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To Cite:
Deshi S, Betageri S, Patgar VG, Kotresha K. Achene morphology of some genera of Cyperaceae Juss. in Karnataka. *Species* 2025; 26: e41s3181
doi: https://doi.org/10.54905/disssi.v26i78.e41s3181

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Peer-Review History
Received: 12 June 2025
Reviewed & Revised: 21/June/2025 to 23/August/2025
Accepted: 27 August 2025
Published: 29 August 2025

Peer-Review Model
External peer-review was done through double-blind method.

Species
pISSN 2319–5746; eISSN 2319–5754

DISCOVERY
SCIENTIFIC SOCIETY

Achene morphology of some genera of Cyperaceae Juss. in Karnataka

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ABSTRACT

Achene morphology of some genera of Cyperaceae Juss. in Karnataka has been conducted using a Scanning electron microscope with beautiful ornamentation of the achene surface. Surface shows smooth, verrecose, trabeculate, punticulate. 12 species and six genera are given easy key up to genera based on seed shape and ornamentation.

Keywords: *Bulbostylis, Cyperus, Eleocharis, Fimbristylis, Hypolatrum, Schenoplectiella*, Seed morphometry.

1. INTRODUCTION

Cyperaceae is one of the most prominent family in monocots, records 5,733 across the world (POWO, 2025). India reports around 500 species across different states (Indian Flora online, 2025). In Karnataka 196 species are recorded. Recent invention reports *Cyperus melanostachyus* was added to the Indian flora based on seed morphometry only. The seed image shows vertical ridges and horizontal lines (Deshi, *et al.,* 2025).

Menapace & Wujek (1987) highlighted the significance of the micromorphology study of the *Carex* genus shows character state of achene, presence and absence of silica bodies by using a 1200 scanning electron microscope, which showing micrographs of epidermal features at various magnifications. Wujek *et al.,* (1994) did the work on micromorphology of *Fimbristylis* achenes. Examined the micromorphological study of achenes and study of taxonomic significance of *Fimbristylis* sections by Menapace *et al.,* (2003) reported work based on the treatment of acid solution and removal the cuticle and also revised the study of sectional parameters recognized by Kern.

Khan (2018) reports nut morphology on eight allied species of *Cyperus* genus from the Khandeshi region. Morphology of 8 species of *Cyperus* genus by using LM and SEM. SEM studies at high magnification show different nut, shape, size, dimensions, colour and nut surface sculptures. Collected 8 species of *Cyperus* L. and mentioned highest dimension value in *C. alutatus.*

Studies on the taxonomic significance of Achene Micro and Macromorphlogy in *Cyperus* L. (Cyperaceae), the 15 species of including three subspecies using SEM (Lamiaa, 2015). Shalabi and Gazer (2015) work on 15 achene micro and macro-morphology of *Cyperus* genus by using LM and SEM. The SEM micrographs shows

regular, irregular and angular exocarp cell pattern, undulated, straight and variable periclinal and anticlinal cell walls of achene surface and also conduct 15 phenetic analysis of *Cyperus* species shows long and small achenes.

Studied on 21 achenes of SEM images shows ornamentation, shape, size, periclinal and anticlinal values by Patil & Prasad (2016). Micrograhs shows straight, sinuous, inconspicuous anticlinal walls, the silhouette of epidermal cells are distinctive and compatible with in species and also shows presence & absence of silica bodies. The SEM image of nut shows the shape, color, nut surface and dimension and shows minor polygonal radial and tangential walls are much prominent forming the colliculate surface. The highest seed dimension record in *Cyperus alutatus* Kern. The lowest dimension record in *Cyperus pumilus* L. Some species nut shape is oblong, some are obovoid and some are narrowly oblong and cylindrical and nut colors are blackish, brownish, reddish brown and greyish brown (Khan, 2018).

Work on morphology and phytochemical diversity among some species of family Cyperaceae by Azeez *et al.,* (2022). A total of 34 species including *Cyperus, Fimbristylis, Kyllinga, Mariscus, Pycerus and Rhyncospora* genus are reported. The highest record of achene length is *K. nemoralis* and breadth in *F. dichotoma var. dichotoma.* Micromorphological work shows the epidermal features like tuberculate, smooth outer periclinal walls also shows the epidermal cell character like chambered, costate, sinous, polygonal, marginate, pitted, and shows the complexity of anticlinal walls by using SEM.

