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BIOLOGICAL AND TECHNOLOGICAL ASPECTS OF SILKWORMS *BOMBYX MORI* L. AFFECTED BY ARTIFICIAL NUTRITION IN COMPARISON WITH NATURAL NUTRITION

Halawa, Samah F.; El-Dash, A.A.; Ibrahiem, M. S.; El-Defrawy, B. and Abdelaal, A.A.A.

Economic Entomology & Agricultural Zoology Dept. Fac. Agric. Menoufia Univ. Shebin Elkom, Menuofia, Egypt.

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ABSTRACT: The present study was carried out during spring seasons, 2020 and 2021,the study aimed to evaluate the feeding of silkworm *Bombyx mori*L. on different artificial diet (T1-T2) in 2020 season and (T1-T2-T3) in 2021 season , on some biological, and technological aspects. The results indicated that the best results were recorded with T_2 diet especially for larvae which fed on young instar (R_1 which fed in 1^{st} and 2^{nd} instar) and R_2 which fed in 1^{st}, 2^{nd} and 3^{th}), during the first season.While in the second season, the best results were noticed also with the larvae which fed on young instarin the treatments (T_1 and T_2) and the same sub treatment (R_1 and R_2) in comparison with other diets and control for biological indexes (larval weight and larval duration) and silk filament characteristics. The current study supports the trend towards the use of artificial diets during the 1^{st} and 2^{nd}instars, due to its importance in the process of natural silk production.

Key words: Bombyxmori, artificial diet, biological, technological characters.

INTRODUCTION

Mulberry silkworm *Bombyx mori* is considered one of the most important sources of natural silk production, it feeds only on mulberry leaves, which is not available throughout the year, so it was necessary to search for other alternatives or industrial diets to feed the worms. Due to its extensive domestication over many centuries, it is a quite adaptable and distinctive species. Consequently, it is not difficult for it to adapt to an artificial diet (Chowdhary, 1996).

Breeding silkworm larvae is one of the industry's cost-effective niches. That has a long history. The mulberry silkworm larvae growth is constrained by their heavy reliance on dietary needs, particularly the seasonality and abundance of the mulberry tree. Due to its biological and morphological traits, *Morus alba* grows effectively and produces copious amounts of food with a high nutritional value, but only during particular seasons of the year. It can grow all year long, regardless of the weather, thanks to artificial feeding. Some plant extracts function as food stimulants and improve nutritional absorption, development, and even disease resistance. (Nikolova, 2020)

The greatest obstacle to artificial diets widespread use in silkworm larval rearing is their high price. To reduce the cost of artificial diets, the nutritional requirements for grown of silkworms were investigated. These requirements included minerals, lipid, sterol, and vitamin B components. Larvae were fed on test diets containing mulberry leaf powder, defatted soybean meal, and maize meal together with various levels of minor feed additives during their fourth and fifth instars (mineral mixture, soybean oil, phytosterol, and vitamin B compounds). The minor components' addition did not alter the larvae's growth or the cocoons' creation, proving that their independent addition was not required. (Hirayama, 2020). In the sericulture industry, the improvement of the cocoon quality as well as quantity, which is affected by silkworm feed, is very important (Matsura, 1994), therefore, many researchers attempt to obtain the best artificial diets with low-cost.

*Corresponding author: samahfathihalawa@gmail.com

For a many reasons, it became necessary to create artificial diets for silkworm, particularly for the young instars, in order to address the difficulties facing the growth of sericulture in Egypt, including (Nilly 2006):

1. The scarcity of fertile land for mulberry farms.
2. The necessity of providing youth in unemployment with a year-round work by rearing silkworms.
3. To promote the young instars' cooperative breeding.
4- The high labor costs, as feeding silkworms three to four times a day on mulberry leaves demands additional labor.
5. The high labor costs associated with creating mulberry gardens that satisfy the larvae's quantitative needs and are microbial free.
6. One of the most recognizable insects utilized in experimental research is the silkworm purposes.

