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INFLUENCE OF ROYAL JELLY AND BEE HONEY ON SOME BIOLOGICAL CHARACTERS OF TWO LOCAL HYBRIDS OF MULBERRY SILKWORM, *Bombyx mori* L.

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ABSTRACT

The present work aimed to study the effects of the royal jelly and honey at different concentrations , on certain biological parameters of the 5th larval instar of the mulberry silk worm *Bombyx mori* L.

The treatments with royal jelly and honey at different concentrations significantly increased both larval and pupal weights , together with rate of growth in comparison to the control . The results indicated leaves mulberry that treated with the royal jelly at both concentrations of 4 and 6 mg / 100 ml water resulted in pronounced significant positive high effects on these biological parameters .

INTORDUCTION

In the developing countries like Egypt , the alternative diets of the mulberry silkworm have not yet been applied due to the high costs of these artificial diets as well as the lack of required technology . Hence , an economically cheeper technique which improves the cocoon and egg production is needed .

Many investigators studied the effect of royal jelly and honey as supplementary nutrients to the mulberry leaves on the silkworm, *Bombyx mori* L. (Singh , 1960 ; Hashida, 1961 ; Ito, 1961 ; Firu *et al* 1968 ; Khier , 1968; Mahgoub , 1976 and El-Karaksy , 1979) . They studied the effects of royal jelly on certain biological parameters .

The importance of bee honey in the nutrition of the silkworm was reported by El-Hattab ,(1985), El-Karaksy *et al.*, (1989) and El- Sayed (1999).

Both diets were chosen for their importance as different rich components on the biological parameters of two local hybrids of the silkworm, *Bombyx mori* L. to improve the silk quality and raise its production .

MATERIAL AND METHODS

Two local hybrids of silkworm, *Bombyx mori* L. (R1 and R2) , Sericulture Res. Dep ., Agric . Res. Center , Giza , Egypt were reared under hygrothermic conditions of 26 ± 2 °C and 78 ± 5% R.H.

The larvae were fed on fresh clean mulberry leaves until the fourth instar . The fifth instar larvae , which moulted on the same day , were randomly selected and grouped in separate trays for the test . The royal jelly and honey have been used in this study were obtained from the Department of Apiculture research , at the A.R.C. Giza , Egypt .

The different concentrations of royal jelly and bee honey were selected from the investigation carried out by (El-Hattab, 2003) as follows :

1-Royal jelly at the concentrations , 4mg and 6 mg / 100 water .
2-Honey at the concentrations , 400mg and 600 mg / 100m water .
Each of the above mentioned nutrients were dissolved in distilled water .

The experiments included four treatments and one control . Each treatment represented one concentration which was replicated three times and each replicate contained fifty newly fifth instar larvae . The larvae were reared in trays of 150 × 80 × 10 cm . Fresh mulberry leaves were dipped in the prepared solutions and introduced to the larvae after being dried . The larvae of the control treatment were provided with untreated leaves .

Daily inspection was made until the larvae reached the pre-pupal stage .

Biological characters of *Bombyx mori* L. in two local hybrids R1 and R2 were determined as follows :

A- The weights of fifty mature larvae and pupae from each replicates were recorded

B- The durations of larval and pupal stage were considered by the hours . The growth rate was calculated according to the formulae suggested by Waldbauer 1968 .

$$(\text{G.R.}) = \frac{\text{Wt .gained during feed period}}{\text{duration of period (days) × mean wt. of insect}}$$

C- The silk glands were washed with distilled water and excess water was removed by using filter paper . The silk glands of each larvae were weighted fresh weight .

RESULTS AND DISCUSSION

1- Effects of royal jelly on some biological parameters of the local hybrid (R1) .

The effect of royal jelly on some the weights of mature larvae , pupae and silk gland , together with the growth rate were investigated .

A- Larval weight :

The last instar larvae of *B. mori L* were raised on mulberry leaves treated with the concentrations of royal jelly , 4 and 6 mg /100 ml water while the control was raised on clean untreated mulberry leaves . All treatments were performal during spring rearing season under the prevailing laboratory conditions .

The obtained results proved that the two concentrations of the royal jelly significantly raised the weights of the treated larvae Table 1 .

The treatment of mulberry leaves with royal jelly concentration, 4 mg/ 100 ml water increased larval weight by about, 3.14g / larvae compared to 2.77 g / larva of the control .

The larval weight 3.20 g / larvae was obtained after feeding on mulberry leaves treated with royal jelly at the concentration of 6 mg/100water , which was still significantly higher than the control .