2. MATERIALS AND METHODS

Collection of specimen:

Plant specimen were collected in different seasons (monsoon, winter and summer) in different districts (Dharwad, Belgaum, Uttara Kannada district, Shivmogga, Bagalkot, Haveri, Gadag, Bijapur, Gulberga, Bidar). And then identified the collected specimen by using different floras.

Identification of Specimen:

Specimen identification with the following flora (Cooke, 1906; Gamble, 1928; Ramaswamy & Razi, 1973; Saldanha & Nicolson, 1976; Saldanha, 1984 & 1996; Sharma *et al.*, 1984; Singh, 1988; Seetharam *et al.*, 2000; Bhat, 2003; Manjunath *et al.*, 2004; Bhaskar & Kushalappa, 2014; Bhat, 2014; Kotresha & Kambhar, 2016; Seetharam *et al.*, 2018; Yoganarasimhan *et al.* 2018; Sanajappa & Sringeswara, 2019)

Seed Morphometric Study:

Mature seeds were collected in dry form (zipper bag) giving those codes. The seeds are shade dried and conducted Scanning Electron Micrographs. The seeds are mounted on a carbon stub and spread using paint brush without damage. Place the stub into a gold sputtering, using a mini-gold sputter, sputter gold for 30s at ~ 70 m Torr pressure. Remove the stub from gold sputtering system. Than stub is kept under an electron microscope to take micro-photography (Mayada, *et al.*, 2019).

3. RESULTS AND DISCUSSION

During survey, conducted twelve species with different genera achene morphology is carried out to identify genus or species level. Each species have different achene morphology and surface ornamentation. Twelve species out of six genera are conducted and has provided easy key using achene shape, ornamentation of surface (Table 1 & Fig. 1-4).

Key to some genera of Cyperaceae Juss. using achene morphology:

1	Oblong, testa cell shape	**4**
1	Obovate	**2**
2	Elliptic, biconvex	***Cyperus***
2	Other than this	**3**
3	Trigonous, biconvex, brown	***Schenoplectiella***
3	Oblong, black	***Hypolytrum***
4	Rectangle, polygonal	***Bulbostylis***
4	Others	**5**
5	Hexagonal	***Eleocharis***
5	Isodiametric	***Fimbristylis***

Table 1. Achene morphology of some selected genera of Cyperaceae Juss. in Karnataka: **D.**-Dimension; **C.**-Color; **A.**- Apex; **S.O.**-Surface Ornamentation; **B.**- Beak

Sl. No.	Scientific name	Shape	D.	C.	A.	S. O.	B.	Testa cells		
								Shape	L.(mm) (Mean±SD)	B.(mm) (Mean±SD)
1	*Bulbostylis densa* (Wall.) Hand.-Mazz.	Trigonous	0.9621×0.654	Purple	+	T	+	Rectangle, polygonal	0.055±14.829	0.020±3.159
2	*Bulbostylis martimus* (L.) Pall	Trigonous	0.992×0.693	Yellowish	+	P	+	Rectangle, polygonal	0.026±0.0023	0.027±0.0032
3	*Bulbostylis thoursii* (Roem. & Schult.)	Obovoid	0.8436×0.4121	Yellowish	_	S	+	Hexagonal, Polygonal	0.0130±0.0027	5.477±4.742
4	*Cyperus alopecuroides* Rottb.	Lentil (biconvex, flattened disk shape)	1.222×0.776	Brown	+	P	+	Hexagona, Polygonal	0.0249±0.152	0.0210±0.075
5	*Cyperus brevifolius* (Rotb.) Hassk.	Elliptical to Slightly obovate	0.7317×0.4163	Brown	+	T	+	Hexagonal	0.0151±0.0031	0.00328±0.0098
6	*Eleochari scongesta* D.Don	Ellipsoid, Trigonus	1.230×0.615	Dark brown	+	P	+	Hexagonal	0.034±0.007	0.0359±0.039
7	*Eleocharis dulcis* (Burm. f.) Trin. Ex Hensch.	Ellipsoid Trigonus	0.7008×0.523	Dark brown	+	V	+	Isodiametric	0.043±0.006	0.040±0.0508
8	*Fimbristylis cinnamometorum* (Vahl) Kunth.	obovate, biconvex	1.684×1.351	Dark brown	+	S	+	Linear	0.045±0.014	0.0135±0.00136
9	*Fimbristylis cymosa* R. Br.	Obovate, trigonus	0.5019×0.285	Yellow	+	V	+	Isodiametric	0.077±0.0028	0.0703±0.001
10	*Hypolytrum nemorum* (Vahl) Spreng.	Oblong	0.00166×0.5509	Blackish	+	T	+	Hexagonal	0.0392±0.0033	0.0301±0.00309
11	*Schenoplectiella juncoides* (Roxb.) Lye	Oblong, trigonus	0.01959×0.01905	Brown	+	T	+	Hexagonal	0.00141±0.0001	0.3221±0.1377
12	*Schenoplectiella mucronata* (L.) J.Jung & H. K.Choi	Biconvex, trigonus	0.00125×0.6266	Brown	+	P	+	Hexagonal	0.0172±0.0016	0.0188±0.0014

