Effect of Pyridalyl on Alkaline Phosphatase and Transaminase Activities in Some Tissues of *Schistocerca gregaria* (Orthoptera: Acrididae).

Salam S. Teleb[1]; Farag A. Ahmed[1] and Ahmed Abdel Zaher M. Mostafa[2,3]

[1]Zoology Department, Faculty of Science, Zagazig University, Egypt
[2]Chemistry Department, Faculty of Science, Zagazig University, Egypt
[3]Shaqra University, College of science and arts at Shagra , Kingdom of Saudi Arabia
salamteleb@gmail.com

Abstract: The effect of the novel insecticide, pyridalyl on the activities of the Alkaline phosphatase (AlP), glutamic pyruvic transaminase(GPT) and glutamic oxaloacetic transaminase(GOT), in both the haemolymph and fat bodies of 5th nymphal instar and newly emerged adults of the desert locust *Schistocerca gregaria* were investigated.
The Pyridalyl, exerted contradictory effects on the ALP activity in locust haemolymph and fat bodies, and this activity appeared to be depending on locust age and pyridalyl concentrations. Results showed that application of different concentrations of Pyridalyl on the 4th nymphal instars, resulted a significant increase in enzyme activity at the early and late -aged nymphs as well as newly emerged adults and a significant decreased in the mid –aged. In locust fat bodies, the ALP activity increased in mid-aged nymphs and the newly emerged adults but decreased at early and late- aged.
Results appeared also that Pyridalyl decrease GPT activity in the haemolymph at high concentrations(500and 100ppm) along the nymphal life while increasing in the early and late aged nymphs at low concentration(10ppm).In newly emerged adults, pyridalyl gave the highest increase in GPT activity than control at the different concentrations. Pyridalyl exhibited an enhancing effect on the GPT activity in the fat bodies along the nymphal instar age and in newly emerged adults.
Treatment of Pyridalyl by different concentrations showed that the enzyme activity of GOT increased in the haemolymph at early aged while at mid, late aged 5th nymphal instar and early adults, the enzyme activity was decreased. Also increasing the GOT activity in the fat bodies of both aged 5th nymphal instar and newly emerged adults was determined.

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1. Introduction

The hydrolytic enzymes, such as Alkaline phosphatase (ALP) is a brush border membrane marker enzyme (Wolfersberger, 1984) and is active in tissues with active membrane transport, such as intestinal epithelial cells ,Malpighian tubules (Etebari and Matindoost, 2004 a & b), and hemolymph (Etebari *et al.*, 2007). However, ALP is located in cells which are the most in the synthesis of fibrous proteins and may be correlated to the gradual growth and development of the imaginal tissues that overlap with histolysis of the larval tissues (Bream, 2003) . ALP is responsible for cytolysis of tissues during the insect development (Sridhara and Bhat,1963; Schin and Clever, 1965; Dadd, 1970) and may act as hydrolases during the final stages of digestion (Cheug and Low, 1975), gonad maturation and metamorphic moults(Rhadha and Priti, 1969). The ALP activity was low during the larval moulting stage and increased gradually after moulting (Miao, 1988).

Aspartate transferase (AST)[also known as glutamic oxaloacetic transaminase (GOT)] and Alanine transaminase (ALT) [also known as Glutamine pyruvic transaminase (GPT)] .Transamination has been demonstrated in a number of insect tissues,particularly that concerning glutamate, aspartate and alanine (Gilmour, 1961). GOT and GPT are key enzymes in the formation of non-essential amino acids, in metabolism in the nitrogen waste, gluconeogenesis and correlated with protein anabolism and catabolism (Mordue and Goldworthy 1973), these transaminases are the important components of amino acid catabolism; which is mainly involved in transferring an amino group from one amino acid to another keto acid. The aspartate aminotransferase and alanine-aminotransferase serve as a strategic like between the carbohydrate and protein metabolism and are known to be altered during various physiological and pathological conditions (Etebari *et al.*, 2005).

Pyridalyl (S-1812; 2, 6-dichloro-4-(3, 3-dichloroallyloxy) phenyl 3- (5-(trifluoromethyl)-2-pyridyloxyl propyl ether], is a novel insecticide that has a phenoxy-pyridaloxy derivative structure, was discovered by Sumitomo Chemical .Co, Ltd. The compound was reported effective on the pests of order Lepidoptera and Thysanoptera(Sakamoto and Umeda 2003) . Its efficacy was also reported against *Plutella xylostella* (Umeda and Strickland, 1999) which are resistant to various currently used insecticides, populations of tobacco budworm, *Heliothis virescens*, cotton bollworm, Helicoverpa zea (Johnson *et al.*, 2000) ,Dahi *et al* .,(2011) on *Spodoptera littoralis* and against the 4th larval instar of *Anopheles pharoensis, Culex pipens* and *Culista longiareolata*(Teleb *et al*., 2012).

