MONITORING *ELDANA SACCHARINA* AND OTHER ARTHROPOD PESTS IN SOUTH AFRICAN SUGARCANE

By

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Abstract

Each year from January to December, field surveys are conducted throughout South African sugarcane primarily for the key pest, *Eldana saccharina* Walker (Lepidoptera: Pyralidae). Monitoring allows detection of excessive larval infestations for early harvesting to assist in reducing populations on an area-wide scale, selection of suitable carryover fields and inspection of seed cane. During surveying, known arthropod crop spoilers are recorded and staff remain vigilant for possible new arthropod incursions. These data provide information about regional infestations of *E. saccharina* in the industry. Furthermore, related agronomic information is recorded thus providing evidence to support the value of current management tactics employed to reduce the adverse affects of *E. saccharina*. Additional applications for the *E. saccharina* records in the database are being researched such as investigating infestations recorded in different varieties, mapping infestations, and for the production of region loss estimates.

Introduction

Since the 1970s, *Eldana saccharina* Walker (Lepidoptera: Pyralidae) has been the key pest in the South African sugarcane industry (Leslie, 2004). Farming management practices and variety selection have been developed as measures to help combat the detrimental effects. Another practice employed in the industry to reduce population build up and subsequent spread is routine surveying for pests during the year by local pest survey teams (Mathew *et al.*, 1990) to detect fields with excessive *E. saccharina* infestations that growers are required to harvest. Such proactive action contributes towards managing infestations on an area-wide scale.

During monitoring, related agronomic information is recorded. Researchers have analysed these data to investigate which factors affect *E. saccharina* infestations (Goebel *et al.*, 2005; Anon, 2006), model validations (Horton *et al.*, 2002), confirm relationships between cane age, water stress, and nitrogen levels and *E. saccharina* infestations (Paxton, 1982; Atkinson and Nuss, 1989; Goebel *et al.*, 2005). Additional factors warrant investigation, for example silicon and water stress synergistic effects in relation to resistance to *E. saccharina* (Kvedaras *et al.*, 2006).

Collating these empirical data will hopefully lead to a better understanding about the ecology of this pest at the regional level that might assist with development of site-specific management strategies. Seasonal trends provided by these monitoring data provide an updated guide of the status of *E. saccharina* in each region and thus indicate how effective the management tactics are that are adopted by growers.

The purpose of this paper is to highlight the value of this monitoring program to local researchers and to discuss future uses for the database with regard to *E. saccharina* under investigation such as varietal resistance, mapping infestations and determining loss caused by the pest on a regional scale.

Methods

Survey protocols are standardised across the industry and based on those developed by the South African Sugarcane Research Institute. Planning these regular surveys is uniform across all regions and structured to cover each area under sugarcane evenly and systemically. Ranges of agronomic and growing conditions are surveyed including different cane age, cane cultivar, and crop age (plant or ratoon). Each year from January to December, 1000 to 1500 surveys are completed by each team based in each of the 14 regions (Way and Goebel, 2003).

Surveying entails examination of 100 stalks randomly taken from 10 ha, 300 stalks in 10–20 ha and 400 stalks from larger fields. Stalks are split lengthwise to record tunnels present in each stalk. Extent of damage per field is expressed as a percentage of the stalks damaged, abbreviated as % SD.

The number of *E. saccharina* larvae recovered from each stalk is recorded and, where necessary, converted to numbers in 100 stalks and abbreviated as e/100. Damage intensity is assessed as the total length of stalk tissue with a red colouration caused by secondary fungal infection converted to a percent of total stalk length examined expressed as % Stalk Length Red and abbreviated as % SLR.

Most sugar industries use the damage index of percentage bored internodes (% BI) to evaluate stalk borer damage (Metcalfe, 1969) but % BI is strongly correlated with % SLR (Goebel and Way, 2003; Gossard, 2004) and can be determined in the field more rapidly.

Most surveys are conducted with the purpose to detect fields with excessive *E. saccharina* infestations that are then harvested in a timely manner. Surveying may also be conducted for the purpose of selecting those fields that are suitable for carryover into the following season based on a reasonable *E. saccharina* larval threshold usually set at between 10–20 e/100.

Surveys may also be conducted to ensure that any seed-cane destined for use at replant is not infested with *E. saccharina*.

This paper presents data collected from June 2005 to May 2006 collated for comparison with values recorded over the last 7 years recorded as the long-term mean (LTM) and collected between 1999 and 2006.

Results and discussion

Data from June 2005 to May 2006 are presented in Figure 1 and show typical *E. saccharina* borer infestations recorded over this period in this sugar industry.

These data are used to keep crop protection workers informed about high infestations that represent potential ‘hot-spots’, for example relatively high damage level recorded in the Malelane region (ML) over this survey period. In this manner the regular monitoring program plays a major role in assisting with the area-wide management of this pest.

