USING IMPROVED TECHNOLOGY METHOD FOR INCREASING THE COCOONS AND EGGS PRODUCTION OF *BOMBYX MORI L.*

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Abstract :The experiments were carried out in Assiut area, Egypt during spring season of 1999 and 2000. The complex applying of the improved technology, by choosing best technological decisions for balanced mulberry fertilization, for house, eggs and bed disinfections, for new temperature regime and natural mounting. Improved technique increased the pupation ratio, cocoon weight, shell weight, and raw cocoon yield per one box to 6.13% -7.63%, 21.26-31.66%, 29.51-40.21% and 36.90-72.05% respectively in comparison to the traditional cocoon production technology.

Implementation of improved technology for seed silkworm rearing lead to increase in fecundity to 67-121 eggs (15.12-26.22%) and yield of standard boxes per one parent egg boxes to 57-78 egg boxes (48.33-51.66%).

Introduction

The information regarding the micronutrients for plant growth in general and mulberry growth in particular are very little (Lokanth and Shivashankar, 1986). Due to continuous depletion of the micronutrients from the soil by the mulberry, the soils become deficient in trace elements (Singhvi *et al.*, 1998). Bleaching powder is the most suitable disinfectant for open type of rearing houses (Baig and Kumar, 1987).

The higher value of silkworm pupation rate after egg surface disinfections is due to the effectiveness of used disinfectants against incorporation of pathogens on the egg surface and subsequently infecting the newly hatched larvae (Michailov, 1984 and Baburashvilli *et al.*, 1988). Barman (1991) studied the effect of some formulated chemicals composites as larval body disinfectants for controlling viral and bacterial diseases of the silkworm *B. mori* and reported the decrease of overall mortality over the control. Kirichenco (1995) reported that acetic acid is used for disinfections of *Bombyx mori* L. loose commercial eggs in the former CIS republics and some East European countries. The egg disinfections by acetic acid from

bacterial, viral and fungal diseases influence up to 98-100%, it is high ecological method. Its germicidal effect has been proved from so long time. It is a cheap and readily available ecological material.

Ikegamy (1995) studied the effect of Chlorotic chemicals as a substitute to bleaching powder for disinfections of the silkworm rearing houses and equipments.

The body temperature of the silkworms influences the physiological activities, food intake and economic parameters (Tzenov and Maldenov, 1996 and Maniraju *et al.*, 1999)

Even if the silkworm crop is healthy, wrong mounting methods, spinning conditions, mounting density, pre or over matured larval mounting and bad type of mountages can result in spinning of inferior quality cocoons (Ullal and Narisimhanna, 1987). The self-mounting method is the natural urge of the matured silkworm to climb up to start spinning cocoons (Tzenov and Petkov, 1999).

In the recent years new silkworms *B. mori* races and hybrids having higher productivity have been selected in different countries (Petkov, 1995a,b, Petkov and Natcheva, 1996, Petkov *at al.*, 1999b, Datta *et al.*, 1999 and Petkov *et al.*, 1998a,b).

However these highly productive races and hybrids require providing excellent feeding and rearing conditions in order to manifest in full extent their potential (Petkov, 1988, Petkov *et al.*, 1999a,b and Datta *et al.*, 1999)

The aim of this work is to study the effect of balanced mulbery fertilization and optimum rearing conditions on commercial cocoons and seeds productiou of some silkworm inbreeds.

Materials and Methods

Practical experiments were carried out in the Agromier Co. SAE mulberry plantation and rearing houses located in Assiut Governorate, Egypt (320 km south of Cairo) in a desert area. The plantation is irrigated by the surfaced water regularly at the plants needs, as there are no rains in this area. Total salinity of irrigating water is 300 PPM

Mulberry plantation is mainly of Kokuso 27 & Canva 2 varieties, sbaped in bush type and pruned in first form after 3 step up branch harvests every year. Soil is sandy loam, consisting of 51.4% silt, 8.8% clay and 39.8% sand. Soil pH is 8.1. The underground water table is below 3 meters. Moisture eontent at field capacity is 24%.

The experiment was conducted during spring rearing of 1999 and

2000 seasons. Eleven silkworm inbreeds were tested (Table 1). Four replicates of 100 larvae from each inbreed were used.