L. Length; B. Breadth; + Present; -Absent; T- Trabeculate; P- Punticulate; V- Verrucose; S- Smooth

Discussion

Colour of seed ranges from purple, brown, black, dark yellow. Shape ranges from obovid, ovoid, trigonous to ellipsoid. *Fimbristylis cinnamometorum* (Vahl) Kunth. records highest length of 1.68 mm and width of 1.35 mm and *Cyperus alopecuroides* Rottb. records highest length of 1.222 mm and width of 0.76 mm. Khan T. A., (2018) reported colour ranging from dark brown-brown, grey and shape ranging from Obovoid, ellipsoid, oblong, ovate. *Cyperus alulatus* reports highest seed volume 1.5-1.8 x 1 mm, from Khandeshi region with other eight species. Shalabi & Gazer (2015) reported twelve Cyperus species variation of primary sculpture with the proposition three ornamentation patterns: reticulate, rugose and granulate. Ornamentation of achene surface is anticlinal walls, superficial silica bodies and the contour of the epidermal cells. Patil and Prasad (2016) using SEM conducted achene studies of 21 species. Achene shape and epidermal patterns were found distinctive and consistent within the species or infraspecific taxon. Variation in the epidermal cells is evident with respect to size of the cell, nature of periclinal wall, the number, thickness and sinuosity of anticlinal walls per cell, and presence or absence of silica bodies. Shaoe varies form biconcve obovate, obtuse and striptate in *Fimbristylis* genus. Deshi et al., (2025) reported the SEM studies on new report to india that is Achenes showing 0.9-1.2 mm long, 0.4-0.6 mm wide, lenticular, ovoid-ellipsoid, apex apiculate, base slightly stiptatae, the faces convex, the surface with transverse undulations, puncticulate, brown. Undulations record 0.05 mm in length and 0.012 mm in width.

