Effect of Certain Evaluated Plant Crude Extracts on the Productivity of Silkworm (*Bombyx mori* L.)

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ABSTRACT: Nowadays, researches are aimed to find out new efficient alternatives supplement for feeding mulberry silkworm by using some food additives which allow the improvement of certain biological and reproductive parameters. The present work represents the use of three tested plant crude extracts i.e. Chamomile, Fennel and Thyme to evaluate their possible profitable effects on silkworm (*Bombyx mori* L.) productivity.
The obtained results revealed that the use of Chamomile at 3%, Fennel and Thyme at 5% significantly increased the weight of larvae and pupae compared with the other performed treatments.
It could be also concluded that Chamomile at a concentration of 3% and Thyme at 5% gave the heaviest fresh cocoon weight with an increase of 18.824 and 21.487%, respectively over control. All types of the evaluated plant crude extracts increased the egg productivity compared with the untreated control.
Keywords: Mulberry silkworms, nutrition, food additives, plant crude extracts, egg and silk production

INTRODUCTION

The improvement and increasing the nutrition values of mulberry leaves by using various food additives were studied by many investigators. Kumaraj *et al*. (1972) reported that the important factor influencing the growth and production of silkworm is the nutritional factor.
Numerous of food additives materials were examined as supplementary nutrients by (Ito and Tanaka, 1962; Majumeder and Medder, 1975; El-Karaksy *et al*., 1983; Moustafa and El-Karaksy, 1988; El-Karaksy and Idriss, 1990; El-Sayed and Mesbah 1992, a & b; El-Sayed, *et al*., 1996; Ashour, 1997; El-Sayed *et al.*, 1997 & 1998).
On the light of abovementioned literature, the present work was initiated for determining the effect of supplementing mulberry leaves with three plant crude extracts (Chamomile, Fennel and Thyme) at certain concentrations on the silkworm (*Bombyx mori*) as a trial for improving and increasing of silk production and female productivity.

MATERIALS AND METHODS

The newly hatched larvae of the eggs of the mulberry silkworm *Bombyx mori* L. (hybrid Giza A) were reared in the laboratory according to the standard rearing technique as advocated by Krishnaswami (1973) under the hygrothermic conditions of 25 ± 2°C and 75 ± 5% R.H. The larvae were raised on fresh clean mulberry leaves until 4th instar. Only the last larval instar was used in the experiment.

Substances used:

Certain types of herbs were chosen as supplementary nutrients for the silkworm *Bombyx mori* L. and these substances were: Chamomile (*Matricaria chamomilla*), Fennel (*Foeniculum vulgare*) and Thyme (*Thymus Vulgaris*).

Fresh aqueous crude plant extracts were daily prepared by blending 350 grams of each herb used with two liters of tap water, soaked for about 24 hrs. at room temperature, evaporated by heating up to one liter as a final volume and filtered to give a stock solution of 35% (w/v). The tested concentrations of 3, 5 and 10% were prepared from the stock solution of each crude extract using tap water. The natural and chemical components of these materials are presented in Table 1.

Table 1: The composition of the natural and chemical components of extracted plant used substances*

Seed extract components	Chamomile Every 237g of flowers contains	Fennel Every 100g of seeds contains	Thyme Every 100g of seeds contains
Energy	5.736 kcal	101 kcal	345 kcal
Carbohydrates	0.5 g	24.45 g	52.29 g
Protein	--	5.56 g	15.80 g
Total Fat	--	1.68 g	14.87 g
Cholesterol	--	--	--
Dietary Fiber	--	14.0 g	39.8 g
Vitamins			
Niacin	--	1.824 mg	6.050 mg
Pyridoxine	--	0.348 mg	0.470 mg
Riboflavin	--	0.471 mg	0.353 mg
Thiamin	--	0.48 mg	0.408 mg
Vitamin A	47.4 IU	4751 IU	135 IU
Vitamin C	--	160.1 mg	21 mg
Electrolytes			
Sodium	2.4 mg	9 mg	88 mg
Potassium	21.3 mg	609 mg	1694 mg
Minerals			
Calcium	4.7 mg	405 mg	1196 mg
Copper	--		1.067 mg
Iron	0.2 mg	17.45 mg	18.54 mg
Magnesium	2.4 mg	160 mg	385 mg
Manganese	0.1 mg	1.719 mg	6.533 mg
Phosphorus	--		487 mg
Zinc	0.1 mg	1.81 mg	3.70 mg

***USDA.** U.S. Department of Agriculture 1400 Independence Ave., S.W. Washington, DC 20250.

Therefore, the initiated experiment included nine treatments and control. Each treatment was replicated three times. Each of which contained 50 fifth instar larvae. The mulberry leaves were dipped in the prepared dilutions of each prepared plant crude extract. The treated leaves were introduced to the treated larvae after being dried. The larvae of the control treatment were provided with untreated leaves.

