BANDEDWINGED WHITEFLY HONEYDEW: ANOTHER POSSIBLE SOURCE OF COTTON STICKINESS

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Abstract

The bandedwinged whitefly, *Trialeurodes abutilonea* (Haldeman) is found in most of the US cotton belt but is only rarely at pest populations. During the past two seasons limited outbreaks have occurred in northern Texas. Microscopic examination of adult insects collected near Vernon, TX showed that they had a series of dark spots across their wings rather than the dark bands typically found on the wings of this species. Examination of nymphs by Dr. Ray Gill of Sacramento, CA confirmed that these spotted insects were, in fact, bandedwinged whiteflies. HPLC analysis established that honeydew collected from an outbreak of these insects in cotton near Vernon and Lubbock, TX and that collected from bandedwinged whiteflies near Maricopa, AZ in 1994 all contained a similar sugar pattern. The predominant sugars in bandedwinged whitefly honeydew are the monosaccharides glucose and fructose, in contrast to honeydew from the sweetpotato whitefly and cotton aphid, which are more complex and dominated by oligosaccharides. Cotton infested with bandedwinged honeydew was found to be approximately as sticky as that with an equivalent contamination of cotton aphid honeydew.

Introduction

The bandedwinged whitefly, *Trialeurodes abutilonea* (Haldeman), is found in most of the US cotton belt but is only rarely a pest in cotton. Butler (1967) found that it commonly infests cotton but only at low population levels. However, sporadic outbreaks of bandedwinged whitefly in cotton have been reported since 1964 when the first really damaging outbreak was reported in Louisiana (Clower et al., 1971; Clower and Watve, 1973). Since 1964, outbreaks of this insect have been found in other areas, including Texas, southern Arkansas, Mississippi, Alabama, Tennessee and South Carolina. During the past two seasons populations of bandedwinged whitefly were found in several scattered locations in north Texas. These insects had an unusual appearance. Instead of solid dark bands across their wings, their wings contained a series of dark spots. Honeydew from bandedwinged whiteflies collected in both Texas and Arizona had a significantly different composition than honeydew from the two other insects which secrete honeydew found on cotton lint, the sweetpotato whitefly (*Bemisia tabaci*) and the cotton aphid (*Aphis gossypii*).

Materials and Methods

Immatures of the spotted variety of the bandedwinged whitefly were collected from a cotton field near Vernon, TX during the summer of 2000 and mailed to Dr. Raymond Gill for identification. Samples of honeydew-infested leaves from this field were also collected, extracted with hot deionized water, and analyzed for carbohydrates by HPLC (Hendrix and Wei, 1994). An additional sample of honeydew from the spotted variety of the bandedwinged whitefly was obtained from cotton leaves supplied by Bobby Wyatt of Texas Tech University in the summer of 2001 from a transient and limited occurrence of the bandedwinged whitefly in the Lubbock area. Honeydew extracted from this second sample was analyzed in a similar fashion to those obtained from Vernon, TX the previous season. Unlike the honeydew from Vernon, TX, the Lubbock sample was quite moldy when received for analysis. The chromatographs of sugars in bandedwinged honeydew from these two locations in Texas were compared to honeydew collected from bandedwinged whiteflies growing in a cotton field in Arizona in 1994 and to honeydew collected from the cotton aphid and sweetpotato whitefly growing on cotton in laboratory culture in Phoenix, AZ.

Results and Discussion

Microscopic examination of the adult bandedwinged whiteflies collected from Vernon, TX showed they had unusual spotted bands on their wings instead of the more usual bands). Examination of the pupae of these spotted winged insects showed that they were, in fact, bandedwinged whiteflies (Ray Gill, personal communication). Both the spotted variety and the more common bandedwinged adults with dark bands on their wings could be readily distinguished from adult *Bemisia tabaci*. In addition to the difference in wing banding, *B. tabaci* is a significantly smaller insect (ca. 1/16" in length) than *T. abutilonea* (ca. 1/8" in length). Also, unlike the bandedwinged whitefly, *Bemisia* characteristically holds its wings over its body at a 45

degree angle to the leaf surface. *T. abutilonea* pupae are 'cake-shaped' with perpendicular sides (not shown). In contrast, *B. tabaci* pupae are dome-shaped with sloping sides. Bandedwinged pupae have wax filaments near their margins and numerous setae on their dorsal surface whereas pupae from *B. tabaci* have no wax fringe and relatively few setae on their upper surface.

