ELDANA SACCHARINA (LEP: PYRALIDAE) AND ITS PARASITOIDS AT KINYARA SUGAR WORKS, UGANDA

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Abstract

Since 1996, regular surveys have been completed for *Eldana saccharina* Walker and parasitoids of its different life stages in sugarcane and *Cyperus papyrus* during visits to Kinyara Sugar Works, Uganda. A complex of dipteran (Tachinidae) and hymenopteran (Braconidae, Ichneumonidae, Bethylidae and Eulophidae) parasitoids have been discovered attacking *E. saccharina* infesting *C. papyrus.* One species of Tachinidae and one species of Ichneumonidae have been recorded from *E. saccharina* attacking very old sugarcane on the estate.

This paper lists the parasitoids of *E. saccharina* found on the estate, and follows the rates of parasitism recorded during visits at different times of the year, and through the years on populations of *E. saccharina* in *C. papyrus* wetlands on the estate. Co-operation between SASEX and Kinyara Sugar Works will benefit both institutions through increased knowledge of pest/parasitoid interactions, and thus facilitate establishing laboratory colonies of parasitoids for introduction into infested sugarcane in both countries.

Introduction

Kinyara Sugar Works is in central western Uganda, in the Bunyoro region between the towns of Masindi and Hoima. It is 14 km west-southwest of Masindi, and about 220 km northwest of Kampala, lying 1° 35' N and 31° 36' E. The topography of the Estate is undulating, with ridge crests reaching 1100 to 1130 m in the south, and slacks between 30 and 50 m lower. Slope gradients are generally less than 10%. The highest point on the Estate, Isagara Hill, is 1326 m in altitude.

Regional drainage has been much modified by uplift associated with the formation of the Rift Valley, becoming complicated in the Kinyara area. The southern part of the Estate drains southwards through the Musoma and Ntoma streams to the Nkusi River, and the central area westwards via the Siba River into Lake Albert. Both systems are the product of uplift of the eastern edge of the Rift Valley. Stream flow is very slow and the valleys have broad flat swampy bottoms. The area north of the Masindi to Butiaba Road drains northwards to the Waisake River, which also flows into Lake Albert (Anon, 1985).

The Estate lies in a vegetation transition zone between the Budongo moist semi-deciduous forest in the north and northwest, and dry savanna in the southeast. The distance between zone margins is 4-5 km, and three types of vegetation are found:

- Moist semi-deciduous forests in isolated patches in sheltered stream valleys
- Moist *Combretum* savanna with a grass layer of *Hyparrhenia rufa*, with isolated patches of *P. purpureum* and *Imperata cylindrica. Cymbopogon afronardus* is found on very poor ground. *Cyperus papyrus* occurs in flat valley bottoms;
- Nearly treeless grassland fringes the forest boundary and occurs also on patches of better soil. *Pennisetum purpureum* is the most common grass. The trees were removed as part of a tsetse fly control operation.

Outside the Estate there is much scattered cultivation, the main crops being bananas, coffee, maize, sorghum, beans, cassava, sweet potatoes and cotton (Anon., 1985).

It is thus apparent that Kinyara is established amidst numerous wild and crop hosts of *Eldana saccharina* Walker, and that sugarcane planted there is susceptible to invasion by this insect. Kinyara Estate planted sugarcane in large areas in anticipation of an early mill opening. This did not happen, and sugarcane had of necessity, to stand over. This resulted in sugarcane becoming older the longer the mill remained inoperative. The old sugarcane was heavily attacked by *E. saccharina,* which was not surprising, as the South African experience has shown that this pest species prefers older, mature sugarcane. However, certain differences became evident when the surveys commenced.

Materials and Methods

Sugarcane

Because it is known that *E. saccharina* prefers older cane, on each visit fields with the oldest cane were selected for surveys. Two sampling approaches were followed. To obtain extent of infestation data, stalks were taken from a field in a stratified random manner. Field inspectors were placed at 20 m intervals, and then asked to enter the cane row opposite to them and collect a stalk every 5 m into the row. The stalk was randomly selected at each 5 m interval. Varying numbers of stalks per site were collected, depending on the state of the cane, and the time available for surveys. Harvested stalks were brought back to the access road, and carefully inspected for borer damage. In the second approach the inspectors collected only damaged stalks from the selected fields. This was done to maximise the possibility of collecting parasitoids, and was the method of choice. Stalks were not collected in a stratified manner, but were

again collected at equal distances through out selected fields. The number of nodes on each stalk were counted, divided by three, after which the stalk was cut into three sections, each with an equal numbers of nodes. The bottom, middle and top sections of the stalk were carefully split and searched for borings, and borer and/or parasitoid life stages, which were collected and placed into vials containing diet medium. The number of nodes in each section which were damaged by borings was recorded. For the purposes of this paper, all sugarcane surveys were combined, but more detailed analyses on effects of cane age and variety can be obtained from reports of surveys at Kinyara housed at SASEX.

Cyperus papyrus

E. saccharina is known to occur in umbels and rhizomes of *C. papyrus* (Conlong, 1990). At Kinyara, rhizomes were generally submerged, and thus only umbels were attacked by *E. saccharina.* Inspectors were sent into *C. papyrus* stands to collect all green umbels. These were brought to swamp margins, and searched for *E. saccharina* and parasitoid life stages as described by Conlong (1990). All life stages found were treated as described for sugarcane surveys above. Although umbels were separated into different age and phenological classes, and infestation data on these classes obtained separately, results presented in this paper are of totals of these surveys. More detailed analyses can be obtained from trip reports to Kinyara Sugar Estate housed at SASEX.

