



Nutlets morphology of some Lamiaceae in Karnataka

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Abstract

Nutlets are the seeds in Lamiaceae family. Seed color ranges from grey-black to yellow-cream color. Shape varies from oblong-ovoid, truncate-ellipsoid. Highest seed volume is recorded in *Leucas biflora* (Vahl) R. Br. ex Sm. (1.81 mm). Surface of the Nutlet varies from genera to genera sometimes from species to species (*Anisomeles*- Hexagonal texture and smooth; *Coleus*- Rugose; *Isodon*- Ruff; *Leucas*- Large wall with deep pits; *Ocimum*- hexagonal surface with deep pit; *Plectranthus*- buttons; *Pogostemon*- ruff; *Scutellaria*- Spiny outgrowth with glochidate apex).

Keywords: *Anisomeles*, *Coleus*, *Isodon*, *Leucas*, Morphology, Nut morphometry, *Ocimum*, *Plectranthus*, *Pogostemon*, *Scutellaria*.

Introduction

The Lamiaceae is a worldwide family with c. 236 genera and c. 7000 species. In New Guinea, it is represented by about 24 genera, including c. 75 species, of which nine genera and approximately half the species are arborescent; the others are herbs and often non-native (POWO, 2025) [5]. Lamiaceae is distributed nearly worldwide, and many species are cultivated for their fragrant leaves and attractive flowers. The family is particularly important to humans for herb plants useful for flavor, fragrance, or medicinal properties. The Mediterranean region is the chief centre of distribution. In India 64 genera and 380 species occurring chiefly in dry areas and moderate altitudes (Flora of peninsular India, 2025) [1]. Seed morphometry refers to the physical characteristics and structure of seeds. It includes the external and internal features, such as size, shape, color, surface ornamentation, and cell patterns. Seed morphology can also provide insights into the domestication process and genetic regulation of seeds (Kasem *et al.*, 2016).

Nutlet micromorphological characteristics of five taxa belonging *Lamium* sect. *Amplexicaule* (*L. amplexicaule*, *L. alepicum*, *L. eriocephalum* subsp. *eriocephalum*, *L. eriocephalum* subsp. *glandulosidens*, *L. macrodon*) and additional data taken from literature for *L. persepolitanum* by stereo-binocular microscopy and scanning electron microscopy to show their taxonomic value. Surface of nutlet is reticulate, penta-hexagonal reticulate, penta-hexagonal colliculate, verrucate, verrucate with reticulate (Ozker *et al.*, 2023) [4]. 39 taxa of Turkish *Nepeta* species was examined using both stereoscopic and scanning electron microscopy (SEM). According to surface ornamentations, 3 main types, smooth, partly smooth, and sculptured, and 7 subtypes, undulate-ridged, cellular, reticulate, protuberance, papillate, verrucate, and tuberculate, were reported by Kaya and Dirmenci (2008) [2]. Nutlet morphological in 40 taxa of *Leucas* and two related species of African *Leucas* found in India were examined by light and scanning electron microscopy. Six types of basic ornamentation patterns can be distinguished: scalariform, verrucate, reticulate, ruminant, colliculate, and rugose. Of these, scalariform type was the most common and was found in all the sections of Asian *Leucas*, but the variation in alignment, size and shape

of its composing cells provide further evidence in distinguishing the taxa (Sajna & Sunojkumar, 2018) [6]. Nutlet morphology by Ozkan *et al.* (2009) [3] of 12 *Salvia* species from Turkey showed variation in size, shape, colour, and surface sculpturing. Mericarp size ranged between 1.6–3.5 mm length and 1.0–2.9 mm width. Observed shapes included spherical, trigonous-prolate spheroidal and prolate spheroidal. Seed Morphometric analysis of Orchidaceae with 103 species from North Karnataka has been reported which gives the evidence of evolution the seeds has evolved and diversified with parameters (Betageri & Kotresha, 2024) [7]. *Cyperus melanostachyus* was added to the Indian flora based on seed morphometry only. The seed image shows vertical ridges and horizontal lines (Spoorthi, *et al.*, 2025) [8].

Results

Nutlet Morphometry

Nutlets qualitative morphological characters observed under SEM micrographs. The size, shape, structure of nutlets are discussed below (Table 1).

