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STUDY OF POLLEN MORPHOLOGY OF SOME ORNAMENTAL PLANTS

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ABSTRACT

Pollen morphology was investigated in ten common ornamental plant species: *Hibiscus rosa-sinensis* Linn, *Rosa indica* L.., *Ixora coccinea* L., *Sphagneticola trilobata* (L.) Pruski, *Catharanthus roseus* (L.) G. Don, *Portulaca oleraceae* L., *Talinum paniculatum* (Jacq.) Gaertn., *Clitoria ternatea* L., *Zephyranthes candida* (Lindl.) Herb., and *Polianthes tuberosa* L. Observations were made using photographic documentation and standard palynological references. The study recorded morphological traits including pollen size, shape, aperture type, and surface ornamentation. Pollen size ranged from small (~18 µm) in *Sphagneticola* to very large (>135 µm) in *Hibiscus*. Most dicot families (Rosaceae, Apocynaceae, Rubiaceae, Fabaceae, Asteraceae, Talinaceae, Malvaceae, Portulacaceae) exhibited tricolporate or colporate (three-aperture) pollen, whereas monocots (Amaryllidaceae, Asparagaceae) displayed monosulcate or disulcate pollen types. Surface ornamentation showed notable variation, such as spiny/echinate exine in *Hibiscus* and perforate or reticulate patterns in other taxa. These variations reflected taxonomic relationships and possible adaptations to different pollination syndromes. The findings highlight the value of pollen morphological characteristics as diagnostic tools in plant identification and as indicators in evolutionary and systematic studies.

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Introduction:

Pollen grains are microscopic structures produced by seed plants, functioning as the male gametophytes that carry the male gametes necessary for fertilization. Typically ranging from approximately 3 to 200 µm in diameter, they are enclosed within two protective layers. The outer wall, the exine, is composed of sporopollenin a highly durable biopolymer that enables pollen grains to withstand harsh environmental conditions. The exine often displays species-specific patterns, making pollen a valuable tool for plant identification. Pollen morphology, encompassing traits such as size, shape, aperture type, and exine ornamentation, is often conserved at the family or genus level (Punt et al., 2007). Pollen grain characteristics are highly reliable within a plant species but may vary extensively between different plant genera and families (Halbritter et al. 2018). Ragho (2020) studied pollen grains of 42 species of angiosperms and found morphological characteristics of pollen grains such as shape, color, exine ornamentations, and type of apertures are very important in plant identifications in field. According to him surface features of pollen grains plays a significant role in taxonomy and detection of crud drugs. This conservation makes pollen characteristics particularly useful in plant taxonomy, systematics, and evolutionary studies. Morphological traits also play a role in reproductive success: for example, the aperture structure influences pollen germination, while surface ornamentation affects adhesion to pollinators. Generally, dicot families produce tri-aperturate (tricolpate or tricolporate) pollen, whereas many monocots possess mono-aperturate pollen types. Plant pollen is one of the most common causes of seasonal allergic disease worldwide Bhattacharya et al. (2013). Pollen morphological investigation are also useful in the systematics of the Asteraceae family, as well as that of some of its genera and species according to (Moore et al. 1991). Jafari and Ghanbarian (2007) studied pollen morphology of 30 species of Asteraceae and found variation in their morphological characters such as in size, aperture type and pattern of exine sculpturing. The present study investigates and compares pollen morphology in ten common ornamental species cultivated in tropical gardens. By documenting variations in size, shape, aperture type, and exine sculpture, this research aims to relate morphological differences to taxonomic groupings and potential adaptations to specific pollination syndromes.

Materials and Method:

Flowers of the plants collected from different localities of Kolhapur District from their natural habitats. The anthers were collected in Petri-dishes. The pollen grains from mature anthers was transferred into a clean glass slide and added mounting medium glycerine, covered with cover slip and observed under compound microscope using 10x eyepiece and 40x objective magnification. Photomicrographs were taken with help of digital camera of 12.1 megapixels. Later on the photographs were enlarged to suitable sizes. The methodology follows in this study as given by Mallick (2019). Diameter of pollen grain is measured by using ocular and stage micrometer. First calibrate the ocular micrometer. The stage micrometer, which has a accurately known scale, is used to determine the value of each division on the ocular micrometer. Once calibrated, the ocular micrometer can be used to exactly measure the size of the pollen grain.

Table 1.

Pollen size, shape, apertures, and surface ornamentation for the ten plants.

Sr. No.	Name of the Plant	Family	Average Size (µm)	Shape / Polar View	Aperture Type	Exine / Surface texture/ Ornamentation
1	*Sphagneticola trilobata* (L.) Pruski	Asteraceae	18	Oblate spherical	Tricolporate	Echinate (Spiny)
2	*Talinum paniculatum* (Jacq.) Gaertn	Talinaceae	54	Spherical	Pantoporate	Granulate–perforate (Smooth)
3	*Hibiscus rosa sinensis* Linn.	Malvaceae	135	Spherical	Tricolporate	Echinate (Spiny)
4	*Clitoria ternatea*	Fabaceae	54	Triangular	Tricolporate	Granulate–fossulate (Smooth)
5	*Ixora coccinea* L.	Rubiaceae	27	Oblate Spheroidal	Tricolporate	Micro reticulate (Smooth)
6	*Catharanthus roseus* (L.) G. Don	Apocynaceae	36	Oblate Spheroidal	Tricolporate	Finely reticulate (Smooth)

