

Palynological studies in some species of Lamiaceae in Karnataka

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ABSTRACT

Palynological studies in different genera shows many variations in the Lamiaceae family species. The present work reports 8 (*Anisomeles*, *Coleus*, *Isodon*, *Leucas*, *Ocimum*, *Plectranthus*, *Pogostemon*, *Teucrium*) genera and 12 species palynological work showing SEM photographs with its parameters. Study reports several groups based on size, shape, and surface structure. The observed pollens has a range of ovoid to rhombus with minor variations. The shapes of testa cells was trigonal, tetragonal, pentagonal, hexagonal, spherical, oval in different species. The majority of the shape of pollen and testa cells were similar. Pollen grains show variation size among species with the measurement of length and breadth. S.E. values vary from species to species. Highest length and breadth of pollen is recorded in *Ocimum filamentosum* Forssk. (75.6 μ m & 59.7 μ m) and lowest in *Coleus carnosus* A. Chev. (24.7 μ m & 16.7 μ m). Key up to species using pollen morphology is given in this work to better and through identification of species.

Keywords: Endemic species, Pollen morphometry, Scanning Electron photographs, Mint family, Testa cells.

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 (5). The members of this family are found to inhabit nearly all climatic conditions. Biochemically, they are characterized by the presence of essential oils, which makes many members of this family as wealth of species with medicinal properties and have great application in the pharmaceutical, cosmetic and perfume industry (8).

Pollen morphology of certain species of the family Lamiaceae in Saudi Arabia (4) reported 20 species in which 16 genera are covered with the pollen parameters like length, breadth, shape, surface, with colpi length and made them into groups and subgroups. Note on taxonomic implication of pollen morphology in Lamiaceae from Eastern Himalaya reported 14 species out of 12 genera from Eastern Himalaya with parameters like length, breadth of pollen, colpi number, size of colpi, with exine ornamentation (10). A taxonomic revision of *Anisomeles* R.Br. (Lamiaceae), A.R. Bean reported 26 species are recognized and 18 species newly described (*A. antrorsa* A.R.Bean, *A. brevopilosa* A.R.Bean, *A. bundeyensis* A.R.Bean, *A. carpentarica* A.R.Bean, *A. dallachyi* A.R.Bean, *A. eriodes* A.R.Bean, *A. farinacea* A.R.Bean, *A. grandibractea* A.R.Bean, *A. languida* A.R.Bean, *A. lappa* A.R.Bean, *A. leucotricha* A.R.Bean, *A. macdonaldii* A.R.Bean, *A. ornans* A.R.Bean, *A. papuana* A.R.Bean, *A. principis* A.R.Bean, *A. viscidula* A.R.Bean, *A. vulpina* A.R.Bean, *A. xerophila* A.R.Bean), and one, *A. ajugacea* (F.M.Bailey & F.Muell). With its trichomes, cauline structure of leaf, and inner surface of calyx with key for identification (1). Pollen characterization and medicinal importance of *Ocimum* species of Lamiaceae from Telangana region of South India reported three species of *Ocimum* viz., *Ocimum tenuiflorum*, *Ocimum gratissimum*, and *Ocimum basilicum*, collected from the Telangana region of South India during 2022 was carried out by

using Light Microscope (LM). The pollen grains showed variations in size, shape, with spheroidal to ellipsoidal shape. All the species had hexacolpate pollen grains. The exine is subtectate and sporoderm ornamentation is reticulate with variations in heterobrochate conditions with medicinal value (Antibacterial & Antiviral) (2). Pollen Morphology of *Teucrium* L. (Lamiaceae, Ajugoideae) in Libya in their work reported Pollen Morphology of *Teucrium* L. (Lamiaceae, Ajugoideae) in Libya, reported palynological attributes for species characterization of *Teucrium* with special emphasis on the five Libyan endemics. Two main pollen shapes were documented, subprolate and prolate or perprolate in *T. fruticans*. The exine sculpture inspected at surface, operculum and pole were mostly verrucate, perforate or scabrate. *Teucrium fruticans* attained the phenomenon of pollen dimorphism with two distinct shapes and specific sculpture for each form (7).

