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Efficacy of Mulberry Varieties on Young Instars Larvae of Silkworm, *Bombyx mori* L.

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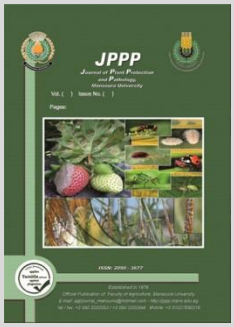

ABSTRACT

Six mulberry varieties were selected for feeding young silkworm, *Bombyx mor*i L. These varieties were *Morus alba* Linn. Var. Iljiros (A), *Morus Ihou* Koidz. Var. Josaengrok (B), *Morus alba* Linn. Var. Kearyang-Seoban (C), *Morus Ihou* Koidz. Var. Nosang (D), *Morus alba* Linn. Var. Afiluniz (E) and *Morus alba* Linn. Var. Kokuso-27(G). During the 4th and 5th larvae instar of silkworm instar, nutritional were tested, data were collected on the biomass of larvae and cocoons for 6 treatments on ingesta, digesta, excreta, approximate digestibility (AD), reference ratio (RR), consumption index (CI), relative growth rate (RGR), respiration (R) and metabolic rate (MR), efficiency conversion of ingesta (ECI) and digesta (ECD) for larva, cocoon, and shell. Further, the ingesta and digesta required for producing one gram of cocoon and shell (I/g and D/g). Characters of young instars duration (YID), fifth duration (FID), total larval period (TLD), cocooning percentage (CP), pupation ratio (PR), sex ratio (SR), number of cocoons/liter (C/L), fresh cocoon weight (FCW), fresh cocoon shell weight (FCSW), fresh pupa weight (FPW), fresh cocoon shell ratio (FCSR) and silk productivity (SP) for female and male. In addition to length of silk filament (FL), weight of silk filament (FW), size of reeled thread (denier; FS) and silk ratio (SR) were investigated.

Keywords: Mulberry varieties, silkworm, young instars, food utilization parameters, economic characters.

INTRODUCTION

The mulberry silkworm, *Bombyx mori*, is a domesticated monophagous insect. It is feed on the leaves of mulberry (*Morus* spp) only for its nutrition (Ramesha *et al.* 2010). Variety mulberry play vital role and cultivated for silkworm rearing. Their leaves are the source of nutrition for growth and development of silkworms (Tang *et al.* 2006). Productivity of the silkworm was controlled by mulberry leaf quality (38.20%), climate (37.00%), silkworm rearing techniques (9.30%), silkworm races (4.20%), silkworm eggs (3.10%) and other factors (8.20%). The two factors that affect most of the successful cocoon crop production are environment and leaf quality (Miyashita, 1986 and Murthy *et al*. 2013a).

Sericulture is a sustainable, eco-friendly and agro-forestry oriented trade comprising cultivation of mulberry plant varieties, rearing of silkworms, and production of silk. It is one of the most labor-intensive sectors and has played a critical role in development and economic growth. Most of the marketable silk around the world is being produced from the mulberry silkworm, *B. mori*, Relationship between the environment and genes depending on the genetic of an organism (Giacobino *et al*. 2003; Milner, 2004; Kang, 2008 and Ogunbanwo & Okanlawon, 2009).

Feed consumption has an impact on larval weight, cocoon weight, silk production and number of eggs laid by a moth. Mulberry leaf quality is an important key influencing the growth and development of silkworm, as the insect obtained all the nutrients from mulberry leaf (Bahar *et al*. 2011). Hence, in recent years maximum attention has been given for the improvement of mulberry in terms of both quality and quantity (Chaudhary and Giridhar, 1987). Quality of mulberry leaves plays a critical role in the economy of sericulture industry (Das and Sikdar, 1970).

Among the various factors influencing silkworm growth and cocoon production, leaf quality plays a major role (Bose, 1989). It is a confirmed fact that, leaf quality differs among mulberry varieties which in turn responsible for the difference in silkworm rearing performances (Aruga, 1994).

The experiments aim to study the utilization of food for six mulberry varieties determined best mulberry varieties to recommend in young larval instar rearing. Also, explain effect of different mulberry varieties on economic traits of silkworm, *B. mori*.