B- Pupal weight :

The data illustrated in Table 1 revealed that the two tested concentrations of royal jelly significantly raised the mean weight of the pupa.

The mean pupal weight of 1.17 and 1.22 g/pupa was recorded when the larvae were fed on leaves treated with , 4 and 6 mg/100ml water , respectively . Mean while the mean weight of the control pupa was , 0.92 g/pupa .

Table (1): Effect of royal jelly an bee honey on some biological parameters of *Bombyx mori* L . local hybrid(R1)

Treatment	Weight of Larva (g)	Weight of Pupa (g)	Growth rate	Weight of Silk gland(g)	Larval duration (days)	Pupal duration (days)
RJ1 4 mg/100m	3.14±0.01a	1.17±0.01b	5.87	0.82±0.02ab	9.00	14.7
RJ2 6 mg/100m	3.20±0.01a	1.22±0.01a	6.86	0.98±0.02a	8.61	13.00
H1 400 mg/100m	2.97±0.01ab	1.12±0.01b	4.71	0.79±0.02ab	9.00	14.70
H2 600 mg/100m	3.00±0.02a	1.19±0.01a	5.56	0.98±0.02a	8.75	13.00
Control	2.77±0.02b	0.92±0.02c	3.30	0.50±0.01b	13.33	16.75

- **Each value presents the mean ± SE.**
- **Means at each column followed by the same letter are not significantly different at 0.01.**

C- Growth rate :

The results in Table 1 , show that treatments of royal jelly , 4 and 6 mg / 100 ml water significantly increased the rate of growth over the control . The obtained growth rate for the treatment of royal jelly ,4 and 6 mg/100 ml water , 5.87 and 6.86 were higher also than control, 3.3 .

D- Silk gland weight :

The results in Table 1 , show also that feeding of *B. mori L* larvae at the rate of , 6 mg /100 ml water raised the weight of the silk gland 0.98 g . The minimal increase in the weight of the silk glands 0.82 was obtained after feeding *B. mori L* larvae on leaves treated with 4 mg/100water royal of jelly compared to , 0.50 g in the control .

E- Larval and pupal durations :

Table 1 shows that the suplementry royal jelly with different concentrations to the mulberry leaves (4 and 6 mg/100water) gave larval durations of 9 and 8.61 days which were short than the control , 13.33 days . The pupal durations were 14.70 and 13 days for the two treatment , while the control was 16.75 days .The larval and pupal durations were significantly shorter than the control .

2- Effects of honey on some biological parameters of the local hybrid R1 .

The effect of honey on some biological parameters such as the weights of *B. mori L* mature larvae , pupae , silk gland and growth rate were investigated .

A- Larval weight :

The last instar larvae of *B. mori L* were raised on mulberry leaves treated with the concentrations of honey, 400 and 600 mg /100 ml water ,while the control was raised on clean untreated mulberry leaves . All treatments were performal during spring rearing season under laboratory

conditions . The obtained results proved that the two concentrations of the honey significantly raised the weights of the treated larvae Table 1 .Treatment of mulberry leaves with honey concentration, 600 mg/ 100 ml water, increased larval weight by about , 3.05g / larvae , compared to , 2.77 g / larvae , of the control .

The larval weight of , 2.97 g / larvae , was obtained after feeding on mulberry leaves treated with honey at concentration of , 400 mg/100water , which was still significantly higher than the control .

B- Pupal weight :

The data illustrated in Table1 indicate that the two tested concentrations of honey significantly increased the mean weight of the pupa . The mean pupal weight was , 1.15 and 1.22 g/pupa, when larvae were fed on leaves treated with 400 mg and 600 mg/100ml water , respectively . Meanwhile , the mean weight of the control pupa was 0.92 g/pupa .

C- Growth rate :

The results in Table 1 , show that treatments of honey ,400 and 600 mg / 100 ml water , significantly increased the effect rate of growth over the control . The obtained growth rate was 4.71 and 5.56 for the treatment of honey at the concentrations of 400 and 600 mg/100 ml water , which were higher than the control 3.3 .

D- Silk gland weight :

The results in Table 1 show that feeding of ***B. mori L*** larvae at the rate of 600 mg /100 ml water raised the weight of the silk gland to 0.91 g . The minimal increase in the weight of silk glands 0.79 was obtained after feeding the larvae on leaves treated with, 400 mg/100water ,honey compared to 0.50 g in the control .

E- Larval and pupa durations :

Table 1 shows that the supplementary honey with different concentrations to the mulberry leaves , 400 and 600 mg/100water , gave larval durations of 9 and 8.75 day , which were shorter than the control 13.33 days . The pupal durations were 14.70 and 13 days for the two treatment , while the control was 16.75 day . The larval and pupal durations were significantly shorter than the control .

