Pak. J. Bot., 42(3): 1423-1427, 2010.

MICROSTRUCTURAL FEATURES OF SEEDS OF *SPERGULARIA MARINA* (L.) GRISEB., (CARYOPHYLLACEAE)

RABIA ASMA MEMON[1*], G. RAZA BHATTI[2], SHAHIDA KHALID[3] MUHAMMAD ARSHAD[4], AMEER AHMED MIRBAHAR[5] AND RAHMATULLAH QURESHI[6]

[1]Institute of Plant Sciences, University of Sindh, Jamshoo, Pakistan
[2]Department of Botany, Shah Abdul Latif University, Khairpur, Sindh, Pakistan
[3]Weed Science, National Agriculture Research centre, Islamabad, Pakistan
[4]Cholistan Institute of Desert Studies, the Islamia University of Bahawalpur, Pakistan
[5]Plant Biotechnology Wing, H.E.J. Research Institute of Chemistry, University of Karachi, Karachi-75270, Pakistan
[6]Department of Botany, Pir Mehr Ali Shah Arid Agriculture University, Murree Road, Rawalpind

Abstract

Seed morphology of *Spergularia marina* (L.) Griseb., occurring in wheat fields of Khairpur district, Sindh was carried out with Scanning electron microscope (SEM). Seed size, shape and surface were examined. The seed shape and surface exhibits great diversity, which provide valuable taxonomic information. In species under investigation both winged and unwinged type of seeds were found. Surface ornamentation showed heteromorphic characteristics of seed.

Introduction

Spergularia marina, a halophyte annual herb is native to California and is also found elsewhere in North America and beyond (Lum, 1975; Walker, 1992). It is commonly found in cultivated fields and waste lands of saline and sandy habitats (Ghazanfar & Nasir, 1986). It was first reported to occur in a wet saline marsh at Rittman, Ohio in 1978 by Riehl & Ungar (1980). According to Ungar (1988) this plant community contains the largest seed bank ever reported for a flowering plant community. Memon *et al*., (2003) reported it as a dominant weed found in fields of wheat crop in Khairpur district, Sindh, producing about 5000 seeds per plant. It produces numerous capsules. Each capsule contains approximately 55 seeds, throughout its growing season (Ungar, 1988). Salisbury (1958) and Sterk (1969a) mentioned that heteromorphic seeds frequently occur within both populations and individuals. These seeds are dispersed from the mature capsules by the effects of wind and water. According to Stebbins (1974) these seeds possess several variable characteristics that can not be considered independently. The relation between intraspecific variation in seed morphology and dispersal is thoroughly treated by Morse & Schmitt (1985) and by Venable *et al*., (1987), who concluded that seed heteromorphism can produce substantial variation in dispersability. According to Sterk & Dijkhuizen (1972) the heteromorphism is genetically determined. Willson (1983) discussing the selective advantages of seed heteromorphism stated that seeds having a winged margin are dispersed farther than unwinged seeds. Present paper aims to describe the variation in seed morphology investigated under SEM.

*E-mail: memon_ra@yahoo.com; rasmamemon@yahoo.com

Review of literature

Seed characterstics of *Spergularia marina* (L.) Griseb., have been observed with light microscopy by many workers. Gleason & Cronquist (1991) mentioned either winged or non-winged seeds in *Spergularia marina*. Davis (1967) reported smooth or densely tuberculate, unwinged or mixed (winged and unwinged) seeds. According to Meikle (1985) seeds are broadly pyriform, winged or unwinged. On the contrary, Ghazanfar & Nasir (1986) described ovoid, unwinged or dimorphic epidermal surface (smooth or finely tuberculate). Whereas Ohwi (1984) described ovate, slightly flattened, minutely mammillate to nearly smooth and barely winged seeds in *Spergularia marina.* Light microscopy, however has a serious limitations due to the small size and fine sculpturing of such seeds. Therefore, a high resolution under Scanning Electron Microscope is essential for viewing their shape and finer surface features.

Materials and Methods

The seeds were obtained from the individuals of *Spergularia marina* growing in mixed population in wheat fields of Khairpur district. The seeds shape and surfaces of *Spergularia marina* were examined by SEM. The samples of seeds were mounted onto Stubs using double sided adhesive tape. The seeds were then coated with gold using JFC-110 ion Sputter Coater for 8-12 minutes. The examination was carried out and photographed using 5 KV, with Jeol JSM-T100 SEM at NARC, Islamabad. The terms used for describing the seed surface patterns were adopted according to Stearn (1992).

