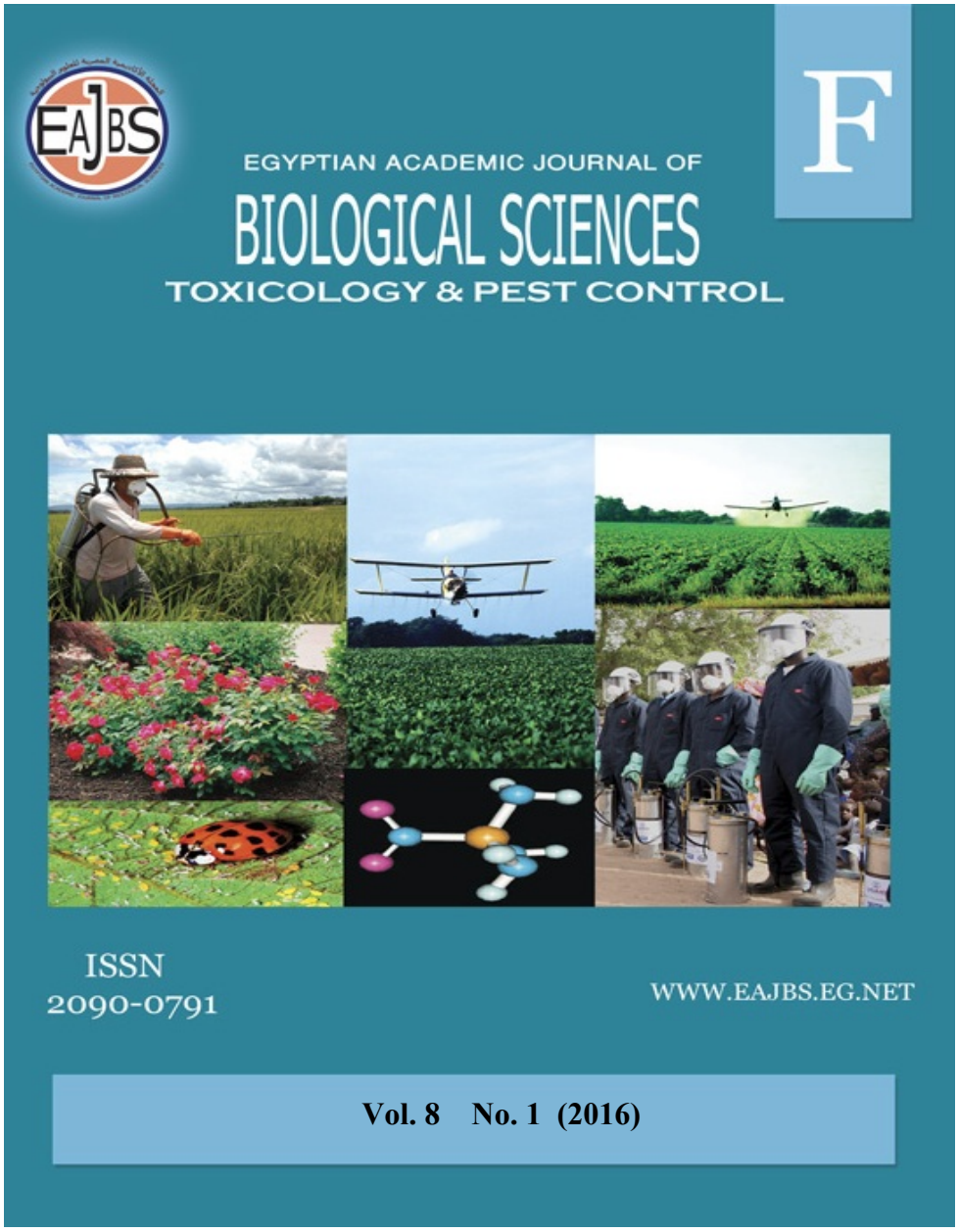

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Toxic Activity of Salicylic and Tannic Acids on some Biological Parameters of Spiny Bollworm, *Earias insulana* and Glassy Clover Snail, *Monacha cartusiana*

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ABSTRACT

The objective of this study was to evaluate the effect of salicylic and tannic acids on some biological aspects of spiny bollworm, *Earias insulana* including hatching percent, immature stages and mature stages. The study also extended to assess the effect of the same acids on the incubation period, hatching period and hatching percent of eggs of the glassy clover snail, *Monacha cartusiana*. Survival of the offspring hatched from *M. cartusiana* eggs treated with these acids has been also investigated. Results indicated that the effect of salicylic acid on *E. insulana* eggs was more than tannic acid effect. 55% was the highly larval mortality achieved by salicylic acid at1900 ppm. Tannic acid recorded the lowest larval duration 13.5 days at the concentration 1000 ppm. 0.0567 and 0.0457 g were the lowest larval and pupal weight recorded by tannic acid at 2000 ppm. The highly decreasing of pupal duration was observed at the concentration 500 ppm of tannic acid. 45 and 11% were the lowest pupation percent exhibited by salicylic acid at 1900 ppm and tannic acid at 1500 ppm, respectively. On the other hand, Tannic acid prevents egg laying at 2000 and 1500 ppm. The two acids decreased significantly the oviposition period, adult longevity, fecundity and the hatching percent. Regarding to the biological parameters of *M. cartusiana* snail, incubation and hatching periods increased by increasing the concentrations of the two acids. While, hatching percent of eggs decreased by increasing the concentrations of each acid. Salicylic acid at 2375 ppm gave the lowest hatching of eggs 43.88%. There was a reduction on survival of the offspring hatched from treated eggs by each tested acid. 65.02 % represent the lowest survival of the offspring snails achieved by salicylic acid at 2375 ppm.

