Entomology

Administration of organic nutrition on cocoon growth, eclosion and fecundity characters of multivoltine silkworm races *Bombyx mori* Linn.

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Abstract

Sericulture is a particularly labour in depth, remunerative and rural welfare orientated agro-based totally industry. It's far an age-antique land-based totally exercise in India with high employment ability and monetary blessings to agrarian families. India, a prime donor to global nourishment generation, customarily applied cultivating techniques like edit revolution, compost, excrements, and polyculture of different races of multivoltine silkworm. In the beyond, agriculturists utilized conventional techniques, but currently they often make use of modern-day approaches with chemical substances to induce more vegetation. Be that as it could, these chemical techniques can harm the surroundings and the nourishment we eat. Impact of natural nutrition on cocoon boom eclosion and fecundity characters of multivoltine natural races, Nistari race and PM race had been investigated. Fortification of mulberry leaf with natural vitamins has proved to be successful in improving the crop yield. The boom in cocoon boom, eclosion and fecundity characters suggests that organic vitamins have stimulatory impact on cocoon growth yield, eclosion and fecundity charge of multivoltine races of Nistari and PM. for this reason organic nutrients can be utilized in sericulture for development of yield and has realistic gain in silkworm grainage and reeling enterprise.

Keywords: Organic Nutrition, Cocoon growth, Eclosion, Fecundity, Nistari race, PM race of multivoltine, Mulberry plant

1. Introduction

Silk, it is the most outstanding of all the textile fibers. Silk which is thought for its richness, softness and flamboyance, is brilliant in coloration, soft in contact and elegant in look. Determined accidentally via Queen Shiling Shi of China approximately 4600 years in the past, this expensive and romantic fabric conjured from the tiny strand. Oozing out of a small malicious program has due to the fact that been reigning very best as “The Queen of Textiles”. Sericulture is an ancient enterprise in India dating returned as a minimum to the second century B.C. in line with a few historians, raw silk changed into exported from India to Rome all through the reign of Kanishka in 58 B.C. Silk is a way of existence in India. Silk in India has always occupied a high function, and contains an air of mystery of royalty. The Indian silks are high-quality recognized for his or her exceptional satisfactory, lustrous shine, traditional hues and art work. Sericulture is an agro-based industry and India enjoys a unique fame by means of developing all the 4 types of herbal silks, specifically, Mulberry, Tasar, Eri and Muga of which mulberry silk debts for ninety percent of India’s overall manufacturing. Mulberry silkworm Bombyx mori L. is monophagous and feeds handiest on mulberry. The beneficial outcomes of numerous organics which includes green manures, bio-fertilizers, vermi compost and alertness of certified natural fertilizers need to be highlighted safely for increasing the yields in mulberry and consequent silk exceptional. Sericulture is the specific aggregate of conventional agronomic practices for rearing of silk generating Lepidopteron larvae Bombyx mori L. at the handiest soul food fabric comprising of mulberry leaves. Therefore, in order to insure exact excellent cocoon yield it’s critical to pay attention for the improvement of host plant mulberry. As mulberry account 36 to 38% of the overall practices liable for a success sericulture. Furthermore, the 60 percentage of the cost of cocoon goes directly to the mulberry leaf. Plant breeders are continuously operating for enhancing the quantitative and qualitative parameters of mulberry for enhancing the output of sericulture in term of cocooning. For understanding complete potential of any mulberry genotypes improvement of the soil health could be performed via application of diverse kinds of fertilizers doses to increase the productiveness. The cutting-edge generation emphasizes the usage of natural nutrition for sustainable agriculture. Natural nutrients are one of the maximum crucial and green natural vitamins commonly implemented to the mulberry area in maximum the improvement sericulture. India is being one of the traditional sericulture use a holds the responsibility for manufacturing of multivoltine silk of international grade. Therefore, the moriculture practices in India especially demand the emphasis on application of organic vitamins for improving the quality and yield parameters of mulberry leaves. it's miles a biological process concerning stabilization and discount in volume of natural sludge moderate temperature among 26±1ºC related to joint action of earthworm lively at 10 to 32ºC and microbes for the transformation of organic wastes into human

