Science Research Reporter, 4(1): 35-38, (April - 2014)
© RUT Printer and Publisher (http://jsrr.net)
ISSN: 2249-2321 (Print); ISSN: 2249-7846 (Online)
Received: 20-01-2014, Revised: 11-02-2014, Accepted: 02-03-2014

Full Length Article

Comparative pollen viability study on *Jatropha curcus* L. and *Jatropha gossypifolia* L.

Gam N K

Department of Botany, Sibsagar College, Assam, India
gamnava@yahoo.co.in

ABSTRACT

The present paper deals with the comparative study of pollen grains of *Jatropha curcus* L. and *Jatropha gossypifolia* L. available in the North Eastern region of India at different sucrose solution and temperature. The pollen grain germination responsive to sucrose concentration and temperature was found almost same in both the species. The highest germination percentage were 79.62±0.83 % in 25% sucrose solution at 30^0C in the former and 76.02±0.78% in 30% sucrose solution at 30^0C in the later.

Key Words: Jatropha, North-eastern India, sucrose concentration, temperature.

INTRODUCTION

The pollens were directly related to the floral ratio of both the species as it was found more male female floral ratio in the *Jatropha curcus* L. than *Jatropha gossypifolia* L. (Gam and Bora, 2012). Pollen grains are simple structured and reproductive unit of plants. Pollentube formation is a good and simple model of growthand development (Taylor and Hepler, 1997). Thus, pollen germination and growth of pollen tubes areimportant research materials for morphological, physiological, biotechnological, ecological, evolutional, biochemical and molecular biological studies (Ottavio *et al*., 1992). The pollen tube formed in many species is amassive structure relative to the reserve materialsstored in the pollen grain, and the reserves often are quickly consumed (Dane *et al.,* 2004). Abundance and availability of energy resources largely determine the economic well-being of a country. Energy independence has to be our first and foremost priority'-said A.P.J. Abdul Kalam, the then President of India (Independence Day address to the nation on 15 August 2005) emphasizing cultivation of TBOs. In India, more than 100 species of forest plants – tree borne oil seeds (TBOs) have been identified as a source of fatty oils with an estimated potential of 11.3 lakh tones.

Jatropha is one such genera about which very little is known and research to meet our future energy requirement is eagerly awaited. The mission for *Jatropha* plantation in North Eastern Regionsof India (NE-India) is even more at its infancy. TBOs (Tree Borne Oilseeds garden) established in 11 states covering 126 acres area in the countrywide. Out of this in North Eastern Regions of India, TBOs is covering 15 acres area, which is only 11.90% of the total area of the country. Two species of *Jatropha* are found wild and available in North Eastern Regions of India. Study on the pollen germination capacity of the identified species lead to the proper cultivation and hybridization programmed in the region (Gam, 2012).

MATERIALS AND METHODS

For the study of pollen germination, the pollens were collected in large quantity from flowers of *Jatropha curcus* L. and *Jatropha gossypifolia* L. Fresh pollens were systematically tested for their viability as suggested by Alexander, (1996). Culture media for pollen were prepared according to the standard method of Brewbaker and Kwack (1963).

Pollen tubes equal to twice the diameter of the pollen grains were counted as germinated, while burst pollens were not counted as germinated. For measurement of pollen tube growth, pollen grains were germinated in 12 petri plates under room temperature ($30^{o}C \pm 20^{o}C$) and allowed to grow for three hours. Length of the pollen tube was measured at one hour interval for three conjugative hours. Measurements were done by using ocular and stage micrometer under a compound microscope (10×10x). The viability of pollen grains was assessed in terms of germination percentage. The pollen grains were germinated in seven different concentrations of sucrose solutions less than seven different temperatures. The different concentrations of sucrose solution used were 10%, 15%, 20%, 25%, 30%, 35% and 40% while the different temperatures were $15^{0}C$, $20^{0}C$, $25^{0}C$, $30^{0}C$, $35^{0}C$, $40^{0}C$ and $45^{0}C$. The observations on pollen germination were made after one hour of inoculation of the pollen grains into the sucrose solution. Co-efficient of correlation was measured for treatment temperature and sucrose solution by the method of Karl Pearson's (Gupta, 1999) using the formula -

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}$$

Where, 'x' and 'y' are series of two associated characters to be compared.

