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RESEARCH ARTICLE

EVALUATION OF ECONOMIC TRAITS OF THREE SELECTED MULBERRY SILKWORM RACES FOR COMMERCIAL PURPOSE

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Abstract

Sericulture is a cottage industry par excellence. It is one of the most labour intensive sectors of the Indian economy combining both agriculture and industry. The present study was carried out in Zoology Research laboratory, Tumkur University. Three different mulberry silkworms (*Bombyx mori*) races viz., FC1, FC2 and FC1×FC2 were selected to conduct the experiments, were fed with V1 mulberry leaves. Theaim of the experiment was to know the comparison of commercial charactersof three selected silkworms races viz., cocoon ratio, larval growth and silk filament. So, the present work would be helpful in rearing technology and better crop yield and management.

Introduction:-

Sericulture is the art of rearing silkworm under artificial or domesticated condition and extraction of raw silk from the cocoons.*Bombyx mori* is an important economic insect, is being used as a tool to convert plant protein (mulberry) into animal protein (silk) (Simi Simon et al., 2024). The *Bombyx mori* is a phytophagous insect that is monophagous feeder on mulberry leaves (SarvananManjulaet al., 2010).The growth rate and development of silkworm larvae and subsequent silk production are greatly influenced by the quality and nutritional constituents of mulberry leaves (Krishnaswamiet al., 1973). The CSR hybrids FC1 (CSR6×CSR26) and FC2 (CSR2×CSR27) are robust and more productive. More care is required in handling these pure races and small ignorance may lead to non-availability of parental cocoons. To overcome this, bivoltine double hybrid breeds were developed. The double hybrids can withstand adverse climatic conditions and resulting in crop stability than single hybrids. FC1×FC2 is a productive bivoltine double hybrid silkworm (Sania Thomas et al., 2022). Silkworms are reared for their cocoons, from which the pure silk is obtained.Commercial parameters play a crucial role in silkworm production because they directly impact the profitability and efficiency of sericulture operations. Larval parameters are very important as they are directly influence the growth, development and overall productivity of the silkworms. The cocoon parameters directly impact the quality and quantity of silk produced. Post-cocoon parameters determine the quality and value of silk extracted from cocoons. So this background, the present paper analyses these economic parameters of three different silkworm racesfor better crop yield.

Materials and Methods:-

Silkworm Rearing:

The experiments were conducted at C.N.R Rao Block laboratory, Tumkur University, Tumakuru. DFL of silkworm (1st instar larvae) were collected, in which FC1 (pure line), FC2 (pure line) &FC1×FC2breed were obtained from

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farmer near Ajjapanahalli , Yallapura, Tumakuru. They were reared under laboratory conditions of 25±3℃, 72±2% relative humidity respectively. The freshly moulted 4th and 5th instar silkworm larvae were grouped into 3 groups; each group has 20 larvae which were supplied with sufficient amount of V1 mulberry leaves. The larvae were reared under standard rearing conditions (Krishnaswami., 1973).

Economic parameter:

The three different *Bombyx mori*races viz., FC1, FC2 and FC1×FC2, were assessed based on larval parameters, Cocoon Parameters, Post cocoon parameters.The Larval weightandSilkfilament weightwasweighed using electronic balance, Silk Productivity (WaktoleSoriet al., 2012).ERR, cocoon weight,Silk filament length,Denier andShell ratio(Harendra Kumar et al., 2013),Growth Index (Rateb., 2015).

