

Pollen grain studies of guava genotypes in winter and rainy season crops

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Abstract

The pollen morphology and germination percentage of guava cultivars during two flowering seasons viz., spring (April-May) and autumn (August- September) were observed. Pollen grain germination was recorded best in two hours after pollination in 12 per cent sucrose solution. Pollen size as well as pollen tube length was recorded larger in cultivar Lucknow-49 as compared to other cultivars.

Key words: Guava, flowering seasons, pollen morphology and germination

Introduction

Guava (*Psidium guajava* L.) is an important fruit crop of tropical and subtropical region. It is aptly known as "Poor man's Apple" and "Apple of the Tropics". In India, it ranks 4th in total cultivated area under fruits after mango, banana and citrus, occupying an area of 0.19 millions hectares. However, guava is 5th most important fruit crop in production with a total production of 1.68 million tonnes (Anonymous, 2002). It occupies a premier position by virtue of its high food value (Kahlon *et al.*, 1987). Three flowering seasons for guava have been observed in the Indian peninsula, viz. ambe bahar, mrig bahar and hashta bahar.

The peak anthesis is found to occur between 5.00 and 6:30 AM in most of the varieties under south Indian conditions. In northern India, guava flowers twice in a year (in April-May and August-September). However, under north Indian conditions, anthesis occurs between 6.00 and 7:30 AM (Singh, 2002).

Only a few attempts to improve its varietal wealth have been made for north Indian conditions. The need for improvement of this fruit crop is therefore, imperative and requires active consideration. Hybridization is one of the most important methods for bringing improvement in the fruit crops. It requires proper study of flower biology (pollen morphology, germination) so crossing can do as per requirement.

Materials and methods

Morphology of the pollens was measured with the help of an Ocular micrometer. Fertility of pollen grains was tested in sucrose solutions of different concentrations at three different time intervals. The pollen grains were cultured in sucrose concentration of 10, 12 and 14 per cent at three different time intervals viz. Pollen collected immediately, two hours and four hours after opening of flowers.

Pollen tube length

Pollen tube length was recorded from the Petri dishes prepared for pollen germination record. Pollen tube length was measured with the help of Ocular micrometer. Average of thirty germination pollens was calculated and expressed as tube length in microns (μ).

Pollen germination assay:

At the flowering stage, flowering buds were collected randomly a day before anthesis from three different plants of each cultivar. The pollen grains from these flowers were mixed thoroughly on a glazed paper and sprinkled with the help of a camel hairbrush on the surface of semisolid germination medium contained in Petri Plates. The composition of the medium was as given below:

Sucrose	=	35 %
Boric acid	=	100 ppm
Calcium nitrate	=	100 ppm
Agar	=	0.8 %

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The medium was supplemented with different concentrations of sucrose (10, 12, and 14, per cent). After pollen inoculation, Petri plates were incubated at 25 ± 2 °C for 24 hour in dark in a BOD incubator with four replicates per treatment. After incubation, the pollen activity was terminated by flooding the surfaces of media with killing and fixing solution of the following composition (Sass, 1951):

Formaldehyde	=	5ml
Glacial acetic acid	=	3 ml
Water	=	72 ml
Glycerine	=	20 ml

Pollen producing a tube length of a size greater than its diameter was designated as germinated. Ten readings for pollen and thirty for tube length from different microscopic fields of each Petri plate were made from area with uniform distribution pollen and fairly good population.

Result and discussion

There was a significant difference in pollen grain length with regard to the cultivars and season of flowering as given in Table-1. Amongst different cultivars, Lucknow-49 produced pollen grains of maximum pollen length (22.65 μ) that was significantly longer than other cultivars. The minimum pollen grain length was recorded in Hisar Safeda (20.48 μ) that was significantly lower than Allahabad Safeda (21.79 μ) and Hisar Surkha (21.66 μ). Lucknow-49 produced significantly longer pollen grains in spring flowering (23.00 μ) and autumn flowering season (22.30 μ) as compared to other cultivars. It was further observed that average pollen grain length was more in autumn flowering season (21.84 μ) as compared to spring flowering season (21.46 μ), however, the difference was non significant. Considerable variations were recorded in pollen grain breadth of different cultivars in spring as well autumn flowering seasons (Table-1). The seasonal effect on average pollen grain breadth in all the cultivars was non significant. Among the different cultivars, pollen grains

Table 1. Pollen grain size, germination percentage and Pollen tube length in guava cultivars during spring and autumn flowering season

