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EFFECT OF COLOR LIGHTS AND EXPOSURE PERIODS ON SOME BIOTECHNOLOGICAL CHARACTERS (SOLUBLE PROTEIN, SOLUBLE FATS AND PROTEIN ENZYMES) OF SILK WORM, *BOMBYX MORI* L.

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ABSTRACT: ***The*** present ***study was carried out during spring season, 2017 in Sericulture Laboratory Economic Entomology Department Faculty of Agric. Menoufia Univ. The study was conducted to evaluate the effect of light color and exposure time, on some technology and physiology characters of silkworm, Bombyx mori L. Reeled silk filament characters, length (m), weight (g) and size (denier) were measured in the cocoons resulted from silkworm larvae exposed todifferent colors and lighting periods. The highest mean treatment length of reeled silk filament of cocoon spun by B. mori larvae exposed during the 4th instar was (1119.2 m) at green light 24 hr, followed by blue light 12 hr recording (1077.76 m) while green light 12hrrecorded (954.4m, compared to control cocoon (1109.76 m). In addition, statistical analysis of the obtained results revealed that there were significant differences in the prolongation in silk filament length as compared to the control. The highest mean of reeled silk filament weight (0.228 g) was recorded at the cocoons spun by B. mori larvae exposed to green light 24 hr, followed by that exposed to red light 12 hr recording (0.216 g) and blue light 12 hr (0.214 g) compared with (0.232 g) for control. Statistical analysis of the data indicated that there were high significant differences between lights and times in all treatments. The highest mean size of reeled silk filament (2.08 dn) was recorded for the larvae exposed to red light 24 hr, followed by red light 12 hr treatment giving (2.01dn), followed by (1.99 dn) at natural light treatment, and (1.96 dn) which was recorded at blue light 24 hr treatment, compared with control which attained (1.91dn). Data regarding the biochemical analysis of total soluble protein, and protein enzymes (ALT and AST) and total fats in silk gland of silkworm larvae exposed to light and several times. The obtained results are as follow: The total soluble protein content in silk worm larvae silk gland ranged between 1.92 mg/ml for blue light 24 hr, 1.88 mg/ml for red light 12 hr and 1.87 mg/ml for green light 12 hr compared to 1.94 mg/ml for the control larvae for silk gland samples. The total soluble protein content in silk worm larvae blood ranged between 2.68 mg/ml for green light 24 hr, 2.61 mg/ml for blue light 24 hr and 2.67 mg/ml for natural light compared to 2.45 mg/ml for the control larvae for blood samples. The total fats content of silk worm larval silk gland ranged between 139 mg/ml for natural light, 137 mg/ml for red light 24 hr and 131 mg/ml for red light 12 hr compared to 127 mg/ml for the control larvae for silk gland samples. The total soluble fats content in silk worm larvae blood ranged between 114 mg/ml for blue light 24 hr, 107 mg/ml for dark and 90 mg/ml for natural light compared to 98 mg/ml for the control larvae for blood samples. Silk gland activities of glutamic oxaloacetic transaminase (ALT) and Glutamic pyruvic transaminase (AST) enzymes in silk worm were measured.***

Key words: ***Bombyx mori, Exposure periods, Color lights, Biotechnological characters.***

INTRODUCTION

The art of silk production is called sericulture that comprises cultivation of mulberry, silkworm rearing and post cocoon activities leading to production of silk yield. Sericulture provides gainful employment, economic development and improvement in the quality of life to the people in rural area and therefore it plays an important role in antipoverty program and prevents migration of rural people to urban area in search of employment. Hence several developing countries all over the world have taken up sericulture to provide employment to the people in rural areas (Walaa Nageip, 2018).

