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Effect of Different Periods of Cold Storing of Bivoltine Eggs on Subsequent Generation Rearing Performance

H. Venkatesh, R. Raghuraman and S. R. Katti*

Karnataka State Sericulture Research and Development Institute Thalaghattapura, Bangalore - 560 062. India.

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Different methods of cold storing of bivoltine eggs are in practice to postpone hatching. Bivoltine eggs undergo hibernation if they are not acid treated within 20 – 24 hrs of oviposition, which depends on race, ambient temperature and humidity. The schedules adopted for cold storing include hibernation schedule (Hib), ordinary chilling (OC), short term chilling (STC) and acid treated layings (AT). Peanut cocooning race NB_4D_2 has been subjected for the present assessment. Cocoons harvested from the crop pertaining to all the four methods of cold storing have been used for producing different combinations and acid treated followed by rearing. The performance in respect of chawki loss, maximum larval weight (5^{th} age), yield/ 10,000 larvae (no), cocoon and shell weight showed maximum values for hibernation × hibernation combination followed hibernation with OC and hibernation with AT. Lowest performance was recorded when STC batch source females were used.

Key words: Short term chilling, Ordinary chilling, Hibernation, Acid treated layings, Rearing performance

Introduction

Bivoltine layings produced in favorable seasons are preserved in cold storage in different schedules so as to enable their release based on demand. Many workers have studied the implications of cold storing of eggs adopting different schedules (Buachoom and Tengratanapraseri, 1976; Venkatalakshmi, 1982; Chaturvedi, 1986; Manjula and Hurkadli, 1990, 1993, 1995; Aswathanarayana *et al.*, 1994). The implications of storing of bivoltine eggs under different schedules developed for tropical conditions on rearing are analyzed. The interaction between different schedules in subsequent rearing has also been assessed. In tropics under natural conditions the bivoltine eggs undergo hibernation within 48 hrs of oviposition and by scientific regulation can be made to hatch between 180 – 300 days (Narasimhanna, 1988). Implication on seed crop performance in relation to egg preservation methods is available. However, the effect of this on subsequent crop has not been studied. The role of female and male originating from different egg preservation schedules on subsequent generation has been examined.

*To whom correspodence should be addressed.
Karnataka State Sericulture Research and Development Institute Thalaghattapura, Bangalore - 560 062. India.
Tel: 091-080-8435221 8435258; Fax: 091-080-8435340;
Email: kssrdi@vsnl.net

Materials and Methods

In this experiment the race used is NB_4D_2 spinning peanut shaped cocoon. Experiment has been conducted twice to get repeatability. The dfls of NB_4D_2, which were in hibernation schedule (Hib), short term chilling (STC), ordinary chilling (OC) and acid treated layings (AT) were synchronized and released to hatch on the same day. The rearing performance has been assessed adopting the standard method of Krishnaswami (1978). The cocoons harvested were assessed and data recorded. Out of cocoons from different sources following combinations of layings were prepared.

Hib × Hib	OC × Hib	STC × Hib	AT × Hib
Hib × OC	OC × OC	STC × OC	AT × OC
Hib × STC	OC × STC	STC × STC	AT × STC
Hib × AT	OC × AT	STC × AT	AT × AT

The layings were acid treated to break the diapause and allowed to hatch on a single day. Following the standard procedure of Krishnaswami (1978) the rearing was carried out. Cocoons harvested were assessed for the required parameters *viz.,* chawki loss, maximum larval weight, yield/10,000 larvae (no.), cocoon and shell weight. Data generated were analyzed as per Sunder Raj *et al.* (1972).

Results

From the two trials conducted it is seen that hibernated batches perform superior over all others in respect of all the considered parameters. The short term chilled batches have performed the least. The maximum larval weight of 44.8 g (10 matured larvae), highest yield of 95.6% along with cocoon weight of 1.8 g and shell weight of 37 cg have been recorded for hibernated batches. The observations for the indicated parameters in respect of short term

Table 1. Effect of different periods of cold storing of bivoltine eggs of race NB_4D_2 on subsequent generation (Pooled data of 2 trials)

Treatment	Eggs/Dfls (next generation)	Chawki loss (%)	Wt of 10 grown larvae (g)	Yield/10,000 larvae. (no)	Cocoon wt. (g)	Shell wt. (cg)
Hibernated	609.51	6.25	44.78	9555	1.83	37
Ordinary chilling	600.83	5.97	44.1	9350	1.82	35
Short term chilling	524.66	8.94	42.38	8994	1.68	33
Acid treated	574.65	6.83	43.76	9408	1.8	35
F test	S	S	HS	HS	HS	HS
CD at 5%	50.98	2.186	0.309	273.17	0.048	0.017
CD at 1%	-	3.012	0.426	376.41	0.066	0.014

Note: NS - Non significant, S - Significant at 5%, HS - Significant at 1%.