useful quit product. In different phrases, vermi composting is a biotechnological manner, pollution unfastened technology and has full-size scope in the recycling of sericulture waste (larva litter, left over mulberry leaves in the course of computer virus feeding and different waste) into valuable give up product. Organic nutrients and vermi composting boom soil fertility, no destructive outcomes on mulberry plant, enhancing mulberry leaf satisfactory and quantity and also enhance soil aeration and many others. consequently, maintaining in view the importance of natural nutrition and vermi compost in mulberry cultivation through sustainable management of Seri-wastes the cutting-edge test entitled "studies on natural vitamins of sericultural wastes: an approach for effective control of "Seri-wastes" has been designed with the following goals; exceptional assessment of organic nutrition generated thru bioconversion of Seri-wastes and impact of organic nutrients on soil and mulberry plant health. Sericulture is each an art and technology of raising silkworms for silk manufacturing. India's conventional and way of life bound home marketplace and a terrific diversity of silk clothes that reflect 'geographic specificity' gave India the popularity of being the second largest producer of raw silk after China. vitamins plays an important role in improving the increase and improvement of the silkworm, Bombyx mori L. and the silk production is depending on the larval vitamins, larval duration, weight of larva, eclosion, fecundity and nutritive value of mulberry leaves and ultimately in producing precise exceptional cocoons and shell weight. Research has been focused mainly at measuring the usefulness of the leaves or their specific additives and the results to date acquired on the silkworm nutrients (Hanson *et al*., 2004) [11]. Fortification of mulberry leaves with supplementary nutrient (Muniandy, *et al*., 2001) [21] and feeding silkworms is a beneficial modern-day technique to growth monetary cost of cocoon. Hence, it's far the concern of every researcher to apply the high-quality elements to launch the top rate silk products and additionally different Seri-byproducts within the marketplace for the consumers. All insects require a selection of minerals and hint elements as micronutrients. The burden of the crude cocoon, the silk increment and the total protein content material of the haemolymph expanded; the silk thread had a extra duration and resistance, having a better content of fibroin and sericin because of mineral dietary supplements administered. The larvae fed with mulberry leaf supplemented with minerals, had a significant boom of the final frame weight as compared to the manipulate organization, on the give up of the 5th age. Additionally, an extended content of overall protein was recorded in all organizations that obtained mineral treatments (Etebari and Fazilati, 2003) [10]. The minerals administered to silkworms determined a growth of the length and weight of the larvae, a stepped forward food intake and food usage (Khan, *et al*., 2010) [18]. Mulberry silkworm, Bombyx mori L. (Lepidoptera: Bombycidae), especially is a totally sensitive and choosy for its meal's addiction. Silkworms calls for sure critical sugars, proteins, amino acids, fatty acids, nutrients and micro nutrients for its regular boom, survival and for boom, survival and for increase of silk gland and better manufacturing of true high-quality silk. Silkworm nutrients are considered because the most important area of studies from the clinical point of view. It's been cautioned that the supplementation with minerals play a vital function within the larval development and cocoon characters. In addition to macro-vitamins (NPK), mulberry plant life also requires numerous micro-nutrients. All this can be performed handiest by using the software of organic nutrient. Vitamins include biochemical and physiological sports which rework food factors into frame elements. The nutritive value of mulberry relies upon on various factors like range and agronomical inputs. The chemical composition of mulberry leaves varies greatly based on genotype and alertness of manures and fertilizers. The load of the cocoons is directly correlated to the protein content material like sericin and fibroin of the leaves for everyday silk production at some stage in the 5th instar of the silkworm larva. The impact of feeding the leaves of the mulberry (Morus spp.) at the larval increase, cocoon yield, cocoon weight, shell weight, fecundity and different financial characters eclosion of the cocoons has been said by using some of investigators. The nutritiousness and palatability provide better criteria for the superiority of 1 kind of leaf over the opposite as meals for the silkworm (Kafian Alexandre. 1960, Parpiev, B.A. 1968) [16, 24] concluded that the water content within the leaves may function one of the standards in assessing their first-rate. Food first-class substantially influences larval boom, weight of cocoons, silk yield and physical-mechanical residences of silk thread as mentioned with the aid of (Samokhvalova, G.V., *et al*., 1972) [27].

2. Materials and Methods

The disease free layings of two pure multivoltine silkworm races, Nistari and PM races were procured from Sericultural station of Baharaich, Uttar Pradesh. The silkworms were reared on fresh mulberry leaf at temperature of 26±1°C, Relative humidity (RH 80±5%) and 12±1 hrs photoperiod. After fourth moult the larvae were separated into three groups. Each group consists of three replications each of 250 larvae for each treatment. Application of organic nutrition was dissolved in distilled water and sprayed on the mulberry leaf at the rate of 10µg/larva and 15µg/larva respectively, and then fed to the larvae of day-1 and day-2 of fifth instar. For the control larvae, mulberry leaf sprayed with distilled water was used. The fifth instar larval duration, weight of fully grown larva, cocoon weight, cocoon shell weight, shell ratio, eclosion and fecundity rate were recorded in control and experimental multivoltine pure races of Nistari and PM races of silkworm *Bombyx mori* Linn.