Other economic characteristics:

- **Larval length (cm):** - Larval length was measured using scale
- **Larval duration (days):** - assessed in IV & V instar larvae, starting from 3rd moult till spinning.
- **Pupa weight (g):**- Cocoon weight – Shell weight
- **Shell weight (g):-** Cocoon weight – Pupa weight
- **No. of cocoons/kg:** - $\frac{100}{\text{Weight of single cocoon}}$
- **Raw silk Percentage (%):** - $\frac{\text{mean weight of Raw silk} \times 100}{\text{Mean weight of cocoon}}$
- **Floss percentage (%):** - $\frac{\text{Weight of floss} \times 100}{\text{Weight of cocoons}}$
- **Renditta:** - $\frac{100}{\text{Shell Percentage}} \times \frac{100}{\text{Raw silk percentage}}$
- **Non-breakable filament length (m):** - $\frac{\text{Average filament length} \times \text{no. of cocoon reeled}}{\text{Total no. of cut end} \times 100}$
- **Moth weight (male & female) (g):** - randomly picked single moth of both genders was weighed using electronic balance

Biostatical Analysis:

The given data was calculated by using standard deviation

$$\text{Formula, } s^2 = \frac{\Sigma x^2 - \frac{(\Sigma x^2)}{n}}{n-1}$$

Where, Σx = individual observation

n = total number of observations

Results:-

In the present study it was observed that the commercial parameters of FC1×FC2were comparatively higher than FC1and FC2in aspects likelarval parameters, Cocoon Parameters andPost cocoon parameters. Data in Table 1 and Fig 1 indicates the larval parameters in IV and V instar larvae of 3 different silkworm breeds. Larval weight and larval length indicated highest in IV and V instar of FC1×FC2 followed by FC1 andFC2 respectively. Larval durationandGI indicates minimum in IV and V instar of FC1×FC2 followed by FC1 andFC2. As the data of Table 2 and Fig 2(a,b,c) shows cocoon parameters of 3 different silkworm breeds. ERR, cocoon weight, shell weight, pupa weight, shell ratioand silk productivityindicated highest value followed by FC1 andFC2 and No. of Cocoons indicated minimum in FC1×FC2 and highest in FC2. As the data in Table 3 and Fig 3(a,b,c,d,e) shows Post cocoon parameters of 3 different silkworm breeds. Silkfilament length, silk filament weight, denier, raw silk percentage (RSP), non-breakable filament length indicates maximum value in FC1×FC2 followed by FC1 and FC2. Renditta, floss percentageindicates in FC1×FC2 and highest in FC2. Pupa weightin male and female and moth weightin male and female indicate high in FC1×FC2 followed by FC1 andFC2 respectively.

Table 1:- Larval parameters of FC1, FC2 and FC1×FC2 of silkworm, *Bombyx mori*. L

Characteristics	FC1		FC2		FC1× FC2	
	IV Instar	V Instar	IV Instar	V Instar	IV Instar	V Instar
Larval weight (g)	6.11±0.03	12.95±0.4	5.41±0.45	11.29±0.11	7.3±0.2	16.57±0.19
Larval Length (cm)	3.25±0.1	4.8±0.07	1.25±0.2	3.8±0.32	4.55±0.3	5.7±0.26
Larval Duration (days)	4.5±0.2	6.38±0.7	6±0.12	8.2±0.5	3.5±0.11	5.12±0.28
Growth Index (g)	3.76±0.53		3.82±0.18		3.20±0.11	