Recently in Karnataka, Palynology has not been carried out, but nutlet morphology of 10 species of some Lamiaceae species has been carried out using a scanning electron microscope (11) and Achene morphology of some genera of Cyperaceae has been conducted using a Scanning electron microscope, ornamentation of the achene surface. Surface shows smooth, verrecose, trabeculate, punctulate. 12 species and six genera are given easy key up to genera based on seed shape and ornamentation (3).

Materials and Methods

Collection of the specimens and identifying using different regional, district floras up to species level. Than dissected the flowers in a Magnus stereo-microscope (1-4x), separated the anthers, stored in 70% alcohol. Than the anthers were dried then subjected to SEM analysis (9) and they were recorded based on Palynology glossary (6).

Result and Discussion

During a survey in Karnataka (Belgaum, Gadag, Dharwad, Uttara kannada district, Kodagu) collected 12 species belonging to 8 genera (*Anisomeles*, *Coleus*, *Isodon*, *Leucas*, *Ocimum*, *Plectranthus*, *Pogostemon*, *Teucrium*) and palynological studies were conducted to study their variations and recorded the parameters of pollens (length and breadth), length and breadth of testa cells with various ornamentation on pollens. Parallel key up to species identification using palynology is given in this work.

Table 1. Collection localities of species from Karnataka

Sl.no.	Scientific name	Location	Habit & Habitat	GPS
1	<i>Anisomeles heyneana</i> Benth.	Handibadgnath, Belgaum	H & SE	15°23'23.2"N 74°34'52.5"E
2	<i>Anisomeles malabarica</i> (L.) R.Br.	Doni road, Gadag	US & RS	15°16'27.6"N 75°41'23.8"E
3	<i>Anisomeles indica</i> (L.) Kuntze	Sattur, Dharwad	US & RS	15°24'35.7"N 75°01'38.7"E
4	<i>Coleus carnosus</i> A. Chev.	Handibadgnath, Belgaum	H & SE	15°23'37.0"N 74°34'53.5"E
5	<i>Isodon lophanthoides</i> (Buch.-Ham. ex D. Don) H. Hara	Bheemeshwar road, Uttara kannada district	H & SE	14°02'57.4"N 74°43'07.1"E
6	<i>Leucas angularis</i> Benth.	Anmode, Uttara kannada district	H & MD	15°26'30.5"N 74°18'15.9"E
7	<i>Leucas ciliata</i> Benth.	Ramnagar road, Belgaum district	H & SE	15°25'29.3"N 74°34'04.9"E
8	<i>Leucas biflora</i> (Vahl) Sm.	Devgundi, Kumta, Uttara kannada district	H	14°25'03.5"N 74°25'35.5"E
9	<i>Ocimum filamentosum</i> Forssk.	Kumta, Uttara kannada district	H & LP	14°25'03.5"N 74°25'35.5"E
10	<i>Ocimum gratissimum</i> L.	Dandeli, Uttara kannada district	US & MD	15°13'43.7"N 74°37'06.6"E
11	<i>Plectranthus barbatus</i> Andrews	Kotebetta, Kodagu	H & SG	12°32'46.9"N 75°45'15.5"E
12	<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	Akethi, Anmoda, Uttarakannada	H & MD	15°27'12.8"N 74°18'41.7"E
13	<i>Pogostemon mollis</i> Benth.	Pushpgiri trek route, Kodagu	H & SG	12°39'56.0"N 75°42'21.9"E
14	<i>Teucrium tomentosum</i> B. Heyne ex Benth.	Somvarpet, Kodagu	US & SE	12°41'41.5"N 75°47'38.8"E

