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Latent Effects on Adults' Emergence of *Pectinophora gossypiella* (Saund.) and *Earias insulana* (BOISD.), Resulted from Magnetized Pupae

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ABSTRACT

In this study, experiments were performed to investigate the effect of the exposure of pupal stage (24 h old) of *Pectinophora gossypiella* and *Earias insulana* to power supply magnetic flux (MF) of level 180mlli- tesla for different times (2, 6 and 12 minutes) and its latent effect on emerged adults. Results showed that a direct effect on exposed pupae caused a percent of pupal mortality in both insects that increased by the increase of exposure time. Data recorded a significant elongation in the pupal duration of both insects, as a result of magnetic exposure with more efficiency for 12min. exposure followed 6min. exposure and no observed effect for 2min. exposure. Data also indicated a high reduction in the percent of emerged adults resulted from magnetized pupae in contrast the percent of adult malformed was highly increased in comparison with control. The reduction in adult emergence and malformed percent was increased by the increase of exposure time in case of *P. gossypiella* treatment while, the process is reversed for *E. insulana.* A high reduction in numbers of eggs laid by females resulted from (12 and 6min.) MFs exposure was also reported differs to the slight effect of (2min.) MFs exposure for both *P. gossypiella* and *E. insulana*, in comparison with control. In addition a high reduction in egg hatchability percentages was also recorded with more efficiency on *E. insulana* especially in12 min. MFs exposure compared to control.
Keywords: *P. gossypiella* Magnetic, biology and magnetic power times

INTRODUCTION

The pink bollworm (PBW), *Pectinophora gossypiella* (Saunder**s**) (Lepidoptera: Gelechiidae) is one of the most serious insect pests infesting cotton, (*Gossypium spp*.) in many cotton producing areas of the world. It causes serious damage in cotton bolls and great loss as in both quality and quantity of cotton yield.

The spiny bollworm (SBW), *Earias insulana* (Boisd.) (Lepidoptera: Noctuidae) is the key pest of cotton. Its larvae are a major cosmopolitan pest of a wide range of crops in various parts of Egypt. It found on all Gossypium species including cotton, Okra and other host plants are mainly confined to the Malvaceae and few species of Tiliaceae. It causes damage bolls reduction of cotton yield

In Egypt, up to now, some trials in the laboratory for used the magnetic field n some insects. The environmental effects of magnetic fields are becoming increasingly important, thus, the number of experimental and theoretical research projects is continually growing the interaction of the electromagnetic field with a biological system is complex (Barnothy, 1964).

Some studies about to knowledge the effects of MFs on some biological aspects of various insects; Pan (1996) reported the effects of MFs on egg hatching. The hatching was delayed and hatching rate was reduced when exposing *the Ephestia kuehniella* (Zeller) adults to increasing levels of MFs and daily egg production and reduction in progeny production. Ramirez *et al.* (1983) found that *Drosophila* treated with (MF 1 mt) reduced the ovipostion rate and increased the immature mortality rate, fecundity and behavior. Kirschvink *et al*. (1997) demonstrated an ability to detect alternating (a.c.) fields of 2.2 mlt peak amplitude from d.c. at frequencies up to 60 Hz by the honeybee. Nenadovic *et al.* (2005) and Said et al (2017) they studied the interaction of some magnetic flux with some biological aspects of *P. gossepeilla*. Kandil *et a.l* (2018) recorded that the Magnetic Ferro- solution high effected on behavioraland reduction the fecundity and fertility of *P. gossypiella***.**

The investigation amid to knowledge of information on the effects of times exposure for MFs on *P. gossypiella* and *E. insulana* observed some biological aspects affects by different levels of MFs, for adults of the PBW.

MATERIALS AND METHODS

Insect used:

Pink bollworm (PBW), *P. gossypiella*

One day old pupae of pink bollworm *P. gossypiella*, used in this study was obtained from laboratory colony of Bollworm Department, Plant Protection Research Institute; Agriculture Research Center (ARC), reared for several generations away from any contamination with insecticides on an artificial diet that previously described by Rashad and Ammar (1985), under laboratory conditions at 26 ±1 °C and 65-70% R.H.

