Population dynamics and damage levels of *Rhabdoscelus obscurus* (Coleoptera: Curculionidae) in Fiji

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**Abstract**

Split-cane traps and pheromone traps were used to monitor populations of the sugarcane weevil borer *Rhabdoscelus obscurus* (Boisduval) in commercial cane fields of Viti Levu, Fiji, from October 2010 to September 2012. Adult borers appeared in all fields and their populations increased gradually during January-April. Populations declined in most fields between July-September, and this was followed by another increase in October-January. An average of 3399.94 and 3878.93 borers per farm were collected from October 2010 to September 2012 using split-cane and pheromone traps, respectively. The sex ratio was female biased in both trap types. Average yield increased by 7.37 and 23.99 t/ha when split-cane and pheromone traps were placed in cane farms, respectively. Improved management practices in some farms may have also contributed to this increase in cane yield. Pheromone trapping proved to be a reliable monitoring method and may also contribute to reducing damage from sugarcane weevil borer in cane fields in Fiji.

**Key words**

Cane weevil borer, *Rhabdoscelus obscurus*, sugarcane, pheromone trapping, split-cane trapping, Fiji

**INTRODUCTION**

In Fiji, the sugarcane weevil borer *Rhabdoscelus obscurus* (Boisduval) (Coleoptera: Curculionidae) is a key pest that causes significant losses to sugar production and quality. A study by Tamanikaiyaroi (1997) in western Viti Levu recorded damage in 58.6% of the farms surveyed, with up to 93.0% of the farms surveyed harboring borer infestation in some sectors and up to 13.2% of cane stalks being damaged by the borer. This pest mainly causes reduction in the levels of commercial cane sugar (CCS), but can also result in reduced cane yield. Studies in Australia showed that borer infestation reduces CCS by up to 2 units and results in increased levels of dextran in cane juice (Robertson and Webster 1995; Telford 1999; Sallam et al. 2004). *R. obscurus* also attacks palms and is considered to be a significant pest in palm nurseries (Halfpapp and Storey 1991). The species is native to Papua New Guinea and has spread to Fiji, Australia, Hawaii and to other Pacific islands (CAB 2001). However, the population in Hawaii may be a sibling species (Dharmaraju 1984; Tamanikaiyaroi 1997; Giblin-Davis et al. 2000).

In Australia, several aspects of weevil borer Integrated Pest Management (IPM) have been implemented. Farming practices such as trash management, clean harvest, tolerant varieties, general farm hygiene and rat and weed control proved effective (Robertson and Webster 1995; Telford 1999). However, no data was available on weevil borer management and yield losses in Fiji, especially when approximately 95% of the total farms in Viti Levu have cultivar Mana as the dominant variety (SRIF 2010), and preliminary results indicate that this variety is prone to heavy borer infestation and damage (Prasad, unpublished data).

Previous work by Sallam et al. (2007) in Queensland cane fields showed pheromone trapping of adult borers to be an effective method of monitoring populations and may also impact on population densities. Therefore, the aim of our study was to assess the effectiveness of pheromone and split-cane traps in monitoring cane weevil borer populations in Fiji. Our study also examined the possibility of minimizing borer populations and damage using trapping of borers.

**METHODS AND MATERIALS**

**Split-cane trapping**

From October 2010 to September 2012, split-cane traps were placed in 17 farms in three mill areas of western Viti Levu (six farms in Lautoka, six farms in Rarawai and five farms in Penang). Fields chosen were about 1 ha each in size. In each field, we placed 10 split-cane traps (five traps in each end of the paddock at a distances of 10 m into the row and 10 rows...
All fields were planted to cultivar Mana. The numbers of adult borers in each trap was recorded every second week and summed for each month.

