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Palynological Investigation of Selected Ornamental Plants, Bharatpur, Nepal

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Abstract

Pollen morphology is a key aspect of palynology with taxonomic and evolutionary significance in angiosperms. This study examines pollen traits of eleven ornamental species from Bharatpur, Nepal, including members of Amaryllidaceae, Cannaceae, Fabaceae, Asteraceae, Caryophyllaceae, Malvaceae, Nyctaginaceae, Solanaceae, Rosaceae, and Apocynaceae. Light microscopy after aceto carmine staining revealed notable variation in pollen size (13.8–75 µm), shape (spheroidal, triangular, oblate, circular), aperture types (inaperturate to polyzonoporate), exine ornamentation (echinate, scabrate, reticulate, rugulate), and polarity (mostly isopolar). All grains were monads with radial symmetry, and viability ranged from 66.67% to 100%. These findings underscore the diagnostic value of pollen morphology and enrich the palynological database of Nepal's ornamental flora.

Key Words: *Ornamental plants, Pollen morphology, Aceto-carmine, taxonomy, exine ornamentation.*

Introduction

Palynology, the study of pollen grains and spores, is an important tool in plant taxonomy, systematics, and evolutionary studies. Pollen grains exhibit considerable variation in shape, size, aperture type, and exine ornamentation, and these features are often species-specific, making them valuable for identification and classification of angiosperms [1], [2]. The presence of sporopollenin in the pollen wall provides high resistance to degradation, allowing their preservation and reliable use in both modern and historical plant studies [3].

Pollen morphology has been widely applied to resolve taxonomic relationships and distinguish closely related species, particularly through the study of aperture configuration and exine patterns [4], [5]. Ornamental plants, widely cultivated for aesthetic and ecological purposes, show notable diversity in pollen characteristics, reflecting their evolutionary adaptations [6].

In urban regions such as Bharatpur, ornamental species are commonly grown, yet their palynological attributes remain poorly documented. Although institutions like the Department of

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Plant Resources Nepal have contributed to plant diversity studies, detailed pollen-based investigations are still limited. Therefore, analyzing pollen morphology of selected ornamental plants is essential for strengthening taxonomic knowledge and providing baseline data for future research.

Method and Material

Study Area

The study was conducted in Bharatpur, located in Chitwan District, Nepal. The district covers an area of approximately 2,238.39 km² in the Terai region and experiences a climate ranging from temperate to subtropical. This region supports a diverse array of ornamental plant species cultivated in urban and semi urban settings. Plant samples were collected from four different sites within Bharatpur, with geographic coordinates recorded using a Global Positioning System (GPS): Site 1 (27°40′14.22″ N, 84°26′18.25″ E), Site 2 (27°39′47.34″ N, 84°26′24.81″ E), Site 3 (27°41′17.84″ N, 84°25′50.77″ E), and Site 4 (27°42′14.86″ N, 84°26′42.50″ E).

