Preliminary Report on Injury to Knock Out Rose from Differential Chilli Thrips Infestation

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Introduction

Chilli thrips (*Scirtothrips dorsalis* Hood, Photo 1) is an economically important pest throughout the tropical and subtropical regions, attacking over 150 plant species among 40 different families, including many fruit, ornamental, and vegetable crops (Ananthakrishnan 1993; Kumar et al., 2012; USDA-APHIS-PPQ-CPHST 2005). In the U.S., chilli thrips was first detected in Hawaii in 1987 (APHIS, 1994) and subsequently in FL (Edwards et al. 2010), TX (Ludwig 2009), GA, AL, and LA, >$ 3.0 billion losses in annual crops is predicted for the U.S. (Garrett, 2004). Chilli thrips infest at least 46 species of ornamental plants in nurseries and the landscapes in the Southeastern US (Seal and Kuma, 2010; Photo 2). Economic loss in ornamental plants can be reduced aesthetic quality and/or slow growth. Both adult and immature feed on aboveground parts of a plant but prefer young leaves, flowers, and buds. Major feeding damage made to foliage include distortion, curling, and dark-brown discoloration. Severe infestation can cause dwarfing and defoliation (Seal and Kuma, 2010). Damage to flowers include dark discolorations and then dark-brown scars (Chang et al., 1995; Stuart et al., 2011). In addition, this thrips vectors several viral and bacterial diseases. Economic injury thresholds need to be defined in order to develop an IPM program.

At $648 million, roses and other deciduous shrubs are the second largest contributor to nursery sales (USDA NASS 2008). Seven varieties in the Knock Out® rose family have been introduced to the market since the introduction of the original Knock Out® rose. Among them, 'Double Red Knock Out®' has been the most vigorous cultivar and is becoming more popular than the original Knock Out®'. This is the variety we used in this project and referred to as 'Double Red'.

Photo 1. Chilli thrips 2nd instar larvae (upper left) and adult (lower left) vs. flower thrips. Photo courtesy Drs. L. Osborne and Steven Arthurs, IFAS UFL

Objective

To quantify chilli thrips injury symptoms and correlate injury severity to thrips population levels on Knock Out roses at various plant ages.

Materials and Methods

Experiment 1

- 'Double Red' 4-inch liners were transplanted into #1 pots on 9 April 2014 and grown inside bench cages and irrigated through drip irrigation.
- Chilli thrips were inoculated onto plants at 4 weeks after transplant at 0, 3, 5, 15, 30, 50, or 75 thrips with 8 replications per rate. Plants were arranged as a randomized complete block design in 4 cages, each divided into 7 compartments, 2 replications per treatment unit.
- Damage Ratings (DR) using a scale from 0 (no damage) to 5 (plant dead) considering all injury symptoms (brown lesion on leaf surface, dark brown leaf edges, puckering and deformed growth on expanding leaves) were assessed at 2 and 4 weeks after inoculation.
- At 4 weeks after inoculation, plants were sampled for number of leaflets, number of flowers, and number of thrips per plants by rinsing plant leaves, stems, and flowers under an ethanol stream .
- Four replications from each treatment were cut at the media surface and dried for shoot dry weight, and plant roots were washed and dried for root dry weight. The other four replications were sprayed with Conserve® and moved to a shade structure for assessment on plant recovery.

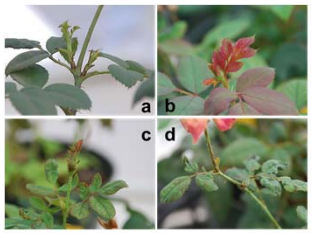

Photo 3. Chilli thrips feeding injury on Double Knock Out rose plants. From (a) to (d): meristem, young leaf, flower bud, and mature leaves. Photo courtesy Dr. Yan Chen, LSU AgCenter.

Experiment 2

- 'Double Red' 4-inch liners at 3 ages: 2, 4, and 8 weeks after being transplanted into #1 pots, were grown inside bench cages and irrigated through drip irrigation (Photo 3 shows the 8-week old age group).
- Chilli thrips were inoculated onto plants of each age group at 2 weeks after transplant of the youngest age group (d0), at 0, 5, 10, and 20 thrips per plant with 6 replications per treatment combination.
- Plants were arranged as a randomized complete block design in 3 bench cages, each divided into 4 compartments, 2 replications per treatment unit.
- Plants were evaluated for DR at d3, 7, 10 and 14.
- Leaf Distortion was assessed for all leaves in each plant using a scale from 0 (no distortion) to 3 (severely distorted) at 2 weeks after inoculation (Photo 4). Total leaf distortion (TD) is calculated as the sum of distortion ratings for each plant, and Leaf distortion index (LDI) at each sample date is calculated as: TD/number of leaves having distortion.
- At 2 weeks after inoculation, plants were sampled for number of leaves, number of flowers, and number of thrips per plants. Leaves showing brown scares were collected after rinsing for thrips, and scanned for image analysis. Percentage of Scared Leaf Area = (area of brown color/total leaf area) x 100.
- Shoots and leaves were then dried for dry weight.

Photo 3. 8-week old Double Red Knock Out grown in a bench cage.

