International Journal of Animal Biology
Vol. 1, No. 4, 2015, pp. 106-109
http://www.aiscience.org/journal/ijab

Impact of the Sesame Seed Bug (*Elasmolomus sordidus*) on Damaging Sesame Seeds

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Abstract

The increased activities in sesame production in the Sudan have led to an interest in studying the pests of economic importance of sesame crops. Four sesame varieties each contained about 50% oil averages were found significantly affected by the sesame seed bug. The influence on the quality and quantity of the sesame oil for domestic consumption and export was assessed. Five levels of infestation 0, 15, 30, 45 and 60 days were used. Results indicated that the highest crop loss was obtained with 60 days of infestation; the weight loss reached an average of 13% while the loss of oil content was almost 50% of the control. The free fatty acids assessed as oleic acid, reached an average of 20%, also the fatty acids were affected. The study showed clearly that the sesame seed bug is now becoming a serious problem and limiting considerably the production of sesame and it is though time to give more attention to the control of this bug by adopting special integrated pest management program in the Sudan.

Keywords

Insect Pest, Oil Quality, Oil Quantity, Sesame

Received: June 15, 2015 / Accepted: June 17, 2015 / Published online: July 7, 2015

1. Introduction

Sesame (*Sesamum indicum* L.) is one of the major oil seed crops grown in the Sudan. Sudan is one of the main sesame producing countries in the world [1]. Many factors affected sesame production in the Sudan, of these insect pest attacks. The lygaeid bug *Elasmolomus sordidus* is currently considered as major post-harvest pest which threatens production in the field and during storage [2], [11]. In the Sudan this insect pest inhabits mainly the central clay lands; which are the major sesame producing areas, besides the sands of the Western states of the country. The main possible causes for emergence of the sesame seed bug; *Elasmolomus sordidus* problem are: the great expansion in the area under sesame, the cultivation of so many sesame varieties; the intensification of rotation, delaying the sesame sowing date and the destruction of the natural predators and parasitic fauna through an increased unwise application of insecticides to control pests [2].

Many authors earlier recorded this pest on groundnut in Africa and Asia [3], [4], [5], [6]. They mentioned that loss in weight, oil content and yield resulted on ground nut seeds if infestation is prolonged. The problems of sesame pests have assumed great importance in recent years particularly the sesame seed bug problem. Although it is so many years since Hassan [2] reported a valuable study on biology and ecology and assessment the damage of this pest, the knowledge regarding this serious pest of oil seed crops has remained very much the same and has, hitherto, received little attention. If the set policy to increase sesame production both horizontally and vertically are to be fulfilled the sesame seed bug problem which constitute one of the main hurdles for production has to be resolved. Hence, attempts under way to bridge the gaps at different levels to raise sesame production.

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The significance of the sesame seed bug is reviewed and hoped to contribute towards this end through assessment of the damage caused.

2. Materials and Methods

2.1. Sampling

Field work was meant to detect the response of sesame varieties to the sesame seed bug attack, and to assess the damage caused. Four sesame varieties namely Local (red colored seed); Kenana 1(late shattering capsules) white colored seeds; Zira 9 (grayish colored seed) and Zira 7 (white colored seeds) were sown at Sim Sim National Rain fed Agricultural Development Centre, Gedarif state, Sudan. Assessment of susceptibility and the damage of sesame seed bug in the field at harvest were studied. Natural population of sesame seed bug was allowed to build up. The first harvest of each of the four varieties were collected and kept as control. After infestation four samples were taken at random from each of the four sesame varieties in fortnightly intervals and this continued for two months. From each sample obtained 100 seeds after drying counted and weighed from the first harvest (uninfected) of each of the four varieties and used for further investigation.

2.2. Laboratory Analyses

2.2.1. Weight Losses of Sesame Seeds

Four random samples were taken every fifteen days from the four varieties under experiment .Moisture equilibration was achieved by sun drying. Hundred seeds of each infested sesame var. were exactly weight with a sensitive chemical balance (Moke) .The shriveled seeds segregated, counted and weighed, and then % loss in weight calculated using the formula:

