

Control of White Grubs *Adoretus emarginatus* Ohaus and *Heteronychus licas* klug (coleoptera: Scarabaeidae) in Sugarcane

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Abstract White grubs *Adoretus emarginatus* Ohaus and *Heteronychus licas* Klug are beetles belonging to (Coleoptera: Scarabaeidae) sited among the serious subterranean pests of sugarcane *Succharum officinarum* L. (Graminae) in The Kenana Sugar Farm in Sudan. In this study, previous work on chemical control and population dynamic of the pest is reviewed. Field experiments and surveys were maintained for the two consecutive seasons (), in Kenana sugar farm targeting the white grubs as pests of the cane crop. Two concentrations from each of the three chemicals insecticides namely Dursban, Regent and Tafaban Chlorpyriphos, were tested for their efficacy against the white grubs. Tafaban 1L. /fed gave the best efficacy against the white grubs with average number of dead grubs (17.467 ± 1.4430).

Keywords: white grubs, control, sugar cane, Kenana, Sudan

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1. Introduction

Sugarcane *Saccharum officinarum* L. (Gramineae) is an important field crop as far as cane sugar industry in Sudan is concerned. The crop is widely grown in the Tropics and Sub-Tropics especially in the Caribbean islands, Latin America, Africa, South-East Asia and elsewhere in the World. In Sudan there, five sugar factories had been established. Kenana is the largest sugar factory in Africa [1] Insect pest, among other factors, are considered as one of the main problems that reduce average productivity per unit area. Among the most important insect pest of sugarcane are scarabid beetles like *Adoretus emarginatus* Ohaus and *Heteronychus licas* Klug. Which are commonly known as white grubs. They are the most serious pests of sugarcane. The beetles have three larval instars with the third instar causing the greatest damage. These larvae are generally found immediately beneath cane stools in infested fields. Normally, only cane roots are eaten by the grubs, although, in some cases the base of the cane stalks is also eaten and larvae may tunnel into it. Infested cane shows signs of water stress and lodging occurs in severely infested cane, and the crop may be deteriorating to such a degree that harvesting becomes uneconomic. In northern Tanzania white grubs had been observed to reduce yield from 125 tons/ha of plant cane and 60 tons/ha of ratoon crop, to an average of 50 tons/ha in both plant cane and ratoon crop [2]. The two species of the white grubs are widely distributed around the world. For instant, *H. licas* is mainly distributed in east, west and

South Africa. Many authors reported this species as a serious pest of sugarcane, grasses, yam, swamp rice, maize, wheat, barely and natural pasture [3-10]. In India and South East Asia, *H. licas* is reported by some authors as a pest of sugar-cane and potato [11,12,13]. *Adoretus emarginatus* Ohaus is distributed in east and South Africa and reported to attack sugarcane, leaves of cacao, grasses, some legumes and tobacco.

Flight time starts about (40 min.) after sunset during the grand flight period between November and January in Mauritius, but is much shorter, about (40 min.), at the start in October and towards the end in February; the lasts about two hour. *Heteronychus licas* is a nocturnal flier. There are two flight seasons during generation in Nigeria. The first lasts from April to June and is a primary flight of the new generation adults. The second usually occurs in late October and November and is distinctly a pre-reproductive flight; females caught at this time had well-developed ovaries and oviposited readily when kept in moist soil. [4,10,14]. The adults of *H. licas* feed on new shoots just below the ground level, destroying the growing point and causing the central heart or the whole shoot to wither and die. Such damage is readily visible in young ratoon cane (2-3 weeks) after harvest. The beetles are subsequently capable of completely destroying the primary diminish as the shoots got older, because the growing points are then above the ground and the beetles rarely right though the stem causing the litters to die back. For this reasons it was at first believed that the damage was confined to young tillers in late season crops. Beetles are active feeders on cane of all ages, boring into both

young and mature stalks and leaving a hole (0.01-0.15 m) in diameter at the base of stalk leading in to an enlarged chamber. Cane damaged in this way does not die, but injury causes serious growth check and loss of uniformity, which is generally the only indication of beetle activity until the stools are inspected below ground level [6]. Damage caused by larvae, while the main food of the first instars larvae is organic matter in the soil, the second instars, as grows, feeds progressively more on green plant material, while the third instars feeds voraciously on the host plant.

