SHORT NON-REFEREED PAPER

# FIRST RECORD OF YELLOW SUGARCANE APHID, *SIPHA FLAVA* (HOMOPTERA: APHIDIDAE), IN THE SOUTH AFRICAN SUGARCANE INDUSTRY

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## Abstract

During 2013, the yellow sugarcane aphid, *Sipha flava* (Homoptera: Aphididae), was recorded in the South African sugarcane industry for the first time. Initially discovered at Mount Edgecombe in the KwaZulu-Natal Province of South Africa, it was subsequently detected across the entire sugarcane industry and more recently in Swaziland and Zimbabwe. Morphological and molecular taxonomic techniques were employed to confirm its identity. Native to North America, it currently has a wide geographical distribution across Central and South America, as well as the Caribbean and Hawaiian Islands. It was first reported on sugarcane in Africa in Morocco in 2006. In the Americas, sugarcane, sorghum (commercial and wild species), rice, maize, cereal crops, several species of lawn and pasture grasses, and *Carex* and *Cyperus* have been recorded as hosts. It has been collected from sugarcane, *Sorgum bicolor, Tragus berteronianus, Echinochloa colona, Digitaria ciliaris, D. ternata* and *D. citratus* in South Africa; however, additional hosts are expected as it becomes more established. *Sipha flava* (2 mm) are yellow with dusky coloured spots, short stiff hairs and reduced cornicles. All stages feed in dense colonies on the lower leaf surface along the mid-rib, causing yellowing and reddening. In South Africa natural enemies such as ladybird beetles, earwigs, hover flies, predaceous ants and spiders prey on *S. flava*. The effect on final sugarcane yield due to *S. flava* infestations in South Africa remains to be determined. Management tactics have yet to be developed and, should natural enemies and weather fail to keep populations in check, then resistant/tolerant varieties and insecticides could be considered.

*Keywords:* sugarcane aphid, biosecurity, IPM, tolerant varieties, natural enemies, biology

## New pest incursion

During 2013, *Sipha flava* (Forbes) (Homoptera: Aphididae) was recorded for the first time in the South African sugarcane industry (Conlong and Way, 2014a). Initially discovered on the plant breeding plants on the terraces at South African Sugarcane Research Institute (SASRI), it was later detected at Pongola and Umfolozi and subsequently in all mill regions in South Africa. It has since then been recorded from the Swaziland and Zimbabwe sugarcane industries.

The first step in response to any new insect pest incursion is accurate identification. Specimens collected from sugarcane speedlings at SASRI, Mount Edgecombe (29°42'16"S, 31°02'47"E) in KwaZulu-Natal were positively identified by the ARC-Plant Protection Research Institute, Biosystematics Division, Pretoria, South Africa, (ARC-PPRI, AcAm 979, 980, 981; Det. I.M. Millar, 2013). This name was corroborated at SASRI by performing CO1 gene-based taxonomic analysis to match the DNA profile with records in Genbank and BOLD. Sequences are stored at SASRI. Specimens subsequently sent in from neighbouring countries were subjected to the same molecular identifications for species identity confirmation.

*Sipha flava* originates in temperate and subtropical regions of North America, and has been recorded in Central and South America, and in the Hawaiian and Caribbean Islands (Reagan, 1994). Abdelmajid (2008) recorded its first African presence in Morocco in 2006. The pathway and mode of entry (single or multiple) of *S. flava* into Morocco, and more recently into South Africa, Swaziland and Zimbabwe is unknown.

## Description

*Sipha flava* is yellow and adults are 1.3 to 2 mm long. These aphids live in dense colonies in sugarcane, usually on the lower leaf surface. The abdomen has two double rows of dusky coloured spots on the dorsal surface and along the lateral margin, and it is covered in short stiff black hairs. The pair of cornicles (siphunculi) on the abdomen are reduced in size to elevated pores. Generally both sexes of adults are wingless, but winged females do occur. Nymphs resemble adults but are wingless and smaller. For more details on their appearance see Conlong and Way (2014b) and Nuessly (2005).

