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Cocoon Parameters of Selected Bivoltine Hybrids of *Bombyx mori* L.

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ABSTRACT: An attempt was made to identify the superior cocoon parameter producing bivoltine silkworm hybrid from KSSR&DI, Thalaghttapura. 10 bivoltine silkworm hybrids were selected *viz.,* HNPD, BBE266, NN6D, DD-1, KCR2, Viet 904, NK2, BRD12, SLX and SP4 their performance were analyzed for traits such as cocoon weight, shell weight and fibroin percentage and found the bivoltine hybrid HNPD was having superior cocoon weight (1.46g) and fibroin percentage (78.69%), whereas superior shell weight was found for the hybrid NN6D (0.272g) and least cocoon weight, shell weight and fibroin percentage was observed for the hybrid SP4, where they having 1.27 g, 0.240 g, and 76.99% of cocoon weight, shell weight and fibroin percentage respectively.

Keywords: Silkworm, Bivoltine, Cocoon parameters, Fibroin.

INTRODUCTION

The silkworm, *Bombyx mori* L spins a protective shell by extruding silk bave at the end of its larval period in order to get protection from the adverse environment during its pupation. The rich legacy of Indian civilization is intimately linked to sericulture. India is the world's second-largest producer of raw silk, after China (Vijayaprakash & Dandin 2005). The silk bave is composed of two components principle *viz.,* fibroin and sericin. It also contains small quantity of waxy matter, carbhohydrates, pigments and inorganic matter. Fibroin is the core of the silk filament representing 70-80% of cocoon weight, while sericin enclose the fibroin in a continuous sheath accounting for 20-30% of cocoon weight. The fat, wax, coloring and mineral matter forms a very small part of the silk bave contributing 2-3% (Carboni, 1952). The main intention of silkworm breeding programme is to develop high cocoon yield silkworm breeds without deteriorating its equality. In this context lot of efforts are made by researchers to developing high yielding silkworm breeds with specific characters *viz.,* longer filament length and low denier, low boil – off loss ratio, less size deviation, higher neatness points and less floss percentage. While sticky sericin protein is easily soluble in boiling alkaline soap solution, the primary silk component, fibroin, is insoluble in alkaline hot water (Sadov *et al.,* 1978). In reeling and weaving operations, the percentage of boil-off loss is crucial (Kannan, 1986). Because sericin is present, raw silk lacks both shine and softness (Roopesh Kumar *et al.,* 2003). The silkworm strains vary genetically from one another (Sinha *et al.,* 1992). Due to genetic makeup, multivoltines have a larger degumming loss percentage than bivoltines (Sidhu & Sonwalker 1969). The environment affects the season, which in turn affects the boil-off loss ratio (Sonwalker, 1969). When mulberry silk is contrasted with non-mulberry silk, sericin's contribution is highest (23 to 30%) (Venugopal, 1991). Recessive genes function in the opposite direction from dominant genes, which exhibit low boil-off ratio content and increased cocoon reeling properties (Gamo & Hirabayashi 1984). There are numerous reports on the boil-off loss ratio in hybrid and breeds of silkworms. Bivoltine hybrids and multivoltine × bivoltine hybrids have an intermediate boil-off loss ratio (Basavaraja *et al.,* 2000; Veeranna Gowda *et al.,* 2013; Seetharamulu *et al.,* 2013; Kumar, 2018). The estimation of boil-off loss ratio (B.O.R) is pertinent during the process of breeding and also one of the improvement parameter for evaluation of hybrids race authorization. However, information available on boil off loss ratio in bivoltine breeds maintained in germplasm of KSSR&DI is rather scanty. Keeping this

in view, the various cocoon parameters have been checked.

MATERIALS AND METHODS

The cocoons of bivoltine silkworm breeds *viz.,* HNPD, BBE266, NN6D, DD-1, KCR2, Viet 904, NK2, BRD12, SLX and SP4 were procured from Karnataka State Sericulture Research and Development Institute (KSSR&DI), Thalaghttapura, Kanakapura Road, Bangalore. The good cocoons were selected and used to record cocoon parameters which includes cocoon weight and shell weight

Cocoon weight (g): Ten cocoons were randomly selected from each silkworm bivoltine breed replication-wise, weighted individually and average single cocoon weight was computed

Shell weight (g): After removing the pupa and larval exuvium from the cocoons, the individual shell weight was recorded.

Fibroin percentage: The fibroin percentage was calculated by using the formula

Fibroin (%) = 100-boil off loss percentage

Analysis of data: The data obtained on the analysis of cocoon parameters were analyzed by employing standard deviation (±) method and mean values were expressed.