INTRODUCTION

Spiny bollworm, *Earias insulana* is an important component of the lepidopteran pest complex of cotton in Egypt. Although it is a pest of cotton, it can also grow on other host plants. This bollworm causes damage by attacking terminal shoots, flower buds and green bolls. The most serious damage to cotton is caused when larvae bore into the bolls, destroying the fiber, consuming seeds and if the attack is not controlled, *E. insulana* larvae can destroy all the cotton bolls in the field (Maria *et al*., 2006).

At the same trend, *Monacha cartusiana* also considered the most common and harmful land snail infested the major plant crops in Egypt. It has also a role as intermediate host for many parasitic diseases which infected human, animals and birds (Mahrous *et al*., 2002 and Gabr *et al*., 2006). The control of these pests becomes necessary in order to reduce the damages caused in crops. The currently used pesticides are highly toxic to the environment (Gasparotto *et al*., 2005). Therefore, considerable effort has been paid to control the pests by using alternative substances replacing the pesticides using (Kozo *et al*., 1998). Organic acids considered a new effective method for control pests and it is safely used due to its rapidly degradation in the soil. Tannic acid can act by a variety of different mechanisms in pests including inhibition of feeding (Schultz, 1989). It has a high effect on the larvae of *Malacosoma disstria* by causing stop of the larvae development and caused lethal effect on pupal deformities (Karowe, 1989). In another direction, Preveen *et al*. (2001) found that some phenolic acids as coumaric, gallic and ferulic acids highly affected on the growth and survival of cotton bollworm causing decrease of the larval weight. The using of salicylic acid in the control of pests also reduced the levels of environmental pollution and attenuate the problems of resistance caused by continual used of a phytosanitary product (Moret *et al*., 2007). This acid highly reduced the egg hatching and survival of *M. cartusiana* juveniles (Shokry, 2013). Tannic acid also appeared to be a great potential for reduce the hatching percent of *Subulina octona* snail eggs so it could be applied as an alternative molluscicide for control land snails (Filho 2010, Lopes *et al*. 2011 and Bruna *et al*. 2014).

The aim of this study was to assess the effect of salicylic and tannic acids on the different biological parameters of the spiny bollworm, *E. insulana* and the glassy clover snail, *M. cartusiana*.

MATERIALS AND METHODS

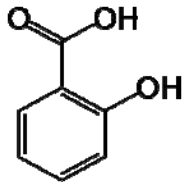
Experimental pests:

Eggs which deposited by the female moth of *Earias insulana* in the Bollworm Research Department, Plant Protection Research Institute (Sharkia branch) were divided into two groups. The first group for the control experiment of eggs but the second group lets to complete its development to give the 1st instar larvae for the control experiment of larvae. These larvae were reared in the incubator at 26 ±1°C and 80 ± 5 % R.H. on artificial diet described by Rashad and Ammar (1985). On the other hand, adults of *Monacha cartusiana* were collected from infested clover field at Malames village, Meniet El-Kamh district, Sharkia Governorate, Egypt. The snails were kept in a muslin bags, transferred to the laboratory at the same mentioned Research Institute. Individuals of *M. cartusiana* were placed on moist clay soil in glass container (30 × 30 × 50 cm^3) and provided with cabbage leaves clean then it was covered with muslin cloth for prevent escaping. Snails were supplied daily with fresh cabbage leaves and allowed to acclimatize to the laboratory conditions for one week (Abd El-Aal, 2001). Egg laying was observed daily and all egg clutches deposited in the rearing container were collected for the egg experiment.

Tested acids:

I - Salicylic acid

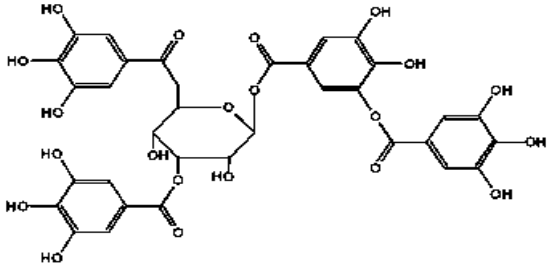
- Trade name: Mediplast (95% powder) white crystalline powder.
- Structure formula:



- Chemical name: 2 – Hydroxy – benzoic acid.
- Molecular formula: $C_7H_6O_3$

II - Tannic acid

- Trade name: Tannic acid (100% powder) brown powder.
- Structure formula



- Chemical name: 2,3-dihydroxy-5-{[(2R,3R,4S,5R,6R)-3,4,5,6-tetrakis ({3,4-dihydroxy-5-[(3,4,5-trihydroxyphenyl) carbonyloxy]phenyl}carbonyloxy)oxan-2-yl]methoxy}carbonyl)phenyl3,4,5-trihydroxybenzoate
- Molecular formula: $C_{76}H_{52}O_{46}$

* These acids were obtained from El – Gomhouria Company, Egypt.

Preparation of the acid concentrations

Five concentrations of 1900, 1425, 950, 475 and 237.5 ppm from salicylic acid and 2000, 1500,1000, 500 and 250 ppm from tannic acid were prepared for investigate there effect on *E. insulana* stages. While, the concentrations 2375, 1900, 1425, 950 and 475 ppm of salicylic acid and 3000, 2500, 2000, 1500 and 1000 ppm of tannic acid were prepared for applied against *M. cartusiana* eggs. These concentrations prepared by solving the amount of each tested acid required to obtain the appropriate concentration in distilled water (Mahmoud, 1994).

Effect of tested acids on *E. insulana* eggs

One day old eggs of *E. insulana* were obtained on a card and counted. The egg cards were dipped in each concentration of salicylic and tannic acid for 10 seconds then left for draying. Four replicates were prepared for each concentration and control. Hatching percent was calculated after ten days of the treatment.

