Evaluating major sources of Iris yellow spot virus in New York

Ashley Leach[1], Marc Fuchs[2], Riley Harding[1], Rebecca Schmidt-Jeffris[3], and Brian Nault[1]

[1] Department of Entomology, Cornell University, New York State Agricultural Experiment Station, 630 W. North Street, Geneva, NY 14456, [2] Plant Pathology and Plant-Microbe Biology Section, School of Integrative Plant Science, Cornell University, New York State Agricultural Experiment Station, 630 W. North Street, Geneva, NY 14456, [3] Department of Plant and Environmental Sciences, Clemson University, Coastal Research and Education Center, 2700 Savannah Highway, Charleston, SC 29414

Abstract

Iris yellow spot virus (IYSV) is an economically significant tospovirus of onion transmitted by onion thrips (*Thrips tabaci* Lindeman). IYSV epidemics in onion fields are common in New York, however the role of various habitats contributing to viruliferous onion thrips populations and thus IYSV epidemics is not known. In a two-year field study in New York, the abundance of dispersing onion thrips, including those determined to be viruliferous via reverse-transcriptase polymerase chain reaction (RT-PCR), was recorded in habitats known to harbor both IYSV and its vector: fields transplanted with imported onion plants, fields planted with onion seeds, onion cull piles and weedy areas near onion fields. Populations of dispersing thrips were monitored early (June), middle (July) and late in the season (August). Results showed viruliferous thrips were encountered in all habitats, with the least found early in the season and the most late in the season. Transplanted onion sites accounted for 74-79% of the total estimated numbers of viruliferous thrips and had 9 to 11 times more viruliferous thrips early to mid-season compared to the other habitats. These results suggest that transplanted onion fields are the most important habitat for generating IYSV epidemics in all onion fields (transplanted and direct-seeded) later in the growing season in New York. Our findings suggest that onion growers should control onion thrips in transplanted fields early in the season to minimize risk of IYSV epidemics later in the season.

Introduction

- Iris yellow spot virus (IYSV) is an economically damaging virus transmitted by onion thrips to onion. Losses upwards of $5 million dollars have been reported in some regions in the US (Gent et al 2006).
- The epidemiology of IYSV is most affected by dispersing adult onion thrips, which transmit the virus from plant to plant.
- Three different sources of inoculum within onion production systems have been identified: onion plants imported and then transplanted elsewhere, certain weed species, and volunteer onions in cull piles (Gent et al. 2006; Hsu et al. 2011).
- The relative contribution of habitats containing these various sources of IYSV and its vector on IYSV epidemics in onion agroecosystems is not known.

Figure 1: Adult onion thrips (*Thrips tabaci*) transmits Iris yellow spot virus to onion.

Objectives:

1) **Determine onion thrips densities in different habitats**
2) **Determine percent thrips testing positive for IYSV in different habitats**
3) **Estimate the number of viruliferous thrips for IYSV in different habitats**

Materials and Methods

Adult onion thrips flight activity was monitored in a total of sixteen sites representing four habitat types (4 weedy areas, 4 culled onion piles, 4 onion fields established with imported transplants and 4 fields that were direct-seeded). **Direct-seeded onion sites were included as an early-season negative control, as IYSV is not seed-transmitted** (Kritzman et al 2001). Yellow sticky cards were placed at each site and replaced weekly. Onion thrips were morphologically identified and recorded (Moritz and Mound 2001). The onion growing season was divided into three sampling periods: early season (June), mid-season (July), and late-season (August-early September). A subsample of 24 thrips per habitat type was selected from the three sampling periods (early season, mid season, and late season) and tested for IYSV using reverse-transcriptase polymerase chain reaction (RT-PCR) assays (Smith et al 2015). Estimated viruliferous adults for each site and sampling period were calculated by multiplying the total onion thrips per card within a site and particular sampling period by the mean incidence of onion thrips testing positive for IYSV within that site during each sampling period.