3- Effects of royal jelly on some biological parameters of the local hybrid R2 .

During the present study , the effects of royal jelly on the weights of ***B. mori L*** mature larvae , pupae , silk gland and growth rate were investigated .

A- Larval weight :

The last instar larvae of *B. mori L* were raised on mulberry leaves treated with ascending concentrations of royal jelly , 4 and 6 mg /100 ml water , while the control was raised on clean un treated mulberry leaves . All treatments were performed during spring rearing season under the prevailing laboratory conditions. The obtained results proved that the two concentrations of the royal jelly significantly affected the weights of the treated larvae Table 2 . The treatment of mulberry leaves with royal jelly concentration , 6 mg/ 100 ml water, increased larval weight by about , 3.35g / larvae , compared to , 2.90 g / larvae ,for the control .

Table (2): Effect of royal jelly an bee honey on some biological parameters of *Bombyx mori* L . local hybrid(R1)

Treatment	Weight of Larva (g)	Weight of Pupa (g)	Growth rate	Weight of Silk gland(g)	Larval duration (days)	Pupal duration (days)
RJ1 4 mg/100m	3.10±0.1d	1.19±0.01b	5.44	0.89±0.01ab	8.33	13.90
RJ2 6 mg/100m	3.35±0.01b	1.26±0.02b	6.78	1.08±0.02ab	7.75	12.50
H1 400 mg/100m	2.94±0.01cd	1.15±0.02c	4.62	0.80±0.01b	8.83	13.90
H2 600 mg/100m	3.11±0.02c	1.23±0.01b	5.58	1.02±0.01ab	7.83	12.50
Control	2.90±0.03de	0.95±0.007e	3.03	0.54±0.02c	13.00	15.45

- **Each value presents the mean ±SE.**
- **Means at each column followed by the same letter are not significantly different at 0.01.**

The larval weight of 3.10 g / larva , was obtained after feeding on mulberry leaves treated with royal jelly at the concentration of 4 mg/100water ,Which was still significantly higher than the control .

B- Pupal weight :

The data illustrated in Table2 revealed that the two tested concentrations of royal jelly significantly increased the mean weight of the pupa . The mean pupal weight of , 1.27 and 1.19 g/pupa was recorded when the larvae were fed on treated leaves with 4 and 6 mg/100ml water , respectively . Meanwhile the mean weight of control pupa was 0.95 g/pupa .

C- Growth rate :

The results in Table 2 , shows that treatments of royal jelly (4 and 6 mg / 100 ml water) significantly increased the rate of growth over the control. The obtained growth rates for the treatments with royal jelly concentration of 4 and 6 mg/100 ml water , were 5.44 and 6.78 ,which were higher than the control 3.03 .

D- Silk gland weight :

The results shows in Table 2 that feeding of *B. mori L* larvae at the rate of , 6 mg /100 ml water , increased the weight of silk gland 1.08 g . The minimal increase in the weight of silk glands ,0.89 , was recorded after feeding *B. mori L* larvae on leaves treated with 4 mg/100water royal jelly comparing to 0.54 g in the control.

E- Larval and pupa durations :

Results recorded in Table 2 shows that the suplementry royal jelly with different concentrations to the mulberry leaves ,4 and 6 mg/100water , gave larval durations ,8.33 and 7.75 days ,which were shorter than the control 13 days . The pupal durations of 13.90 and 12.50 days were obtained for the two treatments , while the control reached ,15.45 days . The larval and pupal durations significantly reduced with respect of the control .

4- Effects of honey on some biological parameters of the local hybrid R2.

The effects of honey on the weights of *B. mori L* mature larvae , pupae , silk gland and growth rate were also investigated .

A- Larval weight :

The last instar larvae of *B. mori L* were raised on mulberry leaves treated with the honey ascending concentrations of 400 and 600 mg /100 ml water , while the control was raised on clean untreated mulberry leaves . All treatments were carried out during spring rearing season under the prevailing laboratory conditions . The obtained results proved that the two concentration of the honey significantly raised the weights of the treated larvae Table 2 . Treatment of mulberry leaves with the honey concentration of 600 mg/ 100 ml water, increased larval weight by about , 3.11g / larvae , compared to , 2.92 g / larva, for the control . The larval weight of 2.94 g / larva , was obtained after feeding on mulberry leaves treated with honey at the concentration of 400 m g/100water ,which was still significantly higher than the control .

