Vegetable Science (2011) 38(2) : 221-224

Short communication

Floral biology studies in Chilli (*Capsicum annuum* L.)

RD Dhall, JS Hundal and Ashish Saxena

Received : Aug 2009 / Accepted : Dec 2010

The knowledge of floral biology is a pre-requisite for embarking upon a crop breeding and hybridization programme. The success of pollination and fertilization depends upon whether the signals carried by the pollen are recognized by the receptors in the stigma, pollen viability, pollen germination, pollen load per flower and other pollination steps. Chilli (*Capsicum annuum* L.) is one of the crops where time of anthesis and dehiscence, pollen viability and germination and stigma receptivity changes over the different locations (Kalloo, 1994). Moreover, in this crop, normally fruits are not formed from all the flowers produced. We can increase yield by higher fruit setting with the knowledge of exact floral biology and seasonal effects. Therefore, the present investigation was carried out on floral biology of various genotypes of chilli which may serve as a guide to the breeder.

The experimental material consists of nine genotypes namely MS-12, I-16, Ludhiana Local Selection (LLS), Pepsi-8-1, PS-4221, Punjab Guchhedar, S-2529, S-2530 and S-2545. MS-12 is a genetic male sterile line and thus only stigmatic observations were taken on it. Rest of the genotypes are male fertile and therefore other floral biological observations were carried out. The experimental material was grown at Farm of Department of Vegetable Crops, Punjab Agricultural University, Ludhiana during November 2000. Each male parent was replicated thrice having at least 40 plants per replication. Sufficient population of MS-12 line was grown for required crossing work. The floral characters viz. time of anthesis and dehiscence, pollen load, pollen viability, pollen germination and stigma receptivity were taken into account.

Time of anthesis and dehiscence : Time of flower opening (anthesis) and bursting of anthers (dehiscence) were recorded on randomly selected ten flowers from 5 a.m. to 7 a.m. and 7 a.m. to 10 a.m. and mean time was calculated. For anthesis and dehiscence, observations were made respectively.

Pollen viability : Freshly opened flowers (before dehiscence) of each genotype were collected and glass slides were prepared from dehisced pollen by staining with freshly prepared 0.2% 2,3,5-triphenyl tetrazolium chloride (TTC) solution. Slides were then placed in dark for half an hour at room temperature and viability of pollen was observed under compound microscope.

Pollen germination : Pollen germination studies were carried out as suggested by the method of Shivanna and Rangaswamy (1992).

Stigma receptivity : Stigma receptivity studies were carried out on MS-12 (male sterile) plants in order to study the best time of pollination. The stigma receptivity was studied by recording fruit setting percent after hand pollination with different male parents at four different time intervals viz. 12 hours before anthesis, at the time of anthesis, 12 hours after anthesis and 24 hours after anthesis (considered time of anthesis between 5-7 a.m.). The extent of fruit setting was recorded 6 days after pollination.

RK Dhall, JS Hundal and Ashish Saxena
Department of Vegetable Crops
Punjab Agricultural University,
Ludhiana-141004
E-mail: dhallrk2007@rediffmail.com

Table 1: Time of anthesis (a.m.) and dehiscence (a.m.) of different pollen parents of chilli from June to September.