Experimental animals were reared under natural solar-day, LD 12:12 conditions at 25°C and 80% RH, feeding V1 mulberry leaves. Ripening patterns in silkworm larvae initiated in the early hours of the day, LD 12:12, expressing diurnal predominance of over phenomenon, occurred in 24 hour intervals, thus expressing circadian nature and prolonged for 3 consecutive days, hence revealing gating rhythmic characteristics in all the three experimental silkworm breed/hybrid, lasting for 47 hours (CSR2and CSR4) to 43 hours (CSR2 x CSR4). Upon application of sampoorna, the silkworm larvae did not follow circadian characteristics straightway in ripening process, expressing continuous ripening activity, lasting for 28 to 30 hours (CSR4and CSR2 respectively) and 26 hours (CSR2 x CSR4) hours (Srinath, *et al*., 2018b).

Conventional methods of silkworm (*Bombyx mori* L.) hatching include incubation, exposure to light dark cycles etc., were in practice. As a recent technology for silkworm egg hatching, use of black-boxing method coupled with incubation is advocated in the contemporary Indian sericulture industry to get economical hatching of over 95%, in a single day with quick hatching. In the present study, an attempt is made to compare the photoperiodic way and the black-boxing method of hatching for better understanding the scientific principles behind the black-boxing method. For the studies, the DFLs of CSR2 x CSR4 were introduced into natural solar day condition, LD 12:12, continuous dark (DD) and continuous light (LL) on the third day of oviposition and continued till the completion of hatching experiments (Srinath, *et al*., 2018a)

The present study was carried out during spring season of 2017 in Sericulture Laboratory, Economic Entomology Department Faculty of Agric. Menoufia University to evaluate the effect of light time and color on some technological and physiological characters of silkworm, *Bombyx mori* L.

MATERIALS AND METHODS

The present investigations were carried out during spring season of 2017 at Economic Entomology & Agriculture Zoology Department Laboratory, Faculty of Agriculture, and Menoufia University.

Fresh green leaves of the mulberry variety, *Morus alba* native (Balady) was used and the fourth & fifth larval instars mulberry silkworm, *Bombyx mori* L. (H1*KK*G2*V2) was used in the present studies. Eggs of silkworm *Bombyx mori* L. were purchased from the Sericulture Research Department of Plant Protection Research Institute, Agricultural Research Center, Ministry of Agriculture and Land Reclamation in Giza, Egypt.

1. Experimental design:

This study was carried out during spring season of 2017 in Sericulture laboratory Economic Entomology Department Faculty of Agric. Menoufia Univ. The study was conducted to evaluate the effect of color lights

and periods of exposure on some technological and physiological characters of silkworm, *Bombyx mori* L., on the 4th instar larval growth and silk production of silkworm (*B. mori* L.).

Three replicates, of each 100 silkworm larvae were separated for every sub-treatment. Larvae of each replicate were reared on a plastic tray (100 × 70 ×15 cm) under a controlled rearing room at 27±2 ˚C and 95±5 % RH for the first three instar larvae, while it was changed for the last two (Fourth and Fifth) instar to 24±2 ˚C and 75±5 % RH. All the rearing room trays, racks and tools, rearing rooms as well as the rearing places were sterilized with formalin (5 %) one week before the beginning of the experiment.

2. Larval feeding:

Mulberry leaves were harvested four times a day, i. e. at 6 am 10am, 2pm and 6 pm. 4th and 5thlarvae were offered complete leaves.

The larval bed was cleared daily, by changing net which containing rectangular holes of 0.20 ×0.30 cm and quadrate holes of 1.0 ×1.0 cm for the younger and the older larvae, respectively.

3. Mounting process and fresh cocoon treatments:

Mature larvae were transferred to carton paper (that used wrapping table eggs) for mounting process. The cocoons were harvested seven days later. Half number of the resulted cocoons of each replicate were dried in an oven (oven temperature was raised gradually until it reached 80 ˚C), and then the heated cocoons were kept under maximum oven temperature degree (80˚C) for 6 hours. Such cocoons were used to study the technological characters. Another half of the cocoons was used for the biological studies. After emergence, each couple was impaired in a sexual paper for copulation and oviposition.

