# INCIDENCE AND SPREAD OF THE BORER *ELDANA SACCHARINA* WALKER (LEPIDOPTERA : PYRALIDIDAE)

By A. J. M. CARNEGIE, G. W. LESLIE and M. E. O. HINDLEY
*South African Sugar Association Experiment Station*

**Abstract**

In South Africa and Swaziland, mill yard surveys of stacked cane and field surveys have shown that the borer *Eldana saccharina* Walker is at present causing crop loss in areas north of the Tugela river, and it occurs in various indigenous host plants in many areas examined even where it is not recorded in sugarcane. Survey methods and results are discussed. Burning cane at harvest caused some suppression in numbers, but *Eldana* is found commonly in both burnt and trashed cane. The spread of *Eldana* in seed cane and in harvested cane was investigated and it was found that hot water pretreatment of seed cane destroyed the borer and preplanting dipping in Benlate and dieldrin suppressed populations. The borer was found to survive in setts at normal planting depth. It survived in cane stacked for 10 weeks after harvest.

## Introduction

The history and status quo of this pest were summarised at earlier congresses ([1,2]). After an apparent absence from the industry of about 30 years, it again caused damage in 1970 at Hluhluwe, and since then has appeared in various parts of northern Natal, the Eastern Transvaal and Swaziland. As a result of particularly heavy damage early in 1975, the work programme against this pest has been greatly intensified and is aimed at covering many aspects of its biology, ecology and control.

Of immediate concern was the regional distribution and possible spread of the pest and, while a more long term programme of research was being planned and implemented, surveys were conducted to pinpoint affected areas. These were based on the methods used earlier[1], but were modified according to the information which it was hoped to obtain.

## Mill yard surveys

These function to indicate estates which may have fields infested with *Eldana*. Such surveys are of two types:

(*a*) inspections by resident mill teams and

(*b*) inspections by teams from the Experiment Station.

The resident mill teams operate on a 24 hour shift basis continuously examining cane entering the mill. For each sample essential data are recorded on appropriate forms. The samples consist of 20 sticks of cane from any grower supplying the mill. Each stick is examined for joints bored and the following statistics are recorded: total joints bored, cane variety, burnt or trashed at harvest, *Eldana* present, absent or suspected. Any borers found are kept for identification by the Extension Officer.

Such teams operate at the 6 mills where *Eldana* may be expected viz. Darnall, Amatikulu, Felixton, Empangeni, Umfolozi and Pongola.

Inspection teams from the Experiment Station operate on the same general pattern as the resident teams, but they visit every mill in the industry, including the two in Swaziland. Twenty sticks are used as the basic sample, but each stick is more critically examined. Not only is the number of bored joints noted, but the total number of joints per stick is recorded. A 20-stick sample is removed and examined from as many consignments as time permits, and an analysis of results gives the following statistics: numbers of stalks with *Eldana*, stalks with suspected *Eldana*, stalks with more than 5% joints bored, and the maximum percentage of joints bored. From these statistics an assessment of the level of *Eldana* infestations throughout the cane belt can be made.

## Field surveys

Cases of *Eldana* recorded at the mills are followed up with field surveys on the farms concerned, which serve to confirm the mill findings and to assess accurately the extent of damage. In the infested field every fifth row is traversed and at 10-pace intervals a complete stool is examined for borings. Any borings are recorded and any insects identified. Relevant information is passed on to the Extension Officer and the grower, with recommendations for control.

## Results of surveys

*Sugarcane*

Figures obtained from mill yard and field surveys were used to draw a map showing general distribution of *Eldana* throughout the industry (Fig. 1). A feature of *Eldana* infestations has been that great variation of intensity is recorded between adjacent farms, and even between adjacent fields which may be similar in age, variety and crop.[1]

During 1975 the most adversely affected area was that between Gingindhlovu and Empangeni, although isolated heavy infestations were recorded also in other parts of northern Natal, the Transvaal and Swaziland.

It is interesting that cane in the Big Bend area of Swaziland has not yet been affected, although the insect has caused considerable damage in northern Swaziland and at Insoko in the south.

