

COMBATING *ELDANA SACCHARINA WALKER* : A PROGRESS REPORT

By A. J. M. CARNEGIE

South African Sugar Association Experiment Station, Mount Edgecombe

Abstract

Recent results of the work being done to combat the cane borer *Eldana saccharina* Walker (Lepidoptera : Pyralidae) are discussed. Topics include: distribution in South Africa, effects of crop management, population monitoring, biological control and chemical control.

Introduction

This paper is a summary of the present situation regarding the pyralid cane borer *Eldana saccharina* Walker, its incidence in the South African industry, and the investigatory programme aimed at its control. It follows similar papers of recent years (Carnegie *et al*⁵, Smaill⁸).

Distribution

The incidence of eldana borer throughout the South African sugar industry is assessed mainly from statistics obtained during routine surveys of cane fields and of cane consignments entering millyards (Carnegie *et al*⁵). Over the years as the borer problem has grown these services have been expanded, and last season saw an increase in team strength at southern mills and the establishment of additional field survey teams, with greater attention being paid to the southern parts of the industry. Eldana incidence, as reflected in mill survey records is shown in Figure 1 and Table 1.

The pattern for the northern mills (Malelane, Pongola, Umfolozi, Empangeni and Felixton) has shown a tendency to stabilize. This was more pronounced in 1980/81 than it was in the previous season, and numbers at Pongola were in fact lower than they were during 1979. The same pattern did not apply to coastal areas to the south of Felixton, all of which showed increases in eldana numbers, and new sporadic outbreaks were recorded at Mount Edgecombe, Sezela and Umzimkulu mills.

Research Programme

Ecology

Aspects of crop management received further attention, the possibility being appreciated that certain cultural practices might favour or be disadvantageous to the insect.

TABLE 1
Numbers of *Eldana saccharina* Walker per 100 stalks cane for four seasons

Mill	<i>E. saccharina</i> numbers per 100 stalks			
	1977/78	1978/79	1979/80	1980/81
Malelane	0,31	0,18	0,23	0,35
Pongola	0,88	1,09	1,30	0,71
Umfolozi	0,27	0,25	0,60	0,49
Empangeni	0,88	0,76	0,90	0,83
Felixton	0,09	0,20	0,43	0,73
Amatikulu	3,68	3,52	5,08	10,83
Darnall	0,06	0,19	0,97	2,77
Gledhow	no record	0,13	0,35	1,30
Glendale	"	0,01	Nil	Nil
Tongaat	"	0,01	0,23	4,73
Mount Edgecombe ..	"	Nil	Nil	0,03
Illovo	"	"	"	Nil
Sezela	"	"	"	0,01
Umzimkulu	"	"	"	0,03

Pre-trashing

In an insectary experiment conducted in 1978 it was found that dry cane leaves constituted a preferred oviposition site (Atkinson¹). Experiments were therefore initiated to assess the effects on eldana populations and on numbers of stalks damaged of pre-trashing the crop. Preliminary results have indicated that in most cases the eldana population is reduced and that this is frequently accompanied by a lowering in the percentage of damaged stalks, although yield is not necessarily affected. More conclusive results will become available during the next milling season.

Harvest Management

A series of seven trials, which were designed to compare the effects of different harvest practices on eldana popula-