Honeydew excreted by bandedwinged whiteflies (Fig. 1) contains fewer sugars than that excreted by either *Bemisia tabaci* or the cotton aphid (*Aphis gossypii*). The bandedwinged honeydew sample from leaves collected near Lubbock, TX appeared very similar to that collected from cotton growing near Vernon, TX except for several prominent peaks near the origin. These 'extra' peaks in the Lubbock sample were due to the polyols mannitol and sorbitol. Sooty mold, such as that found on the leaves from which this sample was extracted, is known to convert honeydew sugars into polyols (Hector and Hodkinson, 1989; Hillocks and Brettell, 1993). The presence of polyols has been also noted in honeydew from other species of insects on lint in which mold growth was apparent. These polyols result from the conversion of glucose and fructose by the fungi living on the honeydew. As a result, the amount of glucose and fructose in this honeydew was considerably less than that collected from Vernon, TX or Maricopa, AZ (Figs. 1,2) which were not contaminated with fungi.

Bandedwinged whitefly honeydew from insects collected in Maricopa, AZ in 1994 (Fig. 2) contained a very similar sugar pattern to those samples collected during 2000 and 2001 in Vernon, Texas. The insects from Arizona had the more common dark bands on their wings, rather than the spots exhibited by those the Texas insects. The honeydew from all bandedwinged samples was relatively uncomplicated, with glucose and fructose being the most prominent sugars. The polyols shown in the bandedwinged honeydew chromatograph in upper right panel of Fig. 1 are unusual. The honeydew of the honeydew-forming insects which feed upon cotton normally do not contain significant amounts of polyols, in spite of the fact that the bodies of these insects do contain these compounds (Hendrix and Salvucci, 1998).

Examination of HPLC chromatographs of the honeydew from both *A. gossypii* and *B. tabaci* shows considerably different sugar patterns than that from *T. abutilonea* (Fig. 1). *B. tabaci* honeydew characteristically contains a substantial amount of the disaccharide trehalulose and *A. gossypii* honeydew contains much more prominent peaks of oligosaccharides larger than trisaccharides. These large oligosaccharides, which elute after 10 min in this system, are very prominent in the honeydew of the cotton aphid (upper left panel, Fig. 1), which contains sugars as large as decasaccharides (Hendrix, 1999).

It has been pointed out that the various sugars in honeydew are not equally sticky and that glucose is less sticky than other sugars in honeydew (Miller et al., 1994). One might therefore expect a different degree of lint stickiness from the same amount of honeydew deposited by the bandedwinged whitefly compared to an equal amount deposited by the cotton aphid or sweetpotato whitefly. Tests at Lubbock showed that bandedwinged honeydew-contaminated cotton lint was approximately as sticky as cotton contaminated with an equal amount of cotton aphid honeydew (E. Hequet, personal communication). Cotton lint collected in summer of 2000 from a field near Vernon, TX (Munday, TX) infested with bandedwinged whitefly was determined to be only mildly sticky using the termodetector test. This lint was collected from a field with a low aphid infestation (ca. 8 per leaf) and had between 50 and 67 bandedwinged nymphs per leaf the week prior to harvest. The thermodetector (by USDA, Clemson, SC) gave this lint a score of 4.6 and H2SD analysis (by Cotton, Inc, Cary, NC) gave a reading of 15.4.

Acknowledgements

The authors would like to thank Cotton Incorporated for support during this project. They would also like to thank Dr. Raymond J. Gill for identifying the spotted variety of the bandedwinged whiteflies in this study and Bobby Wyatt of Texas Tech University for the sample of honeydew from the Lubbock area.