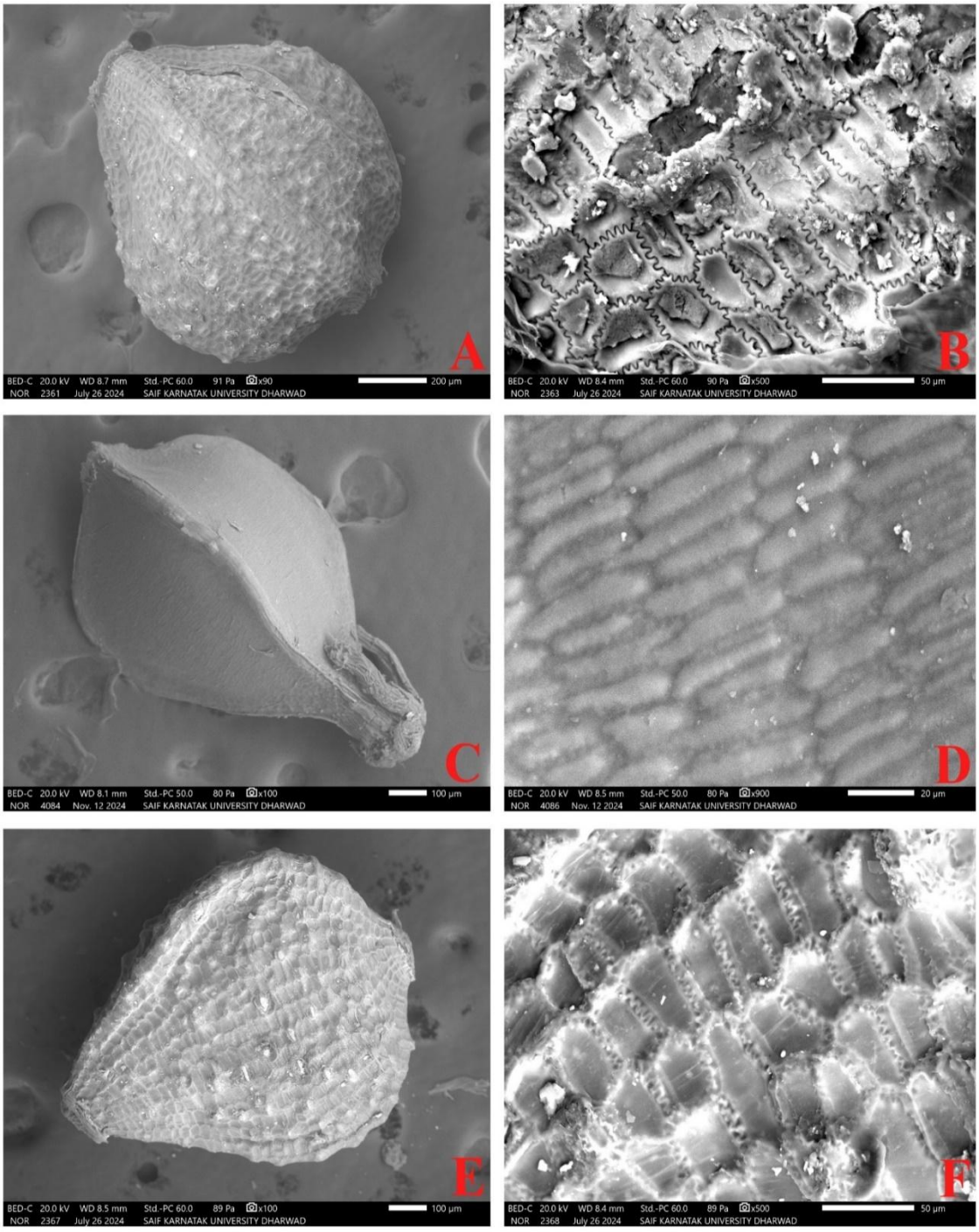

Figure 1. Nut morphology of single seed and enlarged surface: A.B. *Bulbostylis densa* (Wall.) Hand.-Mazz; C. D. *Bulbostylis martimus* (L.) Pall; E. F. *Bulbostylis thouarsii* (Roem. & Schult.) Lye ex Veldkamp & Verloove

