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Effect of giloy on the commercial parameters of the *Bombyx mori*

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Abstract
Mulberry silkworm, *Bombyx mori* is highly domesticated & economically important insect which is primary producer of "Queen of Textile", Silk. The dietary nutritional management influences the rearing, growth, development, population & also commercial parameters of silkworm. In this work when *B.mori* were fed with mulberry leaves fortified with aqueous extracts of giloy. In second instar, a positive response with respect to larval growth, development & commercial parameters was noticed. Highest larval weight in instars *viz* third, fourth while in fifth instar, at the beginning of the instar, in middle and at the time of moulting was noticed at T3 i.e., at 3% concentration of giloy extract. The post cocoon characters increased with increase in concentrations. Further results showed that the maximum EER%, total weight of 50 cocoons, average weight of cocoon, average pupal weight, and average shell weight was noticed at 3% extract of giloy concentration. The possible significance of these results is being discussed. The overall performance of *Bombyx mori* in response to the treatment of different concentration of giloy extracts showed an improvement in growth, development with increasing weight as well as increasing population and also increase in commercial parameters which increases the economic value.

Keywords: *Bombyx mori,* giloy, silkworm, cocoon, pupa

Introduction
Silkworm is an insect belonging to the moth family Bombycidae, order Lepidoptera which produces sleek & sensuous silk fiber, which is also called as "Queen of Textile". The production of silk originates in China in the neolithic age (Yangshao culture, 4th millennium B.C.). Silk remained confined to China until the Silk Road opened for others during the latter half of the 1st millennium B.C.

Thus, silk's history dates back thousands of years. China is home to the mulberry silkworm & it is ancient china where the art of silk farming & silk weaving was first discovered. In China, silk was used for a number of other applications including writing, painting etc. beside its use in clothing.

Silk plays a very important role in this fast economically growing world. The spread of sericulture or silk cultivation for silk production & for its exports becomes more important for the development of the economy of the world. With very high employment potential and economic benefits sericulture plays a very important role in agro based industries. Next to the homeland of silk country China, India is 2nd largest producer of mulberry silk work (Vijay prakash & Pandi, 2005) [32]. Globally in the sericulture industry production of silk & good quality cocoon is the main purpose of the silkworm rearing (Samami *et al*., 2019) [26]. Sericulture not only plays an important role in enriching the economy or production of employment but also plays a very important role in the field of medicine, biotechnology, textile industries, food supplements & biomaterials etc. Man has benefited from silk produced from sericulture & subsequently researchers have always been trying to unveil the factors that can be manipulated to benefit the silkworm rearing (Nair & Kumar 2004) [19]. Mulberry plants, the host of *Bombyx mori* belonging to the Moraceae family, are perennial plants. These mulberry leaves are the sole food of these insects. The silkworm is attracted to the "MORIN " present in the mulberry leaves. Mulberry leaves plays very important role in nutrition of the silkworm & in turn the resultant cocoons & silk products (Nagaraju, 2002) [17] & typical caterpillar which feed exclusively on mulberry leaves during its larval stages utilized for growth, development as well as for accumulation of energy reserves to fuel its metabolism during non- feeding period like larval molting, spinning, pupal & adult stages of

silkworm (Naik & Naik, 2015) [18]. Silkworms also spin composite of two silk fibers out of two converging silk glands. These fibers are surrounded by a glue-like sericin protein coating that holds the fibers & thus the cocoons together. The individual silkworm's silk fibers (brin) are 10-12 micrometers in diameter with triangular cross section, resulting in a composite fiber (bave) of up to 65 micrometers in diameter. For most uses of silk, the sericin layer is boiled off with an alkaline or soap solution.

Silkworms silk is the most commonly used material due to the domestication of this source of the protein for textile manufacturing (Breslauer & Keplan, 2012) [33]. For increasing the nutritional value and to control & also to improve the economic traits of mulberry silkworm in recent years, mulberry leaves are fortified with carbohydrates (Narayanan & Iyengar *et al*., 1987) [20], protein (Goudar & Kaliwal, 1999) [5], amino acid (Subburathinam & Krishna, 1992) [29], cyanobacteria & combination of extracts of plants (Sujatha & Rao, 2003; Kunthamalai & Purushotham, 2004) [9, 10] are done.