3. Results and Discussion

The result presented in Table-1 reveal the extent of changes in the fifth instar larval duration, weight of fully grown larva, cocoon weight, shell weight, shell ratio, eclosion (days) and fecundity (number of eggs laid) of control and experimental multivoltine Nistari and PM races of silkworms, *Bombyx mori* Linn.

Fifth instar larval duration (days)

The larval duration of fifth instar was significantly (p<0.001) increased in the batches treated with organic nutrition of 10µg/larva and 15µg/larva. The percent increase was 14.89 and 12.88 in the multivoltine races Nistari and 14.72 and 11.67 in multivoltine races PM respectively over control when treated with organic nutrition to mulberry leaves.

Weight of fully grown larva (gm)

There was a significantly (p<0.001) increased in the weight of fully grown larva in the batches treated with organic nutrition of 10µg/larva and 15µg/larva. The percent increase was 19.93 and 11.08 in multivoltine races Nistari and 25.40 and 18.29 in multivoltine races PM respectively over control when treated with organic nutrition to mulberry leaves.

Cocoon weight (gm)

There was a significantly (p<0.001) increase observed in the cocoon weight of experimental larvae and the percent increase was 19.86 and 11.83 in multivoltine races Nistari and 18.32 and 11.79 in multivoltine races PM respectively over control when treated with organic nutrition to mulberry leaves.

Shell weight (gm)

There was significant effect (p<0.001) showing a percent increase of 34.12 and 20.46 was recorded in shell weight in multivoltine races Nistari and 32.33 and 18.47 in multivoltine races PM respectively over control when treated with organic nutrition to mulberry leaves.

Shell ratio (%)

The Shell ratio recorded was 21.03, 23.51 and 22.60 in control and organic nutrition in multivoltine races Nistari. In the other races PM the observed shell ratio was 20.31, 22.81 and 21.97 in control and organic nutrition to mulberry as 10µg/larva and 15µg/larva.

Eclosion (days)

Significant effect (p<0.001) was noticed in the period of moth emergence in multivoltine two races when treated with organic nutrition 10µg/larva. A percent increase of 8.17 was recorded over control. Non significant effect was seen over control in the multivoltine two races when treated with organic nutrition15µg/larva.

Fecundity (number of egg layings)

Number of eggs laid per female moth was increased significantly (p<0.001) in multivoltine two races of silkworm when treated with organic nutrition of 10µg/larva and 15µg/larva respectively. The percent increase was 27.59 and 19.95 in the multivoltine race Nistari and 24.27 and 18.39 in PM races.

Thus, all the larval performance and economic characters were increased significantly and the percent increase was more in the multivoltine races like Nistari and PM races. The data presented in (Table-1) reveal the multivoltine races. As a result it could be presumed that the growth in larva, cocoon and silk manufacturing is because of the extra intake of leaf for the duration of the prolonged duration as commonly believed (Akai, H., 1971, Aruga, H., 1994 and Jolly, M.S., 1987) [1, 3, 15]. The extended larval weight might be because of the have an impact on of mulberry plant increase with the aid of organic vitamins on urge for food, nutrients and absorption of the mulberry plant cloth as suggested with the aid of (Newmann, S.V., 1982 and Machii, C *et al*., 1991) [22, 19]. The larval quantity of changes is in the larval, cocoon and economic characters in two multivoltine races of manipulate and when treated with natural nutrients of 10µg/larva and 15µg/larva respectively. The larval length is extended through sooner or later when treated with natural nutrition (10µg/larva) in each weight become accelerated substantially while larvae dealt with gibberellic acid (Magadum, S.B., 1989 and Yokoyama., 1963) [20, 32]. The weights of posterior silk gland, cocoon, shell and shell ratio were elevated and the percentage growth was extra in multivoltine Nistari race when compared to PM races. The percentage become greater while treated with natural vitamins of (10µg/larva) compared to natural nutrition (15µg/larva). The increase in cocoon and shell weights suggests that the ingested food is well transformed to the frame remember when treated with natural nutrients. Consequently, the load of larva becomes increased considerably. Such a boom inside the body weight changed into observed below the affect of exogenous juvenile hormone compound (Sashindran Nair, okay., 1999 and Tayade, D.S., 1983) [26, 28]. The duration of eclosion was superior and increase in fecundity price showed that organic nutrition has stimulatory impact on eclosion and fecundity which has realistic benefit in silkworm grain ages. There's improved emphasis at the impact on environmental first-class because of non-stop use of chemical fertilizers (Das, P. okay. 1990) [9]. The included nutrient control gadget is an alternative and is characterized by using lowering the input of chemical fertilizers and mixed use of chemical fertilizers with organic materials such as animal manures, crop residues, inexperienced manure and composts (Kaur, K, 2020) [17]. Management structures that depend on natural inputs as plant nutrient sources have one of a kind dynamics of nutrient availability from the ones regarding the use of chemical fertilizers. For sustainable crop manufacturing, incorporated use of chemical and natural fertilizers has proved to be exceedingly useful. Several researchers have validated the useful effect of combined use of chemical and natural fertilizers to mitigate the deficiency of many secondary and micronutrients in fields that continuously acquired the simplest N, P and ok fertilizers for a few years, without any micronutrient or organic fertilizer. Ache, A. O.K, 1961 and Ray, D. *et al*., (1976) [23, 25] indicated that feeding of mulberry leaves received by using utility of FYM resulted in expanded silk content and filament period. This in addition helps the present findings and confirms that organically produced mulberry leaves can complement the dietary requirement of silkworm by way of distinctive feature of producing nutritionally balanced mulberry leaf (Venugopal, A., *et al*. 2010; Horie, Y. 1980) [30, 12]. Stated that the uses of organic fertilizers are collectively with chemical fertilizers, as compared to the addition of natural fertilizers on my own, had