Anisomeles indica (L.) Kuntze (Fig. 1 A. A1)

Nutlet small, ellipsoid, subquadrate, smooth 1.533×1.055 mm, cleft apex, black-brown colour. The testa cells hexagonal in shape, SEM observation manifested smooth surface and testa cells differentiated in their length and breadth. Therefore, the mean value of nutlet length is 1.533±0.068 and the mean value of breadth is 1.055±0.025.

Anisomeles malabarica (L.) R. Br. (Fig. 1 B. B1)

Nutlets ellipsoid, glossy brown to black colour, smooth surface, apart from a small basal scar with dimension 2.174×1.63 mm. Testa cells cannot be differentiated because of smooth surface. So calculated mean and S.E value of nutlet length is 2.174±0.042 and breadth is 1.63±0.111.

Coleus repens Gurke. (Fig. 1 C. C1)

Nutlet ovoid or ellipsoid, slightly rough, yellowish brown colour with dimension 1.059×0.897 mm. Testa cells

observed on the surface of nutlet with dotted structure and cells are tetragonal and pentagonal in shape, in SEM micrographs shape and structure is observed. The S.E value of length is 1.059 ± 0.032 and breadth 0.897 ± 0.022 .

***Isodon lophanthoides* (Buch. -Ham, ex. D. Don) H. Hara (Fig. 1 D. D1)**

Nutlet yellowish brown, compressed ovoid, glabrous with dimension 0.949×0.678 mm. Nutlet surface sculpturing patterns indicate testa cells are observed by SEM manifestation and shape of the testa cells can't be distinguished because of the rough surface but the structure is similar to droplets of water. The mean and S.E value of length and breadth of whole nutlet is 0.949 ± 0.001 and 0.678 ± 0.009 . Simultaneously the mean and S.E value of testa cells length is 0.023 ± 0.002 and breadth is 0.021 ± 0.002 .

***Leucas angularis* Benth. (Fig. 2 A. A1)**

Nutlet 1.5 mm long, truncate at top, greyish brown with dimension 1.484×0.909 mm. SEM observation reports testa cells present on the surface of nutlets, they are of tetragonal and pentagonal shape. Finally, the calculated mean and S.E value of length and breadth is 1.484 ± 0.026 and 0.909 ± 0.011 .

***Leucas biflora* (Vahl) R. Br. ex Sm. (Fig. 2 B. B1)**

Nutlets oblong, truncate at top, brown in colour with dimension 1.956×1.086 mm. The SEM observation reported the presence of testa cells on the surface of nutlets which is linear in shape and ensuing tetragonal. According to the

alculation of mean of nutlet, the S.E value of length is 1.956 ± 0.033 and breadth is 1.086 ± 0.0005 .

***Ocimum gratissimum* L. (Fig. 2 C. C1)**

Nutlets brown, subglobose, minutely tuberculate, producing mucilage when wet, and the dimension is 1.174×1.029 mm. Testa cells bell or funnel shape and hexagonal. The S.E value of length is 1.174 ± 0.052 and breadth 1.029 ± 0.033 .

***Plectranthus barbatus* Andrews (Fig. 2 D. D1)**

Nutlets are small, ovoid to spherical and the color ranges from brown to black with dimension 1.281×1.237 mm. The S.E value of length and breadth of whole nutlet is 1.281 ± 0.017 and 1.237 ± 0.027 . Testa cells shape varies from each cell on the surface, it can be observed in SEM micrographs with 0.015×0.012 mm dimension. The S.E value of length and breadth of the testa cells is 0.015 ± 0.0005 and 0.012 ± 0.0008 .

***Pogostemon mollis* Benth. (Fig. 3 A. A1)**

Nutlets spherical, dark brown to black with dimension 0.975×0.920 mm. The testa cells are finely punctate refers to the small dot like markings on the surface of the nutlets, which can be seen under SEM magnification. The S.E value of length is 0.975 ± 0.014 , breadth is 0.920 ± 0.032 .

***Scutellaria discolor* Wall. ex Benth. (Fig. 3 B. B1)**

Nutlets subglobose, minutely tuberculate with dimension 0.831 ± 0.674 mm. Testa cells are blunt tipped and pentagonal, pores present. The S.E of whole nutlet length is 0.831 ± 0.032 , breadth is 0.674 ± 0.027 . Testa cells S.E of length is 0.036 ± 0.007 and breadth is 0.019 ± 0.004 .

