Australian Journal of Entomology (2007) **46**, 35–39

Records of two sugarcane pests *Eumetopina flavipes* Muir (Hemiptera: Delphacidae) and *Chilo terrenellus* Pagenstecher (Lepidoptera: Pyralidae) from Torres Strait and far north Queensland

Judy F Grimshaw[1]* and John F Donaldson[2]

[1]*Australian Quarantine and Inspection Service, PO Box 1054, Mareeba, Qld 4880, Australia*
[2]*10 Pinecone Place, Thornlands, Qld 4164, Australia*

Abstract The State of Queensland includes islands within Torres Strait. However, Quarantine legislation separates these islands from mainland Australia, and divides them into two Quarantine zones. Details of the Torres Strait and far north Queensland distribution and damage levels of *Eumetopina flavipes* Muir (sugarcane leafhopper) and *Chilo terrenellus* Pagenstecher (sugarcane stem borer) are published here for the first time. The delphacid is a known vector of the sugarcane disease, Ramu stunt, which occurs in northern Papua New Guinea (PNG) and possibly other locations. *Eumetopina flavipes* has been known to occur on islands within Torres Strait and the communities near the tip of Cape York Peninsula since 1983. The disease is not known to be present in this population of the bugs. The sugarcane stem borer, *C. terrenellus*, has been detected on a number of occasions in sugarcane on two of the three Torres Strait islands closest to PNG (Saibai and Dauan). Its 'appearance' at these two sites is intermittent and damage levels are never as high as in the nearby communities in the Western Province of PNG. The majority of sugarcane plantings on Torres Strait islands are yellow and purple varieties of chewing cane (*Saccharum officinarum*) which is the host for all records reported here. Recent detection of *Chilo crypsimetalla* (Turner) on several islands in Torres Strait is reported, although this is not thought to be a pest of sugarcane.

Key words *Chilo crypsimetalla*, *Heteropogon triticeus*, Ramu stunt disease, *Saccharum officinarum*, sugarcane leafhopper, sugarcane stem borer.

INTRODUCTION

Funding for quarantine surveillance across northern Australia was established in 1975 but initially focused on monitoring for exotic fruit flies (Tephritidae). From around 1982 this funding extended to more general surveillance and supported extensive entomological surveys of several islands in Torres Strait and parts of Cape York Peninsula (the Northern Monitoring program). In 1985 a Quarantine Act defined two regions within Torres Strait separating these from mainland Australia and placing regulations on the movement of people and goods from Papua New Guinea (PNG) into these regions, and from these regions to mainland Australia. Following a review of quarantine effectiveness and coastal surveillance across northern Australia (Lindsay 1987), the Northern Australia Quarantine Strategy (NAQS) was formed in 1989. NAQS is part of the Australian Quarantine and Inspection Service (AQIS) and still operates within the coastal areas across northern Australia from Broome to Cairns, including the islands of Torres Strait and its role is the early detection of new pests and diseases of plants and animals, particularly those significant to agricultural production. Between 1982 and 1990 this surveillance was supported by the Queensland Department of Primary Industries and Fisheries (DPI&F) and the Bureau of Sugarcane Experiment Stations (BSES).

Early Northern Monitoring surveys detected two sugarcane pests, *Eumetopina flavipes* Muir and *Chilo terrenellus* Pagenstecher, at sites in Torres Strait and the Northern Peninsula Area (NPA) of Cape York Peninsula. These were not thought to be new incursions, but rather new detections, as these sites had not been previously examined. The location of these pests has been monitored by subsequent surveys and reported in assorted internal reports (Gough 1984; Allsopp 1989) but is published here for the first time, along with some notes on their biology, distribution and damage levels. Developing interest in the biology and distribution of *E. flavipes* has prompted recent, additional collection of this insect from many of its previously recorded sites.

