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EFFECT OF ARTIFICIAL DIETS ON THE SLIKWORM, *Bombyx mori* L. OF THE PRODUCTIVITY.

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ABSTRACT

Lab experiments were conducted to study the effect of two different artificial diets on some biological and economical parameters of two silkworm *Bombyx mori* L. races during two rearing seasons, Spring and Autumn.

First diet (T1) had the same components as prepared by (Tsuchida and Yoshitake, 1983), second one (T2) by adding propolis material as natural antibiotic and anabolic agent.

Feeding young larvae (first, second and third instars) on the diet containing propolis (T2) resulted in shortened larval duration and increasing most of the economic characters with preference of Autumn rearing season than Spring one.

INTRODUCTION

The silkworm, *Bombyx mori* L. has been considered as a monophagous insect and only mulberry leaves were known as a silkworm natural food a long time. It is a quite versatile and unique species due to its domestication for a number of centuries. Hence, its adaptability to artificial diet is not difficult (Chowdhary, 1996).

Study on artificial diets for silkworm was applied for the first time in sericulture in Japan for rearing young larvae of the silkworm in cooperative rearing houses.

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 and low-cost artificial diets.

Propolis is one of the valuable apicultural products. propolis has an activity against many pathogens (Hegazi *et al*., 2000) the antibacterial, antifungal and antiviral effects of propolis were observed by (Cheng and Wong, 1996). propolis can be used in scientific medicine. Also, microscopic examination appeared that no flascherie disease was observed among treated larva of *Bombyx mori* L. with propolis (Nour *et al*., 1996).

The present study was carried out to study `the effect of feeding two local silkworm races during the young larval instars on two different diets one including propolis as a component.

MATERIALS AND METHODS

1- Composition of artificial diets:

Two diets were used in the experiment; the first diet (T1) has the same components shown by (Tsuchida and Yoshitake, 1983). Part of the

composition of the conventional diet was changed for use in the test, the antiseptic and citric acid were discarded and 1% propolis was added. Also, the amount of defatted soybean and sucrose were decrease to 40 and 6 g, respectively and this diet is coded (T2).

2- Silkworm resources:

Two silkworm races were used SA105 (R1) and J2PJ (R2); Eggs of silkworm races were obtained from the Sericulture Research Department of Plant Protection Research Institute, Agricultural Research Centre Giza-Egypt. The study was carried out during Spring and Autumn seasons of 2003 and 2004.

3- Rearing technique:

Rearing silkworm and experimental technique were carried out under laboratory conditions (28°C ± 2 and 75 ± 5 % R.H.) during the Spring season, and (25°C ± 1 and 69 ± 6 %R.H.) for Autumn season.

Young larvae (first, second and third instars) were reared on artificial diets, then the grown larvae (fourth and fifth instars) were reared on fresh mulberry leaves of *Morus alba* var kukoso 27**.** Three replicates of each treatment were used, each replicate containing hundred larvae**.**

Data were recorded for different parameters as young instar duration, total larval duration, larval mortality percentage, fresh cocoon weight, cocoon shell weight, pupal weight, and cocoon shell ratio (30 males and 30 females) for each, fecundity, cocooning percentage, pupation ratio, filament length, weight and size.

Also, silk productivity was estimated by using the following formula of (Chattopadhyay *et al*., 1995)

$$\text{Silk productivity per day} = \frac{\text{cocoon shell weight}^{(cg)}}{\text{fifth instar duration}^{(day)}}$$

Statistical analysis was adopted according to Senedecor and Cochran (1967).

RESULTS AND DISCUSSION

1-Evaluation of the artificial diets:

A-Biological Aspects:

a-Duration of larval period:

The data recorded in Table (1) show that the duration period for T1 and T2 were 20.32, 40.87 and 19.70, 41.50 day for young and total larval instars, respectively with highly significant differences. T2 is the best for larval duration. These results are in agreement with El-Hattab (1985) who found that diet containing soybean plus honey or fortified with vitamins or containing casein induced short duration. Also, Lee and Sohn (1985) reported that protein of the diet has been one of important nutritional factor on larval duration period. Mottaghitlab and Pourali (2005) also reported different larval period for *B.mori* L. fed on different artificial diets.

Table (1): Evaluation of the artificial diets.