Each year, mainly on the coastal regions, a certain number of fields are identified that are suitable for carrying over to the subsequent growing season based on level of *E. saccharina* infestation criteria combined with level of damage criteria. Larval thresholds of 10 e/100 to 20 e/100 are accepted for guidance in the field; however, it may be necessary to adjust these depending on mill capacity to process extra cane tonnage out of the planned sequence.

Survey data are also used to review management strategies. For example, harvesting young cane is recommended because this prevents population build up. Equations derived from analyses describe rates of increase in damage levels with increasing cane age (Figure 2).

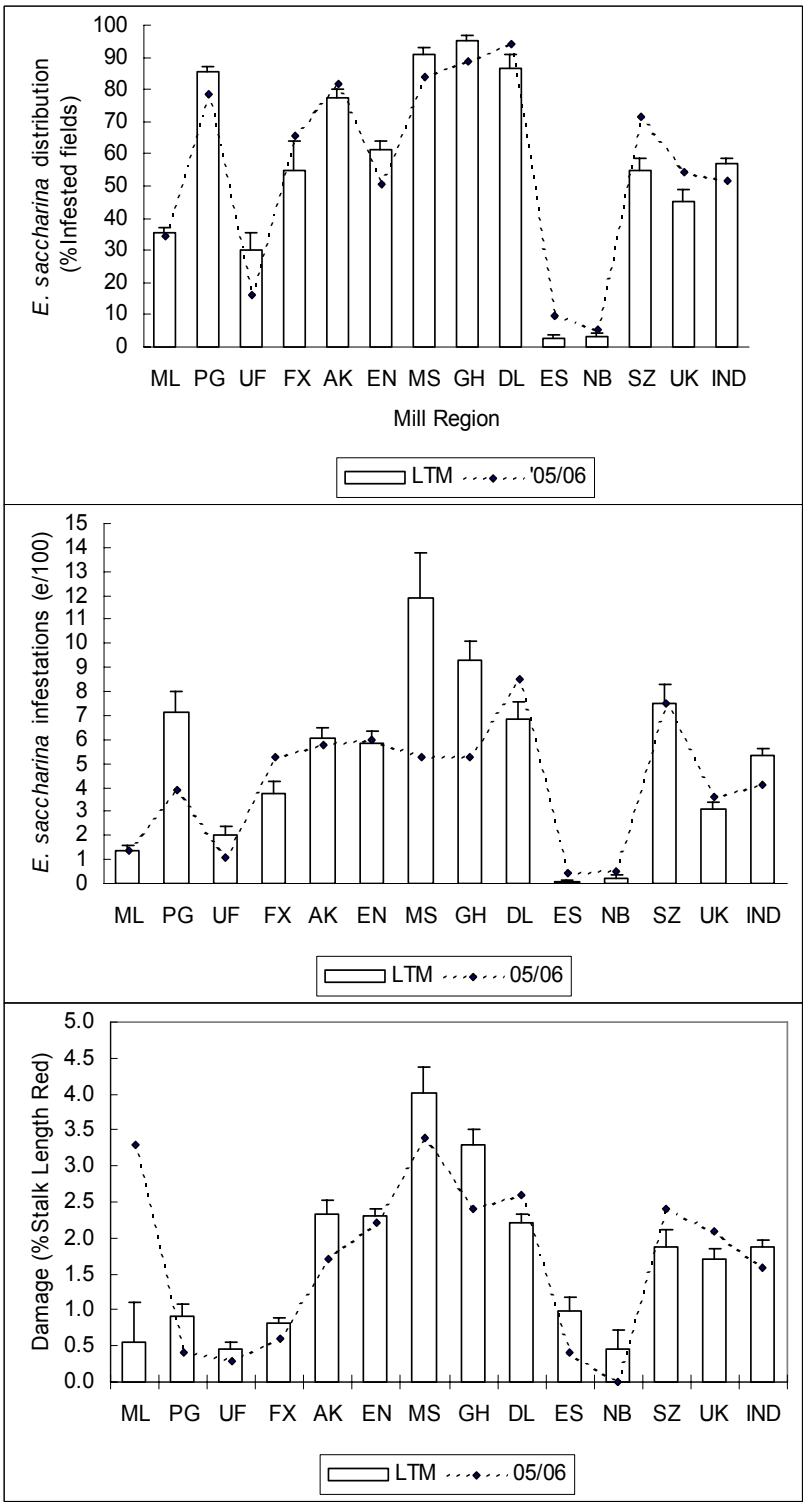

Fig. 1—*Eldana saccharina* distribution (top), infestations (middle) and damage (bottom) in the South African sugarcane industry. LTM = 1999 to 2006 ± SE. Key to mill regions: ML = Malelane, PG = Pongola, Uf = Umfolozi, FX = Felixton, AK = Amatikulu, EN = Entumeni, MS = Maidstone, GH = Gledhow, DL = Darnall, ES = Eston, NB = Noodsberg, SZ = Sezela, UK = Umzimkulu, IND = Industry