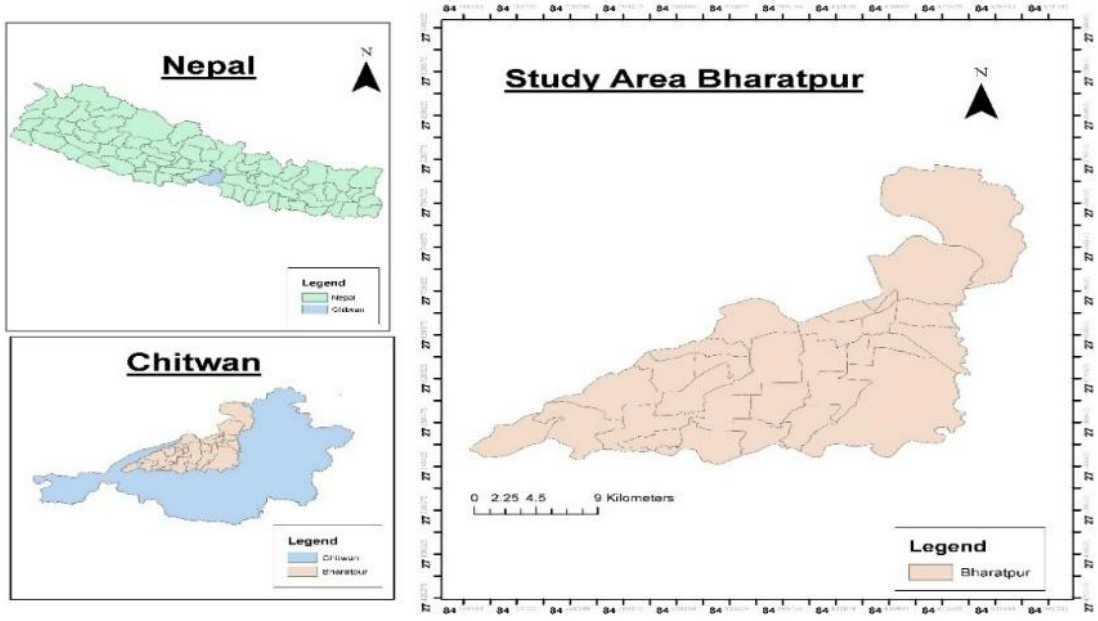

Fig 1: Map Showing the Study Area

Method of data collection

The pollen grains of the several decorative plant species under study were obtained from fresh plant specimens taken from their natural habitats. The buds on each plant were then separately stained with 1% aceto-carmine solution, heated for a few seconds under a spirit lamp, and allowed to sit for an hour to ensure proper staining. One mature anther was taken out of the buds and placed on a glass slide with a thin covering of 1% acetocarmine using a needle. After the debris was removed, the cover slip was placed over it. Blotting paper was used to remove extra dye, and a compound microscope with a 10x eye piece and 45x objective magnification was used to analyze the material. 48-megapixel sensor mobile camera was utilized to capture. The size of pollen grains was calculated by using micrometry.

Results

A total of 11 ornamental plant species belonging to 10 families were documented from Bharatpur, as presented in Table1. The taxa include mostly perennial herbs, along with a few shrubs and a climber, indicating the dominance of herbaceous ornamental flora in the study area. The general morphology of the studied plants along with their corresponding pollen grains is illustrated in Figure 2, where each species is paired with its pollen image. The figure clearly shows variation in pollen, structure, and surface features among the taxa.

The detailed pollen morphological characteristics are summarized in Table 2. Considerable variation in pollen morphology was observed among the studied species. Pollen size ranged from 13.8 µm in *Cosmos sulphureus* Cav. to 75 µm in *Mirabilis jalapa* L. Pollen shapes varied from circular and triangular to oblate and predominantly spheroidal. Aperture types included inaperturate in *Canna indica* L., monosulcate in *Amaryllis* sp. L. and *Hippeastrum puniceum* L., colpate in *Clitoria ternatea* L., tricolpate in *Cosmos sulphureus* Cav. and *Mirabilis jalapa* L., polyzonoporate in *Hibiscus rosa-sinensis* L., and tricolporate in *Dianthus chinensis* L., *Petunia axillaris* Lam., *Rosa indica* L., and *Catharanthus roseus* (L.) G. Don. Exine ornamentation ranged from scabrate and echinate to predominantly reticulate patterns. Pollen surfaces varied from smooth to rough, while all pollen grains were monads and radially symmetrical. Most species exhibited isopolar pollen, whereas *Dianthus chinensis* L. and *Catharanthus roseus* (L.) G. Don were polar, and *Hibiscus rosa-sinensis* L. showed apolar condition. Pollen viability ranged from 66.67% to 100%, indicating generally high reproductive potential among the studied ornamental species.

