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Impact of Spinetoram on Some Nitrogenous Components Related to Protein Metabolites in the Cotton Leaf Worm, *Spodoptera littoralis* (Biosd.)

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ABSTRACT

A laboratory study on the 4th instar larvae of cotton leaf worm. , *Spodoptera littoralis* (Biosd.) was carried out to detect and quantify some nitrogenous components related to protein metabolism and also to evaluate the secondary effect of the bioinsecticide; Spinetoram. It is the first time to detect albumin and creatinine in this species. Acute and latent effects using three concentrations revealed that the excretory product; uric acid was significantly reduced 6-days post treatment by the highest concentration (6.67ppm). It was 14.15 and 10.94 ug/mg protein for control and treated larvae, respectively. Creatinine which is an end product of phosphocreatine that acts as energy storage in skeletal muscles and other tissues is significantly increased on the 4th day post larval treatment. The insecticidal concentration range was not critical in most cases. Albumin was significantly reduced at the 4th day post treatment and this reduction extended significantly to 6th day for all concentrations.Glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminases (GPT) titres were significantly reduced as compared to control at the same time, the situation that reflects the importance of Spinetoram latent effect. Spinetoram could affect protein metabolism of the cotton leaf worm for energy reserves, metabolic enzymes, protein quality and excretory metabolism point of view.

Keywords: Spinetoram, *Spodoptera littoralis*, Biopesticide, Uric Acid, Creatinine, Albumin, GOT and GPT.

INTRODUCTION

Spinetoram is a new member of the spinosyn class of insect management tools. It is derived from fermentation of the bacterium, *Saccharopolyspora spinosa* as other spinosyns, with a unique mode of action via causing excitation of the insect nervous system by altering the function of nicotinic and GABA-gated ion channels (Watson, 2001and Laila, and Hassan 2008). An immediate effect of its ingestion is the cessation of feeding, followed by paralysis and death. It provides long-lasting control of a broad spectrum of insect pests especially lepidoptera, thysanoptera, and other insect orders such as diptera. It is applied at low rates (10µg/ml) and has low impact on most beneficial insects (Williams *et al.,* 2003 and El-Kady *et al.,* 2007). It acts as a stomach and contact poison and degrades rapidly in the environment (Cisneros *et al*., 2002). It is moderately toxic for birds and mammals and it is classified by the U.S. Environmental Protection Agency (EPA) as an environmentally and toxicologically reduced risk product (Bret *et al*., 1997).

Uric acid has been recognized as the major end product of the nitrogen metabolism in terrestrial insects (Cochran, 1975). Rezet (1961) showed that either uric acid or allantoic was a major larval excretory product of several species of lepidoptera, whereas uric acid predominant in pupal stages. However, a large number of lepidopteran species shown to have uric acid as the predominant excretory product of both larval and pupal stages (Cochran, 1975 and Buckner *et al*., 1990).

Some lepidoptera also store uric acid in peripheral tissues, such as adult wing scales and larval integument (Lafont and Pennetier, 1975; Tamura, 1977 and Tamura and Sakate, 1983).

On the other hand, very few studies mentioned the presences of creatinine in some insect species such as termites (Kumaresan *et al.,* 2008) and in bees (McNally *et al.,*2010) and no author had traced or studied the presence of either creatinine or albumen in Lepidoptera and their response toward the exposure of an insecticidal stress.

Reflection of insecticidal application upon insect transaminases is a good monitor since they help in the production of energy (Azmi *et al.,* 1998) and they are important components of amino acids catabolism involving in transferring an amino group from one amino acid into another keto acid, thus forming another amino acid (Manjula, *et al.,* 2010). Such reactions are mainly responsible for the degradation and biosynthesis of amino acids linking the glucose and the protein metabolism (Mordue and Goldsworthy, 1973).

All these previously mentioned biochemical components-revolving around Nitrogen metabolism- forced us to carry out an attempt to elucidate the secondarey effect of Spinetoram upon *S. littoralis* larvae which is a serious polyphagous pest for several important crops by quantitative estimation of these biomolecules under the effect of different concentrations of Spinetoram.

To the best of our knowledge, information on nitrogenous components related to protein metabolism in cotton leaf worm is very few. Accordingly, the aim of the present work is to detect the presence of some nitrogenous components such as uric acids, creatinine and albumin as well as transaminases and Study the effect of Spinetoram with different concentrations on previously mentioned components in the 4th larval instar of *S. littoralis*.