Table 2. Effect of combinations of different chilling schedules on rearing performance of race NB4D2 (Pooled data of 2 trials)

Treatment	Eggs/dfls (no.)	Chawki loss (%)	Wt of 10 grown larvae (g)	Yield/10,000 larvae (no)	Cocoon wt. (g)	Shell wt. (cg)
Hib × Hib	609.5	5.62	48.06	9475	1.77	35
Hib × OC	602.8	6.02	47.58	9308	1.75	34
Hib × STC	560.5	12.49	46.02	8942	1.68	32
Hib × AT	566.2	6.60	47.60	9267	1.73	34
OC × Hib	589.5	6.35	47.68	9192	1.75	34
OC × OC	605.8	7.46	47.63	9092	1.71	34
OC × STC	524.2	11.12	45.97	8825	1.66	31
OC × AT	561.7	8.36	47.25	9067	1.70	33
STC × Hib	554.0	8.89	47.00	8662	1.67	31
STC × OC	549.3	5.96	46.37	8625	1.66	31
STC × STC	524.6	12.26	45.23	8458	1.61	30
STC × AT	537.3	7.82	45.88	8590	1.64	31
AT × Hib	600.0	6.44	47.35	9233	1.74	34
AT × OC	586.6	5.76	46.85	9092	1.71	34
AT × STC	539.6	8.15	45.63	8808	1.65	31
AT × AT	574.6	6.18	46.65	9117	1.71	34
F test	HS	HS	HS	HS	HS	HS
CD at 5%	55.988	1.808	0.327	196.72	0.014	0.004
CD at 1%	74.382	2.403	0.435	261.34	0.019	0.006
1st trial	575.187	7.96	47.55	9052	1.77	0.338
2nd trial	549.375	7.73	46.05	8929	1.62	0.323
F test	S	NS	HS	HS	HS	HS
CD at 5%	19.794	---	0.115	69.55	0.005	0.001
CD at 1%	26.296	---	0.154	92.40	0.007	0.002

Note: NS - Non significant, S - Significant at 5%, HS - Significant at 1%.

Hib - Hibernated, OC - Ordinary chilling, STC - Short term chilling, AT - Acid treated.

chilled batches are 42.4 g, 89.9%, 1.7 g and 33 cg respectively. For ordinary chilled batches, the values were 44.1 g, 93.5%, 1.8 g and 35 cg respectively and for Acid treated batches it was 43.8 g, 94.1%, 1.8 g and 35 cg respectively. On comparing the performance for parameters yield by number, single cocoon weight and shell weight between STC and hibernated batches, the short fall for STC batches were of the order of 5.9, 8.2 and 11.2%, respectively.

Table 1 gives details of rearing performance pertaining interaction response studies. The possible combinations using female from hibernation source as constant and male from different sources is indicated. Table 2 provides rearing data in respect of important parameters when layings are utilized with female and male moths from different sources. Perusal of the data reveals utilization of female moths from hibernation source to perform better over other source females. The average fecundity, chawki loss, larval weight, cocoon harvested (no), cocoon and shell weight are 584.8 eggs per moth, 7.6%, 47.3 g, 92.7%, 1.7 g and 34 cg respectively irrespective of male source. The least performance is seen when short term chilled source females are used irrespective of male origin. The average values are 518.8 eggs per moth, 9.5%, 46.1 g, 85.8%, and 1.7 g, 31 cg for respective parameters.

Ordinary chilled source moths for both the sexes performed next to hibernation source followed by short term chilled source female and male moths originating from hibernated source. Least performance has been recorded when moths are selected from STC. Thus it is seen that the OC source moths for both the sexes performing next to hibernation source followed by STC source male and female moths.