The chemical control of *Heteronychus* spp., and other sugarcane beetles has largely been successful with the introduction of dust formulation of BHC and other soil insecticides. Aldrin (2.5%), dust, which has already been used gave a satisfactory control. It could be applied at planting by a duster mounted on a tractor so that the cane sets are dusted in the furrow and then covered up the plough in one operation. At the rate of (1-2 1b/ha), on such heavy soils, the persistence of aldrin would ensure a high mortality of both larvae and adults for over six months [10]. There were reductions in the numbers of grubs treated by granular insecticides of Sevidal 8% 40 kg/fed, Diazonon 10% gram. 20 kg/fed, Diazinon 5% gram. 35 kg/fed, Lindane 5% gram. 35 kg/fed, Gardona 5% gram. 30 kg/fed, [15]. *Heteronychus licas* the soil treatment at the time of plating is the only practical means of applying insecticide to the main feeding zone to control *H. licas*. Insecticides can be applied either as a 50% W.P. or 15% E.C. at the rate of 2 kg/ha. a.i. sprayed in a band over the planting furrow before the sets are covered back [6]. Control of the beetle during feeding activity in the bushes and on trees was attempted with BHC and D.D.T (0.25 percent suspension) [16]. Isofenphos 10 g at 20 kg /ha., applied in furrow at the base of the sugarcane crop gave the best control of grubs and Quinalphos 5 g at 20 kg/ha, gave the best result [17]. Bendiocarb has been reported to have excellent activity against many species of white grubs [18]. Several insecticides applied at the soil against were compared white grubs, Telodrin (Isobenzan) at 2.3 kg.a.i./ha, was the most effective [19]. *Heteronychus licas* and *Adoretus fuscatus* has been associated with damage to sugarcane in South Africa. Trials of insecticides including aldicarb, chloryrifos, carbosulfan isozofos and ethoprophos suppressed number of white grubs in the soil [20]. *Heteronychus arator* controlled with carbosulfan 25% EC at 125 cm³/100 m, and Landine in granules had some merits as a curative measure. Although treatments applied in liquid form on to the soil surface or into the planting furrow gave substantially inferior results compared with granular treatments. Carbosulfem EC was one of the more effective insecticides [21]. Several insecticides tested with the same varieties of cane crop, Carbofuran at 2 kg/ha, applied to furrow and incorporated, gave the best control of *Heteronychus* spp. [22]. Lindane 5% granules at 200 g/100 m and chloryrifos 3% granules at 240 g/100 m gave outstanding control of *Heteronychus* on maize in South Africa [23,24].

2. Materials and Methods

Sugarcane field (ratoon crop number five) infested with white grubs was selected to evaluated the performance of

three insecticides viz: Chloryrifos (Dursban) 480 EC, Chloryriphos (Tafaban) 48% EC and Phenylpyrozole (Regent) 200 SC. Two concentrations from each of the mentioned insecticides were applied to have the following six treatments in addition to the untreated control:

Chloryrifos (Dursban) 480 Ec at rate of (480 g a.i./fd(0.42ha)).

Chloryrifos (Dursban) 480 EC at rate of (720 g a.i./fd).

Chloryriphos (Tafaban) 48% EC at rate of (480 g a.i./fd).

Chloryriphos (Tafaban) 48% EC at rate of (720g a.i./fd).

Phenylpyrozole (Regent) 200 SC at rate of (50 g a.i/fd).

Phenylpyrazole (Regent), 200 SC at rate of (75 g a.i/fd).

The experimental design used was a Randomized Complete Block Design with three replicates. The plot size was two furrows 1.55 meter a part and 50 meter long, then plot area 50m x 3.1 m. The standard cultural practices adopted in Kenana Sugar Company were followed. Insecticides sprayed using (acp3 lever) pre pressurized nap-sack sprayer at an application rate of 80 L./fed. The plots were irrigated immediately after treatment application. Pre-spraying count of white grubs was made three days before spray. Three pits of 1m x0.5mx 025m each were made in each plot one month after spraying and white grubs were counted. A comparison between the counts before and after spraying was made and accordingly the efficacy of each chemical was determined.

3. Results and Discussion

In these field tests two different concentrations from each of the three chemical insecticides namely chlorpyriphos (Dursban 480 EC) chlorpyriphos (Tafaban 48% EC) and phenylpyrazole (Regent 200 SC) were applied were against the white grubs *Adoretus emarginatus* Ohous, and *Heteronychus licas* Klug. The six treatments were chlorpyriphos (Dursban 480 EC) at 1.0 L/fed and 1.5 L/fed, chlorpyriphos (Tafaban 48% EC) at 1.0 L/fed and at 1.5 L/fed and phenylpyrazole (Regent 200 SE) at 0.250 L/fed and at 0.375 L/fed

Table 1. shows the mean numbers of dead white grubs in each treatment during season (2000/01). The results showed that the chlorpyriphos (Tafaban and Dursban) were more effective for control white grubs compared with phenylpyrazole treatments.

Table 1. Mean number of dead white grubs *Adoretus emarginatus* and *Heteronychus licas* after one month from spraying with control agent under field condition in Kenana Sugar Farm, season (2000/01)

Control Agent	Mean*
Chlorpyriphos (Dursban 1.0 L/fed)	11.300 B
Chlorpyriphos (Dursban 1.5 L/fed)	13.800 AB
Chlorpyriphos (Tafaban 1.0 L/fed)	15.300 AB
Chlorpyriphos (Tafaban 1.5 L/fed)	17.467 A
Phenylpyrazole (Regent 0.250 L/fed)	10.967 B
Phynypyrazole (Regent 0.375 L/fed)	11.300 B
Control	0.867 C

S.E ± 1.4430

*Means within the same column followed by the same letter(s) are not significantly different at p<0.05.