RESULTS

Results in investigation on the analysis of cocoon parameters in bivoltine silkworm breeds were presented in the following paragraphs.

Cocoon weight. Bivoltine breeds exhibit variation in respect of cocoon weight. The maximum cocoon weight was recorded in HNPD (1.46g) followed by BBE266 (1.43g), NN6D (1.41g), DD-1 (1.39G), KCR2 (1.39g), Viet 904 (1.39g), NK2 (1.38g), BRD12 (1.33g), SLX (1.29g). Whereas, the minimum cocoon weight was observed in SP4 (1.27g) (Table 1 & Fig. 1).

Shell weight. The highest shell weight was expressed by NN6D (0.272g) followed by HNPD (0.271g), BBE266 (0.261g), NK2 (0.255g), KCR2 (0.251g), Viet 904 (0.250g), BRD12 (0.246g), DD-1 (0.243g) and SLX (0.241g). In contrast it was lowest in SP4 (0.240g) (Table 1 & Fig. 2).

Fibroin percentage. Among selected bivoltine breeds, maximum fibroin percentage was recorded in HNPD (78.69%) followed by BBE266 (78.61%), NN6D (74.48%), DD-1 (78.41%), KCR2(77.72%), Viet 904(77.63%), BRD12 (77.36%), SLX (77.62%). The breed SP4 registered lowest fibroin percentage of 76.99% (Table 1 & Fig. 3).

Table 1: Cocoon and post-cocoon parameters of bivoltine silkworm breeds.

Sr. No.	Breed	Cocoon weight(g)	Shell weight (g)	Fibroin (%)
1.	HNPD	1.46±0.007	0.271±0.007	78.69±0.049
2.	BBE266	1.43±0.021	0.261±0.002	78.61±0.156
3.	NN6D	1.41±0.014	0.272±0.008	78.48±0.056
4.	DD-1	1.39±0.021	0.243±0.005	78.41±0.128
5.	KCR2	1.39±0.007	0.251±0.005	77.72±0.191
6.	Viet 904	1.39±0.007	0.250±0.010	77.63±0.177
7.	NK2	1.38±0.021	0.255±0.004	77.50±0.007
8.	BRD12	1.33±0.021	0.246±0.001	77.39±0.092
9.	SLX	1.29±0.028	0.241±0.006	77.26±0.169
10.	SP4	1.27±0.007	0.240±0.005	76.99±0.028

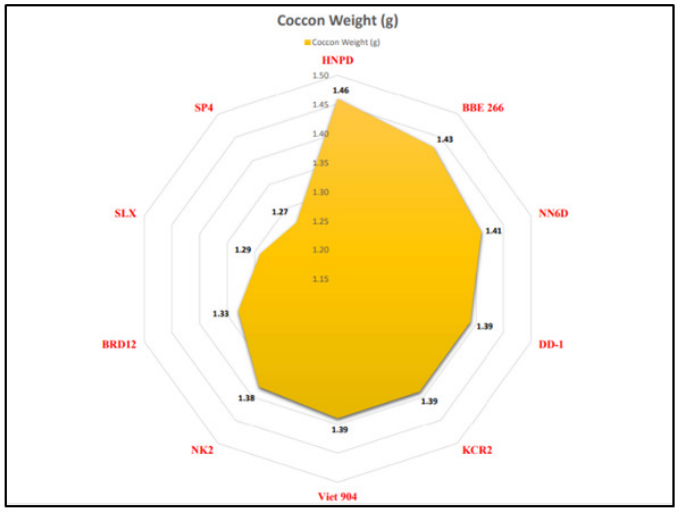

Fig. 1. Cocoon weight of bivoltine silkworm breeds.

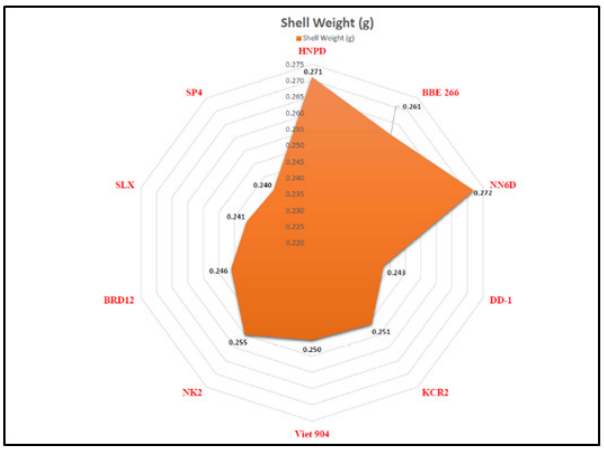

Fig. 2. Shell weight of bivoltine silkworm breeds.