Efficacy of tested acids on *E. insulana* larvae

Five grams of artificial diet were put in a Petri dish (7.5 × 2 cm). One ml from each concentration of each salicylic and tannic acid was added to the surface of the diet, and then left until dryness. Twenty five newly hatched larvae were put in each plate. Each treatment and the control were replicate four times. The alive and dead larvae were recorded for 48 hrs.

Latent effect of acids on *E. insulana* larvae

The larvae which still alive after the treatment with each acid concentration were transferred individually to untreated artificial diet in glass tubes (2 × 7.5 cm) and incubated under the previous conditions. Tubes

were observed daily for recorded the larval, pupal duration and larval, pupal weight and larval mortality. The pupae were separated on glass jar (half kg.) until moths emergence. The newly emerged moths were sexed and placed in glass jars. Each jar contains two pairs of moths fed on 10% sugar solution. Pre-oviposition, oviposition, post oviposition periods male and female longevity, number of deposited eggs and the hatchability were recorded (Zaki, 2014).

Effect of tested acids on the eggs of *M. cartusiana* snail

Suitable number of eggs (1–6 hours age) was dipped in each concentration of salicylic and tannic acid for 10 seconds by using a piece of white cloth. Each dipped eggs group transferred to the plastic box containing 250 g of moistened clay soil at the same depth of eggs laying. Three replicates were prepared for each concentration and other three boxes prepared as a control contains eggs dipped in distilled water only. All boxes covered with muslin cloth and secured with rubber band. Boxes examined each day to calculate the incubation period, hatching period and the hatching percent (Shokry, 2013).

Survival of the offspring originated from treated eggs of *M. cartusiana*

Snails hatched from eggs treated with each concentration of tested acids were kept in the same boxes. These newly hatched were fed on fresh cabbage leaves clean and soil remoistened with water every three days. Observations of mortality were performed every three days for two months. Dead individuals were removed from the boxes and the final survival percent of snails was recorded (Bessa and Araujo, 1995).

Statistical analysis

The obtained data in each experiment were statistically analyzed and the treatment means were compared according to the method of CoStat (2005) statistical program analysis, computer program software.

RESULTS AND DISCUSSION

Efficiency of tested acids on the eggs of *E. insulana*

As illustrated in Table (1) and Figure (1) salicylic acid was more potent against eggs of *E. insulana* than tannic acid. By increasing the concentrations of both acids the hatching percent decreased. 21, 30, 36, 41 and 81% were the hatching which exhibited by salicylic acid at the concentrations 1900, 1425, 950, 475 and 237.5 ppm, respectively. While; 74, 77, 80, 83 and 94% were the hatching which recorded by tannic acid at 2000, 1500, 1000, 500 and 250 ppm, respectively. That is a highly significant difference between the hatching values in case of the two acids. These results are supported by Corcuera (1993) described the phenolic acids as an important biochemical.

Table 1: Effect of tested acids on the eggs of *Earias insulana*

Acids	Concentrations (ppm)	Hatching %
Salicylic	1900	21.00 ± 3.42^{f}
	1425	30.00 ± 3.58^{e}
	950	36.00 ± 1.63^{de}
	475	41.00 ± 3.42^{d}
	237.5	81.00 ± 1.91^{b}
Tannic	2000	74.00 ± 2.58^{c}
	1500	77.00 ± 2.52^{bc}
	1000	80.00 ± 1.63^{bc}
	500	83.00 ± 1.91^{b}
	250	94.00 ± 1.15^{a}
	Control	97.25^{a}
	F. test	**
	$L.S.D_{0.05}$	6.52

The same letter in the same column means not significant at $P < 0.05$

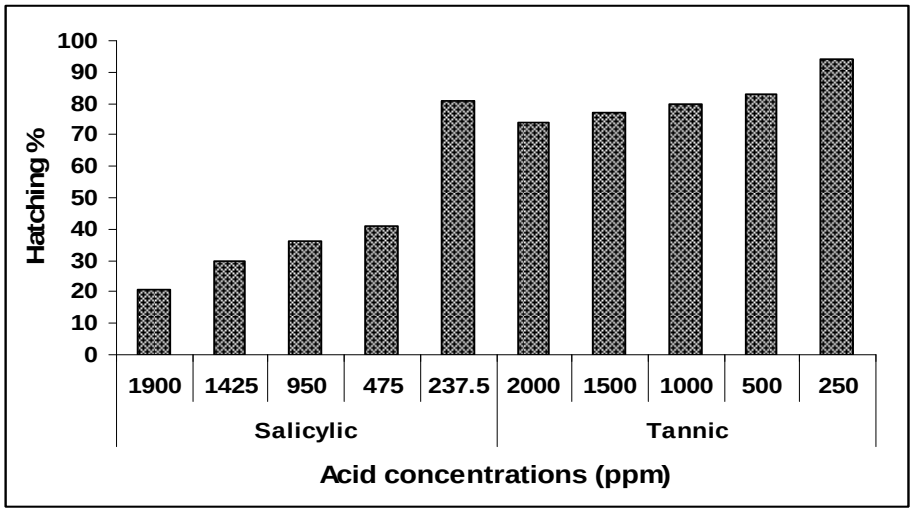


Fig. 1: Effect of tested acids on the egg hatching of *E. insulana*.

Basis of insect resistance. At the same direction, Zaki (2014) reported that the phenol compound able to prevent the hatching of 50% of *E. insulana* and *Pectinophora gossypiella* eggs at the concentrations 6423.6 and 27116.4 ppm, respectively. Salicylic acid has a high lethal effect against the eggs of *P. gossypiella* (Reda and Nafea, 2011). On the other hand, Chen *et al*. (2003) indicated that tannic acid at 0.005% was highly affected on the eggs of the cotton bollworm, *Helicoverpa armigera*. This effect due to its reduction to the activity of glutathione S – transferases (GSTs) in these eggs. In the same trend, Horowitz *et al*. (1992) stated that the dipping of *E. insulana* eggs in the concentration 50 ppm of hexaflumuron caused suppression of 80% egg hatch. The toxic effect of tar oil against the eggs of *P. gossypiella* is due to its contents of phenolic acids (Vitanen *et al*., 2000). While, Kochi and Kaliwal (2005) recorded that the topical application with 100, 200 and 300 ng / ml salicylic acid caused a significant increasing in the hatching percentage of the silkworm, *Bombyx mori* eggs.

