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Effect of *Ocimum sanctum* L. plant extract on the economic parameters of silkworm, *Bombyx mori* L

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Abstract

The "Queen of Herb" Tulsi is a herb with greater medicinal value used in Ayurveda, Siddha, Unani, Greek and Roman medicine for prevention and cure of many illness. Vth instar *Bombyx mori* L. larvae were fed mulberry leaves enriched with different concentrations of (1%, 2%, and 3%.) *Ocimum sanctum* L. leaf extract and its effect on larval weight, cocoon weight, pupal weight, shell weight, shell ratio and silk characteristics was studied. Among the different concentrations, 2% of *O. sanctum* extract has been found to be most effective over the control. *O. sanctum* extract has growth promoting effect on silkworm, which helps to enhance the commercial qualities of silk and can be used in sericulture for yield improvement.

Keywords: *Bombyx mori*, cocoon characters, larval weight, *Ocimum sanctum*.

1. Introduction

The silkworm *Bombyx mori* is a typical monophagous insect and mulberry leaf is its sole food. The healthy growth of the silkworm and ultimately the economic traits are influenced largely by the nutritional status of the leaves fed to silkworms Krishnaswami S *et al.* and Ravikumar C^[1, 2]. Plants are the richest source of organic chemicals on earth and phytochemicals from plants to influence the life and behaviour of different insects Rajashekaragouda R *et al.*^[3]. Recently many attempts have been made to fortify mulberry leaves with botanical extracts so as to improve the mulberry leaf quality and feed efficiency of silkworm, which in turn help to increase cocoon production and silk quality. Previous studies confirmed the effect of many extracts on various metabolic activities resulting in accelerated of silk cocoon formation and spinning Shivakumar RR *et al.* and Murugan K *et al.*^[4, 5] and increase in larval, cocoon as well as shell weight Sridevi G *et al.* and Pardesh AB *et al.*^[6-10]. The present study was an attempt to assess the effect of the leaf extract of *O. sanctum* on the growth, cocoon parameters and silk characters of mulberry silkworm.

2. Materials and Methods

The present study was carried out during the study period of 2013-2014 in the laboratory, Department of Zoology and Research Centre, Scott Christian College (Autonomous), Nagercoil, Tamil Nadu.

2.1. Rearing of *B.mori*

The disease free layings of PM x CSR₂ hybrid of *B. mori* was procured from the Government Grainage Center, Konam, Nagercoil. The silkworm larvae were reared as per the rearing methods Krishnaswami S^[11].

2.2. Plant extract preparation

The fresh *O. sanctum* leaves were collected from areas around Nagercoil. The leaves were washed and shade dried at room temperature and powdered in a mechanical grinder. 10 g of *O. sanctum* leaf powder was extracted in 100 ml of ethanol in a conical flask and kept in rotary shaker at 150 rpm for 24 h. After 24 h, the extract was filtered through Whatman's filter paper No.1 and the solvent was evaporated in a rotary vacuum evaporator. The raw leaf extract was dried and the dry powder was dissolved in distilled water and diluted to different concentrations (1, 2 and 3%) for further experiment.

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2.3. Treatment of *B. mori* with plant extract

Appropriate groups of Vth instar silkworm larvae were fed mulberry leaves coated with *O. sanctum* extract at concentrations of 1%, 2%, and 3% (four feeding /day). The mulberry leaves coated with *O. sanctum* leaf extract were shade dried before providing them to the larvae. The control group was fed fresh mulberry leaves treated with distilled

water. Three replicates, each consisting of 50 larvae were maintained for the control and experimental groups. Larval weight, cocoon parameters like cocoon weight, shell weight, pupal weight, shell ratio and silk characters like fibroin content, sericin content, filament length and denier were recorded and the data were calculated by the following formulas.

Sericin content (g) = Initial weight of the shell - Dry weight of the shell after alkali treatment.

Fibroin content (mg) = Dry weight of the shell - sericin content

$$\text{Filament length (m)} = \frac{\text{Number of rotations in eprouvette}}{\text{Cocoon}} \times \frac{9}{8}$$

$$\text{Denier} = \frac{\text{Weight of the single cocoon filament (g)}}{\text{Length of single cocoon filament (m)}} \times 9000$$

The data were analysed statistically Zar JH [12].

3. Results

The effect of *O. sanctum* extract on the larval and cocoon characters of silkworm, *B. mori* are presented in Table 1. Results showed that *B. mori* larvae treated with 2% *O. sanctum* extract recorded increase in larval weight, cocoon weight, pupal weight, shell weight and shell ratio. The respective maximum values were (in mg) 1613±0.04, 1412.12 ± 99.01, 1156.60±79.22, 255.58±26.03 and 18.10± 3.28 (%)

respectively. The corresponding control values were (in mg) 1505 ± 0.04, 1106.40± 106.1, 924.26 ± 85.48, 182.24 ± 20.76 and 16.41 ± 1.48 (%) respectively. The silk characters are presented in the Table 2. 2 % plant extract treated larvae showed significant increase of silk characters such as, filament length (610.10±17.15m) and denier (1.96±7.16). The corresponding control values were 452.18±12.34 (m) and 1.64±3.54 respectively.