In the eastern Transvaal a moderate infestation was recorded at one farm in 1973 but it was never progressive and the insect is of no importance there at present.

At Pongola occasional heavy infestations occurred early in the season but subsequently numbers were greatly reduced, largely as a result of early milling of standover cane.

South of the Tugela river only isolated instances have been recorded, namely one insect intercepted at each of Darnall, Illovo and Renishaw mills, and no crop loss has been noted.

Figure 2 reflects the situation at 5 of the 6 mills where resident inspection teams were operating from August 1975 until the mills closed. (Only 1 *Eldana* was recorded from the area supplying Darnall Mill which is therefore not included).

With the exception of Amatikulu mill cane, the percentage of consignments with *Eldana* tended to remain static or to

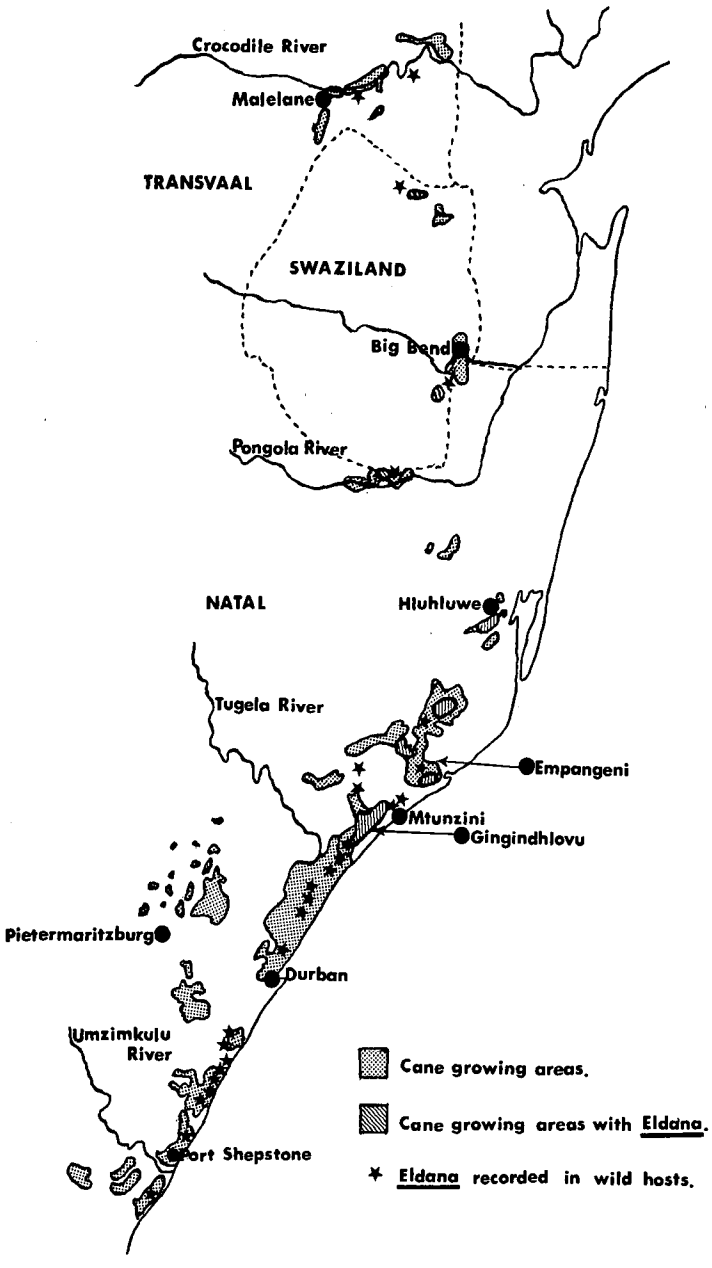


**FIGURE 1** Map of sugar industries of S. Africa and Swaziland showing points at which *Eldana* borer has been recorded.

drop as the milling season closed. At Amatikulu Mill, which is largely supplied from *Eldana* infested areas, the percentage of infested consignments rose progressively in November, December and January. A similar pattern was shown for the percentage of growers with affected cane, except that, at Amatikulu, there was less of a terminal increase than there had been for consignments.