Spiny bollworm (SBW), *Earias insulana*

The culture of *E. insulana*, pupae used in this study was obtained from laboratory rearing of Bollworms Research Department, Plant Protection Research Institute, reared for several generations away from any contamination with insecticides on an artificial diet that previously described by Amer (2015), under laboratory conditions at 26 ±1 °C and 65-70% R.H.

Creating the magnetic field and exposure:

A magnetic apparatus consists of two components: The first components were (8) eight magnetic pieces (each of 30mlli- tesla power) were arranged in a row in an attractive position. Another similar row (with the same number and power) represented the second component. The two rows were put parallels together (with 2 cm distance between) and in repulsion position, which allows the magnetic power to 180 ml t. This apparatus was arranged and measured in faculty of Engineering, Menofiya University using mil. tesla meter (Fig.1). Insects (pupal stages) exposed to the magnetic field power (180 mil. tesla) to various durations of times as indicated (Fig.2).

The method of treatments:

In the experiment (one day old) pupal stages of *P. gossypiella* divided three groups (in tubes 1.5 x15 Cm.). The first group, exposed to magnetic power (180mlli-tesla) for 2 min., the 2nd group exposed to magnetic for 6 min. and, the 3rd group exposed to magnetic for 12 min,

while the 4th group used as the control. The pupae were inspected daily until adults' emergence. Adult emergence and malformed ratios were determined. Newly emerged moths of the two insects as well as the control were sexed and transferred to chimney glass cage (7pairs/cage). Three replicates for each treatment were prepared.

Emerged adults resulted from MFs exposed pupae:

Adults of *P. gossypiella* and *E. insulana* emerged from one day old pupae exposed to Magnetic power for 12, 6 and 2min. were collected in groups each of 7pairs(male and female) for the same exposure time and caged in glass cage. Three replicates for each exposure time were caged under the previously mentioned rearing condition.

Another group of adults was obtained from laboratory colony used as control. All cages fed on the original diet only as 20% sugar. Each cage was examined daily and the total number of eggs produced per female was calculated from daily counts of deposited eggs. The eggs hatchability percentages were calculated according to following equation:

$$\% \text{ Egg hatchability} = \frac{\text{No. hatched eggs}}{\text{No. deposited eggs}} \times 100$$

Fecundity percentage was calculated according to Crystal and Lachance (1963) as follows:

$$\% \text{ Fecundity} = \frac{\text{No. eggs/ treated female}}{\text{No. eggs/ untreated female}} \times 100$$

The recorded data values were statistically analyzed with one – way analysis of variance (ANOVA) ($P < 0.05$ %) (Snedecor, 1952) and Duncans multiple range test of means (Duncan, 1957) were used.

RESULTS AND DISCUSSION

Effect of magnetic power (MP) on pupal stage:

Data presented in (Table, 1) showed that the pupal periods were elongated significantly to12.3 and 10.6 days/ pupa for *P. gossypiella* and *E. insulana*, respectively, when exposed to magnetic power for 12min. followed by 9.6 and 9.0 days/ pupa, respectively, for 6min, compared with 7.3 and 7.8 days/ pupae *P. gossypiella* and *E. insulana* in control, with no observed effect for 2min. exposed, (Table, 1). Results were in agreement with that of Said *et al* (2017) who inducated that the magnetic flux elongated the *P. gossepeilla* and Kandil *et. al.* (2018) who recorded that the Magnetic Ferro- solution high effected on behaviors and the duration of pupal stage, it increased with increased the magnetic of *P. gossypiella*

Pupal mortality:

Exposure to magnetic power affected directly on pupal mortality percentages**.** The effect was obviously observed on, *E. insulana* as it recorded 65.6, 42.6 and 33.3 % for 12, 6 and 2 min. respectively, compared with 1.3 % for untreated check. The pupae of *P. gossypiella* were also affected by magnetic power that resulted in mortality percentages recorded by 43.0, 30.3 and 18.3 % for 12, 6 and 2 min. respectively, compared with 2.0 % for untreated check (Table, 1).

Table 1. Effect of time exposed of magnetic power on some biological aspects of *P. gossypiella* and *E. insulana* pupal stages under laboratory conditions.