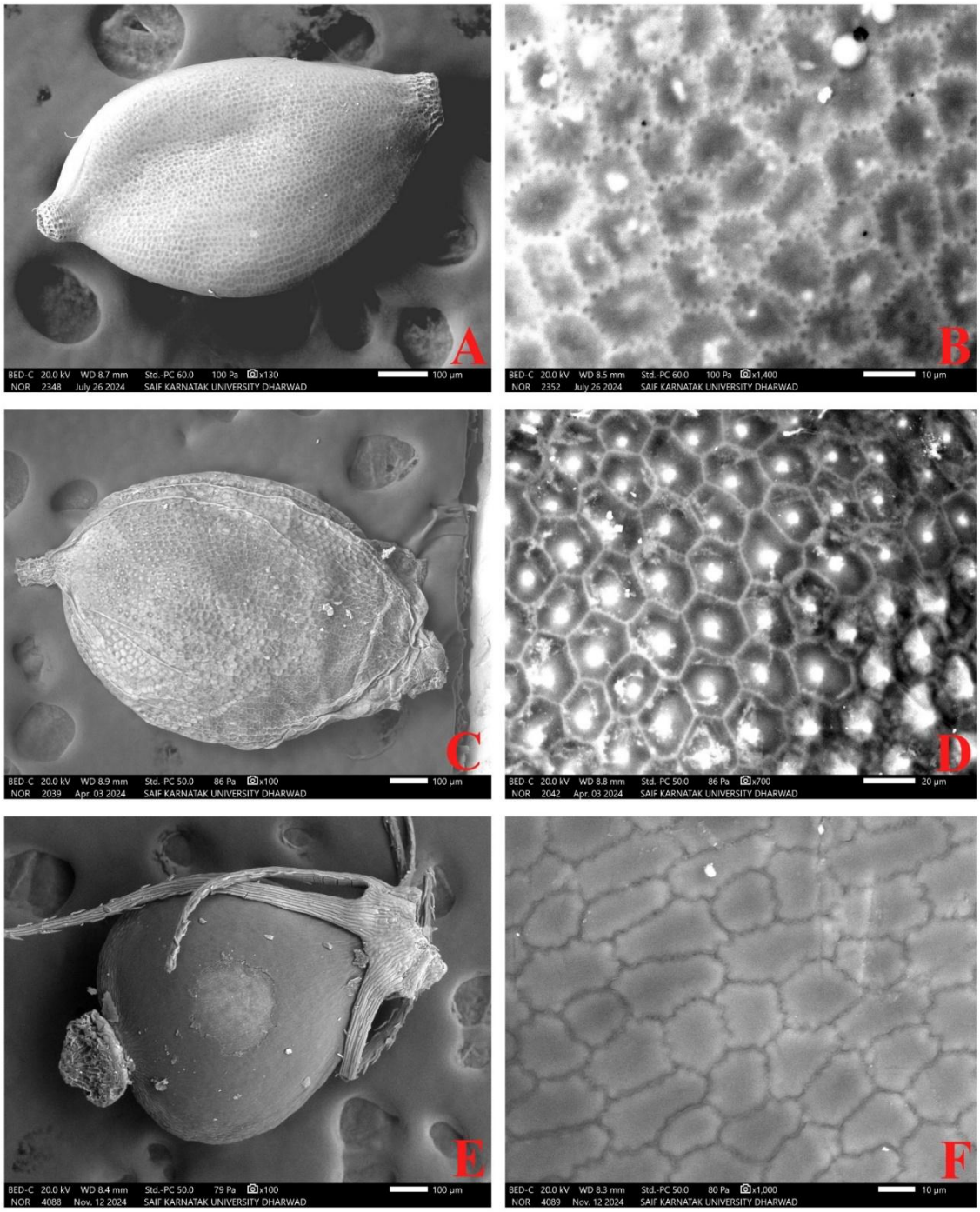

Figure 2. Nut morphology of single seed and enlarged surface: A. B. *Cyperus alopecuroides* Rottb.; C. D. *Cyperus brevifolius* (Rotb.) Hassk.; E. F. *Eleocharis congesta* D. Don