Results and Discussion

Nearly a hundred capsules from different individuals were examined with the objective of determining of heterromorphic seeds. About 60-75 seeds were observed in each capsule which are not easily differentiated with stereomicroscope. Under the SEM, the seeds shapes with different surface structures can be differentiated. The seed shape and surface in the investigated taxon showed wide range of variations. Four types of seeds were observed in each capsule. Among them three types were unwinged and one type was winged. Each type is discussed below:

1. Unwinged ovate with tuberculate (Fig. 1 A&B): This type of unwinged seed is ovate in shape having tuberculate surface pattern at the periphery, the central portion tending to be granulate. The seeds are relatively small, 0.5X0.25 mm.

2. Unwinged ovate with tuberculiformis projections (Fig. 1 C&D): In this type of unwinged seed the shape is ovate. SEM investigation showed tuber-like projections on surface. Distinct lines of irregular pattern are arranged all over the surface. The cells on surface are forming concentric rows of beaded strings of equal size. The beads or globules become compact at the tips of projections. The seeds are rather large as compared to other unwinged seeds, 0.7X0.4 mm.

3. Unwinged ovate with striate pitted (Fig. 1 E&F): This type of unwinged seed is also ovate in shape. The surface sculpture is striate forming a distinct layer towards the narrow end of the seed. Surface is forming irregular pattern towards the periphery. Deep pits are irregularly arranged all over the surface. It's size is somehow equal to first type, 0.5X0.4 mm.

