# In Vitro Consumption Patterns of Pepper Weevil, *Anthonomus eugenii* (Coleoptera: Curculionidae) on Two Commercial Pepper Cultivars in Florida

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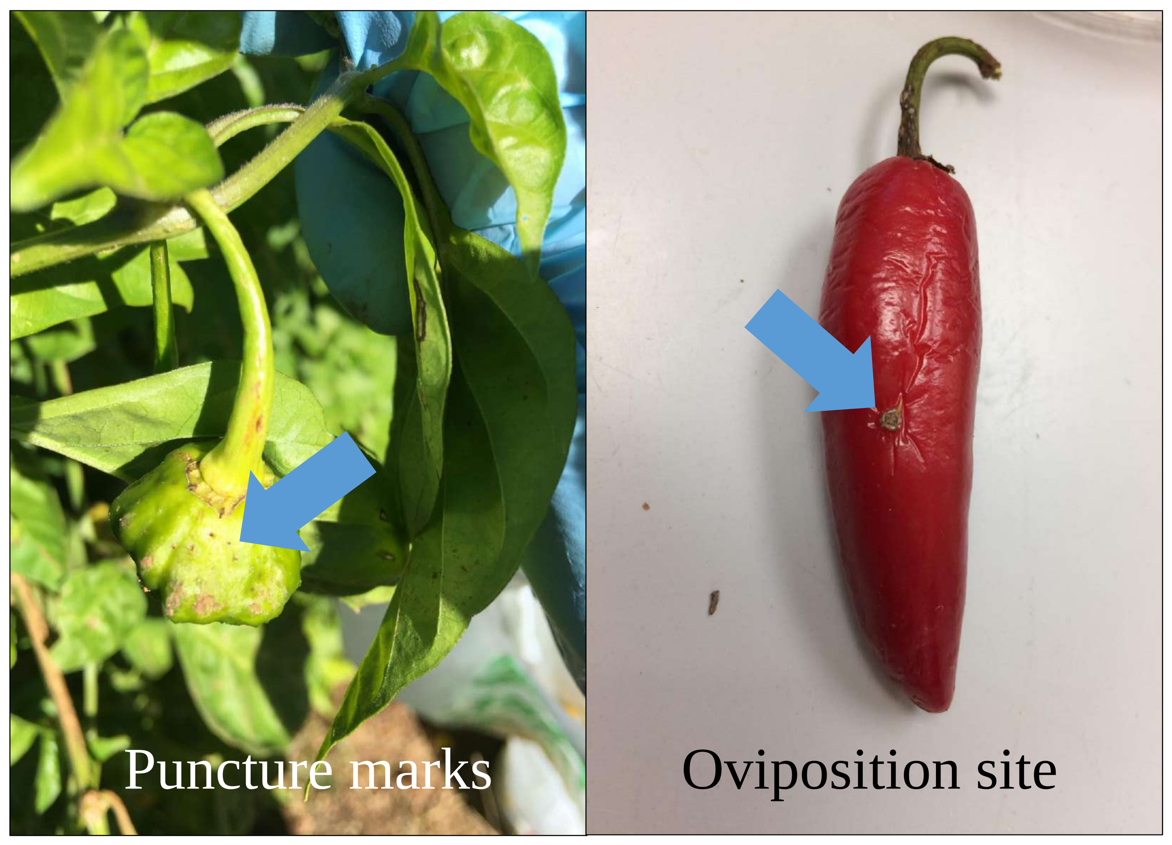
## Abstract

The pepper weevil, *Anthonomus eugenii* Cano (Coleoptera: Curculionidae), is a major pest of peppers in Florida. To determine the consumption patterns of pepper weevils as a reference for pest management strategies, functional response, intraspecific competition and preference of *A. eugenii* were evaluated under the laboratory condition. The results showed that the pepper cultivar Habanero has a higher resistance to *A. eugenii* due to its, lower searching rate, longer handling time and lower consumption rates. Pepper weevils suffered from intraspecific competition when both cultivars (Habanero & Jalapeño) were offered for feeding and oviposition. Fruit wall thickness, weight and size were negatively correlated with the numbers of puncture marks per fruit. The large-sized, thick-walled and mature fruits were more resistant to *A. eugenii's* infestation. The results of present study indicated that careful selection of pepper cultivars and sizes decreased susceptibility to *A. eugenii*. Utilizing the intraspecific interactions between pepper weevils can serve as effective strategies of pest management.