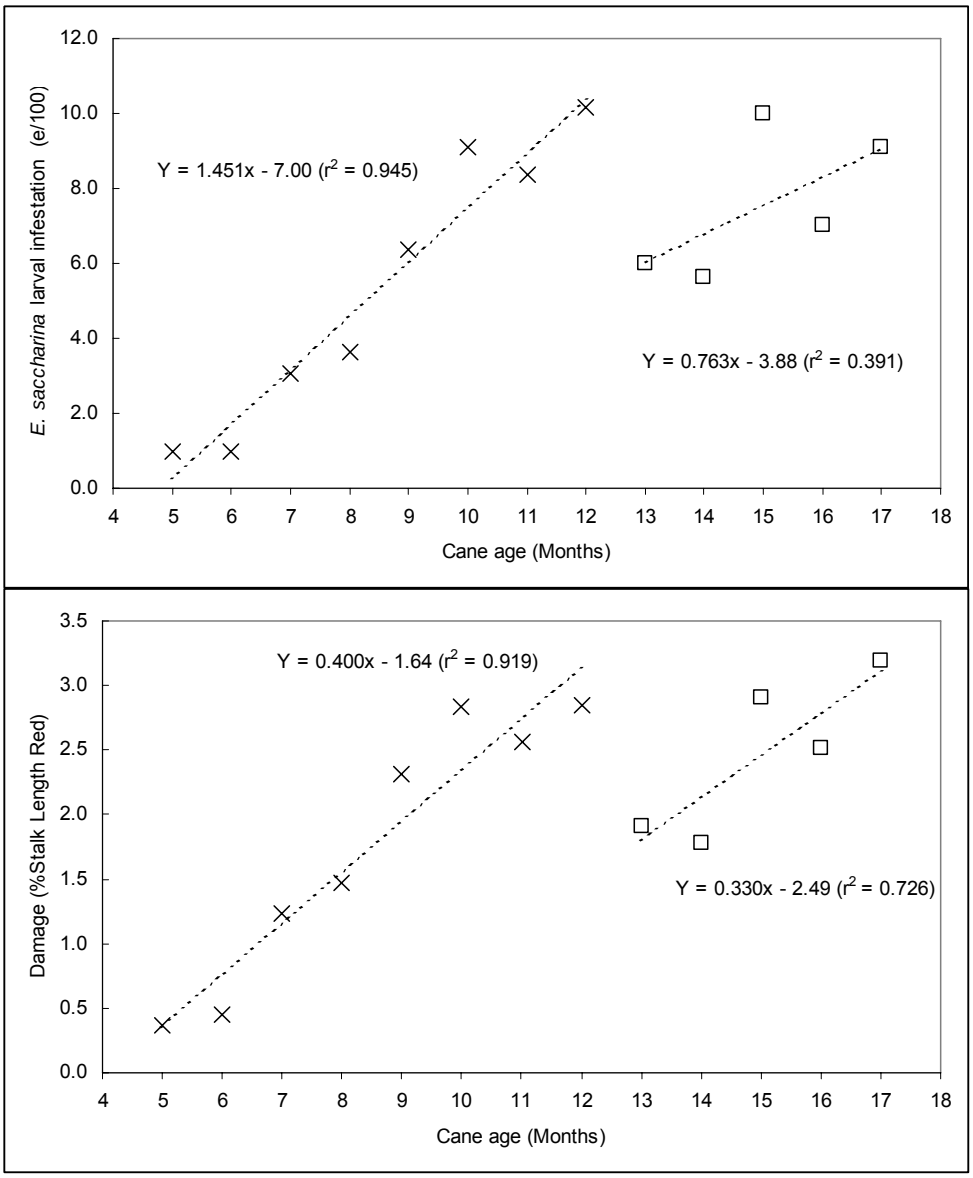

Fig. 2—Rate of increase in *Eldana saccharina* larval populations (top), and damage (bottom) at Sezela region in the South African sugarcane industry in 2005/06.

At Sezela for instance, there exists a strong positive correlation between these parameters between 5 months and 12 months, with less correlation in older cane up to 17 months (see r^2 values). Damage levels have been used with loss indices to estimate the loss from this borer in particular parts of the industry (Goebel *et al.*, 2005). In the past, data from different varieties and from crops grown under different agronomic conditions were pooled; however, it follows that as additional records are added to the database then it will be possible to obtain more precise loss estimates.