Chewing cane, *Saccharum officinarum*, is grown in several 'home gardens' in the communities on Torres Strait islands and in the NPA. There is limited planting of hybrid cane and no commercial plantings in this region. These plantings are examined at least annually as part of NAQS surveillance and in April 2005 a 'new' pyralid larva was detected feeding within the growing tip of hybrid sugarcane on Thursday

*grimshawjudy@hotmail.com

doi:10.1111/j.1440-6055.2007.00582.x

Island. This detection prompted follow-up surveillance and diagnostics that are reported here.

MATERIALS AND METHODS

The records of Northern Monitoring and NAQS surveys were examined for reports of both *E. flavipes* and *C. terrenellus*. Label data on specimens lodged in DPI&F collection in Brisbane (QDPIB) and the NAQS collection in Mareeba (NAQSM) were collated and the identity of the specimens confirmed by re-examination. The newly detected pyralid larva, from sugarcane on Thursday Island, was subjected to DNA sequence analysis at the BSES laboratory in Indooroopilly, and the results were compared with those from previously published data in Lang *et al*. (2004). A female adult reared from this material was identified by Dr Marianne Horak at Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Canberra.

RESULTS

Eumetopina flavipes Muir, sugarcane leafhopper

This pest is known only from sugarcane, and is recorded from Indonesia, PNG, New Caledonia and the Philippines. Its distribution on islands of Torres Strait and in the NPA communities near the tip of Cape York Peninsula is published here for the first time.

Little is known about the life history of this pest. The nymphs, which are pale brown in colour, and the adults, which are black with legs apically white, feed on the sap of the young leaves, within the apical 'spindle' of the growing sugarcane. Density levels vary greatly, but have never been seen to be damaging in Australian detections. High infestation levels have been seen (by JFG) on one occasion (Daru Island, PNG in 2003); on this occasion the young leaves were yellowed and coated in sugary exudates, but there was little evidence of any other damage. There was no evidence of 'stunting'.

The presence of this pest can only be detected by visual inspection deep within the furled leaves of the 'spindle'.

In plantation sugarcane in the Ramu valley, northern PNG, *E. flavipes* is known to be a vector of Ramu stunt disease (Kuniata *et al*. 1994).

