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Myotropic activity of allatostatins in tenebrionid beetles

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Abstract:

Neuropeptides control the functioning of the nervous system of insects, and they are the most diverse signalling molecules in terms of structure and function. Allatostatins are pleiotropic neuropeptides that are considered potent myoinhibitors of muscle contractions in insects. We investigated the effects caused by three distinct allatostatins, Dippu-AST1 (LYDFGL-NH_2 from *Diploptera punctata*), Grybi-MIP1 (GWQDLNGGW-NH_2 from *Gryllum bimamculatus*) and Trica-ASTC (pESRYRQCYFNPISCF-OH from *Tribolium castaneum*) on contractile activity of the myocardium, oviduct and hindgut of two tenebrionid beetles, *Tenebrio molitor* and *Zophobas atratus*. Studies showed that all three peptides exerted myostimulatory effects on the oviduct and hindgut of the beetles, however they did not cause any effect on myocardium.. The effects of Dippu-AST1, Grybi-MIP1 and Trica-ASTC were dose-dependent and tissue and species specific. The highest stimulatory effect was caused by Trica-ASTC, showing stimulation of approximately 82% at a 10^{-12} M concentration and 76% at a 10^{-11} M concentration for *T. molitor* and *Z. atratus*, respectively. The oviduct of *T. molitor* was more susceptible to allatostatins than that of *Z. atratus*. Dippu-AST1 showed the maximum stimulating effect at 10^{-11} M (57%), whereas Grybi-MIP 1 at 10^{-10} M caused a 41% stimulation. Trica-ASTC, in both species, showed a myostimulatory effect over the whole range of tested concentrations but was most potent at a 10^{-12} M concentration and caused a 54% and 31.9% increase in the frequency of contractions in the oviduct of *T. molitor* and *Z. atratus*, respectively. The results suggest that allatostatins may affect the regulation of egg movement within the oviducts and movement of food in the digestive tract of beetles and do not regulate directly the activity of heart, thus being good candidate compounds in neuropeptides based pest control agents in future research.

Key words: allatostatins, neurohormones, beetles, peptides, *Zophobas atratus*, *Tenebrio molitor*

1. Introduction:

Neuropeptides play a crucial role in the nervous system of insects, and they are by far the most diverse signalling molecules in terms of structure and function (De Loof, 2008; Gäde and Marco, 2006; Scherkenbeck and Zdobinsky, 2009; Taghert and Nitabach, 2012). Some of the neuro-endocrine regulation mechanisms in insects occur in similar ways as in vertebrates, and insects may be used as model organisms in comparative research (Andries et al., 1984;