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GENOTYPIC VARIATION IN POLLEN BIOLOGY OF JACKFRUIT (*Artocarpus heterophyllus* lam .)

ADITI GUHA CHOUDHURY*, SONAM ONGMU BHUTIA, S. K. SARKAR AND B. C. DAS
Department of Fruits and Orchard Management,
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia - 741 252, West Bengal
e-mail: aditi.fruits@gmail.com

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***Corresponding author**

ABSTRACT
A study on pollen biology of jackfruit was carried out among ten genotypes, selected from germplasm block of AICRP on fruits, Bidhan Chandra Krishi Viswavidyalaya, Mondouri, Nadia, West Bengal. The study revealed that the pollen diameter varied from 15.50μ to 19.42μ with Genotype No. 10/4 having the maximum value. On staining of pollen grains with 1% acetocarmine exhibited maximum pollen viability (96%) in Genotype No. 10/10. Pollen germination was observed with variable concentration of sucrose solution i.e. 10%, 15%, 20% and 25% along with 1% agar where 25% sucrose showed no germination at all. Germination with respect to genotypes and media was maximum (78.79%) in Genotype No. 10/10 along with 10% sucrose + 1% agar & 6 hours after pollen planting. The mean data regarding pollen germination & pollen tube growth were highest in 10% sucrose + 1% agar media *i.e.* 71.75% and 35.40μm respectively irrespective of genotype. So the above study leads to a precise conclusion that 10% sucrose+1% agar act as best *in vitro* germination medium for jackfruit pollens and all genotypes exhibited high pollen fertility with Genotype No. 9/8, 11/10 and 10/4 will play important role as superior male parents with high number of fertile pollens.

INTRODUCTION

The Jackfruit (*Artocarpus heterophyllus* Lam.) belongs to the family Moraceae which is the largest tree borne fruit crop and known as the "Poor man's food" (Haq, 2006; Mal *et al.,* 2001). Jackfruit is well-known and widely used in Indian culture from ancient times but still it remains underutilised because it has hardly undergone any scientific improvement (APARI, 2012).

Knowledge on pollen biology imparts essential information of genetic conservation and utilization of species for crop improvement (Lyra *et al.,* 2011). Genetic variability among populations, choice of parents for hybridization and selection procedure are critical factors that determine success of any crop improvement programme and pollen viability test simplifies the procedure to select promising cultivars for hybridization (Baswal *et al.,* 2015; Meena and Bahadur, 2013). It is an important factor for plant genetic variability mainly for cross pollinated species as it reveals the male reproductive capacity and enables different allelic combinations (Divakara *et al.,* 2010).

Success of *in vitro* manipulation of pollen grains depends upon the efficient monitoring of viability of treated grains (Vizintin and Bohanec, 2004). Two basic approaches can be taken to estimate pollen viability i.e. staining of pollen grains and *in vitro* germination assay. Staining techniques aim to determine pollen enzymatic activity and membrane integrity whereas *in vitro* germination provides the actual germination ability of pollen under suitable conditions (Tuinstra and Wedel, 2000). Hence the present study was undertaken to generate knowledge on pollen biology of jackfruit under climatic conditions of indo-gangetic region & its genotypic differences.

MATERIALS AND METHODS

The present investigation was carried out during flowering season of 2014-15 with ten different jackfruit genotypes from germplasm block at Mohanpur centre of All India Coordinated Research Project on Fruits, Bidhan Chandra Krishi Viswavisyalaya, Nadia, West Bengal. To study pollen diameter, 12 freshly collected pollen grains of each genotype were chosen at random. Pollen viability was observed by staining with 1% acetocarmine solution (Nassar *et al.,* 2000). Pollen grains were observed through an optical microscope (light microscope x100 magnification). Pollen germination percentage of all genotypes (A_1=Genotype No.-9/7, A_2=Genotype No.-9/8, A_3=Genotype No.-10/4, A_4=Genotype No.-10/6, A_5=Genotype No.-10/9, A_6=Genotype No.-10/10, A_7=Genotype No.-11/6, A_8=Genotype No.-11/7, A_9=Genotype No.-11/9, A_{10}=Genotype No.-11/10) was examined in suitable germination medium (B_1=10% Sucrose solution + 1% Agar, B_2=15% Sucrose solution + 1% Agar, B_3=20% Sucrose solution + 1% Agar) through hanging drop technique (Shivanna and Rangaswamy, 1992). Pollen tube growth in different germination medium (P_1=10% Sucrose solution + 1% Agar, P_2=15% Sucrose solution + 1% Agar, P_3=20% Sucrose solution + 1% Agar) was observed with respect to hours after pollen plantation (V_1= 2 hours after pollen plantation, V_2= 4 hours after pollen plantation, V_3= 6 hours after pollen plantation). Statistical analyses of data regarding pollen diameter and pollen viability were done following complete randomized design (CRD) whereas pollen germination and pollen tube growth were analysed by two factor factorial complete randomized design (FCRD) as per

Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The study revealed that pollen grains were smooth, round shaped with three pores. In the early morning they showed some stickiness but gradually became dry with raising day temperature and were looked like yellow powder covering the inflorescence. Pollen Diameter was minimum (15.50 μm) in Genotype No.-9/8 and maximum *i.e.* (19.42 μm) in Genotype No.-10/4 (Table 1). Pushpakumara (2006) also reported that pollen grains were smooth, spherical in shape, 15-20 μm in diameter with 3 pores.

Pollen viability was found above 90% in all the genotypes under the present study. Highest viability was recorded in Genotype No -10/10 (96%) and lowest in Genotype No-11/7 (91%) (Table 1). However, variation in pollen viability and pollen diameter among genotypes were insignificant. Pollen fertility between 89 and 93% and pollen diameter from 16 to 22 μm were also reported by Joseph and Kumaran (1994) under Tamil Nadu conditions.

Table 1: Pollen diameter and pollen viability percentage of different Jackfruit genotypes

Genotype No.	Pollen diameter (μm)	Pollen Viability (%)
9/7	16.50	93.70 (75.65)
9/8	15.50	95.47 (77.68)
10/4	19.42	94.83 (76.99)
10/6	18.33	92.57 (74.25)
10/9	15.58	93.93 (76.43)
10/10	15.83	96.00 (78.69)
11/6	18.17	92.23 (74.23)
11/7	17.25	91.87 (73.47)
11/9	16.67	94.40 (76.43)
11/10	16.92	92.93 (74.71)
S.E.m(±)	1.001	1.48 (1.87)
C.D. at 5 %	N.S.	N.S.

Values in the perenthesis are transformed values after angular transformation

It is well known that fresh as well as preserved pollen, irrespective of viability, often stains alike with acetocarmine as the staining capacity depends not on the viability of the pollen but its contents (Vasil, 1958). The persuasive data presented in Table 1 and Table 2 clearly showed the differences between pollen stainability and pollen germinability.Einhardt *et al.* (2006), Santos *et al.* (2006) and Nyine and Pillay (2007) found similar results in their experiments, emphasizing that pollen grain viability assessment through the staining method seems to express the germination potential, but not its occurrence. Effects of media containing different sucrose concentrations on pollen germination varied significantly, though no pollens of all ten genotypes did germinate in 25% sucrose solutions + 2% boron + 1% agar which confirms the hypothesis of Premachandra *et al.* (1992) where it was observed that the increase in concentrations of sucrose in the culture medium increases the supply of carbon available to the culture, being the osmotic potential means changed, may inhibit, the formation of pollen tubes *in vitro*. Pollen germination was found maximum in B_1 media (71.75%) followed by B_2 (65.42%) and B_3 (57.54%).

Genotype No.-9/8 (A_2) gave highest pollen germination (68.70%) whereas Genotype No. -11/7 (A_8) showed the lowest (59.44%). According to Kakani *et al.,* 2005 and Frazon *et al.,* 2005, the differences observed in germination *in vitro* reflexed the variability among the cultivars because cultivars within same species requires different conditions of a medium for *in vitro* pollen germination. Among all genotypes and among interaction highest germination (78.79%) found in A_6B_1 treatment (Table 2). Pollen tube growth also varied significantly with hours of pollen planting. Pollen tube growth also varied considerably among different germination media *viz.,* P_1 (68.80 μm), P_2 (46.40 μm) and P_3 (40.20 μm). Highest (68.80 μm) length was recorded after 6 hours of *in vitro* germination in V_3P_1 treatment combination (Table 3). Perusal of data revealed that the higher concentration of sucrose could not accelerate the speed of pollen tube growth.

