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Effect Of Artificial Diet On Certain Biological Aspects(Weight) Of The Silkworm, *Bombyx Mori* Larva.

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ABSTRACT-

A significant monophagous insect in the sericulture sector is the silkworm (*Bombyx mori* L.). Due to the presence of chemo factors and antioxidants, mulberry leaves are valued plants rich in nutrients and nutraceuticals that are traditionally used in the rearing of silkworm larvae. The mulberry is regarded as a suitable plant for sustainable development and is utilized in the food, beverage, pharmaceutical, and healthcare industries.

Starting at the start of the second and fourth instar, the silkworm larvae (*Bombyx mori* L.) are fed four different artificial diets. First instar larvae did not molten, and all of them died frequently. The lowest percentage of larval mortality and the highest weights of larvae, pupae, and fresh cocoons were seen when larvae fed on these diets from the start of their fourth instar and data was analyzed with a test significant level of 0.081.

KEYWORDS- ***Bombyx mori* L., artificial diets, mulberry leaves , silkworm**

INTRODUCTION-

The main diet of the silkworm, *Bombyx mori* L., is mulberry leaves, which are in short supply during the winter months when the trees lose their leaves. Silkworms are extremely sensitive to variations in feed quality.

Silkworm larvae are fed artificial diets by gradually switching from their natural food source, mulberry leaves, to a specially prepared diet. Usually, this procedure starts with a small amount of artificial diet mixed in with their regular food, and over time, the amount of artificial diet is gradually increased. Throughout this change, it is critical to keep a close eye on the larvae to make sure they are adjusting to their new diet and to make any necessary adjustments to ensure their development and health. In addition, the artificial diet will not work unless there is ample access to water.

Depending on how the artificial diet is made, the effects on the biological characteristics of silkworm larvae fed it can change. Important variables include nutritional composition, digestibility, and palatability. Nutritional modifications can impact growth rates, silk yield, cocoon quality, and even the larvae's survival and well-being. Artificial diets are frequently optimized through research and experimentation to make sure they sufficiently support silkworm development.

The only food source for the common monophagous silkworm, B. mori L., is the leaf of the mulberry (*Morus* spp.). Because silkworms produce silk that is so beneficial to humans, scientists have always sought to identify the variables that can be altered in order to
of Nair and Kumar, the silkworm rearers (2004). For silkworm larvae to develop fully, they must consume food that is easily digested and appropriately absorbed into their body tissues to facilitate the synthesis of silk. Using an appropriate mulberry variety and food additives, an attempt was made to increase the growth of young silkworms and cocoon yield in light of the aforementioned facts.
Salimath et al., (2007) tried to improve the quantitative and qualitative of mulberry leaves. They found that the soybean flour proved to be a good supplement for getting quality cocoons.
Silkworms (*Bombyx mori* L.) raised on synthetic feed possess enormous potential for sericulture applications. Dong (2017) offers crucial information about the control of silkworms.
silkworm metabolism and silk protein synthesis during adaptation to a synthetic diet.

Japan was the first country to develop the "artificial diet." and dispersed over the world. The primary ingredient is mulberry flour. component of the manufactured food's formula. It consists of many additional components, including corn starch, soybean meal, Ascorbic acid, sitosterol, preservatives, sitosterol, agar agar, trace elements, and vitamins. Through it is capable of
be grown as larvae all year long, even during the winter.
Development, viability, and productivity can be greatly enhanced through the creation and application of semi-synthetic food blends. Artificial food may be more advantageous in many aspects. compared to natural food (Ovesenska, 2000).
In 1960, Bhattacharyya claims that the silkworm was successfully reared to maturity on artificial diets for the first time. Larval growth at that time was reliant on artificial diet rearing.
was low, cocoons were small, growth was slow, and mortality was elevated.
The development of the silkworm was impacted by the mulberry tree's cultivation. The mulberry leaf's quality has a significant effect on how normally the larvae develop and grow. The choice of Bombyx mori L. is limited by the availability of extremely nutritious mulberry leaves in temperate environments, which are only available in the spring and summer. In Japan and South Korea, feeding artificial food to larvae at early ages is highly common because it results in elderly worms that are healthy and lively while also reducing labor expenses.
In India, artificial food made of mulberry leaf bed quality is used to feed larvae at early ages during certain seasons.

