

Panchagavya foliar spray impacts the yield, outcome, and characteristics of cocoon filament size, denier, and reelability in multivoltine silkworm races *Bombyx mori* Linn

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ABSTRACT

Silk farming is a really labour-intensive business that brings good money and helps rural communities. It's been around in India for ages and provides loads of jobs and income for farming families. India plays a big part in feeding the world and has used farming methods like the green revolution, fertilizers, manure, and raising different types of silkworms that breed multiple times a year. Back in the day, farmers stuck to traditional methods, but nowadays they often turn to chemical approaches to boost their crop yields. The thing is, these chemical methods can harm the environment and affect the quality of our food. Researchers looked into how spraying panchagavya (a mixture of five cow products) on mulberry plants affects the silk production - things like how long the cocoon threads are, how much they weigh, their thickness, how well they can be reeled, and how consistent the length is. They tested this on two types of silkworms: the Nistari and Pure Mysore breeds. Adding panchagavya spray to mulberry leaves really worked well for improving cocoon production. The improvements in thread length, weight, unbroken thread length, thickness, reeling quality, and consistency show that this natural spray has a positive effect on silk production from these multi-breeding silkworm types. So basically, using panchagavya spray in silk farming can boost yields and offers real benefits for silkworm breeding and silk reeling businesses.

Keywords: Race Nistari, race Mysore pure, Post-cocoon stage, and moriculture.

1.0 Introduction

Silk stands out as one of the finest natural fibers available. Known for being luxurious, soft, and glamorous, silk has a brilliant shine, feels incredibly smooth to touch, and looks stylish. The story goes that Chinese Empress Xi Ling Shi discovered this amazing fabric by chance around 4,600 years ago, when she noticed it coming from a tiny silkworm. This discovery earned silk the title 'The Queen of Textiles'. India has been in the silk business for ages - we're talking at least since the second century BC. Some historians reckon that raw silk was actually shipped from India to Rome during Emperor Kanishka's time in 58 BC. In India, silk isn't just a fabric - it's a way of life. It's always held a special place in Indian culture and carries that royal, mysterious feel about it. Indian silk is known around the world for its outstanding quality, gorgeous sheen, classic colors, and fine craftsman ship.

The silk industry in India is based on farming, and the country has something quite special going for it - it produces all four types of natural silk: Mulberry, Tasar, Eri, and Muga. Mulberry silk makes up about 90% of what India produces overall. The mulberry silkworm, called *Bombyx mori* L., is pretty picky about its food and only munches on mulberry leaves. There are loads of benefits to using organic methods like green manures, bio-fertilizers, vermi compost, and approved organic fertilizers - these really need to be properly highlighted because they can boost mulberry yields and, in turn, increase silk production. Silk is often called "Kalpvriksha" or "Kamdhenu" by the farmers who rear the silkworms. Mulberry also grows well in tropical and subtropical countries. One way to tackle production challenges is by using panchagavya foliar spray on mulberry leaves. Foliar spraying is basically a method where you feed plants by applying liquid nutrients directly onto their leaves. Plants can actually absorb essential nutrients through their leaves, and this absorption happens quite effectively.

2.0 Materials and Methods

The first method for making panchagavya is Panchagavya, which is a natural instruction that can be used to improve mulberry production and yield. According to studies, foliar sprays of Panchagavya can significantly improve the diversity of leaves and branches in mulberry trees. Furthermore, it may aid in pest control and promote general plant health. The widely recognized organic product Panchagavya is essential for boosting sales and immunity in *Morus* plant equipment. The five cow products used to make panchagavya are cow dung (7kg), cow urine (10 liters), milk (3liters), curd (2liters), and ghee (1kg) and diverse components, namely, jiggery(3kg), properly ripened proven banana (1 dozen), soft coconut water (3 liters), and undeniable water (10 liters).

