



**COCOON PARAMETERS IN THE SILKWORM, *BOMBYX MORI* ON EXPOSURE TO  
AQUOES PLANT EXTRACTS AGAINST TUKRA DISEASE.**

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**ABSTRACT**

The present study has been aimed at investigating various Economic Parameters of the silkworm cocoon, when fed with aqueous plant extract mulberry leaves with *Azadiractha indica*, *Parthenium hysteron phorus* and *Ocimum sanctum*. The experimental worms were divided in to three groups there are control group, tukra effected group and extract sprayed fed group. The Control group of silkworm larvae was fed with normal mulberry leaves. Cumulatively, the findings of the present study were observed to evaluate the modulatory role of plant extracts with particular reference to the quality and quantity of the silk. The Mixed dose of extracts on selected days significantly elevated all the selected Economic Parameters of the cocoons.

**KEYWORDS:** Bombyx mori. L, Plant extracts and tukra.

**INTRODUCTION**

The major input in the manufacturing of raw silk is cocoons that play an important role in the production and quality of raw silk. In topical countries such as India, cocoons are available throughout the year unlike in temperature countries where the cocoon production is seasonal. Entrepreneurs have to assess the availability of cocoons taking in to consideration the requirement based on different characteristics. The quality of cocoons and its suitability should be ascertained for achieving. Optimum productivity and raw silk quality for an established process line (Madhavappa *et al.*, 2000). The cocoon weight shows a continuous loss of weight from the time of its completion till the emergence of the moth because of loss of moisture. The most important commercial character of cocoon is weight as weight indicates the approximate quantity of raw silk that can be reeled from it that single cocoon weight is very important for the assessment of the quality. The weight of the cocoon depends upon the rate may range from 1g to 3g. The weight of the cocoon is not constant but decreases after the pupa get transformed in to moth and shell weight another important commercial character shell weight means weight of the silk shell excluding pupa (shell weight =cocoon weight-pupa weight).

The shell ratio ranges from 12 to 15 percent in multivoltine hybrids 16-19% in newly evolved hybrids 19-25% in Japanese reeling cocoons. Filament length of cocoon is a direct measure towards the cost of the cocoon. This can be measured by reeling silk thread from

single cocoon and the filament length varies from race to race with multivoltine races can yield 500mts of silk filament and 700-1000mts from the cocoons of bivoltine races. The thickness of the silk filament is called denier the denier is the important character of the cocoon. The quality of cocoon crop depended on the vigor of silkworm breeds and also influenced by the mulberry leaf quality (Venugopal pillai *et al.*, 1987). According to Bajpeyi *et al.*, (1991) the raw silk production per hectare of land is approximately 52 kg in 40 kg in Japan. Silk is a natural fibrous protein. The protein content of the cell is altered from time to time by their degradation and synthesis and thus operating a dynamic equilibrium in protein environment (Young, 1970). According to Harper *et al.*, (1979) the total protein profile of a tissue may be taken as a diagnostic tool and assessing the physiological status of an animal as a whole. It can be concluded that the silk production is in turn depends on the protein synthesis machinery of silkworm. The production of good quality of cocoons is also influenced by some chemicals or insecticides which contaminate the mulberry leaves. Kuwana *et al.*, (1967) had studied the effect of several insecticides on the cocoon of silkworm, *Bombyx mori* by means of subcutaneous injection through microsyringe, topical application and oral administration. Significant changes in the commercial characters of cocoon like weight, shell weight, shell ratio in the larval stage of IV&V instars of *Bombyx mori* in relation to botanicals administered on incidence of mealy bugs (Tukra). Keeping in view of this an attempt is made in this investigation to study the effect of some

promising botanicals against tukra on various cocoon characters of commercial importance like cocoon weight, shell weight and shell ratio.

### MATERIALS AND METHODS

Test species: Silkworm, *Bombyx mori* (Disease-free larvae from local grainages)

Mulberry: V<sub>1</sub> Variety

Larval Instar: 5<sup>th</sup> Instar

Plant extracts: *Azadirachta indica*, *Parthenium hysterophorus*, *Ocimum sanctum*

Economic parameters: Cocoons characters and quality and quantity of silk.

### Test species

The present investigation was carried out on the PM x NB4D2 hybrid variety of the silkworm, *Bombyx mori*. Since the experiments required continuous maintenance of the test species, silkworms were reared in the laboratory itself in accordance with the procedure (Krishnaswami, 1978).

