



Research Article

Palyno-taxonomic studies of some tree species of Fabaceae from Sajjan Niwas Bagh of Udaipur District, Rajasthan, India.

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Abstract: Green corridors are the key elements of urban ecology. These corridors include both new inceptions and historical gardens. Udaipur the historically glorified city of Rajasthan state holds Sajjan Niwas Bagh is popularly known as gulab bagh as one of the rich urban biodiversity hotspot. It bears numerous tree species among which *Bauhinia variegata*, *Cassia auriculata*, *Delonix regia* and *Erythrina indica* of Fabaceae family can be cited for its outnumber. These tree species contribute allergenic composition of the area from January to May of the pollen calendar cycle, but their morphological and morphometric analysis scarcely hit the prevailing studies. The present study deals with pollen morphological observations, viability and germination. The morphometric observations were recorded by scanning electron microscopy and it shows that pollen grains of all the studied species differed in shape but except *Erythrina indica* they were tricolpate. Percent viability and percent germination of *Bauhinia variegata* and *Delonix regia* was nearly similar while in case of *Cassia auriculata* and *Erythrina indica* the percent germination was poor as compared to viability which was comparatively significant. A pollen kit like adhesive structures were observed in *Bauhinia variegata* and *Cassia auriculata*.

Keywords: *Bauhinia variegata*, *Cassia auriculata*, *Delonix regia* and *Erythrina indica*, Sajjan Niwas Bagh, Pollen morphology, Pollen viability, Pollen germination

Introduction

Among the heritage gardens of Rajasthan, the Sajjan Niwas Bagh popularly known as Gulab Bagh finds the important place because of its rich floral diversity and conservation practices of the past. It has a micro-climate of its own and it is a beautiful green patch which functions as the lungs for Udaipur. Beside the aesthetic value it is a rich botanical station of many diversified plants which have been cultivated over here since 1878 (Bowe, 1999). It is not merely the adorned landscape of ornamented plants or recreational track rather it is an integral and important part of local ecosystem which helps in mitigation of air and noise pollution as well as improves the landscape in a nearby residential area. Tree species form the main contour as they are mainly planted for shade and cooling purposes. Despite of many positive attributes these trees are also the source of pollen allergens which affect the local catchment. Generally, the trees have comparatively light weight pollen grains and are carried by wind. Therefore, they form the major portion of composite air, especially in late winters and early springs and hence are responsible for mild to chronic topical and respiratory allergy.

In Sajjan Niwas Bagh around 67 tree species form the skyline among which *Bauhinia variegata*, *Cassia auriculata*, *Delonix regia* and *Erythrina indica* of Fabaceae forms the chief pollen allergen source (Jain, 1998). Fabaceae is characterized by

europalynous pollen, which is characterized with great variation in pollen morphology; however, at the generic level pollen morphology tends to be more consistent (Jose *et al.*, 2014). Pollen grain morphology of the various genera of Fabaceae family is dealt by many workers and forms an important taxonomical assessment parameter (Erdtman, 1969; Melhem, 1971; Ohashi, 1971; Perveen and Qaiser, 1998; Pavlova and Manova, 2000; Pinar *et al.*, 2000). Pollen grains vary in their external features including exine structures with position and structures of colpi and aperture. The pollen viability in turn forms the major parameter for the surveillance of the species as it contributes in the formation of seed and hence lineage to the next generation (Cynthia *et al.*, 2013). The present study aims to attain the palynological characterization of *Bauhinia variegata*, *Cassia auriculata*, *Delonix regia* and *Erythrina indica* to assess their possible role as allergen and their propagating efficiencies through their vitality and germination capabilities.

Materials and Methods

Collection of pollen material

The polleniferous material of flowers was collected from Sajjan Niwas Bagh in their bloom months as *Bauhinia variegata* (January to March), *Cassia auriculata* (January to April), *Delonix regia* (March to May) and *Erythrina indica* (March and April). Mature flower

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buds were collected in between 6-7AM in sealed polythene bags. Herbarium sheets of studied plants were prepared as per standard protocol and stored in Department of Biotechnology in BNPG College (BNU/ 2016-2017/ PB/ FAB 03, BNU/ 2016-2017/ PB/ FAB 04, BNU/ 2016-2017/ PB/ FAB 06, BNU/ 2016-2017/ PB/ FAB 07). For morphological characterization and morphometric analysis the pollen source was dried; followed by transfer and storage in glass vials.