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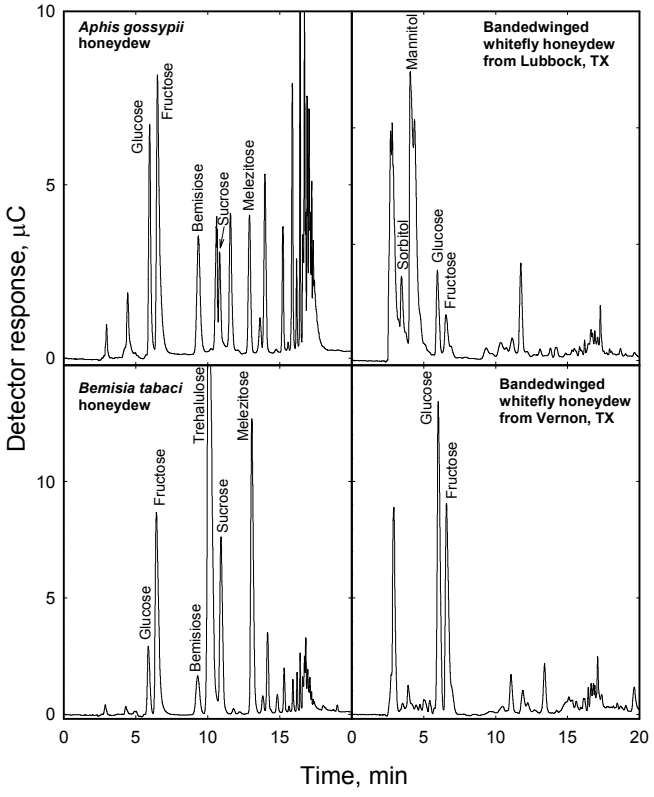

Figure 1. HPLC of honeydew from insects feeding upon cotton leaves. (upper left panel) Honeydew from the cotton aphid. Note the abundance of large sugars (*i.e.*, those which elute after 15 min). (bottom left panel) Honeydew from the sweetpotato whitefly. Note the abundance of trehalulose, the characteristic sugar in this honeydew. (right panels) Honeydew from the spotted variant of the bandedwinged whitefly. Note that the honeydew shown in the upper right panel had become moldy which resulted in the formation of the polyols mannitol and sorbitol from the sugars in this sample.

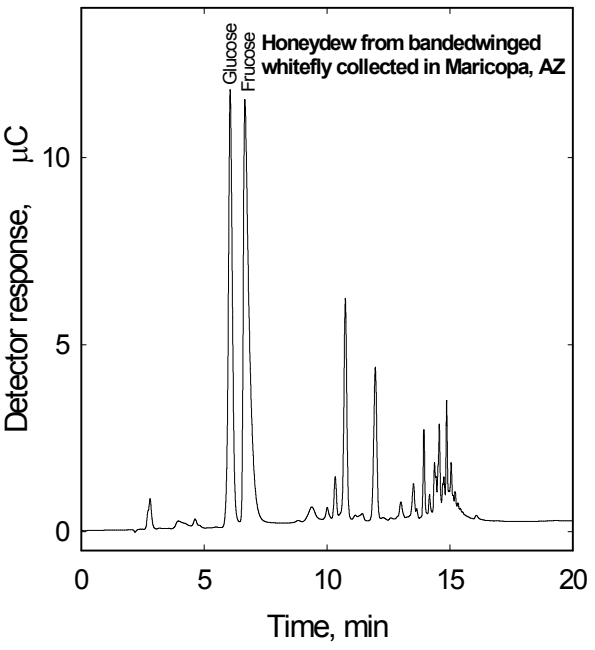

Figure 2. Honeydew collected from bandedwinged whiteflies on cotton at Maricopa, Arizona during the summer of 1994. The strain of whiteflies from which this honeydew sample was obtained had dark bands on their wings rather than the dark spots found on the wings of the insects whose honeydew is shown in both right hand panels of Fig. 1.