

Species

To Cite:

Patil T, Patgar VG, Betageri S, Kambhar SV, Kotresha K. Taxonomic Notes on *Cleome angulata* (DC.) Schult. & Schult.f. and *Cleome chelidonii* L.f. (Cleomaceae), with the First Record of *Cleome angulata* from Karnataka, India. *Species* 2026; 27: e20s3298
doi:

Author Affiliation:

¹Taxonomy and Floristic Laboratory, Department of UG, PG and Research in Botany, Karnatak University's, Karnataka Science College, Dharwad-580001, India.

²Department of Botany, Sriman Niranjan Jagadguru Pancham Shri Nijalingeshwar Mahaswamigalu (S.N.J.P.S.N.M.S) Trust's, Computer Application, Science and Commerce Degree College, Nidasoshi- 591 236, Hukkeri, Belagavi, Karnataka, India.

³J.S.S Banashankari Arts, Commerce and Shantikumar Gubbi Science College, Vidyagiri, Dharwad, Karnataka, India.

*Corresponding Author:

Shreyas Betageri,
J.S.S Banashankari Arts, Commerce and Shantikumar Gubbi Science College, Vidyagiri, Dharwad, Karnataka, India.
Email: shreyasbetageri@gmail.com

E- mail list:

Shreyas Betageri	shreyasbetageri@gmail.com
Vanaja G. Patgar	vanajapatgar3373@gmail.com
K. Kotresha	kotresh_sk@yahoo.com
Tejashwini Patil	tejupatil591@gmail.com
Sidanand V. Kambhar	sidanand.kambhar@gmail.com

ORCID:

Shreyas Betageri	0000-0002-6554-2965
Vanaja G. Patgar	0009-0009-3368-5038
K. Kotresha	0000-0003-1035-3937
Sidanand V. Kambhar	0000-0002-1701-0892

Peer-Review History

Received: 16 February 2026
Reviewed & Revised: 01/March/2026 to 18/July/2026
Accepted: 30 July 2026
Published: 16 August 2026

Peer-Review Model

External peer-review was done through double-blind method.

Species
pISSN 2319-5746; eISSN 2319-5754



© The Author(s) 2026. Open Access. This article is licensed under a [Creative Commons Attribution License 4.0 \(CC BY 4.0\)](http://creativecommons.org/licenses/by/4.0/), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.



Taxonomic Notes on *Cleome angulata* (DC.) Schult. & Schult.f. and *Cleome chelidonii* L.f. (Cleomaceae), with the First Record of *Cleome angulata* from Karnataka, India

Tejashwini Patil¹, Vanaja G Patgar¹, Shreyas Betageri^{3*},
Sidanand V Kambhar², Kotresha K¹

ABSTRACT

Cleome angulata (Cleomaceae) is recorded for the first time from Dharwad District, Karnataka. This species was earlier reported from the states of Andhra Pradesh, Maharashtra, and Telangana. The present record considered as a new distributional record for the state which extends from the known geographical range. The present species has been compared with *Cleome chelidonii* with respect to stem anatomy and seed morphometry. The comparative account is represented with differences in characters such as vegetative, anatomical, and seed which will be reliable taxonomic evidence for species delimitation. The present study provides a detailed morphological description along with coloured photoplate is provided.

Keywords: *Corynandra*, *Polanisia*, stem anatomy, seed morphometry, tubercles.

1. INTRODUCTION

The family Cleomaceae Airy Shaw represented with ca 225 species which is distributed across the tropical and subtropical regions, extending from western and central Canada to Mexico. It includes two principal genera, *Cleome* L. and *Cleomella* DC. According to the Plants of the World Online (POWO, 2026), *Cleome* is the largest genus in the family, reporting 203 accepted species with a tropical and subtropical regions of the world. In India, this family is represented by 17 species including three varieties, of which two species and three varieties are endemic (Reddy & Raju, 2001; Reddy & Reddy, 2016). In, Karnataka, the diversity of Cleomaceae has been studied by several authors, such as Sanjappa and Sringseshwara (2019) has recognized two genera, *Cleome* L. and *Corynandra* Schrad. ex Spreng., represented by six and three species respectively. Successively, Ravikumar et al. (2021) have documented eleven species belonging to two genera, including ten species of *Cleome* and one cultivated species that is *Cleome serrata* which is classified under the split genus *Cleoserrata*.

Corynandra elegans Chandore, U.S. Yadav & S.R. Yadav was described as a distinct species based on its close affinity with *Corynandra chelidonii* (L.f.) Cochrane & Iltis. The new species was distinguished by several diagnostic characters, including its

perennial habit (versus annual or perennial), presence of root suckers (versus absent), 3–5-foliolate basal leaves (versus 7–9-foliolate), larger flowers (5–9 cm versus 1.5–2 cm across), petals up to 4.5 cm long (versus up to 1.4 cm), 125–250 stamens (versus 35–60), longer capsule beaks (8–14 mm versus 2–4 mm), and seeds possessing blunt tubercles with deep, open clefts (versus pointed tubercles with shallow, closed clefts) (Chandore et al., 2016). Earlier, Reddy and Raju (2001) described *Cleome chelidonii* var. *pallae* from Andhra Pradesh based on its erect habit reaching up to 1.2 m in height, variation in leaf size, capsule beaks measuring 5–10 mm, seeds lacking tubercles but bearing scattered scales, together with several additional minor morphological characters.

During the regular field survey in Dharwad District, Karnataka, the several specimens were collected from different habitat, the authors encountered with the collection of *Cleome* species, which was growing in marshy habitats near to ponds in Dharwad. Initially, based on Chandore et al. (2016) literature, it was identified as *Corynandra elegans*. After thorough examination of the morphological characters, stem anatomical features, seed morphometry, and relevant recent taxonomic literature, it was identified as *Cleome angulata* (DC.) Schult. & Schult.f. Recent taxonomic revision by Singh et al. (2022).

2. MATERIALS AND METHODS

Specimen collection and identification

The specimens of the genus *Cleome* were collected in surrounding of marshy regions in Udayagiri Lake, Sattur, Dharwad district, Karnataka, India. The collected specimens were processed and prepared herbarium using standard guidelines by Rao and Jain (1976). The identification was carried out by reference relevant taxonomic literature (Chandore et al., 2016; Singh et al., 2022). Photographs of the specimens were taken using a Nikon DX40 camera. The authenticated specimens were deposited in the Herbarium, Department of Botany, Karnatak Science College, Dharwad, Karnataka, India (HKSCD).