So that, the present study was carried out to evaluate the effect of feeding on different artificial diets and normal feeding on some biological, technological and physiological characters of silkworm larval growth and silk production.

MATERIALS AND METHODS

The present investigations were carried out during spring season of 2020 and 2021 at Economic Entomology & Agriculture Zoology Department, Faculty of Agriculture, Menoufia University. The work conceded to evaluate the feeding on different artificial diets and natural feeding on some biological and technological characters of silkworm, *Bombyx mori* L. Eggs of silkworm *B.mori* were purchased from the Sericulture Research Department of Plant Protection Research Institute, Agriculture Research Center, Ministry of Agriculture and Land Reclamation in Giza, Egypt.

1. Experimental design

The experiment was divided into four main groups (T_1, T_2, T_3 and (control), and the first three main group was divided into four sub-groups (R_1, R_2, R_3 and R_4 according to the feeding of the larval instar as follows:

The first diet was suggested by Wagiha *et al.* (2009) and referred to (T_1), the second diet was suggested by cui *et al*. (2001) and referred to (T_2) and the third diet was suggested by Luciano *et al*. (2005) referred to (T_3).

In addition to the diet's constituents, the following compound were to each of the tested diets formalin (10cc of 2.7% concentration) for each one Kilogram of the diet as aseptic solution for avoiding mould growth on prepared diet Fouda (1997). Each type of the three artificial feeding had four treatments:

A- Sub-treatment (R_1): which the larvae of the 1st and 2nd instar were fed on artificial diet, then they completed the feeding on the natural mulberry leaves.

B- Sub-treatment (R_2): which the larvae of the1st, 2ndand 3rdinstars were fed on artificial diet, then they completed the rest of their lives on the natural mulberry leaves.

C- Sub-treatment (R_3): which the larvae of the 4th and 5thinstarswere fed on artificial diet, while the 1st, 2ndand 3rdinstars were fed on natural mulberry leaves.

D- Sub-treatment (R_4): the larvae were fed on artificial diet throughout their larval stage.

Control: the larvae were fed on fresh mulberry leaves during all larval stages (control of natural feeding)

2- Diets Constituents and preparation

1. The following recipes were used to prepare the diets: According to each item was added at its exact weight (T_1,T_2 and T_3). Ascorbic acid and citric acid are combined with distilled water until fully dissolved.
2. All the remaining ingredients-aside from the salt mixture
3. The remaining distilled water was heated to a temperature of 90 °C.
4. Hot water was used to dissolve agar-agar, which was then cooled to 60°C and added to (for T_1 –T_3)
5. The diet was placed in polypropylene bags, placed in a stainless-steel tray that had been disinfected, and cooked for 50 minutes in an autoclave at 100°C.

6. A large tray filled with tap water was used to cool the diet.
7. The remaining ingredients were combined, added, and maintained at the diets should be suitable for feeding larvae for 5-7 days according to 2.5°C.

3. Mulberry leaves

Fresh mulberry leaves of *M. alba* native (Balady) were harvested, washed, dried at 76°C, then powdered and kept in clean place until use in the diet. The fresh leaves of the same variety were used for larval feeding in the all treatments.

4. Larval feeding

The experiment was divided into four treatments, each treatment had 150 larvae, and the control had 300 larvae. Larvae of each replicate were reared in a plastic tray (100 × 70 ×15 cm) under a controlled rearing room at 27±2 °C and 95±5 % Rh for the first three instar larvae, while it was changed for the last two instars (4^{th} and 5^{th}) to 24±2 °C and 75±5 % RH.

5. Technological studies

Cocoons and reeled silk filament characters:

5.1. Cocoon indices

A- Fresh cocoon weight

B- Cocoon shell weight

- Cocoon shell ratio = $\frac{B}{A} \times 100$ (Krishnaswami *et al*., 1972)

5.2. Reelable silk filament parameters:

The weight (mg) and length (m) of reeled silk filament were measured and recorded. The size of the reeled filament (denier) was estimated according to (Krishnaswami *et al*., 1972) formula:

The size of reeled filament (dn) =

$$\frac{weight\ of\ reeled\ filament\ (mg)(B)}{Length\ of\ reeled\ filament\ (m)(A)} \times 9000$$

Data obtained were statistically analyzed according to Senedecor and Cochran (1967) methods using software COSTAT program.