In the second season (2001/02) the results (**Table 2**) showed that the mortality rate of white grubs increased with increased the concentration of insecticide. The highest numbers of dead white grubs (17.3) were obtained under the treatment of Chlorpyriphos (Tafaban 480 EC) at rate of 1.5 L/fed.

Table 2. Mean number of dead white grubs *Adoretus emarginatus* and *Heteronychus licas* after one month from spraying with control agent under field condition in Kenana Sugar Farm, Season (2001/02)

Control Agent	Mean
Chlorpyriphos (Dursban 1.0 L/fed)	11.933 ^a
Chlorpyriphos (Dursban 1.5 L/fed)	13.300 ^a
Chlorpyriphos (Tafaban 1.0 L/fed)	15.333 ^a
Chlorpyriphos (Tafaban 1.5 L/fed)	17.233 ^a
Phenylpyrazole (Regent 0.250 L/fed)	13.200 ^a
Phynypyrazole (Regent 0.375 L/fed)	12.433 ^a
Control	1.067 ^b
S.E. ±	1.7457

Means within the same column followed by the same letter(s) are not significantly different at $p < 0.05$.

Results of the combined analysis of data of dead white grubs were 17.350, 15.317, 13.550, 12.083, 11.867, 11.617 and 0.967 for Chlorpyriphos (Tafaban 480 EC) at 1.5 L/fed, chlorpyriphos (Tafaban 480 EC) at 1.0 L/fed, chlorpyriphos (Dursban 48% EC) at 1.5 L/fed, phenylpyrazole (Regent 200 SC) at 0.250 L/fed, phenylpyrazole (Regent 200 SC) at 0.375 L/fed, (Dursban 48% EC) at 1.0 L/fed and control, respecting the orders of different treatments. (Table 3).

Table 3. Mean number of dead white grubs *Adoretus emarginatus* and *Heteronychus licas* after one month from spraying with control agent under field condition in Kenana (combine analysis for the two seasons 2000/2001 and 2001/2002)

Control Agent	Mean
Chlorpyriphos (Dursban 1.0 L/fed)	11.617 ^c
Chlorpyriphos (Dursban 1.5 L/fed)	13.550 ^{bc}
Chlorpyriphos (Tafaban 1.0 L/fed)	15.317 ^{ab}
Chlorpyriphos (Tafaban 1.5 L/fed)	17.350 ^a
Phenylpyrazole(Regent0.250 /fed)	12.083 ^{bc}
Phynypyrazole(Regent0.375 /fed)	11.867 ^{bc}
Control	0.967 ^d
S.E. ±	1.105

Means within the same column followed by the same letter(s) are not significantly different at $p < 0.05$.

A very high significant different ($P < 0.05$) among the different treatment of the tested control agent in both seasons (2000/2001 and 2001/2002) were obtained when Duncan's mean comparison was run (Appendix 1 and 2) shows the analysis of variance of respective seasons. Analysis of variance combines of two seasons show very high significant difference ($P < 0.05$) among different treatments of insecticides trial.

The results of the screening of chemicals insecticides against the white grubs performed during the course of this study are clearly indicating that Chloropyriphos (Tafaban 48% EC) was the best chemical control agent. The tested concentrations of this insecticide gave the highest average numbers of dead white grubs in comparison with the other investigated insecticides throughout the two seasons. Screened control agents. Comparing the performance of the tested Tafaban 48% EC concentrations, plots treated at 1.5 L/fed gave highest number of dead white grubs than Tafaban 48% EC applied at 1.0 L/fed. Tafaban 48% EC was followed by Dursban 480 EC applied at 1.5 L/fed. The lowest numbers of dead white grubs were obtained from plots treated with Phenylpyrazole (Regent 200 SC) at 0.250 L/fed and 0.375 L/fed. These results are in line with the results reported earlier by Carnegie [9] who indicated that Chloropyriphos is superior, in efficacy against white grubs, to some other insecticides. Accordingly, he concluded that white grubs populations could be suppressed in the soil when Chloropyriphos is applied in South Africa Moreover, Drinkwater [23] and Kakar *et al.*, [24], they separately

reported that Chloropyriphos is already in use against the white grubs in South Africa and in Zimbabwe especially in field of maize crop

4. Conclusions

The results of the screening of chemicals insecticides against the white grubs are clearly indicating that Chloropyriphos (Tafaban 48% EC) was the best chemical control agent. The tested concentrations of this insecticide gave the highest average numbers of dead white grubs in comparison with the other investigated insecticides.

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