Stem anatomical study

Fresh stem samples were collected from mature individuals of both species, soaked for one day, free-hand transverse sections were prepared stem using a sharp razor blade. The sections were stained with safranin and examined under a Magnus fluorescent light microscope. Digital photomicrographs were captured using mobile camera (OPPO IFS9) and anatomical characters including epidermis, cortex, vascular bundles, and pith were comparatively analysed (Gulaguli et al., 2025).

Seed morphology and scanning electron microscopy (SEM)

Mature seeds from both species were examined under a stereomicroscope to record seed shape, color, and morphometric parameters. Length and breadth of seeds were measured using a calibrated ocular micrometer. For scanning electron microscopy (SEM), clean and dry seeds were mounted on aluminium stubs using double-sided conductive carbon adhesive tape and sputter-coated with gold for 30 s at approximately 70 m Torr using a mini sputter coater. The coated specimens were examined under a scanning electron microscope, and digital micrographs were obtained at different magnifications to observe the seed coat ornamentation, testa cell morphology, and surface sculpturing. SEM observations were performed following the methodology of Deshi et al. (2025).

3. RESULTS & DISCUSSION

Taxonomic treatment

***Cleome angulata* (DC.) Schult. & Schult.f.** in J.J.Roemer & J.A.Schultes, Syst. Veg., ed. 15[bis]. 7: 45 (1829); *Corynandra elegans* Chandore, U.S.Yadav & S.R.Yadav in Phytotaxa 260: 90 (2016); *Cleome chelidonii* var. *pallae* C.S.Reddy & V.S.Raju in J. Econ. Taxon. Bot. 25: 217 (2001); A.P.D. Candolle, *Polanisia angulata* DC. Prodr. 1: 242 (1824). (Figure 1).

Erect, perennial aquatic, much branched up to 2 m high with perennial rootstock. Rootstock ca. 3 cm in diameter, stout, erect, up to 40 cm long, rarely branched, white to cream color inside and brown outside. Stem erect, branched, glabrous, spongy, dark green, smooth. Basal leaves 3–5 foliate; leaflets up to 5 cm long, central leaflet longer than lateral leaflets, hairy, dark green, lanceolate, midrib prominent on ventral side; petiole up to 6 cm long, hairy, grooved on dorsal side; middle leaves 1–3 foliate; leaflets up to 14 cm long, central leaflet much longer than laterals, glabrous, linear, entire at margin, midrib prominent on ventral side; petiole up to 6 cm long, glabrous, slightly swollen at both region, glandular, grooved on dorsal side; upper leaves 1-foliolate, up to 13 cm long, linear, glabrous, entire at margin, midrib prominent on ventral side; petiole up to 6 cm long, glandular throughout, grooved on dorsal side. Flowers in terminal and axillary racemes, racemes 5–10 flowered; pedicels up to 6 cm long, glabrous, with very minute glands. Bracts small, up to 2 mm long, linear, glabrous. Sepals 4, 2 inner, 2 outer, closely opposite-decussate, ovate, acute, 4–5.5 × 3–3.8 mm, scarious at margin,

pinkish at tip. Petals 4, oblong-elliptic to oval, 2.3–4.5 × 1.5–3.1 cm, mucronulate, rosy (pink), yellowish white below. Stamens 125–250; anthers basifixed, brown to black; filaments up to 4.4 cm long, white in lower half and rosy in upper half, abruptly swollen at apex, swollen part with lower half pink, upper half white. Ovary sessile, linear, 1–2.2 cm long, 1–1.2 mm thick, yellowish green, glabrous. Capsule linear-cylindric, 5–10 × 0.25–0.35 cm, narrow at the base and apex, glabrous, beaked at apex, beak 8–14 mm long. Seeds 40–70, spheroidal to ovoidal, 1.8–2.3 mm across, brown to reddish brown, cleft open, deep; testa with blunt tubercles.

Flowering and Fruiting: June–July.

Specimen Examined: India, Karnataka, Dharwad, Sattur, KHB Colony, Udaygeri Lake, 06-06-2025, 15°24'45.2"N 75°01'43.3"E, 003, 05-05-2025, Tejashwini P., HKSCD21495 (Figure 2).

Distribution in India: Maharashtra, Telangana, Andhra Pradesh, Karnataka (Present record).

Cleome chelidonii L.f., Suppl. Pl. 300. (1782); *Corynandra chelidonii* (L.f.) Cochrane & Iltis, Novon 23(1): 22. (2014); B. D. Sharma et al., Fl. Karnataka Anal. 9. (1984); *Polanisia chelidonii* (L.f.) DC., Prodr. 1: 242. (1824); *Cleome chelidonii* var. *pallae* C. S. Reddy & V. S. Raju, J. Econ. Taxon. Bot. 25: 217. (2001), (Figure 3).

Erect, annual herb, much branched up to 1.5 m high; internodes to 12 cm. Basal leaves 3–5 foliate; leaflets up to 4–7 × 0.3–0.7 cm. lanceolate, cuneate at base, acute or rounded at apex, margin crenate to crenate-serrate. Petiole 4–8 cm, upper leaves 1–3 foliate; leaflets linear, base cuneate or rounded, apex acute, serrate. Petiole 2–4 cm. Flowers showy, pinkish or rosy in lax terminal corymbose racemes. Bracts foliaceous 1.5 mm long. Flower buds are ovoid. Sepals elliptic, acuminate 1.5–2 mm. Petals ovate, 1.4–1.7 cm, rosy (pink). Stamens numerous (120–160); filaments 1.5–1.8 cm, purple tinged. Ovary sessile, 8–10 mm long, glabrous. Capsule linear cylindrical, narrow at the base, beak 5–10 mm long. Valves striate, parallel nerved, glabrous. Seeds are asymmetrical to ovoid, comma shaped, compressed. 1.3–1.8 mm in diam. dark brown, central portion paler and smooth, cleft narrow, slightly coloured, about 0.5–0.7 mm deep. Testa with scattered scales, bearing waxy coating, elaiosome absent.

Specimen examined: India, Karnataka, Dharwad, Sattur, KHB Colony, Udaygeri marshy area 15°24'46.1"N 75°01'45.0"E, 004, 10-05-2025, Tejashwini P., HKSCD21496 (Figure 4).

