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Enhancement of Mulberry Silkworm *Bombyx mori* L. Characters Using Foliar Fertilizers Ascobein

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ABSTRACT

Four concentrations of Ascobein foliar fertilizer were used for treated mulberry leaves. Treated leaves used for fed silkworm, *Bombyx mori* L. larvae during first, first and second, young instar, first to fourth instar and during whole instars. Data were collected for economic traits of whole larval duration (LD), fifth larval instar duration (FD), larval mortality (MP), cocooning percentage (CP), pupation ratio (PR), number of cocoon per liter (C/L), double cocoon percentage (DCP), cocoon crop by number (Crop/No) and weight (Crop/W). Also data of cocoon weight (CW), shell weight (CSW), pupae weight (PW), cocoon shell ratio (CSR), silk productivity (SP) for males and females. Results reveal that, A_4 concentration is the best concentration, treatment G_5 is better treatment. The treatment G_5 with concentration A_4 is the best. It is recommended that, using Ascobein fertilizer for traditional rearing, rearers used mulberry leaves from hug trees that doesn't provided by fertilizers and manure, as well as in case of insufficient of shortage of fertilizers. Also, it is safe to sprinkle Ascobein on mulberry plant and collected the leaves for feeding larvae. So, one of the best alternative solutions is using Ascobein foliar fertilizer in cases of traditional rearing and shortage in fertilizers.

Keywords: silkworm, mulberry, foliar fertilizer, Ascobein, ascorbic acids, citric acid.

INTRODUCTION

Mulberry silkworm, *Bombyx mori* L., is monophagous insect. It is feed on many varieties of genius *Morus*. Some varieties were recommended for commercial cocoon production. Mean yield of mulberry is leaves. To obtain high leaves crop and in turn a high yield of cocoons, it is necessary to keep conditions suitable for its biological characteristics and providing manure and fertilizers periodically Zheng *et al*. (1988).

Insufficient nutrition in mulberry leaves caused negative effects on silkworm traits. It is affect larval growth, mortality percentage, cocoons extended to egg production. So that, the nutrition of the silkworm, *B. mori*, has been of primary importance in sericulture (Ito, 1967).

One of the alternative ways of improvement of larval feeding is enrichment of mulberry leaves with supplementary nutrients such as vitamins. Many studies are accomplished on the effects of mulberry leaves enrichment with vitamin on economic traits and biological parameters, and this review is the first trial for organization of all available data related to vitamins for elucidation of this topic of science (Kanafi *et al*. 2007).

Sometime, fertilizers are insufficient or shortage for strategies crop so silkworm rearers cannot found fertilizers for their mulberry plant. Silkworm should be fed by a good quality of mulberry green leaves to obtain a stable and a good quality of cocoons.

Till now there are many rearers depending on hug trees form local variety for feeding mulberry silkworm larvae. This local variety is poor variety. These trees widespread on canal banks, no fertilizers and manure were provided, so that the quality of leaves is poor (Ghazy and Fouad, 2016).

This study aimed to increase the quality of leaves using Ascobein foliar plant fertilizer to raise the profit of traditional rearers. Also, study the safety of adding Ascobein on mulberry silkworm larvae.

MATERIALS AND METHODS

Mulberry leaves of *Morus alba* var Kokuso-27 was offered to silkworm larvae. During young instar leaves were chopped. While during the grown instars the whole leaves were used. Leaves were offered four times daily. Foam and polyethylene sheets were used during three first instars (Ghazy, 2008).

Experiment was applied in Sericulture Research Station–Al Qanater ElKhiraya-Egypt. Average of rearing room temperature was 24.9 °C ± 0.118 and humidity mean was 72.027% ± 5.693. Larvae disinfectant was adopted according to (Hosny *et al*. 2002). Five hundred larvae from imported Bulgarian silkworm hybrid (G_2 X V_2 X H_1X KK) were kept for each replicate for all treatments. Each treatment was represented by three replicates.