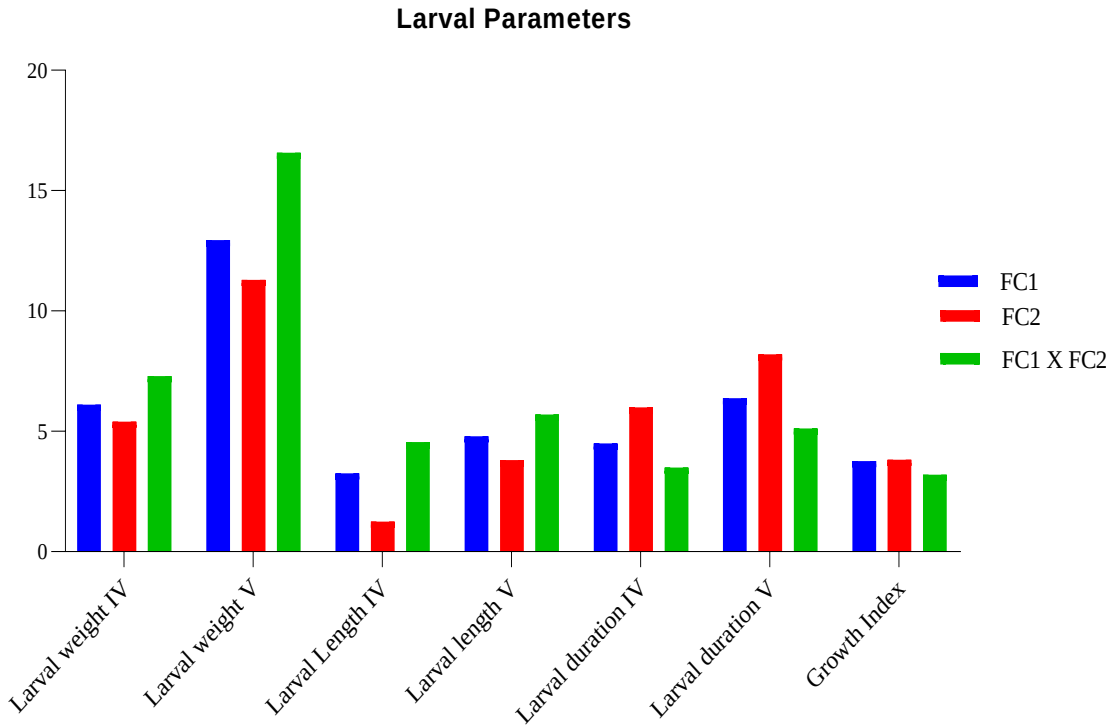


Fig 1: Larval parameters of FC1, FC2 and FC1×FC2 of silkworm, *Bombyx mori*. L

Table 2:- Cocoon parameters of FC1,FC2 and FC1×FC2 of silkworm, *Bombyx mori*. L

Characteristics	FC1	FC2	FC1 × FC2
Effective rate of rearing (%)	62±0.57	58±0.88	73.2±0.57
Cocoon weight (g)	7.68±0.05	6.21±0.18	8.19±0.02
Shell weight (g)	1.12±0.03	0.85±0.02	1.58±0.03
Pupa weight (g)	6.48±0.01	5.36±0.2	6.61±0.03
Shell ratio (%)	16.83±0.2	15.21±0.1	17.21±0.5
Silk productivity (Cg/day)	4.01±0.02	3.82±0.17	4.38±0.15
No. of cocoons /kg	689±8.4	718±2.8	539±8.8

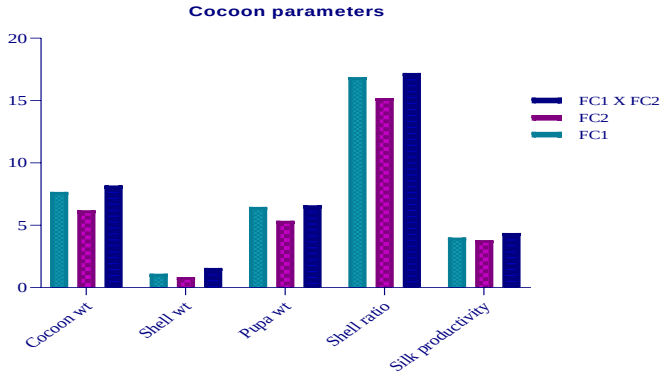


Fig 2(a)

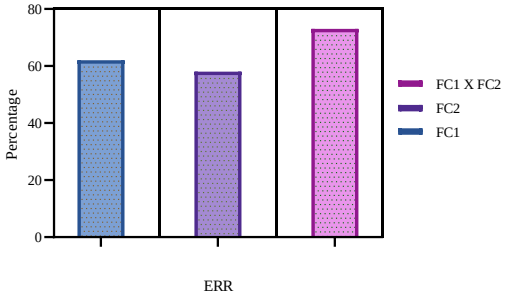


Fig 2(b)