US- Undershrib; RS. Roadside; H. Herbs; E. Evergreen; SE. Semi evergreen; MD- Moist deciduous; Lateritic plateau; SG- Shola grassland

The study shows that these pollen can be broadly divided in several groups based on size, shape and surface structure. In the observed pollens has a range of ovoid to rhombus with minor variations. Shapes of testa cells were reticulate, rhombus, foveolate, heterobrochate and oval in different species. The majority of the shape of pollen and testa cells were similar. Pollen grains shows variation size among species with the measurement of length and breadth. S.E. values vary from species to species. *Anisomeles indica* (L.) Kuntze. Pollen was colpate, equatorial shapes oblate-spherical, pollen surface sculpturing-reticulate. *Ocimum gratissimum* L. has colpate, equatorial shape, oblate, pollen surface sculpturing finely homobrochate. *Leucas biflora* (Vahl) Sm. has small testa cell arrangements with thick wall so we couldn't get the measurements.

Key to some Lamiaceae species using palynology in Karnataka:

1	Ovoid	2
1	Other than that	4
2	Reticulate surface	3
2	Foveolate surface	<i>Leucas angularis</i> Benth.
3	Length & breadth ratio is 1.8 mm	<i>Anisomeles heyneana</i> Benth.
3	Length & breadth ratio is 1.2-1.6 mm	4
4	Colpi length is 28-31 µm	<i>Leucas ciliata</i> Benth.

4	Colpi length is 38-41 µm	<i>Teucrium tomentosum</i> B. Heyne ex Benth.
5	Rhombus	5
5	Other than that	9
6	Reticulate or micro-reticulate surface	7
6	Heterobrochate surface	<i>Pogostemon mollis</i> Benth.
7	Colpi length 30-34 µm	8
7	Colpi length less than 30 µm	<i>Coleus carnosus</i> A. Chev.
8	Reticulate surface	<i>Anisomeles indica</i> (L.) Kuntze
8	Heterobrochate surface	<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze
9	Semi ovoid	10
9	Other than that	11
10	6-Zonocolpate	<i>Ocimum gratissimum</i> L.
10	3-Zonocolpate	<i>Leucas biflora</i> (Vahl) Sm.
11	Semi ellipsoid, 6-Zonocolpate	<i>Ocimum filamentosum</i> Forssk.
11	Ellipsoid pollen shape	12
12	Micro-reticulate surface	<i>Anisomeles malabarica</i> (L.) R.Br.
12	Reticulate with elongated surface	<i>Isodon lophanthoides</i> (Buch.-Ham. ex D. Don) H. Hara

