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(RESEARCH ARTICLE)

Insights into angiosperm pollen morphology and viability in Akot, Akola District: A Comprehensive Study

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Abstract

This study explores the pollen diversity and viability of angiosperms within Akot, Akola District, encompassing a total of 44 plant species from 28 families. Through comprehensive analyses of pollen morphology and viability, we aimed to shed light on the reproductive strategies of these plants. Utilizing standardized methodologies, we conducted in-depth examinations of pollen grains from various angiosperm species. Our findings reveal a wide array of morphological variations among pollen grains, with diameters ranging from 13.63 µm to 122.67 µm. additionally; we assessed pollen viability, with percentages ranging from 20% to 92.85%, providing insights into the reproductive health and success of these plant species. This research contributes to a deeper understanding of angiosperm reproductive biology and underscores the importance of conservation efforts to preserve floral ecosystems.

Keywords: Angiosperms; Pollen Morphology; Pollen Viability; Floral Diversity; Reproductive Biology; Conservation; Akot; Akola District

1. Introduction

Pollen grains, essential for plant fertilization, are intricate structures crucial for angiosperm reproductive success (Muller, 2019) [5].Understanding their morphology and viability is key to deciphering their functional significance, particularly in pollination biology. Pioneering works by Karna-Malick and Bove underscore pollen's taxonomic importance (Karna-Malick, 2017; Bove, 1993) [1][3].Despite methodological challenges, assessing pollen viability remains pivotal for agricultural and research applications (Lincoln et al., 1982) [4]. Recent studies highlight genetic and environmental influences on pollen viability, emphasizing the need for comprehensive analyses (Smith et al., 2020; Johnson & Brown, 2018) [2] 6]. Our research aims to contribute to a nuanced understanding of pollen biology, shedding light on fundamental aspects of angiosperm reproduction through morphology, viability, and germination analyses.

2. Materials and methods

Requirements: IKI Stain, Flowers of different Angiospermic plant species, Magnus digital binocular microscope with 5-megapixel camera, Slides, coverslips Distilled water

2.1. Procedure

- Preparation of IKI Stain Solution: Dissolve 1 g of potassium iodide and 0.5 g of iodine in distilled water to make a final volume of 100 ml.
- Staining of Pollen: Apply 1 or 2 drops of the dye over the pollen and mix thoroughly. Cover the stained pollen with a coverslip. After 5-10 minutes, count the number of darkly stained (viable) pollen grains under the microscope.

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- Collection and Observation of Anthers: Collect flowers from various localities of the Akot region in district Akola. Place the anthers collected in a petri dish. Transfer pollen grains from mature anthers onto a clean glass slide. Add one percent potassium iodide solution drop-wise. Cover with a coverslip and observe under a compound microscope using 10x eyepiece and 40x objective magnification. Capture photomicrographs using a digital camera of 12.1 Megapixels.
- Measurement of Pollen Grain Diameter: Enlarge the photographs to a suitable size. Measure the diameter of the pollen grain with the help of an ocular micrometer scale.

2.2. Study Sample

A total of 44 flowering plant species from 28 different families, including Nyctaginaceae, Rubiaceae, Oleaceae, Portulaceae, Apocynaceae, Euphorbiaceae, Passifloraceae, Solanaceae, Acanthaceae, Caesalpiniaceae, Balsaminaceae, Convolvulaceae, Bignoniaceae, Fabaceae, Malvaceae, Papilionaceae, Rosaceae, Polygonaceae, Caricaceae, Apiaceae, Cucurbitaceae, Primulaceae, Papaveraceae, Combretaceae, Zygophyllaceae, Myrtaceae, Cannaceae, and Commelinaceae, were studied.

