Apple Maggot Fly Ovipositional Preferences for Fruit of Different Apple Cultivars

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To determine AMF ovipositional preferences, each cultivar was assigned a rank from 1 to 12, with 1 being the highest rank and 12 the lowest. The cultivar having the largest proportion of apples accepted for oviposition in a given seasonal period in a given year received the highest rank. We then averaged cultivar ranks across years and compared cultivar acceptance using appropriate statistical methods.

Results

Average ovipositional preference ranks of cultivars at different seasonal periods are shown in Table 1. During early season, the earliest ripening cultivars (Tidemann Red and Vista Bella) ranked significantly higher than some mid-ripening (Gala) and all late-ripening cultivars. During mid-season, early-ripening cultivars that maintained a high flesh firmness (Akane, Tidemann Red, and Jersey Mac) and two mid-ripening cultivars (Gala and McIntosh) received significantly higher ranks than late-ripening cultivars of Delicious, Fuji, and Golden Delicious and an early ripening cultivar that had become too soft (Vista Bella). During late season, all three mid-ripening cultivars were preferred over all four late-ripening cultivars, despite the fact that some of the late-ripening cultivars had acquired a high sugar content and moderate pulp firmness.

Discussion

During early season, AMF preferred to oviposit in sweeter and softer fruit of early cultivars such as Tidemann Red and Vista Bella than in fruit of other cultivars. During mid season, AMF continued to prefer to oviposit in fruit of early cultivars that had not become too soft. Early cultivars ripening slightly later (Jersey

In the preceding article, we reported on apple maggot fly (AMF) preferences among 13 different cultivars of apple. Preference for different cultivars was established by determining which cultivars accumulated the most AMF on traps placed on trees of different cultivars in six commercial orchards over four years.

Because cultivar susceptibility is the result of both the degree to which AMF are attracted to apple trees of different cultivars and their propensity to lay eggs in the fruit they find on trees of those cultivars, we decided to evaluate AMF ovipositional preferences for fruit of 12 of the 13 cultivars of apples that were evaluated in our previously reported field experiment.

Combined results of both studies were employed to establish overall ranking of cultivar susceptibility to AMF.

Materials & Methods

AMF ovipositional preferences among five early-ripening cultivars (Akane, Jersey Mac, Paula Red, Tidemann Red, and Vista Bella), three mid-ripening cultivars (Cortland, Gala, and McIntosh), and four late-ripening cultivars (Braeburn, Fuji, Golden Delicious, and Delicious) were examined. Apples were picked from trees in six commercial orchards on a weekly basis during the growing season (early July to early October) over a 4-year period.

A single apple of each of 12 cultivars was then washed to remove pesticide residue and placed in a 30x30x30 cm Plexiglas cage along with 5-10 mature AMF females. Apples were left in cages for a period of 24-48 hours, after which they were examined for oviposition stings under a microscope. Sugar content of apples was determined with a hand refractometer, and pulp firmness was measured with a penetrometer.

Table 1. Average ovipositional preference rank among apple cultivars according to seasonal period.*

Early		Mid		Late	
Tidemann Red	1.2 a	Akane	1.5 a	McIntosh	1.5
Vista Bella	3.2 ab	Tidemann Red	2.2 ab	Gala	2.0
Jersey Mac	3.5 abc	Jersey Mac	2.8 ab	Cortland	2.5
Cortland	4.1 bcd	McIntosh	2.9 ab	Paula Red	4.0
McIntosh	4.9 bcd	Gala	3.0 ab	Braeburn	4.0
Paula Red	5.0 bcd	Braeburn	4.5 bc	Fuji	5.0
Gala	5.4 cde	Paula Red	5.8 cd	Tidemann Red	6.0
Akane	5.9 def	Cortland	6.1 cd	Red Delicious	6.0
Fuji	7.5 efg	Delicious	7.4 de	Golden Delicious	7.5
Braeburn	8.2 efg	Fuji	7.6 de		
Delicious	8.3 fg	Vista Bella	9.0 e		
Golden Del.	8.5 g	Golden Del.	9.5 e		

* Values within a column followed by the same letter are not significantly different at odds of 19:1. Certain circumstances disqualified results of late-season tests for statistical analysis.

Mac and Akane), along with mid-ripening cultivars (McIntosh, Gala, and Cortland to a lesser degree) and a late ripening cultivar (Braeburn) became acceptable for oviposition during mid season. During late season, all three mid-ripening cultivars (McIntosh, Gala, and Cortland) were the most acceptable for oviposition. Acceptance of late-ripening cultivars was moderately high in 1999, but remained low in 2000 despite the fact that apples of those cultivars had become sweet.

Interestingly, AMF cultivar preferences in terms of accumulation on traps in our field study and ovipositional acceptance here were not always in accord. Some cultivars were both highly attractive (or highly arrestive) as well as highly acceptable for oviposition (Akane, Gala, Jersey Mac, and Tidemann Red) and therefore should be considered as highly susceptible to AMF damage. Other cultivars accumulated large or substantial numbers of AMF but bore fruit comparatively unacceptable to ovipositioning females (Fuji, Golden Delicious, and Delicious), or failed to accumulate large numbers of AMF despite the fact that they bore highly or substantially acceptable fruit (McIntosh, Cortland, and Braeburn). Such cultivars can be considered as being moderately susceptible to AMF damage. Finally, cultivars that were both comparatively unattractive and comparatively unacceptable should be considered as tolerant or of low susceptibility to AMF (e.g., Paula Red).

Conclusions

Combined findings of an earlier study on the influence of tree size and planting density on AMF (Fall 1999 issue of *Fruit Notes)*, the preceding study on cultivar susceptibility to accumulation of AMF, and this study on cultivar susceptibility to AMF oviposition suggest that orchard architecture could have a strong impact on the success of behavioral control of AMF with traps.

For example, an ideal type of orchard architecture to achieve maximum AMF control using odor-baited spheres placed on perimeter-row apple trees (to intercept immigrating AMF) might be as follows: plant trees on dwarfing rootstock (M.9 or M.26) and arrange cultivars in such a way that late-ripening cultivars such

as Fuji, Golden Delicious, or Delicious comprise the perimeter rows that face woods or hedgerows, which are more likely to be colonized by immigrant AMF than are perimeter rows facing open field (see following article). Our previous work has shown that AMF control using perimeter-row traps is better on smaller, high-density trees than on larger, low-density trees. Results given in the preceding article and here suggest that cultivars such as Fuji (in particular) but also Golden Delicious and Delicious are highly or at least moderately attractive to (or arresting of) AMF but are relatively low in susceptibility to AMF oviposition. In concept, immigrant AMF would preferentially accumulate on these cultivars and have a high probability of being eliminated by traps before laying eggs in the comparatively non-susceptible fruit or moving toward the interior of the orchard. Conversely, an architectural arrangement that is likely to be minimally conducive to AMF control using perimeter-row traps might be one where cultivars that are both highly attractive to (or arresting of) AMF and highly susceptible to AMF oviposition (e.g., Gala, Jersey Mac, Tidemann Red) are planted on perimeter rows, especially where perimeter rows border woods or hedgerows.

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