Table 2: Pollen germination percentage of Jackfruit genotypes in different germination media

Genotype No.	Germination (%) 10% Sucrose + 1% Agar(B_1)	15% Sucrose +1% Agar (B_2)	20% Sucrose + 1% Agar (B_3)	Mean A
9/7 (A_1)	63.16 (52.61)	62.42 (52.17)	56.36 (48.64)	60.65 (51.14)
9/8 (A_2)	72.50 (58.35)	70.81 (57.28)	62.79 (52.39)	68.70 (56.01)
10/4 (A_3)	77.08 (61.38)	65.69 (54.12)	59.62 (50.53)	67.46 (55.34)
10/6 (A_4)	70.37 (57.00)	69.64 (56.55)	59.38 (50.39)	66.46 (54.65)
10/9 (A_5)	69.86 (56.70)	68.84 (56.06)	58.11 (49.65)	65.60 (54.14)
10/10 (A_6)	78.79 (62.56)	61.67 (51.73)	57.14 (49.08)	65.87 (54.46)
11/6 (A_7)	71.67 (57.84)	64.29 (53.29)	57.35 (49.21)	64.44 (53.45)
11/7 (A_8)	68.92 (56.10)	56.63 (48.79)	52.78 (46.57)	59.44 (50.49)
11/9 (A_9)	71.11 (57.47)	63.21 (52.64)	53.06 (46.73)	62.46 (52.28)
11/10 (A_{10})	74.00 (59.33)	70.97 (57.38)	58.82 (50.06)	67.93 (55.59)
Mean B	71.75 (57.93)	65.42 (54.00)	57.54 (49.33)	
A	S.E. m(±)	0.60 (0.37)		
	C.D. at 5%	1.69 (1.04)		
B	S.E. m(±)	0.33 (0.20)		
	C.D. at 5%	0.93 (0.57)		
AxB	S.E. m(±)	1.03 (0.64)		
	C.D. at 5%	2 .93 (1.80)		

Values in perenthesis are transformed values after angular transformation.

Table 3: Pollen tube growth of jackfruit pollens in different germination media with respect to hours after pollen plantation

Hours after pollen planting	Pollen tube growth (μm)			MeanV
	10% Sucrose + 1% Agar (P_1)	15% Sucrose + 1% Agar(P_2)	20% Sucrose + 1% Agar(P_3)	
2 hours (V_1)	10.60	7.60	6.40	8.20
4 hours (V_2)	26.80	21.40	14.60	20.93
6 hours (V_3)	68.80	46.40	40.20	51.80
Mean P	35.40	25.13	20.40	
V	S.E. m(±)	2.19		
	C.D. at 5%	6.31		
P	S.E. m(±)	2.19		
	C.D. at 5%	6.31		
V × P	S.E. m(±)	3.79		
	C.D. at 5%	10.92		

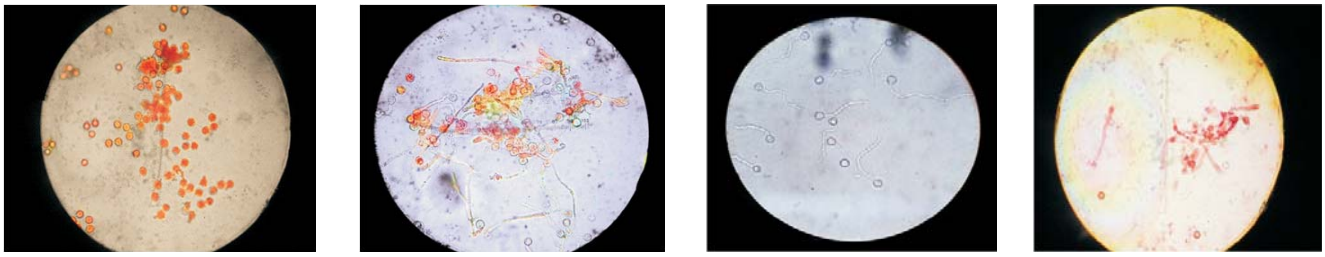

Figure 1: Viable pollens in microscopic field (a), Pollen germination in 10% sucrose 6 hours after pollen plantation (b), Pollen germination in 15% sucrose 6 hours after pollen plantation(c), Pollen germination in 20% sucrose 6 hours after

Thus, the above results clearly indicated that jackfruit pollens have high fertility but high sucrose is not congenial for *in vitro* pollen germination of jackfruit. It could be suggested from present investigation that aqueous medium containing 10% sucrose in combination with 1% agar is the best germination medium for *in vitro* pollen germination of jackfruit. Though pollen fertility was good in all genotypes and they can be further used in breeding program, Genotype No. 9/8, 11/10 and 10/4 will play important role as superior male parent with high number of fertile pollens.

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