3. Results

Table 1 Pollen Viability of Flowering Plant Species

Sr. No.	Plant name	Family	No. of viable pollen	No. of non-viable pollen	Total no. Of pollen	% of pollen grain viability
1	*Mirabilis jalapa*	Nyctaginaceae	04	6	10	40 %
2	*Ixora coccinea*	Rubiaceae	10	12	22	45.45%
3	*Jasminum multiflorum*	Oleaceae	16	17	33	48.48%
4	*Portulaca grandiflora*	Portulacaceae	32	08	40	80%
5	*Allamanda cathartica*	Apocynaceae	05	10	13	38.46%
6	*Bougainvillea spectabilis*	Nyctaginaceae	22	23	45	48.88%
7	*Euphorbia milli*	Euphorbiaceae	20	07	27	74%
8	*Passiflora caerulea*	Passifloraceae	39	03	42	92.85%
9	*Datura metel*	Solanaceae	20	12	32	65.5%
10	*Asystasia gangetica*	Acanthaceae	12	06	18	66.66%
11	*Cassia fistula*	Caesalpiniaceae	40	15	55	72.72%
12	*Barleria prionitis*	Acanthaceae	03	07	10	30%
13	*Ruellia tuberosa*	Acanthaceae	09	12	21	42.85%
14	*Impatiens balsamina*	Balsaminaceae	26	08	34	76.47%
15	*Ipomoea grandifolia*	Convolvulaceae	10	03	13	76.92%
16	*Tecoma stans*	Bignoniaceae	12	18	30	40%
17	*Gliricidia sepium*	Fabaceae	22	04	26	84.61%
18	*Hibiscus subdariffa*	Malvaceae	04	02	6	66.66%

19	*Catharanthus roseus*	Apocynaceae	06	13	19	31.57%
20	*Clitoria ternatea*	Papilionaceae	08	02	10	80%
21	*Rosa damascena*	Rosaceae	22	24	46	47.82%
22	*Jatropha integerrima*	Euphorbiaceae	02	08	10	20%
23	*Antigonon leptopus*	Polygonaceae	04	07	11	36.36%
24	*Butea monosperma*	Fabaceae	12	20	32	37.5%
25	*Canavalia rosea*	Fabaceae	03	03	6	50%
26	*Carica papaya*	Caricaceae	09	21	30	30%
27	*Foeniculum vulgare*	Apiaceae	09	07	16	56.25%
28	*Coccinia grandis*	Cucurbitaceae	20	15	35	57.14%
29	*Anagallis arvensis*	Primulaceae	19	03	22	86.36%
30	*Hibiscus rosa-sinensis*	Malvaceae	06	02	8	75%
31	*Argemone mexicana*	Papaveraceae	28	12	40	70%
32	*Spathodea campanulata*	Bignoniaceae	40	25	45	88.88%
33	*Abutilon indicum*	Malvaceae	06	10	16	37.5%
34	*Justicia adhatoda*	Acanthaceae	32	16	48	66.66%
35	*Eranthemum pulchellum*	Acanthaceae	22	10	32	68.75%
36	*Cucurbita pepo*	Cucurbitaceae	12	10	22	54.54%
37	*Gossypium herbaceum*	Malvaceae	02	05	7	28.57%
38	*Combretum indicum*	Combretaceae	12	06	18	66.66%
39	*Tribulus terrestris*	Zygophyllaceae	9	05	14	64.28%
40	*Melaleuca citrina*	Myrtaceae	50	12	62	88.33%
41	*Canna indica*	Cannaceae	16	02	18	88.88%
42	*Solanum lycopersicum*	Solanaceae	55	20	75	73.33%
43	*Tradescantia spathacea*	Commelinaceae	22	26	48	45.83%
44	*Nerium oleander*	Apocynaceae	12	28	40	30%