Character	T1	T2	F
Young instar duration(day)	20.33	19.70	20.964**
Total larvae duration(day)	41.50	40.88	36.556**
Larval mortality (%)	9.38	10.01	4.138
Cocoon weight(g)	0.832	0.936	140.380*
Cocoon shell weight(g)	0.154	0.183	52.489**
Pupa weight(g)	0.638	0.782	33.599**
Cocoon shell ratio (%)	18.91	19.00	0.147
Silk productivity(cg/day)	1.764	2.084	79.505**
Cocooning percentage (%)	84.56	85.10	2.032
Pupation ratio (%)	88.28	89.11	1.897
Fecundity(eggs/female)	296.39	300.66	0.410
Filament length(m)	891.25	962.75	4.540*
Filament weight(g)	0.176	0.201	7.239**
Denier	1.787	1.936	3.236

*** significant at 5% , ** high significant at 0.05**

b - Larval mortality percentage:

T1 showed less larval mortality than T2 without significant difference (9.38 and 10.01%) for T1 and T2, respectively. (Hori,1995; Shinbo and Yanagawa, 1994) confirmed these results as they found that diet components, shape, size and soybean powder are consider as important factors on diet water content which in turn affected survival growth rate and development speed of larvae. Miranda and Lakahashi (1998) reported that the survival rate varied among four different diets even without presenting significant differences to each other. Mottaghitlab and Pourali (2005) found that some diets showed better growth development and survival rate while other diets produced heavier and more useful cocoons.

B-Economic parameters:

The results of the adaptability test of artificial diets for young larvae were illustrated in Table 1. The results proved the significant differences between the mean weights of cocoon, cocoon shell, pupa weights (0.936,0.832; 0.183, 0.154 and 0.782, 0.638 g) for T2 and T2, respectively . These results are confirmed with the finding of Moon (1974) who found that body weight gain, cocoon quality and feed efficiency of *B.mori* L. were significantly affected by the level of protein, carbohydrate when the larvae were fed on artificial diet.

Also, cocoon shell ratio and silk productivity recorded higher values for T2 (19.00% and 2.084) comparing to (18.91% and 1.764) for T1, respectively. These results go in line with El-Maasarawy, (1995) who reported that adding of propolis extract to silkworm, *Bombyx mori* L. food caused increase of silk productivity in both male and female larvae .

The same trend was observed in cocooning percentage, pupation ratio and fecundity .Also, for silk filament indices, T2 was superior to T1 regarding these economic parameters as affected by the kind of diet. The mentioned results are in agreement with those obtained by EL-Hattab (1985

and 2002) and EL-Sayed Nagda (1999) they proved that weights of cocoon, cocoon shell and number of deposited eggs/ female were affected by the type of the diet.. Nour *et al*., (1996) who reported that female moths which were fed through the larval stages on mulberry leaves soaked in propolis solution laid more eggs than the control one.

2- Evaluation of two races reared on the two diets:

A-Biological Aspects:

a- Duration of larval period:

Statistical analysis of data indicated a significant difference between the calculated larval duration of the young larvae (20.25 and 19.78 day) and highly significant difference of the total larval duration (44.6 and 37.80 day) for the races R1 and R2, respectively. These results go in line with Kumer and Thakur (1999) who reported difference in larval duration between three different *Bombyx mori* L. races reared on artificial diet during young larval instars. Also, Madyarov (2005) who found that larval duration of *Bombyx mori* L. fed on artificial diets differs according the races.

Table (2): Evaluation of two races reared on the two diets

character	R1	R2	F
Young instar duration(day)	20.25	19.78	12.058*
Total larvae duration(day)	44.60	37.80	4265.034**
Larval mortality (%)	10.713	8.681	11.709**
Cocoon weight(g)	0.934	0.834	131.902**
Cocoon shell weight(g)	0.184	0.152	66.758**
Pupa weight(g)	0.779	0.641	39.132**
Cocoon shell ratio (%)	19.13	18.78	2.281
Silk productivity(cg/day)	2.157	1.692	167.281**
Cocooning percentage (%)	83.84	85.82	27.085**
Pupation ratio (%)	87.02	90.40	30.484**
Fecundity(eggs/female)	302.05	295	1.444
Filament length(m)	1047.8	812	46.653*
Filament weight(g)	0.199	0.178	5.140*
Denier	1.703	2.021	14.782**

*** significant at 5% , ** high significant at 0.05**

b- Larval mortality percentage:

The present study showed that the race R1 gave the highest significant difference percentage of larval mortality (10.71%) compared to the race R2 (8.68%).This result go in line with the finding of Magadum *et al*., (1994) who observed that the survival rates after the second ecdysis of four bivoltine silkworm breeds fed on three artificial diets usually varied among the different breeds and diets. Also, Rahmattulla *et al.,* (2005) who reported that retarted growth in insects may not be only due to the nutritional factors, but also may be due the effect of utilization of food which varies from races to races, and even between the different sexes of the same races.

B-Economic parameters:

The obtained results of the two races SA105 (R1) and J2PJ (R2) under study are shown in Table 2. The race R1 is superior than the race R2 for cocoon weight, cocoon shell weight, pupae weight, silk productivity, filament length and weight.