Parallel Key to some Genera using Nutlet Morphometric Characters

1	Ellipsoid	<i>Anisomeles</i>
1	Other than that,	2
2	Truncate, angled	<i>Leucas</i>
2	Other than that,	3
3	Sub-globose	7
3	Other than that,	4
4	Spherical	<i>Pogostemon</i>
4	Other than that,	5
5	Ovoid	6
5	Ovoid-spherical	<i>Plectranthus</i>
6	Rugose surface	<i>Coleus</i>
6	Ruff surface	<i>Isodon</i>
7	Hexagonal texture with deep pits	<i>Ocimum</i>
7	Spiny outgrowths with glochidate apex	<i>Scutellaria</i>

Table 1: Nut Morphometry and Parameters of some Lamiaceae in Karnataka

Species name	Nutlet Shape	Colour	Surface	L(Mean) \pm S. E	B(Mean) \pm S. E	L/B (mm)
<i>Anisomeles indica</i> (L.) Kuntze	Ellipsoid	Black-brown	Hexagonal texture with dot at center	1.533 ± 0.068	1.055 ± 0.025	1.458
<i>Anisomeles malabarica</i> (L.) R. Br.	Ellipsoid	Brown to black	Smooth	2.174 ± 0.042	1.63 ± 0.111	1.333
<i>Coleus repens</i> Gurke.	Ovoid	Yellowish brown	Rugose texture	1.059 ± 0.032	0.897 ± 0.022	1.18
<i>Isodon lophanthoides</i> (Buch. - Ham, ex. D. Don) H. Hara	Ovoid	Yellowish brown	Ruff texture	0.049 ± 0.001	0.678 ± 0.009	1.399
<i>Leucas angularis</i> Benth.	Truncate	Greyish brown	Hexagonal texture with deep	1.484 ± 0.026	0.909 ± 0.011	1.643
<i>Leucas biflora</i> (Vahl) R. Br. ex. Sm.	Oblong, Truncate	Brown	Large wall like layer with ruff texture	1.956 ± 0.033	1.086 ± 0.0005	1.81
<i>Ocimum gratissimum</i> L.	Sub-globose	Brown to black	Hexagonal texture with deep pit	1.174 ± 0.052	1.029 ± 0.033	1.14
<i>Plectranthus barbatus</i> Andrews	Ovoid-Spherical	Dark brown	Ovoid or circular buttons	1.281 ± 0.017	1.237 ± 0.028	1.035
<i>Pogostemon mollis</i> Benth.	Spherical	Black	Ruff texture	0.975 ± 0.014	0.920 ± 0.032	1.06
<i>Scutellaria discolor</i> Wall. Ex Benth.	Sub-globose	Black	Spiny outgrowths with glochidate tips	0.831 ± 0.032	0.674 ± 0.027	0.001