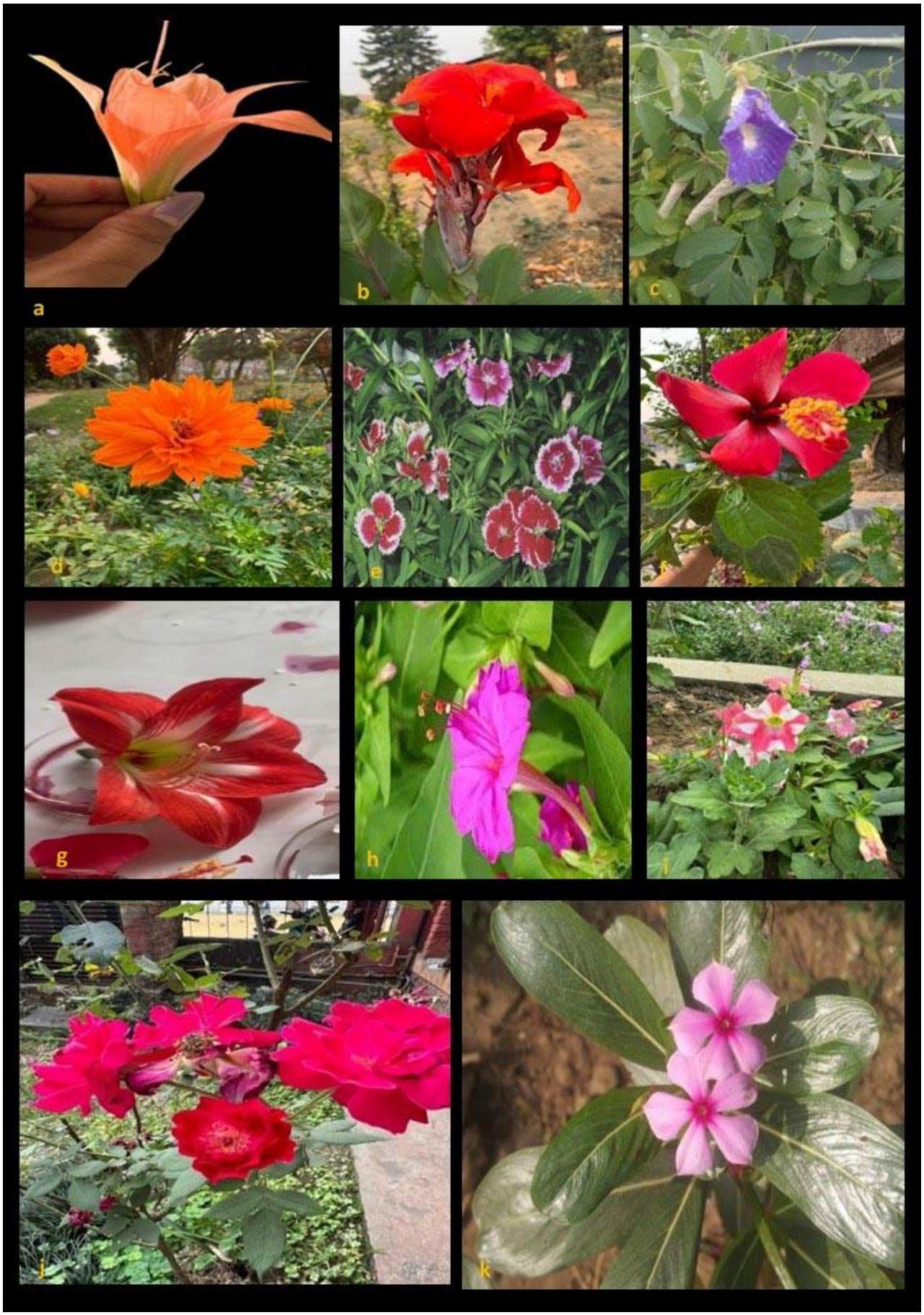

Fig. 2: Ornamental Plants, Bharatpur, Nepal [a. *Amarylis sp.,* b. *Canna indica*, c. *Clitoria ternatea*, d. *Cosmos sulphureus*, e. *Dianthus chinensis*, f. *Hibiscus rosa sinensis,* g. *Hippeastrum puniceum*, h. *Mirabilis jalapa*, i. *Petunia axilaris*, j. *Rosa indica,* k. *Catharanthus roseus*]