At Pongola the high initial figure was largely the result of misidentification by an inexperienced team. Numbers remained low through the latter part of the season, although individual heavy infestations were recorded, especially in very old cane.

The present southern limit of *Eldana* infestation in sugarcane is approximately the Tugela river, and it so happens that trashing at harvest is practised more commonly south of the river than north of it, where burning is more common. This has provoked the opinion that *Eldana* populations are encouraged by burning. A further analysis therefore was made of figures from mills which received both trashed and burnt cane, the results of which are shown in Fig. 3. In all cases trends were similar with no indication that either practice had had any marked influence on *Eldana* numbers.

## Spread of infestation

*Natural dispersion*

Under natural conditions it is the function of the moth to distribute the species. The caterpillar is very active within its host plant but will not normally migrate from one plant to another unless its food supply should fail. Observation suggests that the moths are not very active fliers, and that after emergence they do not necessarily move far from the cocoon before they mate and lay eggs. This may help to explain why adjacent fields may support populations at very different levels.

Fourteen alternate host plants are listed by the Commonwealth Institute of Biological Control.[3] Eight of these are weeds which are common in our sugarcane areas, and to this list the Mount Edgecombe Experiment Station has added several other species. The areas in which *Eldana* have been recovered from wild host plants are shown in Fig. 1, and it can be seen that *Eldana* occurs in many parts of the cane belt even where it is not yet causing crop loss in sugarcane. Therefore, although it may take some time to develop a preference for sugarcane as a host plant, its eventual spread from wild hosts into sugarcane is easy to envisage.

*Passive transportation*

Although, under natural conditions, only the moth will spread an infestation, it is quite possible for eggs, larvae and pupae to be transported on cut sugarcane from one area to another with the same result. This would be expected to occur mainly in seed cane or millable cane.

*Seed cane*

When cane is cut for seed it is usually transported with all trash intact so that the buds may be protected. This means that in addition to any borers which may continue feeding within the sticks, both eggs and pupae may survive on trash and may eventually serve to infest cane fields in the vicinity of the new planting.

*Survival in planting setts*

It had been assumed that once the setts were stripped and planted any borers within them would die. However, when infested setts were planted in an insectary at several depths, and records were kept of germination and of borer survival it was seen that, at normal planting depths, a few borers survived.

In an insectary experiment, 4 cells 2m x 2m x 3m tall were planted with heavily infested setts of mixed varieties, 15 setts to a cell. It was estimated that approximately 50 borers in setts were buried in each cell at depth of 4, 10, 16 and 24 cm. Daily records were kept of frass workings appearing on the soil surface and of germinating shoots, and any frass working was covered with a small bottomless gauze cage in which the emerging moth was caught.

Results are shown in Table 1. Borers survived at depths of 4 cm and 10 cm but not at greater depths, at which germination was very poor. No frass appeared above the soil until the 14th day after planting, but a new frass hole appeared even after 60 days. Six adults were recovered as follows: Cell 1, 3 females after 45 days and 1 male after 52 days; Cell 2, 2 females after 45 days. This is a very low rate of survival, but under field conditions the survivors could serve to spread an infestation.

*Hot water treatment*

As a control measure for ratoon stunting disease, seed cane may be immersed in water at 50°C for 2 hours. The effects of similar treatment on *Eldana* were investigated in two experiments at Mt. Edgecombe and at Mtunzini.

