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PRESENT STATUS AND FUTURE PROSPECTS IN POLYVOLTINE SILKWORM DEVELOPMENT

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ABSTRACT – The races reared in India to produce the silk in different parts have been reviewed in this paper. Further , suggestions have been made for the multivoltine silkworm development in the country

Key words : Polyvoltine, silkworm.

INTRODUCTION

India ranks today as the second largest producer of raw silk in the world, contributing to around 19% of the production. Bulk of the silk produced in India is either form polyvoltines or polyvoltine x bivoltine hybrids and the silk produced from them are low in yield and poor in quality. In silkworm breeding, study of cocoon characters contributing to silk productivity as well as silk quality are very essential. A newly developed silkworm breed with higher cocoon productivity and better cocoon quality can be easily exploited. Silkworm breed with better cocoon quality not only benefits the farmers but also the reelers, weavers and traders. Sericulture is practiced in India since time immemorial and silkworm breeding history is only 100 years. The silkworm breeds were at the hands of traders and graineurs who use to multiply the older stock and popularized in different regions of the country. During pre independence, various British Directors made attempts to develop new breeds by crossing Italian races with local race called, Nistari and resultant breeds named as Nistid, Nishmi, Ichot etc., and were popular during late 19th and early 20th century (Ghosh, 1949). West Bengal also used earlier breeds like Chotopolu and Borapolu for commercial exploitation and are very poor yielders. Simultaneously, Tippu Sultan, the ruler of Mysore province took interest in the development of sericulture in southern states and brought mulberry cuttings from Bengal and silkworm race seed from China. Pure Mysore race is supposed to have been derived from the Chinese silkworm race.

Commercial Exploitation of polyvoltine breeds

There are several indigenous multivoltine breeds like Pure Mysore in the south , Nistari in the east , Sarupat and Moria in the north east India for commercial exploitation. Though these breeds are well acclimatized to fluctuating climatic conditions, the silk produced is low in quality and quantity (Datta, 1984). Systematic attempts were not made for the development of silkworm breeds during pre independence period and continued to exploit breeds like Nistari, Nistid, Nismo , Boropolu and Chotopolu. An attempt was made to develop silkworm breeds by crossing exotic breeds and successful in developing Ichot and Itan. These races were released and were popular during that period. However, due to improper maintenance and poor selection, they were withdrawn from the field (Thangavelu, 1997).

Development of polyvoltine breeds

After the establishment of Sericultural Research Institutes under Central Silk Board, attempts were made to improve multivoltine breeds in early sixties and resulted in the development of Kolar Gold, Kollegal Jawan and Mysore Princess at Central Sericultural Research and Training Institute (CSR&TI), Mysore and MBD-IV, MBD-V, O, L, G, D3C and D14b at Central Sericultural Research and Training Institute (CSR&TI), Berhampore (Sidhu *et al*, 1967, Sengupta *et al,*1968).

Development of productive and shorter larval duration breeds

Systematic breeding approaches were started during eighties to develop productive multivoltine breeds with shorter larval duration, high cocoon weight and shell weight, silkworm breeds with sex-limited larval markings. This has resulted in the development of MY1, P2D1, PM (SL) and RD1 at CSR&TI, Mysore and A-23, A-25, OS-61,OS-68 and OS-616 at CSR&TI, Berhampore (Datta *et al*., 1981,Nagaraju *et al.,* 1987, 1989; Noamani *et al*., 1991).

Efforts made at Universities

University of Mysore, Mysore have attempted and successful in the development of MU and MG series with high cocoon weight, shell weight, shell ratio and longer filament length.(Kalpana *et al* 1998).

State Sericultural Research and Development Institutes

Sincere efforts were also made at Karnataka State Sericultural Research and Development Institute and Andhra Pradesh State Sericultural Research and Development Institute in synthesizing polyvoltine breeds and are successful in the development of MH1 and KSPM (SL) in Karnataka and APS8 at Andhra Pradesh. Attempts made to popularize these breeds with the farmers could not succeed due to various reasons.

Development of productive polyvoltine breeds at CSB units

Realising the need for more productive polyvoltine silkworm breeds, Central Silk Board units reoriented their breeding approaches and evolved productive breeds *viz.,* BL23, BL24 and BL43 and their hybrids *viz.,* BL23 x NB4D2, BL24 x NB4D2 and BL43 x NB4D2 were authorized by Central Silk Board during 1995 and 2002. These hybrids also could not make dent with the farmers. Therefore evolution of suitable breeds for tropics having varied climatic conditions and seasons has always been perceived an extremely challenging task.

