ORIENTAL RICE THRIPS, *STENCHAETOTHRIPS BIFORMIS* (BAGNALL), RECORDED ATTACKING SUGARCANE FOR THE FIRST TIME IN AUSTRALIA

By

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Abstract

ON 4 JUNE 2012, Oriental rice thrips, *Stenchaetothrips biformis* (Bagnall), was detected damaging sugarcane seedlings on the BSES Experiment Station at Meringa, Mulgrave region, Queensland. It has since been detected on young cane plants on two other farms in the Mulgrave area. The pest was first suspected to be Oriental sugarcane thrips (*Fulmekiola serrata* (Kobus)), an exotic pest species. This triggered an Emergency Response course of action, with the Department of Agriculture, Forestry and Fisheries Queensland (DAFF) being notified immediately and all cane movement out of Meringa station being halted. Specimens were sent to the Queensland Primary Industries Insect Collection (QDPC), and an accurate identification was made within 48 hours from initial detection. This resulted in the Emergency Response action being terminated as *S. biformis* is already established in Australia. DNA barcoding was conducted on specimens of *S. biformis*, as well as specimens of *F. serrata* that were sourced from colleagues in Reunion and South Africa for future reference. Reasons for what seems to be an expansion of the host range by *S. biformis* in Australia are unknown, but this incidence highlighted the industry's preparedness to deal with a sudden pest or disease incursion. It also provides the first record of *S. biformis* attacking sugarcane in Australia. The impact of *S. biformis* on sugarcane in Australia and its ultimate geographical distribution in canegrowing regions are yet to be determined.

Introduction

Oriental rice thrips, *Stenchaetothrips biformis* (Thysanoptera: Thripidae), was originally described from *Phragmites* sp. in England (Bagnall, 1913), and is currently widely distributed in Europe, Asia and Oceania. It has recently been recorded in the Caribbean island of Trinidad and the northern part of South America (Mound and Houston, 1987; Mound and Palmer, 1988; White, 2000; Vierbergen, 2004; Azidah, 2011; Mound *et al.,* 2012). *S. biformis* is mainly associated with rice, but it has been recorded attacking sugarcane plants in India (Madan *et al.*, 1989). Although it is a significant pest of rice in many countries around the world, it has only been found on wild grasses in Australia and has never been recorded attacking rice (Stevens *et al.*, 2010).

Oriental rice thrips is morphologically similar to the Oriental sugarcane thrips (*Fulmekiola serrata*) (Thysanoptera: Thripidae), which does not occur in Australia. *F. serrata* is a pest of sugarcane that is widely distributed in Asia and has recently invaded Venezuela and the West Indies as well as South Africa and Indian Ocean islands (Vignes, 1987; Salazar, 2001; Way *et al.*, 2006).

Studies in South Africa record yield losses of up to 28% due to infestation by this species (Way *et al*., 2010). Oriental sugarcane thrips is a pest of biosecurity importance to Australia, being an invasive species that has expanded its geographical distribution into other continents and is also widely distributed in neighbouring South East Asian countries.

The Australian sugarcane industry has been fortunate not to have several significant pests and diseases that exist overseas. In preparedness for possible incursion by any of these, BSES Limited has developed Incursion Management Plans that detail the steps to be taken by government and industry sectors in case an Emergency Response is required. An Incursion Management Plan had been developed, among several others, for *F. serrata* (Sallam, 2009). To date, Oriental sugarcane thrips remains an exotic species. However, the recent detection of Oriental rice thrips attacking sugarcane plants in Australia alerted us to the importance of quickly recognising any unfamiliar symptoms. Since infestation by either species results in almost identical damage symptoms in sugarcane, it is more of a necessity now to become familiar with these symptoms and accurately identify the species responsible for any future infestation.

This paper reports on the first detection of Oriental rice thrips attacking sugarcane plants in Australia. It also gives an account of the steps that were taken following this detection until the identity of the pest species was determined.

Damage detection

On 4 June 2012, unfamiliar symptoms on cane seedlings were reported at the BSES Experiment Station, Meringa, Gordonvale (Figure 1). The symptoms suggested nutrient deficiency or water stress. About 90% of the seedlings showed curling and drying of the leaf tips, with young leaves not unfurling properly. When young leaves that had been trimmed (as a standard practice) were inspected, symptoms that resembled mite feeding were apparent, but no mites were detected. When seedlings that had not been trimmed were inspected, thrips adults and immatures were found inside the seedling whorl (Figure 2).