Efficacy of tested acids on the immature stages of *E. insulana*

Data in Table (2) and Fig. (2) showed clearly that the highest larval mortalities of *E. insulana* 55 and 70% were recorded by salicylic and tannic

Table 2: Effect of tested acids on the immature stages of *E. insulana*

Acids	Conc. (ppm)	Accumulative mortality of larvae (%)	Larval duration (days)	Larval weight (g)	Pupal duration (days)	Pupal weight (g)	Pupation (%)
Salicylic	1900	55.00±3.00^{c}	15.50±0.65	0.0640±0.0023	6.25±0.48^{bc}	0.0555±0.0015	45.00±3.00^{c}
	1425	48.00±2.83^{d}	14.50±0.65	0.0613±0.0018	8.25±0.86^{abc}	0.0494±0.0024	52.00±2.83^{b}
	950	47.00±2.51^{d}	16.00±0.41	0.0626±0.0044	9.75±0.63^{ab}	0.0535±0.0041	53.00±2.52^{b}
	475	44.00±1.63^{de}	14.25±0.48	0.0645±0.0032	8.75±0.75^{abc}	0.0604±0.0019	56.00±1.63^{b}
	237.5	40.00±1.63^{e}	14.50±0.65	0.0677±0.0030	6.75±0.85^{abc}	0.0600±0.97	56.67±.3.71^{b}
Tannic	2000	70.00±0.82^{a}	16.50±0.65	0.0567±0.002	6.75±0.48^{ab}	0.0457±0.003	34.00±2.58^{d}
	1500	65.00±1.96^{ab}	15.50±0.65	0.0638±0.0003	7.25±0.85^{abc}	0.0576±0.004	11.00±1.91^{c}
	1000	63.00±1.08^{b}	13.50±0.65	0.0584±0.003	10.25±0.85^{a}	0.0512±0.002	26.00±3.19^{e}
	500	62.00±1.08^{b}	14.50±0.65	0.0685±0.003	5.25±0.63^{c}	0.0563±0.002	14.00±1.35^{f}
	250	62.00±0.95^{b}	14.50±0.65	0.0677±0.002	7.50±0.65^{abc}	0.0588±0.002	13.75±.2.39^{f}
	Control	3.75±0.61^{f}	15.00±0.41	0.0689±0.0026	10.00±0.41^{a}	0.0579±0.0030	96.25±0.72^{a}
	F. test	**	NS	NS	*	NS	**
	L.S.D$_{0.05}$	5.99	4.65	0.0331	3.57	0.0331	5.25

The same letter in the same column means not significant at $P < 0.05$

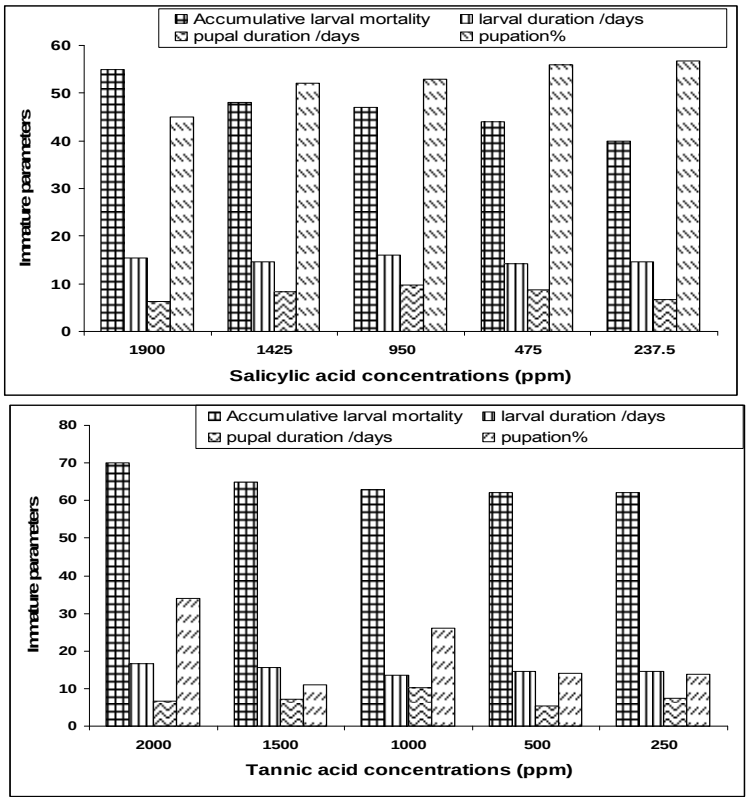


Fig. 2: Effect of tested acids on the immature stages of *E. insulana*.