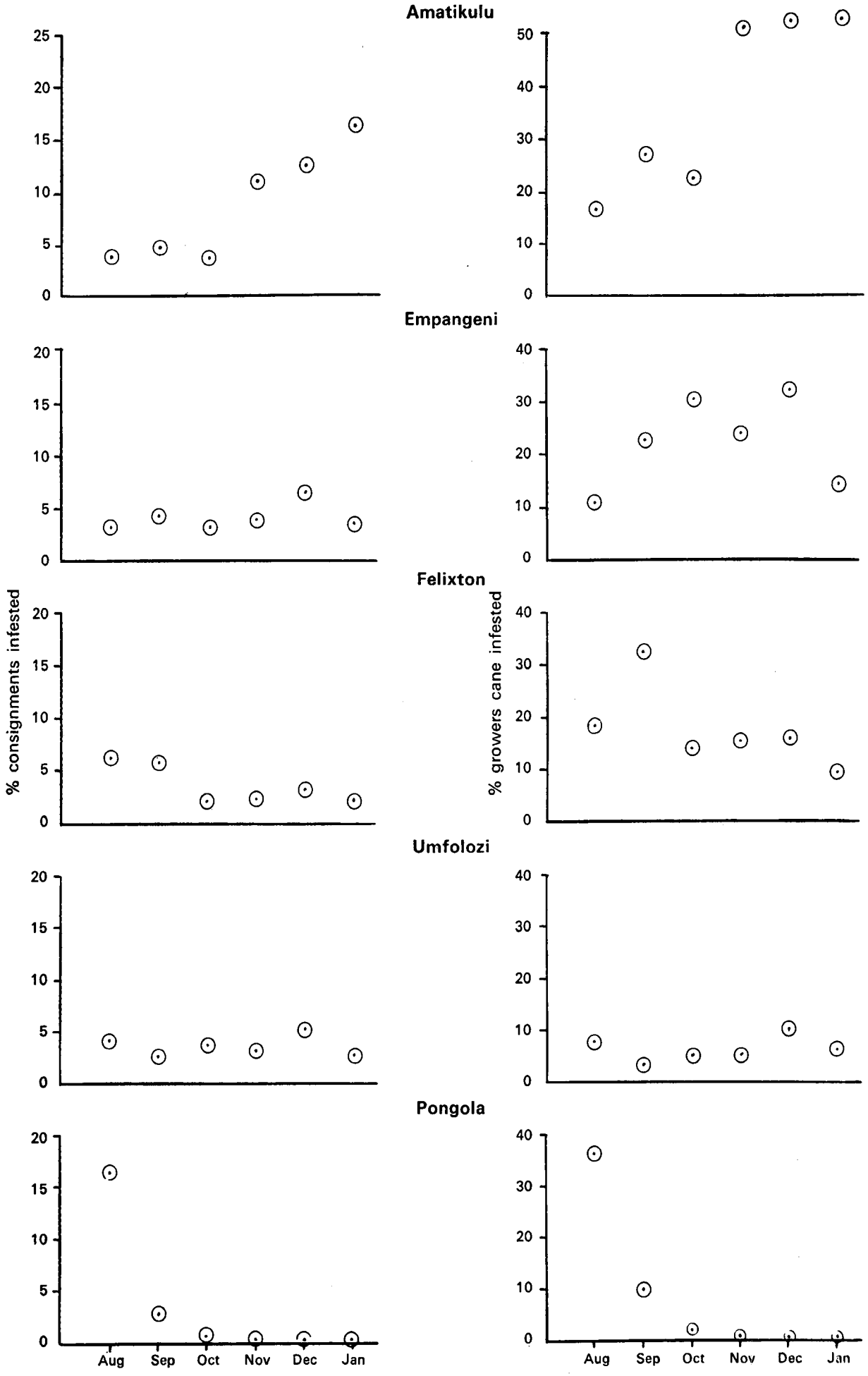


**FIGURE 2** Level of *Eldana* infestation in cane sampled at 5 mills.

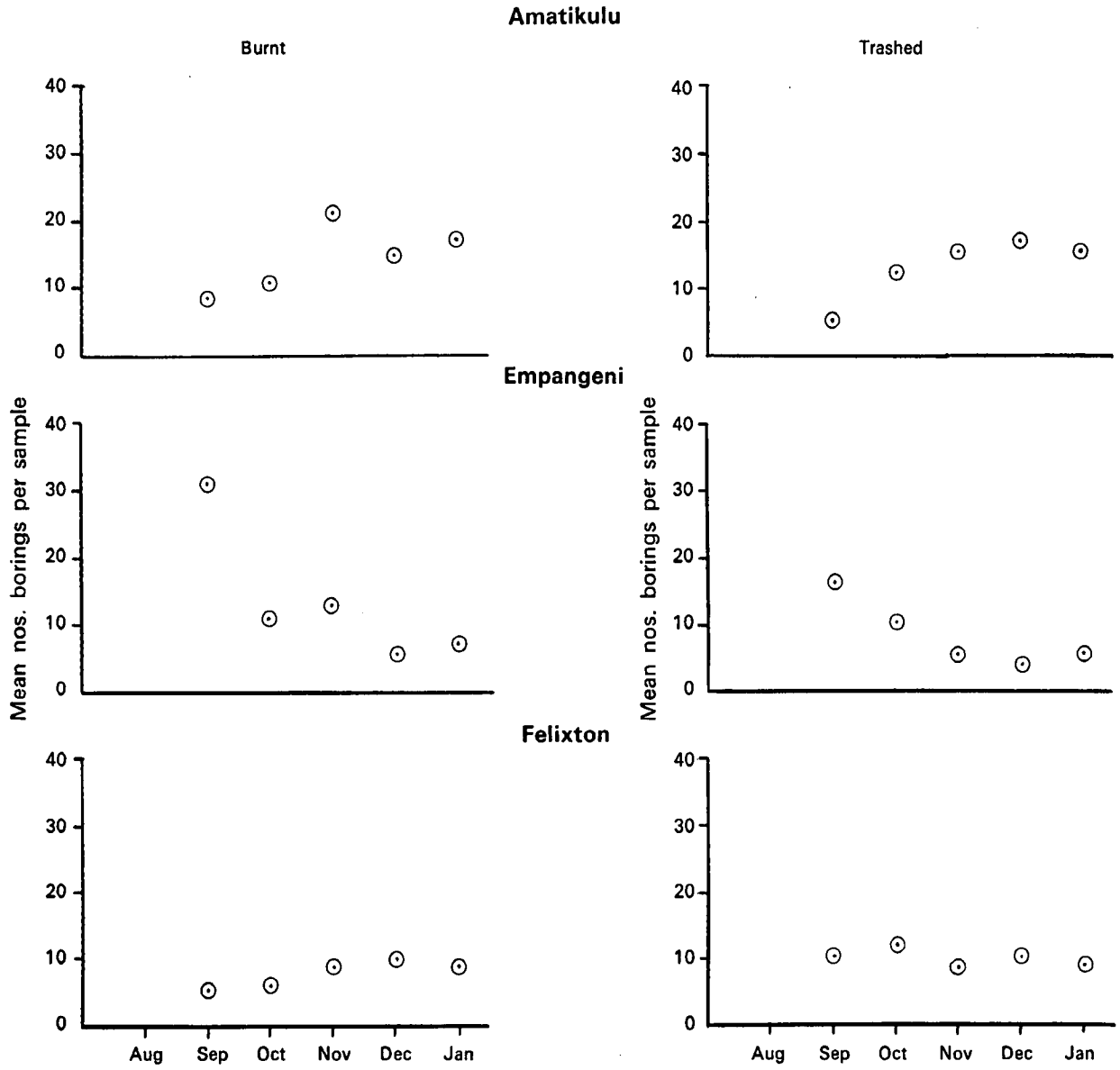


**FIGURE 3** Mean numbers of borings in trashed and burnt cane sampled at 3 mills.

TABLE 1

*Eldana* **survival and germination rate from cane setts planted at different depths**

| Days after planting | Planting depth | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 4 cm | | 10 cm | | 16 cm | | 24 cm | |
| | No. of shoots | No. of frass holes | No. of shoots | No. of frass holes | No. of shoots | No. of frass holes | No. of shoots | No. of frass holes |
| 14 | 7 | 2 | 3 | – | – | – | – | – |
| 20 | 28 | 3 | 14 | – | 1 | – | – | – |