RESULTS AND DISCUSSION

Technological studies

Cocoon indices

Fresh cocoon weight (g)

In the first season (2020): Data presented in Table (1) clear that, the highest fresh cocoon weight was 1.562g recorded for $R_1(T_1)$, followed by 1.562g for R_2, and the lowest fresh cocoons weight was 1.370g for R_4 .

The obtained results clear that there were significant differences between means of fresh cocoon weight for sub-treatments of $T_{1,}$ and the best result was R_1.

The obtained results showed that the results of the second treatment (T_2) were in the same trend, as the highest fresh cocoons weight was 1.566g for R_1, and the lowest weight of fresh cocoons was 1.340g for R_3.

There were no significant differences between the sub treatments as shown by the statistical analysis.

Regarding the second season (2021), the results are shown in Table (2), the highest fresh cocoon weight was 1.938g for $R_1(T_1)$ followed by 1.712g for R_2, while, the lowest fresh cocoonweight was 1.602g for R_3.

Statistical analysis of the data showed that there weresignificant differences between the sub-treatments of T_1 and the fresh cocoonsweight R_1gave the best result.

In connection withthe second treatment T_2, the highestmean of fresh cocoons weight was recorded for R_1 (2.070 g), followed by R_4 (1.759g), while the lowest one was recorded for R_3 (1.513g).

There were significant differences between the different sub-treatments of $T_2$and the fresh cocoons weight R_1 gave the best result.

The third treatment (T_3) recorded the highest fresh cocoons weight 2.030g at sub treatment $R_{1,}$ followed by 1.886g for R_2, however, the lowest fresh cocoon weight was 1.574g for R_3. Statistical analysis showed that there were significant differences between the sub treatments, mean while, the sub treatment R_1 was the dominant.

Cocoon shell weight (g)

Data presented in Table (1) show that, the sub treatment R_2gave the highest cocoon shell weight, which recorded 0.308g for (T_1), followed by R_1which recorded. 280 g, and the lowest cocoon shell weight (0.227g) recorded forR_3.The cocoon shell weights in the various sub-treatments were found to differ significantly; R_2 produced the best results in comparison to the control (0.3007g).

The maximum cocoon shell weight resulted from the treatment (T_2) was 0.659g for R_1 followed by 0.312g for R_2, while the lowest value of cocoon shell weight was 0.236g recorded for R_3. The statistical analysis showed that there were no significant differences between the sub treatments. T_2 and R_1 performed the best in comparison to the control, which produced 0.301g during the first season.

In the second season (2021), Table (2) cleared that, the maximum weight of the cocoon shell weight was 0.400g for R_1 (T_1), followed by 0.359g for R_2. While, the lowest mean value of the cocoon shell weight was 0.323g for R_3, It was revealed that the various sub-treatments had highly significant differences. Moreover, the weights of the cocoon shell in T_1 and R_1 under the various sub-treatments produced the best results.

The greatest value for the weight of the cocoon shell weight was 0.426g (T_2) for R_1 followed by 0.350g for R_2, while the lowest value was 0.339g for R_4. The results show that there were significant differences between the sub-treatments from each other.

Regarding the treatment (T_3) data in Table (2) clear that the highest value of the cocoon shell weight was 0.495g for R_1, followed by.372g for R_2, while the lowest value was 0.319g for R_3

There are highly significant variances between sub treatments. The best outcome for the cocoon shell under the various treatments was R_1.

Table (1): Effect of artificial diet (T1-T2) on fresh cocoon, cocoon shell weight and silk ratio of silkworm, *Bombyx mori* L. in the season2020.