The present study was undertaken to study the newer insecticide pyridalyl on alkaline phosphatase and transaminase activities in the haemolymph and fat bodies of 5th nymphal and early adults of the economically dangerous insect *Schistocerca gregaria*.

2. Materials and Methods

1-Insect Rearing

A gregarious stock of desert locusts *Schistocerca gregaria* (*S. gregaria*) were collected from Anti Locust Research centre Dokki, Giza and reared in Zoology Department, Faculty of Science , under crowded conditions and kept in cages (46 cm x46 cm x 46 cm at temperature of 32±2°C and 75-80% R.H. The insects were reared under crowded breeding conditions outlined by Hunter-Jones (1961) and Hassanein (1965). The bottom was covered with 20 cm layer of sand. Each cages was equipped internally with 60 W electric bulb for lightening .

Successive generations were raised before obtaining the nymphs for the present experimental work .Fresh food plant was lettuce *Lactuca sativa* along the period of study except few weeks every year because of the absence of this plant species. During these weeks, insects were fed on maize. All experiments were conducted with lettuce only.

2- Control agents

The Pleo50%Ec was obtained from Shoura chemicals.

Pleo50%Ec (active ingredients: pyridalyl, (S-1812; 2,6dichloro- 4-(3, 3-dichloroallyloxy) phenyl 3-(5-(trifluoromethyl)-2-pyridyloxyl propyl ether], is a novel insecticide that has a phenoxy-pyridaloxy derivative structure.

3- Nymphal treatments

Three concentrations of pyridalyl were used 500,100and 10ppm. The newly moulted 4th nymphal instar of *S. gregaria* were fed on fresh leaves of lettuce dipping in different concentrations for three minutes. After dipping, the treated leaves were allowed to dry before offering to the nymphs. A day after treatment, all nymphs (treated and control) were provided with untreated food plant. 3 replicates (30 nymph/replicate) were used for each concentration .

4- Preparing samples for enzyme assays:

For the determination of alkaline phosphatase (ALP), glutamate oxaloacetic transaminase (GOT) and glutamate pyruvic transaminase (GPT) activities in the fat bodies and the haemolymph, samples of these tissues were collected from 5th instar nymphs of different ages (early, mid and late) and early adults, after treatment of the early 4th nymphal instar. The fat body samples were weighed and then homogenized in a saline solution (the fat body of one insect / 1 ml saline solution 0.7 %) using a fine electric homogenizer, tissue grinder for 2 min. Homogenates were centrifuged at 4000r.p.m. for 15 min. The supernatant was used directly or frozen until the use for the enzymatic determination. Three replicates were used. Haemolymph was pooled and drawn into Eppendorff Pipetman containing few milligrams of phenylthiourea to prevent tanning or darkening and then diluted five times with saline solution 0.7%, the diluted haemolymph was frozen for rupture the haemocytes. The haemolymph samples were then centrifuged at 2000 r.p.m. for 5 min, and only the supernatant fractions were used for assay directly or frozen until use. Three replicates were used.

5- Determination of alkaline phosphatase activity

The activity of alkaline phosphatase in larval homogenate was estimated according to Belfield and Goldberg (1974).

6-Determination of transaminases enzymes activities

The levels of (GOT) and (GPT) were estimated according to Murray, (1984a) and Murray (1984b) respectively.

7- Statistical analysis of data

Data obtained were analyzed by the Student's t-distribution, and refined by Bessel correction (Moroney, 1956) for the test significance of difference between means.

3. Results

1: Effects of pyridalyl on the ALP activity in haemolymph and fat bodies of S. *gregaria*.

1- a: Effects of pyridalyl on the ALP activity in haemolymph:

Results presented in Table 1 explore the effect of pyridalyl on the alkaline phosphatase (ALP) activity in two tissues: haemolymph and fat bodies of 5th instar nymphs and newly emerged adults of *S. gregaria.* In controlled nymphs ALP content in fat bodies was increased in early , mid and late 5th nymphal instar (21.75, 11.8,and 95.3IU/L,

respectively) as compared in haemolymph(0.69,5.63 and 9.4 in early , mid and late 5th nymphal instar, respectively).Also ALP content in fat bodies was increased in newly emerged adults than haemolymph(2.75 and 0.03 IU/L, respectively).

