American Journal of Experimental Agriculture
4(12): 1616-1624, 2014

SCIENCEDOMAIN *international*
www.sciencedomain.org

Damage and Loss Caused by 'Offa' (*Rhyparochromus littoralis* dist.) [Heteroptera: lygaeidae] on Groundnut in Song Local Government Area of Adamawa State, Nigeria

A. E. Samaila[1*], A. M. Malgwi[2] and M. M. Degri[1]

[1]Department of Agronomy, Federal University Kashere, PMB 0182, Gombe, Nigeria.
[2]Department of Crop Protection, Modibbo Adama University of Technology, PMB 2076 Yola, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author AES designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors AMM and MMD managed the analyses of the study, and the literature searches. All authors read and approved the final manuscript.

Original Research Article

Received 27th April 2014
Accepted 8th July 2014
Published 23rd July 2014

ABSTRACT

Field experiments were carried out in four out of six Districts of Song Local Government Area of Adamawa State in Nigeria. The objectives of this research were to establish the damage potential and loss caused by the 'offa' [the groundnut sucking bug (*Rhyparochromus littoralis* Dist.)] on groundnut during the 2011, 2012 and 2013 cropping seasons. The experiment was set up as a split plot design (SPD) where all treatments were replicated three times. The main treatment was the groundnut cultivar in the main plots while the sub-treatments are the harvesting times. The data collected were analyzed using analysis of variance (ANOVA) on SAS statistical package using the generalized linear model and significant P = 0.05, means were separated using Student Neumann-Keuls (SNK) test. Damage caused includes, kernel shriveling, which increases the free fatty acid content of the oil, distortion or discolouration of the kernel, loss in weight and the production of rancid flavor. The percentage reduction of harvested pod and kernels when groundnut was left for 3 – 28 days fell within 24 – 68%. Results obtained from these investigations indicated that *R. littoralis* causes significant damage on groundnut exposed

**Corresponding author: Email: akewetaes@gmail.com;*

to the insect pest for more than 3 days in the field before picking (decorting). It was therefore concluded that *R. littoralis is* a potential economic pest, emerging as a serious threat to the harvesting of quality, healthy and edible groundnut in the study area.

Keywords: Damage; potential; sucking; harvested; groundnut; investigation and Decorting.

1. INTRODUCTION

The reasons for the high level of damage inflicted by insects to groundnut stocks in Africa are known: deficient collecting networks, inadequate basic infrastructures e.g. road, lack of economic incentives for a better grain quality, inadequate storage structures and management, etc [1]. Groundnuts reach the central stores with high infestation levels and are often left without care to future insect attacks. As most post-harvest groundnut pests except the groundnut bruchid (*Caryedon serratus)* are unable to penetrate intact pods, leaving the crop in the shell for as long as possible during storage is an effective method of limiting damage.

R. littoralis commonly known as Lygaeid bug, is a pod sucking bug that, belongs to the order Heteroptera and family Lygaeidae which occurs in all groundnut growing areas in Northern Nigeria [2,3,4]. The bug is popularly known in the Northern part of Nigeria as '*shamai'* by the Hausa speaking people while the Yungur speaking people of Adamawa State refer to it as *'offa'* [2,3]. [5] further observed that from neo nymphal stage to adulthood, this insect attack pods as well as kernels (seeds), while they are still fresh in the field.

They are found in large chambers, under harvested groundnuts left to dry before picking (decorting) on the field especially, when left for a week or more, the kernels turns out to have small, shrunken seeds, with the testa often turning yellow [3,5,6]. In spite of researches on various pests of groundnut, there is paucity of research report on the damage potential and loss in yield caused by *R. littoralis*.

Therefore, the need for this research on *R. littoralis* as a threatening insect pest of groundnut in Song Local Government Area of Adamawa State, Nigeria, where groundnut cultivation is of tremendous economic importance to the poor resource farmers within the study areas.

2. MATERIALS AND METHODS

The experiments were carried out in four out of the six Districts of Song Local Government Area, namely Dirma, Dumne, Suktu and Waltadi, the highest groundnut producing areas in Song Local Government Area with a record of high density of 'offa' (*R. littoralis)* as reported by [5]. Song Local Government Area lies between longitude 12^0 41' and 12^0 35' North and longitude 9^0 44' and 10^0 12' East of the Equator in the Northern Guinea Savannah agro-ecological zone of North Eastern Nigeria [7].

