http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 7 (4): 525-528, 2004
ISSN 1028-8880

Floral Biology of Snake Gourd

M. Hasanuzzaman, [1]M.A.K. Mian, [2]H.F. El-Taj, [3]S. Huda and [4]M.R. Amin
Department of Genetics and Plant Breeding,
Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh
[1]Department of Genetics and Plant Breeding,
Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh
[2]Department of Entomology, [3]Department of Extension Education, [4]Department of Farm Mechanics,
Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh

Abstract: Floral biology and yield performance of different Snake gourd (*Tricosanthes cucumerina* L. *syn. T. anguina* L.) genotypes were investigated to develop high quality and yielding variety/ies. There were differences between the snake gourd genotypes in respect of floral biology and yield potentiality. Starting of the anthesis occurred within 7 to 8 pm in male flowers and required 19 to 33 minutes for full blooming. The anthesis of the female flower started from 7 to 8 pm and completed their full blooming within 1 to 2 h. Time of anther dehiscence started from 4 pm to 5 pm i.e. about 3 h before anthesis and completed at 7 to 8 pm. The fresh pollen viability percentage was around 99.00 and no pollen grain was germinated before 5 h at field condition. The stigma became receptive about 15 h before anthesis and it remained receptive upto 27 h after anthesis. SG 04 was more cross compatible than the self compatible.

Key words: Floral biology, anthesis, compatibility, *Tricosanthes cucumerina* L

INTRODUCTION

Snake gourd (*Trichosanthes cucumerina* L.) is one of the common summer vegetable. Area covered by it is 2675.40 hectares and annual production is 10,830 metric tones in 1996-97[1]. It is an annual monoecious climbing type herbaceous crop belongs to the family cucurbitaceae having chromosome number, 2n=22[2,3] under order cucurbitales, sub-class polypetalae and class dicotyledon[4]. The center of origin is not precisely known but most of the authors agree India or Indo-Malayan region as the original home[5,6].

Yield of snake gourd is very poor in Bangladesh (4.05 t ha^{-1})[1] than our neighbouring country India (35 t ha^{-1})[7]. There is no recognized variety of snake gourd in Bangladesh but there is a good range of variability in size, shape and colour of fruits available in Bangladesh[8]. Snake gourds are attacked by fruit flies including *Dacus cucurbitae*, *D. diversus* and *D. zonatus*, red pumpkin beetle (*Rephidopala foveicollis*) and epilachna beetles. Several minor pests like cucurbit stink bug (*Cordius janics*), blister beetle (*Mylabris pustulata*) etc. are also found. *Colletotrichum lagenarium* infects the snake gourd. It is also infected by nematodes (*Meloidogyne arenaria* and *M. javanica*)[7]. Study on floral morphology and cross compatibility among different fruit types of snake gourd was given less attention earlier in Bangladesh. Information of such studies is the prerequisite for effective hybridization program to develop high yielding disease resistance varieties of this crop. Considering the scope of varietal improvement, the investigation was undertaken with the following objectives: to study the floral biology such as time of anthesis, time of anther dehiscence, duration of stigma receptivity, pollen viability and pollen tube growth behaviour and to determine the effective hybridization time.

MATERIALS AND METHODS

This experiment was carried out at the experimental farm of the Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur located at 24° 0' North latitude and 90° 25' East longitude during January to June, 1999. Six different fruit morphotypes of snake gourd were used to study the different aspects of floral biology. Seeds of all six fruit morphotypes were first allowed to soak water for 48 h. The soaked seeds were then transferred in polyvinyl pot containing a mixture of soil and well decomposed cowdung (1:1) on 3 February, 1999.

Corresponding Author: Md. Hasanuzzaman, Department of Genetics and Plant Breeding, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh E-mail: mdhasanuzzaman@yahoo.com

Sixty pits were prepared for transplantation of ten seedlings of each of six different morphotypes of snake gourd. One seedling was transplanted in each pit.

