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Response of two silkworm (*Bombyx mori* L.) Races against two different cultivars of mulberry at district Peshawar

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Abstract

The present research work was carried out at the Pakistan Forest Institute to study the response of two *Bombyx mori* L. races (Bulgaria Chinese and Japanese) versus two different cultivars (Chinese Evergreen and Japanese Early) of mulberry *in vitro* condition with 25±2 °C, 70±10% RH at district Peshawar during 2019. In the study focused on weight and size comparison of full grown larvae, sex ratio, mortality and economic parameters of the cocoon on 2 different mulberry cultivars. The highest mean weight and size was recorded in Japanese race while lowest was noticed in Bulgaria Chinese on both mulberry cultivars (Japan Early and Chinese Evergreen). Similarly in percent mortality, the highest mortality was recorded in Japanese race whereas lowest was observed in Bulgaria Chinese race. Highest male individual was recorded in Bulgaria Chinese and lowest was recorded female. While in case of Japanese half of male and half of female was counted. In economic parameters highest length, diameter, with floss weight of cocoon and without floss weight of Japanese race cocoon recorded on Japan Early as followed by Chinese Evergreen. Similarly, in case of Bulgaria Chinese highest economic parameter of cocoon was recorded on Japan Early and lowest was observed when fed with Chinese Evergreen.

Keywords: *Bombyx mori*, mulberry variety, cocoon, larval size, larvae weight, mortality, sex ratio

Introduction

Sericulture is the study of rearing silkworm for the commercial raw silk production (Krishna-swami *et al.*, 1973) [6]. Silkworm is belonging to phylum Arthropoda, class Insecta, order Lepidoptera, sub-order Ditrysia, super-family Bombycoidea and family Bombycidae, Saturniidae, Lasiocampidae, Thaumetopoidae etc (Jolly *et al.*, 1974) [4].

The common silkworm is an important commercial insect. Commonly it's feed on different varieties of mulberry leaves (Khurshid, 1986) [5]. The different mulberry species may effect on *B. mori* growth and as well silk production (Mahmood *et al.*, 1987) [8]. Mulberry leaves are rich in protein and amino acids. It is known that there is high correlation between leaf protein level and production efficiency of cocoon shell, which means cocoon shell weight to the total amount of mulberry leaves consumed by the *B. mori* (Mechii and Katagiri, 1991) [9]. Therefore, increase in protein level may lead to improvement in productivity of cocoons and silk.

Female lay up to 300-500 eggs and these eggs hatched in 12 days (Borrer *et al.*, 1981) [3]. The adults of *Bombyx mori* L. are creamy white in color having weak brownish lines. It lives usually for few days, rarely fly and unable to feed. It has complete metamorphosis with four larval stages i.e egg, larvae, pupae and adult (Anonymous, 1990) [1]. For the commercial purpose the pupae should be killed just before the moth emergence else the emergence of adult break the fiber into parts. A single cocoon surrounded about 914 meter long thread. Approximately 3000 of cocoon is essential for one pound of silk (Borrer *et al.*, 1981) [3]. *Bombyx mori* L. is basically monophagous insect, they feed only on mulberry leaves. The quality and quantity of mulberry leaves ultimately effect the growth and development of silkworm (Nagaraju, 2002) [10]. An environmental factor such as biotic and abiotic have dynamic role in the success of sericulture industry. Amongst the abiotic factor of environment, temperature plays a vital role in the growth and production of silkworm just because *B. mori* is a cold blooded insect (Benjamin and Jolly, 1986) [2].

Keeping in view the above mentioned importance of *B. mori*, the experiment was conducted with the following objectives: To study the economic parameter of silkworm cocoon, feeding performance of two silkworm races on two mulberry varieties on size and weight bases,

mortality and sex ratio of silkworm *in vitro* condition.