Numerous investigations have demonstrated that diet proteins have a major impact on larval growth (Ito and Inokuchi ,1981 and Horie and Watanabe, 1983).
Researchers from all over the world have created sericulture techniques to improve the nutrition of silkworms, frequently by adding additional nutrients to dried mulberry leaves. (Das et Medda,1988; El-Sayed and Nagda,1999; Islam et al.,2004).

When compared to natural food sources, semi-synthetic diets have advantages for silkworm development, viability, and productivity
(Ovesenska,2000).

Artificial diets provide balanced nutrition and disease prevention, particularly during the early larval stages, offering benefits over traditional practices(Jula et al.,2011).
Because silkworms are monophagous and feed only on mulberry leaves during their larval stage, mulberry leaves are essential to sericulture (Bhattacharyya,2016).

Salimath et al. (2007) attempted to enhance the mulberry's quantitative and qualitative mulberry leaves. They found that the soybean flour proved to be a good supplement for getting quality cocoons.

MATERIAL and METHOD-

MATERIAL REQUIREMENTS-

The following materials are usually needed to create artificial diets for silkworm larvae:

Mulberry leaves: In both natural and artificial rearing setups, mulberry leaves are frequently utilized as the main food source for silkworm larvae. They include vital nutrients that silkworms need to grow and develop, especially the proteins needed to produce silk. Mulberry leaves can be added to artificial diets to replicate the natural diet of silkworms, protecting their well-being and maximizing their productivity**.**

Dry mulberry powder: Silkworm larvae can be fed artificial diets that contain dry mulberry powder. It is an easy approach to add the nutrients found in mulberry leaves to the diet plan. Proteins, carbohydrates, vitamins, and minerals are commonly found in mulberry powder and are all necessary for silkworm growth and development. By giving silkworm larvae a reliable and manageable food source, breeders can encourage healthy development and silk production by using mulberry powder.

Sucrose: As a source of carbohydrates, sucrose is a type of sugar that is frequently added to artificial diets for silkworm larvae. For the larvae, it supplies energy during the stages of growth and development. Nonetheless, it is crucial to make sure that the sucrose concentration is balanced with other nutrients to produce a diet that is well-rounded and promotes the silkworms' general development and health**.**

Soybean meal: As a source of protein, soybean meal can be added to artificial diets for silkworm larvae. It offers the vital amino acids required for the larvae's growth and development. In order to give the silkworms a balanced diet that satisfies their nutritional needs, soybean meal is frequently used in conjunction with other protein sources. But it is crucial to make sure that soybean meal does not overpower other nutrients in the diet formulation and has the right concentration.

Agar agar: Seaweed-derived gelatinous material known as agar agar can be utilized to gel artificial diets for silkworm larvae. It provides a stable foundation for other nutrients and ingredients and helps to solidify the diet, making it easier to manage. In order to keep the silkworm larvae at the right levels of hydration, agar agar also aids in the retention of moisture in the food. In general, it enhances the uniformity and efficiency of the synthetic food used to raise silkworms.

Water: A vital component of silkworm larvae's artificial diet is water. It is essential for keeping the diet's moisture content stable, hydrating the ingredients, and making sure the larvae have access to water to drink. Silkworm health and development depend on proper hydration because it promotes healthy digestion, nutrient absorption, and other physiological processes. Breeders are responsible for making sure that the artificial diet contains enough water to meet the silkworm larvae's needs for hydration throughout their life cycle.

Paraffin paper: To stop moisture loss and keep the right humidity levels in artificial diets for silkworm larvae, paraffin paper can be used. It facilitates the creation of a regulated environment that supports the larvae's growth and development. In the rearing setup, it can also help to keep things clean and prevent contamination

Blower- In artificial silkworm larvae rearing, blowers are frequently used to regulate humidity, temperature, and ventilation in the rearing environment. Blowers contribute to the creation of, by **controlling** these variables. Furthermore, blowers can aid in keeping pathogens and hazardous gasses from accumulating in the rearing area, fostering a healthier and cleaner environment for the silkworms.

METHODOLOGY-

After the rearing room, appliances, and floor were thoroughly cleaned, a 5% bleaching powder solution was used for washing. The entire area was made sterile by dispersing 2.5% Sanitizer in 0.5% Slaked Lime solutions (Dandin et al., 2003).The laboratory conditions for conducting the experiments were 22–31°C and 50–68 O/o R. H.

