

THE SEED ATLAS OF PAKISTAN-IV OXALIDACEAE

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Abstract

Seed morphology of 6 species belonging to the family Oxalidaceae was examined using light and scanning electron microscopy (SEM). Seed macro and micro morphological characters were found useful for the taxonomic decisions as all the taxa clearly distinguished at the specific level.

Introduction

The family Oxalidaceae comprises 5 genera and 565 species distributed in tropics and temperate regions (Mabberley, 2008) represented in Pakistan by a single genus *Oxalis* L., with 6 species (Nasir, 1971). The use of seed micromorphological characters has played an important role for the systematics of the family Oxalidaceae. Obone (2005) studied the seeds of South African *Oxalis* species and emphasized on shape, size and surface pattern. Similarly Bojnans & Fargasova (2007) distinguished the two species of *Oxalis* on the basis of seed morphology. However, some workers also paid the attention to endosperm and the structure for the explosive ejection of seed from the capsule in the genus *Oxalis* (Corner, 1976; Watson & Dallwitz, 1992; Kubitzki, 2004; Liu & Watson, 2008). Studies on the seed morphology of the genus *Oxalis* from Pakistan was carried out to provide the additional micromorphological characters.

Material and Methods

Mature and healthy seeds of 6 species of the genus *Oxalis* were collected from herbarium specimens (Appendix I) and examined under the stereomicroscope (Nikon XN Model), compound microscope (Nikon type 102) and scanning electron microscope (JSM-6380A). For scanning electron microscopy, dry seeds were directly mounted on metallic stub using double adhesive tape and coated with gold for a period of 6 minutes in sputtering chamber and observed under SEM. The terminology used is in accordance to Lawrence (1970), Radford (1974) and Stearn (1983) with slight modifications. The characters of seed viz., size, shape, colour, surface, position and number of ribs, margin and hilum were studied

Observation

General seed characters of the family Oxalidaceae: Seeds 1-2.3 x 0.8-1.2 mm, ovate with acute, acuminate or obtuse apex, margin undulate, dentate, crenate or entire, brown, light brown or glossy brown, transversely or longitudinally ribbed, ribs 3-8, reticulate verrucate, faintly reticulate, irregularly reticulate or rugose. Hilum basal (Table 1; Fig. 1 A-L).

Represented by a single genus *Oxalis* L., with 6 species viz., *Oxalis acetosella* L., *O. corniculata* L., *O. corymbosa* DC., *O. latifolia* Kunth, *O. pes-caprae* L., and *O. variabilis* Jacq.

Table 1. Seed morphological characters of the family Oxalidaceae

Name of taxa	Size (mm)	Shape	Apex	Margin	Colour	Surface	Hilum	Position of ribs	No. of ribs
<i>Oxalis acetosella</i>	2.3 x 0.8	Ovate	Obtuse	Undulate	Brown	Faintly reticulate	Basal	Longitudinally ribbed	3-4
<i>O. corniculata</i>	1.5-1.8 x 1.1-1.2	Ovate	Acute	Crenate	Glossy brown	Reticulate verrucate	Basal	Transversely ribbed	7
<i>O. corymbosa</i>	1.3-2 x 0.8-1	Ovate	Acute	Dentate	Brown	Reticulate verrucate	Basal	Transversely ribbed	8
<i>O. latifolia</i>	1.3-2 x 0.9-1.2	Ovate	Acuminate	Crenate	Brown	Rugose	Basal	Transversely ribbed	6-7
<i>O. pes-caprae</i>	1-1.2 x 0.8-1	Ovate	Obtuse	Crenate	Brown	Rugose	Basal	Transversely ribbed	5-6
<i>O. variabilis</i>	1-1.2 x 0.8-1.2	Ovate	Acuminate	Entire	Light brown	Irregularly reticulate	Basal	Transversely ribbed	5

Fig. 1. Scanning electron micrographs. *Oxalis acetosella*: A, seed; B, surface. *O. corniculata*: C, seed; D, surface. *O. Corymbosa*: E, seed; F, surface. *O. latifolia*: G, seed; H, surface. *O. pes-caprae*: I, seed; J, surface. *O. variabilis*: K, seed; L, surface. (Scale bar: A,C,E,G,I,K = 200 μm ; B = 20 μm ; D,F,H,L = 10 μm ; J = 5 μm).

Appendix I. List of the voucher specimens.