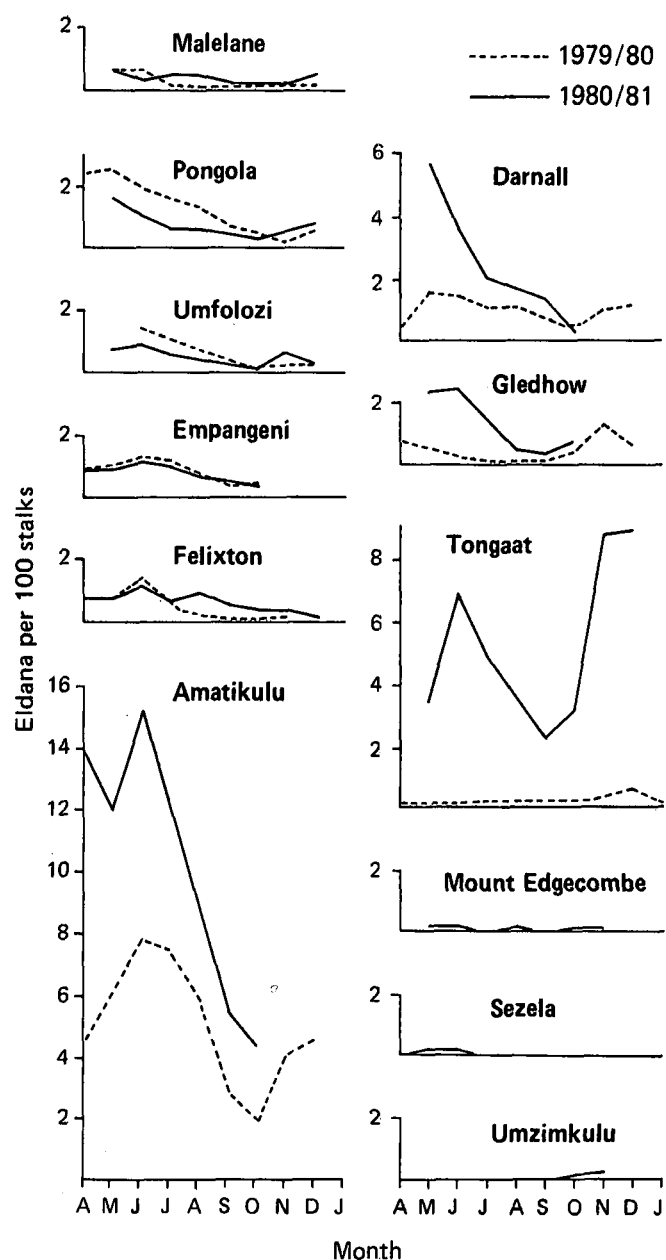


FIGURE 1 Incidence of *Eldana saccharina* Walker recorded during mill surveys in 1979/80 and 1980/81.

tions, was completed last season. At the time of harvest, one-hectare replicated plots were either trashed, burnt, or burnt and all residues subsequently removed. In the following crop monthly assessments were made of the eldana populations which developed which was done by splitting and examining 50 stalks per plot. In addition to the seven trials in Zululand, one trial was established at Mhlume in Swaziland, a region where burning is normally practiced at the time of harvest.

Only small differences were recorded in the final results, representative examples of which are shown in Figure 2. There is an indication that at harvest fields which tend to be dry should be trashed, and that fields which tend to be wet should be burnt.

Nitrogen

The numbers and fecundity of insects can increase when increased amounts of nitrogen are applied to their host plants (McNeil *et al*) and in the case of eldana it is often apparent that poorly grown cane is less heavily attacked than is well grown cane. Two trials to assess the effects of nitrogen fertilizer on eldana have been completed and the results are shown in Figure 3. In both trials numbers of eldana rose as the amount of nitrogen applied increased. Results of

surveys in commercial cane did not confirm these results and the trials therefore are being repeated on a wider range of soil types.

As a separate project and with the co-operation of the University of Natal samples of sugarcane and of indigenous host plants are being analysed for nitrogen and amino acid content, to determine whether these factors are associated with the numbers of eldana.

Varieties

All cane varieties which are commonly grown in South Africa are susceptible to eldana attacks. Some, however, do show a measure of resistance and every opportunity is taken of assessing borer numbers and damage when any variety trial in an eldana area is harvested. The results from such a trial are given in Table 2.

Field Histories

In order to reap full advantage of the very extensive mill and field surveys which have been instituted, a system was introduced whereby for each field sampled a questionnaire was completed by the grower concerned. Answers to the questionnaire provided information which included the following: crop age and variety, soil type, fertilizer, crop stage, herbicides, harvest management, nematicides, irrigation, drainage. Detailed results are filed at the Experiment Station and only an outline will be given here; but the results were less revealing than had been hoped and in some respects they conflicted with the results of field experiments.