Estimated number of viruliferous onion thrips = Total onion thrips adults captured X Mean incidence of onion thrips testing positive for IYSV

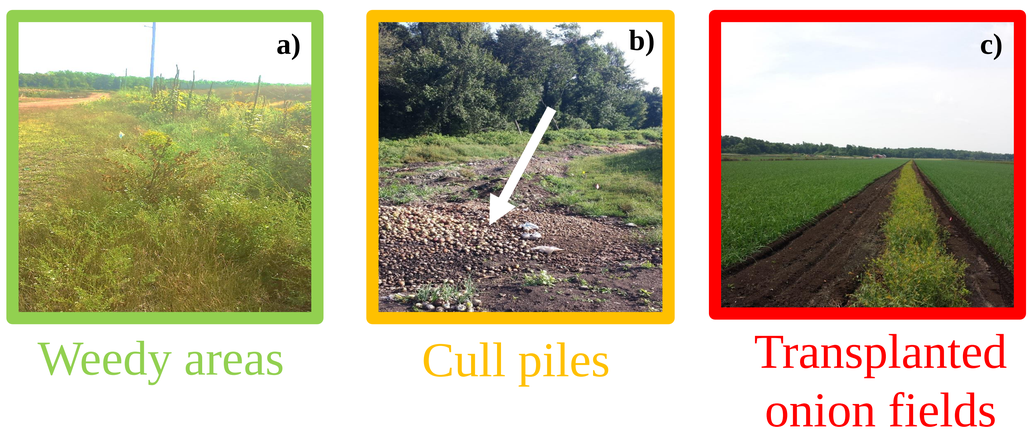

Figure 2 : Adult onion thrips were monitored using yellow sticky cards in the three habitats known to contain sources of IYSV; a) weedy areas, b) cull piles, and c) transplanted onion fields. **Direct-seeded onion fields were also monitored as an early-season negative control, as IYSV is not seed-transmitted.** Four sites per habitat were monitored, for a total of 16 sites. A random sub-sample of adult thrips were extracted from yellow sticky cards during the three sampling periods of monitoring and tested for IYSV with RT-PCR.

Results

Adult onion thrips densities

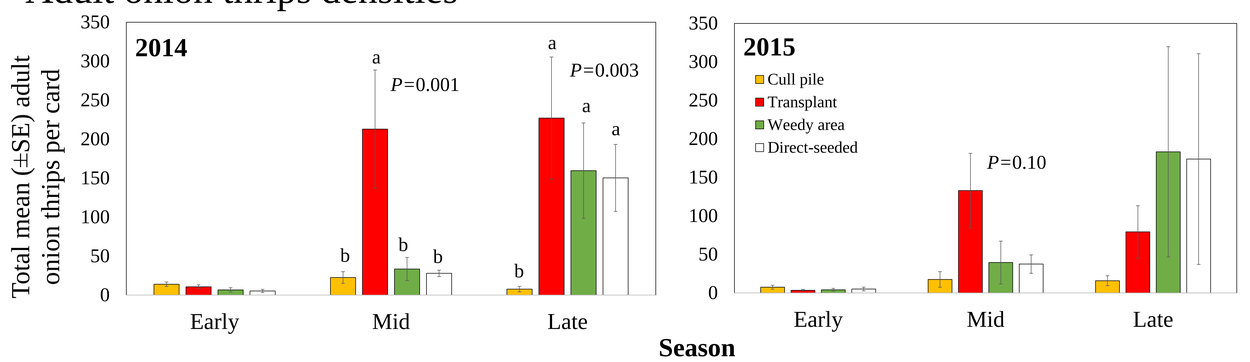

Figure 3: Mean number of adult onion thrips per sampling period in three major habitats of Iris yellow spot virus: onion cull piles, transplanted onion fields, and weedy areas. **Direct-seeded onion fields were an early-season negative control, as IYSV is not be seed-transmitted.**