Materials and Methods

The experiment was performed at the sericulture wing of Pakistan Forest Institute Peshawar, during 2017 in which two *B. mori* races (Bulgaria Chinese and Japanese) performance were checked on two different varieties of mulberry (Chinese Evergreen and Japanese Early) *in vitro* condition at temperature $25 \pm 3^\circ \text{C}$ with relative humidity $70 \pm 10\%$. The rearing rooms were disinfected with 5% bleaching powder solution and exposed all the rearing tools into bright sun for 6 to 8 hours and then dip all the instruments in 5% bleaching powder solution for 30 minutes in order to disinfect them and rearing room was equipped with exhaust fan to remove unwanted gases (CO_2 and NH_3) which was arising by *B. mori* at night on its beds. Furthermore, these eggs were kept in the dark condition up to the worm hatched. After hatching the 1st instars larvae were selected and shifted to the 20 cm to 32 cm long wooden trays and reared up to 3rd instars larvae in these trays whereas 60 to 75 cm trays were used for 4th and 5th instars larvae. The mulberry leaves were chopped and provided 5 times a day with interval of 3 hours. Feeding began at 6 am and feeding end at 10 pm daily.

1st instars larvae were fed with 4th and 5th leaves, 2nd instars larvae were fed with 6th and 7th leaves of mulberry while the remaining young shoots were fed to 3rd instars and 4th, 5th instars were fed full leaves. The beds were changed on daily bases. Before the first feed larvae were highly dusted with 3% bleaching powder in its active stage while the larvae were not dusted and feeding at its molting or sleeping stages.

Statistical Analysis

The data was subjected for mean + SE with the help of GraphPad prism software.

Results and Discussion

Mean weight of full grown larvae

The experiment was performed at the Pakistan Forest Institute Peshawar Pakistan. In current study, investigated the weight comparison of two *B. mori* races (Bulgaria Chinese and Japanese) towards two different mulberry cultivars (Chinese Evergreen and Japan Early). The highest mean weight was recorded in Bulgaria Chinese when fed with Japan Early cultivar as compared with Chinese Evergreen while in case of Japanese race maximum larval weight was observed on Japan Early as compared with Chinese Evergreen diet. Bar chart concluded that overall best performed by Japanese race on both of mulberry cultivars instead of Bulgaria Chinese. Particular chart also concluded that highest mean weight was observed in both races when fed with Japan Early cultivar followed by the Chinese Evergreen (Figure 1). The same varieties of mulberry were used by Shah (2009) against two different races of silkworm our finding is in line with his findings may be due to same varieties were used against same races.

Mean Size of Full Grown Larvae

The data was generated from two different *B. mori* races (Japanese and Bulgaria Chinese) on two different mulberry

cultivars (Japan Early and Chinese Evergreen). The Figure 2 containing information about the mean larval size of *B. mori* races when fed with two different mulberry cultivars. The highest length was recorded in Bulgaria Chinese when fed with Japanese Early as followed by Chinese Evergreen. Moreover, in case of Japanese significantly the highest mean length was observed when provided with Japan Early as followed by Chinese Evergreen. The bar chart also indicated the performance comparison between these two races when fed with different mulberry varieties. In this way both races showed highest performance when fed with Japan Early while the lowest performance was observed in both races when presented with Chinese Evergreen diet.

Sex Ratio

Figure 3 obtained about the sex ratio of two different *Bombyx mori* races. The current chart showed half of male individuals and half of female in case of Japanese race while in Bulgaria Chinese the number of females was recorded higher than the male population.

Percent mortality

Figure 4 showed that total, dead and survival individuals of both *B. mori* races (Japanese and Bulgaria Chinese). Bar chart illustrated that 25 individuals of each race in the experiment. Furthermore, graph showed the highest percent mortality was observed in Japanese race as compared to Bulgaria Chinese. Beside these bar chart also indicated the highest larval survival was observed in Bulgaria Chinese and lowest was recorded in Japanese race. The overall chart concluded that Bulgaria Chinese showed better performance as compared to Japanese race. The larval mortality ratio was also studied by Gangwar (2010) in summer season which was in contradiction with the present findings.

Economic Parameters of Japanese Race and Bulgaria Chinese Cocoon on Different Mulberry Varieties

The investigation concluded that the highest economic parameters including length, diameter, with floss weight and without floss weight of cocoon was observed when Japanese race was fed with Japan Early cultivar moreover, the lowest economic parameters including length, diameter, with floss weight and without floss weight of cocoon was observed when Japanese race was fed with Chinese Evergreen (Figure 5). In such case when Bulgaria Chinese was fed with Japan Early this showed highest performance in cocoon length as compared when particular race was fed with Chinese Evergreen however, the bar graph also concluded that highest diameter of Bulgaria Chinese cocoon was observed when Japan Early was given while the lowest was recorded when fed with Chinese Evergreen. In same study maximum with floss weight was observed in case of Japan Early and minimum was noticed when fed with Chinese Evergreen. Figure also indicated the maximum without floss weight was recorded in case of Japan Early and minimum was recorded in Chinese Evergreen (Figure 6). The present finding in contradiction to the finding of Lakshmi and Yellamma(2013) it might be due to the food consumption.