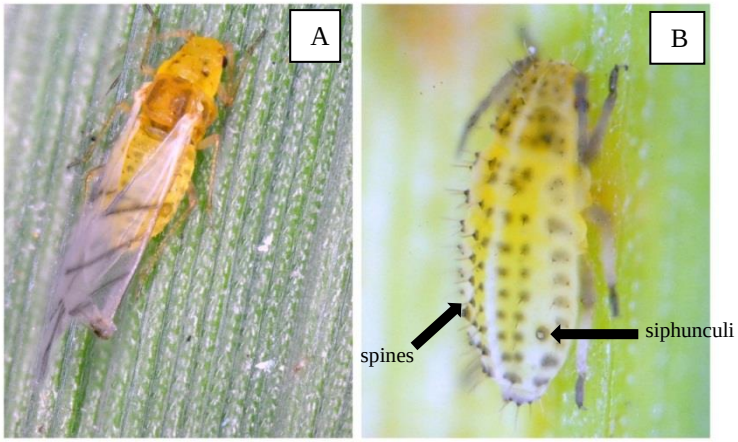


**Figure 1. Yellow sugarcane aphid (YSA) *Sipha flava*: (A) winged adult and (B) wingless nymph, showing the characters used in its identification.**

## Damage symptoms

The damage caused on sugarcane by *S. flava* is often visible on the upper surface of the leaf, although the insects preferentially feed on the lower surface. Sugarcane leaves damaged by *S. flava* turn yellow and, after prolonged feeding, red. On close examination red dots are visible where the insect has pierced through the leaf surface. These symptoms are clearly visible in the section of the leaf behind the colony, which has fed and then moved along the leaf.

Although Hall and Bennett (1994) report the occurrence of honeydew and a black sooty mould associated with colonies of *S. flava* in sugarcane, this phenomenon has not been recorded in South Africa, Swaziland or Zimbabwe.

*Sipha flava* is reported to transmit sugarcane mosaic virus (Blackman and Eastop, 1984); however, this aspect requires further investigation as there is some debate amongst pathologists in the USA regarding the efficiency of the aphid as a vector of the disease.

It is too soon to determine the impact of this pest on commercial sugarcane production in South Africa, Swaziland or Zimbabwe. Nuessly and Hentz (2002a) report that prolonged feeding can result in premature leaf senescence and stalk death. In Florida (USA), where *S. flava* is a major pest of economic importance (Reagan, 1994), when two leaves are damaged due to aphid feeding when the crop is three months old, there may be a 6% lower final yield. Leaf chlorosis and death of three pairs or more of active growing leaves can result in 19% yield loss (Reagan, 1994). According to Hall (2001) yield reduction and reduced tillering are usually caused by feeding damage to early plant growth stages; however, late season crops may also suffer yield loss.

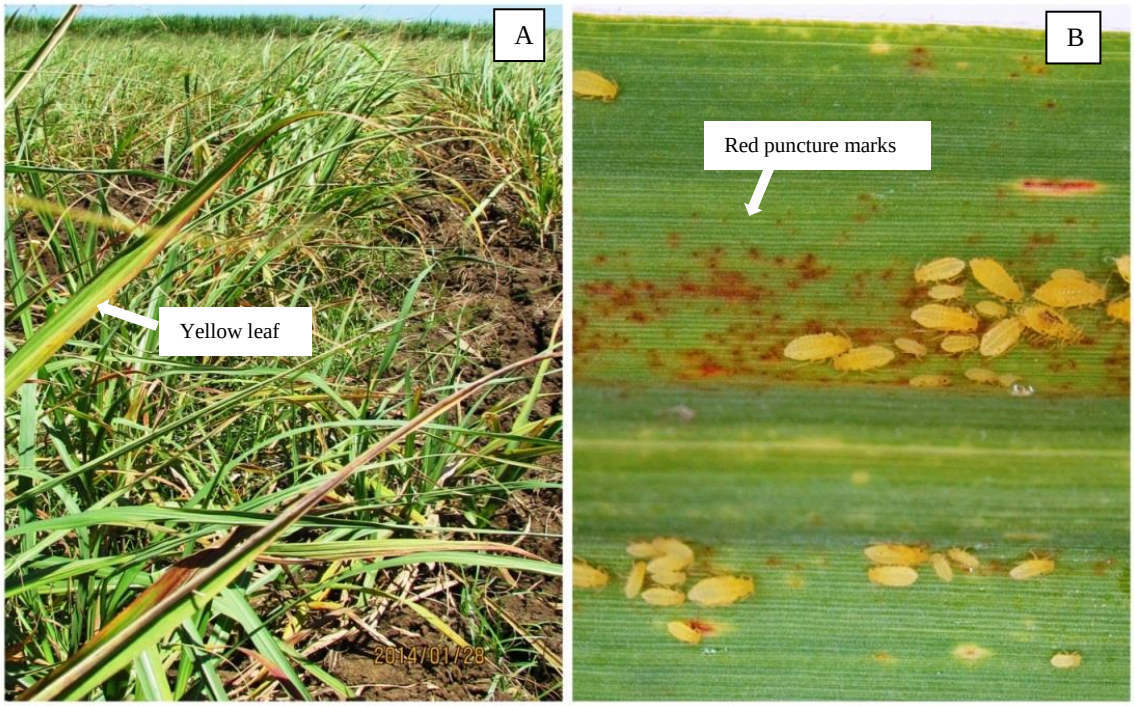


**Figure 2. (A) Yellowish colouration on sugarcane leaves, (B) aphids feeding mainly along the mid-rib of the lower surface, causing reddish marks.**