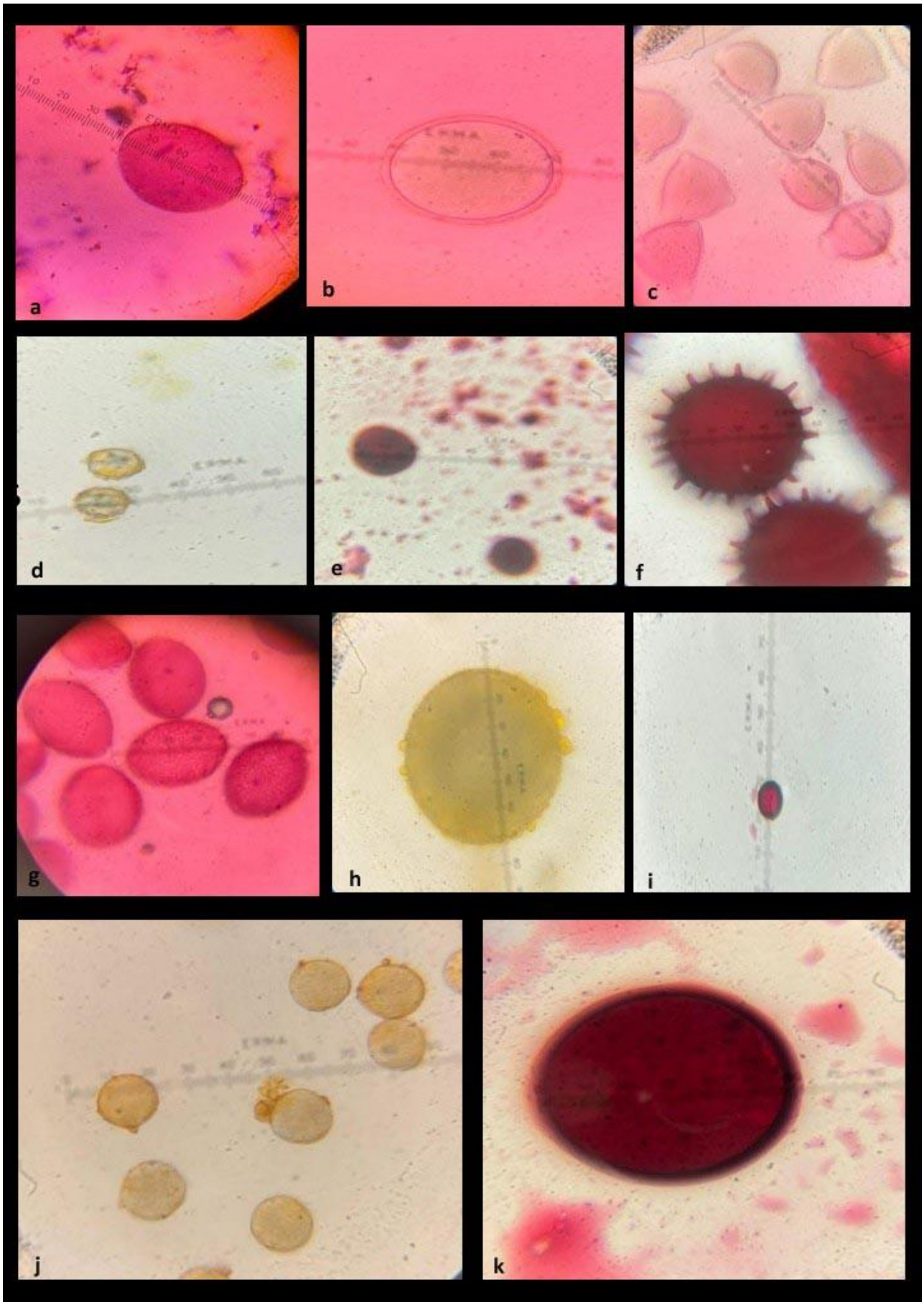

Fig 3: Pollen grain [a. *Amarylis sp.,* b. *Canna indica*, c. *Clitoria ternatea*, d. *Cosmos sulphureus*, e. *Dianthus chinensis*, f. *Hibiscus rosa sinensis,* g. *Hippeastrum puniceum*, h. *Mirabilis jalapa*, i. *Petunia axilaris*, j. *Rosa indica,* k. *Catharanthus roseus*]

Table 1: List of Selected Ornamental Plants for Palynological Investigation Common name,

S. N	Scientific name	Common name	Family	Life cycle	Life form
1	*Amarylis sp. L.*	March lily	Amaryllidaceae	Perennial	Herb
2	*Canna indica L.*	Indian shot	Cannaceae	Perennial	Herbaceous shrub
3	*Clitoria ternatea L.*	Butterfly pea	Fabaceae	Perennial	Climber
4	*Cosmos sulphureus Cav.*	Orange cosmos	Asteraceae	Perennial	Herb
5	*Dianthus chinensis L.*	Sweet william	Caryophyllaceae	biennial	Herb
6	*Hibiscus rosa -sinensis L.*	Shoe flower	Malvaceae	Perennial	Shurb
7	*Hippeastrum puniceum L.*	Easter lily	Amaryllidaceae	Perennial	Herb
8	*Mirabillis jalapa L.*	four o'clock	Nyctaginaceae	Perennial	Herb
9	*Petunia axillaris Lam.*	Petunia	Solanaceae	Annual	Herb
10	*Rosa indica L.*	Rose	Rosaceae	Perennial	Shurb
11	*Catharanthus roseus S.*	Madagascar periwinkle	Apocynaceae	Perennial	Herb