Foliar fertilizer named Ascobein was obtained from General Organization for Agriculture Equalization Fund. (G. O. A. E. F.) - Ministry of Agriculture.

Ascobein is containing organic matter, Citric and Ascorbic acids. Both of Citric and Ascorbic acids are active ingredients. Four concentrations were prepared. Ascobein was diluted using distilled water as follows:

- A_1: 1.33 g/L (recommended concentration for fruit and wood trees).
- A_2: 2.66 g /L.
- A_3: 13.33 g /L.
- A_4: 26.66 g /L.

Leaves dipping in each concentration for five minutes as well as distilled water (Blank treatment). Treated leaves were left for drying using electric fan. Treated mulberry leaves offered one time every day for the follows instars:

- G_1 during first instar only.
- G_2 during first and second instars.
- G_3 during young instars.
- G_4 during first four instars.
- **G_5 during the whole larval duration.**

Fourteen economic characters of whole larval duration (LD), fifth larval instar duration (FD), larval mortality (MP), cocooning percentage (CP), pupation ratio (PR), number of cocoon per liter (C/L), double cocoon percentage (DCP), cocoon crop by number (Crop/No) and weight (Crop/W) were registered. Also, data of cocoon weight (CW), shell weight (CSW), pupae weight (PW), cocoon shell ratio (CSR), silk productivity (SP) for female and male were recorded.

Mortality of silkworm larvae was conducted with following formula:

$$\text{Mortality \%} = \frac{\text{No. of dead larvae}}{\text{Total no. of larvae}} \times 100$$

Ratio of pupation was estimated by the next equation:

$$\text{Pupation ratio \%} = \frac{\text{No. of healthy pupae}}{\text{Correct basic no. of examined}} \times 100$$

Estimation of percentage of cocooning was adopted by using formula of Goudar and Kaliwal (2000):

$$\text{Cocooning \%} = \frac{\text{No. of cocoons formed}}{\text{Total no. of larvae kept}} \times 100$$

Statistical analyses were adopted for collected data using SAS program (1998).

RESULTS AND DISSCUTION

Control and blank treatments acquired lowest performance for all traits under observation. High mortality percentages were observed for control and blank treatments.

Highest concentration of Ascobein cause improving in the characters of no of cocoons/liter, cocooning %, pupation ratio, cocoon weight, cocoon shell weight, cocoon shell ratio, pupae weight, silk productivity, crop by number and weight (Table 1). Fifth and total larval duration didn't affected by using treated mulberry leaves.

From the data registered in Table 2. It cleared that, using treated mulberry leaves during G_5 (whole larval duration) is best treatments followed by G_4, G_3, G_2 and G_1 for economic characters of cocooning percentages, pupation ratio, number of cocoon per liter, double cocoon percentage, cocoon crop by number and weight, weight of cocoon, shell, pupae for female and male, cocoon shell ratio and silk productivity. Insignificant differences were detected for whole larval duration, fifth larval instar duration and larval mortality.

Table 1. Effect of using mulberry leaves treated with different concentrations of foliar fertilizer Ascobein on silkworm, *Bombyx mori* L.

