

1.2 Mestrado em Educação Física na UFV (30 pontos)

Documento escaneado em boa qualidade

1.3. Pós-graduação Lato Sensu: Especialização em Esportes e Atividades Físicas Inclusivas para Pessoas com Deficiência na UFJF (10 pontos)

Documento escaneado em boa qualidade

2.1. Artigo A1: Spiromesifen induces histopathological and cytotoxic changes in the midgut of the honeybee *Apis mellifera* (Hymenoptera, Apidae) (10 pontos + 5 = 15 pontos)

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Spiromesifen induces histopathological and cytotoxic changes in the midgut of the honeybee *Apis mellifera* (Hymenoptera: Apidae)



Raissa Santana Serra^a, Jamile Fernanda Silva Cossolin^b,
Matheus Tudor Cândido Santos de Resende^b, Mayara Arthidoro de Castro^b,
André Henrique Oliveira^b, Luis Carlos Martínez^b, José Eduardo Serrão^{b,*}

^a Departamento de Entomologia, Universidade Federal de Viçosa, 36570-900, Viçosa, Minas Gerais, Brazil

^b Departamento de Biologia Geral, Universidade Federal de Viçosa, 36570-000, Viçosa, Minas Gerais, Brazil

HIGHLIGHTS

- The acaricide/insecticide spiromesifen damages the midgut cells of honeybee.
- The major histological change was disorganization of the epithelial architecture.
- Spiromesifen damaged the rough endoplasmic reticulum in the digestive cells.

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ABSTRACT

The honeybee *Apis mellifera* is an important pollinator that, similarly to other bees, undergoes colony losses due to several problems, including the use of pesticides in the agriculture. In addition to direct mortality, pesticides cause side-effects in some non-target organs, such as the midgut, which is the main organ for digestion and absorption. Spiromesifen is a pesticide used to control mites and whiteflies, which can be ingested by bees feeding on contaminated floral resources. This study evaluated the histopathological and cytological effects of the ingestion of spiromesifen on the midgut of *A. mellifera* workers. The bees were exposed *per os* to the field recommended dose of spiromesifen, and the midgut was analyzed after 24h and 48h of exposure to the pesticide. The midgut has a single layer of digestive cells, with spherical nucleus, nests of regenerative cells and layers of peritrophic matrix in the lumen. Bees treated with spiromesifen presented histological and cytological changes in the midgut, including disorganization of the epithelial architecture, release of cell fragments to the lumen, accumulation of mitochondria in the apical cytoplasm, alteration of the basal labyrinth, changes in the rough endoplasmic reticulum and cell degeneration. The occurrence of damage in the digestive cells of the *A. mellifera* midgut indicates that spiromesifen does not cause mortality in honeybees, but its side-effects can damage the midgut, which may affect the longevity and behavior of this pollinator.

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1. Introduction

The honeybee *Apis mellifera* Linnaeus (Hymenoptera: Apidae) is an important eusocial insect for the production of honey and other

commercial products with nutritional and therapeutic properties (Cornara et al., 2017). In addition, this bee provides a relevant service by pollinating wild (Aguilar et al., 2006; Ashman et al., 2004; Potts et al., 2010) and cultivated plants (Klein et al., 2007; McGregor, 1976; Ricketts et al., 2008).

Despite an increase of more than 300% in pollinator-dependent crops, bee populations have been suffering colony losses, increasing the demand for managed bees (Aizen and Harder, 2009; Castilhos et al., 2019; Neumann and Carreck, 2010). Factors such as food deprivation, diseases and parasites can weaken colonies. Besides, a variety of pesticides affect bees direct and indirectly during the

* Corresponding author.

E-mail addresses: raissa.sserra@gmail.com (R.S. Serra), jamilfscossolin@gmail.com (J.F.S. Cossolin), wm.matheustudor@gmail.com (M.T.C.S. Resende), mayarthidoro@gmail.com (M.A. Castro), andreoliveira.ufv@gmail.com (A.H. Oliveira), lc.martinez@outlook.com (L.C. Martínez), jeserrao@ufv.br (J.E. Serrão).