Estimation of the studied parameters:

The mature 5th instar larvae, pupae, fresh cocoons and cocoon shells were weighed. Moreover, prior to spinning cocoons, a sample of five mature experimented larvae as well as control was dissected and the silk glands were drawn and weigh. For estimating the female fecundity in each conducted treatment and control, five couples of mated moths were randomizly elected; each couple was kept in perforated paper bag till end of egg deposition. Number of eggs laid per female moth were counted and recorded. Increase percentage over control was recorded. Data were statistically analyzed on the basis of " F " test and the least significant difference test (L.S.D.) at 0.05 level (Sendecor, 1956).

RESULTS AND DISCUSSION

Effect of the tested materials on the biological parameters of the silkworm (*Bombyx mori* L.)

The results presented in Table 2 show that the mean weights of full grown larvae were significantly different. The use of Thyme at the concentration rate of 3 and 5%, Chamomile at 3% and Fennel at 5% gave the heaviest level weights of 3.117, 3.242, 3.08 and 3.017 g, respectively, and these weights were more than the lower mean weight of control larvae (2.626 g). The lightest weight of larvae was obtained after feeding on the treated mulberry leaves with Chamomile, Fennel and Thyme at the concentration of 10%.

Statistical analysis of data also proved that both treatments of Thyme and Fennel at 3 and 5% and Chamomile at 3% gave a more or less heavier pupal weights, which decreased in all performed treatments at 10%, but still significantly higher than that of the untreated control larvae (0.873 g), except Chamomile (10%) which rather decreased by -0.572% than that of the control.

The measured increased fresh weights of silk glands of the treated mature larvae indicated insignificant differences between the estimated weights of the most made treatments, while Thyme at 5% gave the lightest weight of (0.583 g) with 17.303% increase over control (0.497 g)(Table 2).

Herein, these abovementioned results are in accordance with those reported by El-Sayed (1989 and 1994); Govindan *et al*. (1988); El-Karaksy and Idriss (1990); Muniandy *et al*. (1995); Manoharan (1997); Mahmoud and Yehia (2007); Benţea *et al*. (2011) and Mahmoud *et al*. (2012) who found that the detected parameters of fitness component of *Philosamia ricini* Boisd or/and *Bombyx mori* L. larvae were significantly affected by the evaluated food additives in their works.

Effect of tested materials on silk and egg production

Results in Table 3 elucidate the effect of each of the tested materials on silk and egg production. The treatment of Thyme at 5% and Chamomile at 3% gave the heaviest fresh cocoon weight of 1.323 and 1.294 g, in respect, with an increase of 21.487 and 18.824%, respectively over control. The lightest weight of (1.102 g) was recorded for the treatment of Chamomile at 10% with an increase of 1.193% over control.

In comparison to different initiated treatments and control, statistical analysis of data proved that Thyme at all its tested concentrations were greatly effective on the detected weights of cocoon shell and that might be due to its higher content of protein and total fats. The corresponding weights of cocoon shells increased by about 10.648, 18.981 and 21.296 %, respectively more than the control. The treatments of Fennel at 10% and Chamomile at 5% were less effective; indicating lower weights than those inspected in the other running treatments, but still significantly heavier than the control.

Moreover, the revealed effect of tested materials on the female reproductivity elucidated that the resulted female moths from the treatments of Thyme 5% and Chamomile 3% laid an average number of 406.2 or/and 405.0 eggs/female moth, respectively as against 333.8 eggs/female laid by control insects, since the rate of produced eggs had been increased by about 21.689 and 21.33 more than the control (Table, 3).

These observations suggest that these materials that enhance egg production would be beneficial to sericulturists, since such materials increase both silk productivity and eggs deposition of these characters meet the demand of sericulturists.

In agreement with our obtained results many authors have reported that the tested nutrients and food additives; besides influencing the overall growth, enhanced fecundity of silkworms (Govindan *et al*, 1988; El-Karaksy and Idriss, 1990; Hosney *et al*., 1991; El-Sayed, 1994; Manoharan, 1997; Yehia, 1998; Mahmoud and Yehia, 2007 and Mahmoud *et al*., 2012).

Generally, it could be concluded that the results of the present study support the fact that identifying the optimum concentration of the chosen nutrient for a chosen insect is an important aspect in supplementation studies for better growth as the tested plant crude extracts, contain many biochemical components such as vitamin A, thiamin, riboflavin, fats and protein. Though, in the present study the optimum concentration for elevating the growth of *Bombyx mori* L. larvae as well as their productivity was found to be 3% of Chamomile and 5% of either Fennel or Thyme.