Treatment	Character													
	FD (days)	LD (days)	MP (%)	C/L (No.)	CP (%)	C W (g)	CSW (g)	CSR (%)	PW (g)	SP (cg/day)	PR (%)	DCP (No)	Crop/No (No)	Crop/W (g)
A_1	9.380	27.420	10.220	119.500	89.200	2.035	0.378	18.722	1.595	3.174	93.400	2.720	8920.200	17206.000
A_2	9.300	27.450	11.607	110.680	88.693	2.072	0.383	18.727	1.627	3.185	95.600	3.680	8856.000	16755.300
A_3	9.330	27.380	8.7067	96.460	90.820	2.058	0.400	19.633	1.595	3.437	96.200	3.200	9232.600	19031.100
A_4	9.450	27.380	11.173	94.304	91.320	2.118	0.406	19.400	1.646	3.438	97.600	1.200	9140.000	19424.100
Blank	9.380	27.380	13.440	120.990	72.773	1.820	0.324	17.862	1.433	2.693	96.800	1.320	7481.270	13546.500
Control	9.380	27.380	17.000	148.400	66.037	1.556	0.284	18.702	1.210	2.380	90.000	4.880	6603.670	10276.000
F. between treatments	0.020	0.010	41.140**	532.390**	113.290**	233.070**	209.500**	12.780**	171.400**	220.630**	5.970**	136.720**	233.270**	303.290**
LSD 5%	-	-	1.277	2.391	2.896	0.039	0.009	0.484	0..036	0.079	3.195	0.342	199.200	570.700

Where: A_1, A_2, A_3,A_4 (Treatments) & 1, 2, 3,4 (Concentrations) (*) significant at 0.05, (**) highly significant at 0.01

Table 2. Impact of using mulberry leaves with foliar fertilizers Ascobein on larval instars of silkworm, *Bombyx mori* L.

Treatment	Character													
	FD (days)	LD (days)	MP (%)	C/L (No.)	CP (%)	C W (g)	CSW (g)	CSR (%)	PW (g)	SP (cg/day)	PR (%)	DCP (No)	Crop/No (No)	Crop/W (g)
G_1	9.340	27.490	12.572	120.890	77.595	1.799	0.324	18.139	1.413	2.699	92.830	2.830	7932.780	14384.500
G_2	9.360	27.320	12.017	116.270	83.651	1.860	0.338	18.368	1.460	2.826	94.170	2.870	8353.940	13449.600
G_3	9.380	27.440	11.433	117.690	84.962	1.929	0.358	18.747	1.509	2.976	96.000	2.600	8616.110	16789.200
G_4	9.440	27.360	11.344	114.120	83.028	2.000	0.377	19.185	1.561	3.172	95.500	3.100	8306.170	16838.500
G_5	9.340	27.380	12.756	106.310	86.467	2.127	0.416	19.767	1.647	3.560	96.170	2.770	8652.440	18737.300
F. between Instars	0.010	0.030	2.420	48.790**	13.000**	97.12**	140.200**	16.760**	59.650**	168.320**	1.820	2.690*	20.310**	132.1400**
LSD 5%	-	-	-	2.182	2.643	0.036	0.008	0.442	0.033	0.072	-	0.313	181.900	521.000

Where: G_1, G_2, G_3,G_4 ,G_5 (Instars) & (*) significant at 0.05, (**) highly significant at 0.01

Data of interaction between using different concentrations of Ascobein foliar fertilizer and treated instars of mulberry silkworm illustrated in Table 3. The results obtained showed that, G_5 was the best treatment for each concentration.

G_5 treatment for concentrations of A_1, A_2, A_3 and A_4 were better than blank and control treatments for cocooning percentages (CP), pupation ratio (PR), number of cocoon per liter (C/L), cocoon crop by number (Crop/No) and weight (Crop/W), weight of cocoon (CW), shell (CSW), pupae (PW), cocoon shell ratio (CSR), and silk productivity (SP).

Interaction between using different concentrations and sex of mulberry silkworm were found in Table 4.

Average weight of cocoon, shell and pupae, cocoon shell ratio and silk productivity for female were higher than male for all concentrations. As well as female of blank and control treatments. Also, female and male of all concentrations acquired best average comparison with control and blank treatments.

Data presented in Table 5 showed that, interaction between treated different instars (using Ascobein foliar fertilizer) and sex of mulberry silkworm. Treatment G_5 earned best mean for cocoon, shell and pupae, cocoon shell ratio and silk productivity for female and male with no significant differences for cocoon weight.