MATERIALS AND METHODS

1. Insect:-

Late 4th instar larvae of *S. littoralis* were obtained from cotton leaf worm rearing laboratory, Plant protection research institute, Agricultural research center. They were maintained under crowded conditions at 28± 2ºC and 16h light: 8h dark photoperiod.

2. Tested Compound:-Spinetoram.

Trade name: Radiant (12 % SC).

Chemical name: This compound is a mixture of major and minor components: (1)Major component (3'-ethoxy-5, 6-dihyro spinosyn J) and (2) Minor component (3'-ethoxy spinosyn L).

3. Bioassays and treatments:-

Albumin, creatinine and uric acid were determined spectrophotometrically using the appropriate kits and standards.

To determine the proper concentrations to be used in this study, boioassays were initially performed using one or two days old 4th instar larvae of *S. littoralis* by a dispersible concentrate formulations of Spinetoram diluted with distilled water from 10^{-2} to $10,^{-5}$ using dipping technique of clover leaves, (*Trifolium alexandrinium*) for 10 seconds then air dried. Control leaves were treated similarly using only distilled water. The dried leaves which were offered to a minimum of 10 larvae per concentration were replicated three times (totally n=30) for 24 h, then they were fed on normal (untreated) leaves. Three concentrations (3.3, 5 and 6.67) which were calculated by using probit analysis (Finney, 1971) and prepared to study the effect of Spinetoram in different concentrations upon the tested biochemical parameters.

4. Biochemical studies:

4.1. Sample preparation:

Early 4th larval instar of *S. littoralis* worms were taken to be tested on the 2nd, 4th and 6th days post treatment of Spinetoram with concentration 1, concentration 2 and concentration 3 (3.3, 5 and 6.67 ppm, respectively).

Larval bodies were homogenized (1gm of tissue in 5 ml of distilled water), using hand glass homogenizer on ice jacket. The body homogenate was centrifuged using Eppendorf refrigerated 5415 (Hamburg, Germany) at 8000 rpm for 15 min. at 2°C. The supernatants were kept at -20ºC till use.

4.2 Biochemical tests:

Uric acid and creatinine were determined using Randox kit (Randox laboratories Ltd., 55 Diamond Road, Crumlin, United Kingdom, BT29Qy. Website:www.randox.com. E mail: applications@randox.com). Uric acid is converted by uricase to allantion and hydrogen peroxide, which under the catalytic influence of peroxidase, oxidizes 3,5-Dichloro-2-hydroxybenzenesulfonic acid and 4-aminophenazone to form a red violet quinoneimine compound.

Creatinine in alkaline solution reacts with picric acid to form a colored complex which read at 492 nm, while uric acid read at 520 nm.

Albumin was estimated by bioMerieu kit (69280 Marcy l'Etoile-France, website: www.biomerieux.com). At ph 4.2, albumin combines with bromocresol green (BcG) to form a blue-green cmplex.The color Read at 628nm against reagent blank.

The levels of both glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminases (GPT) were determined according to Reitman and Frankel (1957) using α-keto glutaric acid and D, L alanine as substrates for GOT and GPT, respectively.

5. Statistical analysis:

Data were subjected to statistical analysis using analysis of variance two ways ANOVA (Snedecor and Cochran, 1967) and the least significant difference (LSD) test was used for mean separation at $P \leq 0.05$.

RESULTS

The present study was conducted to test the effect of Spinetoram against 4th larval instar of the cotton leaf worm, *S. littoralis* for some vital biomolecules in the insect body uric acid, creatinine, albumin and transaminases.

Uric acid: The present study showed that the concentration of uric acid in the control 4th instar larvae of *S. littoralis* exhibited a marked variation during the present study, it was 15.1±0.38 µg/mg protein after two days from starting the experiment then uric acid started to increase up to 16.03±0.35 µg/mg protein. On the 6th day, a significant drop was detected and reached to 14.15 ±0.35 µg/mg protein (Fig.1).

A similar trend was observed in the treated larvae with the lower concentration (3.33 ppm) of Spinetoram where uric acid concentrations reached 13.68±0.38 µg/mg protein 2 days post treatment with no significant difference compared to the control larvae. An elevation of uric acid concentration was detected 4 days post treatment in the treated larval body compared to the 2nd day post treatment and again with no significant difference with the control one. Uric acid started to decrease insignificantly 6 days post treatment to 14.73±0.50 µg/mg protein.