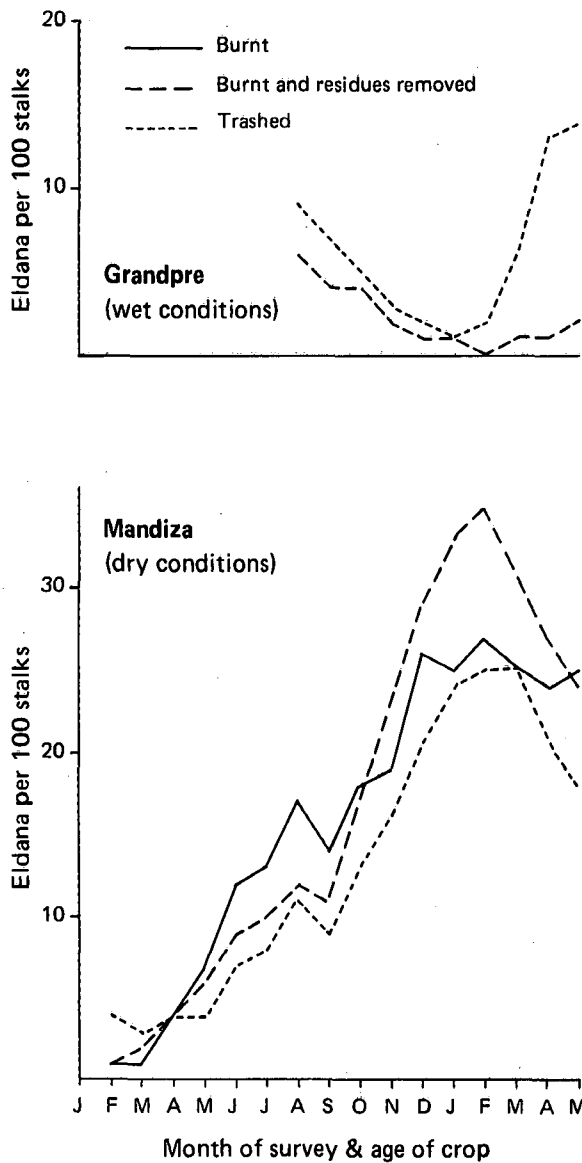


FIGURE 2 Numbers of *Eldana saccharina* Walker per 100 stalks in two harvest management trials (running 3-month means).

TABLE 2
Incidence of *Eldana saccharina* in different cane varieties (from one variety trial)

Variety	% stalks damaged		eldana larvae per 100 stalks	
	April 1979	Sep 1980	April 1979	Sep 1980
N7	23	29	8	2
NCo 376	28	53	6	9
N55/805	36	55	9	5
N11	56	58	22	9
N52/219	61	68	21	11
J59/3	66	66	30	9

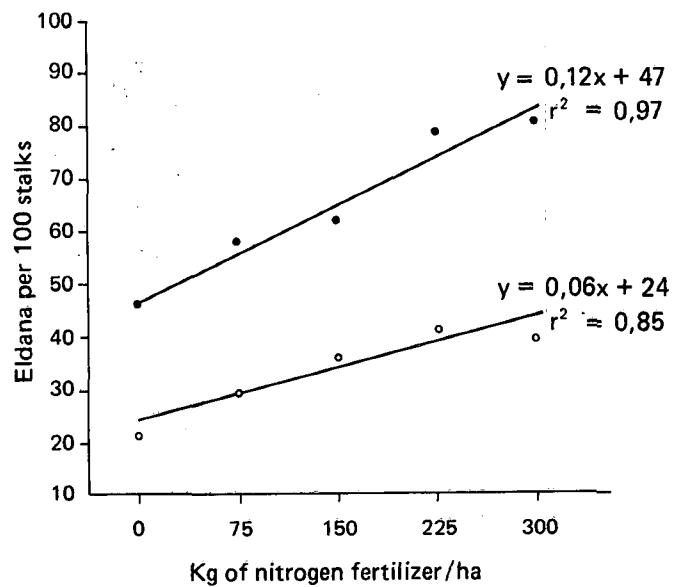


FIGURE 3 Results of two trials to show relationship between number of *Eldana saccharina* Walker and amount of applied nitrogen.