Table (1): Characters of silkworm inbreeds used for the experiments

Inbreed	Type	Egg color	Larval marking	Cocoon shape
E2	Japanese	Gray blue	Marked	Dumbbell
E6	Japanese	Gray blue	Marked	Dumbbell
E15	Japanese	Gray blue	Marked	Dumbbell
E1	Chinese	Greenish	Plain	Oval
E5a	Chinese	Greenish	Plain	Oval
E14	Chinese	Greenish	Plain	Oval
E4b	European	Gray blue	Marked & Plain	Elongated
E8	European	Gray blue	Marked & plain	Elongated
E9	European	Gray blue	Marked & plain	Elongated
E22	Chinese	o Yellow, o Greenish	Light marking	Oval
E23	Japanese	oBrown yellow. o Gray blue.	Marked	Dumbbell

Control (Traditional Technology):

1. As described in literature by Ullal and Narasimhana (1987)

Experimented (Improved Technology) :

1. Application of 2^{ry} macro-nutrients (Ca_{230}, S_{50} & Mg_{55}) and micro-nutrients (Mn_{3}, $Fe_{4.5}$, $Zn_{3.5}$, $Cu_{0.4}$, $B_{0.5}$, $Mo_{0.54}$ & Cl_{200}) to mulberry garden beside the 1^{ry} macro-nutrients ($N_{200}P_{150}K_{120}$) and adding FYM_{15ton} only for young instar rearing garden (Greiss and Petkov, 2001).
2. Double disinfections by bleaching powder 5% W/V and acetic acid 0.2% for house and appliances (Greiss and Petkov, 2000c)

3 Eggs disinfections by acetic acid 0.04% for 15 min. at room temperature (Greiss and Petkov, 2000b).

4 Bed and larval disinfections was done by mixture consists from calcium oxide, 88%; bleaching powder, 10%; benzoic acid, 1% and diathane M45, 1% after every moult at 250gm/m^2 for young instars and 500 gm/m^2 for late instars of bed area (Greiss et al. 2001)

5 Rearing temperature at 23°C, light intensity 25 Lux all over the larval period. Air speed and relative humidity at 0.1m/sec & 85% for young instars and 0.3m/sec & 70% for late instars respectively. During molting the humidity was reduced to 50% RH in all instars, and in the case of young instar larvae, nylon covers were removed from the beds.

6 Natural mounting and spinning at 27°C, light intensity 25 Lux, air speed 0.5m/sec and RH 60% (Greiss and Petkov, 2000a).

Egg box yield per 1 egg box (EY) was calculated using the formula:

$$EY = \frac{H \times PR \times ME \times F}{2}$$

Where : EY= Egg box yield per 1 box, H= Hatchability, PR= Pupation rate, ME= Moth emergence percentage and F= Fecundity.

Results and Discussion

The data shown in Table (2) revealed a definite significant increase in the pupation ratio, cocoon weight, shell weight and cocoon yield per one box, however the shell ratio showed a significant increase in some inbreeds only. A significant decrease in larval duration was recorded. The hatchability percentage was the only character that did not show any change when the improved technology was applied.

The new technology leads to a significant increase in the pupation value in comparison to the traditional technology, silkworms' pupation ratio (I) was increased to 16.13-17.63%. Comparatively highest differences were recorded in inbreeds with Japanese origin E2, E6 & E15, and genetically Sex-limited inbreeds (E22 & E23).

New improved technology leads to decrease of larval duration (II) by one day in all tested inbreeds independent of their genetical or geographical origin. This fact is of great economic importance in practice for saving labor, and indirectly improves the pupation ratio by shortening the active life period thus decreasing the risks of contamination and expression of any latent infection.

Silkworm rearing by improved technology leads to significant

increase of cocoon weight (III), genetical origin of tested races independently of geographical and

