

## Prevention of Diapause in Bivoltine Eggs of the Silkworm, *Bombyx mori*, L., through a Cross with the Race KS-10 as Male Parent

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The present investigation reports a phenomenon hitherto unknown in tropical sericulture, wherein diapause nature of bivoltine eggs is overcome through a cross with a non-diapausing race of silkworm, *Bombyx mori*, L. Eggs of bivoltine silkworm *Bombyx mori*, L. generally do not hatch under tropical conditions. To prevent diapause, they are subjected to acid treatment or low temperature hibernation scheduled. A race developed at KSSRDI is found to prevent the diapause nature of bivoltine eggs when crossed as male parent, without any acid treatment or hibernation schedule. This phenomenon is reported for the first time, being unique, opens up interesting area of research in silkworm genetics of commercial implications in the industry.

**Key Words:** Bivoltine, *Bombyx mori*, Diapause, Silkworm

### Introduction

Silkworm (*Bombyx mori* L.) races are classified on the basis of voltinism as univoltines, bivoltines and multivoltines (or polyvoltines), depending upon the number of generations possible in a year, under natural conditions. In tropics, generally, all of the silkworms producing diapausing type of eggs are referred to as bivoltines and the non-diapausing as polyvoltines. Generally, polyvoltine eggs hatch under natural conditions. However, in bivoltines, to prevent diapause, the eggs are subjected to acid treatment or scheduled low temperature incubation (at 2.5 and 5°C),

which involves certain level of precision, skill and considerable amount of investment.

Voltinism in silkworm is known to be genetically controlled (Murakami, 1990) and is described by Toyama (1906), as a maternally inherited biological event under the control of sex-linked genes. Through a series of experiments, Muarkami (1987, 1988) demonstrated that certain voltine traits are controlled by single sex-linked gene.

### Materials and methods

KS-10 is a race evolved adopting hybridization and selection technique, using an evolved polyvoltine race (SWA) and a Thailand source race as a part of regular silkworm breeding programme at this Institute. The characteristic features of KS-10 are given in the Table 1. KS-10 is a creamish-white oval cocooning race with regular grey colored egg like any bivoltines and with higher cocoon-shell

Table 1. Characters of the race KS-10

Parameters	
Egg color	Grey
Larval markings	Plain
Cocoon shape	Oval
Cocoon color	Creamish white
Fecundity (no.)	315 – 350
Larval duration (d:hr.)	22:00 – 22:12
V Age larval duration (d:hr.)	6:00 – 6:06
Yld/10,000 larvae (for brushing) (no.)	8867 – 9025
Yld/10,000 larvae (for brushing) (kg.)	10.500 – 10.750
Single cocoon wt (g)	1.23 – 1.33
Single shell wt (cg)	25 – 27
CSR%	20.0 – 20.5
Ave. filament length (mts)	700 – 750
Denier	1.45 – 1.46

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**Table 2.** Data on the triggering of hatching in bivoltines by males of KS-10

Bivoltine races	Selfing with males and females of same race				Females crossed with males of KS-10			
	No. of dfls prepared	No. of dfls hibernated	No. of dfls hatched	% of Dfls hatched	No. of dfls prepared	No. of dfls hibernated	No. of dfls hatched	% of Dfls hatched
AVZ-2 (WD)	30	30	0	0	30	0	30	100
KSD-8	30	30	0	0	30	0	30	100
NB4D2	30	30	0	0	30	0	30	100
NP2	30	30	0	0	30	0	30	100
SL-X	30	30	0	0	30	0	30	100
CSR2	30	30	0	0	30	0	30	100
KCT	30	30	0	0	30	0	30	100
KSD-9	30	30	0	0	30	0	30	100
KSO-1	30	30	0	0	30	0	30	100
Viet 902	30	30	0	0	30	0	30	100

ratio (20–20.5%). During the course of our regular multiplication programme, it was observed during the 15<sup>th</sup> generation reared during May–June 2002 that the males of evolved race KS-10 when crossed with bivoltine females, triggers the process of hatching in the eggs laid by these bivoltine females, as a natural phenomenon without acid treatment or any other diapause breaking treatment. To rule out the possibility that it was not a freak chance incident, an experiment was conducted to verify the diapause preventing ability of KS-10 with different bivoltines. Ten bivoltine races namely, AVZ-2 (WD), KSD-8, NB<sub>4</sub>D<sub>2</sub>, NP2, SL-X, (Dumbbell shaped cocoon producing races), KSD-9, Viet-902, KSO-1, CSR2, and KCT (Oval shaped cocoon producing races) were selected from Germplasm stock of KSSRDI, and reared as per the standard techniques (Krishnaswami, 1978). Cocoons were randomly selected for crossing experiment. In each race 30 dfls were prepared by selfing among males and females of the same race and another 30 dfls were prepared by crossing the females of each bivoltine race with the males of KS-10. The findings are given in the Table 2. The results indicate that when KS-10 is used as male parent to cross with bivoltines, the eggs hatched like polyvoltines, where as when they were self-crossed with in each race, the eggs expressed their typical hibernating behaviour. This indicates that KS-10 has a special ability of over coming the diapause nature in bivoltine eggs.

Much of the work on voltinism has been done in temperate zone. Umeya (1925, 1926) opined that gene responsible for diapause is located on the sex-chromosome. Morohoshi (1976) indicated that the major gene for Voltinism (V) is located on the sixth linkage group (21.5 units). Katsumata (1968) detected an autosomal non-diapausing egg mutant “*pnd*” in the Indonesian polyvoltine race “Cambodge”. Murakami (1988) identified “*npnd*” a

sex-linked gene responsible for polyvoltinism which is also epistatic to “*pnd*”. On the other hand literature on voltinism under tropical conditions is scanty. The phenomenon as reported here or any similar or comparable incidents are not so far reported in literature, especially in tropics. Though in the recent years emphasis is being given for evolving bivoltine races and identifying hybrid combinations, ensuring proper hatching has remained a bottleneck in the bivoltine program. The present phenomenon of overcoming of diapause nature in bivoltines through a polyvoltine cross being unique, opens up interesting area of research in silkworm genetics of commercial implications in the industry.

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