W/t X100=loss percentage

- W =Weight of infested sesame seeds (g)
- t =Total weight of 100 sesame seeds

2.2.2. Oil Content Losses

Five harvests each of the sesame varieties were obtained from the field naturally infested with the seed bug. The first harvest kept healthy away from the seed bug attack. The other four harvests collected from infested sesame plots in fortnightly intervals and this continued for two months. The samples were maintained for three days after harvest under equal condition to equilibrate moisture condition. The oil content was determined by Soxhlet extraction apparatus using International Union of Pure and Applied chemistry Method [5]. The method involved extracting oil from the product with petroleum ether B.P.40- 60°C in Soxlet apparatus for 6 hours. The oil obtained was oven dried at 103 ± 2°C. The procedure was repeated until constant weight of oil was obtained. Initially the receiver was weighed (W1) g, and then 5 grams of the sample were put in the thimble and covered with cotton, then the thimble was put in the extraction tube and switch on and finally the receiver was weighed (W2) g. the establishment of % oil was calculated using the formula:

Oil content% = W_2-W_1/S X100

Where: W1= initial weight of receiver .W2 = final weight of receiver.

S=Sample weight.

2.2.3. Free Fatty Acids (FFAs) Test

Sesame oil obtained by Soxlet extraction from four sesame varieties was tested for FFAs. The FFAs of each oil was compared with international standard for edible sesame seed oil which are: 0.6 mg KOH/gram of oil and/or 0.3%as oleic Acid for virgin oil (first class oil), and 4mg KOH/gram of oil and/or 2%as oleic Acid for non virgin oil (second class sesame oil) [7]. After procedure the establishment of % was calculated using the formula:

V X 0.0282/S X100 = FFA

Where V= KOH (0.1 N) ml. S = sample (ml) .0.0282= Standard Oleic Acid.

2.2.4. Fatty Acid Methyl Esters

Sesame seeds contain 85% unsaturated fatty acids about 45% of which oleic acid and 40% linoleic acid and the saturated acids are less than 15% and 8% of which is palmetic acid and the rest is stearic acid [8] Analyses of Fatty acid methyl as esters are conducted by Gas liquid chromatography (GLC) as done by Cover [9]. In this investigation oil samples obtained by extraction were tested for FAMEs. Two sesame seed varieties Zira 9 and Zira 7 infested with the bug in the field were tested and samples from the first healthy seeds, second (fifteen days infested seeds) ,and the third (two month infested seeds) were analyzed and loss in percentage recorded.

3. Results

The sesame seed bug *Elasmolomus sordidus* sucks the seed content; particularly the oil, reducing the quantity and the quality of the oil. Also, the effect of the bug resulted in loss of seed weight. The overall loss is seen as a reduction in yield and contamination of the seeds and insect wastes were observed in two months stored sacks.

3.1. Loss in Weight, Oil Content, Free Fatty Acids of Infested Sesame Seeds

The bug caused losses in weight for the 4 varieties of sesame: Local, Kenana1, Zira 9 and Zira 7 and the loss represented 2.1, 1. 8, 2.2 and 1.9 % percent respectively within 15 days and at the end of two months infestation the weight loss reached 12.4, 10.5, 13.5 and 13.2 % percent respectively. Loss in oil content after 15 days from the first harvest averaged 14.0, 15.0, 11.0 and 11.6 % for the four varieties respectively and reached 56.8, 59.6, 46.3 and 44.6 % within sixty days. After 2 weeks the FFAs are 4.0, 4.0, 3.0, 3.0 % for the four varieties respectively and reached 23.0.24.0, 19.0 and 18.0 % within sixty days (Table 1).

Table 1. The damage caused by the sesame seed bug *Elasmolomus sordidus* to four sesame varieties.

Sesame Variety	Harvest	Days of Infestation	Weight loss of 100 seeds %	Oil content loss %	Free fatty acid % oleic acid	First harvest 100seed weight(g)
Local	First un-infested	0	0	0	2.30*	0.30
	Second	15	2.1	14.0	3. 98	
	Third	30	4.0	20	6.30	
	Fourth	45	n/r	n/r	n/r	
	Fifth	60	12.4	56.8	23.00	
Kenana 1	First un-infested	0	0	0	3.16*	0.32
	Second	15	1.8	15	3.80	
	Third	30	3.03	23.1	7.30	
	Fourth	45	8.0	27.4	9.30	
	Fifth	60	10.5	59.6	23.90	
Ziraa 9	First un-infested	0	0.0	0.0	1.30*	0.27
	Second	15	2.2	11.0	3.44	
	Third	30	3.3	15.3	5.36	
	Fourth	45	7.2	19.7	7.30	
	Fifth	60	13.5	46.3	18.70	
Ziraa 7	First un-infested	0	0.0	0.0	2.20*	0.27
	Second	15	1.96	11.6	2.90	
	Third	30	3.60	17.0	5.30	
	Fourth	45	5.10	28.0	10.30	
	Fifth	60	13.2	44.6	17.60	

*the first harvest FFAs were compared to the recommended international standards and were found within the range.