| 25 | 38 | 3 | 19 | – | 5 | – | – | – |
| 30 | 45 | 3 | 23 | 2 | 6 | – | – | – |
| 35 | 46 | 4 | 23 | 2 | 9 | – | 6 | – |
| 40 | 46 | 4 | 25 | 2 | 9 | – | 10 | – |
| 45 | 47 | 4 | 25 | 2 | 11 | – | 11 | – |
| 50 | 50 | 4 | 25 | 2 | 11 | – | 12 | – |
| 55 | 50 | 4 | 26 | 2 | 11 | – | 13 | – |
| 60 | 51 | 4 | 28 | 3 | 11 | – | 13 | – |
| 65 | 53 | 4 | 29 | 3 | 11 | – | 13 | – |
| 70 | 53 | 4 | 29 | 3 | 11 | – | 13 | – |
| 75 | 53 | 4 | 30 | 3 | 11 | – | 13 | – |
| 80 | 53 | 4 | 30 | 3 | 11 | – | 13 | – |
| 85 | 55 | 4 | 30 | 3 | 11 | – | 13 | – |
| 90 | 55 | 4 | 30 | 3 | 11 | – | 13 | – |
| 95 | 55 | 4 | 31 | 3 | 11 | – | 13 | – |
| 100 | 55 | 4 | 31 | 3 | 11 | – | 13 | – |