Genotype	Time of Anthesis and Dehiscence (a.m.)	Observations during different months				
		June	July	August	September	Mean
I-16	Anthesis (a.m.)	5.45	5.41	5.52	6.23	5.55
	Dehiscence (a.m.)	7.55	7.50	8.05	8.14	8.01
LLS	Anthesis (a.m.)	5.32	5.39	5.57	6.39	5.57
	Dehiscence (a.m.)	7.30	7.37	7.56	8.12	7.49
Pepsi-8-1	Anthesis (a.m.)	5.35	5.30	6.04	6.23	5.53
	Dehiscence (a.m.)	7.41	7.50	8.16	7.55	7.55
Punjab Guchhedar	Anthesis (a.m.)	5.49	5.42	6.06	6.42	6.05
	Dehiscence (a.m.)	7.26	7.44	8.33	8.24	8.02
PS-4221	Anthesis (a.m.)	5.37	5.36	6.23	6.44	6.05
	Dehiscence (a.m.)	7.50	7.42	8.17	8.19	8.02
S-2529	Anthesis (a.m.)	5.42	5.40	5.58	6.21	5.55
	Dehiscence (a.m.)	7.34	7.32	8.15	8.20	7.55
S-2530	Anthesis (a.m.)	5.23	5.29	6.11	6.12	5.48
	Dehiscence (a.m.)	7.16	7.50	8.13	8.19	7.54
S-2545	Anthesis (a.m.)	5.51	5.54	6.15	6.29	6.07
	Dehiscence (a.m.)	7.19	7.51	7.57	8.06	7.48
Mean	Anthesis (a.m.)	5.39	5.39	6.05	6.29	-
	Dehiscence (a.m.)	7.34	7.44	8.11	8.13	-

Table 2: Pollen viability (%) and pollen germination (%) studies of chilli from June to September.

Genotype	Pollen Viability (%) and Pollen Germination (%)	Observations during different months				
		June	July	August	September	Mean
I-16	Viability (%)	39.42	44.32	44.33	48.26	44.08
	Germination (%)	26.88	33.19	33.93	39.55	33.39
LLS	Viability (%)	60.95	62.07	64.83	64.26	63.03
	Germination (%)	27.36	34.43	39.43	39.14	35.09
Pepsi-8-1	Viability (%)	57.41	62.23	66.74	67.81	63.55
	Germination (%)	37.36	45.46	49.99	58.67	47.87
Punjab Guchhedar	Viability (%)	51.28	58.34	58.86	60.93	57.35
	Germination (%)	19.99	33.03	35.56	40.64	32.30
PS-4221	Viability (%)	61.36	63.95	66.83	69.05	65.29
	Germination (%)	31.25	36.06	55.77	51.45	43.63
S-2529	Viability (%)	61.30	75.42	75.18	62.28	68.54
	Germination (%)	37.41	60.34	64.23	56.69	54.67
S-2530	Viability (%)	50.01	53.38	54.24	44.32	50.49
	Germination (%)	36.99	42.89	44.32	42.55	41.69
S-2545	Viability (%)	54.25	54.57	54.57	68.95	58.08
	Germination (%)	35.01	41.54	42.37	42.16	40.26
Mean	Viability (%)	54.40	59.28	60.69	60.73	-
	Germination (%)	31.52	40.86	45.69	46.35	-

Table 3: Receptivity of stigma of male sterile parent plants (MS-12) of chilli at different times of pollination.

Male Parent	Time of pollination	No. of flowers pollinated	No. of fruits set	Percent fruit set
I-16	12BA	84	12	14.29
	AA	84	36	42.86
	12AA	84	24	28.57
	24AA	84	12	14.29
LLS	12BA	84	14	16.67
	AA	80	32	40.00
	12AA	81	27	33.33
	24AA	80	8	10.00
Pepsi-8-1	12BA	84	14	16.67
	AA	84	42	50.00
	12AA	83	23	27.71
	24AA	73	4	5.48
Punjab	12BA	81	7	8.64
Guchhedar	AA	83	36	43.37
	12AA	75	26	34.67
	24AA	84	11	13.09
PS-4221	12BA	80	8	10.00
	AA	80	32	40.00
	12AA	80	24	30.00
	24AA	80	16	20.00
S-2529	12BA	80	15	18.75
	AA	80	30	37.50
	12AA	80	25	31.25
	24AA	80	10	12.50
S-2530	12BA	75	9	12.00
	AA	75	39	52.00
	12AA	75	21	28.00
	24AA	75	6	8.00
S-2545	12BA	78	9	11.54
	AA	78	39	50.00
	12AA	78	21	26.92
	24AA	78	9	11.54

12BA = 12 hours before opening of female flower, AA = At the time of opening of female flower, 12AA = 12 hours after opening of female flower, 24AA = 12 hours after opening of female flower