ALP fluctuations in the haemolymph of nymphs and adults of *S. gregaria* after treatment of the early 4th nymphal instar with different concentrations; 500,100 and 10 ppm . Pyridalyl exerted contradictory effects on nymphs depending on the age and the concentration. At 500ppm ALP activity was very highly significantly increased in early aged (3.42 IU/L) then decreased in mid aged (2.55 IU /L) and very highly significantly increased in late aged (11.11 IU /L). Similarly at 100ppm ALP activity was very significantly increased in early aged(8.23 IU /L) then decreased in mid aged(4.68 IU /L) and highly significantly increased in late aged (14.11 IU/L) while at10ppm ALP activity was significantly increased in early and late aged (5.3 and 17.4 IU/L ,respectively) , and significantly decreased in mid aged (4.43 IU/L). Moreover, the strongest inhibitory effect of pyridalyl on ALP was detected in the mid-aged nymphs after treatment with 500ppm (Change % -54.7) as compared with control 5.63 IU/L of control). Data arranged in the same table (1) clearly show a considerable enhancing effect of pyridalyl on the ALP activity in haemolymph of newly emerged adults. The most potent stimulating effect was achieved by the higher concentration level 500ppm (Change %: +30.7) while the least stimulating one was exhibited after treatment with 100ppm concentration level (Change%: +12.8).

1-b: Effects of pyridalyl on the ALP activity in fat bodies:

Data in the same table(1) showed that the ALP on the fat bodies of nymphs and adults are had opposite trend to as in haemolymph .At 500 ppm ALP activity decreased in early and late-age nymphs (20.4 and 27.95 IU/L ,respectively) but increased it mid-aged ones as compared with control. Furthermore, the strongest reducing effect of pyridalyl was estimated at 10ppm in the early-aged nymphs (Change%: -92.4).compared to control. ALP activity in fat bodies was appreciated in the newly emerged adults. The strongest enhancing effect was represented (Change %+692.7) after treatment with 10 ppm conc. but the slightest enhancing one (Change % +387.3) after treatment with the higher conc.500ppm.

2-: Effects of pyridalyl on GPT activity in haemolymph and fat bodies of S. *gregaria. :*

2-a: Effects of pyridalyl on GPT activity in haemolymph.

According to the data illustrated in table (2) glutamic pyruvic transaminase (GPT) activity in the haemolymph on both nymphs and adults were considerably disturbed by the action of pyridalyl. At500 and 100ppm conc. , the enzyme activity along the nymphal life have reducing effect . The most potent reducing effect was exhibited in the early-aged nymphs at 100ppm conc. (Change %: - 4.0).On the other hand, the enhancing effect on GPT activity in the haemolymph was exhibited in the early - and late aged nymphs at 10ppm (+97.3 and +21.5 IU/L respectively). In respect to the newly emerged adults, pyridalyl increase GPT activity than control at all conc., they were +51.2, +43.5 and +91.0 %, for 500,100 and 10ppm respectively.

2-b: Effects of pyridalyl on the GPT activity in fat bodies of *S. gregaria*:

As shown in table (2), pyridalyl exhibited an enhancing effect on the GPT activity in the fat bodies along the nymphal instar as well as in the newly emerged adults. The highest increase in GPT activity was in late aged 5th nymphal instar at 500ppm (Change%: +941.5) and at100ppm in early adults (Change%: +31.3)

3- Effects of pyridalyl on GOT activity in haemolymph and fat bodies of *S. gregaria.*

3-a-Effects of pyridalyl on GOT activity in haemolymph of *S. gregaria*:

GLutamic transaminase enzyme or aspartate aminotransferase (GOT/ AST) catalyses the transfer of the amino group of glutamic acid and pyruvic acid in reversible reactions. In view of data listed in Table(3) GOT activity in the haemolymph of 5th nymphs and newly emerged adults were investigated. The obtained data indicated that enzyme activity depending on the age and conc.. . At the early 5th nymphal instar of different conc. 500,100 and 10ppm the enzyme activity of GOT increased (Change%: +206.8,+28.5 and+ 378.8 respectively) while at mid 5th instar the activity decreased (Change%: -74.9,-52.1 and -42.6 at500,100 and 10ppm respectively).At late 5th instar the GOT activity was decreased at 500 , 100 and 10 (Change%: -80.7 ,-73.1 and -81.9 respectively) .As shown in the same table, such enhancing effect of pyridalyl on GOT activity in the haemolymph extended to the newly emerged adults and decreased at the different conc. (Change%: -86.3, -65.4 and -58.5at 500,100 and 10ppm respectively).