4. Laboratory experiments:

- **The larvae were separated to nine groups:**

1stgroup exposed to red light for 12 hrs and 12 hrs dark
2nd group exposed to green light for 12 hrs and 12 hrs dark
3rd group exposed to blue light for 12 hrs and 12 hrs dark
4th group exposed to red light for 24 hrs
5th group exposed to green light for 24 hrs
6th group exposed to blue light for 24 hrs
7th group exposed to natural light 24 hrs
8th group exposed to white light 16 hrs & 8 hrs dark
9th group kept in dark (away from light) 24 hrs

5. Technological studies:

5.1. Reelable silk filament parameters:

The weight (mg) and length (m) of reeled silk filament were measured and recorded. The size of the reeled filament (denier) was estimated according to (Krishna swami *et al.,* 1972) formula:

The size of reeled filament =

$$\frac{weight\ of\ reeled\ filament\ (mg)}{Length\ of\ reeled\ filament\ (m)} \times 9000$$

5.2. Preparation of samples for biochemical assay.

The haemolymph was collected from a punctured proabdominal leg of the 5th instar larvae of each treatment in glass tubes with heparin to prevent melanization of sample, Mahmoud (1988). The tubes were deep freezed at -20˚C. The blood samples were centrifuged at 10000 rpm for 10 minutes at 5˚C.

The supernatant was immediately assayed to determine total soluble protein and the activities of glutamic oxaloacetic transaminase (GOT), glutamic pyruvic transaminase (GPT).

5.3. Determination of total soluble protein.

Colorimetric determination of total soluble protein was carried according to Gornall *et al*., 1949) based on the presence of an alkaline cupric sulfate, the protein produce a violet purple color, the intensity of which is proportional to their concentration. Briefly, a volume of 0.2 ml of haemolymph was added to 5ml of Biuret reagent and incubated for 30 min at 20-25ºC. The absorbance of the sample against a blank Biuret reagent was measured at wave length of 546 nm.

Total protein of haemolymph was estimated as mg/ml using the formula derived from the equation of the straight line (Intercept = 0.0147, Slop= 0.003, Protein content = $\frac{ABS - 0.0147}{0.003}$ **)**

Protein content =

$$\frac{Absorbance - Interception}{Slop}$$ **= mg/ml**

5.4. Determination of enzymes activities.

-Transaminase enzymes (ALT& AST):

Glutamic oxalo acetic transaminase (ALT) and glutamic pyruvic transaminase (AST) enzyme activities were determined colorimetriclly according to the method of Reitman and Frankle (1957). ALT transfers the amino group from L-aspartate to α-keto acid (α-Keto glutaric acid) producing a new amino acid (L-glutamate) and a new keto acid (oxalo acetic acid). GPT transfer the amino group from D, L alanine to α-keto acid (α-keto glutaric acid), resulting in a new amino acid (L-glutamate) and a new keto acid (pyruvic acid). Oxalo acetate or pyruvate reacts with 2, 4- dinitro phenyl hedrazine forming oxaloacetate or pyruvate hydrazone which in alkaline medium form a brown colour which can measured spectro photo metrically. The reaction mixture consisted of 1 m l of a mixture of phosphate buffer (pH 7.4) 0.2 m Mα-keto glutaric and 200 m M –L-alanine or L-aspartate, 0.2 ml of haemolymph was then added to the reaction mixture. The mixture was incubated for 30 min. Then after, 10 ml of 0.4 N Na OH was added. The optical density of the produced brown colour is measured after 5 min using spectrophotometer at 520 nm. The enzyme activity is expressed as m M Pyruvate/ gm body weight / min.

The glutamic oxalo acetic transaminase (ALT) and glutamic pyruvic transaminase (GPT) enzyme activities content of haemolymph samples was estimated as mg/ml using the following formula derived from the equation of the straight line.

Intercept = 0.0053, Slop= 0.0164 (AST content = $\frac{ABS - 0.0053}{0.0164}$ **)**

Intercept = 0.023, Slop= 0.0019 (ALT content = $\frac{ABS - 0.023}{0.0019}$ **)**

AST or ALT content =

$$\frac{Absorbance - Interception}{Slop}$$ **= mg/ml**

5.5. Determination of total lipids:

Total lipids were determined in blood of silk worm *B. mori* larvae and silk gland according to the method of Emile Van Handel (1985).