Table (2): Evaluation of cocoons produced under improved technology

Inbreed Exp	E2	E6	E15	E1	E5a	E14	E4b	E8	E9	E22	E23
(I) Exp.	98 13	98 13	98.50	98.25	98.38	98.38	98.00	98.13	98.00	98 00	98.00
Cont. (%)	81.25	80 62	80.87	82.00	81.87	82.00	81.37	82.00	81.62	80.50	81.00
TD	** 17.13	** 17.51	** 17 63	** 16.25	** 16.51	** 16.38	** 16.63	** 16.13	** 16.38	** 17 50	** 17 00
(II) Exp.	705	705	705	681	681	681	705	705	705	705	705
Cont (H)	729	729	729	705	705	705	729	729	729	729	729
TD	** 24	** 24	** 24	** 24	** 24	** 24	** 24	** 24	** 24	** 24	** 24
(III) Exp	2.512	2 469	2.505	2.508	2.710	2 192	2 415	2.310	2.169	2.197	2.110
Cont. (gm)	1 870	1.931	1.887	1 945	1.873	1.903	1.841	1.798	1 831	1.781	1 771
TD	** 0 642	** 0.538	** 0 618	** 0.563	** 0 837	** 0 289	** 0 574	** 0 512	** 0 338	** 0.416	** 0.339
(IV) Exp	0 584	0 594	0 569	0 534	0 618	0.508	0.535	0.554	0 535	0 492	0 506
Cont (gm)	0 399	0 432	0.415	0 415	0 421	0.426	0 412	0 411	0 431	0 361	0 384
TD	** 0.185	** 0 162	** 0.154	** 0.119	** 0.197	** 0.082	** 0 123	** 0.143	** 0.104	** 0 131	** 0 122
(V) Exp	23.25	24.06	22.71	21.29	22.80	23 18	22.15	23.98	24.67	22.39	23.98
Cont.(%)	21 34	22 37	21.99	21 34	22.48	22.39	22.38	22.86	23.54	20 27	21 68
TD	** 1 91	** 1.69	0.69	-0 05	0.32	0.79	-0.23	* 1 12	* 1 13	* 2.12	** 2 3

*P<0 05, **P<0 01

I Pupation

II Larval duration

III Cocoon weight

IV Shell weight

V Shell ratio

Exp Experiment

Cont. Control

TD True difference

The cocoon weights' average increased to 0.599 gm (31 66%) for inbreeds of Japanese origin, 0.560 gm (29.36%) for inbreeds with Chinese origin, 0.475 gm (26 04%) for inbreeds with European origin and 0.375 gm (21 26%) for Sex-limited inbreeds during the period of investigation compared to the traditional technology.

The results for the shell weights (IV) were analogical. The increase of different races was as following, Japanese inbreeds 0.167 gm (40.21%), Chinese inbreeds 0.133 gm (31 54%). European inbreeds 0 123 gm (29 51%) and for Sex-limited inbreeds 0.127 gm (33.96%) These results were expected due to improvement of the food quality, combined with the disease free rearing regime.

In regard to shell ratio character (VI), proved significant differences by the improved technology compared to traditional one, were obtained only at some inbreeds, that is E2 & E6 of Japanese origin, E8 & E9 with European origin and E22 & E23 Sex-limited inbreeds.

It is evident from chart 1 that during the period of investigation for the improved technology, we obtained better results concerning the cocoon yield per box to 16.19-17 19 kg (55 21-59 28%) for Japanese inbreeds, 10.88-20 81 kg (36.90-72 05%) for Chinese inbreeds, 11.48-16.06 kg (40.38-56.65%) for European and 11 60-13 04 kg (43.07-48.14%) for Sex-limited inbreeds These results are due to integration of higher value of silkworm pupation ratio and cocoon weight characters in the new technology.

European Inbreed E9 diverted the gained extra energy for defense and it manifested very high increase rates of shell weight & shell ratio, 24.12% (0.104 gm) and 5.17% (1 22% absolute) respectively, with lowest rate of fecundity increase 14.32% (64 Eggs).

Table 3 shows the hypotbetical sector influence for each genetico-geografic group of inbreeds regarding its net increase in cocoon yield per one box for each of the tested racial groups when the improved technology was applied However adding 2^{N} macro-nutrients and micro-nutrients decreased larval duration by 48 hours (6 58-6 81%). attributing a non calculable share in this table.

Data in table 4 show that the tested element of the new technology (egg surface disinfections with 0.04% acetic acid for 15 min at room temperature) was not of any significant influence on egg hatchability (I). Hatchability show insignificant very slight increase or decrease over the control+0 7% This proves once again that the new