Treatment	Sub Treatment	Season 2020		
		Fresh cocoon weight (g)	Cocoon shell weight (g)	silk ratio %
T1	R1	1.562^{a}	0.308^{a}	19.946^{b}
	R2	1.560^{ab}	0.281^{ab}	19.875^{a}
	R3	1.146^{c}	0.2274^{c}	18.021^{a}
	R4	1.370^{b}	0.2618^{b}	19.166a^{b}
Control		1.563^{b}	0.3007^{ab}	19.494^{a}
F		7.941	7.419	1.801
P		0.000	0.0001	0.145
LSD $_{0.05 \text{ for Sub-treatment}}$		0.191***	0.034***	ns
T2	R1	1.566^{ab}	0.659^{a}	20.514^{a}
	R2	1.486^{a}	0.312^{a}	20.133^{a}
	R3	1.340^{b}	0.236^{a}	17.922^{ab}
	R4	1.404^{ab}	0.275^{a}	19.790^{ab}
Control		1.535^{a}	0.3007^{ab}	19.898^{a}
F		1.538	1.094	1.700
P		0.207	0.371	0.167
LSD $_{0.05 \text{ for Sub-treatment}}$		ns	ns	ns

Table (2): Effect of artificial diet (T1-T2-T3) on fresh cocoon, cocoon shell weight and silk ratio of silkworm, *Bombyx mori* L. in the season 2021.

Treatment	Sub Treatment	Fresh cocoon weight (g)	Cocoon shell weight (g)	Silk ratio%
T1	R1	1.938[a]	0.400a	21.472[a]
	R2	1.712[ab]	0.359ab	21.063[a]
	R3	1.602[b]	0.323b	20.443[a]
	R4	1.586[b]	0.336b	21.007[a]
Control		1.654[b]	0.352b	21.533[a]
F		2.774	3.983	0.214
P		0.038	0.008	0.929
LSD $_{0.05 \text{ for Sub-treatment}}$		0.244*	0.042**	ns
T2	R1	2.070[a]	0.426[a]	23.807[a]
	R2	1.614[b]	0.350[b]	22.925[a]
	R3	1.513[b]	0.353[b]	19.762[b]
	R4	1.759 [b]	0.339[b]	21.169[ab]
Control		1.654b	0.352[b]	21.533[a]
F		5.060	7.674	2.154
P		0.002	0.000	0.090
LSD $_{0.05 \text{ for Sub-treatment}}$		0.270**	0.036***	ns
T3	R1	2.030[a]	0.495a	21.533[a]
	R2	1.886[ab]	0.372[ab]	20.284[a]
	R3	1.574[b]	0.319[c]	20.821[a]
	R4	1.633[b]	0.346[bc]	20.309[a]
Control		1.654[b]	0.352[bc]	21.440[a]
F		2.672	3.071	0.419
P		0.044	0.026	0.794
LSD $_{0.05 \text{ for Sub-treatment}}$		0.336*	0.0516*	ns

Silk ratio (%)

The data presented in Table (1) show that the highest silk cocoon ratio was 19.946% for R_1 with the treatment (T_1), followed by 19.875 % for R_2, and the lowest silk cocoon ratio was 18.02 % for R_3 in comparison with control (19.494 %). Statistical analysis showed that there were no significant changes in the silk ratio produced by the different sub-treatments, further more, T_1 and R_1 gave the best results.

The obtained results show that the highest cocoon silk ratio was 20.514 % for R_1in treatment (T_2), compared to the control group that produced 19.494 %. The following highest percentage of silk ratio was 20.133% for R_2, while the lowest percentage for silk ratio was 17.922 % for R_3. The obtained statistical results show that there were no significant changes between the averages of the different sub-treatments, also, T_2 and R_1achieved the best results in the first season (2020).

Regarding the second season, the data shown in Table (2) clear that the highest cocoon silk ratio was formed from the larvae that fed on the first nutrition (T_1) for the first treatment R_1 (21.472 %), followed by 21.063 % for R_2. Where as, the lowest silk ratio was 20.443% for R_3, compared to control which recorded 21.532%. Statistically analyzed data showed that there were no significant differences between the different treatments of T_1 nutrition, where R_1 gave the best result.

