Chapter 1

Gene expression responses to interactive stressors of diet quality and viral infection in *Apis mellifera*

1.1 Introduction

Commerically managed honeybees have undergone unusually large declines in the United States and parts of Europe over the past decade (vanEngelsdorp et al. 2009, Kulhanek et al. 2017, Laurent et al. 2016), with annual mortality rates exceeding what beekeepers consider sustainable (Caron and Sagili 2011, Bond et al. 2014). More than 70 percent of major global food crops (including fruits, vegatables, and nuts) at least benefit from pollination, and yearly insect pollination services are valued wordwide at $175 billion (Gallai et al. 2009). As honeybees are largely considered to be the leading pollinator of numerous crops, their marked loss has considerable implications regarding agricultural sustainability (Klein et al. 2007).

Honeybee declines have been associated with several factors, including pesticide use, parasites, pathogens, habitat loss, and poor nutrition (Potts et al. 2010, Spivak et al. 2011). Many researchers agree that these environmental stressors have an interactive influence on the large-scale loss of honeybees (Goulson et al. 2015).

interacting

1.2 Methods

1.3 Results

1.4 Discussion

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