Table 2 Pollen Characteristics of Flowering Plant Species

S.N	Plant Name	Pollen Shape	Outline View	Diameter (µm)
1	*Mirabilis jalapa*	Spheroidal	Circular	122.67
2	*Ixora coccinia*	Spheroidal	Circular	54.22
3	*Jasminum multiflorum*	Circular	Circular	54.52
4	*Portulaca grandiflora*	Spheroidal	Circular	40.89
5	*Allamenda cathartica*	Spheroidal	Circular	68.15
6	*Baugainvillea spectabilis*	Spheroidal	Circular	40.88
7	*Euphorbia milli*	Spheroidal	Circular	40.89
8	*Passiflora caerulea*	Spheroidal	Convex	40.89
9	*Dhatura metal*	Spheroidal	Circular	54.52
10	*Asystasia gangetica*	Convex (Rectangular)	Triangular	40.89
11	*Cassia fistula*	Prolate spheroidal	Convex (Triangular)	40.89
12	*Barleria prionities*	Convex (Quinquangular)	Circular	81.78
13	*Ruellia tuberosa*	Spheroidal	Circular	81.78
14	*Impatien balsamina*	Rectangular	Circular	27.26
15	*Ipomoea grandifolia*	Sub oblate- spheroidal	Circular	27.26
16	*Tecoma stans*	Spheroidal	Circular	54.52
17	*Gliricida sepium*	Circular (Triangular) or spheroidal	Circular	13.63
18	*Hibiscus subdariffa*	Spheroidal	Circular	122.67
19	*Catharanthus roseus*	Spheroidal	Circular	54.52
20	*Clitoria ternatea*	Triangular	Triangular	68.15
21	*Rosa damascene*	Spheroidal	Circular	81.78
22	*Jatropha intergerria*	Spheroidal	Circular	68.15
23	*Antigonon leptopus*	Spheroidal	Circular	68.15
24	*Butea monosperma*	Spheroidal	Circular	40.89
25	*Cannavalia rosea*	Triangular	Circular	54.52
26	*Carica papaya*	Circular	Circular	27.26
27	*Foeniculum vulgare*	Rod shape (rectangular)	Circular	40.89
28	*Coccinnia grandis*	Circular	Circular	54.52
29	*Anagilis arvensis*	Sub-spheroidal	Circular	13.63
30	*Hibiscus rosa-sinensis*	Spheroidal	Circular	95.41
31	*Argemon maxicana*	Spheroidal	Circular	54.52
32	*Spathodea campanulata*	Circular	Circular	40.89
33	*Abutilon indicum*	Spheroidal	Circular	81.78
34	*Justicia adathoda*	Cylindrical	Circular	68.15

35	*Eranthimum pulchellum*	Circular	Spheroidal	40.89
36	*Cucurbita pepo*	Spheroidal	Circular	109.04
37	*Gossypium herbaceum*	Spheroidal	Circular	81.78
38	*Combretum indicum*	Spheroidal	Circular	40.89
39	*Tribulus terrestries*	Spheroidal	Circular	54.52
40	*Melaleuca citrine*	Triangular	Concave	13.63
41	*Canna indica*	Circular	Circular	68.15
42	*Solanum lycopersicum*	Spheroidal	Circular	13.63
43	*Tradescantia spathacea*	Boat shape (rod shape)	Elliptic	68.15
44	*Nerium oleander*	Spheroidal	Circular	40.89

4. Discussion

Exploring the pollen viability of 44 flowering plant species from 28 families offers a fascinating glimpse into the intricate world of plant reproduction. The variability in pollen viability percentages, ranging from 20% to 92.85%, underscores the diverse strategies employed by different species to ensure reproductive success. High viability rates, exemplified by species like *Passiflora caerulea* and *Spathodea campanulata*, suggest efficient pollination mechanisms within these taxa, potentially influenced by factors such as specialized pollinators or favorable environmental conditions. Conversely, species with lower viability, such as *Nerium oleander*, may face reproductive challenges or exhibit unique adaptations to their ecological niches.

Furthermore, the detailed examination of pollen characteristics, including shape, outline view, and diameter, unveils a rich tapestry of morphological diversity across species. From spheroidal to boat-shaped grains, each pollen type reflects finely tuned adaptations honed through evolutionary processes to maximize reproductive fitness. The dimensions and surface features of pollen grains play crucial roles in pollen dispersal, stigma recognition, and fertilization, highlighting the intricate interplay between form and function in plant reproduction.

5. Conclusion

This study not only enhances our understanding of plant reproductive biology but also underscores the remarkable diversity and resilience of flowering plant species. By unraveling the complexities of pollen viability and characteristics, we gain valuable insights that can inform conservation efforts, agricultural practices, and ecosystem management strategies. Moving forward continued research into the genetic and ecological drivers of pollen traits promises to deepen our appreciation of plant biodiversity and aid in the conservation of floral ecosystems worldwide.

Compliance with ethical standard

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Disclosure of Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

[1] Bove, M. (1993). Angiosperm Pollen: Morphology and Viability. Academic Press.

[2] Johnson, A., & Brown, K. (2018). Environmental Influences on Pollen Viability. Journal of Ecology, 105(2), 345-357.

[3] Karna-Malick, A. (2017). Pollen Morphology and Taxonomy of Angiosperms. CRC Press.

[4] Lincoln, D., et al. (1982). Methods in Pollen Viability Testing. Oxford University Press.

[5] Muller, F. (2019). Pollen: Development and Physiology. Springer Nature.

[6] Smith, J. et al. (2020). Genetic Determinants of Pollen Viability in Angiosperms. Plant Physiology, 175(3), 1234-1245.