Photo 4. Distortion at a scale ranged 1 - 3 caused by chilli thrip feeding on young and mature rose leaves.

Acknowledgement

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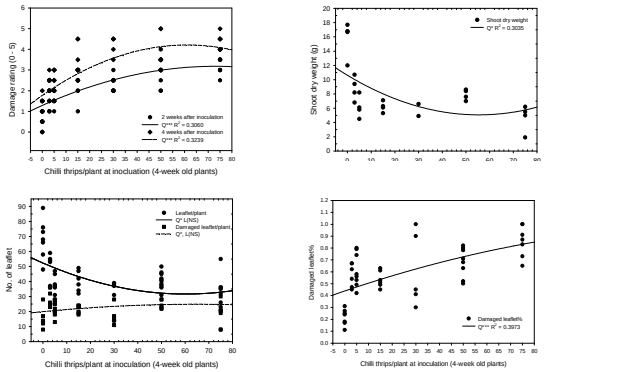

Fig 1. 'Double Red' Knock Out rose damage rating (a), shoot dry weight (b), number of leaflet and damaged leaflet per plant (c), and % of damaged leaflet (d) in response to chilli thrips inoculation rate.

Experiment 1 results:

- Plant damage ratings at 2 and 4 weeks after inoculation responded positively to initial inoculation rate that, severe damage (DR > 3) were found in plants inoculated with 50 or more thrips per plant by 2 weeks after inoculation, and plants had 15 or more chilli thrips at the inoculation by 4 weeks later. and the damages are cumulative (Fig 1a). Minor damage that did not cause significant quality reduction was found with 3 thrips/plant at both 2 and 4 weeks after inoculation with DR at 1.1 and 1.8, respectively.
- Negative response was found in shoot dry weight (Fig 1b) and number of leaflet per plant (Fig 1c), indicating feeding injury actually reduced plant growth. Number of damaged leaflets and percentage of damaged leaflet exhibited positive response to increasing number of thrips inoculated (Fig 1c and d).
- There was no relationship found between chilli thrips population at 4 weeks after inoculation with the initial inoculation rate, partly due to mortality at high inoculation rate and population dynamic over 4 weeks.
- Number of flowers was not affected by initial inoculation rate.
- Four weeks after Conserve spray, plants with initial inoculation rate at 3 or 5 thrips/plant were had acceptable visual quality ratings, and plants inoculated with higher rates were unacceptable, with some of the plants inoculated with 30 or above thrips dead (data not shown).

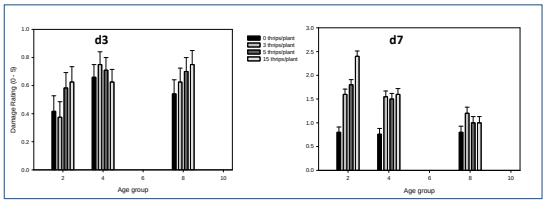

Fig 2. Damage rating of 3 age groups of 'Double Red' Knock Out roses at d3 and d7 after being inoculated with chilli thrips at 0, 3, 5, and 15 per plant.

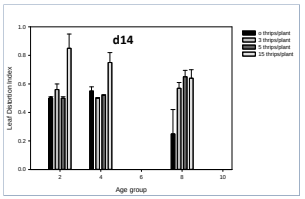

Fig 3. Leaf distortion index of 3 age groups of roses at two weeks after being inoculated with chilli thrips.

Experiment 2 results:

- Plant damage ratings among age groups were similar at d3 although there was a response to increasing thrips inoculation rate (Fig 2a). At d7, plants that were 8-week old at inoculation had lower DR than the younger groups (Fig 2b). There was no age x inoculation rate interactions, however, at d7, response to increasing inoculation rate was more significant in the 2-week old plants than the older groups.
- Leaf distortion was significantly different at d14 among age groups, and both 2 and 4-weeks old plants had higher LDI than the 8-week group. Although within the moderate range (<1), this type of injury to young leaves often lead to significant quality reduction because leaves could not expand normally (Fig 3). A minor distortion (0.2 to 0.4) was observed on no-thrips plants indicating possible environmental factors that may also cause distortion.
- Number of damaged leaves (with any of distortion/scars/browning) were greater in 8-week old plants possibly because there were more leaves available for thrips to explore (data not shown).
- Plant DW and number of flowers were significantly different among age groups but were not affected by chilli thrips inoculation rate (data not shown).

Summary

- Chilli thrips can injure Knock Out rose at very low initial population (i.e. 5 thrips per plant) and cause quality reduction to newly transplanted plants within 1 week. Plant growth and quality can be more quickly affected at higher population levels such as 15 or more thrips per plant. Therefore it is critical to conduct weekly scouting to detect thrips injury before population increase or cumulative damage causes quality loss.
- Plant age at the time of inoculation affect damage development. Younger plants are more prone to develop injury symptoms earlier and more severe than older plants, therefore, it is important to scout you plants more often than older plants.
- Chilli thrips may cause growth and flower reduction if untreated for 4 weeks, and plant may not recover from thrips damage.
- Comparing to percentage of damaged leaves and leaf distortion index, visual damage rating is a quick and relatively accurate method to access injury, although it is subjective and will require training and experience.