Effects of pyriproxyfen on cellular energy allocation of a heterometabolous insect, *Brachynema germari* Kol.

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INTRODUCTION

Physiological energetic of an organism provide some information in key processes involved in acquisition and expenditure the energy content and probably makes a clear understanding about mode of action of the exogenous compounds. Changes in energy reserves are used as an index for environmental contaminations. Studies show that energy metabolism can be a sensitive criterion for environmental stress. Stressor agents can cause a decrease or increase in part of energy reserves (De Coen & Janssen., 1997). Lipid, protein, glucose and glycogen are energy reserves and they can be affected by different factors. Total energy reserves in an insect body (E_a) are the total amount of energy calculated from available total lipid, total protein, glucose and glycogen. Energy consumption (E_c) is measured under saturated substrate conditions and changes in its activity must be measured by altering enzyme production in an organism. Since there is a paradox at results of energy content assay, cellular energy allocation (CEA= E_a/E_c) technique is used as a reliable specific energy parameter that can measure the effect of toxicants on different energy sources as well as a marker of the available energy content of an organism. This short time assay is based on changes in energy reserves (total carbohydrate, total protein and total lipid) and energy consumption (electron transport activity). In this research, the effect of pyriproxyfen (an insect growth regulator) was studied on E_a, E_c and CEA in a heterometabolous insect, *Brachynema germari* Kol (Hem.: Pentatomidae).

MATERIALS AND METHODS

Fifth instars (three-four days old) of *Brachynema germari* were subjected to extraction of total protein, total lipid, glucose and glycogen content. Lipid, glucose and glycogen content were measured by the method of Van Handel (1985a, b) and Yuval *et al*., (1994), and protein content was determined using the method of Bradford (1976). Cellular energy allocation was assayed by the method of De Coen & Janssen (1997) using iodonitro tetrazolium as the chromogenic reagent. The reagents for the energy reserves; lipid, glucose, glycogen and protein were cholesterol, anthron, anthron plus bovine serum albumin respectively. Statistical analysis was performed using the software Statgraphics Plus 5.1.

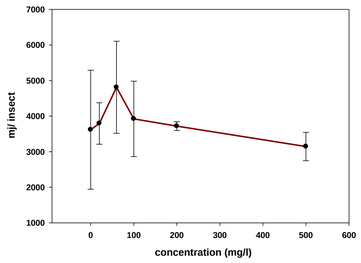


Figure 1. Lipid content in *Brachynema germari* treated with different concentrations of pyriproxifen.

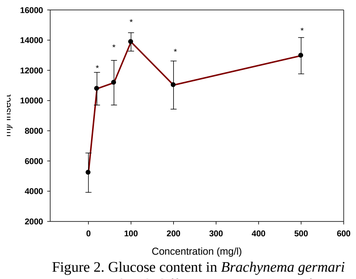


Figure 2. Glucose content in *Brachynema germari* treated with different concentrations of pyriproxifen.

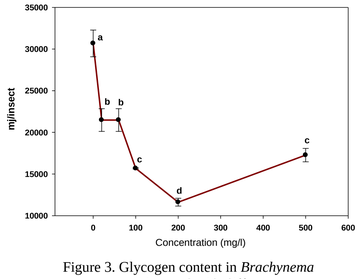
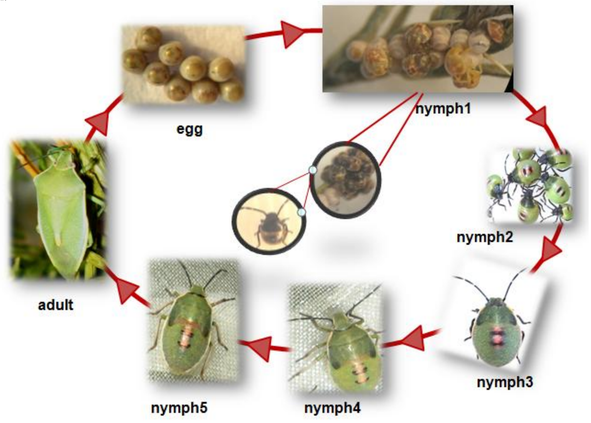


Figure 3. Glycogen content in *Brachynema germari* treated with different concentrations of pyriproxifen



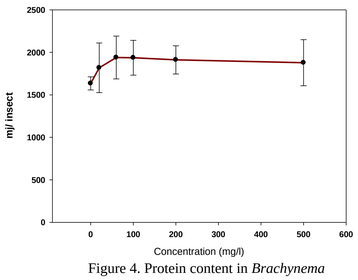


Figure 4. Protein content in *Brachynema germari* treated with different concentrations of pyriproxifen

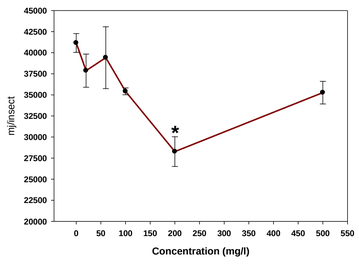


Figure 5. E_a in *Brachynema germari* treated with pyriproxyfen.

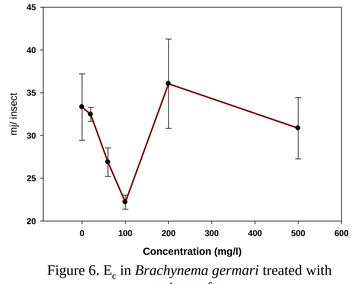


Figure 6. E_c in *Brachynema germari* treated with pyriproxyfen.

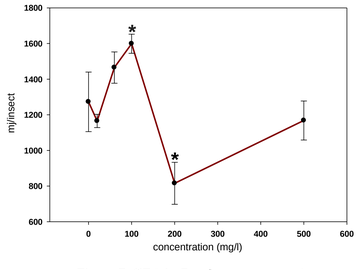


Figure 7. CEA in *Brachynema germari* treated with pyriproxifen

RESULTS

A significant decline was observed in the amount of total lipid of the insects treated with different concentration of pyriproxyfen. The lowest amount of total lipid was observed when the nymphs were treated with the concentration of 200 mg/l of pyriproxyfen (Figure 1). Total glucose showed a significant increase in all concentrations of the compound. There was no significant differences among different concentrations (Figure 2). There was no significant changes in glycogen and protein contents in the insects treated with pyriproxyfen (Figures 3, 4). With increasing concentration of pyriproxyfen a decreasing trend was observed in E_a . Minimum significant of E_a was obtained at the concentration of 200 mg/l of pyriproxyfen. (Figure 5). The electron transport system (ETS) in the energy consumption (E_c) assay was not significantly different among all applied concentrations of pyriproxyfen (Figure 6). In contrast to the E_c, CEA was increased as the concentration increased and Maximum CEA was obtained at 100 mg/l, followed by a decline at 200 mg/l concentration (Figure 7).

DISCUSSION

There are some proposed reasons for decrease in total lipid in treated insects; (1) Lipid is consumed in detoxification system of organism, (2) The insect had no feeding and so did not accumulate lipid and (3) the most important reason for this decrease that assumed is the effect of juvenile hormone analog, pyriproxyfen, on lipid metabolism. Lipid metabolism produces free fatty acids in the insect hemolymph. These fatty acids act as an uncoupler in electron transport chain and therefore no ATP produced. So, there was no alteration in E_c of the treated insects (Cymborowski, 1992). Increased carbohydrate reserves can be occurred as the result of inhibition of carbohydrate altering to lipid in addition to (other than) releasing the carbohydrate from cuticle into hemolyph (Cymborowski., 1992).

REFERENCES

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