Australian distribution records

Records are listed from the most northerly to most southerly. **Torres Strait**: **Boigu** Island: 27.iii.1984, J.W. Turner (QDPIB); 28.iii.1984, J.W. Turner (QDPIB); 27.v.1985, K.J. Chandler (NAQSM); 3.xi.1989, P. Allsopp (QDPIB); **Saibai** Island: 15.iv.1983, J.W. Turner (NAQSM; QDPIB); 29.iv.1984, N. Gough (QDPIB); 28.v.1985, K.J. Chandler (NAQSM); 6.ii.1986, K. Houston & E. Hamacek (QDPIB); 8.ii.1986, K. Houston & E. Hamacek (QDPIB); 3.xi.1989, P. Allsopp (QDPIB); 14.ii.2000, J.F. Grimshaw (NAQSM); 4.vi.2004, J.F. Grimshaw (NAQSM); 7.iv.2005, D.M. MacLeod (NAQSM); **Dauan** Island: 28.iii.1984, J.W. Turner (QDPIB); 1.xi.1984, P. Allsopp (QDPIB); 26.v.1985, K.J. Chandler (NAQSM); 15.iii.2002, K.A. Huxham & D. Healy (NAQSM); **Stephen** Island: 21.iii.1984, J.W. Turner (QDPIB); 30.iv.1984, N. Gough (QDPIB); 25.v.1985, K.J. Chandler (NAQSM); 30.x.1989, P. Allsopp (QDPIB); 28.vi.2001, J.F. Grimshaw (NAQSM); **Darnley** Island: 22.iii.1984, J.W. Turner (QDPIB); 1.v.1984, N. Gough (QDPIB); 29.v.1985, K.J. Chandler (NAQSM); 6.x.1989, P. Allsopp (QDPIB); 11.ii.2000, J.F. Grimshaw (NAQSM); 21.v.2002, J.F. Grimshaw & M. Kame (NAQSM); 12.iii.2004, J.F. Grimshaw (NAQSM); **Yorke** Island: 22.iii.1984, J.W. Turner (QDPIB); 30.v.1985, K.J. Chandler (NAQSM); **Yam** Island: 9.xi.1989, P. Allsopp (QDPIB); 17.vi.1995, J.F. Grimshaw (NAQSM); 17.i.1997, J.F. Grimshaw (NAQSM); 2.vi.2004, J.F. Grimshaw (NAQSM); **Mer** Island: 2.v.1984, N. Gough (QDPIB); 29.v–3.vi.1985, J.F. Donaldson & E. Hamacek (NAQSM; QDPIB); 28.iv.1986, J.W. Turner (NAQSM); 7.xi.1989, P. Allsopp (QDPIB); **Mabuiag** Island: xi.1989, P. Allsopp**; 2.vii.1996, J.F. Grimshaw (NAQSM); 29.vi.2001, J.F. Grimshaw (NAQSM); **Badu** Island: 3.iv.1984, J.W. Turner (QDPIB); 25.v.1985, K.J. Chandler (NAQSM); 8.xi.1989, P. Allsopp (QDPIB); 2.vi.1996, J.F. Grimshaw (NAQSM); 17.i.1997, J.F. Grimshaw (NAQSM); 15.ii.2000, J.F. Grimshaw (NAQSM); **St Pauls** community Moa Island: 13.iv.1983, J.W. Turner (NAQSM); 4.iv.1984, J.W. Turner (QDPIB); 24.v.1985, K.J. Chandler (NAQSM); **Kubin** community Moa Island: 7.ix.1983, J.F. Donaldson (Kubin not stated on specimen label) (NAQSM); 4.iv.1984, J.W. Turner (QDPIB); 24.v.1985, K.J. Chandler (NAQSM); **Warraber** (Sue) Island: iv.1984, J.W. Turner*; **Hammond** Island: 8.iii.2000, J.F. Grimshaw (NAQSM); 27.viii.2001, J.F. Grimshaw (NAQSM); **Thursday** Island: 6.ix.1983, J.F. Donaldson (QDPIB); 2.vi.1985, K.J. Chandler (NAQSM); 2.xi.1989, P. Allsopp (QDPIB); 4.vii.1996, J.F. Grimshaw (NAQSM); 19.x.1996, J.F. Grimshaw (NAQSM); **Horn** Island: 20.iii.1984, J.W. Turner (QDPIB).

Northern Peninsula Area: **Seisia**: 10.ix.1983, J.F. Donaldson (QDPIB); **Bamaga**: 12.ix.1983, J.F. Donaldson (QDPIB); 4.xi.1989, P. Allsopp (QDPIB); 17.i.1998, J.F. Grimshaw (NAQSM); 7.iii.2000, J.F. Grimshaw (NAQSM); 19.i.2002, J.F. Grimshaw (NAQSM); 15.vii.2004, D.M. MacLeod & J.F. Grimshaw (NAQSM); 3.iii.2005, J.F. Grimshaw (NAQSM); 3.iii.2005, J.F. Grimshaw & B.M. Waterhouse (NAQSM); **Injinoo** (previously Cowal Creek): 10.ix.1983, J.F. Donaldson (QDPIB).

*Reported in Gough (1984), specimen not located

**Reported in Allsopp (1989), specimen not located.

J.F. Donaldson's survey of September 1983 detected *E. flavipes* in four of the five settlements of the NPA (Gough 1984). Specimens from only three of these sites have been located.

A Northern Monitoring survey in April 1983 recorded *E. flavipes* from three islands in Torres Strait: Saibai, Moa and Thursday Islands, and in September 1983, from four of the five communities in the NPA.

A 1984 Northern Monitoring survey of seven Torres Strait islands (Boigu, Saibai, Stephen, Darnley, Murray (Mer), Yorke

and Sue (Warraber)) reported the presence of *E. flavipes* on Boigu, Saibai, Stephen, Darnley, Murray (Mer) and Yorke. In his report on this survey, Gough (1984) noted that *E. flavipes* had been recorded from Sue (Warraber) Island by a previous survey in April 1984. Gough also reported that numbers were heavy on Saibai at the time of his visit (late April early May).