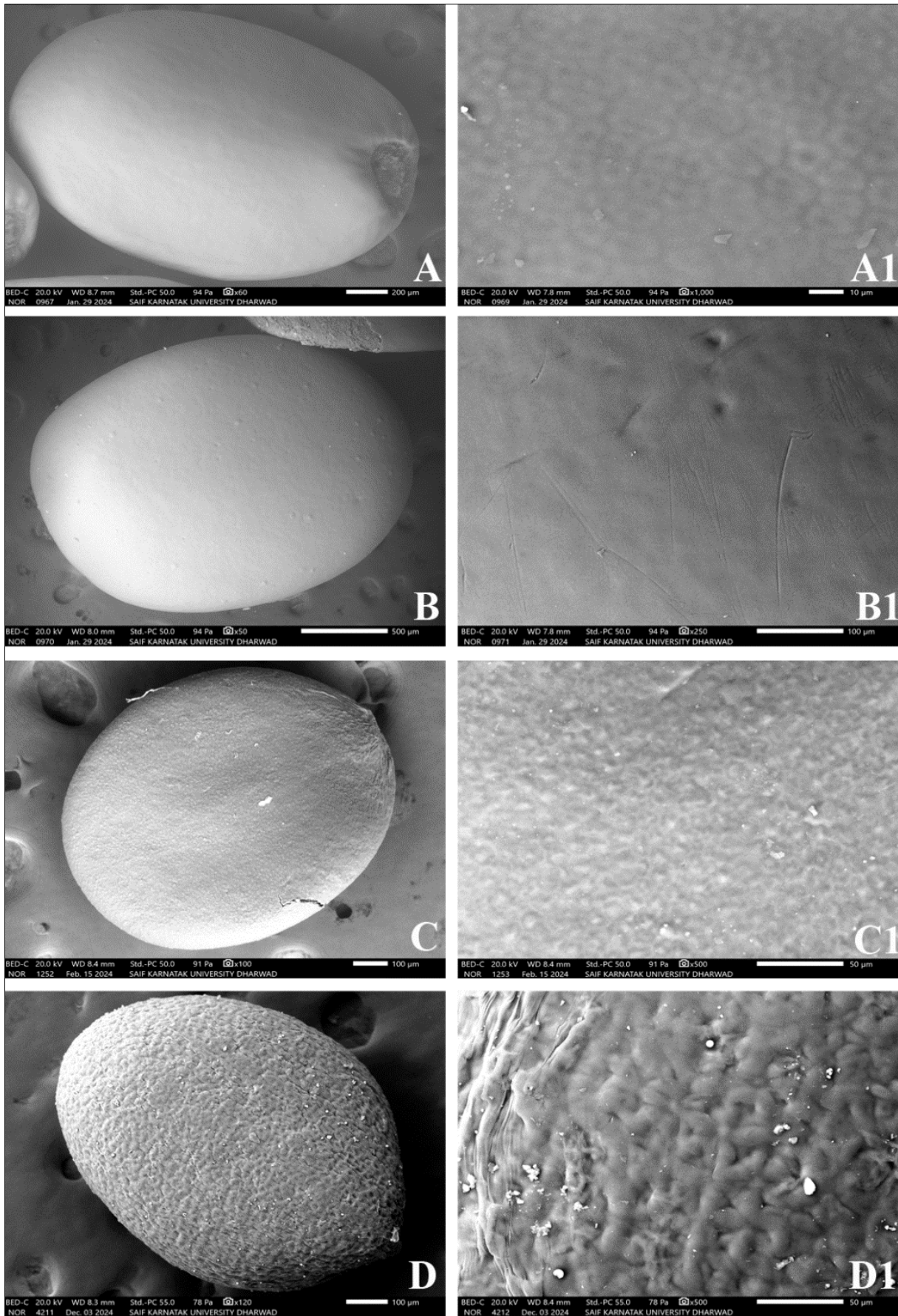


Fig 1: Nut morphometry of some Lamicaeae: A. A1. *Anisomeles indica* (L.) Kuntze; B. B1. *Anisomeles malabarica* (L.) R. Br.; C. C1. *Coleus repens* Gurke.; D. D1. *Isodon lophanthoides* (Buch. -Ham, ex. D. Don) H. Hara.