Comparison between using female moths from hibernated or ordinary chilled and crossed with male moths either from hibernated or ordinary chilled has shown similar trend. The best performance is of 609.5 eggs per moth, 5.6%, 48.1 g, 95.8%, 1.8 g and 35 cg for hibernated source female crossed with hibernated source male moths in respect of fecundity, chawki loss, maximum larval weight, survival rate, cocoon and shell weight, respectively. When female and male from ordinary chilled source are used, the performance is least. The data generated are 605.8 eggs per moth, 7.5%, 47.6 g, 90.9%, 1.7 g and 34 cg for fecundity, chawki loss, larval weight, survival, and cocoon and shell weight, respectively. The data for Hibernated source female and ordinary chilled source male or ordinary chilled source female crossed with hibernated source male have performed between either hibernated source female and male and ordinary chilled source female and male treatments.

In respect of referred parameters for female and male moths from hibernated and short term chilled source for different combinations it is seen that hibernated × hibernated, hibernated × short term chilled, short term chilled × hibernated, short term chilled × short term chilled performing in the indicated order. The data in respect of hibernated or acid treated source female crossed with male from hibernated or acid treated source in different combinations has shown hibernated × hibernated, acid treated × hibernated, hibernated × acid treated, acid treated × acid treated, performing in the indicated order. Similarly utilization of female moths from short term chilled or acid treated or ordinary chilled and crossing with male of similar origin has clearly shown ordinary chilled × ordinary chilled, acid treated × acid treated, acid treated × ordinary chilled, ordinary chilled × acid treated performing in the indicated order at the same time superior over sources involving short term chilled batches irrespective of sex.

Discussion

Bivoltine will not only serve the purpose of male component in hybrid laying production which is predominantly cross breed but also serve as both parents in bivoltine hybrid laying production. The bivoltine eggs undergo diapause as a natural phenomenon, which cannot be terminated immediately (Yamashita and Hasegawa, 1985). Manjula and Hurkadli (1993, 1995) have evolved an appropriate technology enabling release of layings from 0 to 360 days leading to hatching from 10 days of laying to 370 days. Since bivoltine eggs enter diapause at the end of 48 hrs of egg laying under optimum conditions by hydrochlorisation by 24 to 28 hrs the eggs can be prevented from entering diapause. Such treated eggs could be utilized effectively up to 30 days by suitably refrigerating and releasing. Technology for release of layings between the 40^{th} and 70^{th} (STC), between 60 to 120 days (OC) have been developed. To meet the requirement of layings between 120 and 360 days different hibernation schedules have been developed.

Keeping in view the continuous requirements of bivoltine cocoons for seed production under tropical conditions as mulberry leaf is available throughout the year; parent stock rearing on a regular basis becomes essential. Depending upon hibernated source of layings for taking up regular brushings though desirable becomes difficult due to practical reasons.

In the indicated context for enabling effective utilization of seed cocoons/layings studies on comparative performance of acid treated, short term chilling, ordinary chilling and hibernated batches was taken up. Further to note if there are any variations in using different sources of the previous generation as male or female in the laying production studies were taken up. The advantages if any between sources either as male or female would benefit the industry for proper planning.

Govindan and Narayanaswamy *et al.* (1986), Meeraverma and Chauhan (1996) have all studied the egg refrigeration effect on rearing. Manjula and Hurkadli (1993) have recommended refrigeration of the multivoltine and multibivoltine layings up to 60 days. Specific approach to treat the bivoltine eggs enabling proper hatching and rearing have been developed by Biram saheb *et al.* (1996), Puttaswamy Gowda and Jolly (1987) and Hurkadli (1997).

In contrast to the other workers, besides rearing of batches originating from acid treated, short term chilling, ordinary chilling or hibernated schedule an attempt for the first time has been made to assess the effect of interactions if any between the sources in the subsequent generation on rearing performance. The indicated treatments on comparison have shown that longer the duration of cold storing better is the performance. The hibernated batches have performed superior over all other treatments followed by ordinary chilling. The least performance has been recorded for short term chilled batches. It is interesting to note that acid treated batches have performed superior over short term chilled batches implying the short term chilled treatment does not meet the minimum requirement of rearing. The superior performance for hibernated batches is uniform across all the considered parameters.

The relevance of crossing moths derived from previous generation between the referred treatments has also given superior performance only when both male and female from hibernated source are used for laying production. Further using female source from hibernated batch and crossing male from any treatments has performed superior over female from other sources.

Use of ordinary chilled source of female moths crossed with male of any source is better in terms of performance for identified parameters as compared to using female from short term chilled source and crossing with male from any other. The laying requirement in respect of bivoltine should be from hibernated source in the absence of which ordinary chilled could be tapped, while preparing the hybrids, hibernated source or hibernated/ordinary chilled batches could be used for basic seed production.

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