Table 1: Effect of *O. sanctum* on the larval and cocoon characters of silkworm, *B. mori*

Groups	Treatments	Larval weight (mg)	Cocoon weight (mg)	Pupal weight (mg)	Shell weight(mg)	Shell Ratio (%)
I	Control	1505 ± 0.04	1106.40±106.1	924.26±85.48	182.24±20.76	16.41±1.48
II	<i>O. sanctum</i> extract (in %)	1565 ± 0.04 (03.99)	1243.46±86.32 (12.39)	1031.43±64.03 (11.60)	212.24±22.10 (16.46)	17.15±2.16 (4.51)
III	2	1613 ± 0.05 (07.18)	1412.12±99.01 (27.63)	1156.60±79.22 (25.14)	255.58±26.03 (40.24)	18.10±3.28 (10.43)
IV	3	1580 ± 0.05 (04.98)	1390.50±93.98 (25.68)	1142.20±72.84 (23.58)	248.32±23.50 (36.26)	17.85±3.10 (8.78)

Note: Values in parentheses indicate the percentage increased over the control

Table 2: Effect of *O. sanctum* on the silk characters of silkworm, *B. mori*

Groups	Treatments	Fibroin (mg) content	Sericin (mg) content	Filament length (m)	Denier
I	Control	102.80±10.22	70.23±7.32	452.18±12.34	1.64±3.54
II	<i>O. sanctum</i> extract (in %) 1	122.10±14.1 (18.77)	79.00±10.62 (12.49)	578.00±14.48 (27.83)	1.83±5.12 (11.59)
III	2	138.46 ± 18.0 (34.69)	86.50±13.30 (23.17)	610.10±17.15 (34.92)	1.96±7.16 (19.51)
IV	3	126.00±17.58 (22.57)	81.17±12.78 (15.58)	594.00±16.73 (31.36)	1.88±7.02 (14.63)

Note: Values in parentheses indicate the percentage increased over the control

4. Discussion

The data from Table 1 and 2 clearly indicated that there was a significant improvement in the quality and quantity of cocoon and silk characters in the plant extract treated group. Nutrition plays an important role in improving the growth and development of *B. mori* [13]. Sarker [14] reported that the growth of silkworm larvae increased significantly upon feeding them with mulberry leaves supplemented with different nutrients. The nutritional status of mulberry leaves can be improved by enriching them with botanicals such as, herbal tonic [15] and herbal extracts [16, 17]. Rajashekaragouda *et al.* [3] noticed that the plant extracts such as, *Tribulus terrestris* L. and *Psoralea corylifolia* had the growth promoting effect on silkworm. Deshmukh and Khyade [18] observed the increased weight of final instar larvae of *B. mori* upon receiving supplementation

of *Aloe* tonic.

Murugan *et al.* [5] reported that medium concentration (5%) of most botanicals is effective for the augmentation of many beneficial factors of silkworm rearing. Through the present study, it was found that *O. sanctum* concentration at 2% was highly effective. Rajeswari and Isaiarasu [19] suggested that leaf extracts of *Moringa oleifera* showed high larval growth (1974±53 mg/ larva). Patil *et al.* [20] reported that *Parthenium* root extract induced silkworms to feed more, resulting in higher larval, cocoon and pupal weight. *P. corylifolia* extract improved the economic characters of silkworm [21]. Murugesh and Mahalingam [22] reported that *T. terrestris* leaf extract improved the cocoon characters of *B. mori*. The silkworm larvae fed with *Coffea arabica* leaf extracts treated mulberry leaves, recorded higher shell weight [23]. According to Chavan

et al. [24] *Clerodendrum multiflorum* plant extract can be used to increase the economic characteristics of *B. mori*.

The supplementation of *Vignaun guiculata* an aqueous extract with mulberry leaves at different concentration enhanced the quality and quantity of silk in *B. mori* [25]. Pardesh and Bajad [9] reported that the moderate concentration (2.5%) of *Xanthium indicum* L. extract had growth promoting effect in silkworm, *B. mori*. This is due to the physiological stimulation by plant extracts on silkworm larvae leading to remarkable larval growth leading to increased food consumption and cocoon weight. This report is in agreement with the present study, where, the larval weight and all the economic characters increased due to application of 2% ethanolic extract of *O. sanctum* along with mulberry leaves.

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