

SEM STUDIES OF SEED AND SEED COAT STRUCTURES IN *OCIMUM* SPP.

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SEM study of seed surfaces revealed distinct variations and similarities among *Ocimum* (basil; family : Lamiaceae) species (*O. adscendens* Willd., *O. basilicum* L., *O. canum* Sims, *O. gratissimum* L., *O. kilimandscharicum* Guerke and *O. tenuiflorum* L.) in relation to seed shape, seed surface, cells of reticulation and lumen floor. SEM analysis has been considered to be an additional constant for species characterization in *Ocimum*.

Keywords : Micro-morphology of seed; *Ocimum* spp; SEM analysis.

Introduction

Study of seed characters particularly micro morphological features of seed-coat surface has been of vital importance and have settled different taxonomic problems¹⁻⁴. SEM analysis has been successfully employed for better understanding of seed micro morphology and to delineate taxonomic relationship among plant taxa at different level.⁵⁻⁹. The present investigation documented SEM (Scanning Electron Microscopy) analysis of seeds of *Ocimum* (basil-family : Lamiaceae; rich source of essential oil) species (*O. adscendens* Willd., *O. basilicum* L., *O. canum* Sims, *O. gratissimum* L., *O. kilimandscharicum* Guerke and *O. tenuiflorum* L.), to gather information with regards to structural details of seed-coat. Seed morphology and testal nature would be of paramount significance to growers and cultivators of essential oil yielding plants.

Materials and Methods

Seeds of the species of *Ocimum* (*O. adscendens* : wild collection from Mysore; *O. basilicum* : sweet basil, collected from Medicinal Plant Garden, Narendrapur, Ramkrishna Mission; *O. canum* : hoary basil, collected from Kalyani University campus; *O. gratissimum* : shrubby basil, NBPGR – National Bureau of Plant Genetic Resources – Accession No. EC-213933; *O. kilimandscharicum* : camphor basil, collected from NBPGR – Accession No. P-2086; *O. tenuiflorum* : holy basil – purple type, collected from Medicinal Plant Garden, Narendrapur) were grown in the experimental plots of Kalyani University (excepting *O. adscendens* – original seed stock used; Voucher specimens of all species have been deposited in Herbarium, Botany Department, Kalyani University) and mature plants were raised and seeds sampled from mature inflorescences were used to obtain their accurate structure and real colour. Measurements of seeds have been made from an average of 15 seeds per species in a stereo dissecting microscope.

For SEM study the air dried seeds of each species

were put into 50% ethanol in the eppendorf tubes and cleaned in an ultrasonic vibrator (Bran sonic 221) for 4-10 min. Seeds (3-4) of each species were fixed in glass pellets and then mounted to specimen stubs with the double sided adhesive tape and silver painted. Seeds mounted on the respective stubs were placed on the revolving discs and coated with 200-300 Å thick gold in a vacuum evaporator of (Polaron) sputter coating system. The specimen stubs were then observed under SEM test (Model-JSM 5200 Tokyo, Japan) at 25 KV accelerating voltage at USIC, Jadavpur University, Kolkata. The samples were viewed and photomicrographs were taken at different magnifications.

Results and Discussion

Seed and seed-coat morphology has been documented in Table 1. Characteristic features in the species have been outlined and key to identification has been presented below:

Seed shape sub-orbicular to orbicular; seed surface finely reticulate, cells penta- to hexagonal and rarely even polygonal; lumen floor alveolate to shallow with tumid appearance - *O. adscendens* (Figs. 1-2).

Seed shape oblong-ovoid; seed surface reticulate with raised walls, cells regular tetragonal; lumen floor shallow, undulated or wavy – *O. basilicum* (Figs. 3-4).