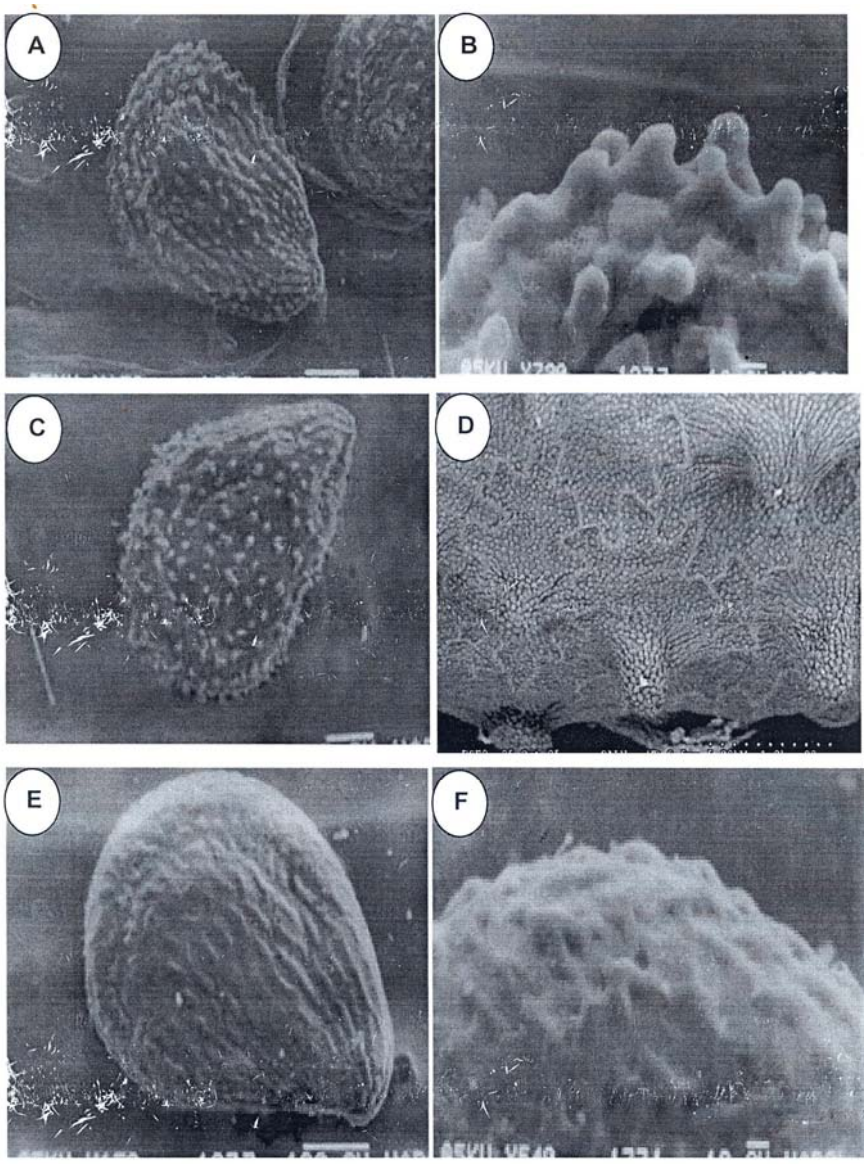

Fig. 1. Scanning electron micrographs of unwinged seeds of *Spergularia marina*. A,C & E, seed shape; B,D & F, seed surface. Bar: A,C,E =100 µm; B, F =10 µm; D =20 µm.

4. Winged ovate with papilliformis protuberances (Fig. 2 A,B,C,D&E): This type of seed is a unique character of the investigated species. The seed shape is distinctly different from all other seed types in which the common seed shape is unwinged ovate. In this type the seed shape is ovate having wing (membranous border) which is attached around the margin of the seed. The surface sculpture is showing irregular lines and beaded strings as in type two. SEM revealed nipple-like projections present on surface. The seeds are relatively large, ca. 0.9 mm in diam.