6- Statistical analysis:

The obtained data were subjected to statistical analysis of variance (ANOVA) at 5 % probability, where the measurements were separated using Duncan's Multiple Range Test (DMRT) through CoStat software program (Version 6.400). CoStat version 6.400 Copyright © 1998-2008 Cohort Software. 798 Lighthouse Ave. PMB 320, Monterey, CA, 93940, USA.

RESULTS AND DISCUSSION

1. Reeled silk filament parameters:

Reeled silk filament characters, length (m), weight (g) and size (denier) were measured in the cocoons resulted from silkworm larvae exposed to different colors and lighting periods.

1.1. Silk filament length (m):

As shown in Table (1) the highest mean treatment length of reeled silk filament of cocoon spun by *B. mori* larvae exposed during the4th instar to (1119.2 m) at the treatment of green light 24 hr, followed by blue light 12 hr recording (1077.76 m) while green light 12 hr. recorded (954.40m) On the other hand, control cocoon gave 1109.76 m. In addition, statistical analysis of the obtained results of all tested lights revealed that there were significant differences in the prolongation in silk filament length as compared to the control.

1.2. Silk filament weight (g):

As shown in Table (1) the highest mean of reeled silk filament weight (0.228 g) was recorded at the cocoons spun by *B. mori* larvae exposed to green light 24 hr, followed by that of the larvae exposed to red light 12 hr recording (0.216 g) and blue light 12 hr recording (0.214 g) compared with (0.232 g) was recorded for control during 2017 season. Statistical analysis of the data indicated that there were high significant differences between lights and times in all treatments.

Table (1): Effect of color lights and periods of exposure on Filament length (m.), Filament weight (g.) and Filament size (dn.) of silkworm, *Bombyx mori* L. in 2017 season

Time	Color	Filament length (m)	Filament weight (g)	Filament size (dn)
12 h	Red	900.160	0.216	2.010
	Green	954.400	0.206	1.620
	Blue	1077.76	0.214	1.820
	mean	977.440	0.212	1.810
24 h	Red	932.100	0.188	2.080
	Green	1119.20	0.228	1.830
	Blue	884.160	0.192	1.960
	mean	978.490	0.203	1.960
Dark 24		841.600	0.160	1.720
Natural light		954.080	0.212	1.996
Control		1109.76	0.232	1.910
LSD. for color		117.0022***	0.037*	ns
P.0.05		0.0000	0.0115	0.7613
LSD for time		77.1390***	0.0290***	Ns
P 0.05		0.0000	0.0000	0.2022

1.3. Silk filament size (dn):

Data presented in Table (1) indicated that the highest mean size of reeled silk filament (2.08 dn) was recorded for the larvae exposed to red light 24 hr, followed by red light 12 hr treatment giving (2.01dn), followed by (1.99 dn) at natural light treatment, and (1.96 dn.) which was recoded at blue light 24 hr treatment, compared with control which attained (1.91dn) Silk filament size. Statistical analysis of the data indicated that there were high significant differences between lights and times in all treatments.

The obtained results are in harmony with those of El-Shaarawy *et al*. (1977), El-Karaksy and Idriss (1990), Babu *et al*. (1992) who found that the maximum lengths of secretory glands and reservoirs and the heaviest weights of reservoirs, fresh and dry cocoon and cocoon cortex and the maximum lengths of reeled silk.

Similar results were recorded with Mubashir and Humayun (2002) and Saad (2009), Zannoon *et al*. (2008). Moreover, Balasundaram and Selvisabhanayakam (2009), Munghate *et al*. (2009) and Omer *et al*. (2009). Also, Saad *et al*. (2014) who cleared that mulberry leaves fortified with 0.5,0.1 and 0.2% with glycine, and 0.125, 0.25 and 0.5% with ascorbic acid for start 5th instar, indicated that there was no significant change in the body weight of the larvae of all three groups, however significantly increases in the silk filament length was recorded with 0.1 and 0.2% glycine and 0.25, 0.5% ascorbic acid. Balasundaram *et al.* (2013) indicated that the ascorbic acid exhibits the presence of certain growth stimulant activity and can be used to increase the silk yield in commercial silkworm rearing.