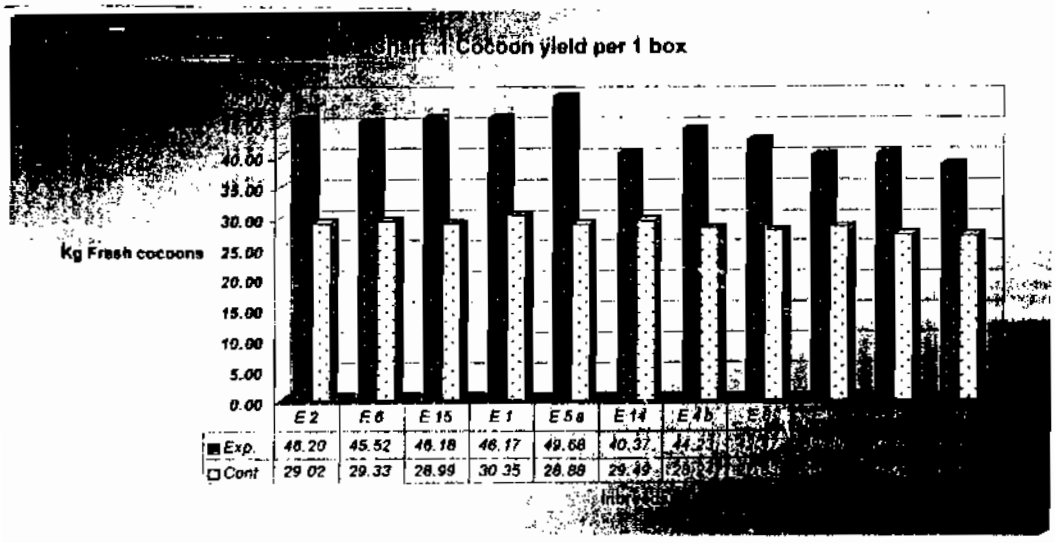
Chart 1 Cocoon yield per 1 box
Kg Fresh cocoons
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
E 2 | E 6 | E 15 | E 1 | E 5a | E 14 | E 4b
Exp. | 46.20 | 45.52 | 46.18 | 46.17 | 49.68 | 40.37
Cont | 29.02 | 29.33 | 28.99 | 30.35 | 28.88 | 29.49

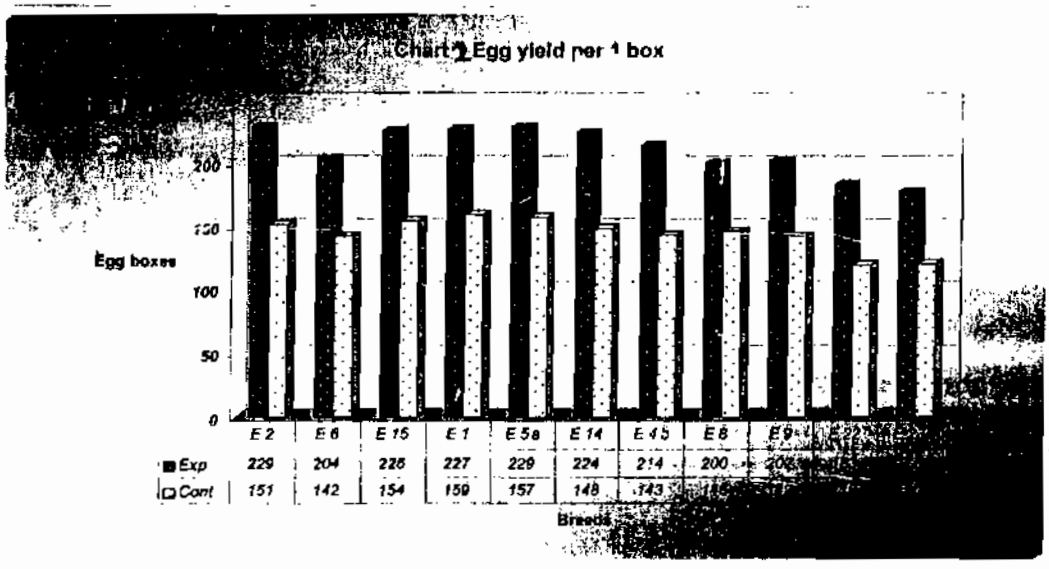
Chart 2 Egg yield per 1 box
Egg boxes
200
150
100
50
0
E 2 | E 6 | E 15 | E 1 | E 5a | E 14 | E 4b | E 8
Exp | 229 | 204 | 226 | 227 | 229 | 224 | 214 | 200
Cont | 151 | 142 | 154 | 159 | 157 | 148 | 143

method for egg surface disinfections did not exert any harmful effect on the embryos inside the eggs or the newly hatched larvae.

Table (3): Hypothetical sector influence

Inbreed Exp.	Japanese	Chinese	European	Sex-limited
Secondary Macro and Micronutrients	14-15%	13-16%	11-15%	13%
House and Appliances Disinfections	16-18%	13-20%	16-17%	18%
Eggs Disinfectants	9-15%	3-11%	6-9%	5-9%
Bed and Larval Disinfectants	33-34%	36-40%	35-37%	31%
Temperature Regimes	10-15%	9-11%	9-11%	10-12%
Mounting techniqnes	14-16%	6-13%	16%	17-23%