3-b- Effects of pyridalyl on the GOT activity in fat bodies of *S. gregaria*:

As shown in the same table (3) clearly reveals highly significant inducing effect of pyridalyl on the GOT activity in the fat bodies of both aged nymphs and newly emerged adults. As seen, the maximal inducing effect in fat bodies of the early aged nymphs was recorded (Change%:+626.9, at conc.

level500ppm) while the lowest inducing effect was in late-aged of the same conc. (Change%:+96.5).

The activity of GOT in fat bodies of the newly emerged adults were significantly increased at 500,100 and 10ppm (Change%:+38.6, +91.3 and +30.0, respectively).

Table (1): Effects of pyridalyl on alkaline phosphatase(ALP) activity in haemolymph and fat bodies of *S. gregaria*.

Tissue type	Conc.(ppm)		Mean enzyme activity (IU/L) ± S.E.			Early adults
			Early5th-aged	Mid5th-aged	Late5th-aged	
Haemolymph	500	Mean ± S.E	3.42c ±0.58	2.55d ±0.58	11.11b ±0.58	9.24d ±0.59
		% Change	+395	-54.7	+18.2	+30.7
	100	Mean ±S.E	8.23d ±0.58	4.68b ±1.2	14.11b ±0.58	3.88d ±0.58
		% Change	+1092.8	-0.17	+50.1	+12.8
	10	Mean ± S.E	5.3 c ± 0.57	4.43b ± 1.2	17.4. c ±1.15	4.74d ±0.57
		% Change	+668	-21.3	+85.1	+15.7
	Control	Mean ±S.E	0.69 ±0.005	5.63 ±0.58	9.4 ±1.15	0.03 ±0.01
Fat bodies	500	Mean ± S.E	20.4a ±0.58	12.2a ±0.58	27.95d ±1.15	13.4d ±1.15
		% Change	-6.2	+3.4	-70.7	+387.3
	100	Mean ± S.E	6.1d ±0.57	30.4 ±0.57	29.9b ±1.15	19.95d ±1.15
		% Change	-72.0	+157.6	-68.6	+625.5
	10	Mean ±S.E	1.72d ±0.35	13.33a ±0.12	26.7d ±1.15	21.8d ±1.15
		% Change	-92.4	+16.9	-71.9	+692.7
	Control	Mean± S.E	21.75d ±1.15	11.8 ±1.15	95.3 ±1.33	2.75 ±0.58

Conc.: Concentration, mean ± SE followed with the same letter (a): is not significantly different (P>0.05) ,(b): significantly different (P<0.05), (c): highly significantly different (P<0.01), (d): very highly significantly different (P<0.001). IU/L: International unit (the amount of enzyme which under defined assay conditions will catalyze the conversion of one micromole of substrate per minute).

Table (2): Effects of pyridalyl on glutamic pyruvic transaminase(GPT) activity in haemolymph and fat bodies of *S. gregaria.*

Tissue type	Conc.(ppm)		Mean enzyme activity (IU/L) ± S.E.			Early adults
			Early5th-aged	Mid5th-aged	Late5th-aged	
Haemolymph	500	Mean ± S.E	11.32d ±0.58	7.52d ±0.58	16.36d ±0.58	32.97d ±1.33
		% Change	-43.8	-82.7	-49.2	+ 51.2
	100	Mean ±S.E	19.34a ±0.58	13.61d ±0.57	12.52d ±1.15	31.29c ±0.58
		% Change	-4.0	-68.7	-61.1	+43.5
	10	Mean ± S.E	39.76d ±0.57	20.15d ±0.58	39.12a ±0.58	41.66d ±1.15
		% Change	+97.3	-53.6	+21.5	+91.0
	Control	Mean ± S.E	20.15 ±1.68	43.41 ±1.15	32.20 ±0.57	21.81 ±1.15
Fat bodies	500	Mean ± S.E	27.35d ±0.57	114d ±2.3	199.45d ±2.3	61.0a ±1.15
		% Change	+104.9	+304.9	+941.5	+0.49
	100	Mean ± S.E	22.8d ±0.58	70.4d ±1.7	112.85d ±1.7	79.7d ±1.73
		% Change	+70.8	+150.1	+489.3	+31.3
	10	Mean ±S.E	28.65d ±0.58	70.2d ±1.7	102.5d ±1.2	70.3d ±1.7
		% Change	+114.6	+149.4	+435.2	+15.8
	Control	Mean± S.E	13.35 ±1.15	28.15 ±2.3	19.15 ±1.2	60.7 ±1.73