(1) Heavily infested cane from Mtunzini was separated into 4 bundles containing an estimated 60 borers each. Two bundles with adhering trash were immersed in the hot water tank at 50°C for 30 minutes, after which they were split open and examined. All larvae were dead. Four pupae were encountered and cultured, but no adults were obtained. Survival of larvae and pupae in the untreated bundles was normal.

(2) At Mtunzini 200 sticks were taken from a badly infested field. One hundred of these with trash were immersed in water at 50,5°C, after which they were split open and examined. There were 46 dead larvae and three dead pupae, but no survivors. The untreated sticks contained 76 live larvae, 5 live pupae but no dead borers.

In the laboratory, eggs similarly treated failed to hatch, while untreated eggs from the same batch hatched normally.

*Preplanting chemical dipping*

As a further control measure against fungi and soil insects, cane setts may be dipped in a mixture of fungicide and insecticide before planting. The effects of this treatment on *Eldana* were investigated in the insectary.

Setts infested with *Eldana* were divided into 2 approximately equal piles, so that there were 156 borer holes in each pile. One pile was dipped into a mixture containing dieldrin at 2,0 g/l and Benlate at 0,75 g/l water, before planting in an insectary cell. The untreated pile of setts was used to plant an adjacent cell.

Results are shown in Table 2. There was some survival of borers in the treated setts until after the fortieth day but no adults were recovered. In the untreated cane, borer activity was noted until after the sixtieth day and three adults emerged through the soil.

TABLE 2

***Eldana* survival in cane setts treated with dieldrin and Benlate before planting**

| Days after planting | Treated | | Untreated | |
|---|---|---|---|---|
| | Frass holes | Moths | Frass holes | Moths |
| 10 . . . | – | – | 1 | – |
| 20 . . . | 2 | – | 4 | – |
| 30 . . . | 2 | – | 4 | 1 |
| 40 . . . | 2 | – | 6 | 1 |
| 50 . . . | – | – | 7 | 1 |
| 60 . . . | – | – | 7 | – |
| 70 . . . | – | – | – | – |

*Millable cane*

Since it is possible for *Eldana* to be passively transported in millable cane an experiment was conducted to investigate how long the insect can survive in cane after harvest.

Mature cane was used from a heavily infested Mtunzini field, a part of which was burnt before harvesting. Eight cane stacks, each containing 100 sticks, were made from each of the burnt and unburnt areas. Starting immediately after harvest and thereafter at approximately 4 day intervals all cane in one stack was split and the numbers of larvae, pupae and adults were recorded.

At the same time two stacks containing 800 sticks of either burnt or unburnt cane were enclosed in 2 large gauze cages 3m x 3m x 2m high. These cages were examined each day for moths and, after 5 weeks, 100 sticks from each cage were split and examined for larvae pupae and adults at approximately 4 day intervals.

Results are shown in Table 3, A and B.