Morphometric analysis

Dried pollen grains were suspended in a drop of ethanol and transpired with a fine pipette to a metallic stubs using double sided cello tape. Stub's were placed in the sputtering chamber for gold-palladium coatings (Polaron sputter Coater). Morphological features of pollen grain were measured using JEOL Scanning electron microscope. Measurements' for pollen size, equatorial axes and polar axes was calculated accordingly.

Pollen Viability test

Pollen viability test was carried out by the tetrazolium staining method (Oberle and Watson, 1953; Brown, 1954). 1% TTC (0.2g TTC and 12g of sucrose was dissolved in 20ml of distilled water) was dropped on a glass slide and the pollens were spread with a brush on TTC solution. Pollen viability was counted after two hours. The viability of pollen was scored according to staining level: pollen with Orange or Dark red color as viable, and colorless as non- viable.

Pollen Germination test

The germination potential of pollen was studied using the hanging drop method. Different sucrose concentration (10, 15 and 20%) was added into media with 0.5% agarose, 50µl boric acid (H₃BO₃), 100µl Calcium nitrate (Ca (NO₃).H₂O) to determine the effects of sucrose concentrations (10% to 20%) on pollen germination. The pollen containing slides were incubated at 27° C and observed after 24 hours under the light microscope at 40X for the respective germination. Germination and viability are expressed in percentage for the evaluation.

Results and Discussion

The pollen composition of any area at various heights is an index of floral diversity of shrub and tree nature of different heights. The generalized height of a human being is considered in between 4' to 6.3' feet. Therefore, medium and large sized trees and large sized shrubs form the maximum composition of allergens. *Bauhinia variegata*, *Cassia auriculata*, *Delonix regia* and *Erythrina indica* are large sized tree and their pollen forms the pollen zone of 5 to 15 feet from ground level. The pollens of all the studied species occurred as monads. Comparative morphological studied reveal that the

equatorial axis was smallest for *D. regia* (17.93µm) while *B. variegata* present largest equatorial axis (63.07µm). The pollen axis do not have deeper theoretical implications; it can be treated as a practical means of orientation on the surface of grain and since it is a practical instrument its circumscription should be as practical as possible (Faegri, 1978).

The polar axis of *B. variegata*, *C. auriculata*, *D. regia* and *E. indica* was found to be 28.46µm, 40.55µm, 39.65µm and 32.35 µm respectively, which forms the P/E ratio as 0.45, 1.43, 2.21 and 0.91. The P/E ratio chiefly provides the screen of pollen shape (Erdtman, 1952). Therefore, according to P/E ratio the shape of *B. variegata*, *C. auriculata*, *D. regia* and *E. indica* was found to be peroblate, prolate, perprolate and oblate spheroidal (Table 1).

Table 1. Morphological and Morphometric characters of *Bauhinia variegata*, *Cassia auriculata*, *Delonix regia* and *Erythrina indica* pollen grains

Pollen Characters	<i>B. variegata</i>	<i>C. auriculata</i>	<i>D. regia</i>	<i>E. indica</i>
Equatorial Axis (µm)	63.07	28.33	17.93	35.29
Polar axis (µm)	28.46	40.55	39.65	32.35
P/E ratio	0.45	1.43	2.21	0.91
Shape	Peroblate	Prolate	Perprolate	Oblate-Spheroidal
Exine ornamentation	Striate	Regulate	Reticulate/Verrucate	Irregular
Aperture	Tricolpate	Tricolpate	Tricolpate	Triporate
Symmetry	Radially	Radially	Radially	Bilateral
Polarity	Isopolar	Apolar	Isopolar	Apolar

The exine ornamentation of pollen grain forms the finger print marks of the species (Dorota *et al.*, 2013). Striate, regulate, reticulate/ verrucate and irregular orientations were observed in *B. variegata*, *C. auriculata*, *D. regia* and *E. indica* respectively. Except *E. indica* all the three species were tricolpate where *E. indica* was found to be triporate. Along with aperture morphology *E. indica* also differed from the other three species as it has bilateral symmetry while the rest three beared radial symmetry. Pollens of *B. variegata* and *D. regia* were unipolar in nature while *C. auriculata* and *E. indica* beared apolar pollen grains (Table 1).