2. Effect of color lights and periods on soluble protein, soluble fats and protein enzymes of Silk Worm, *Bombyx mori* L. in larvae blood:

Data regarding the biochemical analysis of total soluble protein, and protein enzymes (ALT and AST) and total fats in blood larvae of silkworm exposed to different lights and times in Table (2).

2.1. Total soluble protein (mg/ml):

The total soluble protein content in larvae blood of silk worm was 2.68 mg/ml for green light 24 hr, 2.33 mg/ml for red light 12 hr and 2.34 mg/ml for green light 12 hr, compared to 2.45 mg/ml for the control larvae.

2.2. Total fats (mg/ml):

The total soluble protein content in larvae blood of silk worm was 114 mg/ml for blue light 24 hr, 107 mg/ml for dark and 90 mg/ml for natural light compared to 98 mg/ml for the control larvae of blood samples

2.3. AST content (mg/ml):

The mean content of ALT enzymes ranged 703 mg/ml for red light 12 hr, 519 mg/ml for blue light 12 hr and 510 mg/ml for blue light 24 hr compared to 609 mg/ml for the control larvae of blood samples

2.4. ALT content (mg/ml):

The mean content of ALT enzymes ranged 316 mg/ml for green 12 hr, 284 mg/ml for green light 24 hr and 274 mg/ml for red light 12 hr compared to 302 mg/ml for the control larvae of blood samples.

3. Soluble protein & fats and protein enzymes in silk gland larvae of *B. mori*

Results in Table (3) show the total soluble protein and protein enzymes (ALT and AST) and soluble fats (mg/g) in silk gland of *Bombyx mori* larvae as affected by different color lights and photo periods.

3.1. Total soluble protein (mg/ml):

The total soluble protein content in silk gland of larvae was 1.92 mg/ml for blue light 24 hr, 1.88 mg/ml for red light 12 hr and 1.87 mg/ml for green light 12 hr compared to 1.94 mg/ml for the control larvae of silk gland samples.

Table (2): Effect of color lights and periods of exposure on the biochemical analysis of total soluble protein and protein enzymes (ALT and AST) and soluble fats (mg/g) in blood of silkworm larvae, *Bombyx mori* in 2017 season

Time	Color	Soluble protein (mg/g)	Soluble fats (mg/g)	AST	ALT
12 h	Red	2.33 d	77 f	703 a	274 cd
	Green	2.34 d	85 def	318 e	316 a
	Blue	2.63 ab	83 def	519 c	270 cd
24 h	Red	2.47 bcd	79ef	374 de	266 d
	Green	2.68 a	88cde	318 e	284bcd
	Blue	2.61 abc	114 a	510 c	268 d
	Dark 24	2.47 bcd	107ab	460 cd	288bc
	Natural light	2.67 a	90 cd	216 f	106 e
	Control	2.45 cd	98bc	609 b	302ab
LSD 5%		0.17	10.2	87.8	19.8

Means in each column followed by the same letter (s) are not significantly different at 5% level.

Table (3): Effect of color lights and periods of exposure on the biochemical analysis of total soluble protein and protein enzymes (ALT and AST) and soluble fats (mg/g) in silk gland of *Bombyx mori* larvae in 2017 season

Time	Color	Soluble protein (mg/g)	Soluble fats (mg/g)	ALT	AST
12 h	Red	1.88ab	131ab	713 c	440 d
	Green	1.87ab	119abc	135 f	748 a
	Blue	2.00 a	128ab	255 e	540 b
24 h	Red	1.73 b	137ab	805 b	495 c
	Green	1.86ab	101 c	395 d	494 c
	Blue	1.92ab	115bc	810 b	420 d
	Dark 24	1.89ab	119abc	290 e	384 e
	Natural light	1.85ab	139 a	975 a	540 b
	Control	1.94ab	127 ab	225 e	492 c
LSD 5%		0.22	23.9	84.2	26.2

Means in each column followed by the same letter (s) are not significantly different at 5% level.