## Biology

Reproduction can be sexual or without mating (asexual) depending on climatic conditions. In Florida (USA), *S. flava* females mate with wingless males in areas with cold winters (Reagan, 1994). Females produce one to five nymphs each day, and nymphs develop through four instars. Development from nymph to mature adult takes 18-22 days on sugarcane, compared with only eight days on *Sorgum bicolor*. On the latter hosts, females produce one to five nymphs each day over 22 days. On other grasses fecundity ranges from 16-72 nymphs with a lifespan of 16-36 days. Depending on the host, adults require 10-12 days to reach

reproductive maturity (Hentz and Nuessly, 2004). In South Africa there are often small populations of *Melanaphis sacchari* Zehnt. (Homoptera: Aphididae) found on sugarcane amongst colonies of *S. flava*, and according to Nuessly and Hentz (2002a) it is thought that *M. sacchari* emits an alarm pheromone which *S. flava* responds to by dropping off the sugarcane leaf, thereby protecting itself from danger.

## Hosts

*Sipha flava* was first described from specimens collected on *Sorghum bicolor* (L.) in Illinois by Forbes in 1884, and hence was originally referred to as the 'sorghum aphis' (Reagan, 1994). Worldwide many hosts for *S. flava* are reported, including *Sorghum halepense* (Johnson grass), *Pennisetum clandestinum* (kikuyu grass), *Digitaria ciliaris* (crabgrass), *Cymbopogon citratus* (lemon grass), species from the genera *Panicum, Cynodon, Paspalum, Hordeum,* and *Bothriochloa ischaemum,* and the crops wheat, barely, maize, *Avena* (oats) and rice. *Carex* and *Cyperus* from the Cyperaceae, and various pasture grasses, are also hosts (Reagan, 1994).

In South Africa *S. flava* has been collected from sugarcane, *S. bicolor*, *Tragus berteronianus* Schult., *Echinochloa colona* (L.) Link., *D. ciliaris* (Retz.) Koeler, *D. ternata* and *C. citratus*. This host range will undoubtedly increase following wider surveying, and as the insect becomes more established.

## Management

It is too early after the invasion to have developed a management strategy for this pest in southern Africa. However, the following tactics reviewed in the Americas warrant consideration.

*Sipha flava* is monitored every season in their sugarcane industries (Nuessly, 2005). Initially numbers are counted and, when excessive, leaf damage is used as an indicator of the effect on growth. The industries find that natural enemies and weather conditions usually maintain *S. flava* densities at low levels (Hall and Bennett, 1994; Hall, 2001). Temperatures above 35°C and heavy summer rainfalls dislodge *S. flava* from the plants, thus causing a degree of control (Nuessly, 2005). In South Africa natural enemies of *S. flava* are present in sugarcane fields and the surrounds. These comprise ladybird species (Coccinellidae), hover flies (Syrphidae), spiders (Araneae), earwigs (Dermaptera) and ants (Formicidae). Current and future farming practices adopted in South Africa must conserve these natural enemies.

American research has provided evidence for at least partial resistance to *S. flava* attack, using pubescent sugarcane varieties (White, 1990; Nuessly, 2005; Nuessly *et al*., 2010). Varietal resistance has been demonstrated between different sorghum varieties (Strakes and Mirkes, 1979) and grass species (Kindler and Dalrymple, 1999). Furthermore, insecticides are registered against *S. flava* (Nuessly and Hentz, 2002b) but these can have negative knock-on effects, e.g. various predator populations, including coccinellids, were reduced for up to 10 weeks by in-furrow applications of nematicide-insecticide aldicarb during the spring (Showler and Reagan, 1991) and fenvalerate (pyrethroid insecticide) as a foliar spray enhanced *S. flava* populations by 63% while substantially suppressing certain predator groups.

## Conclusion

Despite the current paucity of knowledge available about *S. flava* in southern Africa, the sugar industries in the region take this new incursion very seriously. Therefore, ongoing monitoring exercises and information gathering will continue.

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