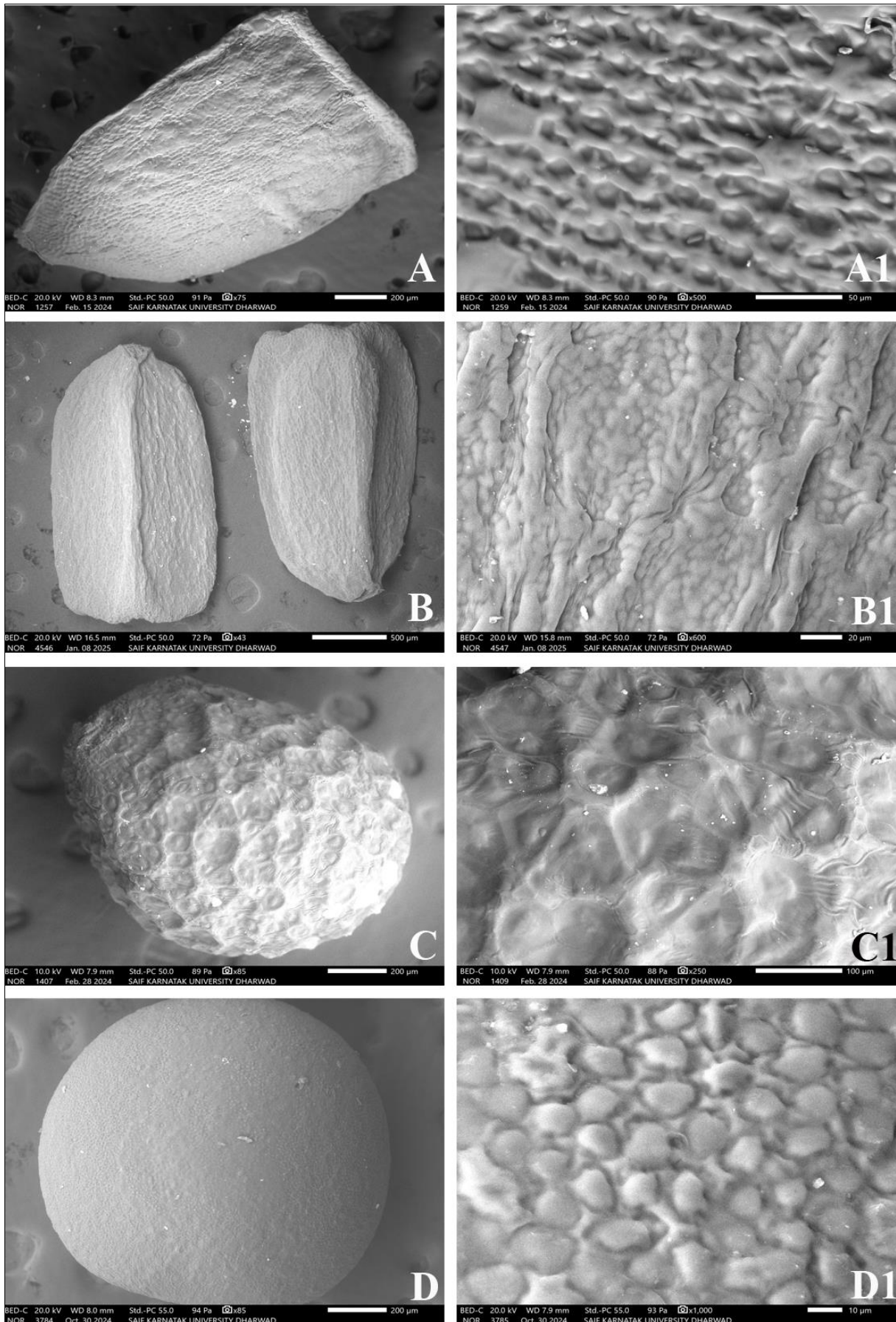


Fig 2: Nut morphometry of some Lamicaeae: A. A1. *Leucas angularis* Benth; B. B1. *Leucas biflora* (Vahl) R. Br. ex Sm.; C. C1. *Ocimum gratissimum* L.; D. D1. *Plectranthus barbatus* Andrews.