Table 2: Effect of the tested materials at different concentrations on the measured weights of larvae, pupae and silk glands

Treatments	Wt. of larva (g) A*	Wt. of pupa (g) A	Wt. of silk gland (g) B*	increase percentage over control (%)		
				Wt. of larva	Wt. of pupa	Wt. of silk gland
# C3%	3.08 bc** ±0.179	1.054 a ±0.110	0.638 a ±0.078	17.557	20.733	28.37
C5%	2.97 cd ±0.149	0.932 cd ±0.121	0.609 a ±0.112	13.358	6.758	22.535
C10%	2.847 de ±0.119	0.868 d ±0.134	0.610 a ±0.108	8.664	-0.572	22.736
F3%	2.984 c ±0.147	1.006 abc ±0.119	0.604 ab ±0.036	13.893	15.234	21.529
F5%	3.017 bc ±0.161	1.023 abc ±0.114	0.608 a ±0.084	15.152	17.182	22.334
F10%	2.759 e ±0.103	0.942 bcd ±0.092	0.615 a ±0.071	5.305	7.903	23.742
T3%	3.117 ab ±0.125	1.026 abc ±0.143	0.661 a ±0.079	18.969	17.525	32.997
T5%	3.242 a ±0.168	1.066 a ±0.136	0.583 ab ±0.097	23.74	22.107	17.303
T10%	2.829 e ±0.099	0.973 abcd ±0.129	0.611 a ±0.087	7.73	11.454	22.937
Control	2.626 f ±0.122	0.873 d ±0.140	0.497 b ±0.037	--	--	--
L.S.D.	17.129	3.208	1.331			

C= Chamomile F= Fennel T=Thyme

* Each value represents the mean ± S.D. of A=10 B=5 records.

** No significant differences among the means followed with the same letter(s).

Table 3: Effect of the tested materials on silk and egg production

Treatments	Wt. of fresh cocoon (g) A*	Wt. of cocoon shell (g) A	No. of dep. Eggs B*	increase percentage over control (%)		
				Wt. of fresh cocoon	Wt. of cocoon shell	No. of dep. Eggs
# C3%	1.294 a** ±0.122	0.240 abc ±0.027	405 a ±20.688	18.824	11.111	21.33
C5%	1.153 bc ±0.134	0.221 bc ±0.022	407.4 a ±18.568	5.876	2.314	19.772
C10%	1.102 c ±0.138	0.234 abc ±0.019	397.4 b ±11.523	1.193	8.333	19.053
F3%	1.248 ab ±0.144	0.242 abc ±0.034	395.2 b ±20.364	14.6	12.037	18.394
F5%	1.271 ab ±0.131	0.247 ab ±0.041	388.8 bcd ±11.627	16.712	14.351	16.476
F10%	1.170 bc ±0.102	0.227 bc ±0.046	392 bc ±6.782	7.438	5.092	17.435
T3%	1.266 ab ±0.168	0.239 abc ±0.038	380.8 d ±16.422	16.253	10.648	14.08
T5%	1.323 a ±0.157	0.257 a ±0.031	383.6 c ±13.685	21.487	18.981	21.689
T10%	1.235 ab ±0.128	0.262 a ±0.025	362.8 e ±15.610	13.406	21.296	8.687
Control	1.089 c ±0.147	0.216 c ±0.024	333.8 f ±18.886	--	--	--
L.S.D.	3.437	2.086	9.456			

C= Chamomile F= Fennel T=Thyme

* Each value represents the mean ± S.D. of A=10 B=5 records.

** No significant differences among the means followed with the same letter(s).

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الملخص العربى

تأثير إضافة بعض مستخلصات المواد النباتية الطبيعية على إنتاجية ديدان الحرير التوتية

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تهدف بعض الأبحاث حاليا إيجاد بدائل جديدة و فعالة لتغذية ديدان حرير القز من خلال استخدام بعض المواد الإضافية التي تسمح بتحسين بعض المقاييس البيولوجية و الإنتاجية. لذلك تم فى هذا البحث تقييم استخدام ثلاثة من المستخلصات النباتية الطبيعية (البابونج والشمر والزعتر) و دراسة آثارها على إنتاجية ديدان الحرير التوتية.

أظهرت النتائج أن استخدام البابونج (٣٪)، الشمر والزعتر (٥٪) أدى إلى ارتفاع و زيادة في وزن كلا من اليرقات و العذارى بالمقارنة بالمعاملاتالأخرى المختبر ة و الكنترول.

بالاضافة إلى ان إستخدام الزعتر (٥٪) والبابونج (٣٪) حققا اعلى المتوسطات المحسوبة فىوزن ثلاثة انق بزيادة قدرها ٢١.٤٨٧ و ١٨.٨٢٤ ٪ على التوالي عن الكنترول . كذلك أدى استخدام كل الأنواع المختلفة من المستخلصات النباتية الطبيعية المختبرة إلى زيادة إنتاجية البيض بالمقارنة بالكنترول. و كانت أعلى إنتاجية للبيض قد تحققت بأستخدام المستخلص النباتى البابونج عند تركيز ٣ و ٥%. و لذلك ينصح باستخدام البابونج لزيادة عدد البيض بينما الزعتر لزيادة وزن الحرير.