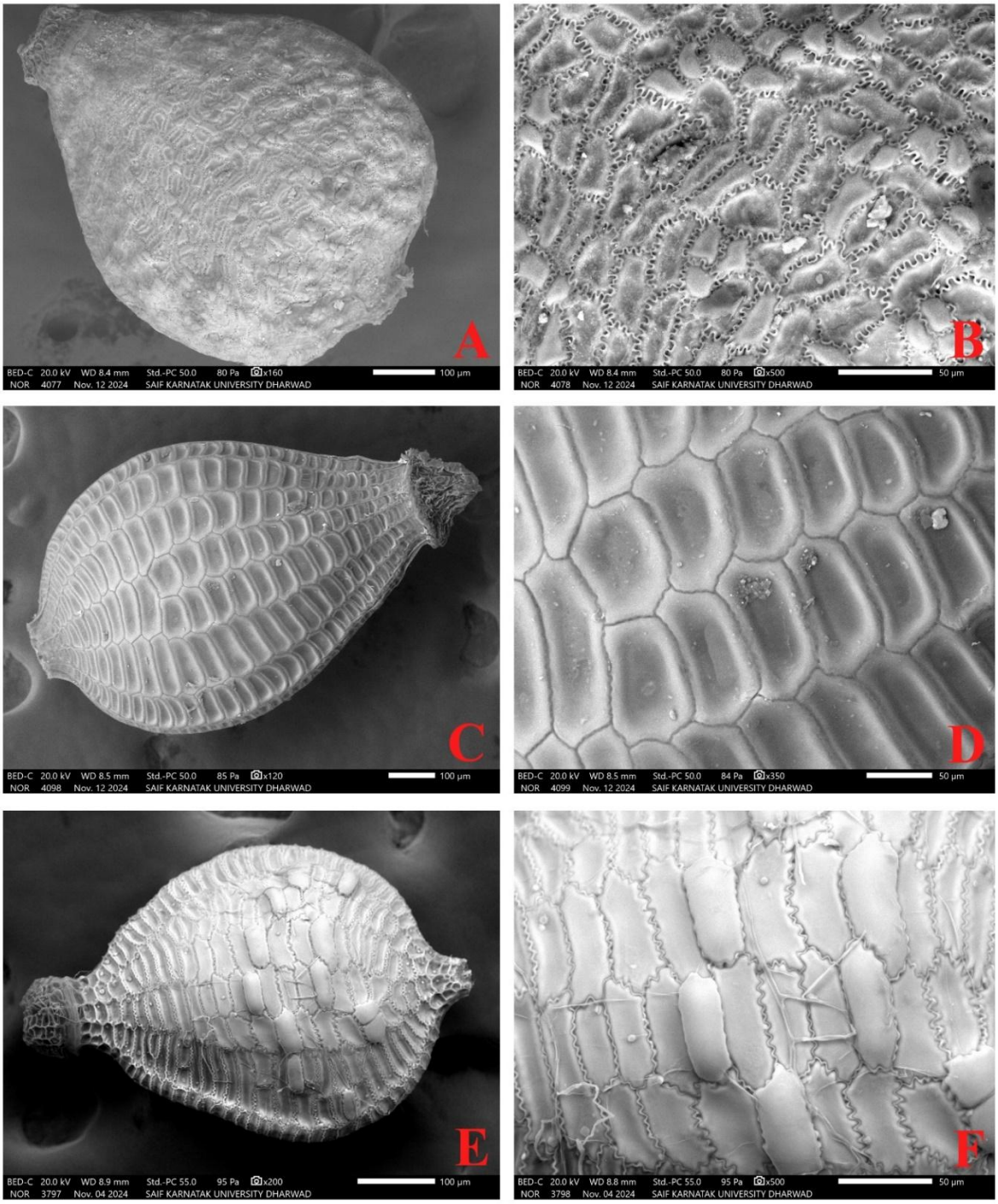

Figure 3. Nut morphology of single seed and enlarged surface: A.B. *Eleocharis dulcis* (Burm. f.) Trin. Ex Hensch. ; C. D. *Fimbristylis cinnamometorum* (Vahl) Kunth; E. F. *Fimbristylis cymosa* R.Br.