An increase in eldana numbers as cane aged (Carnegie *et al*⁵) was once again confirmed and occurred in varying degrees in all areas. The figures showed also, that regardless of cane age, seasonal peaks in larval numbers occurred, one in summer and one in winter.

Only two varieties, NCo 376 and N55/805 are grown sufficiently extensively to be fairly compared in surveys, and both were found to be readily susceptible to attack, as were all crops from plant to eighth ratoon. Cane growing on heavier soils was found to be more severely attacked than that growing on lighter sandy soils. There is no indication that numbers are influenced by applications of phosphorus or potassium.

Slightly higher numbers of eldana were recorded from fields where herbicides had been used than from untreated fields, but the differences were too small for herbicides to be identified as a cause of the problem, and numbers were often high under both conditions.

There was no evidence that eldana numbers were significantly different after burning or trashing the previous crop, nor was there any evidence that numbers were affected by irrigation, drainage or nematicide application; however information for such categories was sparse.

Population Monitoring

To extend the light trap work reported last year (Atkinson²), the light trap grid in the industry was enlarged. It now includes traps on two fire towers at a height of approximately 20 m and two traps in Malawi, where eldana is known to be present in papyrus but is not yet a problem in adjacent cane. Early this year a trap was installed in Mkuze Game Reserve in an area remote from cane and where cane has never been grown. Most traps are now operating satisfactorily and large catches are sometimes recorded, especially in good habitat areas. It is too early yet for trends in population fluctuation to be apparent.

Light traps were used also in individual experiments which involved observations in cane fields at night (Atkinson³). Activity patterns indicated that for mating a pheromone is involved, and the subject is now being further pursued as a co-operative project with Stellenbosch University.

Biological Control

Early experiments in the biological control of eldana borer have been recorded (Carnegie *et al*⁴). The most promising parasitoids were considered to be those natural parasites of eldana which are known to occur in other parts of Africa, and the opportunity was taken of sending an entomologist to West Africa for an extended period. During 14 weeks there he was able to study eldana and some of its parasitoids in both sugarcane and maize, and to despatch to Mount Edgecombe consignments of two promising egg parasites: *Telenomus* sp. (Scelionidae) and *Trichogrammatoidea eldanae* (Trichogrammatidae). For the accommodation and propagation of these and other exotic parasitoids a biocontrol unit was constructed at the Experiment Station. In it are now housed cultures of the host insects *Sitotroga cerealella* Olivier, *Phthorimaea operculella* (Zell), *Ephesia kuehniella* Zell and a culture of *Eldana saccharina*. On these host insects the following egg parasites are being reared: *Trichogramma australicum* from Taiwan, *T. pretiosum*, *T. semifumatum* and *T. perkinsi* from Colombia, and *Trichogrammatoidea eldanae* and *Telenomus* sp. from West Africa.

Candidate parasitoids will be propagated to population levels sufficiently high to warrant experimental field releases.

Initial experiments will include *Telenomus* sp., *Trichogrammatoidea eldanae* and *Trichogramma australicum*.

The use of serological methods to identify eldana predators has continued (Leslie *et al*⁶), with the recent programme employing antisera made against eggs and larval haemolymph. Over 1 000 individuals have been tested, of which about 12% proved positive. Ants and spiders have been of greatest interest although spiders have not included egg predators. Many ants are present in cane fields, some much more abundant than others, and eleven genera in particular were of interest. Tests showed that the most frequently encountered genera (*Paratrechina* and *Pheidole*) were certainly not, per individual, the most frequent feeders on eldana, but because they are so numerous they may constitute an important predatory factor. Specimens of two comparatively rare genera, *Dorylus* and *Aenictus*, were quite often found to have eaten eldana.

A comparatively high number of positive results were recorded also for Blattaria, Heteroptera and Coleoptera, all of which are among the more common arthropods of sugarcane fields.