Data in Table 6 cleared that, the interaction between using different concentrations of Ascobein foliar fertilizer, treated in stars and sex of mulberry silkworm. Lowest data were observed for control followed by blank treatment for both sexes for CW, CSW, CSR, PW and SP traits. G_5 treatment is the best concentration for A_4, A_3, A_2 and A_1. Treatment G_5 of A_4 concentration acquired best data for characters of cocoon weight, cocoon shell weight, cocoon shell ratio, pupal weight and silk productivity.

From the previous tables, A_4 concentration is the best concentration, treatment G_5 is better treatment. The treatment G_5 with concentration A_4 is best. The positive effect may be due to Ascorbic and citric acids the active ingredients of Ascobein fertilizer. These results are in agreements with those found by Thulasi and Sivaprasad (2013) and Tantray and Trivedy (2016) who reported that, Ascorbic acid yielded significant gains in economic parameters. Nutritional importance of ascorbic acid is well substantiated. Ahsan *et al.* (2013) the effect of vitamin B and vitamin C on the growth and development of *B. mori*, has been studied. Oral supplementation of different concentrations of vitamin B and C to the 3rd, 4th and 5th instar larvae of multivoltine silkworm variety, resulted significant increment in the various growth indices following vitamin supplements with the mulberry leaves. Tantray (2016 and 2017) most insects including silkworm are unable to

synthesize the substance. The animals which cannot synthesize vitamin C (VC), lack an enzyme, L-gulono-1, 4-lactone oxidase, which is essential for synthesis of the VC immediate precursor 2-keto-l-gulonolactone.Three silkworm breeds were fed with three different sources of Ascorbate. The study gives an impression that Ascorbate exerts its impact mainly on gonad than whole larval body. In silkworm, dietary fortification of mulberry leaves with VC has been reported to increase the food consumption, coefficient of utilization and economic traits. Also, Khan and Saha (1996) reported that Citric acid supplementation cause increased the growth of *B. mori*, pupae.

Table 3. Interaction between using different concentrations of Ascobein foliar fertilizer and treated instars of mulberry silkworm, *Bombyx mori* L.