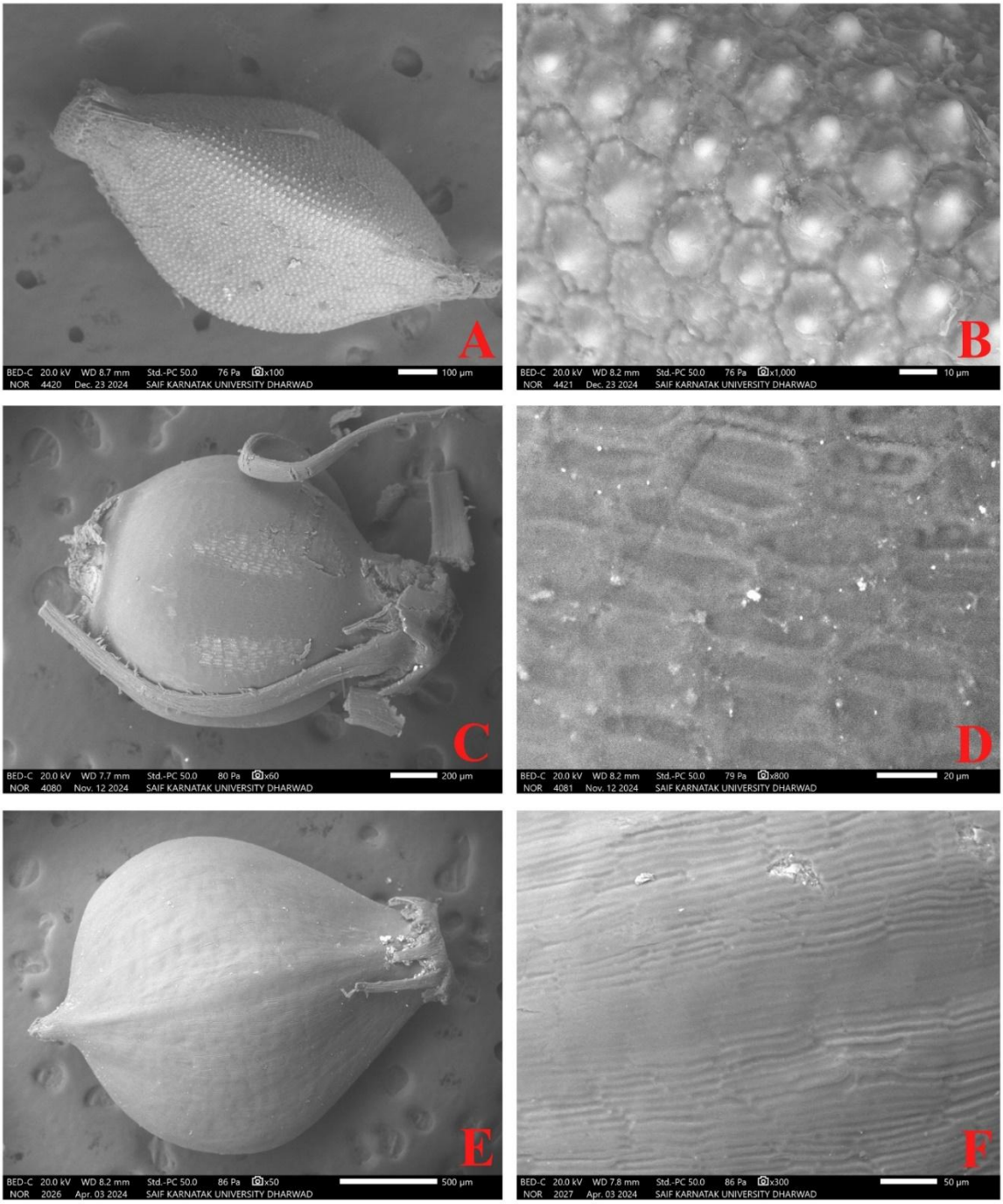

Figure 4. Nut morphology of single seed and enlarged surface: A.B. *Hypolatrum nemorum* (Vahl) Spreng; C. D. *Schenoplectiella juncoides* (Roxb.) Lye; E. F. *Schenoplectiella mucronata*(L.) J. Jung& H. K. Choi

4. CONCLUSION

Cyperaceae Juss. is the conflict family for identification of genera and species, as their glume look similar. So, our study helps to identify by giving parallel key to some genera in Cyperaceae using seed morphometric analysis which is for the first time. And also provided SEM micrographs to identify the seeds using shape of achene also. Some species like *Hypolytrum nemorum* (Vahl) Spreng. and *Bulbostylis martimus* (L.) Pall were conducted for the first time.

Acknowledgment

Authors are mainly thankful to USIC DST SAIF SEM Analysis, Karnatak University Dharwad for SEM photographs and measurements. In addition, the authors are thankful to Rashmi G., Yukti Y., Manjushree K., Rakshitha B. K., and Supriya P. helped us during field visit and collection.

Funding

The study has not received any external funding.

Conflict of Interest

The author declares that there are no conflicts of interests.

Informed consent

Not applicable.

Ethical approval & declaration

In this article, as per the plant regulations followed in the Taxonomy and Floristic Laboratory, Department of UG, PG and Research in Botany, Karnatak University's, Karnataka Science College, Dharwad-580001, India.; the authors observed the Achene morphology of some genera of Cyperaceae Juss. in Karnataka. The ethical guidelines for plants & plant materials are followed in the study for species observation, identification & experimentation.

Data and materials availability

All data associated with this study are present in the paper.

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