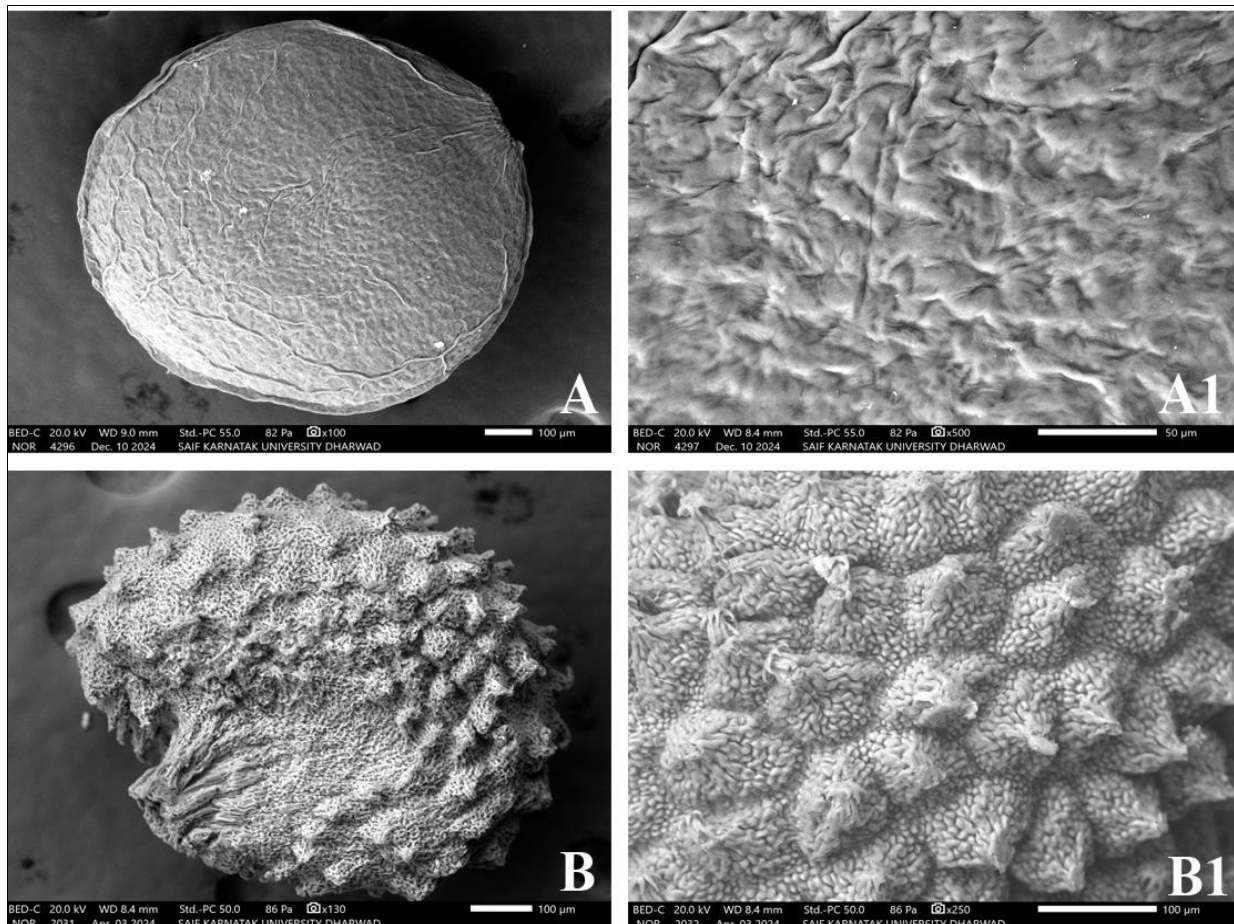


Fig 3: Nut morphometry of some Lamicaeae: A. A1. *Pogostemon mollis* Benth; B. B1. *Scutellaria discolor* Wall. Ex Benth.

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References

1. Flora of Peninsular India Indian Institute of Science (IISc), Bangalore, 2025, 560012. Retrieved on 25/06/2025. <https://indiaflora.ces.iisc.ac.in/FloraPeninsular/index.php>
2. Kaya A., Dirmenci T. Nutlet Surface Micromorphology of the Genus *Nepeta* L. Lamiaceae in Turkey. *Turkish Journal of Botany*, 2008;32:103-112.
3. Ozkan M, Aktas K, Ozdemir C, Gurein G. Nutlet morphology its taxonomic ssutility in *Salvia* Lamiaceae. Mentheae from Turkey. *Acta Bot. Croat*, 2009;68(1):105–115.
4. Ozker CC, Atalay Z, Celep F. Nutlet micromorphology and its taxonomic significance in *Lamium* sect. *Amplexicaule* Lamiaceae. *Acta Biologica Turcica*, 2023;36(1):1-7.
5. POWO Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet, 2025. <https://powo.science.kew.org> Retrieved 27 July 2025.
6. Sajna M, Sunojkumar P. Nutlet micromorphology of Indian *Leucas* Lamiaceae: Lamiaceae with emphasis on its systematic implication. *Rheedea*, 2018;28(1):16–28. <https://dx.doi.org/10.22244/rheedea.2018.28.1.02>
7. Shreyas B, Kotresha K. Seed morphometric with embryo diversity of wild orchids in North Karnataka. *Journal of diversity studies*, 2024;3(2):39-50. <https://doi.org/10.51470/JOD.2024.03.02.39>
8. Spoorthi, D., Betageri S, Patagar GV, Kotresha K. *Cyperus melanostachyus* Kunth (Cyperaceae): A New Report to Indian

Flora. Journal of Diversity Studies, 2025; 4: 73-77.
<https://doi.org/10.51470/JOD.2025.4.1.73>