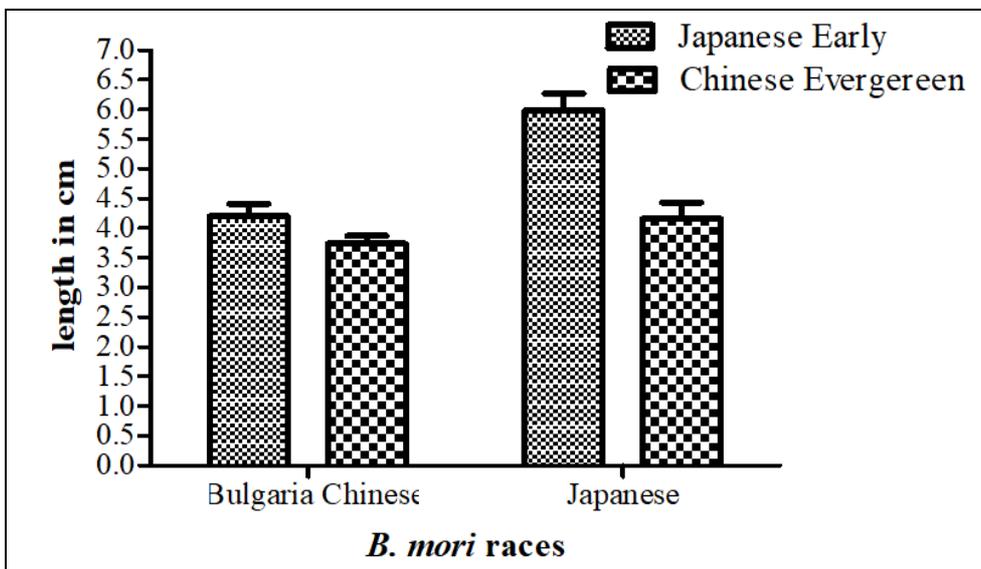


Fig 1: Mean size of *B. mori* races on two different mulberry varieties

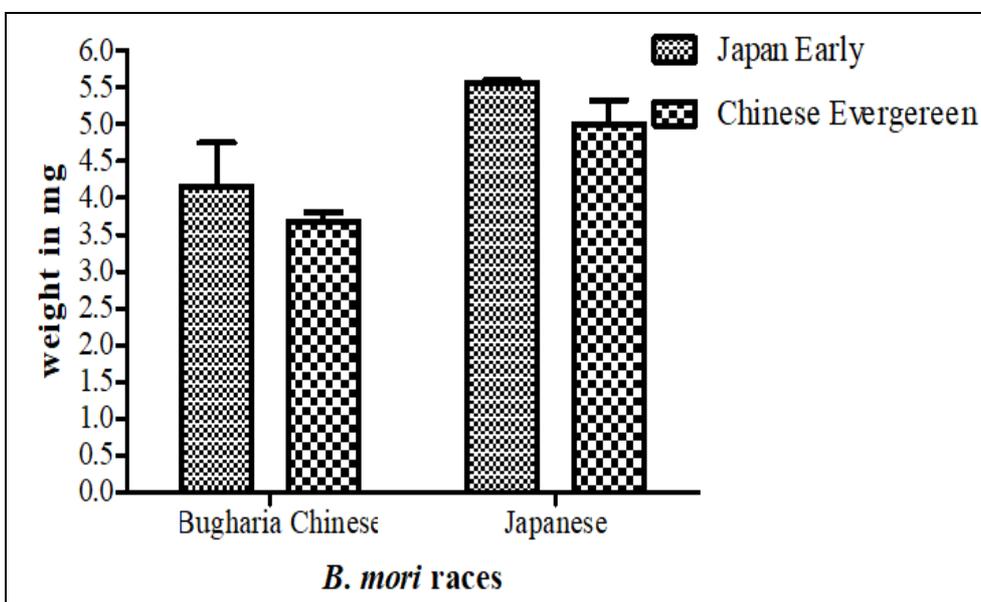


Fig 2: Mean weight of *B. mori* races on two different mulberry varieties