Character / Treatment		FD (days)	LD (days)	M (%)	CW (g)	C S W (g)	CSR (%)	PW (g)	SP (cg/day)	C/L (No)	CP (%)	PR (%)	DCP (%)	Crop/No (No)	Crop/W (g)
A_1	G_1	9.380	27.380	1.400	1.911	0.334	17.534	1.515	2.809	126.000	84.400	85.000	1.200	8440.000	16125.295
	G_2	9.380	27.380	12.200	1.943	0.342	17.725	1.539	2.880	124.320	85.800	92.000	3.200	8580.000	11729.108
	G_3	9.380	27.713	12.733	2.063	0.382	18.676	1.619	3.201	123.760	88.800	94.000	4.600	8880.000	18317.131
	G_4	9.380	27.253	10.000	2.096	0.390	18.985	1.644	3.277	121.520	90.000	97.000	0.800	9000.000	18864.916
	G_5	9.380	27.380	14.767	2.164	0.443	20.692	1.659	3.704	101.920	97.000	99.000	3.800	9701.000	20993.740
A_2	G_1	9.253	28.047	8.833	1.907	0.350	18.448	1.496	2.917	119.280	83.400	92.000	9.200	8340.000	15905.263
	G_2	9.253	27.047	12.200	2.007	0.369	18.615	1.576	3.072	114.800	84.067	94.000	3.200	8340.000	18540.000
	G_3	9.380	27.380	10.400	2.039	0.377	18.640	1.600	3.147	111.580	90.000	96.000	2.400	9000.000	18350.010
	G_4	9.380	27.380	12.600	2.175	0.395	18.692	1.719	3.241	110.320	92.000	96.000	4.000	9200.000	20013.588
	G_5	9.253	27.380	14.000	2.231	0.424	19.240	1.744	3.548	97.440	94.000	100.00	5.600	9400.000	20967.550
A_3	G_1	9.253	27.380	15.600	1.908	0.354	18.678	1.492	2.964	104.720	87.333	95.000	3.800	8733.000	16660.992
	G_2	9.380	27.380	8.000	1.955	0.379	19.505	1.514	3.148	103.320	88.200	95.000	2.800	8820.000	17238.690
	G_3	9.380	27.380	7.133	1.986	0.388	19.772	1.535	3.223	96.880	90.800	96.000	2.000	9800.000	19460.507
	G_4	9.380	27.380	6.867	2.007	0.398	20.029	1.547	3.304	92.620	93.200	97.000	3.800	9320.000	18705.638
	G_5	9.253	27.380	5.933	2.433	0.482	20.179	1.885	4.417	85.120	94.567	98.000	3.600	9490.000	23089.455
A_4	G_1	9.380	27.380	15.600	1.855	0.341	18.464	1.448	2.778	103.040	84.400	97.000	1.600	8480.000	15733.114
	G_2	9.380	27.380	10.700	2.020	0.372	18.573	1.587	3.099	98.650	89.800	97.000	5.000	8980.000	18136.277
	G_3	9.380	27.380	12.133	2.105	0.402	19.415	1.637	3.325	95.760	90.800	98.000	4.800	9080.000	19115.398
	G_4	9.713	27.380	5.200	2.212	0.428	19.830	1.718	3.787	91.280	95.800	98.000	5.200	9580.000	21190.289
	G_5	9.380	27.380	12.233	2.395	0.485	20.720	1.840	4.200	82.880	95.800	98.000	1.800	9580.000	22945.441
Blank	G_1	9.380	27.380	17.000	1.658	0.281	17.011	1.316	2.346	131.600	60.000	94.000	0.000	7000.000	11606.553
	G_2	9.380	27.380	12.000	1.679	0.285	17.086	1.332	2.380	131.040	88.000	97.000	1.800	8800.000	14777.558
	G_3	9.380	27.380	9.200	1.826	0.313	17.278	1.452	2.583	125.580	83.333	98.000	0.600	8333.000	15216.141
	G_4	9.380	27.380	16.400	1.955	0.367	18.869	1.526	3.045	116.480	61.133	99.000	3.600	6133.333	11980.543
	G_5	9.380	27.380	12.600	1.982	0.376	19.066	1.542	3.110	100.240	71.400	96.000	0.600	7140.000	14151.551
Control		9.380	27.380	17.000	1.556	0.284	18.702	1.210	2.380	148.400	66.037	90.000	1.200	6603.667	10275.966
F (treatment X Instar)		0.010	0.030	13.560**	8.040**	8.760**	1.820*	5.970**	14.03 **	15.30**	6.560**	0.970	42.970**	12.530**	26.650**
LSD 5%		-	-	2.854	0.109	0.021	1.198	0.102	0.362	5.346	8.650		0.766	824.390	5848.900

Where: A_1, A_2, A_3,A_4 (Treatments) & 1, 2, 3,4 (Concentrations)& G_1, G_2, G_3,G_4,G_5 (Instars) & (*) significant at 0.05, (**) highly significant at 0.01.

Table 4. Interaction between using different concentrations of foliar fertilizer Ascobein and sex of mulberry silkworm, *Bombyx mori* L.