Table (4): Evaluation of eggs produced under improved technology

Breed Exp	E2	E6	F15	E1	E5a	E14	E4b	E8	E9	E22	E23
(I) Exp	95.43	95.49	95.30	95.35	95.32	95.69	95.37	95.22	95.28	95.12	95.01
Cont (%).	**95.66**	**94.92**	**95.83**	**95.99**	**95.55**	**95.28**	**95.71**	**95.49**	**95.32**	**95.34**	**95.17**
TD	-0.23	0.57	-0.53	-0.64	-0.23	0.41	-0.34	-0.24	-0.07	-0.22	-0.16
(II) Exp	98.13	98.13	98.50	98.25	98.38	98.38	98.00	98.13	98.00	98.00	98.00
Cont(%)	**81.25**	**80.62**	**80.87**	**82.00**	**81.87**	**82.00**	**81.37**	**82.00**	**81.62**	**80.50**	**81.00**
TD	** 17.13	** 17.51	** 17.63	** 16.25	** 16.51	** 16.38	** 16.63	** 16.13	** 16.38	** 17.50	** 17.00
(III) Exp	583	518	574	578	582	567	545	510	515	467	454
Cont(egg)	**462**	**441**	**472**	**482**	**477**	**450**	**436**	**443**	**435**	**370**	**370**
TD	** 121	** 77	** 102	** 96	** 105	** 117	** 109	** 67	** 80	** 97	** 84

**P<0.01

I Hatchability
II Pupation
III Fecundity

Exp. Experiment
Cont Control
TD True difference

The new technology leads to significant increase in the pupation value, during the period of investigation in comparison to the traditional technology, silkworms' pupation ratio (II) was increased by 16.13-17.63% Comparatively highest differences were recorded in Inbreeds with Japanese origin E2, E6 & E15, and genetically Sex-limited Inbreeds (E22 & E23).

The proposed improved technology lead to significant increase in fecundity (III) and accordingly to the egg yield per one box of parent silkworms. On view to the period of investigation in comparison to the traditional technology, and irrespective to the genetic and geographic origin of the tested Inbreeds the fecundity increased by 77-121 eggs (17.46-26.19%) for Japanese Inbreeds, 96-117 eggs (19.92-26.00%) for Chinese Inbreeds, 67-109 eggs (15.12-25.00%) for European inbreeds and 84-97 eggs (22.70-26.22%) for Sex-limited Inbreeds.

The improved technology increased the calculated yield of egg boxes per one egg box to 54-72 egg boxes (36.99-47.37%) chart 2, due to the increase of the pupation ratio together with fecundity. It should be noted that our formula for calculation gives the result in the same standard egg box used, irrespective of standard number of eggs per box used, as standard number of eggs per box is different in different countries.

Chinese Inbreed E 14 diverted its extra energy gained by the new improved technology for proliferation and manifested highest rate of fecundity increase 31.94% (138 eggs), with lower rates of cocoon shell weight and shell ratio increase 19.24% (0.082 gm) and 3.25% (0.79% absolnte).

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استخدام طريقة محسنة لزيادة انتاج شرانق وبيض دودة القز

هشام جريس ، .د. محمد عمر محمد عمر

تاثير اضافة العناصر الغذائية الصغرى والكبرى الى مزرعة التوت وكذلك استخدام نظام تربية خالى من الأمراض وخفض درجة حرارة التربية فى الاعمار الصغيرة على الانتاج التجارى من شرانق دودة القز وكذلك البيض وذلك فى مزرعة شركة اجروميز (قرية مير – القوصية أسيوط) خلال فصل الربيع لموسمى ١٩٩٩ ، ٢٠٠٠ .

أثبتت التجارب أن استخدام التوافيق من الاحتياجات الفسيولوجية المثلى أثناء تربية اليرقات قد أدت الى زيادة معدل التعذر بنسبة تراوحت من ٦,١٣ - ٧,٦٣% ووزن الشرانق بنسبة ٢١,٢٦ ٣١,٦٦% ووزن القشرة بنسبة ٢٩,٥١ - ٤٠,٢١% ومحصول الشرانق الخام بنسبة ٣٦,٩٠ - ٧٢,٠٥% مقارنة باستخدام الطريقة التقليدية فى تربية دودة القز لانتاج شرانق الحرير

كما أدى استخدام الطريقة المحسنة إلى زيادة نسبة الخصوبة فى البيض بنسبة تراوحت من ١٥,١٢-٢٦,٢٢% وإنتاج البيض بنسبة تراوحت من ٤٨,٣٣ الى ٥١,٦٦% على التوالى مقارنة بالطرق التقليدية لانتاج البيض فى دودة القز .