Acids at the concentrations 1900 and 2000 ppm, respectively. On the other hand, the lowest larval and pupal durations were exhibited by salicylic acid as 14.25 and 6.25 days at 475 and 1900 ppm, respectively. While, tannic acid decreased the larval and pupal durations to 13.50 and 5.25 days at 1000 and 500 ppm, respectively. The lowest larval and pupal weights were achieved by salicylic and tannic acids as 0.0613 & 0.0494 g and 0.0567 & 0.0457 g at the concentrations 1425 and 2000 ppm, respectively. The pupation highly decreased to 11 and 45% by tannic and salicylic acids at 1500 and 1900 ppm concentrations, respectively. These results were parallel to those reported by Sharma and Agarwal (1982) cited that tannic acid prevent the larvae of spotted bollworm, *Earias vittella* from reaching to the pupal stage. Added that this acid in general increased the developmental period of insects and decreased the pupal weight. Moreover, Weissenberg *et al*. (1986) stated that the larvae of *E. insulana* did not pupate when fed on diets containing 0.10% coumaric acid. At the same trends, Zhu *et al*. (2012) showed that the sub lethal concentrations of hexaflumuron reduced the larval survival of *Spodoptera littura*. 0.263, 0.2047, 0.1459, 0.0938, 0.0028 and 0.0014 g represents the mean weights of *Heliothis armigera* larvae due to its treating with cinnamic, sinapic, chlorogenic, P - hydroxy benzoic, syringic and ferulic acids, respectively compared to 0.4885 g in the control. Cinnamic, sinapic, chlorogenic and P - hydroxy benzoic acids decreased the pupation to 39.90, 33.40, 11.20 and 5.60%, respectively in comparing to 100% in the control. But syringic and ferulic acids completely prevent the pupation (Perveen *et al*., 2001).

Effect of tested acids on the mature stages of *E. insulana*

The obtained results in Table (3) and Figure (3) indicated that the effect of salicylic acid on the adult emergence was more than tannic acid. Salicylic acid recorded the highest effect on the adult emergence as 24.52% at the

concentration 1900 ppm. While, tannic acid not has any effect on this aspect at the concentrations 1500, 500 and 250 ppm. The lowest pre oviposition period were achieved by salicylic acid as 1.25 days at 475 ppm comparing to 4 days in the control.

On the other hand, tannic acid elongated the oviposition period to 11.25 days at the concentration 1000 ppm compared to 7.25 days in the control. The post oviposition period highly affected by salicylic acid gave 1.50 days at 950 and 475 ppm concentrations in comparing with 3.50 days in the control. But, the adult longevity strongly affected by tannic acid recorded 5 and 4.50 days for the female and male adults, respectively at the highest

Table 3: Effect of tested acids on the mature stages of *E. insulana.*

Acids	Conc. (ppm)	Adult emergence (%)	Oviposition periods (days)			Adult longevity (days)		Fecundity	Hatchability (%)
			Pre - oviposition	Oviposition	Post - oviposition	♀	♂		
Salicylic	1900	24.52±16.25^{g}	1.75±0.48^{cd}	9.75±0.85^{ab}	1.75±0.25^{cd}	13.25±0.95^{bcd}	12.00±0.29^{a}	14.75±2.29^{e}	31.74±7.18^{ef}
	1425	31.21±3.89^{f}	3.25±0.48^{ab}	7.00±0.41^{cd}	1.75±0.25^{cd}	12.00±0.58^{cd}	12.00±0.41^{a}	29.75±2.22^{d}	25.89±6.49^{f}
	950	43.49±3.51^{e}	1.50±0.50^{cd}	8.00±0.58^{cd}	1.50±0.29^{d}	11.00±0.41^{d}	11.75±0.45^{a}	40.25±6.38^{c}	48.43±8.25^{cd}
	475	49.86±5.39^{d}	1.25±0.25^{de}	9.00±0.41^{abc}	1.50±0.29^{d}	11.75±0.25^{cd}	12.00±0.41^{a}	43.75±9.11^{c}	60.17±7.64^{b}
	237.5	58.25±4.73^{c}	4.25±0.25^{a}	6.75±0.48^{cd}	2.00±0.41^{cd}	13.00±0.41^{bcd}	15.00±0.41^{a}	60.00±4.88^{b}	54.15±7.55^{c}
Tannic	2000	96.42±3.15^{ab}	0.00^{e}	0.00^{e}	0.00^{e}	5.00±0.41^{e}	4.50±0.65^{b}	0.00^{f}	0.00^{g}
	1500	100.00^{a}	0.00^{e}	0.00^{e}	0.00^{e}	6.50±0.65^{e}	5.00±0.41^{b}	0.00^{f}	0.00^{g}
	1000	95.83±4.17^{ab}	3.75±0.48^{ab}	11.25±1.11^{a}	2.25±0.25^{c}	17.25±1.49^{a}	7.00±1.08^{b}	16.25±2.98^{e}	32.24±3.51^{e}
	500	100.00^{a}	2.75±0.48^{bc}	5.75±0.48^{d}	2.00±0.41^{cd}	10.50±0.96^{d}	5.50±0.65^{b}	17.00±1.08^{e}	33.70±5.37^{e}
	250	100.00^{a}	3.75±0.48^{ab}	6.25±0.85^{d}	5.50±0.65^{a}	15.50±0.29^{ab}	6.00±0.41^{b}	59.25±11.35^{b}	46.13±5.46^{d}
	Control	91.05±1.56^{b}	4.00±0.41^{ab}	7.25±0.48^{cd}	3.50±0.50^{b}	14.75±0.48^{abc}	15.00±0.41^{a}	221.00±8.74^{a}	93.56±2.16^{a}
	F. test	**	**	**	**	**	**	**	**
	L.S.D$_{0.05}$	5.59	1.45	2.28	0.72	3.39	3.92	6.48	5.72