The results were variable in the second nutrition (T_2), as the treatment R_1 gave the highest cocoon silk ratio 23.807%, followed by 22.926 % for R_2, while the lowest mean of cocoon silk ratio was (19.762%) for R_3, followed by 21.169 % for R_4 in comparison to the control 21.532%. There were no significant differences between various treatments, and R_1 obtained the best result.

For the third nutrition (T_3), the maximum cocoon silk ratio was 21.440 % for R_1, followed by 20.821 % for R_3, and the lowest value was 20.284 % for R_2, compared to the control, which recorded 21.532%. There were no significant differences between the means of sub-treatments., and it was determined that R_1 produced the best results.

2. Reeled silk filament parameters

Silk filament length (m)

The data in Table (3) illustrate the influence of artificial nutrition on the silk filament length during 2020 season. According to the results, the longest silk filament length was 1325 m for R_1 (T_2), followed by 1176.600 m for R_1 (T_1), and the shortest silk filament length was 703.6m for R_2 (T_1).

The statistical analysis showed that there were significant differences between the averages of the different treatments of T_1.

Concerning the 2nd nutrition (T_2). In comparison with control which recoded1094.8m. There are significant differences between the averages of the 2nd nutrition treatments.

Table (3): Effect of artificial diet (T_1-T_2) on silk filament length (m), silk filament weight (g) and silk filament size of silkworm, *Bombyxmori* L. in the 2020 season.

Treatment	Sub Treatment	Season 2020		
		Silk Filament length (m)	Silk Filament weight (g)	Silk Filament size(dn)
T_1	R_1	1176.600^{a}	0.240^{a}	1.820^{b}
	R_2	703.600^{b}	0.178^{b}	2.420^{a}
	R_3	1055.600^{a}	0.210^{ab}	1.746^{b}
	R_4	1074.000^{a}	0.192^{ab}	1.602^{b}
Control		1094.800^{a}	0.202^{ab}	1.674^{b}
F		12.823	1.725	5.416
P		0.000	0.184	0.004
LSD 0.05 for Sub-treatment		151.011***	0.052	0.415**
T_2	R_1	1325.000^{a}	0.224^{a}	2.001^{a}
	R_2	877.400^{c}	0.194^{ab}	1.524^{b}
	R_3	903.000^{c}	0.158^{b}	1.577^{b}
	R_4	1157.200^{b}	0.196^{ab}	1.508^{b}
Control		1094.800^{b}	0.202^{ab}	1.674^{ab}
F		12.715	2.286	2.281
P		0.000	0.095	0.096
LSD 0.05 for Sub-treatment		153.784***	ns	ns

Table (4): Effect of artificial diet (T_1-T_2-T_3) on filament length (m), filament weight (g) and filament size (dn) of silkworm, *Bombyxmori* L. in the 2021 season.

Treatment	Sub Treatment	Season 2021		
		Silk Filament length (m)	Silk Filament weight (g)	Silk Filament size (dn)
T_1	R_1	1447.800^a	0.282^a	1.967^a
	R_2	1387.400^a	0.274^a	1.880^a
	R_3	1236.000^{ab}	0.248^a	1.804^a
	R_4	1045.600^b	0.222^a	1.746^a
Control		1063.000^a	0.216^b	1.821^a
F		4.007	1.510	0.387
P		0.015	0.237	0.816
$LSD_{0.05}$ for Sub-treatment		269.685*	ns	ns
T_2	R_1	1879.000^a	0.310^a	1.845^a
	R_2	1414.400^{ab}	0.238^{ab}	1.622^a
	R_3	1584.200^{ab}	0.284^{ab}	1.422^a
	R_4	1429.000^{ab}	0.280^{ab}	1.759^a
Control		1063.000^a	0.216^b	1.821^a
F		2.728	1.487	0.549
P		0.058	0.244	0.702
$LSD_{0.05}$ for Sub-treatment		ns	ns	ns
T_3	R_1	1490.200^a	0.292^a	1.774^a
	R_2	1385.000^{ab}	0.274^{ab}	1.777^a
	R_3	1172.600^{ab}	0.248^{ab}	1.808^a
	R_4	1380.000^{ab}	0.278^{ab}	1.808^a
Control		1063.000^a	0.216^b	1.821^a
F		2.510	1.454	0.030
P		0.074	0.253	0.998
$LSD_{0.05}$ for Sub-treatment		ns	ns	ns