### Mulberry Plantation

Mulberry crop was maintained by following standard agronomic practices. Treatments were imposed on 15th day of pruning in each plot, five plants were randomly selected and the population of pink mealy bug was counted. In each plant population was counted on three leaves (top, middle and bottom). The total number leaves per plant were also counted and the population was expressed as number per leaf. Observations were made just before spraying (pre-treatment count), 3, 5 and 7 days after spraying. The following plant extracts with naturally existing insecticidal properties were chosen for spray of mealybug infection in mulberry plants.

### Preparation of aqueous plant extract

Plants having insecticidal properties like *Azadirachata indica*, *Ocimum sanctum* and *Parthenium hysterophorus* were taken from the department of Botany, University College of sciences, Acharya Nagarjuna University, Guntur, Andhra Pradesh. The leaves of plants were collected, washed thoroughly with distilled water the fresh leaves were homogenate with the help of mechanical device. Further 200 gm of crude selected plants were subjected to extraction through soxhlet apparatus with 500 ml methanol solvent for 24 hrs. After 24 hrs given extract was filtered and filtrate was evaporated completely. Evaporated extract material was dissolved in distilled water and diluted to 2.5 % concentration and used for spray at the identified plot with earlier infection of mealy bug in mulberry plants. Botanical extracts sprayed to tukra leaves of various concentrations were fed to third instar larvae with four feeding per day. The feeding was maintained up to the earlier end of cocoon stage of the silkworm.

### Economic parameters of cocoons

By the end of seventh day of 5th instar, mounting of the silk worm larvae on the chakra was started. After the

cocoons were completely formed the below given economic parameters were analyzed in control and the experimental groups of silk worms.

### Cocoon weight

The cocoons from tukra infested mulberry fed batch of Vth instar larvae showed decreased cocoon weight over the control and the changes were found to be statistically significant over the control ( $p < 0.05$ ). Less percent decrease in the botanical sprayed fed larvae the cocoons were observed and were not significant equal to control.

### Shell weight

The shell weight of the cocoons from the Vth instar *B.mori* L., larvae fed with tukra infested mulberry exhibited lowered cocoon weight from cocoons and more percent depletion of their shell weights and all the changes observed were found to be statistically significant over the control. Less percent decrease in the botanical sprayed fed larvae the cocoons shell weight were observed and were no significant equal to control.

### Shell ratio

The shell ratio of the cocoons from the Vth instar in silkworm, of PMxNB4D2 larvae fed with tukra infested mulberry exhibited lowered cocoon shell from the larvae more percent depletion of their shell weights and all the changes observed were found to be statistically significant over the control. The botanical sprayed fed larvae the shell ratio was equal compared with control were observed and were no significant equal to control.

### RESULT AND DISCUSSION

Cocoon characters like single cocoon weight, Shell weight, shell ratio, filament length and filament weight in PMxNB4D2 race of silkworms were determined under this study on feeding with tukra and botanicals compared with control by the method as described by Krishnaswami, *et al.*, (1987).



Plate I: Cocoons of PMxNB4D2 fed with normal mulberry leaves.



**Plate II:** Cocoon of PMxNB4D2 fed with tukra diseased mulberry leaves.



**Plate III:** Cocoon of PMxNB4D2 fed with botanical sprayed mulberry leaves.

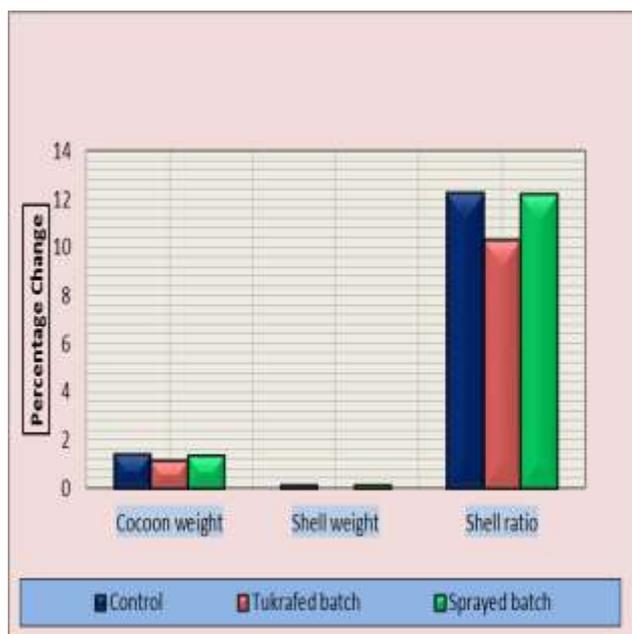
After ripening, the silkworms are allowed for spinning of cocoons on bamboo mountages (3'X2') duly covering the moulting were placed horizontally on the rearing stand in tiers to provide uniform environmental conditions. The ideal spinning temperature (26<sup>0</sup>C-27<sup>0</sup>C) and relative humidity (60%-70%) are maintained in the mounting room. The cocoons were harvested on 6th day mounting and the cocoon characters such as cocoon weight, shell weight and shell ratio were studied.