By Kanafi *et al*., (2007) [7] it has been described that the secret of growth & development of *Bombyx mori* lies in wealthy nutrition. The main reason for nutritional supplementation for *Bombyx mori* is to enhance the economic traits such as cocoon weight, pupal shell weight & cocoon shell Percentage. There are numerous reports that provide information about the positive effect of nutritional supplementation on the economic traits of silkworm (Rajabi *et al*., 2007) [23]. It has been reported that many plants like tulsi, turmeric, and aloe vera can improve the silk yield in mulberry silkworms. The use of herbs has increased & one among them is *Tinospora cordifolia*, commonly known as "GILOY" in Hindi, "GUDDICHI" in Sanskrit, "HEART LEAVED MOONSEED" plant in English. It is one of the most important drugs of the Indian system of medicine. It has medicinal & therapeutic values also, which added bonus to the innese amount of the physiological & pharmacological activities of this plant. In ayurvedic science this herb is also known as "Queen of all Herbs".

As there is no work pertaining to its impact on silkworm, the present work has been undertaken.

Materials and Methods

a) Rearing of *Bombyx mori*

The disease free layings of Nistari plain *Bombyx mori* L. was produced from the Central Silk Board, NSSO, BSF, Purniya (Bihar). The silk worm larvae were reared as per the rearing methods Krishnaswami S.

b) Treatment of *B.mori* with plant Extract

Appropriate group of 5th instar *B.mori* larvae fed with mulberry leaves coated with giloy extract a conc. of 1%, 2% & 3% (four times feeding per day done). The certain group was fed push mulberry leaves treated with distilled water. Three replicates each consisting of 50 larvae were maintained for the control parameter like cocoon weight, shell weight, pupal weight, shell ratio & silk characters like fibroin content, sericin, filament length & denier was recorded data was calculated by the following formulas & also analyzed statically by Jar JH.

i) $$\text{Cocoon shell ratio \%} = \frac{\text{Cocoon shell weight}}{\text{Cocoon weight}} \times 100$$

ii) Sericin content (g) = Intial weight. of the shell - Dry weight of shell after alkaline treatment.

iii) Fibroin content (mg) = Dry weight. of the shell - Sericin content

iv) $$\text{Denier} = \frac{\text{weight. of the Single cocoon filament(g)}}{\text{Length of single cocoon filament (m)}} \times 900$$

Results and Discussion

The effect of Giloy extract on larval & cocoon character of silkworm, *Bombyx mori* are presented in Table 01 & through graph 01 its graphical representation is done.

Result showed that *Bombyx mori* larval treated with 3% Giloy extract recorded increases in larval weight, cocoon weight, pupal weight, and shell weight.

The respective Maximum values were 1615.06, 1414.12 ± 99.05, 1158.60 ± 80.22, 257.58 ± 28.03 respectively.

The corresponding control values were 1505.04, 1106.40 ± 106.1, 924.26 ± 85.48, 182.24 ± 20.76 respectively.

The silk characters are present in table 02 & graph 02 is graphical representation of given data 3% plant extract of giloy treated larvae showed significant increase of silk characters such as filament content 192.82 ± 20.0 mg & Denier 1.98 ± 8.16 mg respectively.

The corresponding control values were 102.80 ± 10.21 mg, 1.64 ± 3.54 mg respectively.

The data from Table 01 & 02 and graphical representation from graph 01 & graph 02 clearly indicate that there was a significant improvement in the quality and quantity of laravae, cocon and silk characters in the giloy extract treated group. Nutrition plays an important role in improving the growth and development of silkworm larvae increased significantly upon feeding them with mulberry leaves supplemented with different nutrients. The nutritional states of mulberry leaves can be improved by enriching them with botanicals such as herbal extracts and herbal tonic like aloe discussed by Manimuthu M and Isaiarasu L.

Rajeshekaragouda *et al*. noticed that the plant extract such as *Psoralea corylifolia* and *Pribulus terrestrif* L. had the growth promoting effect on silkworm. Deshmukh and Khyade observed the increased weight of final instar larvae of *B.mori* upon receiving supplementation of Aloe tonic.