The Biosytematics Division of the Agricultural Research Councils Plant Protection Research Institute (Private Bag X134, Pretoria, 0001.) identified all parasitoids found. Voucher specimens of all species are kept in their laboratories.

Results

Sugarcane

The collection of the Ichneumonid wasp, *Syzeuctus tonganus* Kriechbaumer, and the unknown Tachinid fly parasitoid is of great significance (Table 1). These were the first parasitoids to be collected from *E. saccharina* in sugarcane in Uganda. They were, however, collected from very old sugarcane. Harvestable cane age decreased in the following years, leading to lower *E. saccharina* infestations (Table 1) and thus less time was available for parasitoid colonisation.

Cyperus papyrus

A minimum of 12 different species of parasitoid have been collected during the period May 1966 to April 2000. During every survey, *S. tonganus* has been recovered, as has the Tachinid *Actia* sp. It is thus apparent that these parasitoids occur throughout the year at this location. *Goniozus indicus* Ashmead (Hymenoptera: Bethylidae) was the next most common parasitoid, occurring throughout the year. It was unusual that it was not found in the May 1996 and July 1997 collection periods. *Schembria eldana* Barraclough (Diptera: Tachinidae) was collected on two and possibly three occasions, in January and June, and possibly in May, as was *Campoplex* sp. (Hymenoptera: Ichneumonidae). This indicates that these parasitoids could be more common than the sampling intensity has revealed. The diversity of the parasitoid complex attacking *E. saccharina* in *C. papyrus* at Kinyara is further emphasised in that new species such as *Iphiaulax* sp. (Hymenoptera: Braconidae), *Elachertus* sp. (Hymenoptera: Eulophidae), *Venturia* sp. (Hymenoptera: Ichneumonidae), and unnamed braconids and other Hymenopterans are found during surveys at different times of the year, and even at the same time of year, but in different years. The occurrence of the entomophagous fungus *Beauveria bassiana* further increases the natural enemy arsenal that *E. saccharina* has to face in its indigenous host *C. papyrus.*

Discussion and Conclusion

The diversity of the habitat occurring on Kinyara Sugar Estate has been briefly described in the introduction. It is because of this that the diversity of parasitoids may be so high. Unpublished observations of parasitism of *E. saccharina* in different wetlands on the Estate show that its intensity can vary from very little to 30% parasitism. It is thus of utmost importance to complete more regular and intensive surveys at this estate to increase knowledge on the pest/parasitoid complex and interactions in both sugarcane and *C. papyrus.* Such studies could lead to the provision of parasitoid parent material for laboratory rearing to take place. Laboratory reared progeny can be used to augment field populations in sugarcane in Uganda, and be introduced into South African sugarcane as a biological control agent of *E. saccharina*. The chances of establishment of these parasitoids in southern African conditions are good, as the climate of Kinyara and certain areas of the South African sugar belt are fairly closely matched, indicating that climatic compatibility may not be a major constraint.

Surveys in maize in the area should be included in any survey programme set up for sugarcane and indigenous host sampling, as it has recently been shown that maize in the area is also attacked by *E. saccharina*. As such, the immature stages of this borer may also be attacked by a range of parasitoids, as recorded for other areas in Africa (Conlong, 2000).

REFERENCES

Anon (1985). Rehabilitation of the Uganda Sugar Industry - Kinyala Estate. Volume II, Annex 1, Natural Resources: Annex. 2: Agricultural Development. Government of Uganda and Booker Tate Agriculture International Limited London, UK.

Conlong DE (1990). A study of pest-parasitoid relationships in natural habitats: An aid towards the biological control of *Eldana saccharina* (Lepidoptera: Pyralidae) in sugarcane. *Proc S Afr Sug Technol Ass* 64: 111-115.

Conlong DE (2000). Indigenous African parasitoids of *Eldana saccharina* (Lepidoptera: Pyralidae). *Proc S Afr Sug Technol Ass* 74: 201-211.

Table 1. Age of sugarcane sampled on each visit to Kinyara Sugar Estate, the number of *E. saccharina* found and extent of infestation of the stalks sampled. Also shown is the rate of parasitism of *E. saccharina* and the parasitoid identity.

Date	Cane age (months)	Mean nodes	% Dam. nodes	Total Eldana	Parasitoids		
					Number	% Par.	Identification
5/96	19	29.3	23.8	123	1 1	0.8 0.8	*Syzeuctus tonganus* Unknown Tachinid (*Actia* sp., *Ceromya* sp. *Schembria eldana*)
6/97	11	15.8	5.5	27	0		
6/98	17	25.3	11.8	139	0		
2/99				231	0		
7/99	11	16.2	29.0	124	0		
4/00	14	21.2	22.0	59	0		

Table 2. Diversity of parasitoids attacking *E. saccharina* larvae in *C. papyrus* umbels at Kinyara Sugar Estate, and the percentage parasitism of larval stages by the individual parasitoids recorded from surveys completed during visits to the Estate.

Date	Total umbels	Total Eldana	% parasitism											
			Syzeuctus tonganus	*Actia* Sp.	*Schembria eldana*	*Ceromya* sp.	*Goniozus indicus*	*Campoplex* sp.	*Iphiaulax* sp.	*Elachertus* sp.	*Venturia* sp.	Unknown Braconids	Unknown Hymenoptera	*Beauveria bassiana*
5/96	1363	147	4.1	23.8	?	?								
6/97	1958	497	1.6	1.6	?	?								
6/98	>543	618	3.4	0.8	3.6		0.2	1.9	0.6					0.2
2/99		295	4.1				0.7							
7/99	998	401	8.0	1.0			1.7			0.3				
1/00	6761	992	1.1	1.0	2.9		1.5	1.0				0.3	0.1	
4/00	202	349	0.9	0.3			2.6				0.3			