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Progression of Watermelon Bud Necrosis Virus Infection in Its Vector, *Thrips palmi*

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Abstract: Thrips are important pests of agricultural, horticultural, and forest crops worldwide. In addition to direct damages caused by feeding, several thrips species can transmit diverse tospoviruses. The present understanding of thrips–tospovirus relationships is largely based on studies of tomato spotted wilt virus (TSWV) and Western flower thrips (*Frankliniella occidentalis*). Little is known about other predominant tospoviruses and their thrips vectors. In this study, we report the progression of watermelon bud necrosis virus (WBNV) infection in its vector, melon thrips (*Thrips palmi*). Virus infection was visualized in different life stages of thrips using WBNV-nucleocapsid protein antibodies detected with FITC-conjugated secondary antibodies. The anterior midgut was the first to be infected with WBNV in the first instar larvae. The midgut of *T. palmi* was connected to the principal salivary glands (PSG) via ligaments and the tubular salivary glands (TSG). The infection progressed to the PSG primarily through the connecting ligaments during early larval instars. The TSG may also have an ancillary role in disseminating WBNV from the midgut to PSG in older instars of *T. palmi*. Infection of WBNV was also spread to the Malpighian tubules, hindgut, and posterior portion of the foregut during the adult stage. Maximum virus-specific fluorescence in the anterior midgut and PSG indicated the primary sites for WBNV replication. These findings will help to better understand the thrips–tospovirus molecular relationships and identify novel potential targets for their management. To our knowledge, this is the first report of the WBNV dissemination path in its vector, *T. palmi*.

Keywords: virus–vector relationships; thrips; orthotospovirus; localization; WBNV; melon thrips

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1. Introduction

Thrips belong to the order Thysanoptera, which includes more than 7700 species of tiny, fringed winged insects [1]. Globally, thrips are considered the most economically damaging pests of a wide range of food, feed, and fiber crops [2]. They cause extensive feeding damage by piercing and sucking the epidermal and mesophyll cells, resulting in silvery scars on the leaves, stems, flowers, and fruits and sometimes induce galls. In addition to being plant pests, some thrips can also spread several tospoviruses (genus *Orthotospovirus*, family *Tospoviridae*, order *Bunyavirales*) that cause significant economic losses to crop production across the globe [3]. High fecundity, short lifecycle, high mobility, preference for concealed spaces, and wide host range make them efficient virus vectors as well as pests. To date, 16 thrips species are known to transmit 29 tospoviruses [4–6]. The present understanding of thrips–tospovirus interactions is largely based on Western flower thrips, *Frankliniella occidentalis* (Thysanoptera: Thripidae) and tomato spotted wilt virus (TSWV). Based on this model system, it is understood that thrips transmit tospoviruses in a persistent, propagative manner, and adults are the primary transmitters, as they bear functional wings to fly long distances. Adult thrips become viruliferous if virus acquisition takes place in an early larval instar [7,8]. TSWV replicates in the midgut and surrounding tissues and reaches salivary glands through either the tubular salivary glands (TSG) or