Fixation and preservation of pistil for pollen germination, stigma receptivity and pollen tube growth behaviour study: Flowers were collected after 8, 10, 12 and 20 h of pollination. Only the ovary with the style and the stigma were placed in acetic-alcohol (1 part acetic acid:3 part ethanol v/v) after removal of petals and sepals and the samples were kept at room temperature. After 24 h the samples were removed from the fixative and adhered fixative with the samples was removed by placing them on a tissue paper. Then they were preserved in 70% ethanol at 4°C in a refrigerator until the samples were observed under microscope[9].

Slide preparation: To prepare the samples for florescent microscopy study, preserved pistils were washed gently with distilled water for two to three times and then heated in 1N NaOH at 60°C for 40 min. Then again rinsed with water gently to remove the NaOH and was put in 0.1% aniline blue solution (a fluorescent die) for 15 min[10]. One pistil was taken on each slide, covered with cover slip and then slightly tapped.

Study of cross compatibility: At least 10 female flowers from one genotype were selected for each selected pistillate stage for crossing program. Selfing and crossing was done at the same time. The pistillate flower was bagged two to four days before anthesis.

Numbers of fruit sets per plant allowing artificial pollination were calculated. The success and failure of fruit setting were observed by counting the initial flower number and finally developed fruits. The seed number is also counted on each fruit.

RESULTS AND DISCUSSION

Time of anthesis: The anthesis period of snake gourd genotypes has been summarized in Table 1. The anthesis of the pistillate flowers took place earlier than the staminate flowers. Anthesis period of different snake gourd genotypes did not differ very much from one genotype to another. The earliest starting of anthesis of male flowers were observed in the genotypes SG 05. Within 7 to 8 pm, anthesis of male flowers of all snake gourd genotypes started and required 19 to 33 minutes for full blooming.

The anthesis of female flowers started from 7 to 8 pm and completed their full blooming within the range 1 to 2 h. Among all the genotypes of snake gourd, earliest starting of anthesis of the female flowers was observed in SG 03.

Alam[11] reported in pointed gourd that anthesis of both male and female flowers began at 6:00 to 7:00 pm but completed in male within 8:30 to 9:30 pm and in female within 9 to 10 pm. Bhandari[12] observed that the

Table 1: Anthesis time in different snake gourd genotypes

	Male flower bud		Female flower bud	
Genotype	Starting time of anthesis (pm)	Full blooming time (pm)	Starting time of anthesis (pm)	Full blooming time (pm)
SG 01	7.15±0.04	7.37±0.04	7.35±0.06	8.55±0.04
SG 02	7.17±0.04	7.39±0.04	7.38±0.06	9.10±0.05
SG 03	7.21±0.04	7.47±0.05	7.32±0.05	9.02±0.074
SG 04	7.25±0.05	7.44±0.06	7.35±0.06	9.15±0.04
SG 05	7.12±0.04	7.35±0.05	7.39±0.06	9.23±0.05
SG 06	7.20±0.07	7.53±0.07	7.35±0.07	9.09±0.04

Table 2: Starting and completion time of anther dehiscence for male flower in different snake gourd genotypes

Genotype	Starting time	Completion time
	Mean±SE	Mean±SE
SG 01	4.15±0.07	7.26±0.06
SG 02	4.42±0.06	7.38±0.06
SG 03	4.26±0.10	7.42±0.06
SG 04	4.17±0.04	7.35±0.06
SG 05	4.46±0.07	7.37±0.06
SG 06	4.25±0.07	7.42±0.05

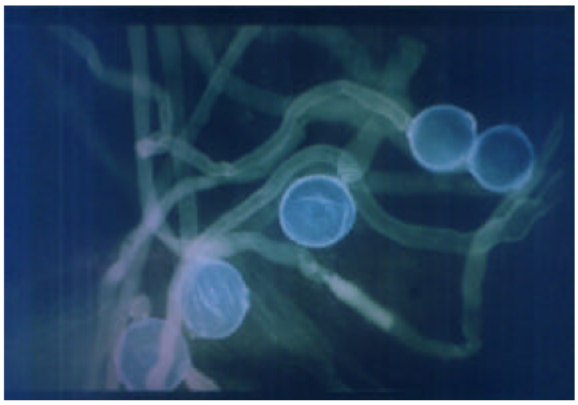

Fig. 1: Germinated pollen grains on the stigma

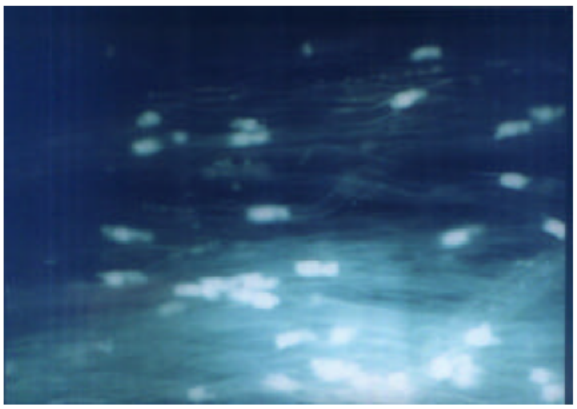

Fig. 2: Penetrated pollen tube in the style

Table 3: Influence of pistil, pollen and time of pollination on fruit set in snake gourd genotype

Genotype	Stage of pistillate flower	Pollen source	Age of pollen	Time of pollination	Fruit set (%)
SG 04	24 h before anthesis	Self/Cross	5 h	9.15 pm	0
	15 h before anthesis	Self/Cross	14 h	6.15 am	20
	5 h before anthesis	Self/Cross	Fresh (Immature)	4.15 pm	0
	5 h before anthesis	Self/Cross	24 h	4.15 pm	40
	At anthesis	Self/Cross	5 h	9.15 pm	100
	2 h after anthesis	Self/Cross	7 h	11.15 pm	100
	14 h after anthesis	Self/Cross	19 h	11.15 pm	55
	24 h after anthesis	Self/Cross	5 h	9.15 pm	45
	27 h after anthesis	Self/Cross	20 h	12.15 am	10
	33 h after anthesis	Self/Cross	14 h	6.15 am	0

Table 4: Mean number of pollen grains adhered per stigma, number of germinated pollen and penetrated pollen tubes in the style of snake gourd

				Pollen tube growth behaviour				Fruit set	
Genotype of snake gourd	Stage of pistillate flower	Pollen source	Age of at pollen pollination	Age of collected pistillate flower	Number of pollen grain adhered/stigma	Number of germinated pollen	Number of penetrated pollen tube in the style	Number of pistil, pollinated for fruit set	Number of fruit set
SG 04	At anthesis	Self/Cross	5h	8	185.7±7.08	0	0	20	20
		Self/Cross	5h	10	211.2±9.09	106.2±9.51	0	20	20
		Self/Cross	5h	12	151.00±11.72	83.50±6.75	48.30±5.60	20	20
		Self/Cross	5h	20	177.10±23.62	101.90±10.45	61.10±6.14	20	20
	5h before anthesis	Self/Cross	24h	20	120.10±11.60	77.80±8.83	41.70±5.25	20	8
	15h before anthesis	Self/Cross	14h	20	87.50±14.40	56.11±10.29	31.20±9.23	20	4
	24h after anthesis	Self/Cross	5h	20	135.6±5.46	64.00±2.20	25.5±1.28	20	9

Table 5: Fruit and seed setting in one genotype of snake gourd after cross and self pollination

Pistillate flower	Pollen source	Mode of pollination	Time of pollination	Number of fruit set	Fruit set (%)	Seeds per Fruit Mean±SE
SG 04	SG 02/SG 04	Self	15h before anthesis	1 (10)	10	25.90±1.16
		Cross	15h before anthesis	3(10)	30	44.10±1.03
		Self	5h before anthesis	3(10)	30	49.30±1.14
		Cross	5h before anthesis	5(10)	50	58.40±1.02
		Self	At anthesis	10(10)	100	70.10±1.20
		Cross	At anthesis	10(10)	100	72.20±1.06
		Self	2h after anthesis	10(10)	100	71.10±1.00
		Cross	2h after anthesis	10(10)	100	72.80±1.04
		Self	14h after anthesis	5(10)	50	55.30±1.37
		Cross	14h after anthesis	6(10)	60	57.90±1.12
		Self	24h after anthesis	4(10)	40	38.90±1.22
		Cross	24h after anthesis	5(10)	50	51.50±1.15
		Self	27h after anthesis	0(10)	0	
		Cross	27h after anthesis	2(10)	20	34.60±1.65

anthesis starts from 4 pm and continues till 8 pm in ridge gourd. Seshadri[5] reported in pointed gourd that anthesis takes place during night.

In all genotypes, anthesis of the male flowers started earlier than female flowers.

Time of anther dehiscence: Anther dehiscence in snake gourd genotypes started before anthesis and completed near about full blooming of flower. The anthers started to dehiscence at 4 to 5 pm i.e. about 3 h before anthesis and completed at 7 pm to 8 pm. The first dehiscence occurred in SG 01 (4:15 pm) (Table 2).

Alam[11] observed in pointed gourd that the anthers were found to start dehiscence at 4 to 6 pm, 1 to 2 h before anthesis and the release of pollen grains continued for the next 7 to 8 h. Begum[13] noted in sponge gourd that the anthers of male flowers of both Japanese and local genotypes started to dehisce 5 h before anthesis and completed at the time of anthesis.

Duration of stigma receptivity and pollen viability: Fruit setting was taken an index to ensure the duration of stigma receptivity and pollen viability. Pollination with 5 h aged pollen just after anthesis produced 100% fruit set indicates highest intensity of receptivity of stigma (Table 3). Pollinating stigma before 15 h of anthesis with 14 h aged pollen resulted in 20% fruit set in SG 04 but pollination before 24 h of anthesis with 5 h aged pollen failed to set fruit indicating that stigma became receptive about 15 h before anthesis.

Twenty four hours aged pollen used to pollinated pistillate flower at before 5 h of anthesis, produced 40% fruit setting and fresh pollen produced no fruit setting with same aged pistillate flower indicated that stigma was receptive before 5 h of anthesis but fresh pollen did not able to fertilize caused no fruit setting.

At the time of anthesis, pollination was done with 5 h aged pollen produced 100% fruit setting but after 24 h of anthesis, pollination was done with same aged pollen

produced 45% fruit setting. Such reduction of fruit setting indicated the lower trend of stigma receptivity with progressing of time after anthesis.

Pollination of pistils after 27 h of anthesis with 20 h old pollen, appeared viable under microscope, resulted in 10% fruit setting but pollination after 33 h of anthesis with 14 h old pollen, younger than the 20 h old pollen, resulted no fruit setting indicated that the stigma remained receptive that the stigma remained receptive 27 h after anthesis. Time of pollination had no fruitful effect on fruit set in snake gourd.

When pollination was done with 24 h aged pollen before 5 h of anthesis, 40% fruits were set indicated that the pollen was viable upto 24 h. It was also viable under microscope about 79.06%.

Bhandari[12] reported in ridge gourd that stigma became receptive 2 to 3 h before anthesis and it continued 36 h after anthesis.

Pollen germination, their penetration through the style and pollen tube growth behaviour: The number of adhered pollen, germinated pollen and penetrated pollen tubes (Fig. 1 and 2) have been presented in Table 4. Self and crossing were done with different aged pollen and the pollinated stigmas were collected at different intervals to observe the above mentioned characteristics. No pollen grain was found germinated on stigma, when pollinated pistils were collected after 8 h of pollination and no pollen tube was found in the style, when pollinated pistils were collected after 10 h of pollination. The pollinated pistils collected after 12 h of pollination, showed 151.00 of pollen grains adhered and 48.30 pollen tubes penetrated into the style.

The 24 h old pistils pollinated with 5 h old pollen showed lower number of adhered pollen grains on stigma, pollen germination on stigma and pollen tube in style (135.6, 64 and 25.5, respectively). It represents that stigma receptivity reduces with the time and declined the ability of fruit set (out of 20 pollinated pistils 9 fruits set).

Higher number of adhered pollen grains were observed on the stigma while collecting the pistil pollinated before 5 h of anthesis with 24 h old pollen than the stigma pollinated before 15 h of anthesis with 14 h old pollen, both pistils were collected after 20 h. Higher number of adhered pollen on the stigma may be one of the factor for higher number of fruit setting.

Cross compatibility: Fruit setting and seed development were taken as index to assess cross compatibility. Table 5 represents the fruit and seed setting ability of a particular genotype SG 04. At the time of anthesis, both in self and cross pollination, 100% fruits were set but before 5 h of anthesis, more fruit was set in cross pollination than self pollination. Seeds setting per fruit were also higher in cross pollination. When pollination was done after 14 and 24 h of anthesis, higher number fruits and seeds were set due to cross pollination than self pollination. Such results showed that the genotype SG 04 was more cross compatible than self compatible.

Effective hybridization requires proper emasculation and pollination. To avoid natural pollination, pistillate flower should be bagged in the morning before anthesis. Pollination should be done at the time of anthesis of pistillate flower with 5 h or more aged pollen and after pollination, bag should be kept for two days. Using the above basic information on floral biology; combination breeding, transgressive breeding, resistance breeding and hybrid variety development might be initiated in snake gourd.

REFERENCES

1. BBS., 1998. Year Book of Agricultural statistics of Bangladesh, 1997. Bangladesh Bureau of Statistics, Ministry of Planing, Govt. Peoples Republic of Bangladesh, Dhaka, Bangladesh.
2. Jeffrey, C., 1980. A review of the cucurbitaceae. Bot. J. Linn. Sco. Lond., 81: 233-247.
3. Chakarabati, A.K., 1982. Fascicles of Flora of India II. Cucurbitaceae. Botanical Survey of India, Hawara W.B., pp: 136.
4. Hooker, J.D., 1867. Cucurbitaceae. In: Genera Plantarum, 1: 337-371.
5. Seshadri, V.S., 1986. Cucurbits. In:. Vegetables Crops in India, T.K. Bose and M.G. Som (Ed.). Naya prokash, Calcutta-six, India, pp: 91-164.
6. Roy, R.P., S. Saran and B. Dutt. 1991. Cytogenetics of the cucurbitaceae. In: chromosome engineering in plants: Genetics, Breeding, Evolution. Edited by T. Tsuchiya and P.K. Gupta. Elsevier, Amsterdam, pp: 181-199.
7. Shanmugavelu, K.G., 1989. Snake gourd. In: production technology of vegetable crops. Oxford and IBH publishing Co. Ltd., New Delhi, India, pp: 722-725.
8. Rashid, M.M., 1993. Sabjibiggan (in Bangla). 1st Ed. Bangla Academy, Dhaka, Bangladesh, pp: 515.
9. Latif, M.A., 1998. Floral biology of Drumstick. M.S. Thesis, IPSA., Gazipur, Bangladesh.
10. Kho, Y.O. and J. Baer, 1968. Observing pollen tubes by means of fluorescence. Euphytica, 17: 298-302.
11. Alam, M.A., 1997. Study of floral biology and parthocarpy in pointed gourd. M.S. Thesis, IPSA., Gazipur, Bangladesh.
12. Bhandari, M.M., 1979. Practical in Plant Breeding. 2nd Ed. Oxford and IBH Publishing Co. New Delhi, India. pp: 248.
13. Begum, T., 1998. Floral biology and cross compatibility in sponge gourd (*Luffa cylindrica* L. Roem.). M.S. Thesis, IPSA., Gazipur, Bangladesh.