Conc.: Concentration, mean ± SE followed with the same letter (a): is not significantly different (P>0.05) , (b): significantly different (P<0.05), (c): highly significantly different (P<0.01), (d): very highly significantly different (P<0.001). IU/L: International unit (the amount of enzyme which under defined assay conditions will catalyze the conversion of one micromole of substrate per minute).

Table (3): Effects of pyridalyl on glutamic oxaloacetic transaminase(GOT)) activity in haemolymph and fat bodies of *S. gregaria*.

Tissue type	Conc.(ppm)		Mean enzyme activity (IU/L) ± S.E.			
			Early5th-aged	Mid5th-aged	Late5th-aged	Early adults
Haemolymph	500	Mean ± S.E	92.99 d ±2.31	10.18 d ±0.58	44.66d ±1.15	47.59d ±1.15
		% Change	+206.8	-74.9	-80.7	-86.3
	100	Mean ±S.E	38.96 c ±1.15	19.42d ±1.73	62.31d ±1.73	51.94d ±1.15
		% Change	+28.5	-52.1	-73.1	-65.4
	10	Mean ± S.E	147.85d ±1.15	23.29d ±1.15	40.0d ±1.73	62.30d ±1.73
		% Change	+387.8	-42.6	-81.9	-58.5
	Control	Mean ± S.E	30.31 ±1.7	40.57 ±1.15	231.63 ±2.31	149.94 ±2.31
Fat bodies	500	Mean ± S.E	1025.0d ±2.9	1840.4d ±5.8	1465.0d ±2.9	2101.65d ±5.8
		% Change	+626.9	+141.2	+96.5	+38.6
	100	Mean ± S.E	684.0 d ±2.9	2152.45d ±2.9	1571.55d ±2.3	2898.35d ±4.6
		% Change	+385.1	+182.1	+112.3	+91.3
	10	Mean ±S.E	562.0 d ±2.31	2826.55d ±3.5	3514.80d ±2.0	1970.55d ±2.9
		% Change	+298.6	+270.4	+374.4	+30.0
	Control	Mean± S.E	141 .0 ±2.31	763.0 ±2.31	740.9 ±2.9	1515.30 ±5.8

Conc.: Concentration, mean ± SE followed with the same letter (a): is not significantly different (P>0.05) , (b): significantly different (P<0.05), (c): highly significantly different (P<0.01), (d): very highly significantly different (P<0.001). IU/L: International unit (the amount of enzyme which under defined assay conditions will catalyze the conversion of one micromole of substrate per minute)

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4. Discussion

1- Effect of pyridalyl on alkaline phosphatase activity in haemolymph and fat bodies of *S. gregaria*:

The effect of pyridalyl on nymphs depending on the age and the conc. In the present study some contradictory effects on the ALP activity in the haemolymph of *S. gregaria* nymphs, was observed in the 5th nymphal instar and newly emerged adults as compared to the control .At higher conc. the enzyme activity increased in the early and late aged but decreased in mid aged . A considerable increasing effect of pyridalyl on the ALP activity in haemolymph of the newly emerged adults was also determined. In respect to the ALP activity in fat bodies were decreased in the early , late -aged nymphs and increased in mid –aged one while increased at early adults at the different conc. The increasing ALP activity level in haemolymph especially at the late age and the newly emerged adults and in fat body of newly emerged adults in the present study might indicate the involvement of ALP in detoxification process against the toxicants contained in pyridalyl. . Sridhara and Bhat (1963) stated that the increase or decrease of both phosphatases enzymes during development is reflected an increase or decrease in the acid-soluble phosphorus content.