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First of all, cow in a plastic container, dung and ghee are thoroughly combined and stirred once in the morning and once in the evening for three days. After that, it is mixed with cow urine and water and left to sit for 15 days with frequent mixing, as describe above [23]. Milk, curd, soft coconut water, jiggery, and bananas are combined after fifteen days. After a month, Panchagavya may be ready. To prevent the growth of silk larval inside the Panchagavya solution, the field should be kept below color and covered with a wire mesh or mosquito net as well as micro nutrients, aside from the increase-hormones (IAA and GA) necessary for producing high-quality mulberry leaves. The disease-free eggs of Nistari and Pure Mysore races of pure multivoltine silkworms were then obtained from Sericultural station in Baharaich, Uttar Pradesh. Fresh mulberry leaves were used to feed the silkworms at a temperature of $(26\pm1^{\circ}\text{C})$, a relative humidity of RH $(80\pm5\%)$, and a photoperiod of (12 ± 1) hours. Following the fourth moult, the larvae were divided into three replicates. Each treatment has three replicates of 250 cocoons in each group. After being dissolved in distilled water, natural organic nutrition is sprayed at the mulberry leaf for 10 and 15 micrograms per larva, respectively which gave the larvae of day-1 and day-2 of the fifth instar larva's food. Mulberry leaves treated with distilled water are used for the manipulated larvae. In addition to the experimental multivoltine, the post-cocoon level, filament length, filament weight, non-breakable filament length, denier, reelability, and length deviation were all noted the natural races of Nistari and Pure Mysore races of the multivoltine silkworm *Bombyx mori* Linn.

3.0 Results

The result shows (Table-1) that the ultimate outcome, which screens the number of changes in the cocoon filament's length, cocoon weight, cocoon denier, reelability, and resistance to breakage and variation in the size of cocoon between the experimental and control multivoltine Nistari and PM (Pure Mysore) breeds of *Bombyx mori* Linn silkworms.

3.1 Filament length: Examines of filament length, revealing statistically significant effects ($P<0.001$) whereby panchagavya foliar application at concentrations of $10\mu\text{g}/\text{larva}$ and $15\mu\text{g}/\text{larva}$ demonstrated percentage improvements of 19.25% and 12.23% respectively in Nistari varieties, whilst PM races exhibited enhancements of 13.99% and 9.94% respectively when compared to control parameters.

3.2 Filament weight: Cocoon addresses the filament weight, demonstrating statistically significant effects ($P<0.001$) with percentage increases of 31.75% and 21.49% observed in Nistari varieties, and 25.0% and 18.0% in PM races following treatment with panchagavya foliar application at $10\mu\text{g}/\text{larva}$ and $15\mu\text{g}/\text{larva}$ concentrations respectively, relative to control parameters.

3.3 Non-breakable filament length: A significant investigates non-breakable filament length, establishing statistically significant effects ($P<0.001$) characterized by percentage increases of 29.31% and 17.67% in Nistari varieties, and 27.83% and 16.83% in PM races when subjected to panchagavya foliar treatment at $10\mu\text{g}/\text{larva}$ and $15\mu\text{g}/\text{larva}$ dosages respectively, compared to control parameters.

3.4 Denier of silk thread: A significant analyses silk thread denier, documenting statistically significant effects ($P<0.001$) with measurements of 3.48%, 3.75%, and 2.69% recorded for control parameters and panchagavya foliar treatments of $10\mu\text{g}/\text{larva}$ and $15\mu\text{g}/\text{larva}$ respectively in Nistari varieties, whilst Pure Mysore races exhibited values of 3.44%, 3.67%, and 3.62%.

3.5 Reelability of silk thread: A significant evaluates silk thread reelability, whereby percentages of 88.91%, 99.19%, and 95.92% were observed in control conditions and following panchagavya foliar treatments of $10\mu\text{g}/\text{larva}$ and $15\mu\text{g}/\text{larva}$ respectively in Nistari varieties, whilst Pure Mysore races demonstrated values of 87.10%, 97.65%, and 92.55%.

3.6 Size deviation: A significant examines size deviation, establishing statistically significant effects ($P<0.001$) characterized by percentage reductions of 27.67% and 14.33% in Nistari varieties, and 25.49% and 11.20% in Pure Mysore races following panchagavya foliar application at $10\mu\text{g}/\text{larva}$ and $15\mu\text{g}/\text{larva}$ concentrations respectively, relative to control parameters.

Table1. Effects of experimental addition of panchagavya foliar spray at $10\mu\text{g}/\text{larva}$ and $15\mu\text{g}/\text{larva}$ on silkworms of the multivoltine Nistari and PM (Pure Mysore) races of *Bombyx mori* Linn that consume mulberry leaves. The data is the average of ten separate observations. Mean $\pm$ S.D, where '+' is a percentage improvement and '-' is a percentage decrease in comparison to the control treatment respectively.