RESULTS AND DISCUSSION

The study of pollen germination of *Jatropha curcus* L. and *Jatropha gossypifolia* L. showed significant correlation between sucrose concentration and temperature with regard to their effects on pollen germination. The common condition for successful germination of pollen in vitro seems to be relatively high requirement of sucrose concentration in the culture media. Temperature is also of important for pollen germination. Most of the author reported that the reproducible results were obtained in between 28 to 35^{0} C (Asma BM, 2008).

Table No. 1: Germination of pollen grains in *Jatropha curcus* Lin. at different levels of Sucrose solutions and temperatures

Sucrose Solution	Temperature						
	$15^{0}C$	$20^{0}C$	$25^{0}C$	$30^{0}C$	$35^{0}C$	$40^{0}C$	$45^{0}C$
10%	56.75±1.30	65.13±0.75	66±0.23	70.06±0.92	72.19±0.39	75.03±0.70	67.53±0.61
15%	59.71±1.22	65.9±0.42	73.83±0.77	74.56±0.12	76.15±0.56	79.01±1.01	71.53±0.64
20%	65.16±1.70	69.73±0.39	74.26±0.39	76.02±0.63	78.01±0.68	80.91±0.82	74.01±0.63
25%	69.06±1.30	73.19±0.60	76.85±0.50	79.62±0.83	80.18±0.64	81.75±0.73	76.78±0.52
30%	57.70±1.78	66.16±0.61	69.28±0.79	70.1±0.87	71.00±0.94	72.02±1.11	67.71±0.88
35%	50.19±0.58	59.10±0.83	62.15±0.72	63.17±1.10	63.2±0.33	65.16±0.40	60.51±0.81
40%	46.25±0.44	52.31±0.89	59.56±0.60	60.12±0.68	61.06±0.48	63.03±0.70	52.36±0.86

Table No. 2: Germination of pollen grains in *Jatropha gossypifolia* L. at different levels of Sucrose solutions and temperatures.

Sucrose Solution	Temperature						
	$15^{0}C$	$20^{0}C$	$25^{0}C$	$30^{0}C$	$35^{0}C$	$40^{0}C$	$45^{0}C$
10%	28.66±0.16	33.20±0.48	52.68±0.82	64.03±0.52	70.08±0.68	72.19±0.68	68.03±0.32
15%	29.78±0.33	35.03±0.96	53.03±0.48	66.26±0.73	73.1±0.68	74.12±0.57	69±0.89
20%	35.7±0.31	37.56±1.05	59.05±0.72	69.23±1.53	76.56±0.68	76.98±0.41	70.25±1.32
25%	37.02±0.24	39.25±0.67	61.03±0.82	70.25±0.90	79.56±0.68	80.1±0.60	75.25±0.98
30%	40.26±0.41	53.01±0.54	65.07±0.92	76.02±0.78	80.03±0.68	82.46±1.06	78.21±1.10
35%	36.35±0.35	46.23±0.97	60.10.95	65.23±1.06	72.06±0.48	73.6±0.31	74.09±0.79
40%	33.09±0.20	35.01±0.64	39.15±0.34	39.97±0.73	41.02±0.46	41.89±0.85	38.9±0.77

Table No.3.Karl Pearson's Coefficient of correlation (r) between temperature and Sucrose solution on the germination of pollen grains in *Jatropha curcus* Lin.