A 1989 survey of Torres Strait islands and communities in the NPA noted the presence of *E. flavipes* on Boigu, Dauan, Saibai, Yam, Stephen, Darnley, Murray (Mer), Mabuiag, Badu, Kubin on Moa and Thursday Islands, and at Bamaga in the NPA. They were not detected on Yorke, Hammond or North Possession Island, nor at St Pauls community on Moa Island on that occasion (Allsopp 1989).

Chilo terrenellus Pagenstecher, sugarcane stem borer

Synonym: *Chilotraea terrenellus*

This pest is recorded to date only from sugarcane and has previously been reported from various parts of PNG (Bleszynski 1970). Its occasional presence on two islands (Saibai and Dauan) in Torres Strait is published here for the first time. These islands are 5 and 11 km off-shore from the island of New Guinea, respectively.

The larvae of this pest have been detected in high numbers (by JFG), causing heavy damage in up to 80% of stalks, in sugarcane grown in coastal villages of PNG adjacent to these Torres Strait islands. However, damage levels observed in the sugarcane on Saibai and Dauan affect only 2–10% of stalks and are not as heavy. The eggs are laid on the underside of the leaves in overlapping clusters of 10–100 with an incubation period of 4–10 days. Larval duration is 2–11 weeks, pupal duration is 6–10 days and adult life span is 2–12 days. There may be four to six generations per year depending on conditions (Shivas & Schneider 1999). The larvae tunnel into the stalks; this can result in dead tops, broken stalks and reduced sugar content, as well as poor-quality 'seed' canes. The tunnels also provide access for other pests and pathogens. Light infestations can only be detected by stripping away the old leaves and looking for emergence/entry holes in the stem. Some infestations will result in the accumulation of fine frass in the axils of the leaves below the infestation.

Australian distribution records

Records are listed from the most northerly to most southerly. **Torres Strait**: **Saibai** Island: 29.iv.1984, N. Gough (QDPIB); 4.vi.2004, J.F. Grimshaw & T. Gunua (NAQSM); **Dauan** Island: 3.vii.1996, J.F. Grimshaw & R. Magarey (NAQSM); 17.v.1999, J.F. Grimshaw & K.L. Anderson (NAQSM).

The earliest Australian record is from sugarcane on Saibai Island in 1984 (Gough 1984; Gough & Peterson 1984). The detection was in sugarcane grown in the settlement area and, at that time, noted to be common. However, a later survey (Allsopp 1989) did not detect this pest in the sugarcane on Saibai, nor any of the other sites visited. Despite bi-annual surveillance of sugarcane on this island, the pest was not seen on Saibai Island again until 2004. The earliest record of *C. terrenellus* on Dauan Island is July 1996; this was in 'untended' sugarcane growing in a gully among tall grasses. Damage levels were around 10%. Later detections on Dauan have been made in the community area in managed cane, where damage was around 5%, and at one other 'untended' site, which also showed around 2–5% damage.

Detection of a second *Chilo* species in Torres Strait

Chilo crypsimetalla (Turner)