Upon applying the median concentration (5ppm), a similar trend of uric acid content reached 13.79±0.26, 15.46±0.41 and 13.19±0.30 µg/mg protein in the 2nd, 4th and 6th days post treatment, respectively. Results trend was very similar to both control larvae and the treated ones with the lower concentration (3.33ppm) as in Fig.1.

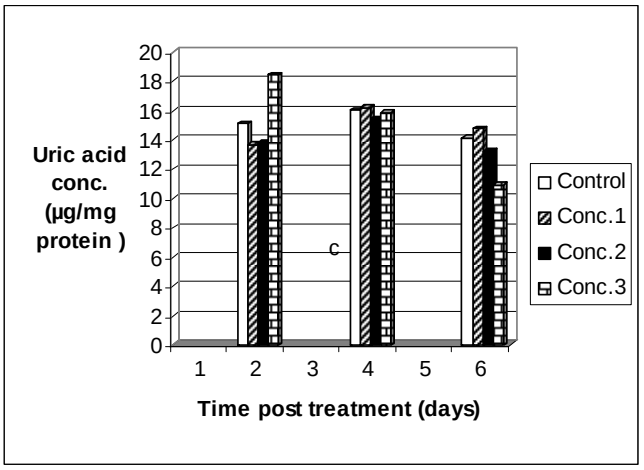

Fig. 1: uric acid concentration in the larval homogenates of the 4th larval instar of *S. littoralis* after being treated with Spinetoram using three concentrations (Conc.1, Conc.2 and Conc.3 which are 3.33, 5 and 6.67ppm, respectively) .
*Each column depict mean of value recorded in three separate replicates.

On the other hand, the highest concentration (6.67ppm) showed a quite different trend. The maximum highly significant increase was detected 2 days post treatment compared to both untreated and the lower concentrations (3.33 and 5ppm) treated larvae where it reached 18.40±0.99 µg/mg protein. Then, it started to decline by the 4th day post treatment. Six days post treatment, a dramatic highly significant decrease reached up to 10.94±0.58 µg/mg protein.

Creatinine: Creatinine was detected in the body tissue of *S. littoralis* larvae and its concentration in the control larvae did not show a significant change during larval duration along the present study as its values were 0.196±0.012, 0.193±0.015 and 0.192±0.007 µg/mg protein at 2nd, 4th and 6th day, respectively (Fig.2). In case of larvae treated with the two lower concentrations of Spinetoram (3.33 and 5 ppm), a significant increase was observed 4 days post treatment while no significant change was determined in the larvae treated with the highest concentration (6.67ppm).

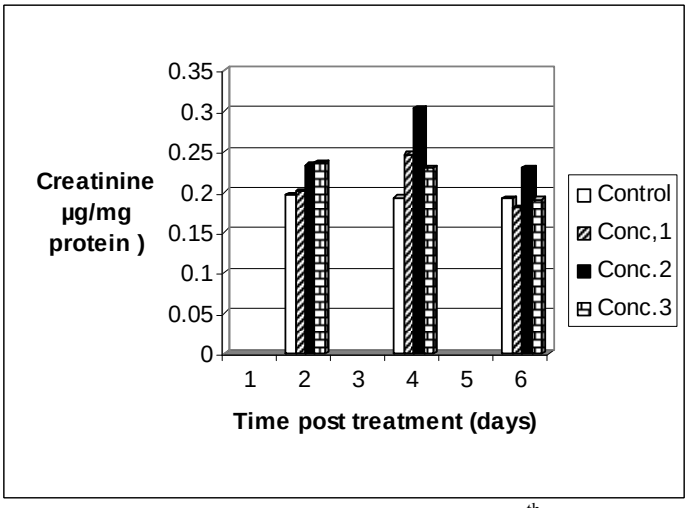

Fig. 2: Creatinine concentration in the larval homogenates of the 4th larval instar of *S. littoralis* after being treated with Spinetoram using three concentrations (Conc.1, Conc.2 and Conc.3 which are 3.33, 5 and 6.67ppm, respectively) .
*Each column depict mean of value recorded in three separate replicates.