(a)  (b) 

Fig. 1—Thrips damage at BSES Meringa (a) on seedling beds and (b) symptoms on seedlings (curling and drying of leaf tips).

(a)  (b) 

Fig. 2—(a) Thrips detected on seedlings at Meringa station. (b) These were later identified as Oriental rice thrips (*Stenchaetothrips biformis* Bagnall), which is not an exotic pest.

Emergency response

Since the detected insects resembled Oriental sugarcane thrips (*Fulmekiola serrata*), which is an exotic species with a record of invading new areas and also a biosecurity concern for the Australian sugar industry (Figure 3), an Emergency Response needed to be activated quickly. However, accurate identification needed to be conducted first. Hence, the following actions were taken:

- Experts in thrips identification were contacted and samples of adults were collected from the leaves using an aspirator, placed in 95% ethanol and sent to the Queensland Primary Industries Insect Collection (QDPC) in Brisbane.

- Biosecurity Queensland was notified and two officers from the Department of Agriculture, Forestry and Fisheries (DAFF, QLD) travelled to the site and inspected the damage. A decision was made not to initiate any delimiting surveys until identification was made.
- All cane movement out of BSES Meringa was halted, and all seedlings were treated with an insecticide to curb any further dispersal of the pest.

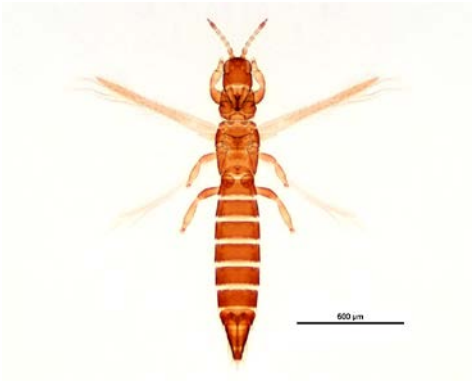

Fig. 3—Oriental sugarcane thrips (*Fulmekiola serrata* Kobus), an exotic pest species that is not present in Australia.

Specimen identification

On 6 June 2012, the insects were identified as the endemic/established Oriental rice thrips (*Stenchaetothrips biformis*). Seven females and one male thrips were processed onto slides that have been lodged as voucher specimens into the QDPC Insect Collection. Accession numbers are QDPC 0-167013 to QDPC 0-167019 for females and QDPC 0-167020 for males. This resulted in the Emergency Response action being terminated.

Follow-up action

Reporting

An incident report was compiled and sent in the form of a Preliminary Information Data Sheet to the Biosecurity Incident Response Coordinator, Biosecurity Queensland, DAFF. In that report, it is acknowledged that Oriental rice thrips is now a pest of sugarcane in Australia.

Distribution maps

We developed distribution maps for both pest species (Figure 4). Oriental rice thrips is widely distributed in Asia, Europe and in the northern part of South America (Mound and Palmer, 1988). Although a pest of rice, its main host plants include a range of wild grasses (Poaceae). It is also present in Australia but was only recorded on wild grasses in damp areas of eastern Queensland and New South Wales (Mound, 2011; Mound *et al*., 2012; Stevens *et al.*, 2010).

Oriental sugarcane thrips is native to Asia and was first described in Java on sugarcane (Kobus, 1893; van Deventer, 1906). It is also recorded from China, India, Japan, the Malay Archipelago and Taiwan (Setokuchi and Miyazaki, 1989; Bal *et al.*, 1995; Chang, 1995; Mann *et al.*, 2006). The pest has expanded its geographical range and is now recorded in Madagascar, Mauritius, Reunion, Venezuela and Barbados and Guadeloupe (Moutia and Mamet, 1947; Palmer *et al.*, 1989; Mound and Marullo, 1996; Salazar, 2001). The pest invaded mainland Africa and was recorded infesting sugarcane for the first time in 2004 in South Africa (Way *et al.*, 2006). This pest species feeds mainly on sugarcane (Williams, 1956).

DNA barcoding

We developed DNA barcodes to provide a future rapid confirmatory identification tool. Samples of Oriental rice thrips collected at Meringa were sent to BSES Indooroopilly for DNA barcoding.