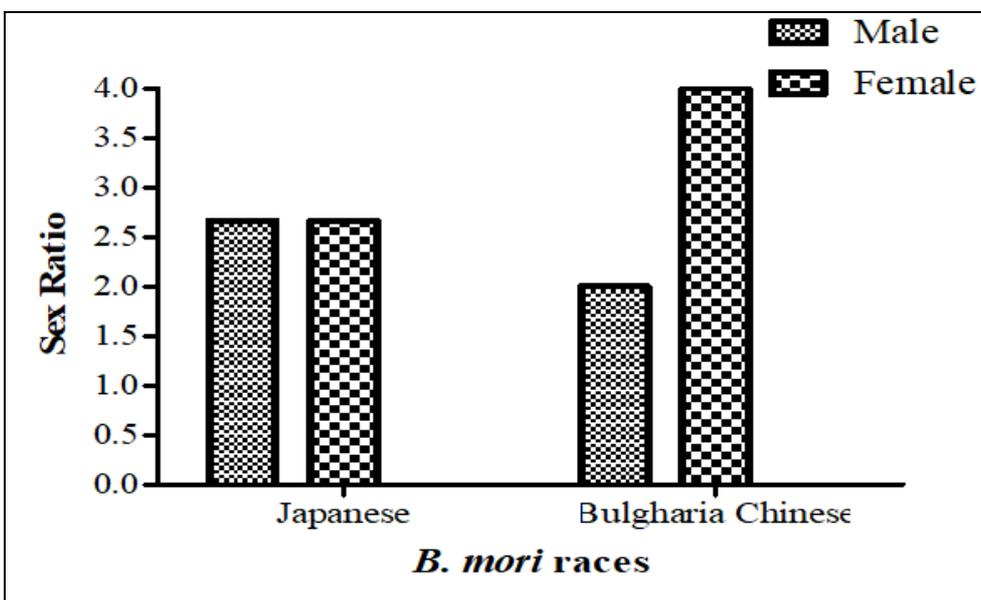


Fig 3: Sex Ratio of 2 different *B. mori* races

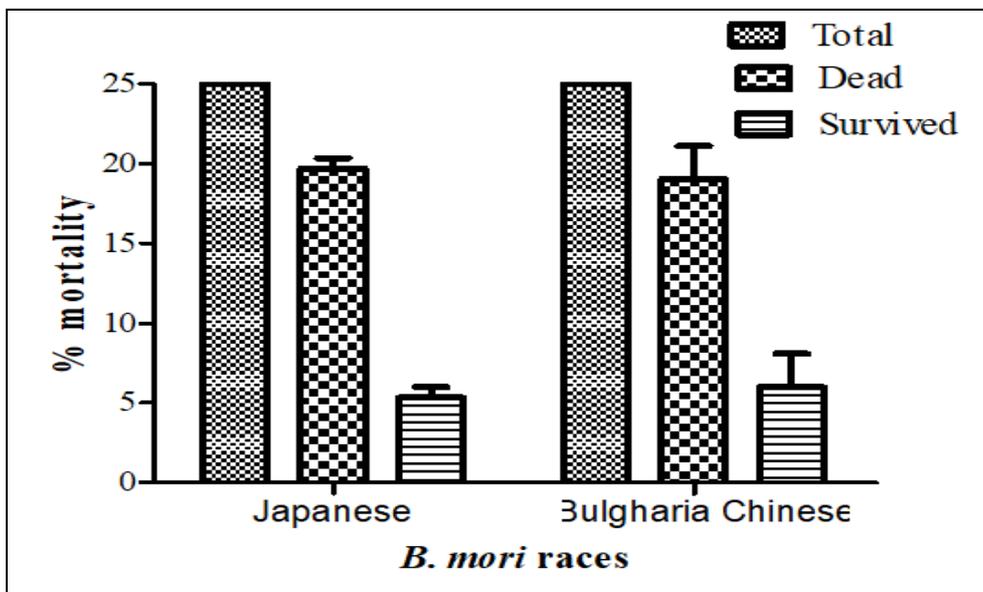


Fig 4: Mortality Ratio of 2 *Bombyx mori* races

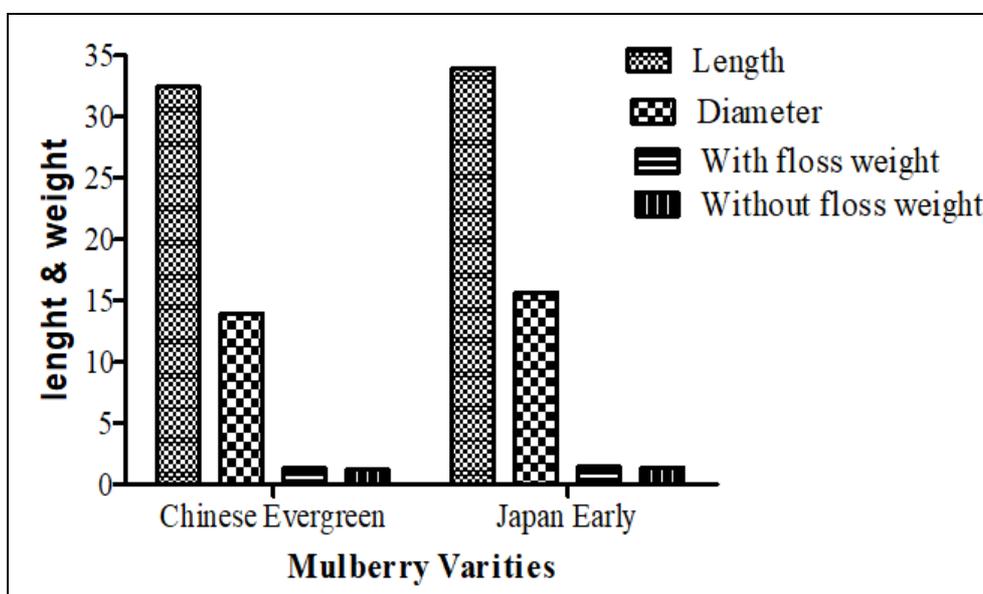