Used stage	Times exposed (min.)	*P. gossypiella*		*E. insulana*	
		Duration (days)	Mortality (%)	Duration (days)	Mortality (%)
One day	12	12.3±0.3[c]	43.0	10.6± 0.4[c]	65.6
old	6	9.6±0.8b	30.3	9.0 ± 0.5b	42.6
pupae	2	7.3±0.6[ab]	18..3	7.9± 0.5[a]	33.3
Control	-	7.3±01[a]	2.0	7.8± 0.15[a]	1.3
LSD	-	0.29	-	0.341	-

Fig.1. Magnetic apparatus.

Fig. 2.Exposure to magnetic flux.

Adult emergence

Data in Table (2) showed that, the adult emergence percentages from pupae exposed to magnetic for (12, 6 and 2min.) decreased to 57.0 % in *P. gossypiella* and 40% in *E. insulana* for 12min. exposure. These percent increased gradually when the exposed time decreased to 2 min. to reach81.7 % and 66.7% for, *P. gossypiella* and *E. insulana,* respectively, compared to 99.7% and 98.7% in control of *P. gossypiella* and *E. insulana*, respectively.

Table 2. Effect of times exposed on adults of *P. gossypiella* and *E. insulana* resulted from pupal stages magnetization under laboratory conditions

Examined stage	Times exposed (min.)	*P. gossypiella*		*E. insulana*	
		Emergence (%)	Malformed (%)	Emergence (%)	Malformed (%)
Emerged adults	12	57.0	20.3	40.0	34.4
	6	69.7	8.3	5.0	57.4
	2	81.7	0.33	1.3	66.7
Control	-	99.7	1.3	98.7	1.0

On the other hand Table (2) also, indicated a percent of malformed adults estimated by 20.3, 8.3 and0.33% in *P. gossypiella* compared to 1.3% in control and 34.4, 57.4 and 66.7 in *E. insulana* compared to 1.0% in control was observes as a result of magnetic field exposure for 12, 6 and 2 min., respectively, (Fig. 3 & 4).

Total eggs lied:

As given in Table (3), the egg laying rate was 253.3 eggs deposited/ normal female of *P. gossypiella* and 243.0 eggs deposited/ normal female of *E. insulana*. The number of eggs/ female highly decreased (approximately 3times less) to record 95.0 and 64.0 eggs/ female *P. gossypiella* and *E. insulana* when female resulted from pupae exposed to magnetic power for 12min., respectively, while, The number of eggs/ female increased to 199 and 126.3 eggs/ female of *P. gossypiella* and *E. insulana* when female resulted from pupae exposed to magnetic power for 2min. The deposited eggs have hatchability percentage 97.0 and

94.6 % for normal deposited eggs for *P. gossypiella* and *E. insulana* (control), respectively. While, it being (75 &77%) at 2min. and (68 & 61.3) at 6min. for *P. gossypiella* and *E. insulana* when adults resulted from pupae exposed to magnetic power, and highly decreased to 56.0 and 45.0 % hatchability when adult resulted from pupae exposed to 12 min. of magnetic power, (Table, 3). In the same trend Pan (1996) reported the biological effects of a 7 T MFs on egg hatching of *Tenebrio molitor as* it was delayed and hatching rate was reduced. Also, Pandir (2013) recorded the effects of MF on *E. kuehniella* adults and found that the fecundity of adults and daily egg production highly decreased. In addition to Said *et al* (2017) as they showed that the magnetic flux affected on some biological aspects of *P. gossepeilla*. These results were also; agree with that of Kandil *et. al.* (2018) as they recorded that the Magnetic Ferro- solution resulted in reduction of the fecundity and fertility of *P. gossepeilla*.

Table 3. Latent effect of times exposed magnetic power total eggs laid and hatchability percentages of *P. gossypiella* and *E. insulana* under laboratory conditions.