Treatment	Character									
	C.W (g)		C.S.W (g)		C.S.R (%)		P. W (g)		S.P (cg/day)	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
A_1	2.272	1.799	0.394	0.362	17.376	20.069	1.816	1.374	4.202	2.147
A_2	2.224	1.920	0.387	0.380	17.525	19.929	1.776	1.478	4.119	2.251
A_3	2.260	1.856	0.405	0.396	17.924	21.341	1.791	1.398	4.316	2.507
A_4	2.306	1.929	0.413	0.396	16.496	21.438	1.842	1.450	4.253	2.623
Blank	1.969	1.672	0.325	0.323	16.289	19.229	1.581	1.286	3.471	1.915
Control	1.636	1.476	0.293	0.275	18.175	19.228	1.281	1.139	3.129	1.630
F(TreatmentXSex)	14.590**		5.390**		8.550**		17.400**		13.870 **	
LSD 5%	0.055		0.013		0.506		0.047		0.115	

Where: A_1, A_2, A_3,A_4 (Treatments) & 1, 2, 3,4 (Concentrations) (*) significant at 0.05, (**) highly significant at 0.01

Table 5. Interaction between treated different instars using Ascobein foliar fertilizer and sex of mulberry silkworm, *Bombyx mori* L.

Treatment	Character									
	C.W (g)		C.S.W (g)		C.S.R (%)		P. W (g)		S.P (cg/day)	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
G1	1.940	1.658	0.329	0.319	17.123	19.156	1.549	1.276	3.509	1.889
G2	2.023	1.697	0.346	0.330	17.178	19.557	1.615	1.305	3.691	1.962
G3	2.095	1.763	0.362	0.354	17.344	20.150	1.672	1.346	3.856	2.097
G4	2.341	1.912	0.378	0.376	17.683	20.686	1.715	1.407	4.027	2.317
G5	2.197	1.854	0.421	0.411	18.053	21.480	1.856	1.437	4.490	2.630
F(InstarXSex)	4.630		0.700**		2.900*		5.430**		2.790 *	
LSD 5%	-		0.011		0.455		0.041		0.097	

Where: G_1, G_2, G_3,G_4,G_5 (Instars) & (*) significant at 0.05, (**) highly significant at 0.01.

From the previous results, it's recommended that using Ascobein with concentration A_4 (26.66g /L) for treated mulberry leaves (dipping) for to feed silkworm larvae during all instars G_5 is better for traditional rearers. As well as, in case of shortage or insufficient of fertilizer or manure it could be use Ascobein. It is safe to sprinkling Ascobein on foliar of mulberry plant and harvesting leaves for feeding mulberry silkworm larvae.

Table 6. Interaction between using different concentrations of Ascobein foliar fertilizer, treated instars and sex of mulberry silkworm, *Bombyx mori* L.

