PREFACE

Consistency in bivoltine sericulture depends on the maintenance and multiplication of authorized silkworm races for commercial utilization. The production of hybrid eggs for commercial rearing involves a long chain of interdependent and specialized operations right from the systematic multiplication of the races for production of quality cocoons in order to meet the demand of the industry. Race maintenance is defined as maintenance of silkworm breeds conforming to their original characteristics with constant expression of hybrid vigour in their hybrids. In India, though a three tier system is practiced for maintenance and multiplication of basic stocks for the last three decades (Narasimhanna, 1988) the quality of the cocoons produced are not in conformity with the original characters. This may be attributed to continuous inbreeding, non-replacement of original races for long time from breeders and adoption of continuous directional selection (ex; Selection of big sized cocoons) during different levels of maintenance and multiplication. This has led to the change of original characters and becomes a new race but continued in the old name. Therefore, maintenance of silkworm races conforming to their original characters for many generations is of utmost importance. To avoid such type of drawbacks, strict implementation of one way system of race maintenance and multiplication was initiated during 1997. In this system, only the breeders and the P4 centres apply the selection for the maintenance of original characters while P3, P2 and P1 centres sort out the inferior cocoons (Basavaraja, et al., 2001). The task of maintenance of breeder’s stock (original race) is entrusted with the well trained breeders as in China and private egg producing companies of Japan and Brazil.
The race / breed evolved by the Research station / Institution and recommended for use in hydrid for producing the industrial eggs or either maintained by Research Institution themselves or by the egg producing farmers themselves as in the case of Zhanjian egg farms in the maintenance of race, at most attention is paid to selection at every stage of rearing of the basic stocks to ensure that race / breeds retain their genetic purity and breed true to the characteristics of the race/ strain. At the Zhanjian of egg farm races like Tongfi x Huabe and Tonge 34 x Gainsu maintained in the state of productivity for such a long time having to get, them replenished from Research Institute at periodical intervals. This shows the high degree of efficiency in the maintenance of the nucleus / basic stock.

It is the responsibility of the silkworm breeders to maintain the breeder’s stock (Parental breeds) once the silkworm hybrids are authorized for commercial exploitation, the parental breeds are to be properly maintained in the same genetic configuration by up-keeping the original breed characteristics for commercial rearing. The purity of the breeds is defined when they are in conformity with the original characteristics for “n” number of generations. Original characters such as larval pattern, cocoon colour, cocoon shape and cocoon wrinkles are to be maintained as per the breed characteristic features. Besides, the purity is measured on the basis of expression (magnitude) of hybrid vigour in every cycle of maintenance. This will facilitate to maintain both qualitative and quantitative traits of the breeds and realize the maximum hybrid vigour when F1 hybrids are prepared for commercial exploitation (Basavaraja, et al., 2001) even generation after generation. On the other hand, improper maintenance and multiplication will lead to the decline/deterioration
of the designated characteristics of the breeds. In light of the above, the breeds are to be maintained systematically to minimize loss or change in the original characteristics.

In silkworm, most of the economic characters are quantitative in nature and are greatly influenced by the environmental factors such as temperature, relative humidity, nutrition and rearing technique (Kogure, 1993; Miyagawa and Sato, 1954; Legay, 1958; Takeuchi, 1959; Ueda, and Lizuka, 1962; Suzuki, et al., 1962; Yokoyama, 1963; Aria and Ito, 1967 and Horie, et al., 1967). It is important to measure the phenotypic expression of the major contributing traits of economic importance under different environmental condition in order to understand the genetic endowment with regard to productivity of the breeding material. The performance of a strain or a race is mainly dependent on the combined action of hereditary potential of its population and the extent to which such potential is permitted to express in the environment to which they are exposed. Besides, it is well established that the dynamic environmental conditions prevailing in different seasons of the year bring about definite changes in the physical and biotic factors influencing the growth, development and the expression of economic traits in silkworm strain (Kogure, 1933; Suzuki, 1954; Narayan, et al., 1967; Krishnaswami, et al., 1970 a, 1970 b, Ueda, et al., 1969; Muslim, 1986 and Kobayashi, et al., 1986). Seasonal studies carried out both in mulberry and non-mulberry silkworms indicated differential expression of different breeds to varied climatic conditions during different seasons (Kumar, 1962; Krishnaswami and Narasimhanna, 1974; Watanabe, 1928; Hassanein and Sharawy, 1962; Kasivishwanathan, et al., 1970 and Ueda, et al., 1975).
In silkworm, studies carried out for selection of various characters have shown that the characters could be changed to breeders choice. Selection for one trait has correlation with the genetic change with other characters. The correlation for some characters is negative and for some it is positive. (Tsuchiya and Kurashima, 1956, 1959; Suzuki and Naruyamu, 1961; Kurasawa, 1968 a; Ohi et al., 1970; Gamo and Ichiba, 1971 and Gamo, 1976). Hence, during the course of developing new breeds, the breeders have to be aware of the response of the characters to selection and its correlated changes with other economic characters.

The basic effect of selection is to change the array of gene frequencies, which will be completely hidden because one cannot deal with the loci concerned with a metric trait. The effect of selection that can be observed are, therefore, restricted mainly to the change in the population mean. To describe the change of genetic traits and phenotypic expression by selection from one generation to succeeding generation are studied.

Heterosis is being exploited to improve the productivity in plants and animals. Silkworm, *Bombyx mori* L. with large number of strains is best exemplified for utilization of heterosis by crossing those strains which differ in their silk yield attributes both quantitatively and qualitatively (Tazima, 1964; Bhargava, 1995). It has been noticed that silk productivity of hybrids is better than that of the parents (Hirobe, 1961; Kobayashi, *et al.*, 1968; Bhargava, *et al.*, 1992). The commercial exploitation of hybrid vigour created a new era in sericulture which contributed substantially to the increased silk production. Research carried out in USSR from 1930~32 at Central
Asiatic and Georgin Scientific of Sericulture showed that hybrid combination possesses desirable characteristics in comparison with pure breeds, for example greater survival rate and harmonious development of silkworm, shorter larval duration and higher yields of cocoons and raw silk (Kovalov, 1970). Continuous efforts are still being made to understand the mechanism contributing to heterosis. The manifestation of heterosis in a particular hybrid mainly depends on the purity of the two parents. The purity of the breed can be retained for a long time when they were maintained systematically. Hence in the present study, different types of selection on pure stocks were applied continuously (upto 8 generations) and the selection effect on its hybrids were studied. The hybrid vigour expressed in the different types of selection methods were compared at 9th generation and the selection techniques were further continued for another four generations on the pure stock followed by the measure for hybrid vigour in the 12th generation to understand the effect of different types of selection on the racial characters.