Chemical Control

During the last five years extensive insecticide trials have been conducted against eldana in the field, but positive results have been so lacking that the trials have been recorded only in internal reports. The subject of chemical control is considered to be of such importance that a new programme of insecticide trials is now in progress. The envisaged programme will include both laboratory bio-assay experiments and field trials, and will cover the full range of potentially useful insecticides, with due consideration being given to formulation and application methods.

Discussion

With the recent general increase in numbers of eldana recorded in central and southern Zululand, the apparent stabilization indicated by results from mills in northern Zululand and the eastern Transvaal is interesting. This has come about probably because the cutting cycle in the north is shorter and because in recent years there have been fewer instances of cane standing over for lack of milling capacity. The fact that the cane is largely irrigated and less stressed probably helps also. Farther south the cutting cycle is more variable, generally longer, and there is a large area of cane of susceptible age present all the year round, with the result that there is no period during which eligible cane is largely absent. Studies in harvest management have had some interesting results, but it may be concluded that if eldana is locally abundant, cane of all varieties and under all growing conditions is liable to attack. Preliminary results from pre-trashing trials show that this practice can be advantageous, and that it may reduce numbers of eldana in the crop without causing any marked set-back to the cane itself.

It has been noted that where cane is grown habitually under conditions where nitrogen nutrition is poor, heavy eldana populations seldom develop. Trials in which controlled quantities of nitrogen were applied substantiated these observations, although extensive field surveys which took account of commercial fertilizer application in relation to eldana numbers did not. Results now are awaited of detailed analyses for amino acid content of wild host plants of eldana and of cane grown under different conditions.

There are differences in varietal susceptibility, but all our commonly grown varieties are subject to attack and to economic loss.

Little of practical value has emerged from the association of eldana survey data with historical features of the fields concerned. To the industry however, the surveys constitute an important service which is to be continued, and during the coming season more information will be gathered. It is still possible that adjustments to certain management practices might lead to a lowering of eldana numbers, but there is no single identified factor in management which may be responsible for the increase in the number of outbreaks.

Work on population monitoring has resulted in large numbers of moths being collected in light traps and there is some promise that any trends in adult movement may become apparent. Responses to pheromones also seem likely and have been sufficiently encouraging for the work to be expanded. In the recently constructed biocontrol unit host insects and a number of candidate parasitoids are being reared successfully, and experimental field releases have begun. At the same time the screening of feral eldana for local parasites continues, as does the identification of arthropod predators by serological methods. Serology is showing certain comparatively rare ant species to be much more avid eldana predators than are some of the more common ones.

The important subject of chemical control is being reassessed.

REFERENCES

1. Atkinson, P. R. (1979). Distribution and natural hosts of *Eldana saccharina* Walker in Natal, its oviposition sites and feeding patterns. *SASTA Proc* 53 : 111-115.
2. Atkinson, P. R. (1980). Light-source tests for trapping *Eldana saccharina* moths. *SASTA Proc* 54 : 151-153.
3. Atkinson, P. R. (1981). Mating behaviour and activity patterns of *Eldana saccharina* Walker (Lepidoptera: Pyralidae). *J. ent. Soc. sth. Afr.* (in press).
4. Carnegie, A. J. M. and Leslie, G. W. (1979). Attempts at the biological control of *Eldana saccharina* Walker (Lepidoptera: Pyralidae). *SASTA Proc* 53 : 116-119.
5. Carnegie, A. J. M. and Smaill, R. J. (1980). The incidence of moth borers in South African sugarcane during the 1979/80 season. *SASTA Proc* 54 : 154-157.
6. Leslie, G. W. and Boreham, P. F. L. The identification of arthropod predators of *Eldana saccharina* Walker (Lepidoptera: Pyralidae) by cross-over electrophoresis. Personal communication.
7. McNeill, S. and Southwood, T. R. E. (1977). The role of nitrogen in the development of insect-plant relationships. Biochemical aspects of plant and animal coevolution. J. B. Harborne (Ed.) Academic Press. London.
8. Smaill, R. J. (1978). Millyard surveys of the lepidopterous cane borers *Eldana saccharina* Walker and *Sesamia calamistis* Hampson. *SASTA Proc* 52 : 139-142.