Table 2. The fatty acid methyl esters % of sesame oil from seeds infested with sesame seed bug *Elasmolomus sordidus*.

	Fatty acids			
Condition	**Palmetic 16:0**	**Stearic 18:0**	**Oleic 18:1**	**Linoleic 18:2**
1- Sesame oil from Zira 9 var.				
a- uninfested sesame oil	4.8	2.0	43.8	42.0
b- fifteen days infested oil	4.7	1.98	42.0	41.0
c- sixty days infested oil	4.6(6)*	1.90 (5)*	38.0(11)*	37.8(12)*
1- Sesame oil from Zira 7 var.				
a- uninfested sesame oil	9.0	5.0	45	43
b- fifteen days infested oil	4.8	4.7	44	42
c- sixty days infested oil	4.6 (8)*	2.8 (7)*	37 (12)*	36(16)*

( )* Loss in percentage within sixty days

3.2. Fatty Acids Methyl Esters of Infested Sesame Seeds

The sesame seed bug affects the quantity of the fatty acids of the sesame oil: palmetic, stearic, oleic and lioleic. The quantity of each was measured in the crude oil extracted from healthy Zira 9 and Zira 7 varieties and was compared with the fifteen and sixty days infested seeds of the two varieties. A loss percentage of the fatty acids esters quantity was recorded in Table 2.

4. Discussion

Sesame crop plays an important role in the Sudan economy and it is one of the Sudan's major oil seed crops. One of the main problems of production of sesame in the Sudan is the insect pests attack. According to the results obtained from earlier studies on groundnuts, the sesame seed bug *Elasmolomus sordidus* (f.) recorded as occasionally causing damage to groundnuts in many African countries, south of the Sahara [3], [4], [10], probably in the Sudan that it has

attained the status of a serious pest of sesame crop on many production areas within the country. The preliminary studies to assess the loss due to the sesame seed bug *E. sodidus*, which usually suck the oil from the seeds, indicated that at the beginning the injured seeds shriveled and when the damage was sever the sesame seeds, which contain about 50% oil of its content, remained completely empty and probably the reason for the bitter taste. The four varieties used in this study were found significantly affected by the sesame seed bug *E. sodidus.*

A positive correlation was found between the time days and the bug infestation. At heavy infestation, caused by a rapid population build up and influx from outside the field, losses in both the yield and quality of sesame content were severe. The oil extracted from the two months infested sesame seeds were more viscous compared to the un-infested sample, this was indicated in Table 1, the weight, the oil content and the free fatty acids were significantly affected. The FFAs assessed as % oleic acid averaged 20%, where the control was only 3%. While the loss in oil content was almost 50% of the control and the weight loss reached an average of 13%. These findings agreed with previous study by Conway [4] working on groundnut. The fatty acids methyl esters were significantly decreased and there was loss of 4.0% palmetiate, 5.0% stearate, 11.0% oleate and 12.0% linoleate within two months of infestation by the sesame seed bug on zira 9 sesame seed variety. A loss of 8.0% palmetiate, 7.0% stearate, 12.0% oleate and 16.0% linoleate on zira 7 sesame variety was occurred in two months period (Table 2).

In the Sudan the presence of the sesame bug in sesame fields was reported on October usually .the sesame sowing date depends on the rainy season and this differs from region to region. The sesame growing takes about three months and more in some varieties. This may result in delaying the sowing date from the optimum dates in late June or early July resulting in high reduction of yield due to the probable overlap of harvest time and the appearance of the bug in the field. in this study the harvested sesame was left in the field for drying in such a way to resemble the farmer's practice during harvest and post-harvest time. The sesame bug damage obtained in the field indicated the expected economic loss to the farmers and the country which can be inflicted due to this avoidable practice. Efforts have to be directed to the field management, since any reduction in initial infestation rate of harvested sesame will have a profound effect on the size of sesame infestation under storage condition. We concluded that the sesame seed bug *E. sordidus* adults and nymphs attack the sesame seeds and reduction in the yield and quality is heavy and the damage indicated economic losses. The damaged seeds shrivel and lose weight. Bitterness of the damaged seeds is probably due to ember empty seed coat and /or the increase of free fatty acids.

5. Conclusions

The study provide additional information on the damage caused by the sesame seed bug which may contribute to a better understanding of the pest problem in the sesame production areas in the Sudan. It is though time to give more attention to the control of this bug by adopting special integrated pest management program.

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