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ARTICLE

Relation between Flower Colour and Pollen Size Polymorphism in Accessions of *Hibiscus Rosa-Sinensis* L.

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Abstract

Flower colour and pollen size in sixty accessions of *Hibiscus rosa-sinensis* L. collected from different parts of Thiruvananthapuram and Kollam districts, Kerala were studied. The accession A-6 was male sterile, while A-57 was completely sterile. In the remaining 58 accessions, the pollen grains were consistently pantoporate, spheroidal and spinate. Ten accessions possessed gigantic pollen (>200µm), while the remaining 48 possessed very large grains, suggesting an ongoing process of evolutionary advancement within the species-complex. But the pollen of most accessions exhibited size polymorphism, being monomorphic (40%), dimorphic (51%) or trimorphic (9%). The trimorphic pollen were limited to the dark flowered varieties belonging to the red, magenta and saffron colour groups only. The yellow flower colour group was predominantly monomorphic.

Keywords: accessions, flower colour, *Hibiscus rosa-sinensis* , pollen size , polymorphism, relation

Introduction

Hibiscus rosa-sinensis L. is one of the most attractive and well-known members of the mallow family Malvaceae. This popular ornamental is pantropical in distribution with several thousands of varieties constituting the H. rosa-sinensis species-complex (Singh and Khoshoo 1970; Sivarajan and Pradeep 1996). The available taxonomic literature on this species is vast, with most of the morphological studies being made on the variation of its floral characters (Davis and Ghoshal 1966; Satapathy 1978; Heel 1978). Flower colour still remains a major criterion in the visual recognition of the different members. The large spiny Hibiscus pollen have caught ample attention, and are described as pantoporate, spheroidal and spinate (Erdtman 1952; Nair 1961). However, no attempt has so far been made to connect the two traits- viz. flower colour and pollen size. The present study focuses on this aspect.

Materials and Methods

Flower colour and pollen size were studied from sixty accessions of *Hibiscus rosa-sinensis* L. (A1-A60) collected from different households in the urban areas of Thiruvananthapuram and Kollam districts of Kerala, South India. Herbarium specimens of the taxa studied are maintained in the Department of Botany, S.N. College, Kollam. Polliniferous materials were collected from live plants and fixed in glacial acetic acid. Pollen preparations were made by the acetolysis method standardized by Erdtman (1952) and modified by Nair (1970). Permanent slides for light microscopic studies were prepared by mounting the acetolysed pollen in glycerine jelly and sealing with paraffin wax. The size of pollen grains was measured using an ocular micrometer from a random sample of twenty-five pollen per slide. The pollen grains were grouped into different size classes following Walker and Doyle (1975).

Results and Discussion

The pollen grains were pantoporate, spheroidal and spinate in all the sixty accessions studied. A-6 was male sterile, while A-57 was completely sterile. In all the remaining accessions the pollen grains were monomorphic, dimorphic or trimorphic with regard to their size (Fig.1). Table 1 shows the different flower colour groups studied, with the accessions coming under them. The relation between flower colour and pollen size polymorphism is represented in Table 2 and Figs.2 and 3.

The pollen size has been considered to be an unstable character as it is often affected by the method of preparation (Walker and Doyle 1975; Joosten and de Klerk 2002). However, Nair and Kapoor (1974) have considered pollen size variation as an index to varietal taxonomy in certain Cucurbits. Stebbins (1950) and Powell (1965) studied pollen samples from herbarium sheets for surveying polypoidy within certain taxa. Infraspecific pollen size variations have been attributed to environmental or nutritional conditions (Muller 1979) or variations in the plant population (Clau-

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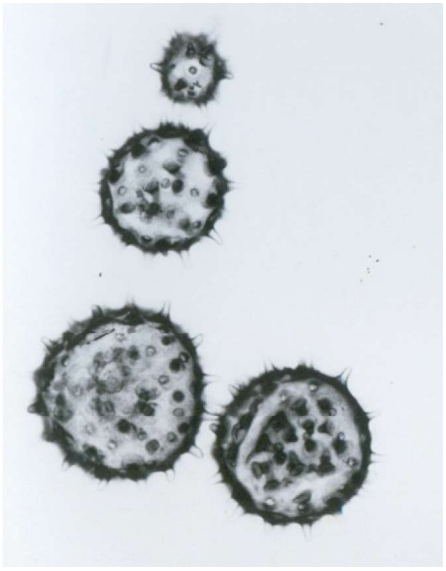
Table 1. The different flower colour groups of *Hibiscus rosa-sinensis* L. and the accessions coming under each group

Flower colour	No. of taxa	Accession Numbers
White	4	A-36 to A-39
Cream	3	A-40 to A-42
Pink	14	A-16 to A-29
Mustard	1	A-43
Yellow	9	A-44 to A-52
Saffron	8	A-53 to A-60
Orange	2	A-14, A-15
Red	12	A-1 to A-5 and A-7 to A-13
Magenta	6	A-30 to A-35
Mixed	1	A-6

Figure 1. Trimorphic pollen



sen 1960), being either ecotypic (Bragg and Macmillan 1962) or developmental (Clausen 1962). A positive correlation between flower size, style length, vector size and pollen size was reported by Lee (1979). Goldblatt *et al.* (2004) have considered large grains with elaborate apertures to be an evolved condition over medium sized grains with small lumina in the genus Aristea.