2.1 Field Layout

The experiment was set up in a split plot design (SPD), the main treatment was the groundnut in the main plots while the sub-treatments are the harvesting times. All treatments were replicated three [3] times. Groundnuts were planted 40 cm between rows with 1 plant/hill, the plant spacing was 25 cm within rows, again with 1 plant/hill according to the

recommendations of [4,8]. The plot size for the main treatment was 70 m x 20 m, with each sub-plot being 5 x 4 m.

2.2 Cultural Practices

At the establishment of rainfall in June/July of the respective cropping seasons (2011, 2012 and 2013), the fields were ploughed and sowed in all locations within the study area. Popular local groundnut cultivar, '*Kampala'* which is late maturing was purchased from the Dumne Friday open Market.

2.3 Data Collected

At maturity, when the groundnut was ready for harvest each sub-plot in the replication was randomly sampled within the main plots and then exposed to infestation for 0, 3, 7, 9, 14, 21 and 28 days after harvesting (DAH).

2.4 Sampling Method

Matured groundnut were harvested within the sub-plot treatments and subjected to 7 different levels of destructive sampling. Matured nuts were decorted on the day of uprooting (digging out) from the ground (0), and then the remaining harvested groundnuts were left exposed in the field for 3, 7, 9, 14, 21 and 28 DAH before decorting. The harvested groundnut pods on each subplots sampled were weighed before and after shelling.

The percentage loss was determined by comparing the weight loss of the groundnut that was promptly harvested and dried outside the field with each of the groundnut harvested subsequently and expressed as percentage reduction in yield/ha similar to [4] as follows:-

% reduction in yield loss due to infestation by the insect:

$$= \frac{a - b/c/d/e/f/g \text{ respectively}}{a} \times 100\%$$

Where:

a = Groundnut Harvested Promptly (0DAH)
b = Groundnut Harvested 3DAH
c = Groundnut Harvested 7DAH
d = Groundnut Harvested 9DAH
e = Groundnut Harvested 14DAH
f = Groundnut Harvested 21DAH
g = Groundnut Harvested 28DAH

2.5 Statistical Analysis of Field Work

The data collected were analyzed using analysis of variance (ANOVA) using SAS [9] statistical package software version 8.2 generalized linear model and significant P = 0.05 means was separated using Student Neumann- Keuls (SNK) test.

2.6 Yield Loss

To estimate the damage (%), each sample was divided into damaged and undamaged pods or kernels and the percent damage was calculated using the following formula by [10]:

$$\text{Damage (\%)} = \frac{\text{Number of damaged pods} \times 100}{\text{Total number of pods}}$$

$$\text{Weight loss (\%)} = \frac{(UNd) - (DNu) \times 100}{U(Nd + Nu)}$$

Where:

Nu = No. of undamaged pods; Nd = No. of damaged pods; U = Dry mass of undamaged pods; D = Dry mass of damaged pods.

3. RESULTS

3.1 Weight of Groundnut after Harvest

The weight of groundnut pods significantly vary from 0 DAH to 28 DAH proportional to the number of days the pods were exposed to the pest on the field to dry after digging up from the ground. The highest values of unshelled pods were recorded at 0 DAH (6080.00, 5079.67, 5082.00 and 4719.30)g in Dirma, Dumne, Suktu and Waltadi in 2011, so also in 2012, 0 DAH (6036.33, 5699.67, 5036.33 and 4650.7), in the same vein, in 2013 (5936.00, 5219.67, 5736.00 and 4530.33) 0 DAH in Dirma, Dumne, Suktu and Waltadi shown in Table 1.

The weight of shelled groundnuts varied significantly from (5066.66, 4233.66, 4235.00 and 4719.30) in 2011, (5030.33, 4749.66, 5036.33 and 4650.7) in 2012, while (4966.06, 4349.33, 5736.00 and 4530.33) in 2013 for Dirma, Dumn, Suktu and Waltadi respectively as shown in Table 2.