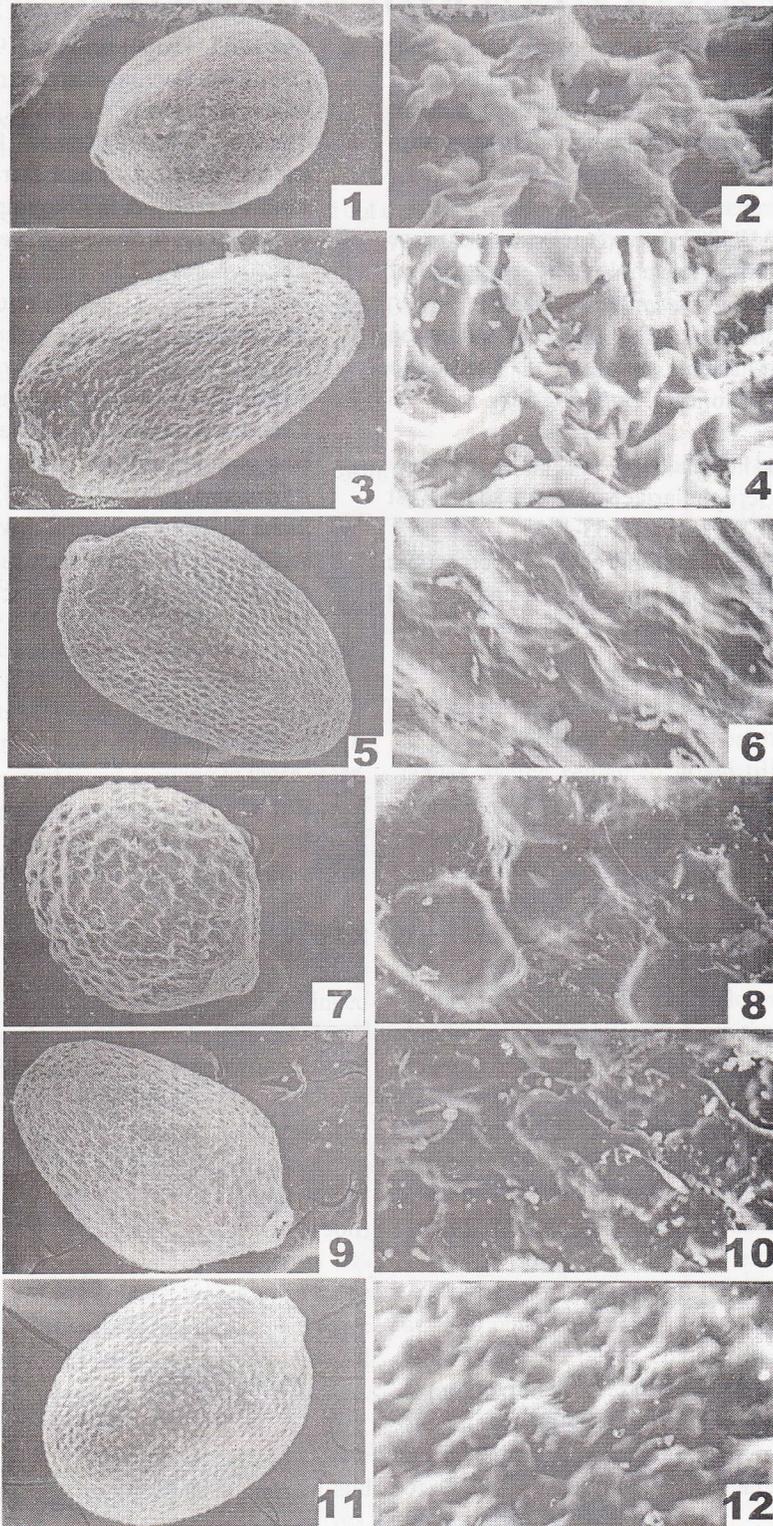
Seed shape ellipsoid; seed surface regularly reticulate, cells pentagonal somewhat rounded; lumen floor shallow uneven – *O. canum* (Figs. 5-6).

Seed shape ovoid; seed surface regularly reticulate with raised walls, cells rounded to polygonal; lumen floor shallow sometimes with verrucose lines – *O. gratissimum* (Figs. 7-8).