The same letter in the same column means not significant at P < 0.05

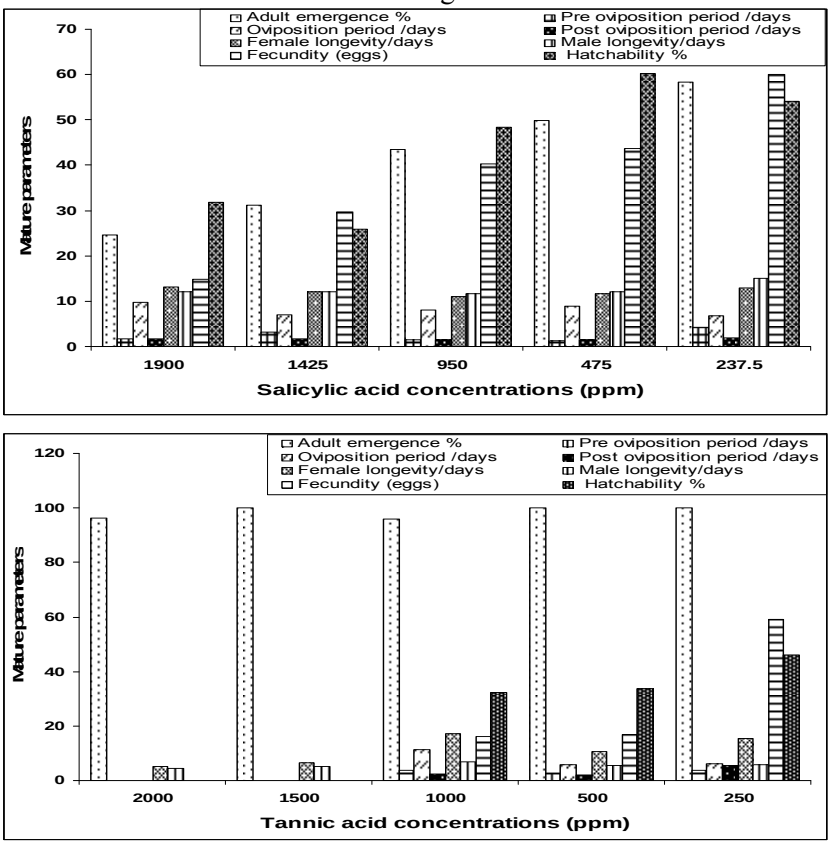


Fig. 3: Effect of tested acids on the mature stages of *E. insulana*.

Concentration 2000 ppm comparing to 14.75 and 15.00 days for females and males control, respectively. That is no fecundity and of course hatchability recorded in case of tannic acid at 2000 and 1500 ppm concentrations. At the other side, salicylic acid gave the lowest fecundity 14.75 at the highest tested concentration 1900 ppm and exhibited the lowest hatchability 25.89% only at the concentration 1425 ppm. Our results are in agreement with those obtained by Zaki (2014) reported that phenol compound decreased the oviposition period of *E. insulana*, *P. gossypiella* and *H. armigera* bollworms. On the other hand, it was increased the post oviposition period of these bollworms and decreased their longevity. This compound also caused a high significant reduction in the fecundity and decreased the hatchability in case of the three species. Moreover, Sammour *et al*. (2008) recorded that chlorfluazuron and leufenuron caused decreasing of the adult emergence, fecundity and longevity of the cotton leafworm, *Spodoptera littoralis*. On the other hand, El-Barkey *et al*. (2009) stated that radiant compound highly affected on the biological aspects of the pink bollworm, *P. gossypiella*. It was decreased the oviposition and post oviposition periods to 8.56 and 1.1 days comparing to 14.2 and 2.8 days in the control, respectively. In addition, it was decreased the female and male longevity to 15.46 and 9.7 days compared to 18.8 and 15.4 days in the control, respectively. Zaki (2012) showed that the leaf and bark extracts of *Casuarina equisetifolia* caused an increasing of the pre and post oviposition periods of *E. insulana* and decreased the adult longevity and eggs fertility of it.

Influence of the tested acids on the egg hatching of *Monacha cartusiana*

Data in Table (4) and Figure (4) demonstrated that the effect of salicylic acid on the biological parameters; incubation period, hatching period and hatching percent of *M. cartusiana* eggs was more than the tannic acid effect. Both acids increased the incubation and hatching periods by increasing its concentrations. 23.00, 22.66, 22.33, 21.00 and 20.66 days were the incubation periods which recorded by salicylic acid at 2375, 1900, 1425, 950 and 475 ppm concentrations, respectively.

Table 4: Effect of tested acids on egg hatching of *M. cartusiana* snail

Acids	Conc. (ppm)	Incubation period (days)	Hatching period (days)	Hatching %
Salicylic	2375	23.00^{a}	6.33^{a}	43.88^{h}
	1900	22.66^{a}	6.33^{a}	51.84^{g}
	1425	22.33^{ab}	5.66^{ab}	58.82^{f}
	950	21.00^{cd}	5.33^{bc}	62.26^{e}
	475	20.66^{cd}	5.00^{bc}	68.20^{c}
Tannic	3000	21.33^{bc}	5.66^{ab}	58.31^{f}
	2500	20.66^{cd}	5.33^{bc}	63.88^{de}
	2000	20.00^{de}	5.33^{bc}	66.64^{cd}
	1500	20.00^{de}	5.00^{bc}	68.35^{c}
	1000	19.33^{ef}	4.66^{c}	72.27^{b}
	Control	18.66^{f}	5.00^{bc}	81.03^{a}
	F. test	***	*	***
	$L.S.D_{0.05}$	1.075	0.980	2.849

The same letter in the same column means not significant at $P < 0.05$.