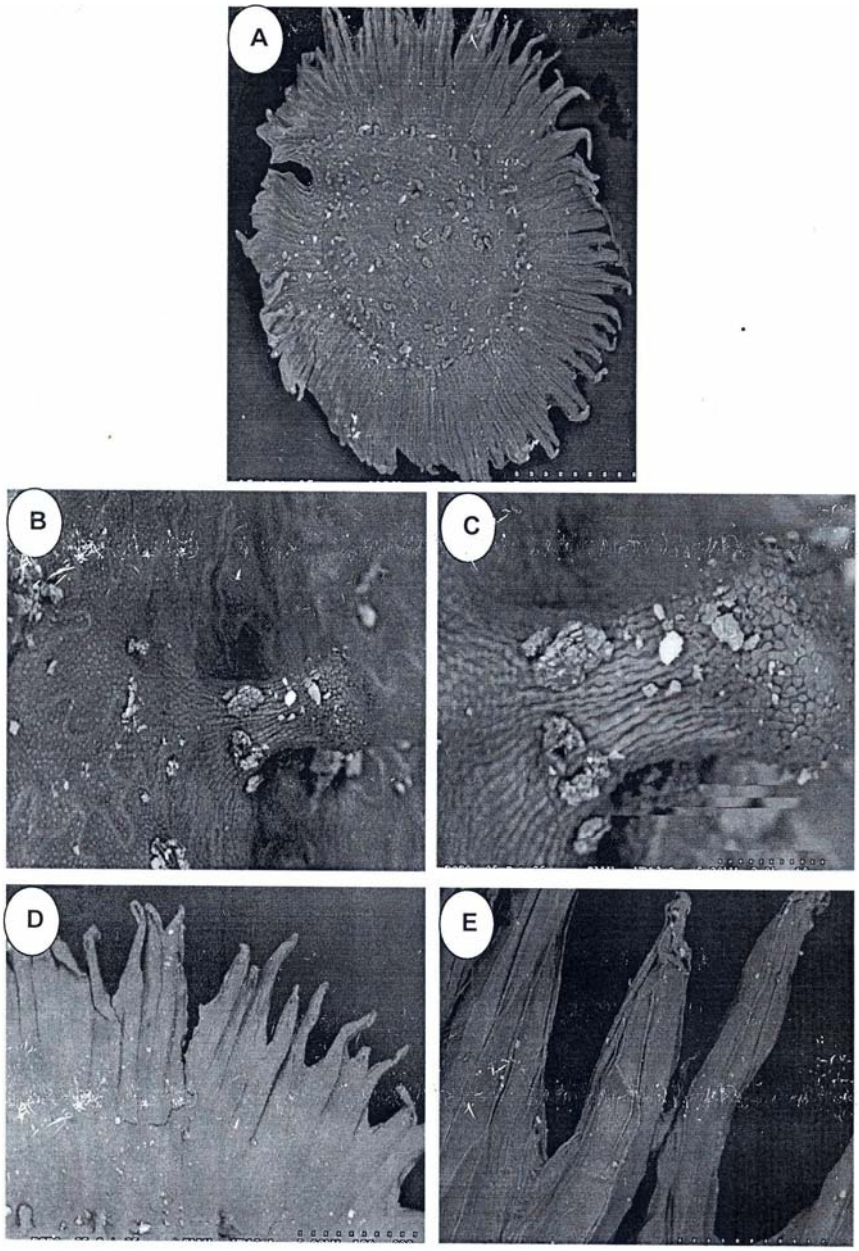

Fig. 2. Scanning electron micrographs of winged seed of ***Spergularia marina.*** A, seed shape; B,C,D & E, views of seed surface and wings. Bar: A = 500 µm; B,E =50 µm; C =10 µm; D =200 µm.

Present findings are congruent with the findings of Davis (1967) and Meikle (1985), who reported both winged and unwinged seeds. Similarly, Ohwi (1984) reported ovate and barely winged seeds in *Spergularia marina* which support the present results. However, they could not differentiate among four types with diverse surface sculptures as described in the present study using SEM.

Conclusion

The result of present investigations with SEM depicts the heteromorphic seed features of *Spergularia marina*, which will be considered as additional useful taxonomic character.

References

Davis, P.H. 1967. *Flora of Turkey*. Vol. II. Edinburgh.

Ghazanfar, S.A. and Y.J. Nasir. 1986. In: E. Nasir and S.I. Ali. *Flora of Pakistan.* No. 175. Caryophyllaceae. Department of Botany, University of Karachi.

Gleason H.A. and A. Cronquist. 1991. *Manual of vascular plants of northeastern United States and adjacent Canada, 2nd edn.* Bronx: New York Botanical Garden.

Lum, K.L. 1975. Gross patterns of vascular plant species diversity in California. Unpubl. MS Thesis, Ecology. Univ. of California, Davis. 154 pp.

Meikle, R.D. 1985. *Flora of Cyperus.* Vol. I. Royal Botanic Garden, Kew.

Memon, R.A., G.R. Bhatti and S. Khalid. 2003. Weed diversity of wheat crop in Khairpur District, Sindh. *Pak. J. Weed Sci. Res*., 9(1-2): 99-103.

Morse D.H. and J. Schmitt. 1985. Diaspore size, shape and fall behavior in wind-dispersed plant species. *Oecologia*, 67: 372-379.

Ohwi, J. 1984. *Flora of Japan*. Smithsonian Institution Washington, D.C.

Riehl, T.E. and I.A. Ungar. 1980. *Spergularia marina*, a new species record for the flora of Ohio. *Ohio J. Sci.*, 80: 36-37.

Salisbury, E.J. 1958. *Spergularia salina* and *Spergularia marginata* and their heteromorphic seeds. *Kew Bull*., 1: 41-51.

Stearn, W.T. 1992. *Botanical Latin.* 4th edition. David & Charles Pub., London.

Stebbins, G.L. 1974. *Flowering plants: evolution above the species level.* Belknap Press of Harvard University Press, Cambridge, Mass.

Sterk A.A. and L. Dijkhuizen. 1972. The relation between the genetic determination and the ecological significance of the seed wing in *Spergularia media* and *S. marina*. *Acta. Bot. Neerl*., 21: 481-490.

Sterk, A.A. 1969a. Biosystematic studies on *Spergularia media* and *S. marina* in the Netherlands II. The morphological variation of *S. marina*. *Acta. Bot. Neerli*, 18: 467-476.

Ungar, I.A. 1988. A Significant Seed Bank for *Spergularia marina* (Caryophyllaceae) *Ohio J. Sci.*, 88(5): 200-202.

Venable D.L, A. Burquez, G. Corral, E. Morales and F. Espinosa. 1987. The ecology of seed heteromorphism in *Heterosperma pinnatum* in central Mexico. *Ecology*, 68: 65-76.

Walker, R.E. 1992. Community models of species richness: regional variation of plant community species composition on the west slope of the Sierra Nevada, California. Unpubl. MA Thesis, Geography. Univ. of California, Santa Barbara. 155 pp.

Willson, M.F. 1983. *Plant reproductive ecology*. Wiley and Sons, NY.

(Received for publication 19 October 2009)