Albumin: Surprisingly may be the first trial as far as the authors know, albumin was found with considerable quantities in the larval body of *S. littoralis*. The value of Albumin in the untreated larvae started with 8.26±0.30 µg/mg tissue on the 2nd day of the onset of the experiment. Its value continued to increase significantly till it reached 10.30±0.91 and 12.20±0.85 µg/mg tissue (Fig. 3) i.e. albumin concentration increases with the larval age. An opposite trend was found in case of larvae treated with all concentrations with Spinetoram. In case of the lowest concentration of Spinetoram (3.33 ppm), albumin started with 9.43±0.51 µg/mg tissue (2 days post treatment) then it started to decrease insignificantly to 7.93±0.30 and 7.23±0.49 µg/mg tissue for larvae at the 4th and 6th day after insecticidal treatment as shown in Fig.3.

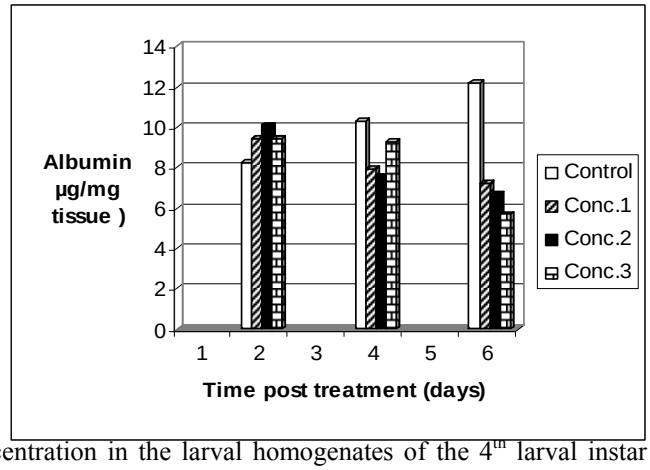

Fig. 3: Albumin concentration in the larval homogenates of the 4th larval instar of *S. littoralis* after being treated with Spinetoram using three concentrations(Conc.1, Conc.2 and Conc.3 which are 3.33, 5 and 6.67ppm, respectively) .

*Each column depict mean of value recorded in three separate replicates.

The same trend was repeated in case of the treatment with conc.2 (5 ppm) of Spinetoram where the levels of albumine were 10.13±0.92, 7.60±0.30 and 6.86±0.75 µg/mg tissue at the 2nd, 4th and 6th day after insecticidal treatment respectively, showing a marked decrease in the 4th and 6th days post treatment. On treating larvae with the highest concentration of Spinetoram (6.67ppm), values of albumin concentrations were 9.43±0.50, 9.30±0.78 and 5.7±0.43 µg/mg protein on the 2nd, 4th and 6th day post treatment, respectively.

Transaminases; In the untreated larvae, GPT level was 21±0.6 U×10^3/mg protein on the 2nd day from the onset of the experiment where a dramatic elevation reached on the 4th day and this elevation was nearly maintained till the 6th days as shown in Fig. 4. After the insecticidal treatment with different concentrations of Spinetoram, a more or less similar trend to enzyme activity as with the control (Fig.4).

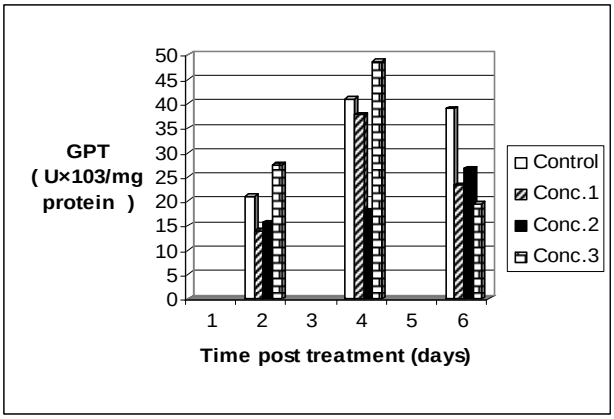

Fig. 4: GPT activity in the larval homogenates of the 4th larval instar of *S. littoralis* after being treated with Spinetoram using three concentrations(Conc.1, Conc.2 and Conc.3 which are 3.33, 5 and 6.67ppm, respectively) .
*Each column depict mean of value recorded in three separate replicates.