## Introduction

Pepper weevil, *Anthonomus eugenii* Cano (Coleoptera: Curculionidae), is an economically important invasive insect pest of cultivated peppers in the Southeastern United States, especially in Florida (Stansly & Kostyk, 2017). Adult pepper weevils feed on fruit and leaf buds and lay eggs on flowers, buds and fruits. Eggs are laid singly by female adults inside an egg cavity, which is subsequently covered by an anal secretion that hardens and darkens (Toapanta et al. 2005). Pepper weevil infestation is characterized by larval feeding inside the fruit, causing premature fruit drop. Pepper weevil has a potential to invade other pepper-growing areas due to frequent international shipments and trade. Most pesticides cannot reach the larvae feeding inside pepper fruits, pest suppression is tough once *A. eugenii* infestation is detected (Riley et al. 1992a & 1992b). Therefore, studying consumption patterns of pepper weevil is valuable for effective integrated pest management (IPM). Selecting more resistant/tolerant pepper cultivars to control *A. eugenii* is highly desirable. While utilizing the intraspecific interactions between pepper weevils to suppress their population, and finding the optimal fruit-characteristics resistant to pepper weevil.




Puncture marks (left) and oviposition site (right) on infested peppers

## Objectives

To determine consumption patterns of pepper weevil on two commercial pepper cultivars under laboratory conditions.

## Materials and methods

The study was conducted in the Center for Biological Control, Florida A&M University in 2017 and 2018. Fruit densities tested were 20, 30, 40, 50 or 60 for a weevil adult in a plastic container. The number of fruits consumed were examined after 24 h.

The fruit densities examined were 20, 40, 60, 80 and 100 for 1, 2, 3, 4 and 5 weevil adults in a plastic container, respectively. The fruit/weevil ratio was kept at 20 for each number of weevils placed together in a plastic container, with intraspecific competition for space increasing with increased number of weevils placed together. The coefficients of mutual interference were calculated by counting the number of consumed fruits after 24 h.

One hundred pepper fruits were collected from the experimental farm to measure the wall thickness, weight and size, respectively. Then the puncture marks per fruit were counted to estimate the relationship (positive or negative) between puncture marks and fruit characteristics (wall thickness, weight and size) via linear regression analysis.

## Results and discussion

The functional response data for Habanero and Jalapeño consumption of *A. eugenii* over a 24 h period fitted the Holling Disc Equation well (Fig. 1). Pepper weevil developed less efficient skills in searching for Habanero than Jalapeño. It also cost *A. eugenii* tremendous amount of time to handle Habanero compared to Jalapeño. Thus, compared to Jalapeño, Habanero presumably has lower susceptibility or a relatively higher repellence to *A. eugenii* infestation (Seal & Bondari, 1999).