Table: 2. Palynological parameters of some species of Lamiaceae in Karnataka

Sl. No.	Scientific name	Shape	L(Mean)±S.E	B(Mean)±S.E	L/B	Surface	TL(Mean)±S.E	TB(Mean)±S.E	TL/TB	Colpi length (µm)	Colpi type
1	<i>Anisomeles heyneana</i> Benth.	Ovoid	36.61±1.005	21.42±0.620	1.709	Reticulate	2.474±0.259	1.457±0.227	1.698	29.74±0.7	3-Zonocolpate
2	<i>Anisomeles indica</i> (L.) Kuntze	Rhombus	37.66±1.146	25.51±0.514	1.476	Micro reticulate	2.459±0.193	1.48±0.161	1.661	34.83±0.3	3-Zonocolpate
3	<i>Anisomeles malabarica</i> (L.) R.Br.	ellipsoid	40.84±3.1	29.43±1.005	1.387	Micro reticulate	2.34±0.188	1.263±0.112	1.852	35.40±0.9	3-Zonocolpate
4	<i>Coleus carnosus</i> A. Chev.	Rhombus	24.7±0.448	16.74±1.126	1.475	Reticulate	1.19±0.172	1.247±0.091	1.531	21.24±0.5	3-Zonocolpate
5	<i>Isodon tophanthoides</i> (Buch.-Ham. ex D. Don) H. Hara	Ellipsoid	0.048±0.0005	0.039±0.001	1.23	Reticulate with elongated cells	0.005±0.0003	0.001±0.0003	5	37.72±0.8	3-Zonocolpate
6	<i>Leucas angularis</i> Benth.	Ovoid	29.75±0.398	19.58±1.038	1.495	Foveolate	1.353±0.017	1.264±0.017	1.07	25.93±0.8	3-Zonocolpate
7	<i>Leucas biflora</i> (Vahl) Sm.	Semi ovoid	33.68±0.630	21.88±0.366	1.539	Foveolate	-	-	-	30.23±0.7	3-Zonocolpate
8	<i>Leucas ciliata</i> Benth.	Ovoid	35.19±0.652	24.18±0.393	1.455	Foveolate	1.51±0.024	1.28±0.024	1.17	30.64±0.6	3-Zonocolpate
9	<i>Ocimum flamentosum</i> Forssk.	Semi ellipsoid	0.756±0.006	0.597±0.023	1.266	Homobrochate	0.152±0.021	0.048±0.041	3.16	39.44±0.1	6-zonocolpate
10	<i>Ocimum gratissimum</i> L.	Semi ovoid	46.77±0.682	41.05±0.643	1.139	Homobrochate	1.37±0.218	2.09±0.218	0.65	28.55±0.2	6-zonocolpate
11	<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	Rhombus	34.35±0.305	24.71±0.534	1.39	Heterobrochate	2.70±0.351	1.868±0.049	1.44	32.49±0.2	3-Zonocolpate
12	<i>Pogostemon mollis</i> Benth.	Rhombus	0.322±0.004	0.259±0.007	1.243	Heterobrochate	0.002±0.0003	0.001±0.0003	2	32.44±1.1	3-Zonocolpate
13	<i>Plectranthus barbatus</i> Andrews	Ovoid	0.374±0.010	0.285±0.005	1.31	Perforate	0.001±0.0003	0.001±0.0003	1	20.55±0.5	6-zonocolpate
14	<i>Teucrium tomentosum</i> B. Heyne ex Benth.	Ovoid	35.67±0.012	30.22±3.58	1.18	Verrucate	0.81±0.001	0.56±0.001	1.44	48.66±1.2	3-Zonocolpate

L. Length of pollen; B. Width of pollen; S.E Standard error; L/B Length/breadth; P-Pentagonal; H-Hexagonal; Tri-Triangular; Tetra-tetragonal; L-Linear; S-Spherical; O-Oval; TL- Testa cell length; TB- Testa cell breadth; TL/TB- Testa cell length/ breadth