Similarly, both untreated larvae as well as treated ones showed a common trend in GOT activity as a significant increase was detected on the 4th days post the onset of the experiment. On the other hand, results on the both 2nd and 6th for control and treated larvae showed that the enzyme nearly recorded the same level except for the treatment with the highest concentration (6.67ppm), where a very highly significant elevation was detected 2 days post treatment reached nearly three folds compared to the control. GOT gradually was significantly inhibited being less than the control on the 6th day post treatment (Fig. 5).

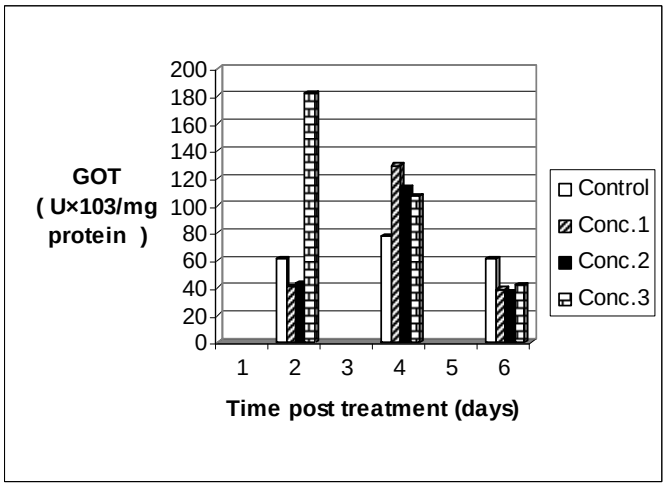

Fig. 5: GOT activity in the larval homogenates of the 4th larval instar of *S. littoralis* after being treated with Spinetoram using three concentrations (Conc.1, Conc.2 and Conc.3 which are 3.33, 5 and 6.67ppm, respectively).
*Each column depict mean of value recorded in three separate replicates.

DISCUSSION

The present data in this paper demonstrate for the first time, under laboratory controlled condition, the biochemical effect of the safely used bioinsecticide, Spinetoram against 4th larval instar of the cotton leaf worm, *S. littoralis* to evaluate some vital components in the insect body (uric acid, creatinine and albumin) as well as important enzymes (Transaminases).

Uric Acid: Protein catabolism leads to the production of ammonia in addition to water and carbon dioxide .Ammonia must be eliminated outside the body due to its cellular toxicity. In insect,

ammonia is not usually excreted but it is converted into less toxic uric acid (Chapman, 1982).

As observed in the results uric acid in case of untreated larvae fluctuated in a limited range with a significant increase on the 4th day post treatment.

The relative observed constancy of uric acid in *S. littoralis* larvae in the present work may be due to abundance of permanent fixed source of diet where larvae were fed regularly on clover leaves allover the entire experiment. This guaranteed fixed nitrogen supply which seems to be a limiting factor in controlling the amount of uric acid either stored or excreted outside.Van Zyl *et al*., 1988) considered that feeding conditions had the major influence on the excretory products of antlion larvae where low or non nitrogen nutrition was responsible for changes in uric acid levels in insects. Larvae of antlion, excreted smaller quantities of nitrogenous excretory products during starvation than during periods of food abundance. This seems to be true as experiments showed that quality and quantity of diet have a major impact upon the concentrations of uric acid in many insects (Cochran, 1979; karowe and Martin, 1989). Some insects can synthesizes uric acid not only as a waste product, but also as a storage one when it ingests an excess amount of amino acids (Mullins and Cochran, 1975a, b; Hongoh and Ishikawa, 1997; Kramer *et al.,* 1990; Kells *et al.,* 1999). Uric acid production and internal storage are well-developed traits in *P. americana* and are responsive to nitrogen levels in the diet (Haydak, 1953; Mullins and Cochran, 1975a,b).

It seems also that the insect age has a role in the quantity of uric acid. Cochran (1975) found that the amounts of uric acid present per nymphs of the American cockroach, *Periplaneta americana* had more or less a steady increase as the nymphs increase in age. This is paralleled by a corresponding gain in weight. During the larval development of *Musca domestica*, uric acid metabolism had a significant increase of uric acid levels in the whole body, which becomes more pronounced prior to pupation (Schwantes, 1989). In contrast, uric acid concentrations declined with aging in male *Drosophila melanogaster* (Massie *et al.*, 1991). This may be due to that in several insects; uric acid is retained internally where it may serve a variety of functions (Corbet and Rotheram, 1965 and Harmsen, 1966). For insects with a low nitrogen diet, the usefulness of such retained uric acid, its low toxicity, and the expense of its synthesis (Gilmour, 1961) and can provide a source of nitrogen for growth and reproduction during times of nitrogen stress (Mullins and Cochran, 1975a,b).