a higher positive impact on microbial biomass and consequently soil health. utility of organic manure in mixture with chemical fertilizer has been mentioned to boom absorption of N, P and ok in sugarcane leaf tissue in the plant and ration crop, compared to chemical fertilizer alone as compared the change of chemical and organic homes in soils receiving FYM, fowl manure and sugarcane filter cake on my own or in combination with chemical fertilizers for seven years underneath a cropping sequence of pearl millet and wheat. Outcomes confirmed that every one treatment besides chemical fertilizer utility progresses the soil organic C, total N, P, and K popularity. Research performed with the aid of (Jayaraj, S. *et al*., 2005) [14] on included nutrient control (INM) in farmers' fields also showed the possibility of lowering NPK utility via 25% after the primary yr and via 50% after the second year in mulberry cultivation, except improving the chemical, bodily and biological houses of soil. Thippeswamy, T. *et al*., (2005) [29] confirmed via a test that it's miles feasible to reap exceptional mulberry leaf ranging from 55-60 metric lots per 12 months with the aid of adoption of the incorporated technology bundle (ITP). area test performed for seven years constantly to evaluate the have an impact on of mixed applications and organic and chemical fertility build up and nutrient uptake in a mint (Mentha arvensis) and mustard (Brassica juncea) cropping sequence indicated that included deliver of plant vitamins thru FYM (farmyard manure) and fertilizer NPK, along with Sesbania green manuring, performed a substantial position in maintaining soil fertility and crop productiveness (Chanotra. S., 2019) [7] primarily based at the evaluation of soil exceptional indicators, use of organic manures has been discovered to be promising in arresting the decline in productivity thru correction of deficiencies of secondary and micronutrients and its beneficial influence on the bodily and biological residences of soil (Yadav, D.S and Kumar, A. 2009) [31]. Numerous boom parameters of mulberry were stronger because of the software of various organic and organic cloth as assets of nutrients in the location of chemical fertilizers (Babu, 2012) [4] in advance it's been properly set up that the exercise of incorporated nutrient control (INM) in mulberry sustains the crop production with first-rate foliage and excellent cocoons (Anil Kumar, A. S. 2000, Bongale, U. D. 2003, Jaishankar 2007 and Thippeswamy, T., 2005) [2, 5, 13, 29]. consequently, the existing examine confirms that by adopting INM i.e. following the organic farming in mulberry cultivation, with the aid of reducing the number of chemical fertilizers it is viable to supply quality mulberry leaf for silkworm rearing. This would similarly advantage the sericulture enterprise and especially the small and marginal farmers who cannot afford to use the recommended dose of chemical fertilizers in mulberry cultivation ensuing in lack of cocoon crops. even though the mulberry leaf manufacturing is most effective part of an extended chain of sports worried in silk production, the price of manufacturing of mulberry leaves performs a vital function in making sericulture a profitable only while the fee of mulberry leaf production is minimized, as it money owed for almost 60% of the overall cost of cocoon manufacturing (Dandin and Verma; 2002) [8]. The value of mulberry leaf production incorporates of fixed costs (established order of mulberry garden) and viable fee (garden upkeep). Value of chemical fertilizers forms a primary a part of the value of manufacturing of mulberry. (Thippeswamy, T., 2005) [29] said that the value of fertilizers can be curtailed to the occasion of fifty percent via adopting the included nutrition era bundle developed on the important Sericultural research and education Institute (CSR & TI), Mysore.