Detecting fields where action is needed to address excessive *E. saccharina* infestations has recently been facilitated through the introduction of modified Excel software spreadsheets to better capture and collate the extensive data that are collected every season. This change came about as a direct result of the closer involvement by the local researchers in this monitoring program. There was a need to simplify the data capturing system used and to allow greater flexibility to ensure data retrieval when possible. The value of ensuring the software matches capacity skills is that local

extension officers use these data more extensively and are able to solve a number of local issues arising during the course of the year. This development, therefore, ultimately assists with the area-wide crop protection initiative, and specifically with *E. saccharina* control in the short term.

The information based on the results from these regular pest surveys are disseminated to the stakeholders, and field staff are reminded of the importance of remaining vigilant for all arthropod pests. In sugarcane, these typically include occasional pests such as grasshoppers (Acrididae) and scale insects (Coccidae). Teams are also required to monitor white grub species (Scarabaeidae) and to conduct surveys for the sugarcane thrips, *Fulmekiola serrata* Kobus (Thripidae) that recently invaded this industry (Way *et al.*, 2006). Surveying is also of value to monitor for any possible exotic arthropod incursions such as *Chilo sacchariphagus* (Bojer) (Crambidae), which poses a threat to this industry because of its presence in Mozambique (Way and Turner, 1999).

Future research aims to use the results collected from this monitoring program to quantify the loss due to this pest in specific regions in the industry. This development will incorporate the *E. saccharina* loss indices that have been produced by other research with the levels of damage recorded during these surveys. Future work aims to produce illustrative infestation maps employing geographical position systems and geographical information systems.

In conclusion, extensive and regular field surveying for *E. saccharina* plays a vital role in this industry by assisting in reducing infestations. The program is also valuable because it ensures that the crop protection workers remain vigilant for possible new incursions. By approaching the database from the research perspective, as opposed to merely routine monitoring, it has been possible to demonstrate the value of the database, and moreover has opened the way towards more extensive use of these monitoring data.

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LA SURVEILLANCE D'*ELDANA SACCHARINA* ET D'AUTRES RAVAGEURS ARTHROPODES DE LA CANNE À SUCRE EN AFRIQUE DU SUD

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MOTS CLÉS: Canne à Sucre, *Eldana Saccharina*, Systèmes de Surveillance.

Résumé

TOUS LES ANS, de janvier à décembre les champs de canne à sucre en Afrique du sud sont sondés pour déterminer la présence du ravageur principal, *Eldana saccharina* Walker (Lepidoptera: Pyralidae). La surveillance permet la détection des fortes infestations larvaires pour récolte précoce afin d'aider à réduire les populations sur l'ensemble du territoire, pour la sélection des champs appropriés pour une récolte reportée et pour l'inspection du matériel de plantation. Pendant les inspections, la présence des arthropodes nuisibles aux plantes est enregistrée et l'attention est aussi portée à des éventuelles incursions de nouvelles espèces d'arthropodes. Ces données fournissent des informations sur les infestations par *E. saccharina* dans la région. Par ailleurs, des observations agronomiques sont aussi relevées, témoignant ainsi de l'importance des méthodes de luttes actuellement utilisées pour réduire les effets néfastes de *E. saccharina*. Des informations additionnelles sont recherchées sur des infestations observées dans différentes variétés, la cartographie des infestations et les estimations de pertes en rendement par région pour augmenter la base de données sur *E.saccharina*.

RECONOCIMIENTO DE *ELDANA SACCHARINA* Y OTROS ARTRÓPODOS NOCIVOS EN CAÑA DE AZÚCAR DE SUDÁFRICA

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PALABRAS CLAVE: Caña de Azúcar, *Eldana Saccharina*, Sistemas de Reconocimiento.

Resumen

CADA AÑO, desde enero hasta diciembre, se llevan a cabo reconocimientos de campo a lo largo del sector azucarero sudafricano, fundamentalmente para la plaga, *Eldana saccharina* Walker (Lepidoptera: Pyralidae). Este reconocimiento permite detectar altas infestaciones larvales para realizar cosechas tempranas con el fin de disminuir su población en áreas amplias, la selección de campos adecuados para cosechar fuera de la zafra e inspeccionar cañas para semilla. Durante los reconocimientos, se registra la abundancia de otros artrópodos reconocidos como plagas y se mantiene una vigilancia para la aparición de artrópodos invasores. Estos datos suministran información acerca de infestaciones regionales de *E. saccharina* en el sector. Aún más, se registra información agronómica relacionada de tal forma que proporciona evidencias para apoyar el valor de las tácticas de manejo recientes que se emplean para minimizar los efectos adversos de *E. saccharina*. Se investigan usos adicionales para los registros en la base de datos de *E. saccharina*, tales como infestaciones determinadas en diferentes variedades, mapeo de las infestaciones y para la determinación de pérdidas a escala regional.