On the other hand, fixed environmental laboratory conditions during the present study may be an important factor in causing restricted changes in uric acid content. Similar finding were found by Machida *et al*., (2000) who suggested that ecological conditions other than food conditions affected the pattern of uric acid storage.

Regarding to the insecticidal treatment in the present work, larvae of *S. littoralis* which were treated with lower concentrations of Spinetoram (3.33 and 5 ppm) showed no significant difference with those of control. In contrary, applying the highest concentration of Spinetoram (6.67ppm) caused dramatic changes especially on the 2nd and 6th days post treatment compared to the control. This may be attributed to insecticidal stress of Spinetoram which may alter many metabolic activities. Similar findings were reported by Ramdev and Rao (1989). Shekari *et al*., (2008) support this hypothesis and reporetd that insecticidal application caused uric acid to the extent that prevented the natural excretion of uric acid and attributed this to altered metabolic pathway after treatment. Also, azadirachtin injected into final instar larvae of *S. litura* significantly decreased uric acid (Ayyangar and Rao, 1990). It seems that the high

metabolic activity under insecticidal stress, with a general trend towards amino acid nitrogen elimination (Rao and Rajendar, 1992). On the other hand, Suiter *et al.,* (1933) attributed mortality and reproductive failure after insecticidal treatment due to inhibition of uric acid synthesis while Etebari *et al.,* (2004) demonstrated that the differences in uric acid amounts was not depended on insecticidal concentration.

On of the most important observations found in the present work, was the relatively higher uric acid content on the 4th day post treatment in both control and treated larvae with respect to the two lower concentrations (3.33 and 5ppm). This was correlated -by the observation during the time of our experiment- with that most of these larvae moulted and got rid of the old integument just after the 4th day post treatment. Accordingly, the larvae by the 6th day were all entered to 5th instar with a new integument. This may shed our mind to think about two points: (1) the uric acid content was stored in the old excuvia thus causing this relative increase in the uric acid content recorded during the 4th day which was lost with the shed of these excuvia causing a decrease recorded in the 6th day and (2) The increased amount of uric acid probably resulted from metabolic activities associated with moulting process under hormonal control.This seems to be true as one of the major functions suggested for the storage of uric acid in external tissues is to provide pigmentation in insects (Cochran, 1975, Tamura, 1977 and Tamura and Sakate, 1983) particularly in larval stage (Wigglesworth, 1942, 1965 and1987).Uric acid has been also associated with pigmentation of larval lepidopteran integument and deficiencies in xanthine dehydrogenase activity for several mutants of the silkworm, *Bombyx mori*, were correlated with a suppression of the formation of uric acid that resulted in the transparent larval integument of the mutants (Tamura, 1977; Tamura and Sakate, 1983).

In the present work, hormonal induced changes in pigmentation may play a major role in uric acid content of *S. littoralis* larvae. Similar findings were obtained by Buckner and Newman (1990) who found that uric acid storage in *M. sexta* fat body and different epidermal cells is an ecdysone-mediated event and the process of temporal movement of uric acid into epidermal and fat body cells appear to be regulated by the endocrine system. On the other hand, juvenile hormone analogue (Admiral) on silkworm affected the amount of uric acid significantly and had irreversible effects on protein metabolism of silkworm larvae (Bizhannia *et al.*, 2005).

In fact, uric acid seemed also to have many vital functions rather than being only an excretory product or induces pigmentation. Mitlin and Mauldin (1966) reported that uric acid can possibly serve as an amino acid precursor and many authors documented that it also can act in biological system as a powerful antioxidant (Timmermann and Berenbaum, 1999). Thus, it serves a protective function not only against predators in mimicry system, but also against oxidative stress generated by the phototoxic allelochemicals. (Timmermann and Berenbaum,1999). Similarly, Souza *et al*. (1997) and Becker, (1993) considered uric acid as a powerful antioxidant and radical-scavenging properties. Massie *et al.* (1991) explained the declining uric acid concentrations in male *D. melanogaster* may represent a loss of antioxidant potential in aging Drosophila.