Four types of diets suggested. Table 1 displays the ingredients of these diets.

The larvae were raised in small rectangular boxes measuring 18 cm by 2 cm.A wet piece of filter paper was positioned at the base of every dish, and the diet was placed on a piece of paraffin paper that covered it.

The larvae were split into four groups after hatching, and for the first three instars (10 larvae each), they were replicated ten times, and for the final two instars (10 times) (5 larvae each).

The artificial diet was prepared and provided to Larvae at the start of each instar, twice a day, at 9.0 a.m. and 6.0 p.m. Larvae raised on fresh mulberry leaves during the first three instars were reared on artificial diets starting in the fourth instar. The weights of the larvae, cocoons, and pupae were noted at the conclusion of each instar.

OBSERVATIONS-

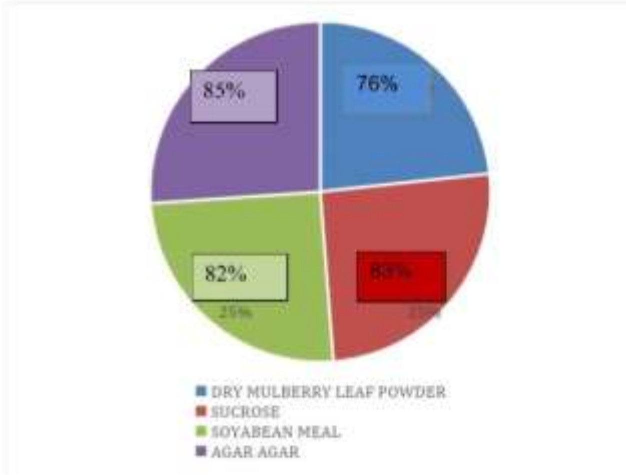
Mean weight among larvae (means of 10 replicates)

TABLE 2- MEAN WEIGHT

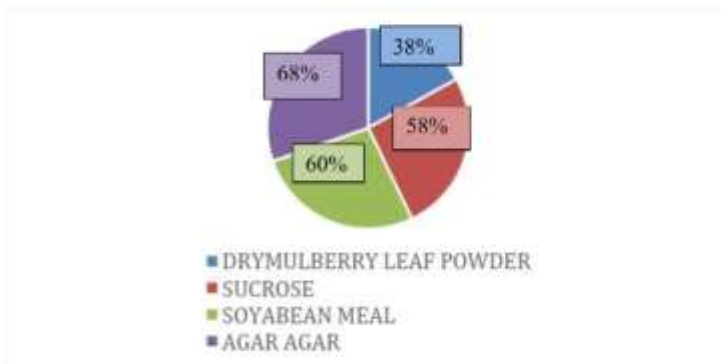
DIET	4^{TH} INSTAR LARVA	PUPA	COCOON	5^{TH} INSTAR LARVA	PUPA	COCOON
DIET 1 DRY MULBERRY POWDER	0.50±0.001	0.74±0.001	1.20±0.01	2.40±0.002	0.60±0.008	1.35±0.003
DIET 2 SUCROSE	0.54±0.002	0.70±0.002	0.90±0.006	2.24±0.009	0.60±0.003	1.00±0.005
DIET 3 SOYABEAN MEAL	0.49±0.007	0.64±0.005	0.89±0.001	2.02±0.005	0.60±0.004	1.32±0.002
DIET 4 AGAR AGAR	0.50±0.002	0.64±0.004	0.86±0.004	1.84±0.004	0.70±0.001	1.01±0.001

S.NO.	DIETS	DIET FORMULATION
1.	DRY MULBERRY POWDER	DRY MULBERRY POWDER(5.5gm) + WATER (20ml)
2.	SUCROSE	SUCROSE (18.0gm) + WATER (20ml)
3.	SOYABEAN MEAL	SOYABEAN MEAL(3.0gm) +WATER (20ml)
4.	AGAR AGAR	AGAR AGAR(2.0gm)+WATER(20ml)

Table 2: Diet measurement and formulation.



MORTALITY PERCENTAGE OF 4TH INSTAR LARVAE



MORTALITY PERCENTAGE OF 5TH INSTAR LARVAE

STATISTICAL ANALYSIS-

The weight of larvae examined calculated with help of analysis of Variance (ANOVA) was used to find the (Mean±Standard Error). The graph was created using GraphPad Prism 10.0 software.