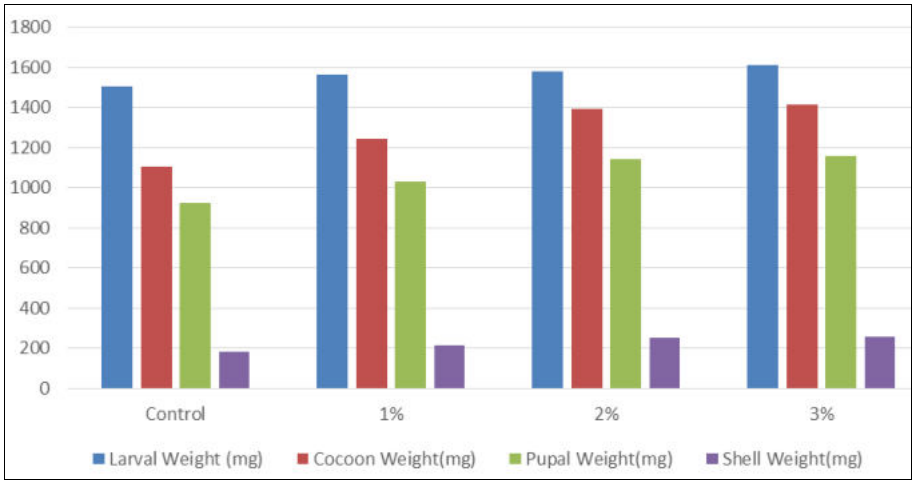
For the Augmentation of many beneficial factors of silkworm rearing Murgan *et al*. reported the beneficial effective botanical. Through the present study it is found that giloy concentration 3% was highly effective. Patil *et al*. Reported that parthenium root extract induced silkworm to feed more, resulting in higher larval, cocoon and pupal weight *P.coryifolia* extract improved the economic characters of silkworm.

Murugesh & Mahalingam (2021) [15] reported that *T.ferrestris* leaf extract improved the cocoon characters of *B.mori*. The silkworm larvae fed with coffee arabica leaf extracts treated mulberry leaves recorded shell weight.

According to Chavan *et al*. *Clerodendrum multiflorum* plant extract can be used to increase the economic characteristics of *B.mori*, this work was supported to my research work. Saravanan *et al*. (2011) [28] suggested the supplementation of Vignaun quiculata an aqueous extract with mulberry leaves of different conc. enhanced the quality & quantitiy of *B.mori*. This is due to the physicological stimulation by plant extracts on silkworm larvae leading to remarkable larval growth leading to increased food consumption & cocoon weight.

Table 1: Effect of Giloy on the larval & cocoon characters of silkworm *Bombyx mori*

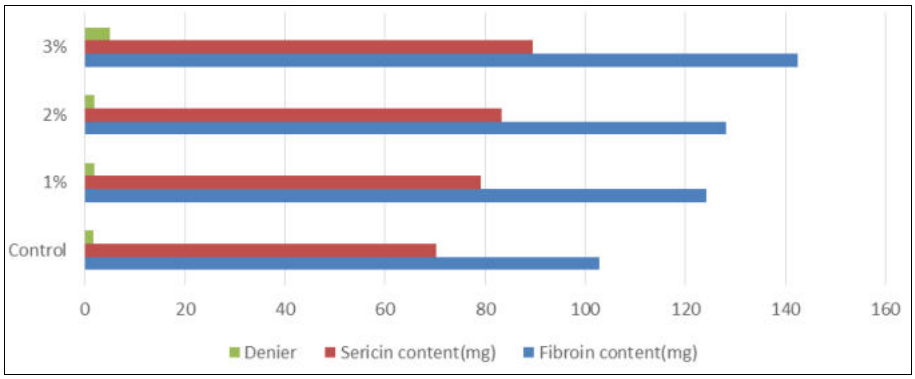
S. No	Treatment	Larval weight (mg)	Cocoon weight (mg)	Pupal weight (mg)	Shell weight (mg)
1	Control	1505±0.04	1106.40±106.1	924.26±85.48	182.24±20.76
2	1%	1566 ±0.04	01244±86.31	1032.43±65.03	214.25±23.11
3	2%	1582±0.05	1392.50±94.98	1144.20±74.84	250.32±24.50
4	3%	1615±0.06	1414.12±99.05	1158.60±80.22	257.58±28.03



Graph 1: Effect of Giloy on the larval & cocoon characters of silkworm *Bombyx mori*

Table 2: Effect of Giloy on the silk characters of silkworm *Bombyx mori*

S. No.	Treatment	Fibroin content (mg)	Sericin content (mg)	Denier
1	Control	102.80±10.22	70.23±7.32	1.64±3.54
2	1%	124.10±14.2	79.09±10.64	1.85±5.18
3	2%	128.05±18.60	83.19±14.80	1.90±8.02
4	3%	142.48±20.0	89.50±15.30	1.98±8.16



Graph 2: Effect of Giloy on the silk characters of silkworm *Bombyx mori*

Conclusion

The present study was only an attempt to assess the influence of Giloy which can be used as a stimulant & antibacterial agent, nutrition & medicinal properties. Screening of this plants giloy which are abundantly found in nature & within the reach of Sericulturist which are also growth promoter may prove to be useful in augmenting commercial product of *Bombyx mori* i.e larval & cocoon characters & silk characters of silkworm *B.mori*.

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