Cultivars	Pollen grain size (μ)						Germination percentage			Pollen tube length (μ)		
	Pollen length (μ)			Breadth (μ)			Spring	Autumn	Mean	Spring	Autumn	Mean
	Spring	Autumn	Mean	Spring	Autumn	Mean						
Hisar Safeda	20.52	20.45	20.48	19.3	18.82	19.06	36.17	39.44	35.06	40.50	41.00	40.75
Hisar Surkha	21.90	21.42	21.66	20.53	19.95	20.25	34.92	35.47	35.18	39.00	38.25	38.62
Lucknow-49	23.00	22.30	22.65	20.90	21.00	21.02	43.17	43.14	43.16	41.50	43.00	42.25
Allahabad Safeda	21.92	21.65	21.79	20.25	19.92	20.09	39.50	40.58	40.04	37.25	38.50	37.87
Mean	21.84	21.46	21.79	20.25	19.96	20.11	38.44	38.28	38.36	39.56	40.31	39.94
CD at 5%	Cultivar = 0.67						1.27			3.59		
	Season = 0.48						1.80			N.S.		
	Season X Cultivar = 0.95						2.55			5.08		

Table 2. Germination percentage of pollen grains under different concentrations of sucrose

Concentration of sucrose	Time				Mean
	Immediately after anthesis	after 2 hrs. after anthesis	4 hrs. after anthesis		
10%	39.16	43.34	21.91		34.80
12%	49.56	51.94	30.84		44.11
14%	38.78	43.78	25.91		36.16
Mean	42.58	46.78	26.21		
CD at 5%	Time = 1.56	Conc. = 1.56	Time X Conc. = 2.70		

of Lucknow-49 have maximum pollen breadth ($21.02\ \mu$), which was significantly at par with Allahabad Safeda ($20.09\ \mu$) and Hisar Surkha ($20.25\ \mu$). The minimum pollen grain breadth was observed in Hisar Safeda ($19.06\ \mu$), which was significantly lower than other cultivars except, Allahabad Safeda ($20.09\ \mu$). Interaction of season with cultivar showed that pollen grains breadth was found non significant in all the cultivars during both the seasons. Kahlon *et al.*, (1987) also favored pollen grain size of various cultivars of guava.

The percentage of pollen grains germination in different guava cultivars was found significant. Seasonal effect on pollen grain germination was found non significant in all the cultivars except Hisar Safeda. Amongst the cultivars, maximum percentage of pollen grain germination was observed in Lucknow-49 (43.16 per cent), which was significantly higher as compared to other cultivars, whereas, minimum pollen germination was observed in cultivar Hisar Safeda (35.06 per cent) that was at par with Hisar Surkha (35.18 μ). Interaction of season and cultivar was found significant. Significantly higher pollen germination was recorded in Lucknow-49 during spring flowering (43.17 per cent) and autumn flowering season (43.14 per cent) as compared to other cultivars.

Data regarding pollen tube length present in the Table-1 indicated that pollen tube length varied from $37.25\ \mu$ to $41.50\ \mu$ in spring flowering season and $38.25\ \mu$ to $43.0\ \mu$ in autumn flowering season of flowering in different cultivars of guava. It was also recorded that longer pollen tube was obtained in autumn flowering season as compared to spring flowering season in all the cultivars except Hisar Surkha where it was other way round. The results of the present study are similar to that of Nalawadi *et al.*, (1973) who also reported maximum pollen tube length of $52\ \mu$ in Lucknow-49 variety of guava.

An appreciable difference was observed in pollen grain germination at three different sucrose concentrations with regard to three time intervals from the Table-2 respectively. Maximum percentage of pollen grain germination was recorded two hours after opening of flowers (46.78 per cent), which was significantly higher

as compared to other times of germination. Among the different concentrations of sucrose solution pollen grain germination was found maximum at 12% concentration (44.11 per cent) in all the cultivars. It was further observed that percentage of pollen grain germination increased with the increase in sucrose concentration up to 12 % in all the cultivars and later it declined at 14 % concentration of sucrose solution. The findings of Rattanpal and Dhaliwal (1995), Dhaliwal and Singla (2002) and Kahlon *et al.*, (1987) corroborated the results of present investigation who also obtained maximum pollen germination of guava in 10 and 15 per cent sucrose solution. It was further observed that cultivar Lucknow-49 showed statistically better pollen germination than other cultivars and rainy season established its significant superiority over winter season.

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