On the other hand R2 recorded high pupation and cocooning percentage (90.40 and 85.82 %) compared to (87.02 and 83.84 %) for R1, respectively with highest significant difference. Hiro *et al.*, (1997) reached similar results as they reported that larvae of the polyphagous races reared on the diets and transferred to mulberry leaves in the 5th instar produce a large amount of cocoon of good quality, whereas the larvae of the commercial hybrids were unable to survive normally on the diets. Also, Kumer and Thakur (1999) observed difference in cocoon characters as well as filament, weight and size among three silkworm breeds fed on artificial diet during young instars.

3-Effect of two artificial diets during two rearing seasons:

A-Biological Aspects:

a- Duration of larval period:

Longest larval duration was observed during Spring rearing season (20.4 and 41.55 day) for young and total larval duration, respectively compared to Autumn rearing season which recorded (19.62 and 40.82 day) for the same period, respectively with significant differences. Similar results were obtained by Hosny and Mahmoud (2002) who found that shortest larval duration was recorded during the Summer rearing season while the longest duration in late Autumn. Also early Autumn was shorter than Spring one.

b- larval mortality percentage:

The larval mortality percentage of the two rearing season Spring and Autumn were (9.25 and 10.13), respectively without significant difference. Similar results were obtained by Hosny *et al*., (1997) who observed that survival rates during Autumn were less than Spring seasons.

B-Economic parameters :

The economic parameters exhibited better results during Autumn rearing season than Spring one (Table 3). There are highly significant differences between the two seasons for all parameters except pupation ratio and filament weight and size. whereas cocoon, cocoon shell and pupa weights recorded (0.967, 0.811; 0.188,0.149 and 0.781,0.638g) during Autumn and Spring seasons, respectively. Similar result was obtained by Genova (1994) who reported that the Spring silkworm feeding with high-quality mulberry leaves added to artificial diets, led to poor results, while Autumn feeding of silkworm on artificial diets gave better results.

Also, cocoon shell ratio and silk productivity recorded more values during Autumn (19.55% and 2.177) , respectively. These results are confirmed by Jian-Hui *et al.* (1998) who found that the characteristics of cocoon and silk production differ during Spring, Autumn and Summer when *Bombyx mori* L. were fed on artificial diet through the first two instar.

More pupation and cocooning percentage of (89.15 and 85.77%) in Autumn followed by (88.22 and 83.83%) in Spring. The mentioned results are

in agreement with those obtained by Hosny and Mahmoud (2002) who reported that the economic parameters: cocoon weight, cocoon shell weight, cocoon shell ratio, filament parameters differ according to the rearing season. Jaiswal and Goel (2003) who found that different hybrids and races exhibit different values for different quantitative traits in the different seasons. Kobayashi *et al.,* (1986) who reported that different seasons express different changes in the physiological and biotic factors governing the expression of commercial characters in the silkworm.

Table (3): Effect of two artificial diets during two rearing seasons

character	S1	S2	F
Young instar duration(day)	20.40	19.62	33.731**
Total larvae duration(day)	41.55	40.82	49.101**
Larval mortality (%)	9.255	10.137	1.020
Cocoon weight(g)	0.811	0.967	177.680**
Cocoon shell weight(g)	0.149	0.188	100.824**
Pupa weight(g)	0.638	0.781	41.300**
Cocoon shell ratio (%)	18.40	19.55	27.700**
Silk productivity(cg/day)	1.671	2.177	198.253**
Cocooning percentage (%)	83.83	85.77	24.837**
Pupation ratio (%)	88.22	89.15	2.375
Fecundity(eggs/female)	289.70	307.35	8.561**
Filament length(m)	892.31	961.75	4.214*
Filament weight(g)	0.184	0.193	1.081
Denier	1.89	1.83	0.506

*** significant at 5% , ** high significant at 0.05**

The results of the present study showed that the race SA105 (R1) showed the greater values for the most economic characters when larvae fed on the second diet T2(propolis diet) during Autumn rearing season.

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تأثير التغذية الصناعية علي إنتاجيه دوده الحرير التوتية

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أجريت هذه التجارب بغرض دراسة تأثير تغذيه يرقات ديدان الحرير التوتية علي بيئات صناعية خلال الأعمار الصغيرة وتأثيرها علي إنتاجيه الحرير و جودة الشرانق. وقد تم تغذيه ديدان الحرير علي بيئتين صناعتين : البيئة الأولي صممت بواسطة (Tsuchida and Yoshitake) أما البيئة الثانية استخدم بها نفس مكونات البيئة الأولى مع استبدال المواد المطهرة وحامض الستريك بماده البروبليس و ذلك خلال موسمي الربيع والخريف .

وقد اثبت هذه الدراسة إن تغذيه يرقات ديدان الحرير التوتية خلال الأعمار الصغيرة على البيئة المحتوية على ماده البروبليس خلال موسم الخريف أدت إلى تقليل العمر ليرقى وزيادة أوزان الشرانق ونسبه المحتوى الحريري