No adults were noted during daylight or evening inspections of the large field cages in which the two bundles of 800 sticks each were stacked. Since numbers of pupae, particularly in the

TABLE 3

***Eldana* survival in burnt and unburnt cane after harvest**

**A. Cane stacked in the open**

**B. Cane stacked in gauze cages**

| | Days after harvest | BURNT | | | | | | UNBURNT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Larvae | | Pupae | | Adults | | Larvae | | Pupae | | Adults | |
| | | alive | dead | alive | dead | alive | dead | alive | dead | alive | dead | alive | dead |
| A | 0 . . . . . | 28 | 3 | 2 | – | 1 | – | 26 | 3 | 3 | – | – | – |
| | 4 . . . . . | 15 | 3 | 1 | 1 | – | – | 43 | – | 5 | – | – | – |
| | 8 . . . . . | 26 | 2 | 1 | 2 | – | – | 23 | – | 4 | – | – | – |
| | 11 . . . . . | 57 | 1 | 1 | 3 | – | – | 79 | – | 2 | – | 1 | – |
| | 15 . . . . . | 139 | 1 | 1 | 3 | – | – | 54 | – | 3 | – | – | – |
| | 21 . . . . . | 92 | 1 | 4 | – | – | – | 102 | – | 5 | – | – | – |
| | 25 . . . . . | 68 | 1 | 4 | – | – | – | 174 | – | 4 | – | – | – |
| | 29 . . . . . | 71 | – | 2 | – | – | – | 151 | 6 | 12 | 1 | – | – |
| Total | | 496 | 12 | 16 | 9 | 1 | – | 652 | 9 | 38 | 1 | 1 | – |
| B | 43 . . . . . | 104 | – | 10 | – | – | – | 226 | – | 28 | – | – | – |
| | 48 . . . . . | 104 | – | 9 | – | – | – | 271 | – | 50 | – | – | – |
| | 52 . . . . . | 98 | – | 24 | – | – | – | 215 | – | 40 | – | – | – |
| | 56 . . . . . | 55 | – | 20 | – | – | – | 187 | – | 43 | – | – | – |
| | 59 . . . . . | 62 | – | 19 | – | – | – | 127 | – | 46 | – | – | – |
| | 63 . . . . . | 64 | – | 25 | – | – | – | 141 | – | 43 | – | – | – |
| | 66 . . . . . | 84 | – | 40 | – | – | – | 79 | – | 23 | – | – | – |
| | 70 . . . . . | 53 | – | 23 | – | 1 | – | 31 | – | 13 | – | – | – |
| | 73 . . . . . | 51 | – | 25 | – | – | – | 34 | – | 11 | – | – | – |
| Total | | 675 | – | 195 | – | 1 | – | 1 311 | – | 297 | – | – | – |

unburnt stack, fell towards the end of the period, adults probably emerged but their cryptic habits hid them from view.

There was considerable survival of immature stages in both burnt and unburnt stacks. In the caged bundles numbers fell during the course of the experiment, but there were considerable numbers of both larvae and pupae even after 73 days of isolation. For the period of a month during which the 8 exposed stacks were examined, numbers in the unburnt stacks tended to increase, and included very small larvae. This suggests that adults from an adjacent field had flown to the bundles and laid eggs or that emerging adults relaid in the same bundles. In all cases survival of larvae and pupae was greater in unburnt than in burnt cane.

In theory, therefore, it would be easy for *Eldana* larvae and pupae in harvested cane to survive in mill yards and loading zones long enough to produce adults, which could mate and lay eggs in adjoining cane fields.

## Discussion and conclusions

The results of surveys and available records suggest that *Eldana* is an indigenous insect which, in some areas, has become established in sugarcane in which it thrives. In our cane fields it is restricted at present almost entirely to areas north of the Tugela river, in some of which it is worse than in others. It is quite commonly found in indigenous hosts in areas where it is not damaging sugarcane, although it has not yet been found in higher altitude areas of the midlands. Whether or not it will spread into sugarcane in these areas remains to be seen.

Its presence becomes more evident once the cutting season starts, and it may appear worse at the beginning of the season because of the relatively larger numbers in older cane.

Although it is not particularly abundant in cane fields adjoining mill yards or loading zones, the possibility of its being transported in millable cane exists, and there should be minimum delay between cutting and milling. It can be transmitted also in seed cane, but is killed by normal hot water treatment and greatly suppressed by chemical dipping before planting. It cannot be assumed that burying untreated setts at normal planting depth will kill *Eldana*.

## Acknowledgements

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