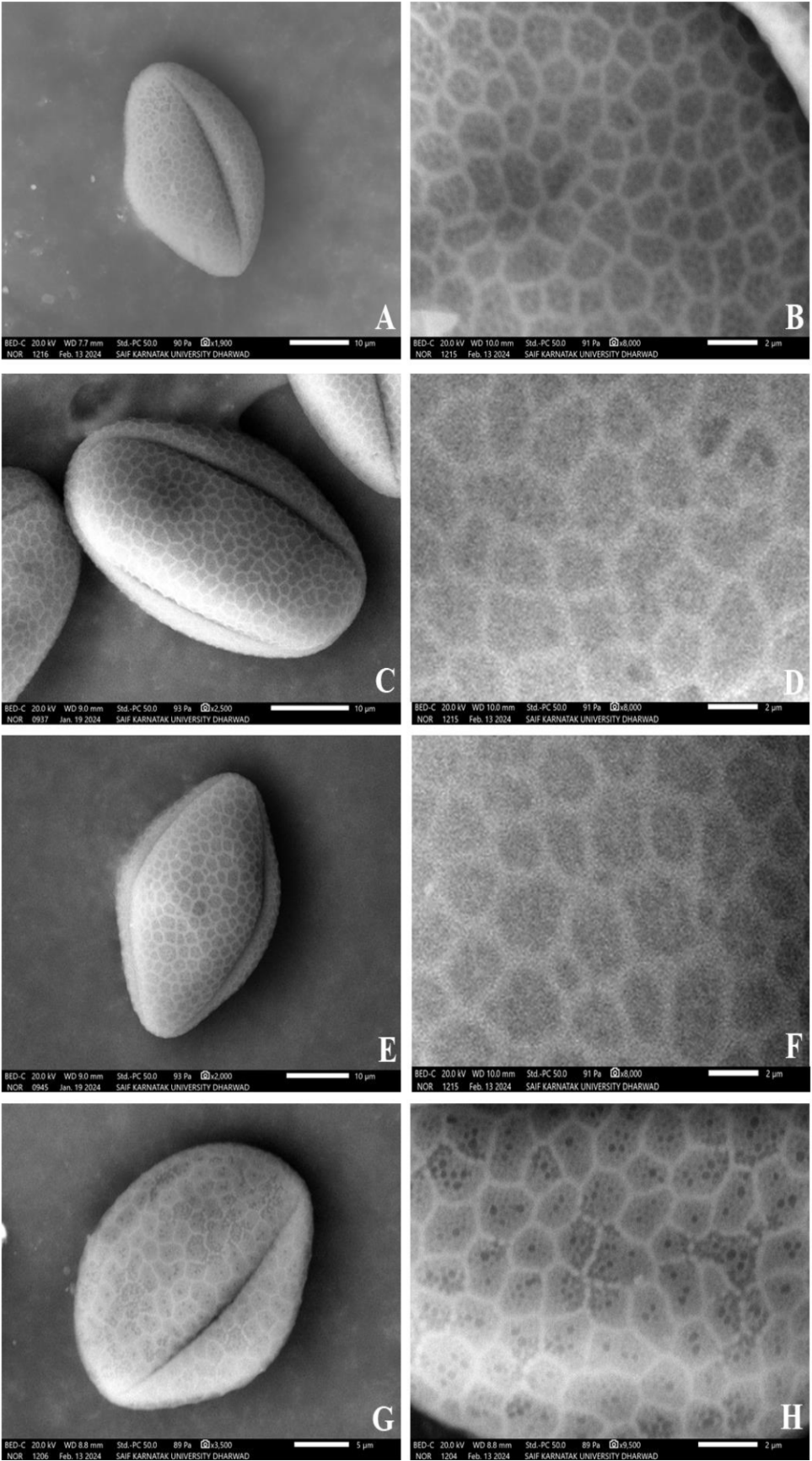


Fig. 01. Pollen & testa cells enlarged: A & B. *Anisomeles heyneana* Benth.; C, & D. *Anisomeles malabarica* (L.) R.Br.; E, & F. *Anisomeles indica* (L.) Kuntze; G, & H. *Coleus carnosus* A. Chev.

