Intraspecific competition may drive resource use diversity in Drosophila suzukii
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Intraspecific competition can increase resource use diversity within natural populations and may favor individuals who are willing to accept a wider range of hosts and/or host qualities. Drosophila suzukii (Matsushita) is a highly polyphagous, invasive vinegar fly that severely threatens berry and cherry production in North America, Europe, and South America. To determine if intraspecific competition affects D. suzukii host use and population growth, we compared oviposition and infestation patterns in ripe and unripe blackberries, a highly preferred host, as fly numbers increased in an unmanaged research planting with a history of high D. suzukii infestation. We hypothesized that females would oviposit in unripe berries, which are suboptimal hosts compared to ripe berries, as levels of intraspecific competition increased. We haphazardly collected 20 ripe berries and secured drawstring mesh bags over 20 purple, red, and green-pink berries, and deployed traps to catch adults, weekly in June-August 2015. Infestation occurred first in ripe berries, while unripe berries were infested only after the number of female D. suzukii caught in traps increased sharply. These results suggest that intraspecific competition affects D. suzukii host use and population growth. These data may help growers better time management treatments and more effectively manage D. suzukii populations.

Discussion

Results of Previous Studies

Part I. Infestation patterns across ripe and unripe berries
- Ripe berries became more prevalent in the plot after 15 July, while the proportions of red and purple berries in the plot remained low (Fig. 7).
- Infestation was detected in ripe berries before unripe berries (Fig 8A).
- Infestation rates in unripe berries were highest on 15 July, when the number of female D. suzukii caught in traps increased sharply (Fig. 8B).
- Ripe berries were infested at higher rates than unripe berries on 8, 15, and 22 July, while infestation rates in purple berries were higher than in green-pink berries on 15 July only ($F_{(2,229)} = 6.35, P < 0.0001$).

Part II. Infestation patterns within individual ripe and unripe berries
- First instar larvae were found in red berries, suggesting that D. suzukii eggs were able to hatch in blackberries at the red stage (Fig. 11).
- Second instar larvae were found in purple berries on 22 July only (Fig. 11C), whereas 2nd and 3rd instars were found in ripe berries each week.
- Ripe berries had higher proportions of 1st instars on 8 July than on 22 July, while ripe berries had higher proportions of 2nd instars on 22 July than on the other dates ($F_{(2,48)} = 3.42, P = 0.010$).

Materials and Methods

Part I. Obtained weekly snapshots of infestation patterns in ripe and unripe ‘Von’ blackberries in an untreated plot at Piedmont Research Station in Rowan County, NC, in 2015.
- Counted green, pink, red, purple, and ripe berries present each week on 10 branches spaced equally throughout the plot to document the progression of fruit ripening.
- Collected 20 ripe berries and secured 5x7” mesh bags over 20 purple, 20 red, and 20 green-pink berries to prevent additional oviposition (Fig. 4).
- Left bagged berries to ripen naturally on the plant and collected them once they were ripe.
- Held berries in individual rearing containers at 20°F until D. suzukii developed (Fig. 5).
- Deployed and serviced three monitoring traps with yeast-sugar bait each week to capture adult D. suzukii throughout the plot.

Part II. Obtained weekly snapshots of infestation within individual ripe and unripe berries.
- Collected 20 berries at each ripeness stage each week after infestation was first detected.
- Counted eggs and preserved berries in saltwater.
- Dissected berries and counted 1st, 2nd, and 3rd instars.

infestation occurred in ripe berries first and increased in unripe berries as fly populations increased throughout the season. However, this pattern did not persist past 15 July, perhaps due to unseasonably hot weather that suppressed D. suzukii population growth.

More 2nd instar larvae were found in purple and ripe berries later in the season (22 July) than earlier in the season (8 July), suggesting that females may have laid eggs in berries at earlier ripeness stages when more flies were present in the plot later in the season.

These results suggest that unripe berries may be more susceptible to infestation in areas or at times of the season when pressure from D. suzukii is higher.

Intraspecific competition likely contributed to the highly polyphagous nature of D. suzukii and may also push females to maximize their reproductive potential within individual hosts by accepting a wider range of host qualities — if so, this tendency could help explain why D. suzukii has become established in a wide variety of environments.

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References