Percent thrips testing positive for IYSV

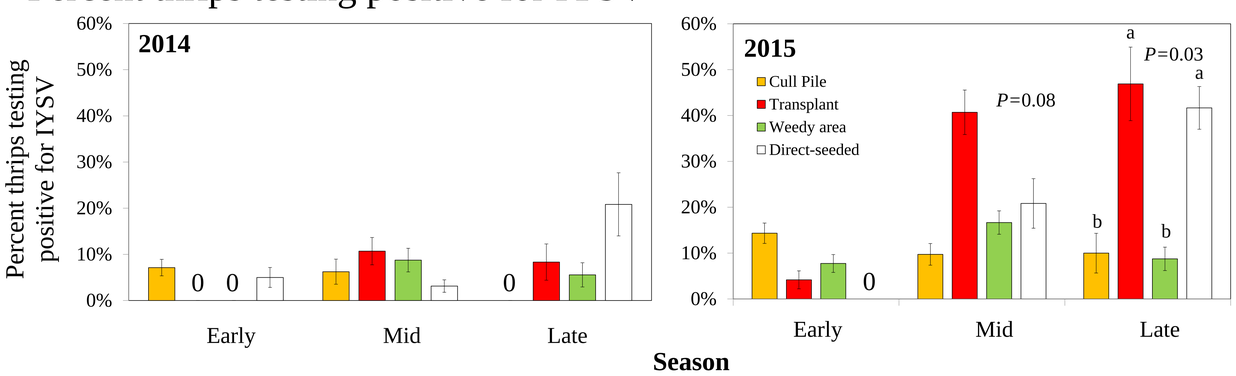

Figure 4: Percent thrips testing positive for IYSV per sampling period in three major habitats of Iris yellow spot virus; onion cull piles, transplanted onion fields, and weedy areas. **Direct-seeded onion fields were an early-season negative control, as IYSV is not be seed-transmitted.**

Estimated number of viruliferous adult onion thrips

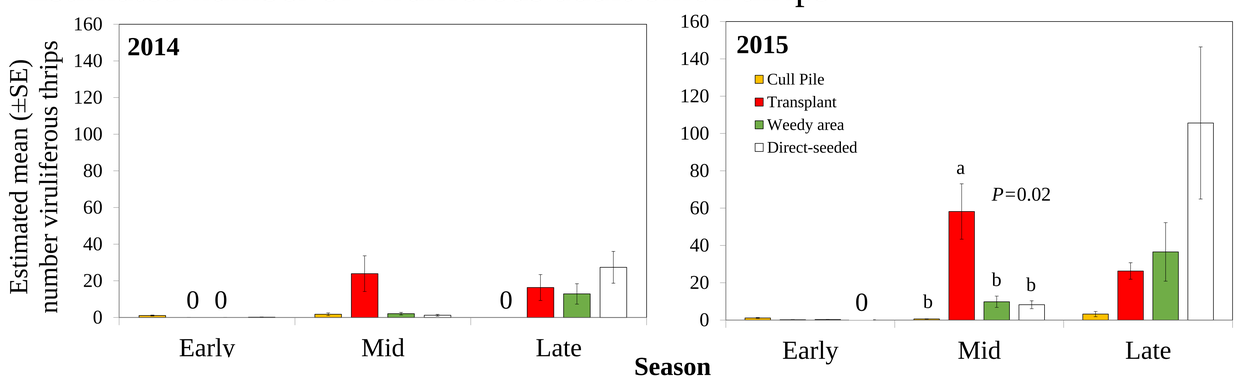

Figure 5:Estimated mean number viruliferous onion thrips per sampling period in three major habitats of Iris yellow spot virus; onion cull piles, transplanted onion fields, and weedy areas. **Direct-seeded onion fields were an early-season negative control, as IYSV is not be seed-transmitted.**

- Onion thrips densities early in the season tended to be highest in transplanted onion fields (Figure 3).
- Incidence of thrips testing positive for IYSV differed between years, and ranged between 5-40%, with greatest incidences mid to late in the season (Figure 4).
- Transplanted onion sites accounted for 74-79% of the total estimated numbers of viruliferous thrips and had 9 to 11 times more viruliferous thrips early to mid-season compared to the other habitats (Figure 5).
- Direct-seeded onion fields experienced highest number of viruliferous thrips late in the season (Figure 5).
- Cull piles had lowest estimated number of viruliferous thrips throughout the growing season (Figure 5).

Discussion/ Conclusions

1) Transplanted onion fields had highest estimated number of viruliferous thrips early to mid season in both years, suggesting that this habitat is most important for generating IYSV epidemics in less mature onion fields (transplanted and direct-seeded) later in the season. Viruliferous thrips adults are known to disperse from mature transplanted fields into neighboring less mature fields. Thrips should be managed effectively in transplanted onion fields to reduce secondary spread of IYSV.
2) Cull piles are not likely a major source contributing to IYSV epidemics in onion fields.

References

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Acknowledgements

We thank Torrey Farms, Mortellaro Farms, and Triple G Farms for allowing us to conduct research on their property. We are also thankful to M. Cappiello and D. Ritter for collecting data, P. Marsella-Herrick and E. Cieniewicz for their technical assistance with RT-PCR. Funds from the New York Onion Research and Development program supported this study.