MATERIALS AND METHODS

Five mulberry varieties were used for feeding young silkworm, *Bombyx mori* L. furthermore the recommended variety of Sericulture Research Department (SRD). These varieties were *Morus alba* Linn. Var. Iljiros, *Morus Ihou* Koidz. Var. Josaengrok, *Morus alba* Linn. Var. Kearyang-Seoban, *Morus Ihou* Koidz. Var. Nosang, *Morus alba* Linn. Var. Afiluniz and recommended variety of *Morus alba* Linn. Var. Kokuso-27. These varieties were coded as A, B, C, D, E and G, respectively. It used for feeding young instars. After the third moult the recommended variety used for feeding the fourth and the fifth instar for all treatments. Each treatment was started with three replicates.

Larvae of silkworm, *B. mori*. hybrid of Giza C were used for the experiments. It was obtained from breeding program of the Sericulture Research Department of The Agriculture Research Center, Giza, Egypt (Ghazy, 2012). Silkworms were reared under the normal conditions. The average of room temperature was 21.54 ±1.60 ºC While the relative humidity was 59.27 ± 7.35%. Foam strips and polythene sheet used as bottom and cover during young instars (Ghazy, 2008). Chopped mulberry leaves and whole leaves were offered four times for young and fourth instars. Shoots were offered for fifth instars.

During the 4th and 5th silkworm nutritional are study, data are collected on the biomass of larvae and cocoons for 6 treatments on ingesta (g), digesta (g), excreta (g), approximate digestibility (AD%), reference ratio (RR/g),

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consumption index (CI g/larvae/day), relative growth rate (RGR g/larvae/day), respiration (R/g) and metabolic rate (MR g/larvae/day), efficiency conversion of ingesta (ECI%) and digesta (ECD%) for larva, cocoon, and shell.

Further, the ingesta and digesta required for producing one gram of cocoon and shell (I/g and D/g) were collected and calculated as described by standard gravimetric methods (Waldbauer 1968; Scriber & Feeny 1979; Kogan & Parra 1981 and Slansky & Scriber 1985), the equations with brief description of the nutriagenetic traits evaluated given below.

Ingesta (g) = Dry weight of leaf fed (g) – dry weight of left over leaf (g).

Digesta (g) = Dry weight of leaf ingested (g) – dry weight of litter (g).

Excreta (g) = Ingesta (g) – Digesta (g).

$$\text{AD (\%)} = \frac{\text{Dry weight of digesta(g)}}{\text{dry weight of food ingested(g)}} \text{X100}$$

$$\text{RR (g)} = \frac{\text{Dry weight of food ingested(g)}}{\text{dry weight of excreta (g)}} \text{X100}$$

$$\text{CI (g/larvae/day)} = \frac{\text{Ingesta}}{\text{stage mean fresh larval weight (g) X stage larval duration (day)}}$$

$$\text{RGR (g/larvae/day)} = \frac{\text{Weight gain of the larva during feeding period (g)}}{\text{stage mean fresh larval weight (g) X stage larval duration (day)}}$$

R (g) = Dry weight of food digested (g) – Maximum dry weight of larvae (g).

$$\text{MR (g/larvae/day)} = \frac{\text{Respiration}}{\text{stage mean fresh larval weight (g) X stage larval duration (day)}}$$

$$\text{ECI larvae (\%)} = \frac{\text{Maximum dry weight of larvae (g)}}{\text{dry weight of ingesta(g)}} \text{X100}$$

$$\text{ECD larvae (\%)} = = \frac{\text{Maximum dry weight of larvae(g)}}{\text{dry weight of digesta(g)}} \text{X100}$$

$$\text{ECI cocoon (\%)} = = \frac{\text{Dry weight of cocoon (g)}}{\text{dry weight of ingesta (g)}} \text{X100}$$

$$\text{ECDcocoon (\%)} = = \frac{\text{Dry weight of cocoon (g)}}{\text{dry weight of digesta(g)}} \text{X100}$$

$$\text{ECI shell (\%)} = = \frac{\text{Dry weight of shell(g)}}{\text{dry weight of ingesta(g)}} \text{X100}$$

$$\text{ECD shell (\%)} = \frac{\text{Dry weight of shell(g)}}{\text{dry weight of digesta(g)}} \text{X100}$$

$$\text{(I/g) cocoon} = \frac{\text{Dry weight of ingesta(g)}}{\text{dry weight of cocoon (g)}}$$

$$\text{(D/g) cocoon} = = \frac{\text{Dry weight of digesta(g)}}{\text{dry weight of cocoon (g)}}$$

$$\text{(I/g) shell} = = \frac{\text{Dry weight of ingesta(g)}}{\text{dry weight of shell(g)}}$$

$$\text{(D/g) shell} = = \frac{\text{Dry weight of digesta(g)}}{\text{dry weight of shell(g)}}$$