Time of anthesis and dehiscence: Time of anthesis and dehiscence in eight chilli genotypes under Ludhiana conditions varied from 5.23 to 6.44 a.m. and 7.16 to 8.33 a.m., respectively (Table-1). Anthesis and dehiscence was earliest in June (5.39 a.m. and 7.34 a.m., respectively) and late in September (6.29 a.m. and 8.13 a.m., respectively). Variation in the time of anthesis and dehiscence was due to decrease in temperature and increase in relative humidity from June to September. Among the genotypes, flowers of S-2530 opened earlier (5.48 a.m.) but anthers of S-2545 dehisced earlier (7.48 a.m.). The irregularity in the time of anthesis and dehiscence was probably due to genotypic response to climate. Similar types of variation for anthesis were reported by Legesse (1999) while Padda and Singh (1971) and Olarewaju (1989) reported similar results for dehiscence. It was also observed that there is positive and significant correlation between time of anthesis and dehiscence.

Pollen viability and germination : Experiments made on pollen viability and germination indicated that these characters varied 39.42 to 75.42% and 19.98 to 64.23%, respectively (Table-2). The lowest pollen viability and germination were observed in the month of June (54.40% and 31.52%, respectively) while these were highest in September (60.73% and 46.35% respectively). The increase in pollen viability and germination percent from June to September might be due to change of climatic conditions from unfavourable to favourable. Among all the genotypes, S-2529 had highest pollen viability and germination of 68.54% and 54.67%, respectively. These findings of pollen viability and germination were supported by Takagaki *et al.* (1995), Han *et al.* (1996) and Wang (1997). So it can be concluded that flowers opened during September resulted in highest pollen viability and germination which further resulted in more fruit setting and high seed yield.

Receptivity of stigma: To ascertain the receptivity of stigma, per cent fruit set was taken as an index. The maximum fruit setting (44.47%) was observed when pollinated at the time of anthesis and declined thereafter (Table-3). Fruit setting was also found better (30.08%) when pollinated at 12 hours after anthesis. On the other hand, delayed pollination (24 hours after anthesis) results in drying up of stigmatic surface and reduced fruit setting (11.86%). Similar results were obtained by Gaddagimath (1998) in different genotypes. Hence, we can conclude that though the stigma remain receptive for 24 hours after anthesis, it is necessary to pollinate the flower when they are completely open or latest 12 hours after opening to get maximum fruit set and hybrid seed yield.

References

Gaddagimath NB (1998) New cytoplasmic genetic male sterility for exploitation of hybrid vigor in *Capsicum annuum* var. acuminatum L. I- Pollen viability, stigmatic receptivity and pollination techniques. Xth EUCARPIA Meeting on Genetics and Breeding of Capsicum and Eggplant, Avignon, France. pp 49-51.

Han XB, Li RQ, Wang JB and Miao C (1996) Effect of heat stress on pollen development and pollen viability of pepper. Acta. Hort. Sinica 23(4): 359-64.

Kalloo G (1994) Vegetable Breeding pp 22-23. Panima Educational Book Agency, New Delhi.

Legesse G (1999) Anther dehiscence and stigma receptivity in hot pepper. Agritopia 14: 1-7.

Olarewaju JD (1989) Effect of night temperature on fruit set and development in sweet pepper (*Capsicum annuum* L.). Haryana J Hort Sci 18: 36-39.

Padda DS and Singh J (1971) Studies on some aspects of floral biology in chillies. Indian J Agric Res 5: 217-18.

Shivanna KR and Rangaswamy NS (1992) Pollen biology- a laboratory manual. Narosa Publishing House, New Delhi, pp 9-21.

Takagaki M, Kakinuma M and Ito T (1995) Effect of temperature on pollen fertility and pollen germination of 3 pepper varieties. Japanese J Tropical Agric 39(4): 247-49.

Wang SX (1997) Effect of high temperature and plant growth regulating materials on the viability of pollen in hot pepper. J Henan Agric Sci 12: 23-25.