Distribution in India: Karnataka (Belagavi, Dharwad, Kalburgi, Mysuru, Uttara Kannada), Andhra Pradesh, Bihar, Goa, Himachal Pradesh, Jammu & Kashmir, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu.

Stem anatomy

The stem anatomy of *Cleome angulata* and *C. chelidonii* exhibited a similar basic anatomical organization, consisting of a single-layered epidermis, cortex, a ring of vascular bundles, and a well-developed central pith (Figure 5). However, several qualitative differences were observed between the two species. In *Cleome angulata* (Figure 5A–A3), the stem in transverse section appeared nearly circular with a comparatively thicker cortex and a broad vascular cylinder. The epidermis was uniseriate and covered by a distinct cuticle (Figure 5A1). The cortical region consisted of compact parenchymatous cells. Numerous collateral vascular bundles were arranged in a continuous ring, with well-developed xylem and phloem tissues (Figure 5A2). The xylem occupied a relatively larger portion of the vascular bundle, showing prominent vessel elements. The central pith was extensive and composed of compact, thick-walled parenchymatous cells with comparatively smaller intercellular spaces (Figure 5A3).

In *Cleome chelidonii* (Figure 5B–B3), the stem was comparatively smaller in diameter. The epidermis was also uniseriate but appeared comparatively thinner (Figure 5B1). The cortex consisted of parenchymatous cells with relatively larger cell size. The collateral vascular bundles were arranged in a ring similar to those of *C. angulata*, although individual bundles appeared relatively smaller with less developed xylem tissue (Figure 5B2). The pith was composed of large, thin-walled parenchymatous cells with conspicuous intercellular spaces, giving it a comparatively loose appearance (Figure 5B3).

These two species shared the same common stem anatomical pattern, but differed in the thickness of the cortical region, development of vascular tissues, and the structure of the pith. *Cleome angulata* was characterized by a broader vascular cylinder with comparatively robust xylem and a compact pith, whereas *C. chelidonii* possessed relatively smaller vascular bundles and a looser pith composed of larger parenchymatous cells.

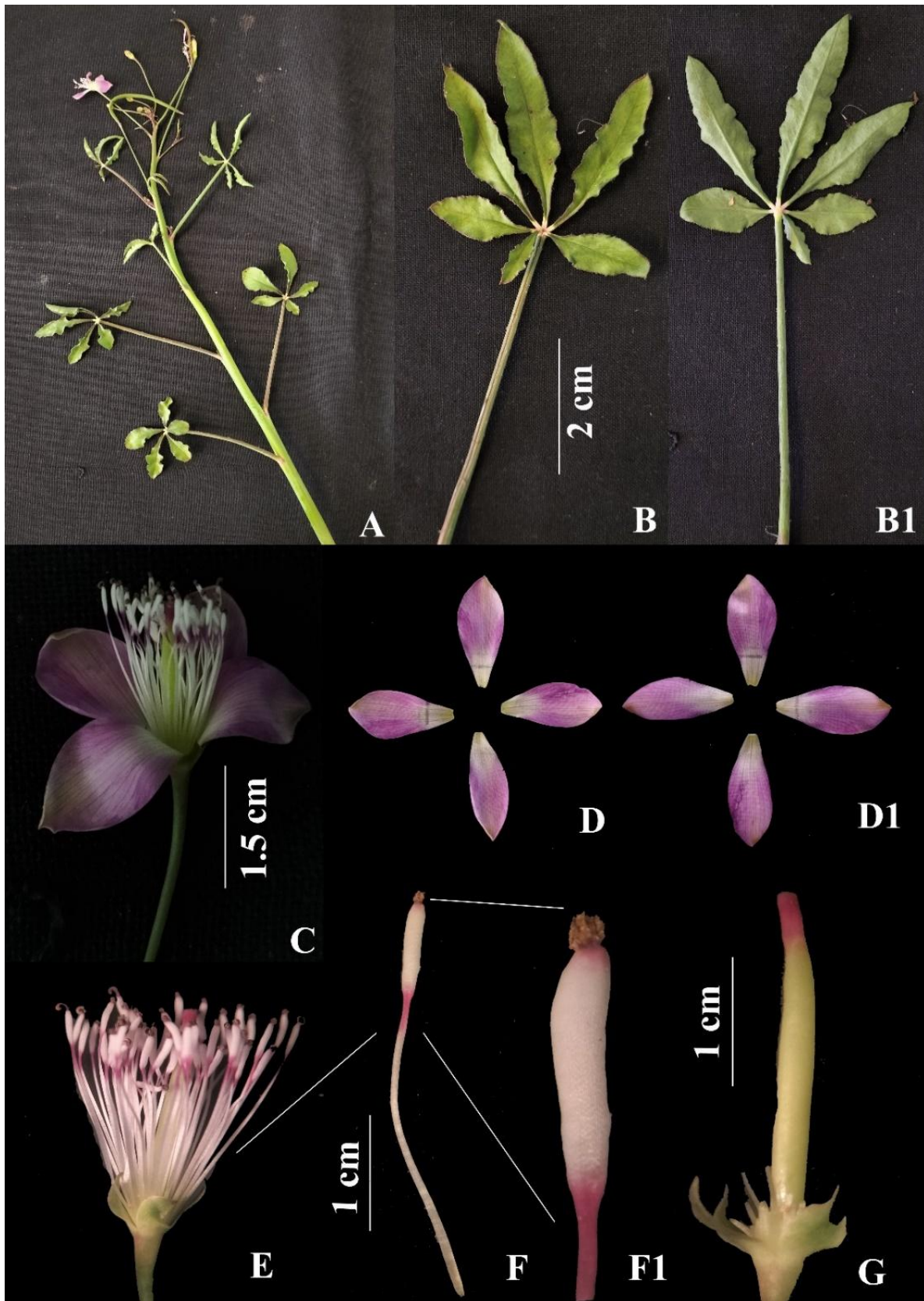


Figure 1. *Cleome angulata*, A. Habit; B. Dorsal and ventral Leaf; C. Flower side view; D. Dorsal and ventral petals; E. Bunch of anthers; F. Single anther; F1. Anther lobe enlarged; G. Ovary; H. (Photos by Dr. Shreyas Betageri).

