Recent research on *Galleria mellonella* as one from most important insect model organisms

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**INTRODUCTION:**

The greater wax moth, *Galleria mellonella* (L. (Lepidoptera: Pyralidae)) is one from most widely used insects in physiology, immunology, biochemistry and parasitology; even when it is considered as a pest for the apiculture. Surprisingly this classical model was not sequenced yet, so cannot be used for Drosophila or Tribolium in this area. The knowledge about population density and the lifecycle, size of larvae, easy rearing on artificial diet and commercializing in countries like Spain, Germany, United States, Mexico, Argentina, Chile and Peru.

**Nematodes**

The most used to test the pathogenicity of entomopathogenic nematodes (EPN) with potential application to biological pest control (Figure 2, left), newly also co-infections are studied. The EPN *Steinernema* and *S. kraussei* as single species, simultaneous or sequential were studied in *Galleria mellonella* to know the number of nematodes per larva that can induce oxidative stress in the hemolymph of larvae. This research demonstrates that larval stage and species of nematode used is determinant for the resistance of host. The *S. kraussei* challenged larvae showed lower percentage of host survival than *S. affine* (2007) they applied boric acid (BA) in different concentrations in artificial diet to evaluate malondialdehyde content and the antioxidant enzymes, catechol (CAT), glutathione S-transferase (GST) and glutathione peroxidase (GPx) in hemolymph and fat body of VII instar. They showed that levels of proteins in adults increased according to age in the first days only in females and later decreased; however carbohydrates in adults increased in both sex. Recent studies show different approaches how to apply chemicals or pathogens on Gm larvae (Table 1). In this work we take very briefly into account the conventional strategies (organic insecticide) until most innovative like secondary metabolites produced by bacteria and fungi.

**Bacteria**

In studies reported by Mukherjee et al. (2010) used *Listeria* spp strain to evaluate virulence against Gm. They showed that Gm has the ability of distinguish among pathogen and non-pathogen strain. In addition, *Listeria* infection induce the expression of immune defense genes such as those for lysozyme, gallowycin, gallowycin, and insect metalloproteinase inhibitors (IMPs). Pre-inoculation of antimicrobial activity by treatment of larvae with lipopolysaccharide (LPS) significantly improved survival against subsequent *L. monocytogenes* challenge and strong antioxidant activity was detected in the hemolymph of LPS pretreated larvae. Bacteria are used also for experiments with antioxidant, see specialized section for more details.

**Fungi**

Larvae of Gm are excellent in vivo models and have been used with a variety of entomopathogenic fungi and antifungal agents. Factors affecting the use of Gm larvae are described and examples of where these larvae have been utilized are discussed in review by Kavanagh and Fallon (2010). For example, fungal spores of *B. thuringiensis* (Bt) results to impaired enzymatic antioxidant defense capacity and metabolic functions with increasing oxidative stress. Durmu et al. (2010) used sodium tetraborate (ST) a different concentrations (0.005, 0.1, 0.2, or 0.3%) in artificial diet in order to evaluate the survival, development, longevity and fecundity of Gm larvae; reporting that the oviposition, survival and lysozyme at higher concentrations of ST was inhibited in VII instar larvae. Opposite e.g. lysozyme content of fat body was increased twice in low concentrations of ST. Continuing with organic insecticides, in the work reported by Hyrš et al. (2007) they applied boric acid (BA) in different concentrations in artificial diet to evaluate malondialdehyde content (MDA), an oxidative stress indicator and antioxidants of the enzymes antioxid (superoxide dismutase (SOD), catale (CAT), glutathione transferase (GST) and glutathione peroxidase (GPx)) in hemolymph and fat body of VII instar Gm larvae. MDA was significantly increased in larvae challenged with *S. affine* strain and pupal hemolymph. Antioxid enzymes varied, in lower doses of BA activity usually increased but decreased in higher concentrations. Dietary BA also affected larval survival, higher concentrations led to significantly increased larval and pupal mortality and prolonged development, so BA toxicity is related, at least in part, to oxidative stress management. Similarly *B. thuringiensis* infection increased activity of MDA and antioxidant enzymes in first day of infection, but than decreased which can be explained by increased level of the oxidants in larvae (Dubovsky et al., 2008).

Penicillin as fungal product was also used in different concentrations in artificial diet applying to Gm for evaluated MDA and antioxidant enzymes activity by Kavanagh and Kalender (2007). They reported that MDA content was increased in larval tissues in higher concentrations of penicillin, but antioxidant activity not showed a consistent pattern with respect to the penicillin concentration. Other results reported that SOD activity was negative correlated with CAT activity.

**CONCLUSION:**

- *Galleria mellonella* is used more than 100 years in research, but still this specie was not sequenced.
- *Gm in the toxicity bioassays has been recently used to test chemical insecticides, parasitoides, nematodes, fungical and bacterial metabolites etc. applied by injection, ingestion or contact.*

**REFERENCES:**