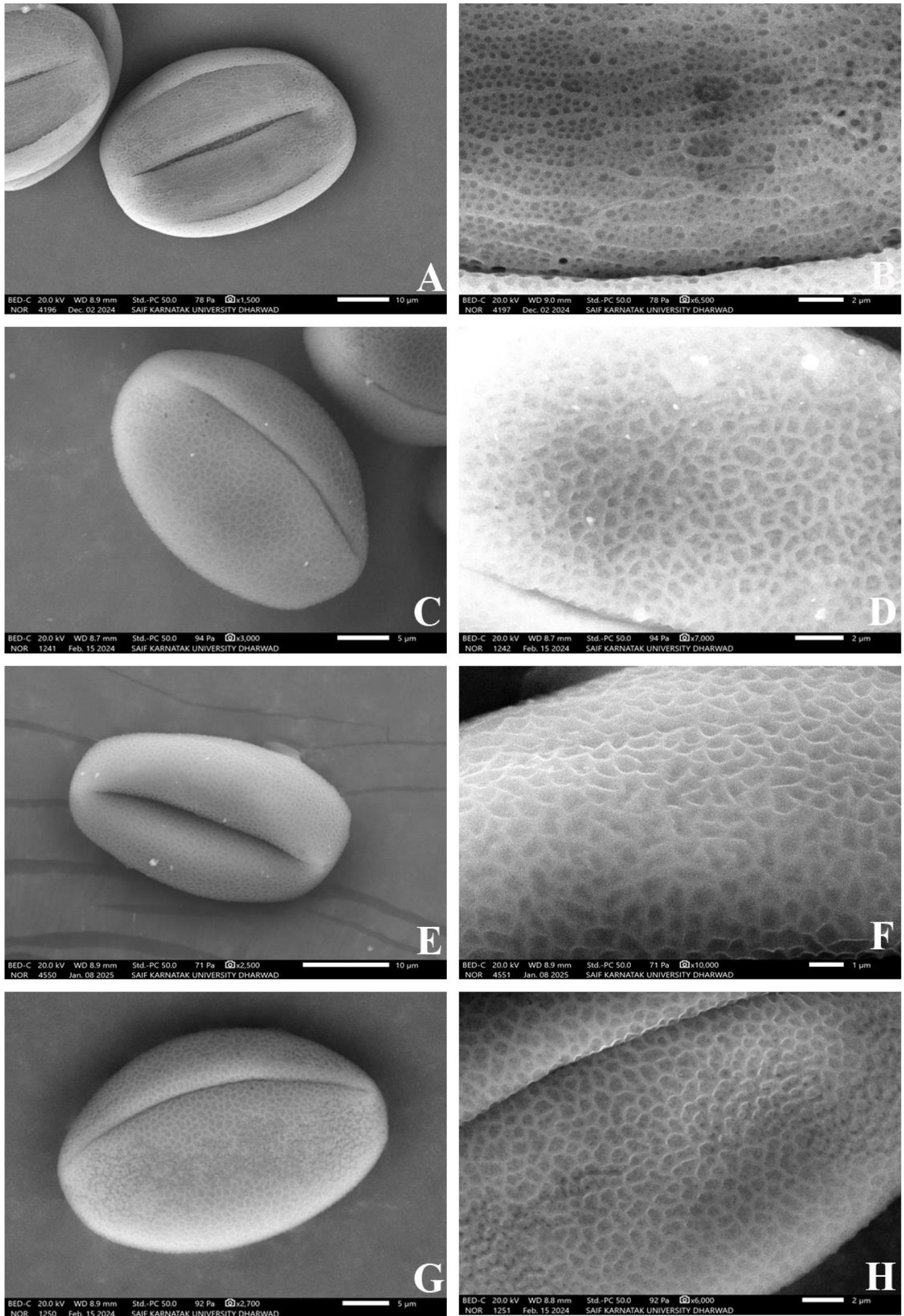


Fig. 02. Pollen & testa cells enlarged: **A & B.** *Isodon lophanthoides* (Buch.-Ham. ex D. Don) H. Hara; **C. & D.** *Leucas angularis* Benth.; **E. & F.** *Leucas biflora* (Vahl) Sm.; **G. & H.** *Leucas ciliata* Benth.