Fig 5: Economic parameter of Japanese Race cocoon on two different mulberry varieties

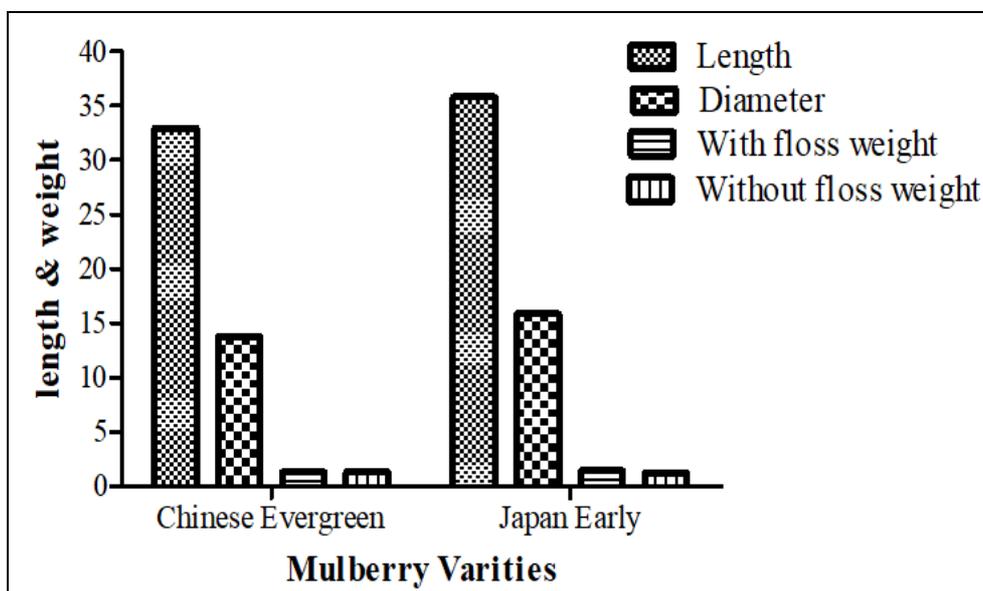


Fig 6: Economic parameter of Bulgaria Chinese Race cocoon on two different mulberry varieties

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