**Pheromone trapping**

Pheromone traps were used to monitor borer populations from October 2010 to September 2012 in four farms in the Nadi district. These farms were at least 5 km away from areas where split-cane traps were placed. At each farm, we placed 10 pheromone traps, each 3 m away from the edge of the field. Each trap contained a packet of pheromone lures (*Rhabdoscelus obscurus* and *Rhabdoscelus ferrugineus* Klures) and small pieces of split cane. A plastic 35 cm diameter pot was used that had a plastic inner lining. The top of the pot was covered with wire mesh to keep out animals such as cane toads. The pheromone and cane billets were enclosed in a ventilated container that was suspended from a wire mesh into the pot. The pot was half filled with water and a few drops of detergent were added to drown the borers. The inner plastic lining was pierced around the top section to allow draining off any excess rainfall water. The number of borers in each trap was recorded every second week and summed for each month.

**Damage assessment**

Damage due to borers was assessed on the day of harvest. We collected 100 cane stalks at random from each field and split them open. The total number of damaged stalks was recorded.

**RESULTS AND DISCUSSION**

**Split-cane trapping**

Figures 1-3 show the number of borers collected in split-cane traps each month from October 2010 to September 2012 in Lautoka, Rarawai and Penang districts, respectively. Adult borers appeared in all fields and their populations generally increased between December and April. Populations declined in most fields between July and September, and this was followed by another increase in October to January. Overall, the sex ratio of borers was female biased (0.86:1) (M=26886: F=31224).

![Graph showing the number of borers collected in split-cane traps each month from October 2010 to September 2012 in Lautoka, Rarawai and Penang districts, respectively.](image)

**Fig. 1.** Average numbers per farm of sugarcane weevil borers in split-cane traps from October 2010 to September 2012 in six farms in the Lautoka mill region (blue columns). Red line shows rainfall in mm.
Fig. 2. Average numbers per farm of sugarcane weevil borers in split-cane traps from October 2010 to September 2012 in six farms in the Rarawai mill region (blue columns). Red line shows rainfall in mm.

Fig. 3. Average numbers per farm of sugarcane weevil borers in split-cane traps from October 2010 to September 2012 in five farms in the Penang mill region (blue columns). Red line shows rainfall in mm.

Pheromone trapping

Figure 4 shows the average borer numbers per farm from October 2010 to September 2012 that were caught in pheromone traps. Trap counts followed a similar trend to split-cane trap counts in all fields, with sex ratio being 0.73:1 (M=7111: F=9683) overall. Similar observations have been recorded in Australia, where borer numbers in both pheromone and split-cane traps increased gradually until they reached a peak around March-April, then declined during the winter months and built up again in December–March (Sallam et al. 2007).
Fig. 4. Average numbers per farm of sugarcane weevil borers in pheromone traps from October 2010 to September 2012 in four farms in the Lautoka mill region (blue columns). Red line shows rainfall in mm.

Fig. 5. Average stalk damage in 10 farms in 2011 and 2012 where split-cane trapping was used from October 2010 to September 2012.

Fig. 6. Average stalk damage in four farms in 2011 and 2012 where pheromone trapping was used from October 2010 to September 2012.
Damage assessment

Figures 5 and 6 show the percentage of damaged stalks following split-cane and pheromone trapping, respectively. Except for one case in the Rarawai area, the average number of damaged stalks decreased where split-cane trapping was used. The reason for the increase in damaged stalks in Rarawai (R3) is not known. However, the average number of damaged stalks also decreased in the four farms where pheromone trapping was used.

Cane yield

The average cane yield of the 17 farms where split-cane trapping was used was 55.48 t/ha in 2010, compared to 62.84 t/ha in 2011, showing an increase of 13.3% (7.36 t/ha). The average yield in the four farms where pheromone trapping was used was 61.74 t/ha in 2010 compared to 85.74 t/ha in 2011, showing an increase of 38.9% (23.99 t/ha).