	10%	15%	20%	25%	30%	35%	40%
15°C	-0.19336						
20°C		0.589826					
25°C			-0.24783				
30°C				0.197872			
35°C					0.437246		
40°C						0.654691	
45°C							-0.43069

Table No. 4: Karl Pearson's Coefficient of correlation (r) between temperature and sucrose solution on the germination of pollen grains in *Jatrophagossypifolia* Lin.

	10%	15%	20%	25%	30%	35%	40%
15°C	0.751761						
20°C		0.049187					
25°C			0.332384				
30°C				0.212997			
35°C					0.076212		
40°C						0.82418	
45°C							0.115194

The responsive germination percentage in *Jatropha curcus* L. were 75.03% in 10% sucrose concentration at 40^{0}C; 79.01% pollen germination in 15% sucrose concentration at 40^{0}C; 80.91% pollen germination in 20% sucrose concentration at 40^{0}C; 81.75% pollen germination in 25% sucrose concentration at 40^{0}C; 72.02% pollen germination in 30% sucrose concentration at 40^{0}C; 65.16% pollen germination in 35% sucrose concentration at 40^{0}C and 63.03% pollen germination in 40% sucrose concentration at 40^{0}C. Mert (2009) reported that the rate of pollen viability of all the cultivars of walnut tested was high (> 75%). The highest pollen germination percentage was obtained from 15% and 20% sucrose concentrations in both years of his experiment of walnut. The effects of temperature on pollen germination and pollen tube growth have been reported by several workers in various fruit species (Cerovic and Ruzic 1992, Egea*et al*., 1992, Godini*et al*., 1987 and Luza*et al*., 1987). Pırlak (2002) investigated different temperatures (5,10,15 and 20^{0}C) on pollen germination and pollen tube growth rate of different apricot and sweet cherry cultivars and observed that pollen germination was low at 5^{0}C and optimum germination at 15 and 20^{0}C.

The responsive germination percentage in *Jatropha curcus* Lin. were 56.75% pollen germination in 10% sucrose concentration at 15^{0}C; 59.71% pollen germination in 15% sucrose concentration at 15^{0}C, 65.16% pollen germination in 20 % sucrose concentration at 15^{0}C; 69.06% pollen germination in 25% sucrose concentration at 15^{0}C; 57.7% pollen germination in 30% sucrose concentration at 15^{0}C; 50.19% pollen germination in 35% sucrose concentration at 15^{0}C and 46.25% pollen germination in 40% sucrose concentration at 15^{0}C The Table No. 1 clearly shows that the gradual increase in temperature enhanced the pollen germination in *Jatropha curcus* Lin. to a certain point. In each percentage of sucrose solution (10% to 40%), temperature increasing from 15^{0}C to 40^{0}C increased the rate of germination gradually. After 40^{0}C, the germination of pollen grain was decreased. The responsive germination percentage in *Jatropha gossypifolia* L. were 70.08% pollen germination in 10% sucrose concentration at 40^{0}C; 74.12% pollen germination in 15% sucrose concentration at 40^{0}C; 76.56% pollen germination in 20% sucrose concentration at 40^{0}C; 79.56% pollen germination in 25% sucrose concentration at 40^{0}C; 80.03% pollen germination in 30% sucrose

concentration at 40^0C; 72.06% pollen germination in 35% sucrose concentration at 40^0C and 41.02% The responsive germination percentages in *Jatropha gossypifolia* L. were 28.66% pollen germination in 10% sucrose concentration at 15^0C; 29.78% pollen germination in 15% sucrose concentration at 15^0C; 35.7% pollen germination in 20% sucrose concentration at 15^0C; 37.02% pollen germination in 25% sucrose concentration at 15^0C; 40.26% pollen germination in 30% sucrose concentration at 15^0C; 36.35% pollen germination in 35% sucrose concentration at 15^0C and 33.09% pollen germination in 40% sucrose concentration at 15^0C. The Table No.2 clearly shows that the gradual increase in temperature enhanced the pollen germination in the *Jatropha gossypifolia* L. to a certain point. In each percentage of sucrose solution (10% to 40%) temperature increasing from 15^0C to 40^0C increased the rate of germination gradually. After 40^0C, the germination of pollen grain was decreased.