Characters of young larval instars duration (YID/days), fifth duration (FID/days), total larval duration (TLD/days), cocooning percentage (CP%), pupation ratio (PR%), sex ratio (SR%), number of cocoon/liter (C/L,No.), fresh cocoon weight (FCW/g), fresh cocoon shell weight (FCSW/g), fresh pupa weight (PW/g), fresh cocoon shell ratio (FCSR%) and silk productivity (SP cg/d) according formula of Chattopadhyay *et al*. (1995) for female and male. In addition length of silk filament (FL/m), weight of silk filament (FW/g), size of reeled thread (denier; FS/d) and silk ratio (SR%) were recorded. Statistical analysis was applied to the collected data using SAS program (1998).

RESULTS AND DISCUSSION

Data presented in Table (1), described the effect of some mulberry varieties on food utilization of silkworm *B. mori*. There were highly significant differences between all varieties for all nutritional parameters except digesta parameter.

Lowest ingesta parameter was observed for E followed by A and B., highest ingesta recorded for G, C and D. Regardless the insignificant differences of digesta parameter, highest values registered for E and A. the lowest value recorded for B, D, C and G. Lowest excreta were observed for varieties of E, A and B. And highest showed for G, C and D varieties. Lowest values were obtained for G, C and D for AD parameter. Highest were appeared for E, A and B varieties. Varieties of E, A and B registered highest values for reference ratio (RR) parameter, lowest values were appear for C, D and G varieties.

Parameter of CI (consumption index) showed highest average for C, D and G varieties. Lowest value noticed for the other varieties. Relative growth rate (RGR) parameter revealed highest value for G, C and D varieties. Lowest respiration (R) was found in G, C and D comparing with the remaining varieties.

Between the examined varieties, metabolic rate (MR) was recorded highest value for C, D and G. So, varieties of G, C, and D have lowest averages for AD, RR and R parameters. Varieties of G, C, and D acquired highest means for ingesta, digesta, excreta, CI, RGR and MR parameters.

These results are in coincidence with those founded by Sabhat *et al*. (2019) evaluate the nutritional efficiency of selected silkworm breeds of *Bombyx mori* L. reared on different varieties of mulberry under temperate climate. They concluded that variety of Goshoerami has higher mean values of ingesta, digesta, growth rate, and consumption index followed by Ichinose and Kokuso-20 varieties.

Table 1. Effect of some mulberry varieties on food utilization of silkworm *B. mori*.

Varieties characters	A	B	C	D	E	G	F varieties	LSD 0.05
Ingesta	2.555	2.570	2.633	2.598	2.541	2.667	146.910**	0.117
Digesta	2.194	2.188	2.193	2.190	2.200	2.193	0.610	-
Excreta	0.362	0.383	0.440	0.409	0.342	0.474	168.070**	0.011
AD	88.180	87.415	85.883	86.762	89.083	84.644	142.950**	0.390
RR	9.300	8.614	7.698	8.243	10.409	6.921	83.440**	0.391
CI	0.249	0.247	0.293	0.289	0.249	0.274	4357.960**	0.001
RGR	0.122	0.123	0.141	0.139	0.119	0.148	192.740**	0.002
R	1.856	1.833	1.825	1.828	1.874	1.803	22.400**	0.015
MR	0.192	0.188	0.221	0.219	0.195	0.199	1000.490**	0.001

Where: (*) significant at 0.05, (**) highly significant at 0.01.

Table 2. represented the differences between instars and interaction of varieties and instars for some mulberry varieties on food utilization. The differences were highly significant between instars and the interaction of varieties X instars for parameters of ingesta, digesta, excreta, AD, RR, CI, RGR, R and MR parameters except AD for the interactions.

For the differences between instar, parameters of 5th larval instar has highest values for ingesta, digesta, excreta and R than fourth instar. Lowest values were observed for AD, RR, CI, RGR and MR parameters for fifth instar comparing with fourth instar. About the interaction between varieties and instars, varieties of G, C and D earned highest results for ingesta, digesta, excreta, CI , RGR of fourth and fifth instars except digesta for G, C and D also, (CI) for C and D of fifth instar. Also, G, C and D have lowest values for (AD) and (RR).