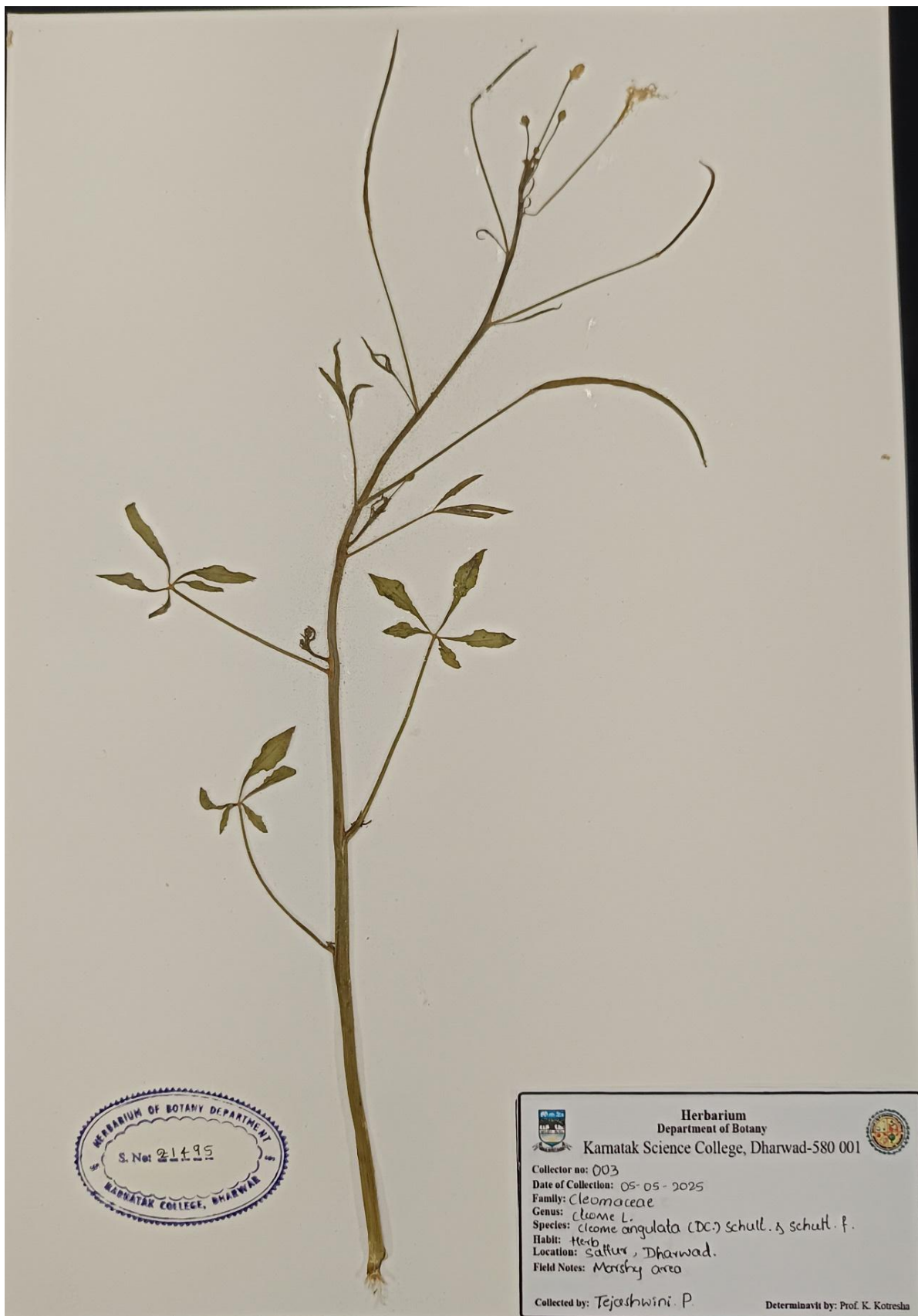


Figure 2. Herbarium voucher specimen of *Cleome angulata* (DC.) Schult. & Schult.f. deposited in the Herbarium of the Department of Botany, Karnatak Science College, Dharwad (HKSCD).