The second season (2021), Table (4) clear that the longest silk filament length was 1447.8m for R_1 with 1^{st} nutrition (T_1), followed by 1387.4m for R_2. While, the shortest silk filament length was 1045.6m for R_4, in comparison with the control which recorded 1063m. Statistical analysis shows that there were significant differences between the means.

For 2^{nd} nutrition, data obtained that the longest filament length was 1879m for R_1, followed by 1584.2m for R_3. While, the shortest silk filament length was 1414.4m for R_2, compared to the control which was 1063m. Statistical analysis shows that there were significant differences between the means.

The data also show that, the longest silk filament length was 1490.2 m for R_1 (T_3), followed by 1385m for R_2, while, the shortest silk filament length was 1172.6m for R_3, in comparison to the control which reached 1063m.

Silk filament weight (g)

The results obtained in Table (3), show that the highest silk filament weight was 0.24g for R_1 in the first nutrition (T_1), followed by 0.21g for R_3. While the lowest silk filament weight was

0.178g for R_2. Statistical analysis showed that there were no significant differences between the means of silk filament weightin the different treatments of T_1 compared with the control 0.202g.

Regarding the second feeding, the highest silk filament weight was 0.224g (T_2) for R_1, followed by 0.196g for R_4, and the lowest silk filament weight was 0.158g for R_3. There were no significant differences between the means of silk filament weight.

The data presented in Table (4) shows the weights of the silk filament for the second season 2021, where the highest silk filament weight was 0.282g for R_1, followed by 0.274g for R_2 for the first nutrition (T_1). While the lowest silk filament weight was 0.222g for R_4. For the second nutrition (T_2), the highest silk filament weight was 0.310g for R_1, followed by 0.284g for R_3, and the lowest value was 0.238g for R_2.

As for the third feeding (T_3), the highest silk filamentweight was 0.292gfor R_1, followed by 0.278g for R_4, while the lowest silk filament weight was 0.248g for R_3. The statistical analysis showed that there were no significant differences between the averages of the different treatments.

Silk filament size

Data in Table (3) show that the highest silk filament size was 2.420dn for R_2, followed by 1.82dn for $R_3$for the first nutrition (T_1). Whereas, the lowest value was 1.602dn for R_4, compared to the control 1.674dn. In second nutrition (T_2), the maximum silk filament size was 2.001dn recorded for R_2, followed by 1.577dn for R_3, and the lowest value was 1.524dn for R_1.

According to Table (4), there were no appreciable differences in the silk filament size in the different sub-treatments in the first nutrition (T_1). The obtained results cleared that R_1 gave the best result. The highest silk filament size was 1.967dn for R_1 followed by 1.880dn for R_2, and the lowest value was 1.746dn for R_4.

For the second nutrition (T_2), the highest silk filament size was 1.844dn for R_1, followed by 1.759dn for R_3, and the lowest value was 1.422dn for R_3.

Regarding the 3rd treatment (T_3), the highest silk filament size was 1.808dn recorded for R_3 and the lowest value being 1.774dn for R_1 and R_2.

From the obtained results, we can conclude that the artificial nutrition's used in the young larval instar (1st and 2nd) gave the best results compared to those used in the mature larvae. Also, the artificial nutrition referred to (T_2) gave the best results for the characteristics of cocoons and silk filament, so it is recommended to use(T_2) with young instar larvae, during the two seasons of the study. This results areagree with Shanthala *et al.* (2003) who reported that Silkworm (*Bombyxmori*) which fed on artificial diets, throughout the second instar, the larvae gained more weight with the diet-fed than in the control. Also, Avramova, and Grekov (2013) who found that the artificial diet method of rearingsilkworms has some advantages over the traditional method of feeding, especially in terms of the artificial diet-fed silkwormsshortened larval period. Moreover, Avramova (2020) who cleared that the key finding is that rearing silk worms using a mix of artificial diets during the summer months would result in higher successful diets in the first three instars and on mulberry leaves in the fourth and fifth instars provide more employment opportunities and higher silkworm reared income.