For respiration (R) and metabolic rate (MR) highest values registered for fourth instar and lowest values for fifth instar of G, C and D varieties.

The previous results are agreed with those founded by Kumar and Kumar (2011) evaluating the nutritive value of eleven mulberry, *Morus* sp. (Moraceae) varieties. They showed that variety of G-9 earned highest ingesta and digesta parameters, and lowest for digestibility.

Effect of some mulberry varieties on food efficiency conversion showed that in Table (3) highly significant differences were detected for ECI and ECD parameters of larvae, cocoon and shell, ingesta per gram (I/g), digesta per gram (D/g) parameters for cocoon and shell parameters. Varieties of G, C and D have highest values for ECI larvae, ECD larvae, ECI cocoon, ECD cocoon, ECI shell and ECD shell parameters. And lowest values of I/g cocoon, D/g cocoon, I/g shell and D/g shell parameters.

These results are confirmed by the results of Ramesha *et al*. (2011) they recorded that, race of RMG_4 was highest mean of efficiency of conversion of ingesta and digesta to larval biomass ECI larvae and ECD larvae), efficiency of conversion of ingesta and digesta to cocoon and shell (ECI cocoon, ECD cocoon, ECI shell and ECD shell) while, it was lowest for ingesta and digesta per gram to cocoon and shell (I/g cocoon, I/g shell, D/g cocoon and D/g shell).

Table 2. Differences between instars and interaction of varieties X instars of some mulberry varieties on food utilization.

Varieties characters		A	B	C	D	E	G	Mean	F Instars	LSD 0.05	F varieties X instars	LSD 0.05
Ingesta	4th	0.862	0.881	0.914	0.892	0.843	0.934	0.888	1097309.000**	0.007	17.940**	0.017
	5th	4.248	4.259	4.351	4.305	4.239	4.400	4.301				
Digesta	4th	0.791	0.801	0.821	0.808	0.783	0.825	0.805	419301.000**	0.009	12.950**	0.022
	5th	3.597	3.574	3.564	3.572	3.616	3.560	3.581				
Excreta	4th	0.072	0.080	0.092	0.084	0.060	0.109	0.083	41487.400**	0.007	75.640**	0.016
	5th	0.652	0.685	0.788	0.733	0.623	0.840	0.720				
AD	4th	91.698	90.909	89.870	90.552	92.861	88.375	90.711	4641.830**	0.225	1.920	-
	5th	84.661	83.922	81.900	82.971	85.306	80.912	83.278				
RR	4th	12.076	11.006	9.873	10.614	14.010	8.603	11.030	2087.000**	0.226	23.320**	0.553
	5th	6.524	6.223	5.524	5.873	6.807	5.239	6.032				
CI	4th	0.339	0.341	0.426	0.418	0.334	0.384	0.374	673050.000**	0.001	4323.890**	0.001
	5th	0.160	0.153	0.159	0.159	0.164	0.165	0.160				
RGR	4th	0.155	0.156	0.186	0.184	0.151	0.194	0.171	12353.000**	0.001	68.920**	0.003
	5th	0.089	0.090	0.096	0.095	0.088	0.101	0.093				
R	4th	0.689	0.698	0.716	0.703	0.683	0.704	0.699	278719.000**	0.009	44.040**	0.022
	5th	3.022	2.969	2.934	2.953	3.064	2.901	2.974				
MR	4th	0.271	0.270	0.334	0.330	0.270	0.290	0.294	253716.000**	0.001	1342.930**	0.002
	5th	0.114	0.106	0.107	0.109	0.119	0.109	0.111				

Where: (*) significant at 0.05, (**) highly significant at 0.01.

Table 3. Effect of some mulberry varieties on food efficiency conversion.