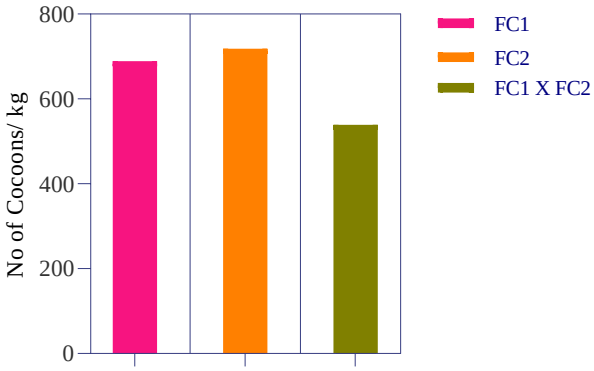
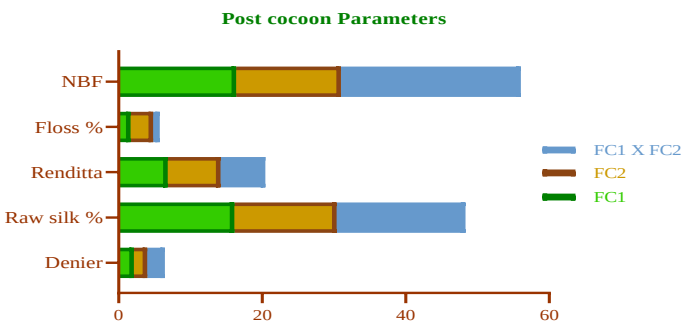


Fig 2(c)

Fig 2(a,b,c): Cocoon parameters of FC1,FC2 and FC1×FC2 of silkworm, *Bombyx mori*. L

Table 3:- Post cocoon parameters of FC1,FC2 and FC1×FC2 of silkworm, *Bombyx mori*. L

Characteristics	FC1		FC2		FC1× FC2	
Silk filament length (cm)	983±1.53		880±0.18		1003.6±1.38	
Silk filament weight (g)	0.18±0.2		0.11±0.02		0.23±0.01	
Denier (d)	2.11±0.29		1.88±0.04		2.45±0.02	
Raw silk percentage (%)	16.13±0.29		14.23±0.14		17.98±0.13	
Renditta	6.83±0.11		7.35±0.06		6.28±0.04	
Floss percentage (%)	1.65±0.17		3.15±0.1		0.93±0.1	
Non-breakable filament length (cm)	16.38±0.02		14.6±0.3		25.09±0.2	
	Male	Female	Male	Female	Male	Female
Pupa weight (g)	0.31±0.53	0.78±0.11	0.19±0.12	0.42±0.01	1.25±0.82	1.83±0.34
Moth weight (g)	2.88±1.15	3.07±1.1	2.15±1.28	2.27±0.05	3.12±1.12	3.25±1.32



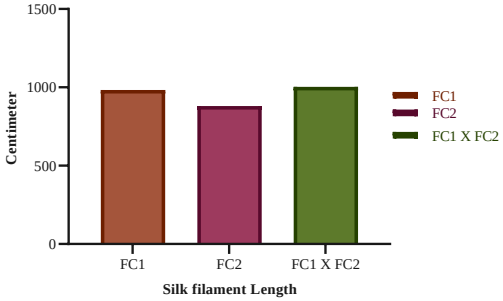
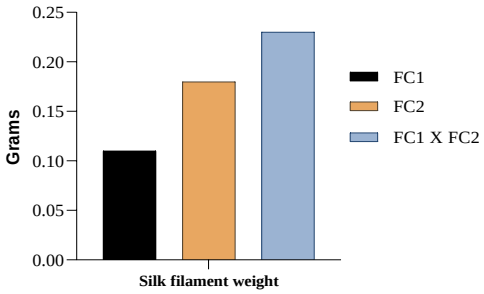


Fig 3(a)Fig 3(b)