Character		CW (g)		CSW (g)		CSR (%)		P W (g)		SP (cg/day)	
Treatment		Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
A_1	G_1	2.133	1.688	0.351	0.317	16.6731	18.395	1.720	1.310	3.742	1.877
	G_2	2.153	1.732	0.360	0.323	16.729	18.721	1.731	1.347	3.844	1.916
	G_3	2.297	1.829	0.396	0.367	17.266	20.086	1.839	1.440	4.227	2.175
	G_4	2.349	1.844	0.407	0.374	17.473	20.497	1.880	1.408	4.340	2.213
	G_5	2.427	1.901	0.455	0.431	18.740	22.644	1.910	1.408	4.855	2.553
A_2	G_1	2.061	1.753	0.357	0.342	17.353	19.543	1.642	1.349	3.806	2.027
	G_2	2.157	1.858	0.373	0.365	17.475	19.755	1.723	1.430	3.979	2.163
	G_3	2.199	1.879	0.384	0.371	17.517	19.763	1.753	1.448	4.098	2.195
	G_4	2.235	2.116	0.380	0.409	17.527	19.857	1.793	1.645	4.057	2.425
	G_5	2.467	1.994	0.436	0.413	17.754	20.727	1.969	1.520	4.652	2.444
A_3	G_1	2.083	1.733	0.366	0.341	17.636	19.721	1.655	1.329	3.906	2.023
	G_2	2.140	1.769	0.381	0.377	17.772	21.239	1.697	1.330	4.063	2.233
	G_3	2.186	1.786	0.390	0.386	17.887	20.497	1.734	1.337	4.162	2.284
	G_4	2.209	1.806	0.400	0.395	17.672	21.657	1.747	1.347	4.261	2.347
	G_5	2.680	2.187	0.486	0.479	18.047	22.012	2.123	1.646	5.189	3.646
A_4	G_1	1.901	1.811	0.318	0.364	18.279	22.079	1.520	1.376	3.399	2.159
	G_2	2.206	1.833	0.377	0.367	17.104	19.824	1.767	1.407	4.026	2.171
	G_3	2.322	1.888	0.397	0.408	17.115	20.031	1.863	1.410	4.232	2.418
	G_4	2.386	2.038	0.418	0.438	17.150	21.680	1.898	1.538	4.457	3.117
	G_5	2.713	2.077	0.483	0.487	17.584	22.075	2.160	1.520	5.152	3.248
Blank	G_1	1.826	1.490	0.288	0.273	17.859	23.581	1.476	1.155	3.076	1.616
	G_2	1.844	1.515	0.298	0.304	15.797	18.225	1.489	1.174	3.106	1.655
	G_3	1.930	1.722	0.298	0.298	16.073	18.484	1.560	1.343	3.290	1.877
	G_4	2.119	1.791	0.342	0.330	17.294	20.445	1.690	1.363	3.919	2.171
	G_5	2.123	1.840	0.367	0.366	17.509	20.623	1.692	1.393	3.964	2.255
Control		1.636	1.476	0.293	0.275	18.175	19.228	1.281	1.139	3.129	1.630
F (Treatment X Instar X Sex)		2.170**		0.850**		0.460**		2.000**		2.200**	
LSD 5%		0.109		0.021		1.198		0.102		0.362	

Where: A_1, A_2, A_3,A_4 (Treatments) & 1, 2, 3,4 (Concentrations)& G_1, G_2, G_3,G_4 ,G_5 (Instars) & (*) significant at 0.05, (**) highly significant at 0.01.

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تحسين صفات ديدان الحرير التوتية *Bombyx mori* L. بإستخدام المخصبات الورقية الأسكوبين

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تم إستخدام أربعة تركيزات من المخصب الورقي الأسكوبين ومعاملة أوراق التوت ثم إستخدام الأوراق المعاملة في تغذية يرقات ديدان الحرير التوتية *Bombyx mori* L. خلال العمرالأول، العمر الأول والثاني، الأعمار الصغيرة، من العمر الأول حتي العمر الرابع وكذلك تغذية جميع الأعمار. وتم جمع بيانات الصفات الإقتصادية طول العمر اليرقي الكامل، طول العمر اليرقي الخامس ، نسبة الموت اليرقية ، النسبة المئوية لتكوين الشرانق ، النسبة المئوية للتعذير ، عدد الشرانق في اللتر ، النسبة المئوية للشرانق المزدوجة ، محصول الشرانق بالعدد والوزن . أيضا بيانات وزن الشرنقة ، وزن الغلاف ، وزن العذراء ، نسبة المحتوي الحريري و إنتاجية الحرير لكلا من الذكور والإناث . وقد أظهرت النتائج أن التركيز A4 كان أفضل التركيزات والمعاملة G5 كانت أفضل المعاملات . وكانت المعاملة G5 مع التركيز A4 كانت الأفضل . لذا يوصي بإستخدام مخصب الأسكوبين في التربية التقليدية حيث أن المربي التقليدي يستخدم أوراق التوت من الأشجار الضخمة والتي لا يتم تسميدها كيماوي أو عضوي ، وبالمثل في حالة عدم كفاية أو نقص الأسمدة . أيضا من الآمن رش مخصب الأسكوبين علي نباتات التوت وجمع الأوراق لتغذية اليرقات . لذلك يعتبر إستخدام المخصب الورقي الأسكوبين من الحلول البديلة في حالات التربية التقليدية ونقص الأسمدة .