7	*Zephyranthes candida* (Lindl.) Herb.	Amaryllidaceae	36	Spherical to slightly Oblate	Monosulcate	Smooth slightly reticulate
8	*Rosa indica* L.	Rosaceae	27	Spherical to slightly Oval	Tricolpate	Finely reticulate (Smooth)
9	*Portulaca oleraceae* L.	Portulacaceae	54	Spherical	Pantoporate	Echinate (Spiny)
10	*Polianthes tuberosa* L.	Amaryllidaceae	45	Spherical	Monosulcate	Smooth to slightly granular

Result:

The Malvaceae (Hibiscus) produced very large (>135 μm) pollen with numerous pores (pantoporate). This contrasts with the smaller pollen of most other species. Pantoporate pollen is relatively rare among angiosperms and is characteristic of Malvaceae; it is thought to facilitate high pollen output and efficient pollination by insects, as each grain can deliver many gametes. The echinate (spiny) exine of Hibiscus provides extra surface area and adhesion for pollinators. Similarly, the small, pollen of Sphagneticola (Asteraceae) is adapted for dispersal by bees and other insects (Plate 2).

Pollen size also showed ecological patterns. The largest grains occurred in showy, nectar-rich flowers (Hibiscus) likely pollinated by large bees or butterflies, whereas diminutive grains occurred in the small-headed Sphagneticola, reflecting its Asteraceae lineage. Ixora and Catharanthus (shrubby ornamentals) had medium-large pollen (27–36μm) typical of tropical Rubiaceae and Apocynaceae. The Fabaceae (Clitoria) also had large pollen, as is common in legumes with butterfly pollinators (Plate 1).

Overall, the observed pollen features agree with standard botanical sources. Dicot families consistently showed tricolpate pollen, while monocots had monosulcate/disulcate types. Such consistency underscores the taxonomic value of pollen characters: these traits often vary little within a genus or family and thus aid in confirming plant identity (as shown by our literature references).

Discussion:

The present analysis confirms the correlation between pollen aperture type and plant taxonomy. Dicots such as Rosa, Ixora, Catharanthus, Clitoria, and Sphagneticola predominantly exhibited tricolporate or tricolpate pollen, while monocots

(Zephyranthes, Polianthes) showed monosulcate forms. The exceptionally large, pantoporate pollen of Hibiscus is consistent with their heavy reliance on insect pollinators, where multiple pores may enhance pollen tube emergence. Small, echinate pollen in Sphagneticola is typical of Asteraceae, aiding in adhesion to pollinator bodies. Surface ornamentation varied from smooth-reticulate to heavily echinate, reflecting adaptations to specific pollinators and environmental conditions.

Conclusion:

Our comparative survey of ten ornamental flowers reveals distinct pollen morphologies aligned with plant taxonomy and pollination biology. Key findings include: Malvaceae species (Hibiscus) have very large, echinate pollen with many pores. Most dicots (Rosa, Ixora, Catharanthus, Clitoria, Sphagneticola) share medium-sized, tricolporate pollen with varied sculpture. Monocots (Zephyranthes, Polianthes) exhibit large, monosulcate pollen with reticulate exine. These patterns highlight how pollen size, aperture, and ornamentation reflect both family and pollination strategy. The results support the use of pollen morphology in plant identification and phylogenetic studies, and they match descriptions in standard botanical references. Future work could include more quantitative microscopy and a broader range of species to refine these observations.

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Plate 1: Photographs of flowers and their pollen grains:

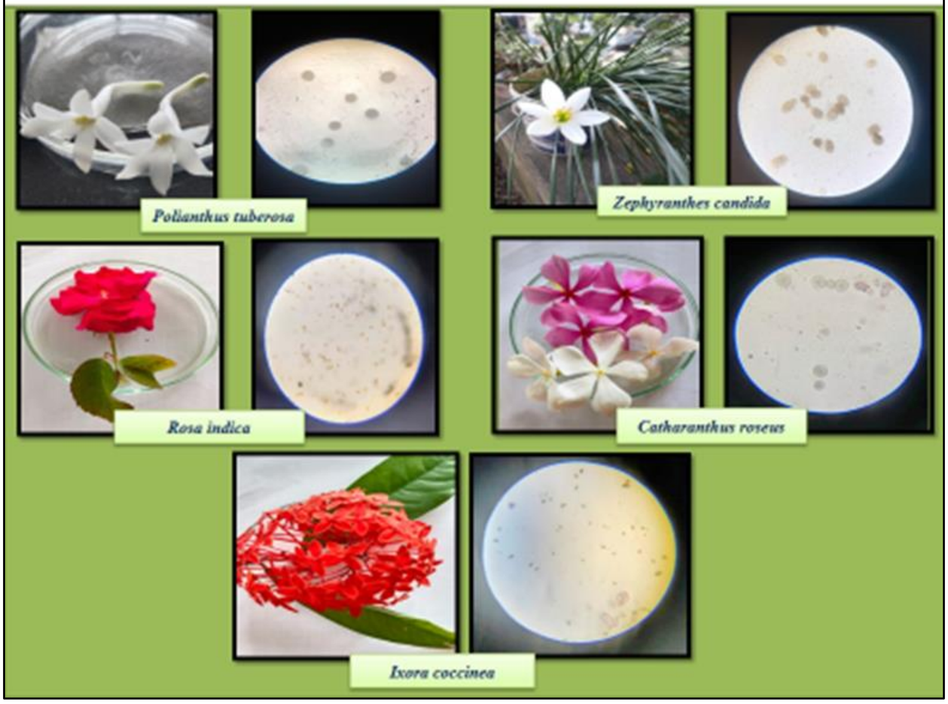

Plate 2: Photographs of flowers and their pollen grains: