

**EFFECT OF MULTIPLE MATING OF (SK6 X SK7) : A NEWLY EVOLVED
BIVOLTINE HYBRID ON GRAINAGE PERFORMANCE FOR SUSTAINABLE
MULTI X BI DFL PRODUCTION IN WEST BENGAL**

S. CHANDA, L.M. SAHA, N.B. KAR, N.K. DAS, A.K. SAHA AND B.B. BINDROO
CENTRAL SERICULTURAL RESEARCH AND TRAINING INSTITUTE,
BERHAMPORE-742 101, INDIA
(e-mail : saha.lalmohan@rediffmail.com)

Multiple mating ability of male moths of (SK6 x SK7) : a newly evolved bivoltine hybrid upto 4 times was investigated in 5 seasons viz. Baisakhi (March), Shrivani (June), Ashwina (August), Agrahayani (October) and Falgooni (January) by crossing with newly evolved multivoltine (MV) breed, M.Con.4 and traditional multivoltine breed, Nistari. Nistari x NB4D2 - the popular Multi x Bi cross breed of tropical region was kept as control. Pooled data of recovery of disease free layings (DFLs) obtained in 5 seasons reveal that DFLs produced by M.Con.4 x (SK6 x SK7) and Nistari x (SK6 x SK7) are significantly higher than the DFLs produced by M.Con.4 x NB4D2 and also Nistari x NB4D2. Hatching percentage was found highest in DFLs obtained from 1st mating, 2nd mating, mixed DFLs followed by 3rd and 4th matings of both of the male components of bivoltine crossed with M.Con.4 and Nistari. Based on these findings exploitation of male components of (SK6 x SK7) can be recommended for commercial cross breed DFL production under tropical condition as above bivoltine hybrid has more tolerance capacity than pure bivoltine breed in fluctuating environmental condition of the tropical region during seed crop rearing.

Key words : Multiple mating, Bivoltine hybrid, Multivoltine breed, Commercial DFL, Tropical condition.

INTRODUCTION

Farmers of West Bengal rear Multi x Bi cross breed DFLs during favourable seasons i.e. Agrahayani (November-December), Falgooni (February-March) and Baisakhi (April). For preparation of above cross breed DFLs West Bengal has to depend on southern sates for bivoltine components as bivoltine seed crop rearing is not assured under fluctuating environmental conditions in tropical parts of West Bengal. Apart from that due to transportation hazards and non-synchronization of emergence of bivoltine and multivoltine moths there has average loss of 10-15% male components. Again from a consignment on an average 35-40% males emerge from which only 30-35% active males are obtained. This loss is compensated by commercial seed producers to a great extent by exploiting the efficiency of males of bivoltine through multiple mating without compromising with the loss in commercial seed production. Benchamin *et al.* (1990) stated that "Use of bivoltine hybrids as male parent can be popularized with added advantage of better effective rate of mating, laying yield and fertility than pure breeds". He also stated that, "Rearing of bivoltine hybrids is easy than pure breeds as seed crop". Keeping in view, the present investigation was attempted to evaluate the mating efficiency of the newly evolved bivoltine hybrid (SK6 x SK7) with females of M.Con.4 - a newly evolved multivoltine breed and the traditional Nistari and its impact on grainage performance with special reference to quality and recovery both in percentage and gram (g)/Kg. MV seed cocoon.

MATERIALS AND METHODS

Both the bivoltine and multivoltine seed cocoons were produced in the rearing house of the Central Sericultural Research and Training Institute, Berhampore (W.B.) under controlled condition in each season. Sexes were separated at pupal stage and the male and female pupae of BV and MV respectively were kept in separate rooms under optimum climatic conditions for emergence. Males of (SK6 x SK7) and NB4D2 (control) were collected early in the morning and preserved at $09\pm 2^{\circ}\text{C}$. Female multivoltine moths of M.Con.4 and Nistari (control) were collected and pairing was given with bivoltine males for 3 hrs. After depairing female moths were kept in three replications (30 female moths/replication) for each combination. Females were allowed 20 hrs. to lay egg. Males which were used for 1st pairing were reused after giving 18-20 hrs. rest in cold storage at $09\pm 2^{\circ}\text{C}$ for 2nd, 3rd and 4th pairing with fresh females by following mass egg laying method. DFLs produced by each combination from each mating were weighed and recovery both in percentage and gram was recorded. DFLs in equal quantity by gram from each mating were mixed to observe its performance in comparison to individual mating. From each combination 3 samples were kept to note the hatching percentage. Same experiment was conducted in 5 consecutive seasons to see the sustainable performance of Multi x Bi DFL production. Recovery was calculated on the basis of 20 gram/ 100 DFLs. The data were analyzed statistically.

RESULTS AND DISCUSSION

A comparative performance of male components of (SK6 x SK7) and NB4D2 in respect of recovery of DFLs in percentage and gram has been shown in Table I and Table 2 respectively. Analysis of season wise performance of each combination showed that during Shravani there was no significant variation in recovery of DFLs both in percentage and gram. During Ashwina and Falgooni significant difference was observed in M.Con.4 x (SK6 x SK7) and Nistari x (SK6 x SK7) in comparison to M.Con.4 x NB4D2 and Nistari x NB4D2. Performance of M.Con.4 x (SK6 x SK7) and Nistari x (SK6 x SK7) were significantly higher than M.Con.4 x NB4D2 and Nistari x NB4D2 in recovery by percentage and gram. During Baisakhi recovery in percentage and gram was significantly higher in M.Con.4 x (SK6 x SK7) than M.Con.4 x NB4D2 while reverse result was observed in case of Nistari x (SK6 x SK7) – which was significantly less than the performance of Nistari x NB4D2. However, pooled data of 5 seasons showed that recovery in percentage and gram was significantly higher in the combinations utilizing bivoltine hybrid (SK6 x SK7) as male component irrespective of female component of multivoltine in comparison to use of NB4D2 as male component.

Recovery in percentage and gram : Recovery percentage obtained from 1st, 2nd and 3rd mating of male component of (SK6 x SK7) and NB4D2 (control) showed no significant difference. Data pertaining to 4th time mating in recovery percentage and 3rd & 4th time mating in recovery by gram showed significantly higher achievement in case of (SK6 x SK7) with the females of M.Con.4 and Nistari (control) than males used of NB4D2 which confirms the findings of Beani & Turillazzi (1988) that the males of territory actively interact with females than do the migrating one. Firman & Rusina (2009) also agreed with this observation. Mean performance of male component of (SK6 x SK7) showed significantly higher achievement in comparison to NB4D2. In this experiment upto 4 times mating had been considered based on the views of Leopold

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Table I : Mating wise and combination wise average recovery in percentage.

Combination	Time of mating				Mean
	1st	2nd	3rd	4th	
M.Con.4 x (SK6 x SK7)	49.92	45.21	40.39	36.97	43.61
M.Con.4 x NB4D2	50.96	45.71	41.27	33.63	42.89
Nistari x (SK6 x SK7)	39.33	36.42	33.36	30.27	34.85
Nistari x NB4D2	39.75	35.63	32.70	29.31	34.35
CD at 5%	1.20	0.95	3.41	0.49	0.62
CV%	1.42	1.24	4.91	0.80	0.85

Table II : Mating wise and combination wise average recovery in gram/ Kg. cocoon

Combination	Time of mating				Mean
	1st	2nd	3rd	4th	
M.Con.4 x (SK6 x SK7)	90.39	81.92	76.72	67.23	79.07
M.Con.4 x NB4D2	92.54	83.01	74.80	60.88	77.80
Nistari x (SK6 x SK7)	77.78	72.18	66.33	60.31	69.15
Nistari x NB4D2	78.44	70.33	64.41	57.64	67.71
CD at 5%	2.30	1.69	0.91	0.90	1.16
CV%	1.44	1.17	0.68	0.77	0.84

Table III : Season and combination wise average recovery in percentage.

Combination	Season					Mean
	Bais- akhi	Shra- vani	Ashw- -ina	Agraha- yani	Falgoo- ni	
M.Con.4 x (SK6 x SK7)	38.24	44.00	43.85	38.35	53.59	43.60
M.Con.4 x NB4D2	37.33	44.24	43.44	39.35	50.10	42.89
Nistari x (SK6 x SK7)	32.81	34.10	33.44	36.45	37.45	34.85
Nistari x NB4D2	38.47	34.18	32.76	30.86	35.48	34.36
CD at 5%	0.58	0.54	1.04	0.50	1.87	0.62
CV%	0.84	0.73	1.44	0.74	2.24	0.84

(1970) stating that 3-4 successive matings are required to deplete all stored accessory substance from the ejaculatory duct which plays a vital role in succession of mating. According to Jolly *et al.* (1966), Ram & Singh (1992) and Biram Saheb *et al.* (2005) by resorting to repeated matings of selected males the cost of seed cocoons and consequently the cost of DFLs for commercial rearing can be reduced. Variation of recovery both in percentage and gram in different seasons is due to internal physiological process involved in digestion, assimilation and conversion of food to energy for utilization in formation and maturation of ovum and sperm. This is in accordance with Freeman & Perkins (1971), Khan *et al.* (2001) who stated that relative performance of the different breeds depends on their genotypes which alter in different environment. Pooled data of 5 seasons reveal that recovery both in percentage and gram was maximum in 1st mating in all 4 combinations followed by 2nd, 3rd and 4th matings. This corroborates with the findings of Ravikumar *et al.* (1995) and Krishnaprasad *et al.* (2002).

Hatching Percentage : Concerning hatching percentage it was observed that highest hatching percentage was recorded in 1st mating followed by successive matings upto 4th time. Lowest hatching percentage was observed in 4th time mating. In case of mixed DFLs hatching percentage was observed higher than 3rd and 4th time mating establishing the fact that to compensate loss at graineure level mixed DFLs are to be distributed at commercial level in order to supply same quality of DFLs to each farmer. Similar observation in case of PM x NB4D2 was recorded by Ravikumar *et al.* (1995). Dubey *et al.* (1993) stating that the male factor *i.e.* fecundity enhancing substance & Prostaglandin is supposed to involve in sperm maturation as well as stimulating overall process of oviposition. During 1st mating sufficient quantity of prostaglandin was released by the fresh males in the reproductive tract of females which may be the reason for highest hatching percentage in 1st mating in case of all combinations. During successive matings due to depletion in releasing of Prostaglandin the hatching percentage was affected. This observation is in conformity with Taylor (1967), Royer & McNeil (1993) that "Successive matings by a single male resulted in a linear decline in both lifetime fecundity and fertility of females".

Table IV : Season and combination wise average recovery in gram/Kg cocoon.

Combination	Season					Mean
	Bais- akhi	Shra- vani	Ashw- -ina	Agrah- ayani	Falgoo- ni	
M.Con.4 x (SK6 x SK7)	54.173	84.797	74.931	77.269	104.150	79.064
M.Con.4 x NB4D2	52.895	85.261	74.234	79.268	97.375	77.807
Nistari x (SK6 x SK7)	54.993	71.187	69.161	75.148	75.262	69.150
Nistari x NB4D2	64.483	71.357	67.739	63.638	71.310	67.705
CD at 5%	0.93	1.05	1.90	1.02	3.62	1.16
CV%	0.87	0.71	1.41	0.73	2.21	0.84

Table V : Season wise and combination wise average hatching percentage.

DFLs obtained from	Combination			
	M.Con.4 x (SK6 x SK7)	M.Con.4 x NB4D2	Nistari x (SK6 x SK7)	Nistari x NB4D2
1 st Mating	96.59	96.68	96.93	96.87
2 nd Mating	95.68	95.79	95.69	95.63
3 rd Mating	93.30	92.20	93.19	92.42
4 th Mating	87.92	87.33	88.73	86.45
Mixed DFLs	95.08	94.40	95.32	94.53
CD at 5%	0.72	0.74	0.49	0.94
CV%	0.41	0.43	0.28	0.54

Results obtained from present experiment clearly indicate that in all seasons and in combination with different multivoltines *viz.* M.Con.4 and the traditional Nistari, the male components of bivoltine hybrid (SK6 x SK7) show better result or at par with the pure bivoltine NB4D2. Therefore, male component of (SK6 x SK7) can effectively be utilized in production of Multi x Bi hybrid DFLs for ever fluctuating weather in West Bengal. This is in accordance with the view of Gowda & Reddy (2006) that the hybrids

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that are stable under different environmental conditions can only be recommended to farmers. Further, (SK6 x SK7) can successfully be reared under tropical condition and transportation of NB4D2 from south India can be discontinued/ avoided on economical point of view as locally available hybrid bivoltine male components will bring down the cost of production.

Keeping in view of these points (SK6 x SK7) - the newly evolved bivoltine hybrid may be recommended as promising bivoltine hybrid both for seed crop rearing and for use as male component for production of Multi x Bi DFLs in West Bengal.

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