S. No.	PARAMETERS	Multivoltine Nistari races			Multivoltine PM (Pure Mysore races)		
		Control	Experimental (Panchagavya foliar spray)		Control	Experimental (Panchagavya foliar spray)	
			Panchagavya $10\mu\text{g}/\text{larva}$	Panchagavya $15\mu\text{g}/\text{larva}$		Panchagavya $10\mu\text{g}/\text{larva}$	Panchagavya $15\mu\text{g}/\text{larva}$
1-	Filament length (m)	1167 ± 11.35	1380 ± 13.56 $P<0.001$	1298 ± 12.73 $P<0.001$	1108.5 ± 11.91	1252 ± 10.13 $P<0.001$	1207.0 ± 9.32 9.94 $P<0.001$
2-	Filament weight (gm)	0.322 ± 0.028	0.42 ± 0.038 31.75 $P<0.001$	0.38 ± 0.34 21.49 $P<0.001$	0.30 ± 0.021	0.37 ± 0.035 25 $P<0.001$	0.35 ± 0.030 18 $P<0.001$
3-	Non- breakable Filament length (m)	1056 ± 8.23	1355 ± 11.87 28.31 $P<0.001$	1232 ± 10.72 17.67 $P<0.001$	954 ± 7.58	1210 ± 7.37 27.83 $P<0.001$	1105 ± 8.64 16.83 $P<0.001$
4-	Denier (d)	3.48 ± 0.22	3.75 ± 0.26 11.89 $P<0.001$	3.69 ± 0.24 9.47 $P<0.001$	3.44 ± 0.020	3.67 ± 0.24 10.83 $P<0.001$	3.62 ± 0.22 8.38 $P<0.001$

5-	Reelability (%)	88.91	99.19	95.92	87.1	97.65	92.55
6-	Size deviation	0.45±0.43	0.33±0.031 -27.67 P<0.001	0.39±0.038 -14.33	0.49±0.042	0.37±0.033 -25.49 P<0.001	0.44±0.035 -11.2

"P"- Statistical Significant SD- Standard Deviation/ Standard Error

4.0 DISCUSSION

The reeling parameter results indicate that the quality of silk had been found to be superior, which has significant financial implications for the silk reeling sector. The most crucial sector characteristics within them are increase in filament length, unbreakable filament duration, cocoon reelability percentage, and high-quality silk filament with significantly less deviation. The creation of silk is with a pleasant yield of cocoon. The rise in the silk production is likely caused by a direct stimulatory effect of panchagavya on the stomata of mulberry leaves, which increases their protein content from the silkworm body to the production of silk glands. The accelerated performance of converting ingested food supplements made from mulberry is another possibility. So, that a higher plant peak can be attributed to increased protein synthesis and more silk produced from a unit amount of mulberry food [7, 18]. The mobile department, cell proliferation, and cell enlargement that favor increased inters nodal growth may be made more desirable in panchagavya by growth regulators like IAA and GA [3]. The course lasts for 19 weeks and covers legumes and veggies [12]. The lower plant peak in control may be the result of inadequate nutrient supply at some point in the cocoon increasing levels [15, 11]. Chemotropism and Panchagavya contains autotrophic bacteria (ammonifiers and nutrifiers) that colonize the interior of the mulberry leaves, increase the uptake of ammonia, and improve the overall delivery of nitrogen, hence fostering the growth of the mulberry plant top and vegetative growth [20, 24]. By enhancing cell division, cell elongation, and the mulberry plant growth chemical in panchagavya, it facilitates rapid changes in plant phenotype. Regular supply of vital plant nutrients to the crop, moisture availability, and ideal soil physical environment may also contribute to productivity and growth [26, 9, 23 and 22]. The earlier and quicker emergence of leaves and fruiting may be the reason why mulberry plants have been sprayed with panchagavya flower earlier and also because it contains growth-promoting chemicals such as IAA, GA, and cytokinin, as well as a variety of mineral nutrients that support the translocation of higher photo assimilates as a result, reproductive components induced early bloom [6, 2]. This may be because the vitamins in panchagavya induced micronutrient and macronutrients like nitrogen (N), phosphorous (P), and potassium (K) are necessary for the development and advancement of vegetation. Furthermore, there are a number of amino acids, vitamins, growth regulators such auxins, gibberellins, cytokine, and helpful bacteria such as pseudomonas, Azotobacter, and phosphorus bacteria which led to yield-related features such as pod variety by mulberry plant, and 100 seed weight gains the sphere stands [16, 1 and 3]. The primary cause of the increase in seed yield was an increase in seed weight and the quantity of seeds. This aligned with the results of [14, 8] in green gram. Vitamin rich delivery may have enhanced the protoplasmic elements and accelerated the process of cell division and elongation. As a result, the yield of cocoon increased. The hormonal compounds in panchagavya, particularly cytokinin, which has a role in the vegetative components of plants with nutrients, may be the reason for yield increase in (T2) high levels of nutrients mobilization and