Examined stage	Times exposed (min.)	*P. gossypiella*			*E. insulana*		
		Total eggs /♀	Fecundity (%)	Hatchability (%)	Total eggs /♀	Fecundity (%)	Hatchability (%)
Emerged adults	12	95.0±5.1	37.51	56	64.0±4.3	26.34	45.0
	6	178.0±3.5	70.27	68	103.3±6.1	42.51	61.3
	2	199.0± 4.3	78.56	75	126.0±4.3	51.85	77.0
Control	-	253.3±5.1	100	97	243.0±6.1	100	94.6
LSD	-	3.721		-	2.847		-

Fig.3. (A,B,C and D) *P. gossypiella* malformed adults

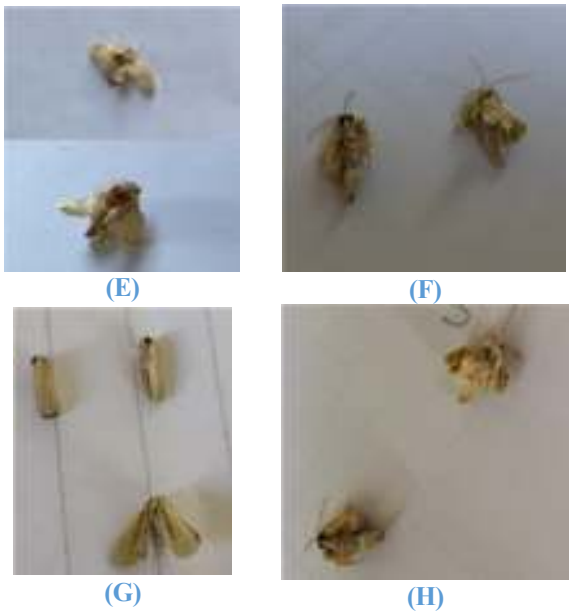

Fig. 4. (E,F,G and H) *E. insulana* malformed adults

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التأثيرات المتأخرة على خروج الأطوار البالغة لدودتي اللوز القرنفلية و الشوكية الناتجة من العذارى الممغنطة

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اجريت تجارب لدراسة تاثير تعريض طور العذراء لكل من دودة اللوز الشوكية و دودة اللوز القرنفلية للمجال المغناطيسي بقوة 180ملى تسلا للمدد الزمنية (2, 6 و12) دقيقة والاثر المتاخر لهذا التعريض على الفراشات الناتجة. أظهرت النتائج تاثيرا مباشرا على العذارى المعاملة حيث سببت نسبة موت للعذارى زادت بزيادة المدة الزمنية للتعريض لقوة المجال المغناطيسى. كما سببت المعاملات اطالة معنويه فى فترة حياة العذارى لكلا الحشرتين بلغت اقصاها عند التعرض لقوة المجال المغناطيسى لمدة 12 دقيقة ثم 6 دقيقة بينما لم يظهر التعرض لمدة 2 دقيقة اي تاثير. كما أوضحت النتائج تاثيرا على الطور البالغ الناتج من العذارى المعاملة حيث انخفضت نسبة خروج الفراشات بشكل واضح بينما ارتفعت نسبة التشوه فى الفراش الناتج مقارنة بالكنترول، وكانت النسبة الاكبر في الخفض والتشوه في الفراش الخارج لدودة اللوز الشوكية عنها في دودة اللوز القرنفلية مع الاختلاف حيث زادت نسبة الخفض والتشوه في الفراش الخارج بزيادة المدة الزمنية للتعريض في حالة دودة اللوز القرنفلية على العكس من ذلك في حالة دودة اللوز الشوكيةحيث ارتفعت نسبة الخفض والتشوه في الفراش الخارج بتقليل المدة الزمنية للتعريض. كما إنخفض عدد البيض/أنثى لكلا الحشرتين، وكان التاثير اوضح في حالة دودة اللوز الشوكية خاصة عند التعرض لقوة المجال المغناطيسى لمدة 12 دقيقة والذى إنعكس بدوره على النسبة المئوية للخصوبة. امتد التأثير أيضا ليشمل نسب الفقس فى البيض الناتج حيث ادت المعاملات المذكورة الى خفض ملحوظ فى تلك النسب لكلا الحشرتين وكان التاثير اكثر وضوحا في حالة دودة اللوز الشوكية خاصة عند التعرض لقوة المجال المغناطيسى لمدة 12 دقيقة. مما سبق يتضح تاثير اختلاف المدة الزمنية للتعريض للمجال المغناطيسى على طور العذراء لحشرتي دودة اللوز الشوكية و دودة اللوز القرنفلية والفراش الناتج مع زيادة فاعلية المجال المغناطيسي على دودة اللوز الشوكية وذلك مقارنة بدودة اللوز القرنفلية و الكنترول.