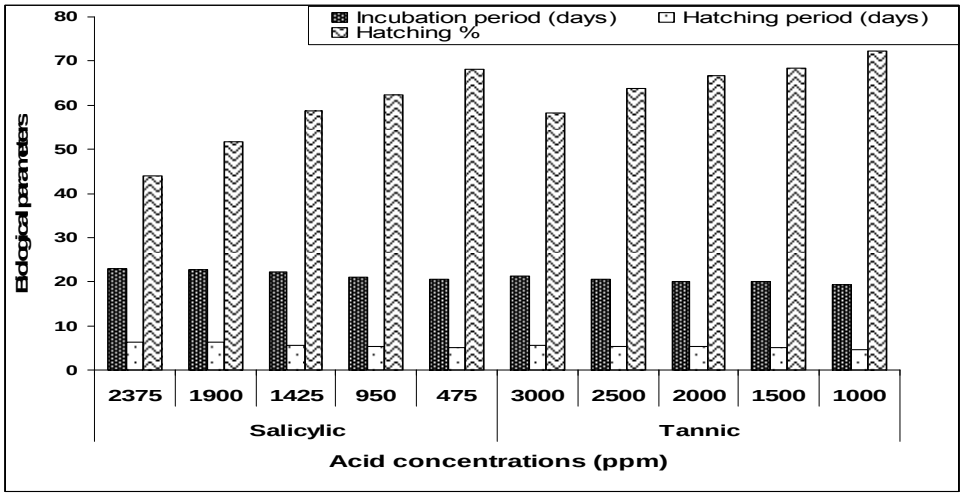


Fig. 4: Effect of tested acids on the egg hatching of *M. cartusiana* snail.

While, the incubation periods which recorded by tannic acid were 21.33, 20.66, 20.00, 20.00 and 19.33 days at the concentrations 3000, 2500, 2000, 1500 and 1000 ppm, respectively. On the other hand, salicylic acid elongated the hatching period to 6.33 days at the concentrations 2375 and 1900 ppm but tannic acid gave the highest hatching period 5.66 days at 3000 ppm compared to 5 days in the control.

Salicylic and tannic acids decreased the egg hatching to 43.88 and 58.31% at the highest concentrations of each acid at 2375 and 3000 ppm, respectively compared to 81.03% of the untreated eggs.

These results are in harmony with those achieved by Shokry (2013) indicated that the incubation period of *M. cartusiana* eggs was increased by increasing the concentrations of salicylic acid. It was recorded 22.00, 21.00, 20.33 and 19.66 days for 2, 1.5, 1 and 0.5% concentrations of salicylic acid, respectively comparing to 18 days in the control. This acid recorded hatching periods 5.33, 5.00, 5.00 and 4.66 days at the same concentrations, respectively. The treatment with this acid also caused hatching 62.76, 68.18, 77.76 and 80.55% at 2.00, 1.50, 1.00 and 0.50% concentrations, respectively compared to 81.66% in the control. Acetic acid able to decrease the hatching of *M. cartusiana* eggs to 68.32 and 75.34% at the concentrations 2.00 and 1.50%, respectively. In the same trend, Labieniec and Gabryelak (2007) cleared that tannic acid induced a poptosis and necrosis effect against mollusca eggs. This acid also caused changes in the proteins and DNA function and caused different physiological changes of the mollusca organs (Labieniec *et al*., 2007). Graveland and Wal (1996) reported that ferulic acid and limonene caused a significant reduction in protein, amino acid, DNA and RNA levels in the eggs of land snails and the anthropogenic acidification caused increasing defects of the egg shell. On the other hand, Lemma and Yau (1974) explained that the low efficiency of molluscicides in eggs is probably due to their high molecular weights that prevent the passing of molluscicides through the egg membrane. Caffeic acid at 5 g – L recorded an average hatching of 12.50% for the eggs of the land snail *Subulina octona* (Ferreira *et al*., 2009). Moreover, Simoes *et al*. (2010) stated that the exposure of snail eggs to tannic acid has a negatively effect on the embryo this due to its penetration through the pores of the thin calcite layer.

Survival of the offspring hatched from *Monacha cartusiana* eggs treated with tested acids

As shown in Table (5) and Figure (5) the survival of *M. cartusiana* hatched from eggs treated with salicylic acid was highly affected than the other eggs which treated with tannic acid. 65.02, 71.99, 77.67, 82.21 and 83.62% and 79.19, 82.95, 86.01, 92.19 and 94.08% were the survival of snails hatched from eggs dipped in 2375, 1900, 1425,950 and 475 ppm concentrations of salicylic and 3000, 2500, 2000, 1500 and 1000 ppm concentrations of tannic acids after 8 weeks of hatching, respectively. The means of the survival snails hatched from eggs treated with both acids were significantly higher in comparison to the untreated eggs.

These results are parallel to those achieved by Bruna *et al*. (2013) showed that the exposure of the land snail *Subulina octona* eggs to tannic acid at the sublethal concentration reduced significantly the survival of the offspring hatched from exposed eggs. The same authors in (2014) added that the exposure of *S. octona* eggs to the aqueous extract *Mikania glomerata* which include tannins for 24 and 48 h. reduced significantly the survival of the offspring hatched from the exposed eggs. Shokry (2013) reported that 83.20, 83.34, 87.90 and 90.80% represent the survival of *M. cartusiana* hatched snails from eggs dipped in 2.00, 1.50, 1.00 and 0.50% concentrations of salicylic acid, respectively.

Table 5: Survival of the offspring hatched from *M. cartusiana* eggs treated with tested acids