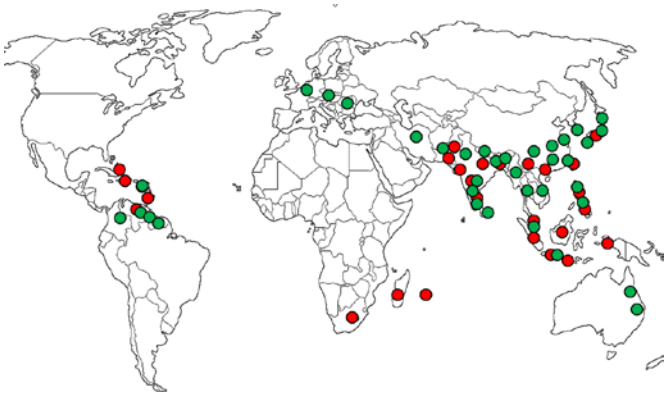

Fig. 4—World distribution of the Oriental rice thrips (*Stenchaetothrips biformis*) (green circles) and the Oriental sugarcane thrips (*Fulmekiola serrata* Kobus) (red circles).

Samples of Oriental sugarcane thrips from Reunion and South Africa were used for comparison. The Reunion sugarcane thrips were collected at Bellemene and Savannah and were provided by Dr. Samuel Nibouche of CIRAD (Centre de coopération internationale en recherche agronomique pour le développement). The South African sugarcane thrips were collected at the South African Sugar Research Institute Farm, Mount Edgecombe, Kwa-Zulu Natal and were provided by Mr. Kelvin Naidoo. DNA was extracted from individual insects using a Qiagen QIAamp micro DNA kit.

Two conserved insect genes were amplified using the technique of PCR (polymerase chain reaction). The mitochondrial cytochrome oxidase I (COI) gene, used in the Barcode of Life, was amplified with the primers LCO1490 and HCO2198 (Folmer *et al*., 1994) using conditions supplied by Stuart Rutherford (South African Sugarcane Research Institute). The second gene was the mitochondrial large ribosomal RNA subunit (16S), amplified with the primers 16ScbF and 16ScbR, using the conditions described by Lange *et al.* (2004).

The PCR products were purified and sent to the Australian Genome Research Facility for DNA sequencing. The sequences obtained were edited and matched against those in the publically available databases: BOLD (The Barcode of Life Data System; http://www.boldsystems.org) for COI only, and the GenBank database operated by NCBI (National Center for Biotechnology Information) using the program BlastN (Basic Local Alignment Search Tool; http://blast.ncbi.nlm.nih.gov) for COI and 16S. The thrips sequences available in public databases at the time of the Meringa detection are summarised in Table 1.

Table 1—Publicly available DNA sequences for Oriental rice thrips (*Stenchaetothrips biformis*) and Oriental sugarcane thrips (*Fulmekiola serrata*).

	16S sequences	COI sequences
Sequences available at the time of the Meringa detection:		
Stenchaetothrips biformis	No sequence available	GenBank accession: HQ540413 No publically available sequences in BOLD
Fulmekiola serrata	No sequence available	GenBank accession: EU004558 BOLD sequence ID: GBMH5037-08 (mined from GenBank)
GenBank accession numbers for sequences contributed by BSES:		
Stenchaetothrips biformis Meringa, Australia	 KC505475	 KC505479
Fulmekiola serrata Bellemene, Reunion Savannah, Reunion Mt Edgecombe, South Africa	 KC505476 KC505477 KC505478	 KC505480 KC505481 KC505482

Despite there being few publicly available sequences for the two thrips species, we were able to confirm that the thrips detected at Meringa were not Oriental sugarcane thrips. The sequences obtained by BSES are now available to help identify the cause of any future thrips infestations (Table 1).

Future research

The reasons why *S. biformis* is now attacking sugarcane in Australia are not known. It might be the case that prolonged dry weather during the winter of 2012 in Mulgrave (FNQ) may have stressed cane plants and made them vulnerable to infestation by secondary pests. Future research could examine this theory.

In any case, this incident demonstrated that the industry is well prepared to respond to a possible incursion. It also highlights the importance of investing in biosecurity, especially with world travel becoming easier coupled with population increase and expansion of cultivated areas through Australia and the rest of the world.

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