Synonym: *Nephalia crypsimetalla*

Sugarcane on all Torres Strait islands is examined by NAQS scientists at least annually for the presence of stem borers. During a routine NAQS survey of Thursday Island in early April 2005, a pyralid larva was collected from a stem within a small stool of untended, hybrid sugarcane. This larva was subjected to DNA sequence analysis by staff at BSES in Indooroopilly, using a method based on that of Lang *et al*. (2004). Their 'diagnosis' supported the original, morphology-based identification of *Chilo* sp. but not *C. terrenellus*. A subsequent survey of sugarcane on Hammond, Thursday and Horn Islands, later in April, reported damaged sugarcane on Hammond Island, but no larvae present, and recovered a second larva and a pupa from the same stool of sugarcane on Thursday Island. The larva was flown to the Quarantine insectary in Brisbane and fed on fresh sugarcane 'tips' from the BSES facility at Indooroopilly; it survived through two moults, but died at the third moult. The pupa was held on Thursday Island and emerged as a female moth; this was identified as *Chilo* sp. by Dr M. Horak at CSIRO, Black Mountain in Canberra, using morphological characters. A routine NAQS survey in October 2005 collected a larval pyralid from bored sugarcane stems on Hammond Island. This was subjected to DNA sequence analysis, and proved to be the same 'species' as that collected in early April. Comparison of the DNA sequence results from the larvae collected on Thursday and Hammond Islands (Nutt 2005) with those from an identified, adult specimen showed a 100% match with that of *Chilo crypsimetalla* (Turner). This species is described in Bleszynski (1970) from adult material collected in Darwin, Cedar Bay (north Queensland) and Prince of Wales Island in Torres Strait, noting that specimens (females) from Prince of Wales Island differed slightly from 'that typical of the species', and that only discovery of a male specimen from this location would determine whether this was a variation or a distinct species.

A NAQS survey on Torres Strait islands in March 2006 detected larval pyralids feeding within the developing flower heads and upper stems of giant speargrass (*Heteropogon triticeus*). These larvae were morphologically identical with those collected previously from sugarcane on Thursday and Hammond Islands. A selection of these larvae was subjected to DNA sequence analysis and showed a 100% match with the previous specimens collected from sugarcane on Hammond and Thursday Islands, and with the adult specimen of

C. crypsimetalla provided from the collection at CSIRO Black Mountain (Nutt 2006).

Chilo crypsimetalla occurs in the Northern Territory and northern Queensland. Specimens held in the CSIRO Australian National Insect Collection (Canberra) came from six sites in the north of the Northern Territory and 16 sites in northern Queensland; the most southerly record is from Rollingstone near Townsville in north Queensland (M. Horak pers. comm. 2005). The specimen provided from the CSIRO collection, and used for comparison with the larval specimens reported here, was collected by trapping at Heathlands (north Queensland) in 1999. Many of the collection records for these adult moths are from sites 'remote' from sugarcane plantings (e.g. Heathlands and Hann River Crossing in northern Queensland).

Material examined

Records are listed from the most northerly to most southerly. **Torres Strait**: **Dauan** Island: 9.iii.2006, A.D. Rice & J.A. Walker, ex *Heteropogon triticeus*; **Hammond** Island: 5.x.2005, J.A. Walker, ex *Saccharum officinarum*; **Thursday** Island: 8.iv.2005, D.M. MacLeod, ex *Saccharum* sp. (hybrid cane); 21.xi.2005, A.C. Postle, ex *Saccharum* sp. (hybrid cane); 12.ii.2006, J.A. Walker, ex *H. triticeus*; **Horn** Island: 11.iii.2006, A.D. Rice, ex *H. triticeus*; **Prince of Wales** Island: 6.iii.2006, A.D. Rice & J.A. Walker, ex *H. triticeus*. All specimens are held at NAQSM.

In March 2006 larvae of this species were very common in the flower heads and stems of *H. triticeus*, indicating that this is a primary host. The low incidence of larvae within sugarcane, and the poor survival on sugarcane of the specimen fed in quarantine at Brisbane, suggest that sugarcane is not the 'natural' host of *C. crypsimetalla*. However, its detection feeding within sugarcane at two sites warrants further study of this insect and its distribution.