Thus, the high concentrations of uric acid may serve multiple purposes contributing to a mimetic-protective resemblance to the surrounding environment while at the same time scavenging free radicals generated by ultraviolet exposure and ingestion of photosynthesizers. Such physiological economy may be enhanced further by the

fact that accumulation of uric acid, a waste product generated as a consequence of processing food does not divert nitrogen away from other physiological needs (Timmermann and Berenbaum, 1999).

Creatinine: Creatinine is a catabolic end product of anhydride creatine (or phosphocreatine). Creatinine is methylguanidinoacetic acid, widely distributed in animal tissues.Creatinine is synthysied from amino acid and then transported by the blood to the muscles. The enzyme creatine phosphokinase (CPK) catalyzes the reaction of creatine with ATP to form phosphocreatine which contains a high energy phosphate bond and serves as energy storage mechanism (Lothr Thomas, 1998).

Unfortunately, only few studies have been conducted on the presence of creatinine in inects.The present data may indicate that creatinine is a constituent in the larval body and its amount varies conspicuously during the period of study. It seems also that it is not affected directly with Spinetoram and no linear relation between creatinine quantities and the treated concentrations of Spinetoram while its quantity may alter due another indirect effect of such bioinsecticide.

Creatinine seems to be affected by the diet quality offered to the insect and it accounted for about 12% of the total excreted nitrogen for bees fed no protein, but for only about 3% for bees receiving pollen. In general, excretion of creatinine is lowest for pollen and soy hydrolysate and highest for egg albumin and non-protein diets (McNally *et al.,* 2010).

Soldiers of termites *Macrotermes convulsionarius* have huge creatinine reserve and others were having less. In the same time, other possible nitrogen metabolic end products were searched and found creatinine as a potential metabolite in all termite castes (Kumaresan *et al.,* 2008).

Baldwin (1937) concluded that creatinine is a regular constituent of tissues and excreta of *Lucilia sericata.* And when creatinine were administered and after 7 days, the results indicated that: (1) Creatinine is converted almost entirely into creatine; this is probably due to the alkalinity of the excreta. (2) A small amount of these two substances is retained within the larvae, possibly entirely accounted for by gut contents.Thus these experiments indicate that larvae of *Lucilia* treat creatine and creatinine as physiologically inert substances. (Brown, 1938).

Mayer *et al*., (1975) reporeted that their finding of creatinie in the tissues of horn flies was unusual, and the fairly large amount present was significant. Moreover, horn flies exposed to irradiation showed higher amounts of creatinine in the treated insects than in the control and they concluded that it may serve as an energy source for muscle tissue of the horn fly resembling vertebrates.

The finding of the presence of creatinine in substantial amounts in the present work suggests that it is an important nitrogenous compound of the haemolymph (Kuzhivelil and Mohamed, 1997). Further studies are needed due to scarcity of information about creatinine levels, role and metabolism in different tissues in the insect body.

Albumin: Albumins are proteins of relatively small molecular mass(15000-70000 a.m.u.); They posses a surplus negative charge and exhibit acidic properties. Plasma proteins were separated by electrophoresis into seven groups: Albumin, alpha 1, alpha 2, beta 1, beta 2, gamma globulin and fibrinogen. The plasma blood albumins are physiologically important as transport agents (Stroev, 1989).

The present work shows a pioneer trial to evaluate albumin in *S. littoralis* as well as the effect of Spinetoram which even at low concentrations had altered the levels of albumin at relatively latent time (4 days post treatment). Further extensive studies are required to reveal its

complete physiological significance of albumin in insects.

Transaminases; In the present study, *S. littoralis* larvae showed in both control as well as treated one, the highest elevation records of GPT activity was on the 4th day from the onset of the experiment (just prior to moulting) except in case of treatment with the median concentration (5ppm).It seems that GPT activity is either involved or at least affected by moulting process. This is may be due to the fact that the interrelationships between protein synthesis and transaminases levels was affected by the hormonal control of protein synthesis and neurosecretory hormones which involved in the regulation of transaminases levels.The results in the present work, some how is similar to those found by Ender *et al*., (2005) who reported that the diet with high level of methyl parathion significantly increased the activities of transaminases in greater wax moth, *Galleria mellonella* larvae. But, the activity levels of transaminases were decreased by low level of this insecticide.

