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PROGRESS IN EVALUATING CONVERTED COTTON RACE STOCKS FOR RESISTANCE TO WHITEFLIES AND APHIDS

M. M. Toothaker, C. W. Smith and M. K. Harris
Texas A&M University Department of Entomology
College Station, TX

Abstract

Previous research indicated six of 116 cotton race stocks as showing some resistance to sucking insects, specifically whitefly (Bemisia tabaci), using an excised leaf technique as described by Ripple. Current research focusing on these six race stocks indicates intrastock variation in resistance to whitefly is present using two criteria, percent mortality and days to adulthood. Mortality appears to be the better selection criteria as more variability occurs in percent mortality. Current focus is on demonstrating resistance is also expressed in whole plants, determining the best individual plants within each race stock and making individual plant selections for further breeding and extension of work from the laboratory into the field.

Finding resistant cultivars is beneficial for several reasons. Boll weevil eradication programs have brought pests like whiteflies and aphids out of secondary pest status and into key pests. Honeydew from excessive whitefly and aphid populations affects ginning and fiber quality. Feeding by these insects also affects nutrient availability in the plant and many of these insects carry plant viruses such as cotton anthocyanosis. Aphids especially are becoming a bigger problem with the increased use of Bt varieties. Aphid densities are higher in Bt fields than in non-Bt fields, probably because of a decreased use of insecticides (Xiang 2005).

Research done in 2003 and 2004 determined that 6 cotton race stocks out of 116 converted to be photoperiod insensitive and available for study showed resistance to whitefly (Ripple 2005). TX0154 and TX0156 were shown to be significantly lower in percent survival while TX0188, TX0195, TX0221, and TX0242 were shown to be significantly longer in developmental time. The purpose of this study is to examine variability in resistance characteristics within each race stock. and determine selection criteria for screening for resistance.

The six race stocks: TX0154, TX0156, TX0188, TX0195, TX0221, and TX0242 were used as test groups. These were compared to two known commercial susceptibles, Delta Pearl and PSC355. Four plants of each race stock were grown in an insect-free greenhouse. At 8-10 leaf stage, 4 leaves with petioles were removed from each plant. The petiole was wrapped in a cotton batting and placed in a vial containing a 25% Hoagland's solution. Ten adult whiteflies (*Bemesia tabaci*) were contained within an inverted plastic vial on the leaf for 24 hours. After 24 hours, the adult whiteflies were removed and clip cages placed over the same circular area to contain the motile first instar nymphs. The clip cages were left on for 14 days to allow for hatch and nymph settling. After 14 days, the number of nymphs of each instar were counted every 24 hours until all of the nymphs were either dead or emerged as adults. The average number of days to adulthood and percent survival for each plant within each race stock was calculated.

Mean days to adulthood did not show significant variability among the plants within each race stock, nor between the race stocks themselves. Most were very similar to the susceptible checks. Mortality appeared to be the better selection criteria. The test groups did, however, have a slightly longer time to adulthood than the checks on average.

There was much more variation in percent mortality within race stocks compared to the susceptible checks that were fairly consistent. This indicated greater genetic variation occurred within race stocks that were available for selection. Four individual plants were especially noticeable as showing the highest percent mortality: TX0154 Plant D, TX0156 Plant B, TX0195 Plant D, and TX0221 Plant C.

Continued projects testing these selection criteria are in progress using the whole plant rather than excised leaves. Ultimately, resistance must be effective in the commercial field and detection of expression in whole plants is part of the transition from identifying promising race stocks in the laboratory to developing a commercial line. Four plants of the same 6 test race stocks and two known susceptibles were used. Insect cohorts are established at the 5-6 leaf stage on three leaves by infesting them with ten adult whiteflies in clip cages for 24 hours. Adults are then removed and egg densities are recorded. The clip cages are replaced to allow egg incubation and hatching crawlers to settle

in a defined space. After 14 days, the cages are removed and the number of each instar is counted and recorded every 24 hours until all the nymphs have either died or emerged as adults. A study using aphids is very similar to this, except only 7 adult aphids are used, and larger leaves are chosen to infest.

By using the whole plant, we can make individual plant selections out of each race stock using the selection criteria. This particular plant can be grown out to seed and used for further breeding.

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References

Ripple, B. W., M. K. Harris, C. W. Smith (2004). *Host plant resistance to whiteflies, Bemisia tabaci (Gennadius), Biotype B, (Homoptera: Aleyrodidae) in cotton race stocks for breeding improved cotton cultivars*. Unpublished master's thesis 137 p., Texas A&M University, College Station, Texas.

Xiang, D. L., B. P. Zhai, X. X. Zhang, J. M. Zong (2005) Impact of transgenic cotton plants on a non-target pest, *Aphis gossypii* (Glover). *Ecological Entomology*, 30, 307-315.