Our results agree with those obtained by Saha *et al*. (1986) using JHA and ecdysterone against *C. stollii*; Anan *et al*. (1993) using pyriproxyfen against *P gossypiella* and *E. insulana* ;[Mostafa (1993) using pyriproxyfen ,Sokar (1995) using hexaflumuron and Abdel-Aal (2002) using pyriproxyfen] against *S. littoralis*., Assar, *et al*.,(2010) using admiral ,consult, match, mimic and applaud against *M. domestica* larvae and Assar, *et al*., (2012) using (cyromazine) as chitin synthesis inhibitor against, 4th larval instar of *Culex pipiens*

Reduced activity of ALP was recorded after treatment of *Culex pipiens* 3rd instar larvae with some other plant extracts (El-Bokl *et al.,* 1998). Feeding of *S. litura* on *Ricinus communis* leaves treated with Azt. decreased the ALP activity in the mid gut (Senthil Nathan *et al*., 2005). Also, consumption of *Melia azedarach* seedextract-containing rice leaf diet resulted in a 71 % reduction of ALP activity in *Cnaphalocrocis medinalis* (Senthil Nathan, *et al.,* 2006). Remarkable reducing effects of some limonoids (neem extracts) on ALP activity in the mid gut of the later nymphal instars of *E. plorans* were estimated (Al-Dali, 2007). After treatment of the 5*th* instar larvae of *Bombyx mori* with the

juvenoid pyriproxyfen caused a significant decrease of ALP level during 24h post-treatment and it could not recover its normal level even in 120h (Etebari *et al.,* 2007). However, the reduced ALP activity at different time points in the last instar nymphs and adults of *S. gregaria* by *F. bruguieri* extracts, (Basiouny, *et al*.,2010), may be attributed to some developmental disturbance as previously suggested by Wu-Tsiu Yan and Wu-Ty (1990) for the mosquito larvae of *C. pipiens* after treatment with the insecticide diflubenzuron .

2- Effects of pyridalyl on the GPT activity in haemolymph and fat bodies of *S. gregaria*

In the present study , the enzyme activity along the nymphal life have reducing effect in the haemolymph especially at higher conc. with regard to the newly emerged adults the activity of GPT was increased . Pyridalyl exhibited an enhancing effect on the GPT activity in the fat bodies along the nymphal instar as well as in the newly emerged adults. .Reducing effect of IGRs and insecticides on the GPT activity were reported for *Chrysocoris stolli* by an ecdysteroid (Saha *et al.,* 1985), *Sitophilus. oryzae* by permethrin *T. castaneum* by the neem extract RB-a (Tabassum *et al.,* 1994), *A. diaperinus* by Danitol (Tufail, 1991) and *S. littoralis* by *M. azedarach* extracts (Hassan, 2002), *Euprepocnemis plorans* by some neem limonoids (Abdel-Ghaffar and Ghoneim, 2007) .Tanani, *et al*.(2009)showed that methanolic extract from *F. bruguieri*, induced the GPT activity in haemolymph of *S. gregaria* along the nymphal life while the petroleum ether and n-butanolic extracts induced such enzyme activity only at the mid- and late ages of nymphs.However, the varying effects of pyridalyl on the GPT activity in decreasing or increasing levels may be due to the effect on the synthesis or functional levels of this enzyme directly or indirectly by altering the cytomorphology of the cells (Nath, 2000).

3- Effects of pyridalyl on the GOT activity in the haemolymph and fat body of *S. gregaria*:

The activity GOT depends not only on the insect species but also on age, tissue, and its developmental stage(Tabassum *et al.,* 1994,1998; Zohry, 2006; Abdel-Ghaffar and Ghoneim, 2007; Al-Dali, 2008).In the present study The GOT activity in haemolymph of the 5th instar nymphs of *S.gregaria*, depended on the age and the conc. . Pyridalyl increased GOT activity in haemolymph of the early –aged while decreased in mid ,late - aged and early adults Also an increasing in the enzyme activity in the fat bodies of early , mid and late aged nymphs was recorded In addition, the nymphal treatments with pyridalyl resulted in a stimulatory enhanced in the enzyme activity in the fat bodies of early adults .

The increasing GOT activity in haemolymph of *S. gregaria*, in the present study, generally after treatment suggest the mobilization of amino acids during the insecticidal stress exerted by certain toxic components to meet the energy demands (Zeba and Khan, 1995). The increasing GOT activity on the total AST activity by pyridalyl in the present study agree with the results obtained by pyriproxyfen against *P. gossypiella* and *E. insulana* (Anan *et al*., 1993), pyriproxyfen against *S. littoralis* (Mostafa, 1993 and Abdel–Aal, 2002); by Admiral, mimic and applaud induced asignificant stimulatory effect on total AST activity on *M. domestica* (Assar,*et al*.2010).

Corresponding author
Salam S. Teleb
Zoology Department, Faculty of Science, Zagazig University, Egypt
salamteleb@gmail.com

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