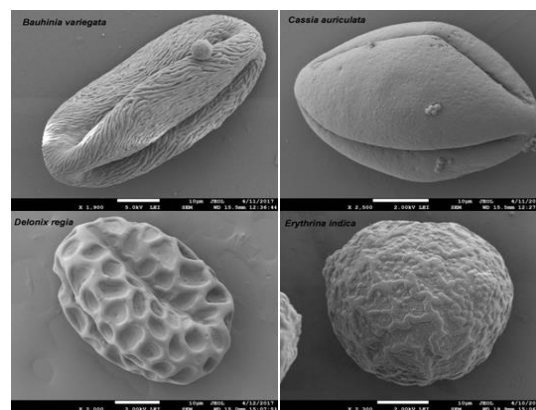
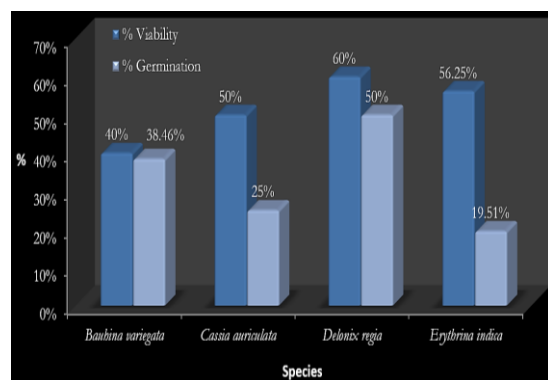


Plate 1.1- Pollen Morphology of *Bauhinia variegata*, *Cassia auriculata*, *Delonix regia* and *Erythrina indica* under Scanning electron microscope.

The SEM micro graphed structures reveal honey comb like meshes on the surface of exine of *D. regia* while pollen kit like adhesive substance were found on *B. variegata* and *C. auriculata* exine. Such adhesive structure retain grains into anther till dispersal and enable pollen packaging by bees; being resistance protects pollen from water, UV radiation and other particles and allergens (Wang *et al.*, 2017) (Figure - 1.1).

Pollen viability and pollen germination forms an important parameter to access the amount of progenitor in the composite floral community. Higher the pollen viability and pollen germination, higher account of fertilized units can be expected (Fei and Nelson, 2003).

The pollen viability and germination was nearly equal for *B. variegata* while slightly it differed in *D. regia*. In *C. auriculata* the 50% pollens were viable, but the germination scored up to 25% only. In *E. indica* 56.25% pollens were viable, but germination was merely one third (Graph 1.1). In *C. auriculata* and *E. indica* the low germination rate, despite of significant viability may be an attribute of some peripheral or extrinsic factor due to which the pollen being viable was not able to germinate (Abdelgadir *et al.*, 2012). Hindering role of gynocase is not possible as the germination experiment was carried out *in vitro*. The probable extrinsic factor may include nutrition, pH or the presence of inhibitors.



Graph 1.1: Germination Score

Conclusion

Sajjan Niwas Bagh, the prominent green corridor of Udaipur city is lushed with green crowns of prominent *B. variegata*, *C. auriculata*, *D. regia* and *E. indica*. Among the studied tree species grains of *D. regia* are smallest while *B. variegata* grains to be largest. These two species have nearly equal viability and germination capacity while *C. auriculata* and *E. indica* showed comparatively lower germination values. Therefore, it can be concluded that *B. variegata* and *D. regia* form major risk zone of pollen allergens as compared to *C. auriculata* and *E. indica*.


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