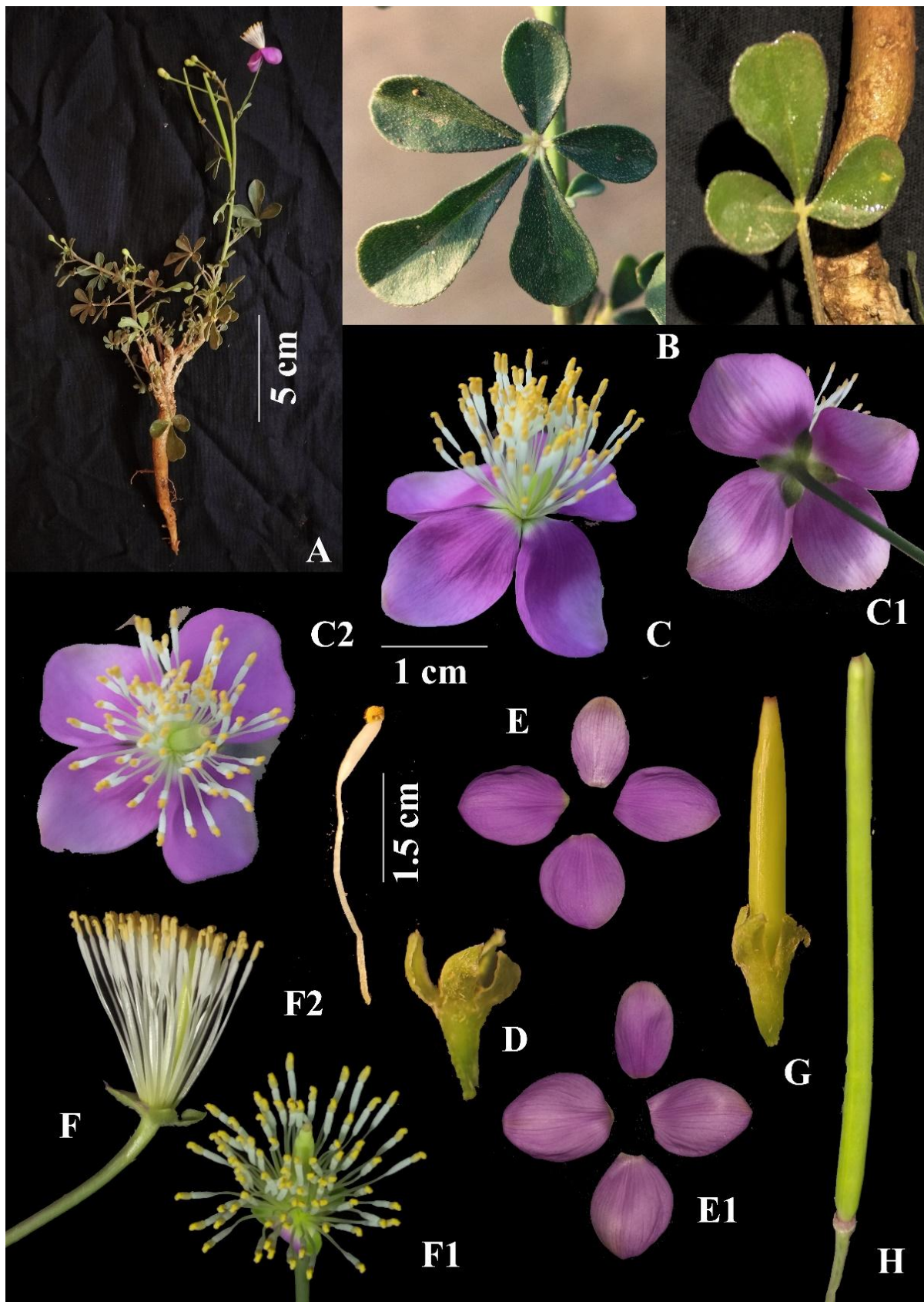


Figure 3. *Cleome chelidonii*, A. Habit; B. Leaves; C. Flower side view; C1. Flower back view; C2. Flower top view; D. Calyx; E. E1. Dorsal and ventral petals; F. F1. Bunch of anthers; F2. Single anther; G. Ovary; H. Fruit (Photos by Dr. Shreyas Betageri).

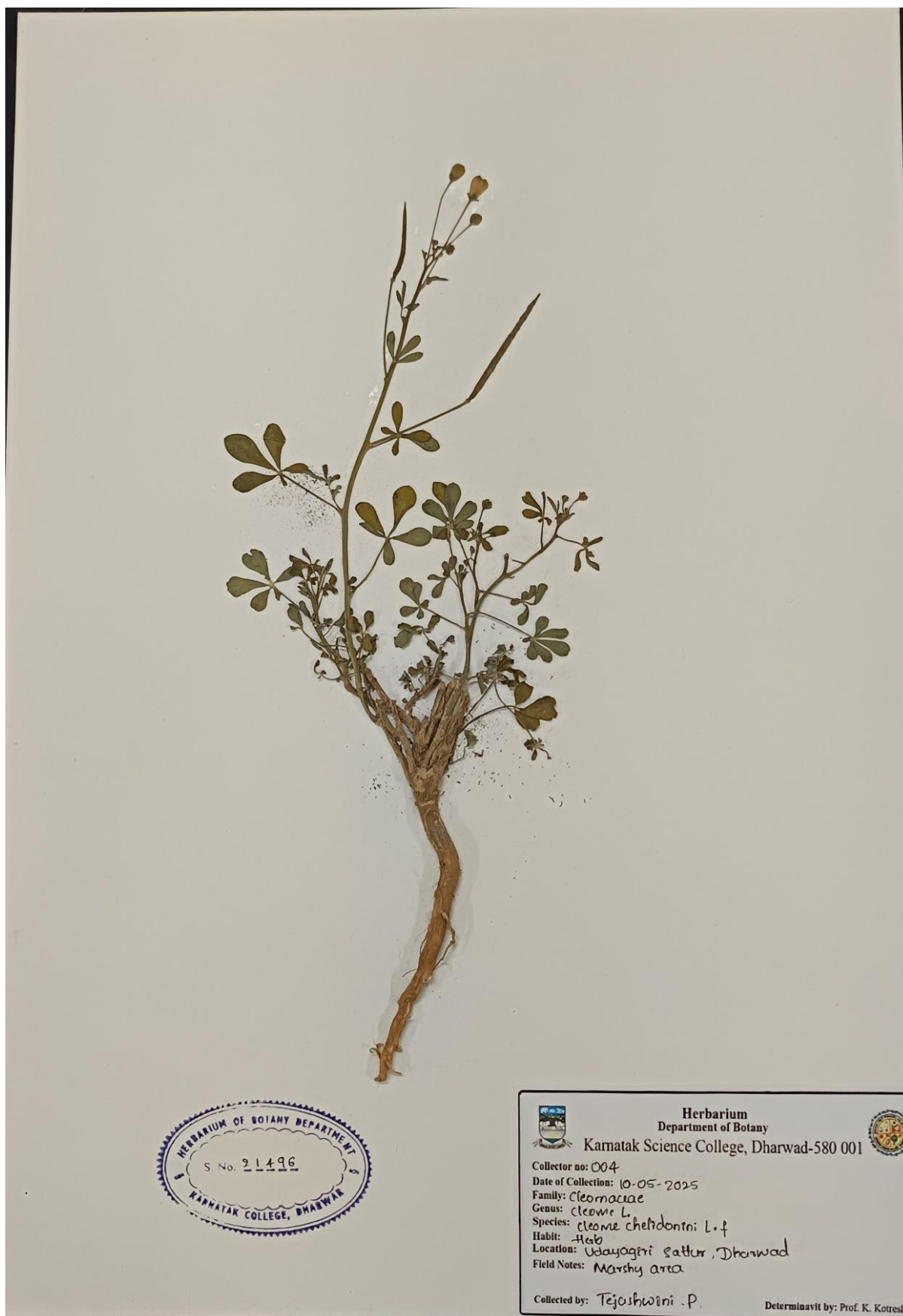


Figure 4. Herbarium voucher specimen of *Cleome chelidonii* L.f. deposited in the Herbarium of the Department of Botany, Karnatak Science College, Dharwad (HKSCD).