DISCUSSION

Records from Northern Monitoring and NAQS surveillance indicate the continuous presence of *E. flavipes* on islands of Torres Strait and in communities of the NPA from 1983, when surveillance began, to the present. Intensive surveillance of sugarcane has not detected this insect at any of the other sites surveyed elsewhere on Cape York Peninsula or any other parts of northern Australia. The large gap in the presence of sugarcane between the NPA and production sites 850 km to the south will prevent the natural spread of this insect and strict restrictions on movement of plant material imposed by DPI&F, on behalf of BSES, will prevent its human assisted relocation. The sugarcane stem borer (*C. terrenellus*) has an intermittent occurrence on Saibai Island, probably 'sourced' from the nearby population in village sugarcanes in PNG. The occasional, almost total harvesting of sugarcane for special feasting occasions, results in temporary eradication here. On Dauan Island there are several patches of untended sugarcane and *C. terrenellus* maintains a low level of infestation in these canes. NAQS scientists maintain regular surveillance of sugarcane on all Torres Strait islands and across northern Australia, and have not to date detected this pest elsewhere. AQIS manages rigorous quarantine between the Torres Strait islands and mainland Australia and this will prevent human-assisted relocation of this pest. The detection of *C. crypsimetalla* in giant speargrass on several islands in Torres Strait is the first host record for this species. Surveillance of other large grasses may find other hosts. Its low incidence in sugarcane, only detected when few other grasses were available, indicates that this is not a preferred host. However, the life history of this species merits further study. The slight morphological difference between female specimens of *C. crypsimetalla* from different locations as noted by Bleszynski (1970) is not supported by the results of DNA sequence analysis reported here.

ACKNOWLEDGEMENTS

The authors acknowledge the support from continuous funding of surveillance activities in northern Australia as provided by the Federal Government via its Australian Quarantine and Inspection Service. We also thank Dr P. Allsopp and Dr K. Nutt of BSES Indooroopilly for facilitating the DNA sequence analysis of larval specimens of *Chilo* sp. and adult specimen of *C. crypsimetalla*; Dr M. Horak for examination of the adult female specimen of *Chilo* reared from sugarcane on Thursday Island, and provision of a specimen of, and locality data for *C. crypsimetalla* from specimens held in the CSIRO collection, also Barbara Waterhouse of NAQS at Mareeba, who suggested *H. triticeus* as a potential host for *C. crypsimetalla* and identified this grass in the field for collectors, and Dr M. Wilson of the National Museums and Galleries of Wales for confirmation of the identification of a selection of the *E. flavipes* specimens.

REFERENCES

Allsopp PG. 1989. Quarantine survey of sugarcane on the Torres Strait islands 1989. Report to BSES Queensland, Bundaberg, January 1990.

Bleszynski S. 1970. A revision of the world species of *Chilo* Zincken (Lepidoptera: Pyralidae). *Bulletin of the British Museum (Natural History) Entomology* **25**, 1–195.

Gough N. 1984. Report on a quarantine survey of insects from gardens on seven islands of Torres Strait (26 April–4 May, 1984). Report to DPI, Brisbane.

Gough N & Peterson R. 1984. Cane stem borer on Torres Strait islands. *BSES Bulletin* **8**, 20–21.

Kuniata LS, Young GR, Pais E, Jones P & Nagaraja H. 1994. Preliminary observations on *Eumetopina* sp (Hemiptera: Delphacidae) as a vector of Ramu Stunt Disease of Sugarcane in Papua New Guinea. *Journal of the Australian Entomological Society* **33**, 185–186.

Lang CL, Scott KD, Graham GC, Sallam MN & Allsopp PG. 2004. Sugarcane moth borers (Lepidoptera: Noctuidae and Pyraloidea): phylogenetics constructed using COII and 16S mitochondrial partial gene sequences. *Bulletin of Entomological Research* **94**, 457–464.

Lindsay D. 1987. Report on aerial littoral surveillance and northern Australian quarantine strategy. Interim report by the quarantine review

committee to the Department of Primary Industries and Energy. Australian Government Publishing Service, Canberra.
Nutt K. 2005. Identification of sugarcane borers using molecular methods. BSES Report. Reports No. DMM079 and JW008.
Nutt K. 2006. Identification of sugarcane borers using molecular methods. BSES Report. Report No. JG280306.
Shivas RG & Schneider MA. 1999. Review of the Northern Australia Quarantine Strategy (NAQS) target lists for insect pests and pathogens. Report to AQIS. Brisbane.

Accepted for publication 21 May 2006.