Recent developments in polyvoltine improvement

Considering the need of the Industry, efforts made by the silkworm breeders of at CSR&TI, Mysore during late nineties to improve silk quality in polyvoltine breeds/ hybrids resulted in the development of productive polyvoltine x bivoltine hybrid *viz*., Cauvery (BL67 x CSR101). Raghavendra Rao *et al* (2002) with gradable silk and the hybrid was authorized during 2005 for commercial exploitation (Table 1). Efforts were also made to develop productive polyvoltine breeds with low boil-off loss ratio and high neatness by Kariappa (2005). Dandin *et al.* (2006) have developed a productive polyvoltine breed ND7 and its hybrid "JAYALAKSHMI" (ND7 x CSR2) is being evaluated with the farmers in large scale (Table 2). Recently, Raghavendra Rao *et al*. (2007) have successfully introgressed sex-limited larval markings to a productive polyvoltine breed (Table 3). Ravindra Singh *et al* (2007) have developed a polyvoltine breed, NP1 tolerant to nuclear polyhedrosis virus . These breeds are yet to be proved their performance with the farmers in large scale. CSRTI, Berhampore has also developed congenic polyvoltine x bivoltine hybrids viz., MC1 x BC4 and MC4 x BC4.

Constraints encounterd in popolarisation of new breeds/hybrids

Though different breeding schools in India have developed several polyvoltine breeds/hybrids during past three decades, their commercial exploitation with the farmers could not give encouraging results because of:

- Crop instability,
- Poor extension system,
- Occurrence of diapausing eggs,
- Poor management practices
- Erratic emergence of moths
- Poor or non adoption of new technologies
- In adequate trained scientific personnel for race maintenance.

Strategies for development of productive polyvoltine breeds with quality

During past two decades, thrust was given to develop productive polyvoltine breeds and the goal was achieved in terms of yield but the quality parameters associated with silk fiber remains poor. Though polyvoltines are tolerant to adverse climatic conditions like temperature and humidity, efforts made by the scientists could improve the shell weight, shell percentage, filament length, raw

Table 1 : Performance of cauvery, BL67 x CSR101 with PM x CSR2

Characters	CAUVERY (BL67xCSR101)	KOLAR GOLD (PMxCSR2)
Fecundity	485-550	450-510
TLD(Hrs)	22-23	23-24
VLD(Hrs)	5-6	6-7
Pupation Rate (%)	96.2	98.2
Yld/10,000 larvae	21.212	20.133
Single cocoon wt.(g)	2.220	1.950
Single shell wt.(g)	0.478	0.388
Cocoon-shell ratio	21.5	19.9
Floss %	5.65	9.18
Filament length(m)	1106	895
Denier	2.76	2.93
Raw silk %	15.4	14.3
Neatness (P)	90	88
Renditta	6.5	7.0
Reelability (%)	90	89.7

Table-2: Performance of JAYALAKSHMI a new multivoltine x bivoltine hybrid with control

Characters	ND7 x CSR2	PM x CSR2
Fecundity	537	521
Pupation rate (%)	96.62	97.00
Cocoon yield/10000 larvae (kg)	18.497	16.842
Cocoon weight (g)	1.918	1.737
Shell weight (cg)	39.1	31.6
Shell Ratio (%)	20.4	18.2
Filament length (m)	946	779
Denier	2.77	2.75
Raw silk (%)	15.5	13.0
Reelability (%)	84.0	82.0
Renditta	6.45	7.69
Neatness (p)	90	88

silk recovery, boil off loss and neatness up to certain extent but the quality parameters like size deviation, tenacity, elongation and neatness are still at lower level only due to which the grade of the silk produced is not comparable with that of the bivoltine silk. Hence efforts should be made to improve the characters associated with the silk quality viz.,

- Tenacity,
- Elongation,
- Size deviation and
- Neatness

Stratagies to achieve the goal

- Diversified genetic resource material with wide genetic base to select suitable breeding resource material.
- Adoption of appropriate breeding methods to identify and select progeny at different generations.
- Adoption of bio-technological tools to improve target traits associated with quality.
- Meticulous assessment of parameters associated with silk quality and selection.
- Mid term corrections if any required to achieve the desired goal.
- Test of combining ability to select the promising combinations
- Contribution of male parent will also improve the cocoon and larval characters. Hence selection of appropriate male component for hybrid preparation is vital.

Table 3 : Performance of BL67 (SL) with Pure Mysore and BL67

Character	BL67(SL)	PM	BL67
Fecundity	488	485	481
Larval span (hrs)	520	662	520
Pupation rate(%)	85.73	88.83	91.57
Cocoon weight (g)	1.330	1.113	1.331
Shell weight (cg)	23.2	15.1	23.8
Shell ratio (%)	17.4	14.3	17.8
Filament length (m)	685	352	696
Denier	2.48	2.04	2.46
Neatness (p)	88	75	87

- Systematic maintenance of developed breeds true to the original characteristics both at breeders and down stream multiplication levels.
- In additional to conventional breeding methods, application of parthenogenetic and androgenetic approaches shall be tried in order to homogyous silkworm breeds.
- Strong extension / marketing system.
- Forward linkage to process the produce.

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