Karl Pearson's Coefficient of correlation (r) between temperature and sucrose concentration on germination of pollen grains of *Jatropha curcus* L. shows significant correlation in the 15% sucrose concentration and at 20^0C temperature (r=0.589826); 35% sucrose concentration and at 40^0C (r=0.654691; Table No. 3). In the *Jatropha gossypifolia* L. the significant correlations were in the 10% sucrose concentration at 15^0C (r=0.751761); 35% sucrose concentration and at the 40^0C temperature (Table No. 4; r=0.82418). Thus, the pollen grain germination responsive to sucrose concentration and temperature was same in both the species.

The present study concluded that temperature as well as sucrose concentration play important role in the germination of pollen grains up to a limit. As geographical location and the species belong to the same genus and family (*Jatropha* and Euphorbiaceae) the responsive to both conditions was almost same.

LITERATURE CITED

Alexander MP, 1996. Different staining of aborted and non-aborted pollen. *Stain Technology*, **44**: 117-122.

Asma BM, 2008. Determination of pollen viability, germination ratios and morphology of eight apricot genotypes. *African J. Biotech*, **7**(23): 4269-4273.

pollen germination in 40% sucrose concentration at 40^0C.

Brewbacker JL and Kwack BH, 1963. The essential role of calcium ion in pollen tube growth. *Amer. J. Bot.,* **50**: 859-865.

Cerovic R, and Ruzic D, 1992. Pollen tube growth in sour cherry (Prunuscerasus) at different temperatures*. J. Hort. Sci.,* **67**: 333–340.

DaneFeruzan, GökselOlgun, ÖzlemDalge, 2004. In vitro pollen germination of some plant species in basic culture medium. *Journal of Cell and Molecular Biology*, **3**:71-76.

Egea J, Burgos L, Zoroa N, and Egea L, 1992. Influence of temperature on the in vitro germination of pollen of apricot (Prunusarmeniaca L.). *J. Hort. Sci.,* **67**: 247-250.

Gam NK, 2012. *Studies on cytology, floral biology, seed morphometrics and oil content of Jatropha L. spp. for the selection of potential germplasm in NE-India,* Ph.D. thesis, Gauhati University, Assam. India. Pp. 8.

Gam NK and Bora SP, 2012. Study on floral parts and male female flower ratio of the Jatropha curcus L. and Jatropha gossypifolia L. of North-eastern region of India. *Science Research Reporter* **2**(3): 251-255.

Godini A, De Palma L, and Petruzzella A, 1987. Interrelationships of almond pollen germination at low temperatures, blooming time and biological behaviour of cultivars. *Adv. Hort. Sci.,* **1**: 73–76.

Gupta SC, 1999. *Fundamentals of statistics* (Etd. By Indira Gupta). Himalaya Publishing House, Mumbai, 400004, 519.

Luza JG, Polito VS, and Weimbaum SE, 1987. Staminate bloom date and temperature responses of pollen germination and the tube growth in two Walnut (Juglans) Species. *Amer. J. Bot.,* **74**:1898-1903.

Mert, Cevriye., (2009). Temperature Responses of Pollen Germination in Walnut (Juglansregia L.). J. *Biol. Environ. Sci*., **3**(8), 37-43.

Ottavio E, Mulahy D, Sari Goria M, Mulahy GB, (1992). *Angiosperm Pollen and Ovules,* Springer-Veriag.

Pırlak L, 2002. The effects of temperature on pollen germination and pollen tube growth of apricot and sweet cherry. *Gartenbauwissenschaft*, **67**(2): 61-64.

Taylor LP, Hepler PK, 1997. Pollen germination and tube growth. *Ann Rev of Plant Physiol and Plant Mol Biol*. **48**: 461-49.