Varieties characters	A	B	C	D	E	G	F varieties	LSD 0.05
ECI Larvae	12.628	12.955	13.008	13.054	12.433	13.972	1230.740**	0.044
ECD Larvae	14.385	14.901	15.258	15.414	14.010	16.591	946.980**	0.085
ECI cocoon	33.269	33.423	33.502	33.635	33.414	37.448	2010.090**	0.107
ECD Cocoon	36.791	37.290	37.908	37.727	36.511	43.058	1083.660**	0.216
ECI Shell	13.252	13.424	13.772	13.941	12.939	16.485	6890.240**	0.045
ECD Shell	14.655	14.977	15.583	15.637	14.138	18.955	3158.290**	0.089
I/g cocoon	5.357	5.267	5.203	5.228	5.407	4.622	1416.200**	0.022
D/g cocoon	4.599	4.483	4.333	4.406	4.680	3.800	907.910**	0.030
I/g shell	13.448	13.113	12.657	12.613	13.963	10.500	4414.730**	0.053
D/g shell	11.545	11.162	10.541	10.630	12.087	8.633	2271.710**	0.073

Where: (*) significant at 0.05, (**) highly significant at 0.01.

Differences between larval instars and interaction of varieties and instars of some mulberry varieties on food efficiency conversion were found in Table.4. The differences between instars and interaction of varieties and instars were highly significant. Fifth instar has highest averages for ECI larvae, ECD larvae, I/g cocoon, D/g cocoon, I/g shell and D/g shell. And lowest averages for ECI cocoon, ECD cocoon, ECI shell and ECD shell parameters.

Generally interaction between varieties and instars revealed that, varieties of G, C and D have highest averages for ECI larvae, ECD larvae, ECI cocoon, ECD cocoon, ECI shell and ECD shell criteria for fourth and fifth instars. Lowest averages of G, C and D varieties noticed for I/g cocoon, D/g cocoon, I/g shell and D/g shell parameters. Data revealed that the qualities of leaves are differed according to the mulberry variety. So some varieties are good in feeding young instar silkworm larvae than other.

These results are in agreement with those founded by (Matsumara, 1951 and Bongale *et al.* 1997) they reported that, among the various factors influencing silkworm growth and cocoon production, leaf quality plays a major role. It is a confirmed fact that, leaf quality differs among mulberry varieties which in turn responsible for the difference in silkworm rearing performances.

Results obtained in Table.5. Characterized the effect of different mulberry varieties on the young instars larvae of silkworm economic characters, there were highly significant differences for all traits except those of FL and SR.

Results revealed that, varieties of G, C and D have best results for young instar duration (YID), fifth instar duration (FID), total larvae duration (TLD), cocooning percentage (CP), pupation ratio (PR), number of cocoon/liter (C/L), fresh cocoon weight (FCW), cocoon shell weight (CSW), cocoon shell ratio (CSR), silk productivity (SP), filament length (FL), filament weight (FW), filament size (FS) and silk ratio (SR) traits.

Similar results are obtained by Murthy *et al*. (2013 b) assessment six mulberry varieties for some economic characters of silkworm, *B. mori*. they registered that, variety Tr8 was the highest values of single cocoon weight, single shell weight, shell weight percentage, filament length.

Data arranged in Table (6), determined the differences between sex and interaction of varieties and sex on some mulberry varieties fed the young instars larvae. Differences between sexes were highly significant. While, insignificant differences were detected for the interaction of varieties and sex. It is obvious that, the results of females are

highest comparing males except the fresh cocoon shell ratio (FCSR) character. For the interaction between varieties and sex, varieties of G, C and D acquired best results for females and males of fresh cocoon weight (FCW), fresh cocoon shell weight (FCSW), fresh pupae weight (FPW), fresh cocoon shell ration (FCSR) and silk productivity (SP) characters.

Table 4. Differences between instars and interaction of varieties X instars of some mulberry varieties on food efficiency conversion.