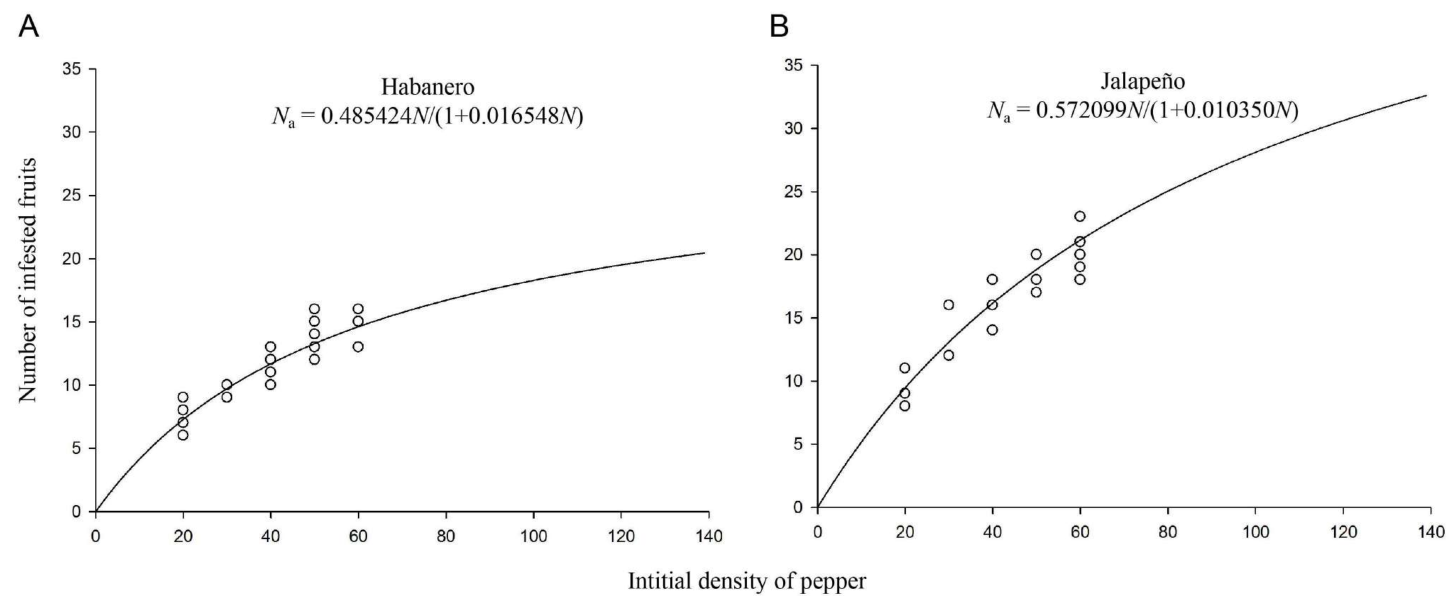



**Fig. 1.** Functional responses of *A. eugenii*. Solid lines showed the functional response curves of *A. eugenii* on A. Habanero and B. Jalapeño by fitting a Holling Disc Equation. Circles showed the number of fruits infested by pepper weevil.

Mean consumption rates of weevils decreased with increasing fruit-weevil density because of intraspecific competition associated with space limitation (Fig. 2). Lower theoretical maximum rates of Habanero consumption were detected than those of Jalapeño. Pepper weevils were greatly interfered when Jalapeño was consumed compared to Habanero. Both physical competition and chemical interaction caused the intraspecific competition. Fruit wall thicknesse, weight and size were negatively correlated with the numbers of puncture marks per fruit. Pepper weevils preferred small-sized, thin-walled and young fruits for oviposition and feeding.