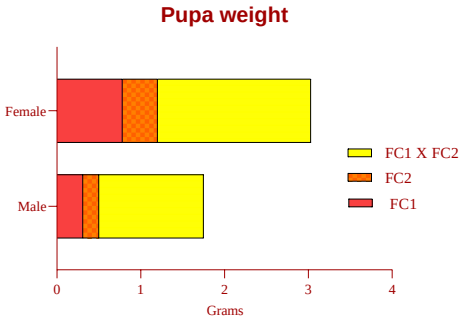


Fig 3(c) **Fig 3(d)**

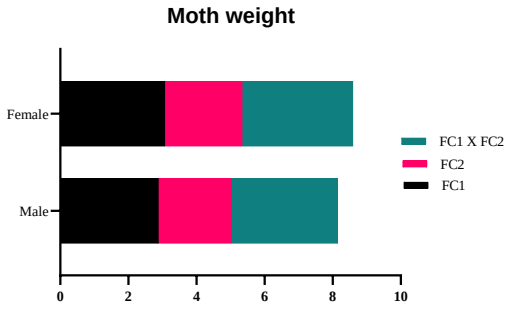


Fig 3(e)

Fig 3(a,b,c,d,e):- Cocoon parameters of FC1,FC2 and FC1×FC2 of silkworm, *Bombyx mori*. L

Discussion:-

The present study revealed that the silkworm *Bombyx mori* FC1×FC2 exhibited significant results as compared to other raceson commercial parameters like Larval, cocoon and post cocoon parameters.

Larval Parameters:

Larval weight, larval length, larval duration, Growth Index was evaluated. The considerable variations are seen in V instar larvae in weight, length, growth index and duration. Highest larval weight leads to higher silk production (Venugopal Reddy Bovilla., 2015).The difference among FC1×FC2 was significant than FC1 and FC2. Significant shorter larval duration was observed in FC1×FC2 andthis attributed to the assumption that the worms'nutritive requirement might have been fulfilled within lesser duration because of feed supplementation of mulberry leaves (Vijakumaret al., 2016). Larval length helps in tracking the progress of their stages. GI depends on the rearing conditions, quality, nutritive elements and quantity of the mulberry leaves supplied during rearing.

Cocoon Parameters:
The cocoon weight, shell weight, pupa weight, Shell ratio are referred as the quantitative parameters which contribute to the production of maximum biomass (Manu et al., 2020). Cocoon weightwashigher in FC1×FC2and this indicates the approximate quantity of raw silk output. Shell weight referred as the total silk content of the cocoon (Manu et al., 2020), which showed highly significant inFC1×FC2 respectively. Shell ratio indicates the total quantity of silk available from single cocoon. Effective Rate of Rearing, Raw Silk percentage can influence the pricing, marketing and fabric quality (Naga Jyothiet al., 2010). Variations in Shell weight and silk output indicate good quality of cocoons while those pupa weights influence the fecundity in the subsequent generations (Naga Jyothiet al., 2010).

Post cocoon parameters:
The filament characters are referred as qualitative parameters including filament weight, filament length and denier**.** They are crucial indicator of silk quality, its fineness and thickness.Increased shell weight and shell ratio reflected in the filament length is an indication of the improvement in the filament length (Manu et al., 2020). FC1×FC2 shows maximum values compared to other two. Renditta indicates the quantity of cocoons required to produce 1kg of raw silk, with minimum weight FC1×FC2 can satisfy the requirement compared to others. Floss percentage was lower in FC1×FC2as it consists of the shorter and less uniform fibres that break during cocoon processing. Non-breakable silk filament length offers better durability and longevity providing value for money over time and which is satisfied with FC1×FC2.

Conclusion:-

In the present study it was observed that the FC1×FC2silkworm race was better than other races in aspects of larval, cocoonand post cocoon parameters. This is because FC1×FC2is a bivoltine double hybrid race which exhibit vigour, resulting in higher silk production, better disease resistance, seed crop performance and higher seed recovery and has better crop stability as a result of genetic diversity inherited from both parent races i.e.,FC1 and FC2. So, this work would be of great help to farmers in term of crop yield, management and commercial purpose.

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