة دمياط. تم التعرف على ٢٩ نوع والتي تنتمي إلى ٢٧جنس. وتم دراسة مدى تلاؤم هذه الأنواع في ١٠بيئات مختلفة وهى الاراضى الزراعية ، حواف الحقول الزراعية ، الاراضى الملحية ، الاراضى المهملة ، الحدائق ، المصاطب الرملية ، حواف الترع والقنوات ، جوانب الطرق ومصادر المياه المختلفة. تم التعرف على خصائص البذور الوصفية وهى شكل البذرة ، انتشار البذرة ، ملمس البذرة ، المحيط الخارجي للبذرة. بالإضافة إلى خصائصها الكمية وهى كتلة البذرة ، عرض البذرة ، طول البذرة وذلك باستخدام الأدمة الرقمية. كما تم دراسة العلاقات بين كتلة البذور وانتشارها وتوزيع الأنواع في البيئات المختلفة. تم اختبار إنبات البذور فنبت ١٥نوع تحت الظروف العادية وعلى العكس بذور ١٤ نوع لم تنبت تحت الظروف العادية لذلك تم معاملتهم معاملة خاصة قبل الإنبات مثل النقع في محلول نترات البوتاسيوم لمدة ٥ دقائق أو النقع فى ماء ساخن مع حمض كبريتيك أو ماء ساخن فقط. أظهرت النتائج أن الأنواع ذات البذور صغيرة الحجم أكثر انتشارا بالرياح وتوزيعا على العكس من الأنواع ذات البذور كبيرة الحجم. وأظهرت النتائج اختلافات معنوية بين كتلة البذور وانتشارها وتوزيع الأنواع في البيئات المختلفة. وتدعم هذه الدراسة إستراتيجية مقاومة الأعشاب الضارة من خلال معرفة خصائص البذور.

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