RESULT-

When the larvae were fed on all four of the prescribed artificial diets starting at the first instar, they did not molt and most of them died. Some larvae completed their development regularly when fed the same food as the larvae of the previous two instars.

Percentage mortality among larvae-

The percentage of mortality in larvae fed from the start of the fifth instar is displayed in table 2. There were mean percentages of 81.5 and 56.0 for each, respectively. Larvae given diet 1 had the lowest mortality (76-38%), whereas those raised on diet 4 had the highest mortality (85-68%).

Artificial diets were fed to larvae developing at 4^{th} instar and 5^{th} instar. At 4^{th} and 5^{th} instar when fed to Dry Mulberry leaf Powder showed maximum mean weight in their development. After Mulberry Powder most consumed diets were SUCROSE>SOYABEAN MEAL=AGAR AGAR at 4^{th} Instar larvae showed mean weight of 1.64>1.54>1.42=1.42.

At 5th instar larvae the most consumed diet was DRY MULBERRY LEAF POWDER> SUCROSE >SOYBEAN MEAL> AGAR AGAR i.e. 3.45> 3.17> 3.06 >2.87. It is observed the development of instar larvae showed significant growth from instar stage to pupa to cocoon and finally to adult completing their life cycle. The value of p is 0.081.

PUPA OF SILKWORM

WEIGHT OF SLIKWORM LARVA

DISCUSSION–

Horie (1995) outlined th[illegible] criteria: Fulfilling the nutritional needs of silkworms, possessing suitable physical properties, being free from contaminants, excluding substances that may adversely impact silkworms. the artificial diets consist of varying proportions of dried mulberry leaf powder, defatted soybean meal, wheat meal, corn starch, soybean fiber, ascorbic acid, citric acid, a vitamin blend, a salt blend, agar, sorbic acid, propionic acid, chloramphenicol, and β-sitosterol (Cappellozza et al., 2005).

Trivedy et al. (2001; 2003) developed five multi-voltine and six bivoltine strains that readily adopted the artificial diet, demonstrating favorable economic traits similar to those raised on mulberry leaves.

Diet 1 as Dry Mulberry powder taken 5.5 gm showed a significant result rearing silkworm larva on artificial diets containing a significant proportion of mulberry leaf powder has yielded results comparable to those obtained from rearing them on whole mulberry leaves. Avramova et al. (2020) noted that silkworms raised on an artificial diet during the summer season in their initial three instars, and subsequently fed mulberry leaves during their fourth and fifth instars, displayed comparable technological attributes and favorable sanitary conditions when compared to silkworms raised solely on mulberry leaves.

Carbohydrates serve as a primary energy source for silkworms (Ito, 1967), which can be synthesized from lipids and amino acids (Nation, 2001). All disaccharides were found to be of high quality, particularly sucrose. In Diet 2, Sucrose serves as a source of energy and carbon for silkworm larvae, and it also stimulates their feeding behavior.

Bhattacharyya et al. (2017) examined the antioxidant activity of components in artificial diets, including defatted soybean meal, rice meal, wheat meal, corn starch, potato starch, and Aloe vera gel, in combination with mulberry leaf. Their study revealed that soybean had a greater effect on increasing the weight of cocoon shells. Diet 3 as Soyabean meal as a source of protein help larvae for their gradual increase in their weight both in fourth and fifth instar larva.

Diet 4 as Agar-Agar show significant result along with soyabean meal with 1.42 as significant mean weight. Dong et al. (2017); Dong et al (2018) profiles to date, research on artificial diets has primarily aimed at enhancing silk production and quality. However, with the growing attention towards using silkworms for drug discovery purposes, there's a need for an artificial diet that is simple, applicable to a wide range of users, and suitable for research purposes.

CONCLUSION:

In Conclusion, the experiment was performed to analyze effect of biological aspect on artificial diet consumption. Experimental silkworm rearing has been made easier by the development of artificial diets. Researchers in the fields of science and sericulturist can create and alter diets to investigate the effects of particular nutrients on silkworm growth, silk quality, and resistance to disease. Improvements in artificial diet development and sericulture techniques are facilitated by this ongoing research.

In general, artificial diets for silkworm larvae are important because they can improve the production of silk, facilitate the efficient use of resources, guard against disease, give seasonal independence, and support ongoing research and development in the sericulture sector.

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