partitioning while in reproductive organs. Additionally, the reality that cow excrement in panchagavya serves as a medium for the development of beneficial bacteria and that there will be an increase in yield are related. Nitrogen, which is essential for plant development, is produced by cow urine [4, 17]. This would be consistent with the publications of [21, 5 and 25]. The lack of may be the cause of the lowest yield on top of anything else. The crop receives a sufficient supply of nitrogen and phosphate, which in turn has an impact on its growth and yield components, ultimately affecting yield [10, 13], had reported comparable outcomes. When compared to panchagavya, the application of 10µg/larva of panchagavya foliar spray resulted in a dramatic increase in the quantity of fibroin and sericin, as well as in reelability of a foliar spray of 15µg/larva. The Panchagavya foliar spray on the mulberry has an immediate stimulatory effect on protein synthesis of silk gland and it may regulate silk gland protein synthesis by fibroin and sericin, which offers a clear benefit to the reeling sericulture industry. Enhancements in reeling parameters result in silk of higher quality in higher demand on international sericultural market.

5.0 Conclusions

It may conclude that effectively using panchagavya foliar spray can yield high-quality mulberry leaves rich in nutrients and resistant to diseases and pests. Panchagavya nutrients enhance the biochemical composition of mulberry plants, leading to improved rearing, cocoon, and post-cocoon traits in the Nistari and Pure Mysore multivoltine silkworm varieties. Their research provides strong evidence that leaf quality remains stable even with partial reductions or complete replacements of chemical fertilizers when mulberry cultivation is supported by various natural fertilizers. Applying panchagavya foliar spray to mulberry trees had a significant positive effect, greatly enhancing all key aspects of cocoon production and post-cocoon characteristics for silkworm breeds like Pure Mysore and Nistari races. Foliar spraying with panchagavya represents a proactive ecological management strategy that boosts microbial and enzymatic activity, improving soil fertility and nutrient content while helping plants absorb nutrients more efficiently. Consequently, the multivoltine Nistari and Pure Mysore races produce cocoons with superior quality traits. These findings hold important implications for sericulture farmers aiming to produce sustainable cocoons. The use of panchagavya foliar spray on mulberry plants led to improvements in both production and quality, spinning from cocoon formation to silk processing. The nutritional action of panchagavya foliar spray demonstrates metabolic flexibility and natural adaptability, optimizing the insect's basic metabolism to its fullest potential. Since insect lifespan is indirectly linked to basal metabolism, molecular or physiological changes can stimulate the silk gland to actively synthesize silk protein. Further research is needed to explore the widespread application of panchagavya foliar nutrition. After thorough trials, the growth of Morus plants promoted by panchagavya foliar spray nutrients can be effectively utilized in sericulture, benefiting the sericulture industry.

5.1 Recommendation

The available information regarding the potential use of panchagavya foliar spray on mulberry leaves is limited. Consequently, it may be essential to conduct large scale trials to determine the appropriate proportion of organic inputs to be applied to mulberry gardens situated in various soil types across different agro-climatic zones. Such studies could also motivate sericulture rearers to achieve a higher yield of leaves with enhanced nutritional value, which is crucial for the healthy growth and development of silkworm larvae. This, in turn, may lead to improved quality of cocoons and the post-cocoon stage, serving as a cost-effective strategy to enhance silk production in sericulture.

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