3.2. Total fats (mg/ml):

The total fats content in silk gland of larvae was 139 mg/ml for natural light, 137 mg/ml for red light 24 hr and 131 mg/ml for red light 12 hr compared to 127 mg/ml for the control larvae of silk gland samples.

3.3. ALT content (mg/ml):

The mean content of ALT enzymes ranged 975 mg/ml for natural light, 920 mg/ml for dark and 810 mg/ml for blue light 24 hr compared to 522 mg/ml for the control larvae for silk gland samples.

3.4. AST content (mg/ml):

The mean content of AST enzymes in silk gland of larvae was 748 mg/ml for green light 12 hr, 540 mg/ml for both dark and blue light 12 hr, compared to 492 mg/ml for the control larvae of silk gland samples.

It is known that there is a high correlation between the leaf protein level and production efficiency of the cocoon shell, which means the cocoon shell weight of the total amount of mulberry leaves consumed by the silkworm Machii (1989), Machii and Katagiri (1991).

Therefore, an increase in the protein level of mulberry leaves may lead to improvement in silk productivity. The mulberry trees in Egypt, are among the poorest in terms of nutrition, due to their neglect in terms of fertilization, irrigation and agricultural practices. There are many varieties of mulberry over the world, which are characterized by high productivity of leaves as well as high protein content and mineral salts and vitamins. Mulberry is a rich source of protein, carbohydrates, carotenoids, lipids, ascorbic acid, antho cyanins. Five mulberry M5, RFs-135, V1, S36, S13 were analysed for their leaf quality through phytochemical tests. Results reviled the best one containing highest total soluble protein (111.40µg/g), total free amino acid (9.88 µg /g) and total phenol (4.96%) content compare to other four varieties so V1 is the highly recommendable feed for silkworm (*B.mori* L.) to increase their silk productivity Jyothi *et al*. (2014) and Madhu *et al.* (2014).

Also, Singh *et al*. (1985) estimated the enzyme activities of Glutamate oxalo acetate transaminase (GOT) and Glutamate pyruvic transaminase (GPT) in the silk gland of eri-silkworm, *Philosamia ricini*. It was found that getting activity was higher than GPT (about twice) in the middle portion, while in the posterior silk gland, GPT activity was higher (3-4 times) than got activity.

Moreover, El-Karaksy and Idriss (1990) found that ascorbic acid at different concentrations (0.25, 0.5, 1 and 2%) lead to increase significantly the weights of both larvae and pupae.

El-Bermawy and Abdel Fattah (2000). Also, Singaravelu *et al*. (2004) found that oral supplementation of magnesium sulphate with different concentrations to silkworm larvae of *B. mori* L. resulted in a significant influence on the assessed economic characters. Assessment of biochemical parameters of biomolecules (protein, carbohydrate and lipid) of digestive tissues illustrate its biological effect.

Rahmathulla *et al*. (2007) reported that dietarysupplementation of folic acid (Vitamin B) to silkworm larvae did notsignificantly increase the glycogen content of the body, where as in haemolymph treh alose content increases significantly.

Khedr *et al*. (2013) in a comparative study in Egypt, using two mulberry varieties *Morus alba*var. Kokuso-27 and *M. indica* var. Kanva-2 were compared with *M. alba*var. Balady (native) in their effects on the protein banding patterns of 5th-instarlarvae of *B. mori*. There was an

obvious variation in the number and position of the bands, with many bands specific to a particular treatment. Protein of larvae fed on Kokuso-27 was characterized by the presence of 29 and 10 KDa bands; Kanva-2 produced bands at 251, 74 and 8 KDa; and Balady was characterized by bands at 38 and 11 KDa. When Kokuso-27 was enriched with vitamins C or B, or any of three kinds of bee-honey (clover, cotton and citrus honey) at various concentrations, new protein bands appeared relative to controls.