Varieties characters		A	B	C	D	E	G	Mean	F Instars	LSD 0.05	F varieties X instars	LSD 0.05
ECI Larvae	4th	11.734	11.691	11.557	11.728	11.836	12.956	11.917	31230.400**	0.026	440.010**	0.062
	5th	13.522	14.219	14.460	14.379	13.030	14.987	14.100				
ECD Larvae	4th	12.797	12.860	12.859	12.952	12.746	14.660	13.146	25873.400**	0.049	203.670**	0.120
	5th	15.972	16.943	17.656	17.331	15.275	18.522	16.950				
ECI Cocoon	4th	55.309	55.387	55.375	55.724	55.740	61.782	56.553	2265049.000**	0.062	664.290**	0.151
	5th	11.229	11.458	11.629	11.546	11.087	13.114	11.677				
ECD Cocoon	4th	60.317	60.927	61.617	61.539	60.026	69.909	62.389	642351.000**	0.125	316.990**	0.305
	5th	13.264	13.653	14.199	13.915	12.996	16.208	14.039				
ECI Shell	4th	22.031	22.246	22.763	23.097	21.584	27.197	23.153	2115139.000**	0.026	2472.140**	0.064
	5th	4.428	4.602	4.780	4.785	4.293	5.773	4.784				
ECD Shell	4th	24.026	24.470	25.329	25.507	23.244	30.774	25.558	633816.000**	0.051	1031.330**	0.126
	5th	5.283	5.484	5.837	5.768	5.032	7.135	5.757				
I/g Cocoon	4th	1.808	1.805	1.806	1.795	1.794	1.618	1.771	1220934.000**	0.013	801.110**	0.031
	5th	8.905	8.728	8.600	8.662	9.020	7.626	8.590				
D/g Cocoon	4th	1.658	1.642	1.623	1.625	1.666	1.431	1.607	430646.000**	0.018	479.000**	0.043
	5th	7.539	7.324	7.043	7.187	7.695	6.170	7.160				
I/g Shell	4th	4.539	4.495	4.393	4.330	4.633	3.677	4.345	1293619.000**	0.030	2269.120**	0.074
	5th	22.357	21.730	20.920	20.897	23.293	17.322	21.087				
D/g Shell	4th	4.162	4.086	3.948	3.920	4.302	3.250	3.945	444915.000**	0.042	1096.480**	0.103
	5th	18.929	18.237	17.133	17.339	19.871	14.016	17.587				

Where: (*) significant at 0.05, (**) highly significant at 0.01.

These results are in agreements with the findings of Murthy *et al.* (2013 c) they investigated ten mulberry varieties. The results showed that, silkworms reared on S1708 leaves recorded highest ten larval weight, cocoon weight, shell weight, shell percentage, filament length, denier and E.R.R.

Table 5. Effect of different mulberry varieties on the young instars larvae of silkworm economic characters.

Varieties characters	A	B	C	D	E	G	F Varieties	LSD 0.05
YID	17.217	17.090	16.100	16.033	17.034	16.009	94.240**	0.187
FID	9.234	9.226	8.670	8.773	9.333	8.101	6.670**	0.563
TLD	35.482	35.327	32.828	32.887	35.424	32.799	34.270**	0.742
CP	94.573	95.975	98.249	96.821	94.068	99.421	36.500**	0.975
PR	95.415	96.290	98.588	97.362	93.967	99.964	66.050**	0.758
C/L	170.400	168.800	154.400	164.800	171.200	151.600	6.410**	9.520
FCW	1.158	1.164	1.202	1.174	1.149	1.242	5.870**	0.040
FCSW	0.213	0.216	0.244	0.227	0.211	0.257	21.250**	0.011
FPW	0.925	0.934	0.960	0.938	0.907	0.998	7.020**	0.034
FCSR	18.544	19.120	20.589	19.472	18.437	20.929	14.270**	0.768
SP	2.308	2.337	2.814	2.484	2.257	3.169	63.420**	0.123
FL	930.000	937.000	965.000	961.00	926.500	990.500	0.700	-
FW	0.190	0.196	0.208	0.206	0.182	0.254	14.780**	0.019
FS	1.817	1.890	1.946	1.936	1.816	2.313	5.890**	0.216
SR	39.487	40.677	41.940	41.483	38.952	44.411	1.330	-

Where: (*) significant at 0.05, (**) highly significant at 0.01.

Table 6. Differences between sex and interaction of varieties X sex on some mulberry varieties fed the young instar larvae.

Varieties characters		A	B	C	D	E	G	Mean	F Sex	LSD 0.05	F varieties X sex	LSD 0.05
FCW	♀	1.286	1.297	1.350	1.299	1.268	1.389	1.315	518.770**	0.023	0.660	-
	♂	1.031	1.032	1.055	1.049	1.030	1.095	1.048				
FCSW	♀	0.221	0.224	0.249	0.233	0.218	0.263	0.235	16.610**	0.007	0.140	-
	♂	0.205	0.207	0.240	0.221	0.203	0.251	0.221				
FPW	♀	1.045	1.062	1.104	1.064	1.019	1.139	1.072	684.040**	0.019	0.990	-
	♂	0.805	0.806	0.817	0.812	0.795	0.858	0.815				
FCSR	♀	17.232	17.300	18.408	17.922	17.209	18.938	17.835	223.220**	0.443	1.910	-
	♂	19.855	20.940	22.770	21.023	19.666	22.919	21.196				
SP	♀	2.398	2.428	2.866	2.651	2.336	3.246	2.654	25.190**	0.073	0.750	-
	♂	2.219	2.246	2.762	2.317	2.178	3.092	2.469				

Where: (*) significant at 0.05, (**) highly significant at 0.01.