CONCLUSIONS

Pheromone trapping of adult borers can provide a useful component of an integrated pest management program. Many factors impact on population trends among seasons and regions, and borer movement is a dynamic process as adult weevils travel continually within and among fields (Veitch 1917; Mungomery 1937). Our results show that both pheromone and split-cane trapping are useful monitoring tools to determine weevil borer populations. Our results also show a possible yield effect following extensive trapping. We certainly acknowledged that several factors impact on the overall yield, but trapping of weevil borers may have also contributed to improved yield. Since the sex ratio was consistently female biased (which agrees with Robertson et al. 1997, 1998; Sallam et al. 2007), pheromone trapping could be effective in removing females if deployed early in the season as the borer population starts to increase in cane fields. This is likely to reduce damage levels and contribute to overall improvement of the cane yield.

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Robertson LN, Giblin-Davis RM, Oehlschlager AC. 1998. Field experiments to optimize lures for mass- trapping of cane weevil borer. BSES Project Report PR98003.
La dynamique des populations et des niveaux de dommages de *Rhabdoscelus obscurus* (Coleoptera: Curculionidae) à Fidji

**Résumé.** Des pièges à base de cannes fendues et de phéromones ont été utilisés pour effectuer un suivi les populations du charançon de la canne sucre *Rhabdoscelus obscurus* (Boisduval) dans les champs commerciaux de Viti Levu, Fidji, d’octobre 2010 à septembre 2012. Les adultes apparaissent dans les champs et leurs populations augmentent graduellement de janvier à avril. Ces populations déclinent ensuite dans la plupart des champs entre juillet et septembre, et ceci est suivi par une autre augmentation d’octobre à janvier. Une moyenne de 3399.94 et 3878.93 individus par ferme ont été collectés entre octobre 2010 et septembre 2012 utilisant les 2 types de pièges. Le sex-ratio des individus piégés ont été en faveur des femelles dans ces pièges. Les rendements moyen augmenté de 7.37 et 23.99 t/ha quand les pièges à canne et phéromone sont placés au sein des exploitations cannières. L’amélioration des stratégies de management de certaines fermes peuvent avoir contribué à cette augmentation des rendements. Le piégeage à l’aide de phéromones s’est montré fiable comme méthode de suivi des populations et peut être utile pour contribuer à faire baisser les dégâts du charançon dans les champs de canne aux Fiji.

Mots-clés: Charançon de la canne, *Rhabdoscelus obscurus*, canne à sucre, piégeage phéromone, piégeage canne, Fidji

Dinámica poblacional y niveles de daño de *Rhabdoscelus obscurus* (Coleoptera: Curculionidae) en Fiji

**Resumen.** Las trampas de caña troceada y con feromonas, se utilizó para monitorear las poblaciones del picudo barrenador de la caña *Rhabdoscelus obscurus* (Boisduval) en campos comerciales en Viti Levu, Fiji, desde octubre de 2010 a septiembre de 2012. Los barrenadores adultos aparecieron en todos los campos y su población aumentó durante los meses de enero-abril. Las mismas disminuyeron en la mayoría de los fincas entre julio y septiembre, y se presentó otro aumento desde octubre-enero. En las fincas, mediante el uso de trampas de caña troceadas y de feromonas, se obtuvieron de octubre 2010 a septiembre 2012 un promedio de 3399.94 y 3878.93 barrenadores, respectivamente. La proporción de sexo femenino fue sesgada en ambos tipos de trampas. El rendimiento promedio aumentó entre 7.37 y 23.99 t/ha cuando las trampas de caña troceada y de feromonas se colocaron en el campo, respectivamente. Este aumento del rendimiento en el cañaveral puede estar influenciado por la mejora en las prácticas culturales en algunas fincas. Las trampas con feromonas, demostraron ser un método de monitoreo eficiente y además pueden contribuir a reducir el daño del picudo barrenador de la caña en los cañaverales en Fiji.

**Palabras clave:** picudo barrenador de la caña, *Rhabdoscelus obscurus*, caña de azúcar, trampas de feromonas, trampas de caña troceada, Fiji