Acids	Conc. (ppm)	Survival % of juveniles / week								Mean of survival %
		1	2	3	4	5	6	7	8	
Salicylic	2375	100	93.65^{c}	83.55^{f}	60.76^{h}	45.57^{h}	45.57^{i}	45.57^{i}	45.57^{i}	65.02^{j}
	1900	100	94.94^{bc}	88.60^{d}	64.56^{g}	56.96^{g}	56.96^{h}	56.96^{h}	56.96^{h}	71.99^{i}
	1425	100	95.71^{b}	95.71^{b}	71.41^{f}	65.70^{f}	64.29^{g}	64.29^{f}	64.29^{f}	77.67^{h}
	950	100	100.00^{a}	92.20^{c}	86.66^{c}	80.00^{de}	74.43^{d}	62.20^{g}	62.20^{g}	82.21^{f}
	475	100	95.77^{b}	92.98^{c}	92.98^{b}	80.30^{d}	69.01^{f}	69.01^{e}	69.01^{e}	83.62^{e}
Tannic	3000	100	96.10^{b}	85.73^{e}	77.94^{e}	77.94^{e}	71.43^{e}	62.35^{fg}	62.35^{fg}	79.19^{g}
	2500	100	100.00^{a}	86.95^{de}	81.13^{d}	78.26^{de}	72.43^{de}	72.43^{d}	72.43^{d}	82.95^{e}
	2000	100	100.00^{a}	87.99^{d}	87.99^{c}	78.03^{e}	78.03^{c}	78.03^{c}	78.03^{c}	86.01^{d}
	1500	100	100.00^{a}	95.01^{b}	93.77^{b}	90.02^{c}	86.27^{b}	86.27^{b}	86.27^{b}	92.19^{c}
	1000	100	100.00^{a}	100.00^{a}	93.75^{b}	93.75^{b}	87.50^{b}	87.50^{b}	87.50^{b}	94.08^{b}
Control		100	100^{a}	100^{a}	100^{a}	100^{a}	100^{a}	100^{a}	100^{a}	100^{a}
F. test			***	***	***	***	***	***	***	***
$L.S.D_{0.05}$			1.518	1.978	2.349	2.183	2.270	2.032	2.032	0.679

The same letter in the same column means not significant at $P < 0.05$

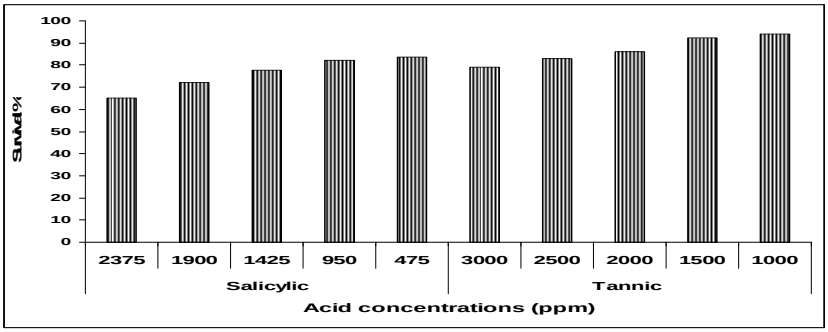


Fig. 5: Survival of the offspring hatched from *M. cartusiana* eggs treated with tested acids.

While, acetic acid at the same concentrations recorded 85.37, 87.51, 95.82 and 96.45% survival of hatched *M. cartusiana* snails, respectively. On the

other hand, salicylic acid at the concentrations 2, 1.5, 1 and 0.5% caused 47.05, 51.24, 71.44 and 72.73% survival of the *Eobania vermiculata* offspring hatched from eggs treated with these concentrations, respectively. At the same direction, Kumar *et al*. (2010) published that the sublethal treatment (20 and 60% of 24 hr. LC_{50}) of *Lymnaea acuminata* snail with ferulic acid caused a significant reduction in the survival of snails which out from eggs treated with this acid.

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ARABIC SUMMERY

التأثير السام لحامضي السالسيلك و التانيك على بعض الظواهر البيولوجيه لدوده لوز القطن الشوكيه إيرياس إنسيولانا و قوقع البرسيم الزجاجي موناكا كارتوسيانا

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أجريت هذه الدراسه لمعرفه تأثير حامضي السالسيلك و التانيك على الظواهر البيولوجيه لدوده لوز القطن الشوكيه إيرياس إنسيولانا و قوقع البرسيم الزجاجي موناكا كارتوسيانا بطريقه الغمر تحت الظروف المعمليه و قد أظهرت النتائج أن تأثير حامض السالسيلك على بيض دوده لوز القطن الشوكيه كان يفوق تأثير حامض التانيك كما حقق حامض السالسيلك أعلى نسبه موت ليرقات دوده لوز القطن الشوكيه وصلت إلى ٥٥٪ عند تركيز ١٩٠٠ جزء من المليون بينما كان حامض التانيك هو الأكثر تأثيرا على العمر اليرقي للدوده حيث سجل ١٣,٥ يوم فقط عند التركيز ١٠٠٠ جزء من المليون بالإضافه إلى أنه أيضا كان الأكثر تأثيرا على وزن اليرقات و العذارى عند تركيز ٢٠٠٠ جزء من المليون. حقق نفس الحامض أعلى نقص في عمر العذارى عند التركيز ٥٠٠ جزء من المليون في الإتجاه الأخر سجل حامضي السالسيلك و التانيك أقل نسبه تعذير وصلت إلى ٤٥ و١١٪ عند التركيزات ١٩٠٠ و ١٥٠٠ جزء من المليون على التوالي. أشارت النتائج أيضا إلى أن حامض التانيك إستطاع أن يمنع وضع البيض تماما عند التركيزين ٢٠٠٠ و ١٥٠٠ جزء من المليون كما كان للحامضين تأثيرا معنويا واضحا في تقليل فترات وضع البيض و حياه الأفراد المذكره و المؤنثه و الخصوبه و نسبه الفقس لدوده لوز القطن الشوكيه. فيما يخص قوقع البرسيم الزجاجي فقد أوضحت النتائج أن بزياده تركيزات الحامضين إزدادت فترتي الحضانه و الفقس للبيض على العكس تماما من نسبه الفقس التي قلت بوضوح بزياده التركيزات المختبره للحامضين حيث سجل السالسيلك عند تركيز ٢٣٧٥ جزء من المليون أقل نسبه فقس لبيض قوقع الموناكا وصلت إلى ٤٣,٨٨٪ و كان لنفس الحامض أعلى تأثير على الأفراد الصغيره الناتجه من البيض المعامل به عند تركيز ٢٣٧٥ جزء من المليون تمثل في نسبه الموت ٦٥,٠٢٪ بعد ٨ أسابيع من الفقس