Thulasi and Sivaprasad (2013) and Thulasi *et al*. (2015) cleared that, highly significant elevation in the total soluble protein and increased number of protein bands, while decreased significantly the activity of transaminase enzymes (AST and ALT) either in honey or Pharovit treatments comparing to control. Though, the nutritional importance of ascorbic acid is well substantiated, the role of lemon juice needs further investigations at higher concentrations .

Moreover, Thulasi and Sivaprasad (2015) suggested that honey is a profitable supplementary diet for silkworm which reinforces the day-to-day larval growth, silk gland growth and the gland-body ratio. It stimulates silk protein synthesis in all the three segments of the silk gland. Also, Ohila and Asiya (2016) indicated that administration of vitamin C stimulate metabolic activity which is used to increase the growth and feeding efficiency with reference to silkworm rearing observed that the 0.5%vitamin C treated group plays a significant role with an increase in growth and better food intake compared to control group and other vitamin C treated groups.

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تأثير لون الاضاءة وفترات التعرض على بعض القياسات البيوتكنولوجية (البروتينات الذائبة والدهون الذائبة والانزيمات الخاصة بالبروتين) فى يرقات دودة الحريرالتوتية

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الملخص العربى

أجريت هذه الدراسة خلال موسم الربيع لعام ٢٠١٧ بمعمل الحرير بقسم الحشرات الاقتصادية والحيوان الزراعى كلية الزراعة جامعة المنوفية ، لقياس تأثير تعرض يرقات ديدان الحريرالتوتية *Bombyx mori* للضوء الطبيعى والالوان المختلفة (الاخضر والازرق والاحمر) والاظلام التام لعدد مختلف من الساعات(٠، ١٢ ، ١٦ ، ٢٤) على بعض الصفات الفسيولوجية .

توضح النتائج التالية القياسات الفسيولوجية في غدة الحريرلليرقات التي تعرضت للمعاملات المختلفة والقياسات التي تم تسجيلها وهي البروتين الكلي القابل للذوبان والدهون الكلية الذائبة وكذلك الانزيمات الناقلة للبروتين ALT and AST)) كما يلي :

١- طول الخيط الحريري (م) :

سجل أعلي طول للخيط الحريري لليرقات التي تعرضت للضوء الاخضر لمده ٢٤ ساعه (١١١٩.٢م) ، يليها اليرقات التي تعرضت للضوء الازرق لمده ١٢ ساعه والذي سجل (١٠٧٧.٧٦م) ، بينما سجلت لليرقات التي تعرضت للضوء الاخضر لمده ١٢ ساعه (٩٥٤.٤٠م) ،وعلي الجانب الاخر سجل الكنترول(١١٠٩.٧٦م) ، هذا بالاضافة الي ان هذه الاضافات المختبرة سببت أعلي طول خيط حريربالمقارنة مع الكنترول.

٢- وزن الخيط الحريري(جم) :

سجل أعلي وزن للخيوط الحريرية للشرانق التي نتجت من اليرقات التي تعرضت للضوء الاخضر لمده ٢٤ ساعه حيث سجلت٢٢٨ .جم يليها اليرقات التى تعرضت للضوء الاحمر لمده ١٢ ساعه حيث سجلت ٢١٦ .جم ثم اليرقات التي تعرضت للضوء الازرق لمده ١٢ ساعه سجلت ٢١٤.جم مقارنة بالكنترول الذي سجل ٠,٢٣٢ جم في ٢٠١٧ .

كما أشارالتحليل الاحصائي الي ان هناك فروق معنوية كبيرة بين الوان الاضاءه وفترات الاضاءه.

٣ – حجم الخيط الحريري (دنير):

سجلت اليرقات التي تعرضت للضوء الاحمر لمده ٢٤ ساعه اعلي سمك للخيط الحريري حيث سجلت ٢.٠٨ دنير بينما سجلت معاملة التى تعرضت للضوء الاحمر لمده ١٢ ساعه أعلي سمك للخيط الحريري حيث سجلت٢.٠١ دنير يليها اليرقات التى تعرضت للضوء الطبيعى حيث سجلت ١.٩٩ دنير ثم الضوء الازرق التى تعرضت ل٢٤ ساعه والتي سجلت ١.٩٦ دنير بينما سجل الكنترول ١.٩١ دنير ووجد ان هناك فروق معنوية بين الوان وفترات الاضاءه في الموسم ٢٠١٧.