CONCLUSION

Varieties of G, C, and D acquired highest means for ingesta, digesta, excreta, CI, RGR, MR, ECI larvae, ECD larvae, ECI cocoon, ECD cocoon, ECI shell and ECD shell.

Generally interaction between varieties and instars revealed that, varieties of G, C and D have highest averages for ECI larvae, ECD larvae, ECI cocoon, ECD cocoon, ECI shell and ECD shell criteria for fourth and fifth instars parameters. Varieties of G, C and D have best results for young instar duration (YID), fifth instar duration (FID), total larvae duration (TLD), cocooning percentage (CP), pupation ratio (PR), number of cocoon/liter (C/L), fresh cocoon weight (FCW), cocoon shell weight (CSW), cocoon shell ratio (CSR), silk productivity (SP), filament length (FL), filament weight (FW), filament size (FS) and silk ratio (SR) traits. And, the same varieties have lowest averages for AD, RR, R, I/g cocoon, D/g cocoon, I/g shell and D/g shell parameters. Lowest

averages of G, C and D varieties noticed for I/g cocoon, D/g cocoon, I/g shell and D/g shell criteria for fourth and fifth instars.

Some varieties are good in feeding young instar silkworm larvae than other. So that, the varieties of *Morus alba* Linn. Var. Kokuso-27 (G), *Morus alba* Linn. Var. Kearyang-Seoban (C) and *Morus Ihou* Koidz. Var. Nosang (D) are recommended for young silkworm rearing.

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كفاءة أصناف التوت بالنسبه للأعمار اليرقية الصغيرة لديدان الحرير التوتيه *Bombyx mori* L.

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تم إستخدام ستة أصناف من التوت لتغذيه الأعمار الصغيرة من دودة الحرير التوتية *Bombyx mori* L. هذه الأصناف كانت *Morus alba* Linn. Var. Iljiros (A), *Morus Ihou* Koidz. Var. Josaengrok (B), *Morus alba* Linn. Var. Kearyang-Seoban (C), *Morus Ihou* Koidz. Var. Nosang (D), *Morus alba* Linn. Var. Kokuso-27(G)والصنف *Morus alba* Linn. Var. Afiluniz (E). خلال العمر الرابع و الخامس تمت الدراسة الغذائية و تجميع البيانات علي اليرقات والشرانق لستة معاملات و هم كمية الغذاء المتناول، كميه الغذاء المهضوم، الإخراج، قابليه الهضم التقريبية (AD %) ، النسبه المرجعية (RR)، معدل الإستهلاك (CI)، معدل النمو (RGR) ،التنفس (R)، معدل التمثيل (MR)، كفاءه تحويل الغذاء المبتلع لكتله الجسم (ECI)، كفاءة تحويل الغذاء المهضوم لكتلة الجسم (ECD) لكلا من اليرقات و الشرانق و غلاف الشرانق. علاوة علي قياسات كميه الغذاء المتناول، كميه الغذاء المهضوم اللازمة لإنتاج واحد جرام من الشرانق و واحد جرام من غلاف الشرانق (I/g and D/g). و تم فحص عدد من الصفات و هي طول الأعمار اليرقيه الصغيرة (YID) ،طول العمر الخامس (FID)، طول الفترة اليرقية (TLD)، نسبة التشرنق (CP) ،نسبة التعذير (PR) ،النسبة الجنسية (SR) ،عدد الشرانق في اللتر (C/L) ،وزن الشرانق الطازجه (FCW) ،وزن غلاف الشرانق الطازج (FCSW) ، وزن العذراء الطازجه (FPW) ،نسبه المحتوي الحريري الطازج (FCSR) و إنتاجية الحرير (SP) و ذلك لكلا من الذكور و الإناث. بالإضافة إلي طول الخيط (FL) ،وزن الخيط (FW) ،حجم الخيط المحلول (denier; FS) و نسبه الحرير (SR) .