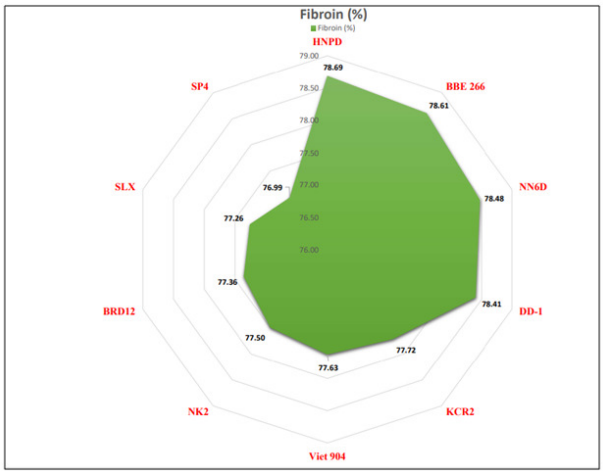

Fig. 3. Fibroin percentage of bivoltine silkworm breeds.

DISCUSSION

The silkworm, *Bombyx mori* domesticated since time immemorial is one of the most beneficial insects producing natural silk, which is also one the important laboratory tool to study the genetic composition responsible of the expression of the qualitative and quantitative traits. It is well documented that in silkworm all the economic traits are under the control of polygene except neatness which is controlled by a semi dominant major gene with few minor genes supporting it. However, the degree of manifestation of the economic traits is governed not only be genotypes but its expression also depends upon the environment. The results on the analysis of cocoon parameters and degumming loss percentage in bivoltine silkworm breeds are discussed in the light of earlier work in the following paragraphs

Cocoon weight: Cocoon weight is an important attribute for the yield as this character mainly depends on the race/breed and its ability to convert mulberry leaf into cocoon. The bivoltine breeds differ one another for cocoon weight. The highest cocoon weight of 1.46g was recorded in HNPD and it was lowest in SP4 (1.27g). The variations in the cocoon weight among the bivoltine silkworm breeds differ due to their genetic constitution and interaction with dynamic environmental factors. The present findings are in conformity with the observations of Kumar (2009); Anantha and Subramanya (2010); Kumaraesan *et al.* (2007). This type of observation was made in bivoltine breeds *viz.,* P31, CSR4 and NB7 exhibited higher cocoon weight than JROP and JRMD showing variations for the said characters among bivoltine breeds (Kumar *et al.,* 2018). Similar trends were also observed n multivoltine breeds by Datta (1984); Sudha and Nangia (2000) who have opined that the multivoltine breeds are characterized with low cocoon weight as their potentiality is poor and its poor efficiency to build a better cocoon even in favorable climatic conditions.

Shell weight: It is an important economic character which indicates the actual silk content. The expression of this character differs among silkworm breeds depending upon rearing condition and quality of mulberry leaves provided to silkworms. The maximum shell weight of 0.272g was expressed by NN6D. In contrast it was minimum in SP4 (0.240g). These results are on par with the observation of Kumar (2009), Anantha and Subramanya (2010); Kumar *et al.* (2018) who have observed that bivoltine breeds *viz.,* CSR2, CSR4, JRMD and P31 expressed higher shell weight than JROP. The CSR4 excelled over the other breeds for this trait which indicates its genetic superiority. Similar results were also noticed by Anantha and Subramanya (2010) in some multivoltine breeds.

Fibroin percentage: The fibroin percentage is one of the important parameter considering in the process of weaving and dyieing. This parameter varies among the silkworm breeds. Among bivoltine breeds maximum in SP4 of 76.99%. This corroborates the earlier worker Jeong and Chang (1987) who have reported that the amount of fibroin per cent is more in bivoltine breeds compared to multivoltine breeds is due to additive effect gene was higher than the dominance effect on the amount of sericin and fibroin. This work is supported by Kumar (2020) who has noticed that the bivoltine breeds CSR2, CSR26, NB4D2, Zebra scored better for this trait over Ursa. Similarly, among multivoltine breeds MU1 stood first for the said trait as compared to Hosa Mysore, Nistari, MU303 and PM. Further, irrespective of breeds the male exerted more fibroin than the female

SUMMARY

Among bivoltine breeds HNPD, NN6D and BBE266 excelled over remaining breeds in respect of cocoon parameters such as cocoon weight, shell weight and fibroin percentage.

CONCLUSIONS

The result of the present study inferred that the bivoltine breed, HNPD registered highest cocoon weight and fibroin percentage and this character can be utilized during the development of silkworm breed.

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Conflict of Interest. None.

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