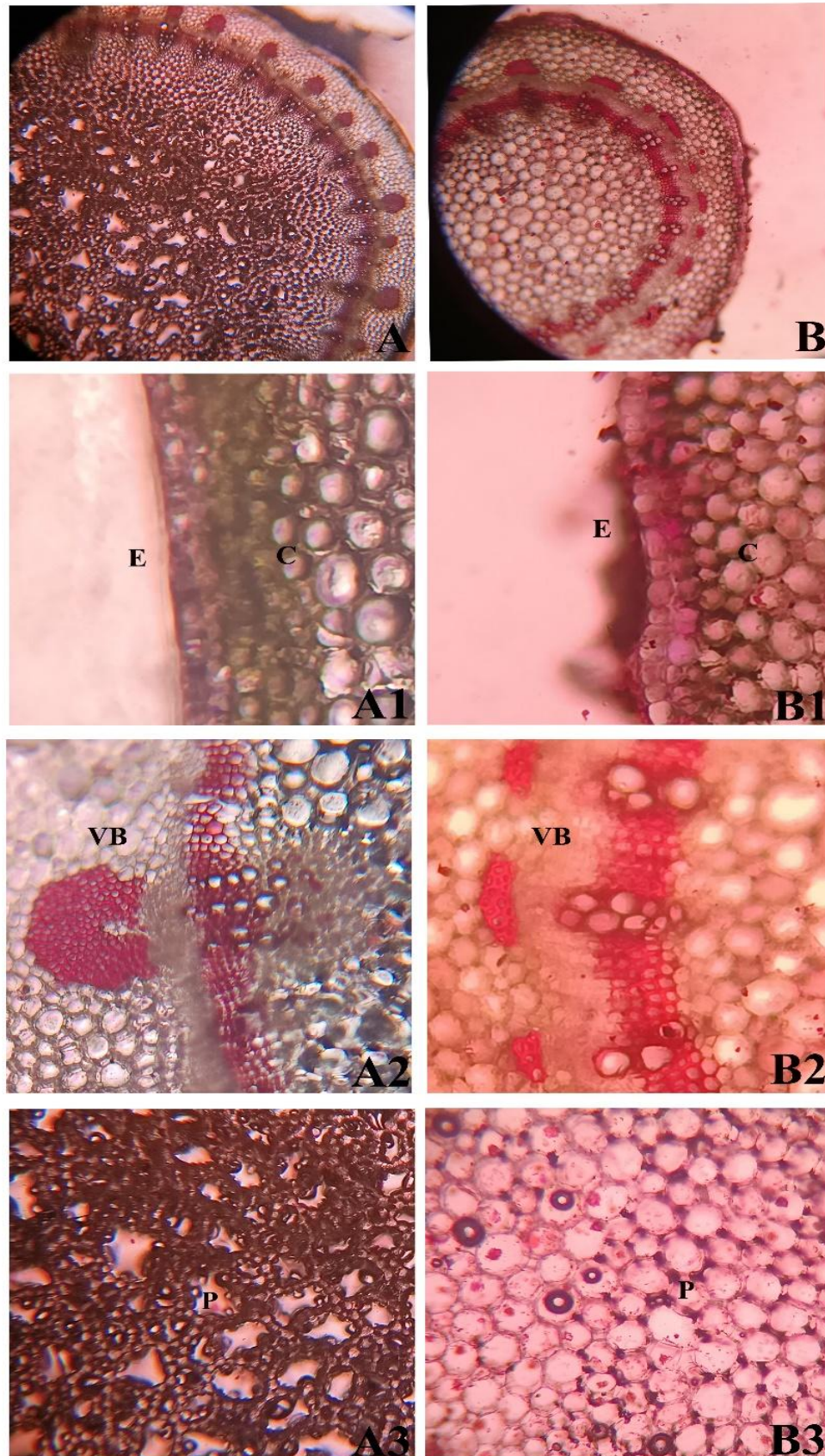


Figure 5. Stem anatomy of *Cleome angulata*, A. Half stem; A1. Epidermis; A2. Vascular bundles enlarged; A3. Pith; *Cleome chelidonii*, B. Half stem; B1. Epidermis; B2. Vascular bundles enlarged; B3. Pith. (E-Epidermis; C-Cortex; VB- Vascular Bundle; P-Pith)