Table 2: Morphological character of pollen grains of plant species

S. N.	Pollen size (µm)	Pollen shape	Aperture	Exine ornamentation	Pollen surface	Pollen unit	Symmetry	polarity	Viability (%)
1	48.75	Spheroidal, elliptic	Monosulcate	Microechinate	rough	monad	radial	isopolar	78
2	41.25	oblate	Inaperture	Echinate	granular	monad	radial	isopolar	100
3	41.25	Triangular	Colpate	Reticulate	Smooth	monad	radial	isopolar	80
4	13.8	spheroidal	Tricolpate	Scabrate	rough	monad	radial	isopolar	100
5	25.00	Circular	Tricolporate	Reticulate	rough	monad	radial	polar	84
6	63.75	Oblate, spherical, round	Polyzonoporate	Echinate	Spinous granular	monad	radial	apolar	100
7	46.25	Spherical, oblate	Monosulcate	Reticulate	rough	monad	radial	isopolar	75

8	75.00	Spheroidal slightly oblate	Tricolpate	Reticulate	rough	monad	radial	isopoplar	66.67
9	15.00	Spheroidal	Tricolporate	Reticulate	Finely reticulate	monad	radial	isopolar	66.67
10	18.75	Spherical oval	Tricolporate	Rugulate or reticulate	Granulated, bumpy	monad	radial	isopolar	85.71
11	41.25	Spheroidal, slightly oblate	Tricolporate	Reticulate	rough	monad	radial	polar	100

Discussion

The present study revealed considerable variation in pollen morphology among 11 ornamental plant species from Bharatpur. Differences in pollen size, shape, aperture type, and exine ornamentation support their taxonomic significance, which is consistent with earlier studies [1], [2]. The observed diversity in aperture types and exine patterns agrees with the standardized descriptions of Willem Punt et al. [4] and Michael Hesse et al. [5], confirming their importance in distinguishing plant taxa.

The predominance of monad pollen units and radial symmetry, along with variation in polarity, is also in line with general angiosperm pollen characteristics reported by Knut Faegri and Johannes Iversen [3]. Overall, the findings agree with previous palynological studies and highlight the value of pollen morphology as a reliable tool for plant identification and classification.

Conclusions

In Nepal especially in the condition of Bharatpur, palynological studies have not been so far directed. Hence, the present study on pollen morphology of blooming plants has been taken up. The point of this study comprises of two goals: To concentrate the morphological element of pollen grains of blossoming plants found in and around Bharatpur area and to set up a pollen database.

Declaration

Conflict of interest: The author declared that they have no conflict of interest.

References

[1] G. Erdtman, *Pollen Morphology and Plant Taxonomy: Angiosperms*. Stockholm, Sweden: Almqvist & Wiksell, 1952. [Online]. Available: https://books.google.com/books/about/Pollen_Morphology_and_Plant_Taxonomy.html?id=UfkpPQAACAAJ

[2] P. D. Moore, J. A. Webb, and M. E. Collinson, *Pollen Analysis*, 2nd ed. Oxford, U.K.: Blackwell Scientific Publications, 1991. [Online]. Available: https://books.google.com/books/about/Pollen_Analysis.html?id=KiWaQgAACAAJ

[3] K. Faegri and J. Iversen, *Textbook of Pollen Analysis*, 4th ed. Chichester, U.K.: John Wiley & Sons, 1989. [Online]. Available: https://books.google.com/books/about/Textbook_of_Pollen_Analysis.html?id=HMKsQgAACAAJ

[4] W. Punt, P. P. Hoen, S. Blackmore, S. Nilsson, and A. Le Thomas, "Glossary of pollen and spore terminology," *Review of Palaeobotany and Palynology*, vol. 143, nos. 1–2, pp. 1–81, Jan. 2007, doi: 10.1016/j.revpalbo.2006.06.008

[5] M. Hesse, H. Halbritter, R. Zetter, M. Weber, R. Buchner, A. Frosch-Radivo, and S. Ulrich, *Pollen Terminology: An Illustrated Handbook*. Vienna, Austria: Springer, 2009, doi: 10.1007/978-3-211-79894-2

[6] R. O. Kapp, O. K. Davis, and J. E. King, *Ronald O. Kapp's Pollen and Spores*, 2nd ed. College Station, TX, USA: American Association of Stratigraphic Palynologists Foundation, 2000. [Online]. Available: https://openlibrary.org/books/OL16429640M/Ronald_O._Kapp%27s_pollen_and_spores