Taxa	Collector, Number & Herbarium
1. <i>Oxalis acetosella</i>	R.R. & I.D. Stewart 6048 (RAW); R.R. Stewart 2087, 19555, 24497 (RAW) and R.R. Stewart & E. Nasir s.n. (RAW).
2. <i>O. corniculata</i>	M. Qaiser 333 (KUH); R.R. & I.D. Stewart 386 (RAW); Sultanul Abedin 2304, 2779 (KUH); R.R. Stewart 4143 (RAW); Y. Nasir 4562 (RAW) and E. Nasir 2492 (RAW).
3. <i>O. corymbosa</i>	M. Qaiser 321 (KUH); Joshi s.n. (RAW); Sultan ul Abedin 2321 (KUH) and M. Qaiser & A. Ghafoor 7241 (KUH).
4. <i>O. latifolia</i>	K.A. Malik 1348 (KUH); R.R. Stewart s.n. (RAW); Saida Qureshi 250 (KUH) and Farhat Hussain 6233 (RAW).
5. <i>O. pes-caprae</i>	Zaffar Ali & Y. Nasir 3549 (RAW); Jagan Nath s.n. (RAW); R.R. Stewart s.n. (RAW); Khurshid Rehman 5 (KUH); M. Qaiser 250 (KUH) and Sultanul Abedin 2352 (KUH).
6. <i>O. variabilis</i>	E. Nasir 4366, 4574 (RAW) and G.R. Sarwar & S. Omer s.n. (KUH).

Key to the species

- 1 + Seeds transversely ribbed 2
 - Seeds longitudinally ribbed *O. acetosella*
- 2 + Seeds with dentate or crenate margin 3
 - Seeds with entire margin *O. variabilis*
- 3 + Seeds with acute or acuminate apex 4
 - Seeds with obtuse apex *O. pes-caprae*
- 4 + Seeds with acute apex, reticulate 5
 - Seeds with acuminate apex, rugose *O. latifolia*
- 5 + Seeds glossy brown with crenate margin *O. corniculata*
 - Seeds brown with dentate margin *O. corymbosa*

Result and Discussion

The order Oxalidales is represented by a monotypic family Oxalidaceae with the genus *Oxalis* L. In the present study all the *Oxalis* species were observed with ovate seeds which is in contrast to the earlier findings of Obone (2005) where elliptic or broadly elliptic seeds have been reported.

Amongst all of the species of *Oxalis*, *O. acetosella* seems to be unique by having longitudinally ribbed seeds (Nasir, 1971; Bojnans & Fargasova, 2007) while in the remaining species seeds are of transversely ribbed form where *O. variabilis* remains distinct with entire margin and rest of the species have dentate or crenate margin. *O. pes-caprae* is distinguished with obtuse apex while the remaining species have acute or acuminate apex which may be further differentiated on the basis of surface patterns such as *O. latifolia* is characterized by rugose surface and *O. corniculata* and *O. corymbosa* having reticulate surface pattern but both the species remain distinct due to the presence of glossy brown seeds with crenate margin and brown seed with dentate margin

respectively. Presently glossy brown seeds are observed in *O. corniculata* which is not supported by the previous findings of Obone (2005) where orange brown seeds have been observed.

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References

- Bojnans W.V. and A. Fargasova. 2007. *Atlas of seed and fruit of central east Europe*, Springer.
- Corner, E.J.H. 1976. *The Seeds of Dicotyledons* Vol: 1. Cambridge University press, Britain.
- Kubitzki, K. 2004. *The Families and Genera of Vascular Plants, Flowering Plants Dicotyledons, Celastrales, Oxalidales, Rosales, Cornales, Ericales*. 285-290. In: K. Kubitzki. Springer-Verlag Berlin, New York.
- Lawrence, G.H.M. 1970. *Taxonomy of Vascular plants*. The Macmillan company, Collier-Macmillan Canada, LTD., Toronto, Ontario, New York.
- Liu, Q. and M. Watson. 2008. *Fl. China*, Oxalidaceae, Vol: 11. Science Press, Beijing, China.
- Mabberley, D.J. 2008. *The plant-book*. Cambridge University Press, Cambridge.
- Nasir, Y. 1971. *Fl. W. Pak.*, Oxalidaceae, No. 4. In: E. Nasir and S. I. Ali. Dept. Bot. Univ. Karachi and Stewart Herbarium, Gordon College, Rawalpindi.
- Obone, C. 2005. The Systematic significance of the fruit and seed morphology and Anatomy in selected *Oxalis* L. (Oxalidaceae) species. Unpublished M.Sc. Assignment. Dept. of Botany and Zoology, Univ. of Stellen Bosch, South Africa.
- Radford, A.E., W.C. Dickison, J.R. Massey and C. Ritchie Bell. 1974. *Vascular Plants Systematics*. Harper & Row, New York, Evanston, San Francisco, London.
- Stearn, T.W. 1983. *Botanical Latin*, 3rd edition. David & Charles. Britain.
- Watson, L. and M.J. Dallwitz. 1992. *The families of flowering plants*.

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