B- Pupal weight :

The data illustrated in Table2 revealed that the two tested concentration of honey significantly increased the mean weight of the pupa . The mean pupal weight of 1.15 and 1.25 g/pupa , was recorded when the larvae were fed on leaves treated with 400 and 600 mg/100ml water , respectively . Meanwhile the mean weight of the control pupa was 0.95 g/pupa .

C- Growth rate :

The results in Table 2 , shows that treatments of honey , 400 and 600 mg / 100 ml water , significantly increased the rate of growth over the control . The obtained growth rates for the treatment of honey ,400 and 600 g/100 ml water were 4.62 and 5.58 , which were higher than the control 3.03 .

D- Silk gland weight :

The results shows in Table 2 that feeding of *B. mori L* larvae at the rate of 600 mg /100 ml water , increased the weight of silk gland 1.02 g . The minimal increase in the weight of silk glands 0.80, was obtained after feeding the larvae on leaves treated with 400 mg/100water , of honey compared to 0.50 g for the control .

E- Larval and pupa durations :

Table 2 shows that the suplementry honey with different concentrations 400 and 600 mg/100water, to the mulberry leaves gave larval durations of 8.83 and 8.73 days which was shorter than the control 13days . The pupal durations 13.9 and 12.50 days ,were obtained for the two treatments , while the control was 15.45 days . The larval and pupal durations were significantly shorter than the control .

In conclusions , the results generally indicate that the tested concentration of honey exerted salient effects on the larval and pupal weights together with the growth rate of *B. mori* L , which are in agreement with the findings of Singh (1960) and Ito (1961). They recorded an increase in the larval weight and survival period due to the use of the royal jelly as a supplementing agent to the food of *B. mori* L. Hashida (1961) stated that royal jelly decreased the percentage of mortality of the silkworm B. mori, and increased the weight of larval body and cocoons. He also found that honey is a valuable agent that can be added to mulberry leaves. According to Khier

(1968) and Mahgoub (1976) ,the castor leaves treated with royal jelly or injected in to the larvae with the prepared concentrations of royal jelly, shortened the larval and pupal durations of the eri – silkworm, *Ph. ricini*, which the weights of larvae and pupae were increased . El - Karaksy (1979) concluded that the use of royal jelly with yeast as food additives gave the heaviest weights of larvae, silk gland of *B. mori* and *Ph. ricini*. El - Hattab (1985) found that the weights of *Ph. ricini* larvae, and silk gland were heavier for those larvae fed on semi - artificial diet containing honey. El - Sayed (1999) reported that the mixture of honey and black cumin seeds increased silk production and gave the heaviest weight of larvae, pupae, dry silk gland. Cheng and Wong (1996) also reported that honey and propolis have antibacterial, antifungal, antiviral and antitumor effects.

Generally, the supplementation of the royal jelly and honey caused significant higher positive effects on all tested biological parameters.

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تأثير الغذاء الملكي وعسل النحل على بعض الخصائص البيولوجية لهجينين محليين لديدان الحرير التوتية

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يهدف هذا البحث الى دراسة تأثير الغذاء الملكي وعسل النحل كعناصر غذائية مضافة إلى أوراق التوت بتركيزات مختلفة على بعض الخصائص البيولوجية للعمر اليرقي الخامس لهجينين محليين (R1 , R2) من ديدان الحرير التوتية بالتغذية على أوراق التوت المعاملة وكذلك على إنتاجيتها من الحرير. وقد أدت معاملة أوراق التوت بالتركيزات المختلفة للغذاء الملكي وعسل النحل الى زيادة معنوية في بعض الخصائص البيولوجية بالمقارنة بالكنترول . وأوضحت النتائج أن معاملة أوراق التوت بالغذاء الملكي بتركيز (٤ – ٦ ملى جرام / ١٠٠ ملل ماء) قد أدي إلى تأثيرات معنوية موجبة في الخصائص البيولوجية مما أدى إلى زيادة في تحسين إنتاج الحرير في كل من الهجينين المحليين R2 , R1 . مقارنة بالكنترول وكان الهجين المحلى R2 أكثر تأثرا معنويا عند معاملته بالغذاء الملكي (٤ – ٦ ملى جرام / ١٠٠ ملل ماء) حيث كانت الأوزان ٣,١٠ ، ٣,٣٥ جم / يرقة ، ١,١٩ ، ١,٢٧ جم / عذراء ، ٠,٨٩ ، ١,٠٨ جم / غدة الحرير ومعدل النمو ٥,٤٤ ، ٦,٧٨ والعمر اليرقي ٨,٣٣ ، ٧,٧٥ .