The stimulatory capacity of the botanicals against tukra on various cocoon characters contributing to silk yield may be attributed to the synthesis of proteins and nucleic acids in the silkworm. Further the tukra infested mulberry fed batch may affect body cells or regulation of the organs *viz.*, Neurosecretory glands and decreases the biochemical constituents corresponded to increases in cocoon weight and silk output. The increase in cocoon weight and biosynthesis of silk protein (fibroin and sericin) concentration which in turn is related to superior silk quality can be attributed to the increased synthesis of RNA in silkworm.

**Table: 1:** Effect of botanical extracts against tukra on cocoon characters of PMxNB4D2 race of silkworm, *Bombyx mori* when fed with tukra and botanical extract sprayed mulberry leaves.

Parameter	Control	Tukra fed batch	Botanicals sprayed batch
Cocoon weight	1.491 ±0.007	1.220 ±0.001 18.28(%) P<0.05	1.444 ±0.002 3.15(%) P<0.05
Shell weight	0.196 ±0.005	0.146 ±0.001 25.51(%) P<0.05	0.190 ±0.003 3.06(%) N.S
Shell ratio	12.252 ±0.005	10.271 ±0.001 16.17(%) P<0.05	12.195 ±0.012 0.456(%) P<0.05

S.D.±: Standard deviation P: level of significance. N.S: Not Significant.



**Fig: 1. Percent change over control in cocoon characters of PMxNB4D2 hybrid silkworm at different days of V<sup>th</sup> instar larvae fed with tukra and botanical extract sprayed mulberry leaves.**

The increase in cocoon weight and biosynthesis of silk protein (fibroin and sericin) concentration which in turn is related to superior silk quality can be attributed to the increased synthesis of RNA in silkworm. The results of the present study clearly demonstrated that the botanical sprayed mulberry fed to silkworm significantly elevated all the parameters related to the economic traits of the cocoons such as the total weight of cocoon, weight of shell and shell ratio. This observation derives support from the research findings of Etebari and Matindoost (2005) who reported that feeding of silk worm on mulberry leaves enriched as equal to normal mulberry feed from fourth instar increased cocoon shell weight at 2.5% concentration while pupal weight.

The silk threads of the cocoons of the silkworm, *Bombyx mori* are composed of two major proteins (fibroin and sericin) produced by secretions of the silk glands. The silk gland is divided into three regions: anterior, central and posterior. The posterior silk gland secretes fibroin while sericin a glycoprotein which coats fibroin is secreted by the central silk gland. The fibroin protein is transferred by peristalsis into the central silk gland where it is stored until required for spinning (Shimura, 1993). Mulberry leaves are rich in protein and amino acids and there is a high correlation between leaf protein levels and the production efficiency of the cocoon shell, i.e. the cocoon shell weight relative to the total amount of mulberry leaves consumed by the silkworm (Machii & Katagiri, 1991). It is therefore possible that an increase in the protein level of mulberry leaves may lead to improvements in cocoon productivity.

Mane *et al.*, (1997) opined that some of the commonly available plants with phagostimulant properties should

be screened and feed to silkworms along with mulberry leaves, thus supplementation of phagostimulant may increase the appetite with least wastage of leaves and increase overall productivity. Ito, (1961) and Ito *et al.*, (1964) reported many sterols have the feeding stimulants. Jaypaul *et al.*, (2003) observed treatment with leaf extracts of certain plants on mulberry leaves can increase the productivity of silkworm with limited food leading to economic gain. It is reported (Murugan *et al.*, 1998; Sreedevi *et al.*, 2003) that the medium concentration of the botanicals is highly effective for the improvement of many parameters of silkworm rearing. In the present study also the medium concentration (5%) was found highly effective with less impact of high as well as low concentration of botanicals may be due to the deleterious action of high or low action of lower dosage. Some of the plants used in this study such as *Achyranthes* sp. (Kim *et al.*, 1997), *A. Spinosus* (Jayaprakash rao, 1998) as well as *P. histerophorus* (Hipparagi *et al.*, 2003; Sreedevi *et al.*, 2003) are reported to have positive influence on various quantitative and qualitative characters of silkworm feeding with supplementation of different plant extracts.

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