

Starvation and Cadmium Affect Glutathione and Detoxifying Enzymes in Larvae of *Spodoptera Exigua* from Control and Cadmium Strain

Anna Pompka¹, Alina Kafel¹, Elżbieta Szulińska¹

¹University of Silesia in Katowice, Department of Natural Sciences, Institute of Biology, Biotechnology and Environmental Protection, Bankowa 9, 40-007, Katowice, Poland
anna.pompka@us.edu.pl; alina.kafel@us.edu.pl; elzbieta.szulinska@us.edu.pl

Extended Abstract

Related to industrial and urban pollution, high load of cadmium in soil has been commonly noticed. That may cause an increase of metal amounts in herbivore food, host plant, among the others, in the hyperaccumulators of cadmium. Various environmental factors such as short period of starvation and metal exposure may affect differently detoxification processes in insects. The one of the indicative of metal toxicity may be oxidative stress, and enhanced cost of antioxidant defence. Glutathione is the main thiol in living cells. It plays an important role in antioxidant defense. About 90% is present in reduced form. Excessive oxidation can result in the formation of more disulfide, oxidized glutathione [1]. In a study carried out on *Spodoptera exigua*, the activity of the detoxifying enzyme glutathione S-transferase was checked in larvae from the first and second generation of these insects treated with zinc and cadmium added to the medium. Increase in the activity of the GST enzyme in the fat body and Malpighi tubules caused by zinc and its reduction under the influence of cadmium have been observed [2]. The presence of cadmium in the diet of the last instar *S. exigua* larvae resulted in lower larval survival rate and longer larval stages duration. Cadmium also contributed to an increase of total antioxidant capacity in the larval hemolymph [3].

The aim of this experiment was to compare cadmium and starvation effect on the 4th instars larvae, assessing their survival rate, the level of reduced glutathione (GSH), and activity of sensitive environmental biomarkers: glutathione S-transferase (GST) and nonspecific esterase, between larvae of a common pest *S. exigua* originated from control and cadmium strains. They were exposed to cadmium during larval period and starving period (lasting 1 or 2 days during the 3rd instar period). It is appeared that the 4th instars larvae originated from cadmium strain characterised enhanced amount of GSH, higher activity of EST and GST, but only those which were not starved. Two days starving significantly decreased survival rate of the larvae. Sensitivity to two days lasting starvation, distinguished cadmium strain animals, for whom the lowering GSH level and drop in examined enzymes activity and the lowest number of survived animals were registered. A drop in GSH concentration was noticed for earlier starving larvae, exposed to cadmium and originated from control strain. It seems that in the case of esterases, lowering of the activity was growing with length of starvation period, similarly for control and cadmium strain animals. When, glutathione and glutathione related enzyme role seems differentiated the animals from control and cadmium strain, exposed to metal.

References

- [1] T. Roušar, O. Kučera, H. Lotková and Z. Cervinková, "Assessment of reduced glutathione: Comparison of an optimized fluorometric assay with enzymatic recycling method," *Anal. Biochem.*, vol. 423, pp. 236-240, 2012.
- [2] A. Kafel, K. Bednarska, M. Augustyniak and I. Witas, "Activity of glutathione S-transferase in *Spodoptera exigua* larvae exposed to cadmium and zinc in two subsequent generations," *Environ. Int.*, vol. 28, pp. 683 – 686, 2003.
- [3] A. Kafel, A. Zawisza-Raszka and E. Szulińska, "Effects of multigenerational cadmium exposure of insects (*Spodoptera exigua* larvae) on antioxidant response in haemolymph and developmental parameters," *Environ. Pollut.*, vol. 162, pp. 8-14, 2012.