٤- البروتين الكلي القابل للذوبان (ملجم/مل) :

المحتوي البروتيني في غدة يرقة الحرير لمعامله الضوء الازرق المعرض لفتره (٢٤ ساعه) ٨٨ .١(ملجم/مللتر) بينما سجل الضوء الاخضر المعرض لفترة (١٢ ساعه) ١.٩٤ (ملجم/مللتر) وسجل معامله الضوء الاخضر المعرض

لفترة(٢٤ساعه) ٢.٦٨(ملجم/مللتر) في حين سجل الازرق لفترة (٢٤ ساعه) ٢.٦١(ملجم/مللتر.) بينما سجل الضوء الطبيعى ٢.٦٧ (ملجم/مللتر) وسجل الكنترول ٢.٤٥(ملجم/مللتر).

٥- الدهون الكلية (ملجم/مل) :

سجلت الدهون الكلية في غدة يرقة الحريرللضوء الطبيعى ١٣٩ (ملجم/مللتر) وفى الضوء الاحمر المعرض لفترة (٢٤ساعه) ١٣٧(ملجم/مللتر) بينما سجلت في الضوء الاحمر لفترة (١٢ ساعه) ١٣١(ملجم/مللتر)في حين سجل الكنترول١٢٧(ملجم/مللتر) بالنسبه لتحاليل الغده بينما سجل اللون الازرق المعرض لفتره (٢٤ ساعه) ١١٤ (ملجم/مللتر) بينما سجل الظلام التام ١٠٧ (ملجم/مللتر)والضوء الطبيعى سجل ٩٠ (ملجم/مللتر) وسجل الكنترول ٩٨ (ملجم/مللتر).

٦- الانزيمات الناقلة للبروتين (ALT and AST):

٦-١ ALT :

سجلت اليرقات المعرضة للضوء الاحمر لفترة (١٢ ساعه) ٧٠٣(ملجم/مللتر) ومعاملة الضوء الازرق لمده(١٢ ساعه) ٥١٩ (ملجم/مللتر) وسجل الضوء الازرق لفترة(٢٤ ساعه) ٥١٠ (ملجم/مللتر) بينما سجل الكنترول ٦٠٩(ملجم/مللتر) بالنسبه لتحاليل الدم اما بالنسبه للغده فسجل الضوء الطبيعى ٩٧٥(ملجم/مللتر) والظلام التام سجل ٩٢٠ (ملجم/مللتر) بينما الضوء الازرق لفترة (٢٤ ساعه) ٨١٠ (ملجم/مللتر) وسجل الكنترول ٥٢٢(ملجم/مللتر) .

٦-٢ AST:

سجلت اليرقات المعرضة الضوء الاخضر المعرض لفترة (١٢ ساعه) ضوء ٣١٦ (ملجم/مللتر) بينما سجل الضوء الاخضر لفترة (٢٤ ساعه) ٢٨٤ (ملجم/مللتر) وسجل الضوء الاحمر لفترة (١٢ ساعه) ٢٧٤ (ملجم/مللتر)، اما الكنترول فسجل ٣٠٢(ملجم/مللتر) هذا بالنسبه للتحاليل التى اجريت لعينات الدم ، اما بالنسبه لعينات الغده فسجلت المعامله المعرضه للضوء الاخضر لمده (١٢ ساعه) ٧٤٨(ملجم/مللتر) بينما سجلت المعامله المعرضه للظلام التام ٥٤٠ (ملجم/مللتر) والمعامله المعرضه للضوء الازرق لمده (١٢ ساعه) ٥٤٠ (ملجم/مللتر) اما الكنترول فسجل ٤٩٢ (ملجم/مللتر).

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