DISPELLING THE RASPER MYTH AND INVESTIGATING HOW VIRUS INFECTION CHANGES THRIPS FEEDING BEHAVIOR

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Long ago people discovered extraordinarily tiny yellow to brown insects (thrips!) that seemed to be responsible for causing unsightly areas of silvery damage flecked with dark spots on the leaf surface. Indeed, thrips feeding is a serious problem for a multitude of food, fruit and fiber crops. How could such a small insect inflict such large areas of damage? Several researchers proposed that thrips must utilize a feeding strategy somewhere between sucking and chewing. A simple statement made in 1915 that thrips exhibit a "sort of rasping movement" to break open cells and then suck up the contents, led to classification of thrips as raspers or rasping-sucking insects. This classification can be found in numerous entomology text books and web based fact sheets despite many reports showing that thysanopteran mouthparts do not have any structures for rasping. Thrips have asymmetrical stylets that clearly serve in piercing cells and sucking out plant fluids, composed of a single mandibular peg and a pair of maxillary stylets that form a feeding tube. Video recordings and electrical penetration graph recordings of feeding confirm that thrips utilize a "piercing-sucking" feeding strategy. These recordings show that the very visible silvery damage caused by thrips feeding arises from the emptying of a large number of individual cells. I have shown that thrips engage in three basic types of probing behaviors: non-ingestion probes, short ingestion probes, and long ingestion probes. During non-ingestion probes thrips do not actively ingest plant sap but are likely sampling cell contents to determine suitability of the food source. In short ingestion probes thrips suck out individual cells, and during long ingestion probes thrips engage in sustained ingestion, from an unknown food source, possibly the xylem. Even more important than the direct feeding damage thrips cause is the damage inflicted by the viruses they transmit. Several species serve as vectors of *Tomato spotted wilt virus* (TSWV) type member of the tospoviruses (the only plant-infecting genus in the *Bunyaviridae*), and a devastating plant virus that infects over 1000 species of plants. I have recently shown that infection with TSWV alters the sexually dimorphic feeding behavior of its thrips vector, *Frankliniella occidentalis* (Pergande) in a sexually dependent manner. Male thrips infected with TSWV fed more than uninfected males, with the frequency of all feeding behaviors increasing by up to 3 fold, thus increasing the probability of virus inoculation. Importantly, infected males made almost 3 times more non-ingestion probes compared to uninfected males. Non-ingestion probes leave cells largely undamaged and able to support virus replication and movement. Furthermore we have shown that thrips salivate immediately before and during these probes indicating that this behavior is most likely to establish virus infection. Although several plant viruses infect their insect vectors, this has been the first report that vector infection by a plant virus alters feeding behavior.