Except for the higher concentration of Spinetoram, most of the enzymatic measures of GPT were less than the control. Our data are agreed with Tabassum *et al.,* (1994) and (1998) and Etebari *et al*.(2004) only in case of GPT who stated that toxic chemicals in food decreases transaminases activity however this is contradicted with our findings in case of GOT activity, except for the larvae treated with the highest concentration (6.67ppm) which showed a highly significant elevation at the 2nd day after treatment . Tufail, (1991) attributed the different responses of transaminases activities to the differences in the insect strains..It seems that the highest concentration of Spinetoram was responsible for the dramatic enhanced activity of GOT. Similar findings were found in scale insect, *Fresia fergata* treated with different chemical control agents (Ezz and Fahmy, 2009). Changes in transaminases activities might be correlated with protein metabolism and also these changes probably, due to the differences in the mode of action of the used bioagents (Abulyazid *et al.,* 2005 and El-Shershaby, 2008).

GPT was more inhibited in both lower concentrations, possibly because pyruvate is the precursor of Kreb's cycle compounds, concerned with the mitochondrial oxidation phenomenon and ATP production (Azmi *et al.,* 1998).

In *S. littoralis*, the tested insect growth regulators (IGRs) showed flactuated activity of both GOT, and GPT according to time elapsed post treatment as well as the larval instar (Khedr *et al.,* 2005) while Abdel-Hafez *et al*., (1988) found that in the cotton leaf worm, *S. littoralis*, the changed in GOT and GPT activity were in harmony with those changes of proteins.

Transaminases activities were widely variable in there response in the present work as well as other studies dealing with the effect of different control agents in insect control . This is may be due to the difference in the method of application or might be due to the difference in the insect species or the compound used in the treatment (Azmi *et al.,* 1998).

The present preliminary study paved the way toward a scientific approach to evaluate vital components related to protein metabolism in insects under insecticidal stress. Such study is still in its infancy and further research efforts are necessary to shed light on this largely negligible topic which may offer new opportunities for developing more efficient delivery strategies in insect control.

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ARABIC SUMMARY

تأثير السبينوترام على بعض المكونات النيتروجينية المتعلقة بأيض البروتين فى دودة ورق القطن سبودوبترا ليتوراليس

طارق رئيس امين ونضال محمود فهمى
معهد بحوث وقاية النباتات -مركز البحوث الزراعية-الجيزة - مصر

تمت الدراسة المعملية على يرقات العمر الرابع لدودة ورق القطن *سبودوبترا ليتوراليس* بهدف الكشف و التحديد الكمى عن بعض المكونات ذات الصلة بالايض فى للبروتينات وايضا لتقييم التأثير الثانوى للمبيد الحيوى سبينتورام وللمرة الاولى يتم الكشف عن الالبومين والكيرياتينين فى هذا النوع من الحشرات.وقد كشف كلا من التاثير الشديد و الكامن لهذا المبيد باستخدام ثلاثة تركيزات مختلفة عن انخفاض ملحوظ فى كم حمض اليوريك بعد ستة ايام من المعاملة باعلى تركيز تم استخدامة (٦.٦٧ جزء فى المليون) فكان١٤.١٥ و ١٠.٩٤ وميكروجم/ مجم البروتين فى كلا من اليرقات المعاملة ويرقات المجموعة الضابطة. بالنسبة للكرياتينين -هو الناتج النهائى للفسفوكرياتينين الذى يعمل كمخزن للطاقة فى العضلات الهيكلية والانسجة الاخرى- وجد انة قد زاد زيادة ملحوظة فى اليوم الرابع بعد المعاملة بالسبينتورام. وقد لوحظ ايضا ان مدى التركيزات المستخدم لم يكن حرجا فى معظم الحالات. أما بالنسبة الى الالبومين فقد انخفض بشدة فى اليوم الرابع بعد المعاملة واستمر هذا الانخفاض الملحوظ حتى اليوم السادس لكل التركيزات المستخدمة. اشارت الدراسة الى ان عيار الانزيمات الناقلة للامين مثل انزيم الجلوتاميك اوكسالواستيك ترانزامينيزو انزيم الجلوتاميك بيروفيك ترانزامينيز كان فى العموم اقل فى اليرقات المعاملة مقارنة بالمجموعة الضابطة. واوضحت التجارب أهمية التأثير الثانوى للمبيد فقد تمكن ال سبينتوام من احداث تغيير فى ايض البروتينات فى يرقات دودة ورق القطن شاملا محتوى الطاقة وانزيمات الايض و جودة البروتينات و ايضا ايض الاخراج.