The food components that make up the artificial dietplay a very important role in the quality of the diet, which in turn reflected in the silkworms as well as the production of natural silk. Nutritional components such as mineral salts, vitamins, amino acids, and protein are great importance in the formation of natural silk, this are in agree with Hayashiya (2001) who reported that the quality of cocoons during the initial stage of artificial rearing, based on the fibroin and sericin contents, effects of diet composition on cocoon shell weight and reelability percentage, rearing using various artificial diets and the characteristics of the resulting cocoon. Also, Miao (2000) who cleared that the nutritional value of various artificial diet ingredients such mulberry leaf powder, defatted soybean meal, sugar, starch, sterols, and other lipids, vitamins, and minerals are very important for produce good silk. The importance of amino acids and their impact on silkworm growth and survival are supported.

Moreover, Miao *et al* (2001) registered that the physical properties of the artificial diet which includes its shape, texture, hardness and viscosity, have direct effect on the feed activity, growth and development of silkworm larvae. Wagiha *et al* (2009) indicated that all these materials were effective in extending the shelf life of the diet as well as improving the rate of growth and productivity of silkworm *B. mori*. The maximum improvement in all tested criteria was occurred with supplementing devoid to the diet, in comparison to the other tested materials.

In addition, the nutritional components are found in the content of natural mulberry leaves, but in different proportions according to the quality of the mulberry leaves provided, which is due to the mulberry variety used, as well as its agricultural processes of fertilization and the use of fertilizers that contain nutrients. The results also agree with Sbrenna *et al* (2000) who found that the best production in terms of the cocoon weight, the cocoon shell weight, and the silk filament length was obtained by larvae reared on a diet containing 25% mulberry leaf powder from its first to fourth instar, and on a diet containing 5% mulberry leaf powder in its last instar. The findings indicated that fake diet preparation might be done to reducethecost without lowering the amount of mulberry leaves in the diet of the last instars. In the opposite study, Boon and Roddee (2020) mentioned that the maximum cocoon weight was observed in the silkworms fed mulberry leaves, which was significantly different (P 0.05).

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الجوانب البيولوجية والتكنولوجية لدودة الحرير المتأثرة بالتغذية الصناعية مقارنة بالتغذية الطبيعية

سماح فتحى حلاوة، احمد أحمد عبد الحميد الدش، محمود سعد ابراهيم سعد،
باسم محمد الدفراوى، أحمد عبد القوى احمد
قسم الحشرات الاقتصادية والحيوان الزراعى– كلية الزراعة – جامعة المنوفية

الملخص العربي

أُجريت هذه الدراسة خلال فصلي الربيع 2020 و 2021 ، لتقييم تأثير أنظمه غذائية صناعية مختلفة على بعض الخصائص البيولوجية والتكنولوجية لدودة الحرير التوتية *Bombyx mori* L ، وقد أشارت النتائج إلى ان الافضل هي التغذية الصناعية الثانية على وجه الخصوص والتى تغذت فيها اليرقات فى اعمارها الصغيره (R_1- R_2)خلال الموسم الاول

بينما في الموسم الثاني، لوحظت أفضل النتائج كانت للتغذية (T1-T2) وان تغذية الاعمار الصغيرة R1-R2 هى الافضل مقارنة مع باقى المعاملات والكنترول من حيث الصفات البيولوجية (وزن اليرقات وفترة العمر اليرقي) وصفات الخيط الحريرى

تدعم الدراسة الحالية الاتجاه نحو استخدام النظم الغذائية الاصطناعية خلال الاعمار الصغيره (الاول والثانى) ، نظرًا لأهميتها في عملية إنتاج الحرير الطبيعي.