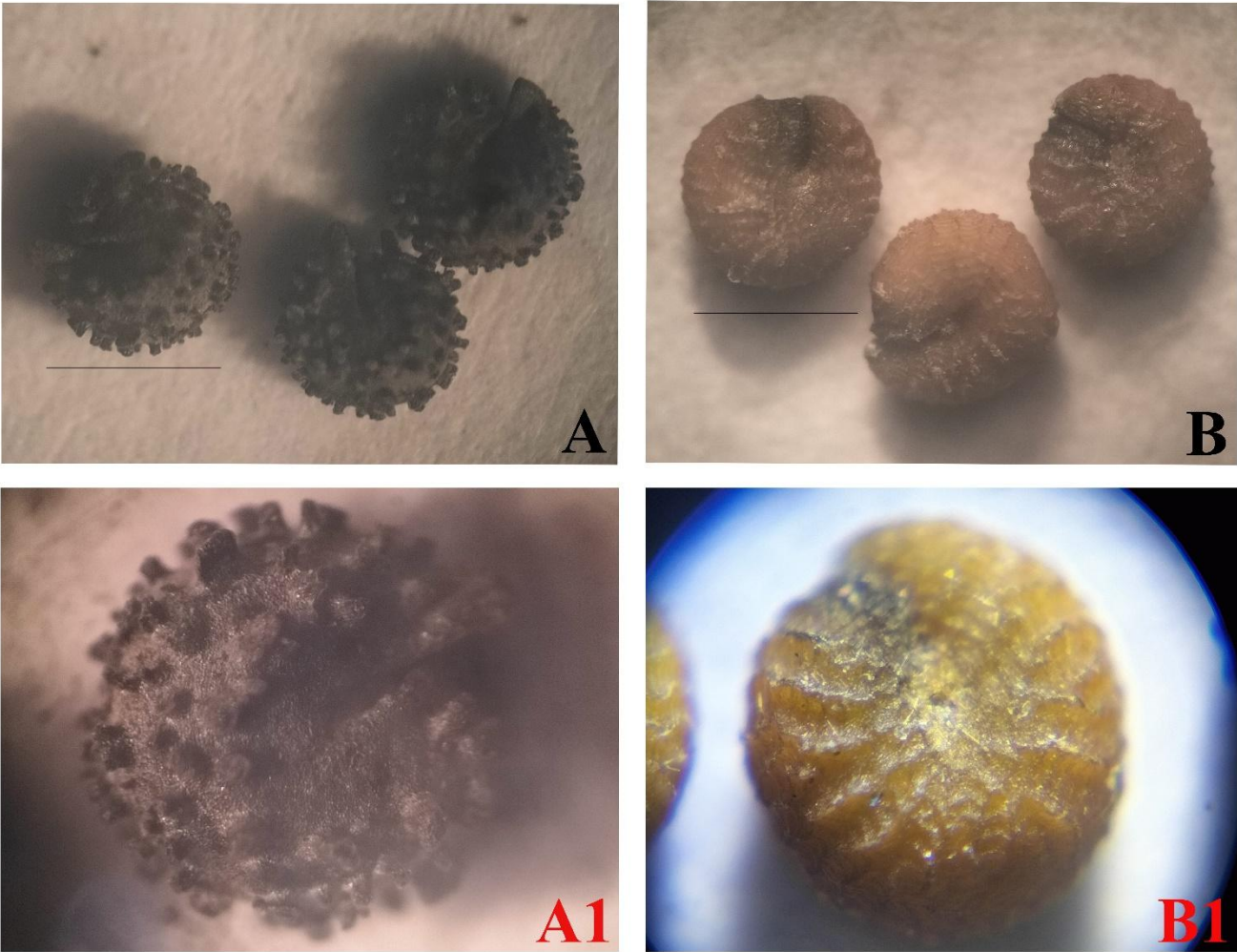


Figure 6. Light microscopic images of seeds of **A.** *Cleome angulata*; **B.** *Cleome chelidonii*

Table 1. Comparative seed morphometric and testa micromorphological characters of *Cleome angulata* and *C. chelidonii*.

Species name	Seed shape	LS(M)±S. E	BS(M)±S. E	L/B	Seed coat sculpture	Testa cell	LT(M)±S. E	BT(M)±S. E
<i>Cleome angulata</i>	Sub-globose to spherical	1.774±0.037	1.698±0.069	1.04	Reticulate with tubercles and knots	pentagonal to irregular multi-sided polygonal	20.51±1.426	13.22±0.277
<i>Cleome chilidonii</i>	Circular	1.321±0.051	1.175±0.003	1.12	Wavy reticulate surface	Non-regular polygonal	113.9±11.12	40.49±6.84

L (Length of seed); **B** (Breadth of seed); **L/B** (Length of seed/ Breadth of seed); **LT** (Length of testa cell); **BT** (Breadth of testa cell)

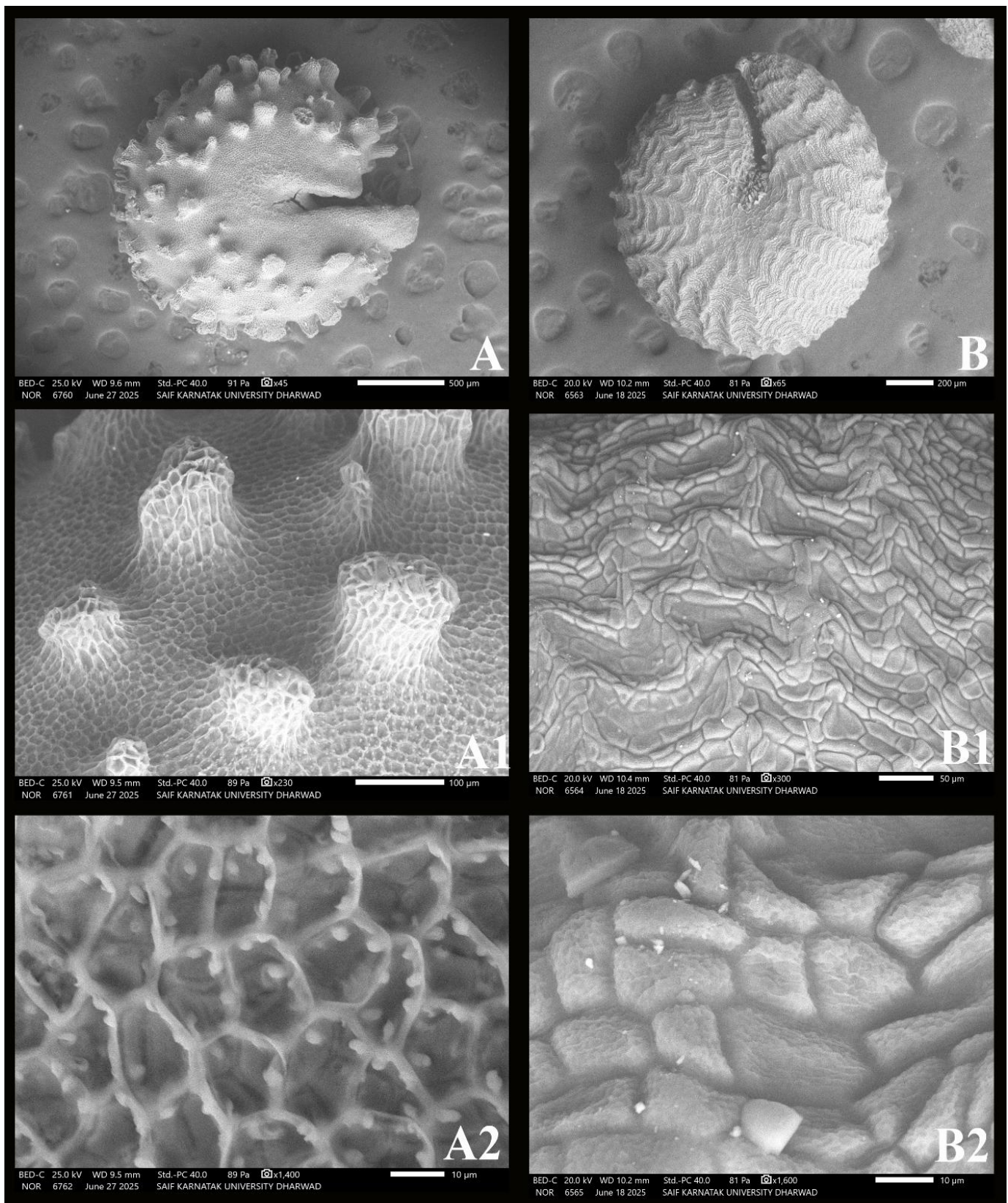


Figure 7. SEM images of seed of A. A1. A2. *Cleome angulata*; B. B1. B2. *Cleome chelidonii*

Seed morphology

Cleome angulata

The seeds of *Cleome angulata* are dark brown to black, asymmetrical, and subglobose to nearly spherical in shape (Table 1) (Figures 6A–A1, 7A). They are comparatively larger than those of *C. chelidonii*, measuring 1.737 mm in length and 1.767 mm in width. The seed surface is distinctly coarse owing to the presence of numerous prominent tuberculate projections distributed over the testa. Scanning electron microscopy (SEM) revealed that these tubercles are conical to blunt, irregularly arranged, and arise from a distinctly reticulate seed coat (Figure 7A1).