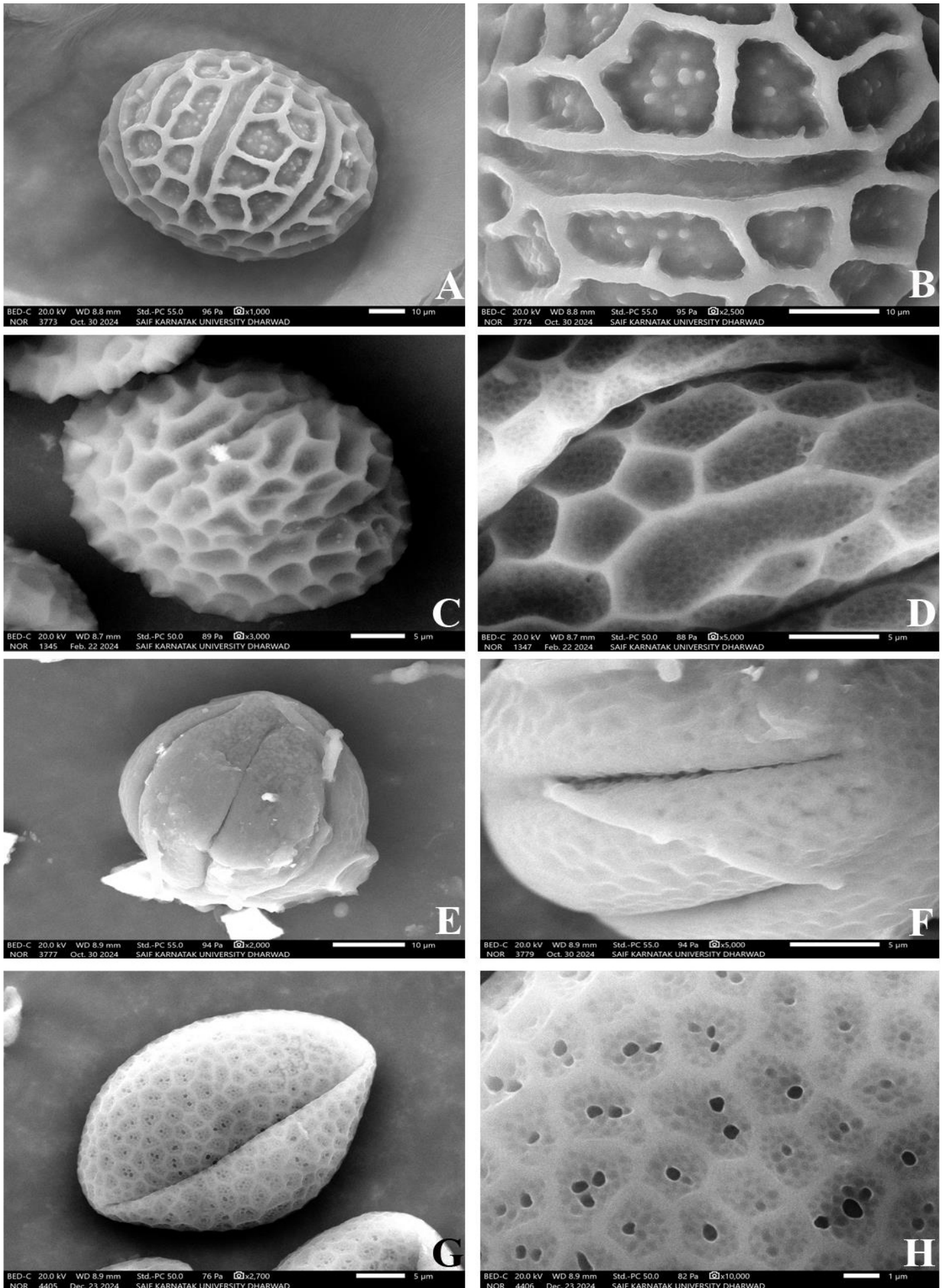


Fig. 03. Pollen & testa cells enlarged: **A & B.** *Ocimum filamentosum* Forssk.; **C. & D.** *Ocimum gratissimum* L.; **E. & F.** *Plectranthus barbatus* Andrews; **G. & H.** *Pogostemon benghalensis* (Burm.f.) Kuntze