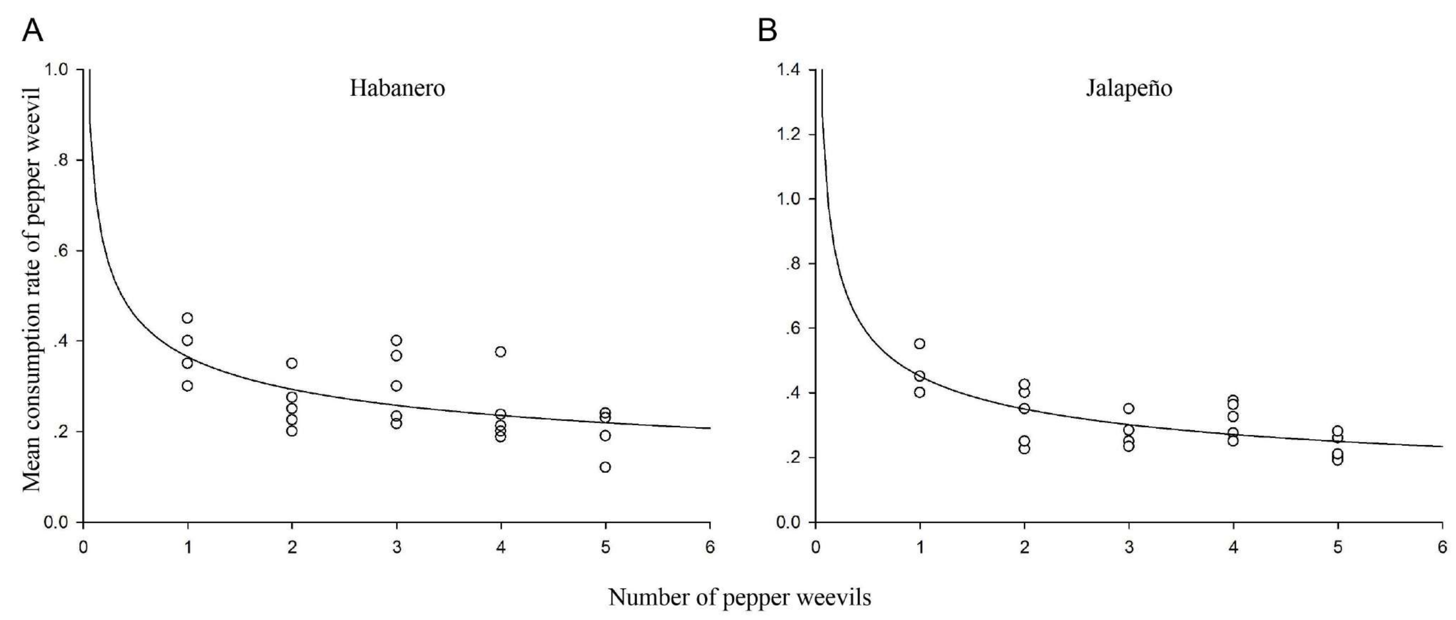
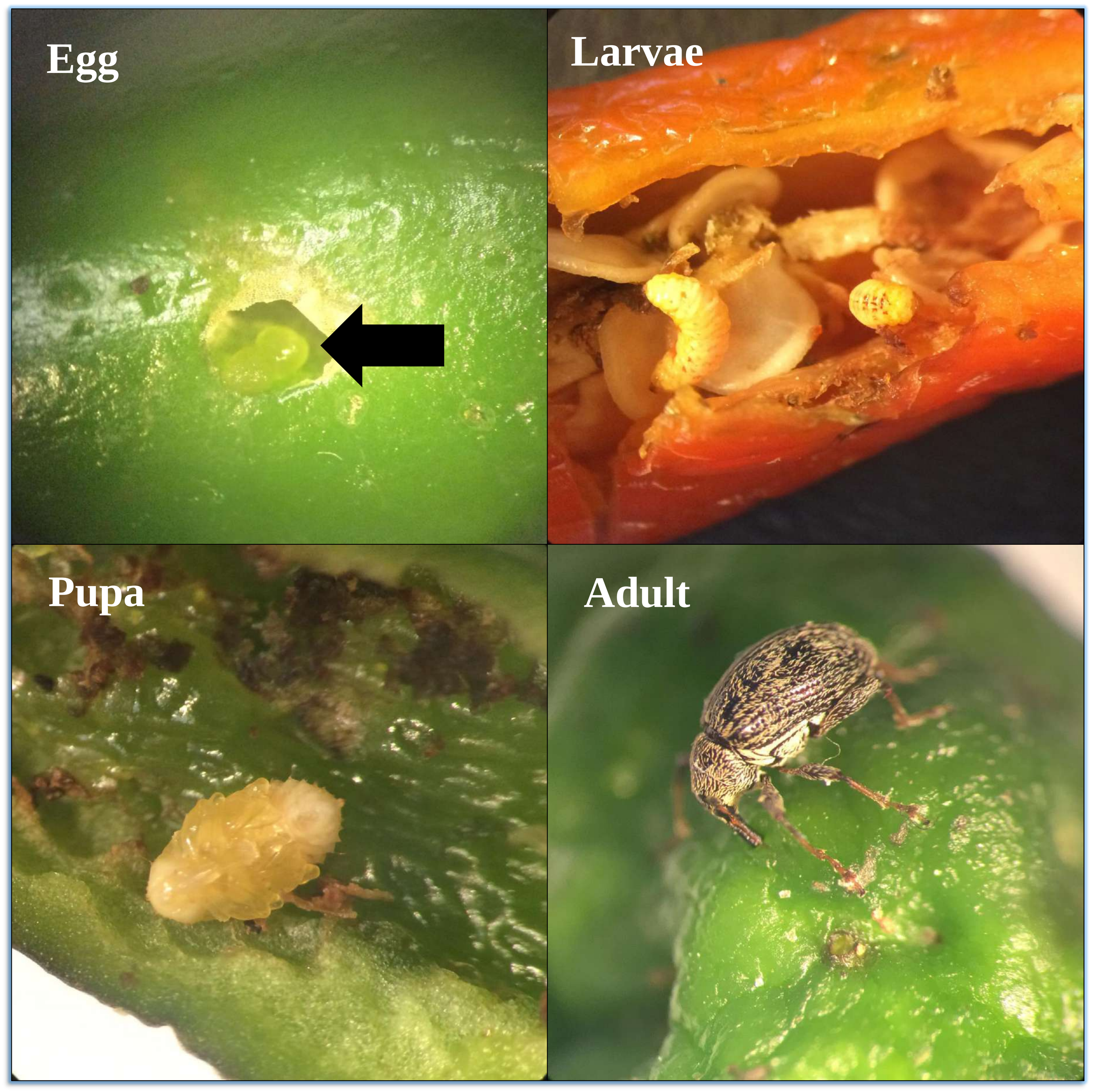



**Fig. 2.** Intraspecific competition among individuals of *A. eugenii*: A. Habanero and B. Jalapeño were consumed. Each data point represents the mean rate of fruits consumed by an individual pepper weevil. Curve was fitted using the intraspecific competition equation (eq. 2).

## Conclusions

Pepper cultivar Habanero showed higher resistance to *A. eugenii* due to its lower searching rate, longer handling time, and lower consumption rates. Pepper weevil suffered from intraspecific competition when both cultivars were offered. Fruit wall thickness, weight and size were negatively correlated with the numbers of puncture marks made by the weevils per fruit. In addition, the large-sized, thick-walled and mature fruits were avoided by *A. eugenii* female for oviposition and feeding. A careful selection of pepper cultivars and sizes decreased susceptibility to *A. eugenii*. Utilizing the intraspecific interactions between pepper weevils can serve as effective strategies for IPM.




Stages of pepper weevil with signs and symptoms of infestation

## Acknowledgments

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