The testa is made up of tightly packed pentagonal to irregular polygonal epidermal cells with distinct anticlinal walls (Figure 7A2). The periclinal walls are slightly outwards, resulting deeply sculptured surface. The individual testa cells measure on average 20.25 μm in length and 12.73 μm in width. The precise tuberculate ornamentation and polygonal reticulate testa pattern, supports a unique distinguish character of *C. angulata*.

Cleome chelidonii

The seeds of *Cleome chelidonii* are light brown to brown, nearly circular to subglobose in outline, and comparatively smaller than those of *C. angulata*, measuring 1.270 mm in length and 1.170 mm in width (Table 1) (Figures 6B–B1, 7B). In contrast to *C. angulata*, the seed surface lacks tuberculate projections and exhibits a finely rugose to undulate ornamentation. Under SEM, the testa displays conspicuous sinuous, wavy longitudinal ridges that form an irregular reticulate pattern over the entire seed surface (Figure 7B1).

The testa is made up of compactly arranged cells that are elongated to irregular polygonal epidermal cells with irregular anticlinal boundaries (Figure 7B2). The periclinal walls are showing smooth to slightly rugose without noticeable projections in *C. angulata*. These cells are measure roughly 31.96 μm long and 93.30 μm wide. The presence of tubercles and absence of undulate ridges are the important micromorphological features to distinguish features of *C. chelidonii*.

The shape of seed and its seed coat (testa) characters considered as a reliable character to differentiate the two closely related species. The species of *Cleome angulata* has large, dark and asymmetrical seed with rough seed coat which covering tubercles that shows reticulate pattern of cells. Similarly, in *C. chelidonii*, the seeds are nearly round without any tubercule pattern. The seed coat showing wavy ridges and irregular reticulate pattern of cells. Eventually, these clear differences in seed size, textures, cell shapes and surfaces provides a strong support to consider as two distinct species of *Cleome*.

4. CONCLUSION

The species of *Cleome angulata* is representing as a new distribution record for the Karnataka State. Previously, it was recorded only from Andhra Pradesh, Maharashtra and Telangana. This species can be easily recognized by its variations in physical appearance, stem structure, number of stamens, seed morphology, stem anatomy details. The identify of *C. angulata* supported by stem anatomy and Scanning electron microscope (SEM) images. It clearly indicated as a distinct species within Cleomaceae members. The present records represented an addition to the diversity of flowering plants and suggesting to conduct regular plant exploration within state.

Acknowledgement

The authors are grateful to the USIC–DST Sophisticated Analytical Instrumentation Facility (SAIF), Karnatak University, Dharwad, for providing the scanning electron microscopy (SEM) facility and technical support for SEM imaging and seed morphometric measurements.

Author contributions

All authors have read and approved the final version of the manuscript. The authors believe that this manuscript represents honest work done by us.

Funding

This research did not receive any external funding like specific grant from funding agencies in the public, commercial, or nonprofit sectors.

Conflict of Interest

The author declare that they have no conflicts of interest, competing financial interest or personal relationship that could have influenced the work reported in this paper.

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 Taxonomic Notes on *Cleome angulata* (DC.) Schult. & Schult.f. and *Cleome chelidonii* L.f. (Cleomaceae), with the First Record of *Cleome angulata* from Karnataka, India. 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 will be available based on the reasonable request to corresponding author.

REFERENCES

1. Candolle APD. *Polanisia angulata*. Prodrum Systematis Naturalis Regni Vegetabilis. (1824). 1: 242.
2. Chandore AN, Yadav SU, Yadav SR. A new elegant species of *Corynandra* (Cleomaceae) from Konkan region of Maharashtra, India. Phytotaxa. 2016; 260 (1): 089–094.
3. Deshi S, Betageri S, Patgar VG, Kotresha K. Achene morphology of some genera of *Cyperaceae* Juss. in Karnataka. *Species*. 2025; 26 (78): e41s3181. doi: <https://doi.org/10.54905/diss.v26i78.e41s3181>.
4. Gulaguli R, Betageri S, Patgar GV, Kotresha K. Anatomical studies (Stem and Ovary) of Genus *Datura* L. (Solanaceae) in Karnataka, India. Journal of Plant Biota. 2025;41(1):77-81.
5. POWO "Plants of the World Online", 2026. Facilitated by the Royal Botanic Gardens, Kew. Published on the internet: <https://powo.science.kew.org/>. Retrieved 28 January 2026.
6. Rao R, Jain SK. A Handbook of Field and Herbarium Methods. Scholarly Publications. 1976; 18-25.
7. Ravikumar K, Tangavelou AC, Page N. Seed Plants of Karnataka, India: A Concise Dictionary. FRLHT-TDU. Bangalore. 2021; 528-530.
8. Reddy CS, Raju VS. A new variety of *Cleome chelidonii* L. f. (Cleomaceae). Journal of Economic and Taxonomic Botany. 2001; 25: 217–218.
9. Reddy KN, Reddy CS. Flora of Telangana state, India. Bishen Singh Mahendra Pal Singh, Dehradun. 2016.
10. Roemer JJ, Schultes JA. *Cleome angulata*. Systema Vegetabilium (1829). Ed. 15[bis]. 7: 45.
11. Sanjappa M, Sringseshwara AN. Flora of Karnataka, a Checklist. Vol I. Gymnosperms and Angiosperms. Karnataka Biodiversity Board, Bangalore. 2019; 221-222.
12. Singh RK, Arigela RK, Reddy CS. Identity of *Polanisia angulata* (Cleomaceae) and Typification of Two Linnaean Names and Three Linnaeus Filius' Names in *Cleome*. Annales Botanici Fennici. 2022; 59(1): 1-8. doi: <https://doi.org/10.5735/085.059.0101>