Table 1: Effect of experimental organic nutrition of 10µg/larva and 15µg/larva silkworm multivoltine Nistari & PM races of *Bombyx mori* Linn fed on mulberry leaf. Values are the mean of the 10 individual observations. Mean ±S.D; and '+' indicate percent increase and decrease over control respectively

S. No.	Parameters	Multivoltine Nistari races			Multivoltine PM (Pure Mysore) races		
		Control	Experimental (Organic Nutrition)		Control	Experimental (Organic Nutrition)	
			Organic N. 10µg/larva	Organic N. 15µg/larva		Organic N. 10µg/larva	Organic N. 15µg/larva
1.	Fifth instar larval Duration (days)	8.20 ±0.62	8.3±0.74+14.87 *p*<0.001	8.1±0.79+12.88 *P*<0.001	8.5±0.073	8.5±0.81+14.72 *p*<0.001	8.6±0.79+11.67 *p*<0.001
2.	Weight fully grown Larva (gm)	5.80 ±0.39	5.3±0.54+19.93 *p*<0.001	5.4±0.49+11.08 *p*<0.001	5.2±0.43	5.41±0.52+25.40 *p*<0.001	5.02±0.47+18.29 *p*<0.001
3.	Cocoon weight (gm)	2.87 ±0.18	2.27±0.21+19.86 *p*<0.001	2.11±0.19+11.83 *p*<0.001	2.76±0.16	2.11±0.18+18.32 *p*<0.001	1.95±0.17+11.79 *p*<0.001
4.	Shell weight (gm)	0.41 ±0.04	0.55±0.047+34.12 *p*<0.001	0.49±0.041+20.46 *p*<0.001	0.38±0.031	0.51±0.042+32.33 *p*<0.001	0.45±0.042+18.47 *p*<0.001
5.	Shell ratio (%)	21.03	23.51	22.60	20.31	22.81	21.97
6.	Eclosion (days)	18.00±1.32	15.3±1.25+08.17 *p*<0.001	15.8±1.26-05.58 NS (Non Significant)	15.2±1.41	14.21±1. 25+07.40 *p*<0.001	14.02±1.27-04.29 NS (Non Significant)
7.	Fecundity (number of egg)	754 ±12.35	854.0±18.39+28.62 *p*<0.001	810.0±10.04+20.46 *p*<0.001	760.0±22.74	740.0±17.34+24.37 *p*<0.001	670.0±11.34+20.47 *P*<0.001

N.S- Non Significant "P"- Statistical Significant SD- Standard Deviation/ Standard Error

4. Conclusion

The observe truly indicates that the leaf quality became no longer adversely affected even after partial discount or complete alternative of chemical fertilizers and supplementation via the utility of numerous natural fertilizers in mulberry cultivation. Utility of organic vitamins sprayed on mulberry showed a superb effect in drastically growing values in all of the first-class parameters of cocoon production. Natural farming is a proactive ecological control approach. This approach improves soil fertility, complements natural content of the soil, will increase microbial and enzymatic pastime consequently facilitating green uptake of vitamins by the plant ensuing in development of exceptional parameters of the multivoltine Nistari and PM races of cocoons. Remedies with organic nutrients have considerably increased the quality parameters viz. weight of 250 matured Silkworm larvae, larval length, completely grown larva, unmarried cocoon weight, single shell weight, shell percentage (Shell ratio), eclosion and fecundity compared to the application of chemical fertilizers and multivoltine Nistari and PM races. The cost gain ratio is substantially higher inside the remedy with natural nutrient in comparison to chemical fertilizer which indicates the reduction of price of production and growth in satisfactory parameters of cocoons. Subsequently the finding of the existing look at guarantees to be of immense significance to sericulture farmers for sustainable production of best cocoons. Natural vitamins showed significant development in terms of productiveness and exceptional proper from cocoon manufacturing to processing of silk. The action of organic nutrition stands for example of the metabolic flexibility and intrinsic adaptability; wherein inside the basal metabolism of insect turned into improving to a maximum quantity. Basal metabolism was not directly correlated to life span of bugs. Modifications within the physiological or molecular level would possibly bring about lively biosynthesis of silk protein in silk gland. On massive scale, software of organic nutrients must be studied. The Morus plant boom by means of natural nutrients sprayed may be efficaciously used in sericulture for benefit of the enterprise after massive scale trials. Those may be encouraged to the sericulture farmers to reap a better leg yield with proper nutritive fee for the healthful increase and development of silkworm larvae and to get good best of cocoons.

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