The pollen diameter ranged from 128.33µm (A-2) to 228.07µm (A-28). In general, ten accessions possessed gi-

Figure 2. Frequencies of different types of pollen size polymorphisms in accessions of *Hibiscus rosa-sinensis* L.

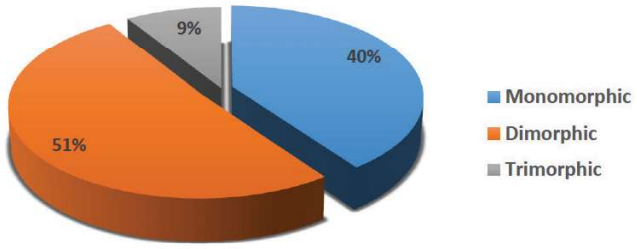
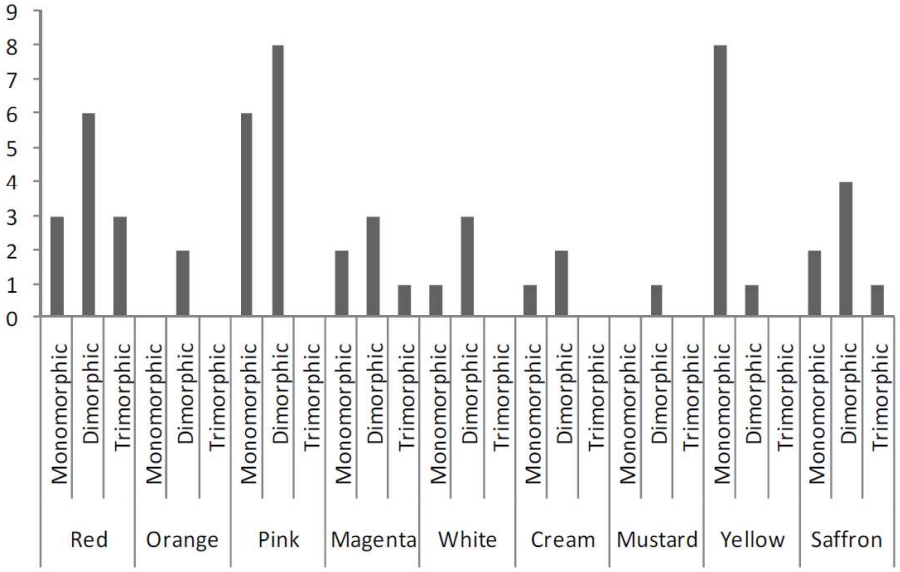


Table 2. Relation between pollen size polymorphism and flower colour in accessions of *Hibiscus rosa-sinensis* L.

Sl. No.	Flower colour	Type of pollen size morphism	No. of accessions	Total
1	Red	Mono Di Tri	3 6 3	12
2	Orange	Mono Di Tri	0 2 0	2
3	Pink	Mono Di Tri	6 8 0	14
4	Magenta	Mono Di Tri	2 3 1	6
5	White	Mono Di Tri	1 3 0	4
6	Cream	Mono Di Tri	1 2 0	3
7	Mustard	Mono Di Tri	0 1 0	1
8	Yellow	Mono Di Tri	8 1 0	9
9	Saffron	Mono Di Tri	2 4 1	7

Figure 3. Frequencies of pollen size polymorphism types in different flower colour groups of accessions of *Hibiscus rosa-sinensis* L



gantic pollen (>200µm), while the remaining 48 possessed very large grains (100-199µm). Evolutionarily, gigantic pollen are considered to have evolved from the primitive angiosperm pollen of the large grain size class ranging from 50-99µm (Walker 1971; Christensen 1986).Gigantic and very large pollen grains observed within the present species-complex may be suggestive of its ongoing process of evolutionary advancement.

The pollen grains were either monomorphic (40%), dimorphic (51%) or trimorphic with regard to their size (Fig. 2). Fig. 3 shows the distribution pattern of the different morphism types in the different flower colour groups. Tejaswini (2002) has considered pollen size polymorphism to be a survival strategy, as larger pollen showed higher frequency of germination and more adaptation to adverse conditions, while smaller pollen exhibited faster pollen tube growth in populations of *Dianthus caryophyllus* and *Dianthus chinensis*. The trimorphic pollen were observed in the dark flowered varieties belonging to the red, magenta and saffron colour groups only (Table 2). The yellow flower colour group was predominantly monomorphic (89%). However, in all the flower colour groups there was predominance of dimorphic pollen.

Conclusion

The pollen grains were in general pantoporate, spheroidal, spinate and gigantic or very large in size. The pollen of most accessions also exhibited size polymorphism, being monomorphic (40%), dimorphic (51%) or trimorphic (9%). Large sized pollen and pollen size polymorphism are suggestive of the ongoing process of evolutionary advancement within the species-complex, and the latter may reflect a strategic means for improving reproductive efficiency for better survival of the species. The flowers of all the sixty accessions belonged to nine colour classes, among which the yellow flower colour group was predominantly monomorphic. Trimorphic pollen were limited to the dark flowered varieties belonging to the red, magenta and saffron colour groups only.

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