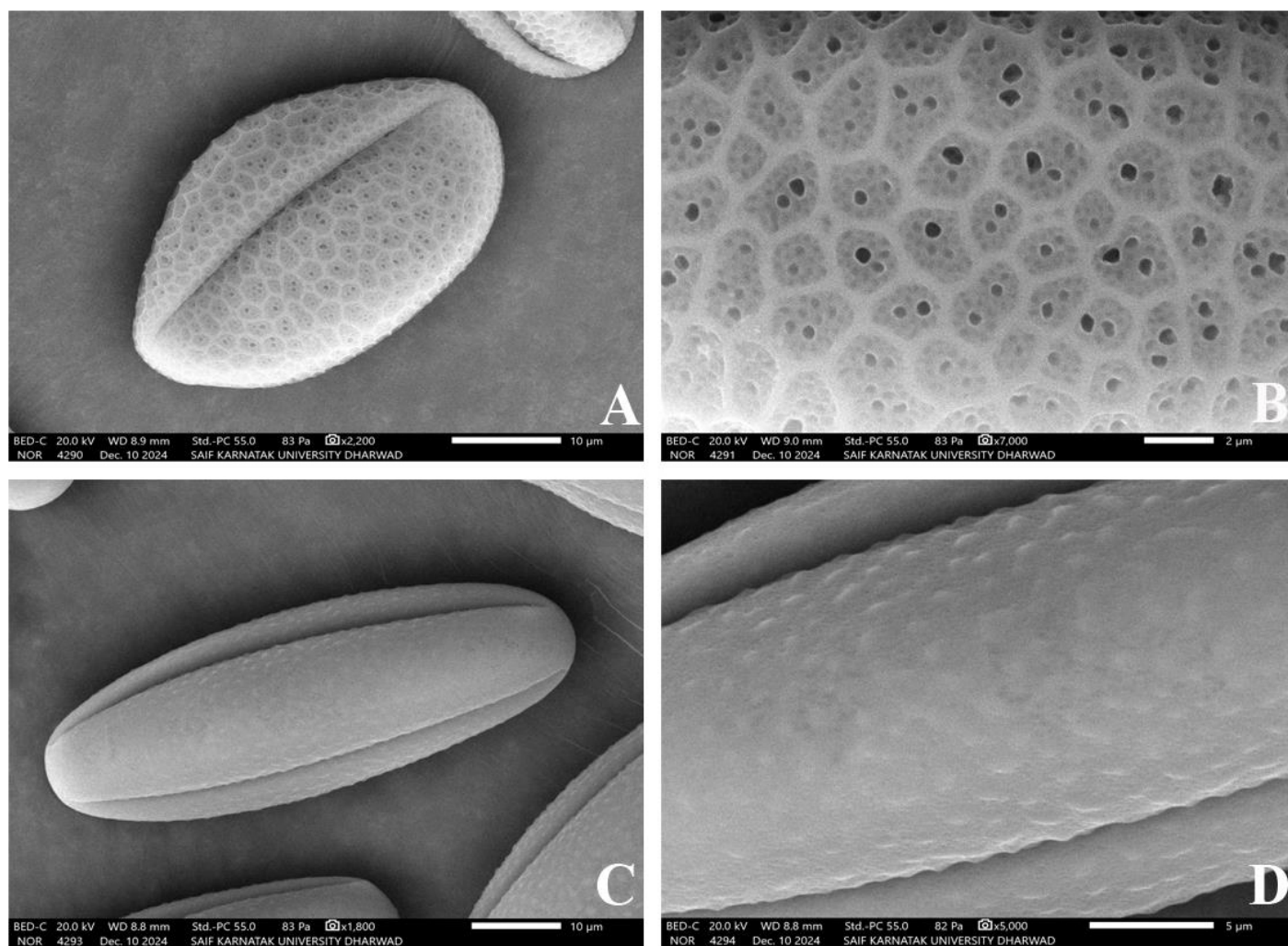


Fig. 04. Pollen & testa cells enlarged: A. & B. *Pogostemon mollis* Benth; C. & D. *Teucrium tomentosum* B. Heyne ex Benth

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