Seed shape ellipsoid; seed surface inconspicuously reticulate with raised walls, cells rectangular to polygonal; lumen floor shallow, sometimes with wavy uneven raised surface – *O. kilimandscharicum* (Figs. 9-10).

Table 1. Seed and seed-coat morphology in *Ocimum* spp.

Sl. No.	Attributes	<i>O. adscendens</i>	<i>O. basilicum</i>	<i>O. canum</i>	<i>O. gratissimum</i>	<i>O. kilimandscharicum</i>	<i>O. tenuiflorum</i>
1	Seed shape	Sub-orbicular to orbicular. Areolar projection small tumid. Both ends uniformly rounded.	Oblong-ovoid, upper end rounded, lower end obcordate with prominent areolar marks.	Ellipsoid, broadened towards base, rounded above; below with prominent areolar marks; outline somewhat angular with rounded angles.	Ovoid more broadened below the middle, upper end rounded, lower end tapered and angular with distinct areolar projections.	Ellipsoid, broadened towards base, upper end rounded, lower end gradually tapered with distinct areolar marks.	Ovoid, upper end rounded, basal end rounded with areolar short projections.
2	Seed size (mm ²)	1.02 ± 0.01 × 0.74 ± 0.01	2.13 ± 0.03 × 0.97 ± 0.03	1.46 ± 0.03 × 0.60 ± 0.02	1.49 ± 0.05 × 1.07 ± 0.02	1.21 ± 0.03 × 0.78 ± 0.03	1.18 ± 0.02 × 0.77 ± 0.02
3	Seed colour (MunSell soil colour chart 1975)	Yellow red 5.0 YR, 4/4	Yellowish yellow red 7.5 YR, 4/2	Yellowish yellow red 7.5 YR, 4/2	Yellow red 5.0 YR, 4/4	Yellowish yellow red 7.5 YR, 4/2	Yellow red 5.0 YR, 4/4
4	Seed surface	Finely reticulated, reticulation smaller than other species	Reticulate with elongated raised walls	Reticulate regular	Regularly reticulate with raised walls	Inconspicuously reticulate, even in appearance with raised cell walls and the floors	Regularly somewhat muricated formed with the thick cellular joining of the walls, especially the corners of the cells
5	Cells of reticulation	Penta- to hexagonal and rarely polygonal. The walls of reticulae are irregularly thickened due to appearance of granular and tumid structures	Regular tetragonal	Pentagonal to rounded, along the ridge rectangular	Regular, rounded to polygonal	Rectangular to polygonal	Regular, tetragonal to reticulate
6	Lumen floor	Alveolate to shallow also with tumid appearance. Area of the wall is more than lumen floor area	Shallow, undulated or wavy; cellular surface wrinkled, uneven, irregular	Shallow, uneven thickening of wall, wall wavy to undulated	Shallow and sometimes with verrucose lines	Shallow, sometimes with wavy uneven raised surface	Shallow and pitted; pitted surface uneven; walls thick, corner more thicker forming muricate appearance



Figs. 1-6. Seeds (1, 3, 5) and surface ornamentations (2, 4, 6) of seeds. 1-2. *O. adscendens* (1 - $\times 50$, 2 - $\times 1600$). 3-4. *O. basilicum* (3 - $\times 50$, 4 - $\times 1000$). 5-6. *O. canum* (5 - $\times 75$, 6 - $\times 1000$).

Figs. 7-12. Seeds (7, 9, 11) and surface ornamentations (8, 10, 12) of seeds. 7-8. *O. gratissimum* (7 - $\times 50$, 8 - $\times 350$). 9-10. *O. kilimandscharicum* (9 - $\times 75$, 10 - $\times 1000$). 11-12. *O. tenuiflorum* (11 - $\times 75$, 12 - $\times 500$).

Seed shape ovoid; seed surface regularly somewhat muricated, cells regular, tetragonal to reticulate; lumen floor shallow and often pitted – *O. tenuiflorum* (Figs. 11-12). Thus, identification of seed-coat characters through SEM may be an additional constant to decipher interrelationship among *Ocimum* spp.

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