The least weight at 0 DAH were recorded in Waltadi (4719.30, 4650.70 and 4530.33) in 2011, 2012 and 2013 respectively, while Dumne and Suktu display insignificant difference in weight loss as indicated in Tables 1 and 2.

The reduction in weight retrogressed with the increase in number of days the groundnut was exposed to the pest in field from 3 – 28 DAH from the values of (5238.67, 5699.67 and 5499.33)g; (5401.67, 5476.33 and 5205.33)g; (4239.67, 5599.67 and 5522.33)g and (4247.70, 3991.00 and 4230.67)g at 3 DAH in Dirma, Dumne, Suktu and Waltadi respectively. Interestingly, the level of infestation and damage caused in all location followed the same trend with 0 DAH recording the highest weight of harvested groundnuts, while 28 DAH shows the least weight (1840.00, 2085.67 and 2225.33)g; (1185.33, 2135.33 and 2923.33)g; (1942.00, 2535.67 and 3425.33)g and 1025.30, 1245.30 and 1140)g in Dirma, Dumne, Suktu and Waltadi respectively (Table 1). These trends continue in the same characteristic manner displayed in the shelled groundnuts as shown in Table 2.

Groundnuts harvested on 0 DAH in both shelled and unshelled were not significantly different since they were not attacked by the bug, whereas there was significant difference for groundnuts harvested on 28 DAH, which recorded the least weight of both shelled and unshelled groundnut.

Table 1. Mean weight of groundnut kernels caused by *Rhyparochromus littoralis*

Harvesting	Dirma			Dumne			Suktu			Waltadi		
days	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013
0DAH	6080.00^{a}	6036.33^{a}	5936.00^{a}	5079.67^{a}	5699.67^{a}	5219.67^{a}	5082.00^{a}	5036.33^{a}	5736.00^{a}	4719.3^{a}	4650.7^{a}	4530.33^{a}
3DAH	5238.67^{b}	5699.67^{b}	5499.33^{b}	5401.67^{b}	5476.33^{b}	5205.33^{b}	4239.67^{b}	5599.67^{b}	5522.33^{b}	4247.7^{b}	3991.0^{b}	4230.67^{b}
7DAH	5036.33^{c}	4776.33^{c}	5076.33^{c}	3837.33^{c}	4224.67^{c}	4411.67^{c}	4038.33^{c}	4866.33^{c}	5346.33^{c}	3485.7^{c}	3387.3^{c}	3580.7^{c}
9DAH	4992.67^{d}	4224.67^{d}	4624.33^{d}	3445.33^{d}	3540.00^{d}	3740.00^{d}	3995.67^{d}	4534.67^{d}	4994.33^{d}	2828.7^{d}	2840.3^{d}	2826.7^{d}
14DAH	3699.33^{e}	3540.00^{e}	3840.33^{e}	2652.33^{e}	3135.33^{e}	3531.33^{e}	3698.33^{e}	3750.00^{e}	3990.33^{e}	2747.7^{e}	2232.7^{d}	2563.67^{e}
21DAH	2776.33^{f}	2135.33^{f}	2935.67^{g}	1274.00^{f}	3085.67^{f}	3123.67^{f}	2875.33^{f}	2875.33^{f}	3935.67^{g}	1040.7^{f}	1343.7^{e}	1240.7^{f}
28DAH	1840.00^{g}	2085.67^{g}	2225.33^{h}	1185.33^{g}	2135.33^{g}	2923.33^{g}	1942.00^{g}	2535.67^{g}	3425.33^{h}	1025.3^{g}	1245.3^{f}	1140.3^{g}
Mean	36383	3523.0	3352.6	2592.4	3255.6	3120.5	2785.6	3215.67	4215.7	2261.9	2217.9	2218.6
C.V.(%)	11.00	11.43	11.63	11.61	14.4	14.67	15.30	17.10	18.69	17.4	16.7	17.6

Means with the same letters in the same column are not significantly different at P ≤ 0.05 using student Keuls Newman (SNK) test for variables
C.V.=Coefficient of variability,
DAH=days after harvest.

Table 2. Effect of *R. littoralis 0n* mean weight of Shelled groundnut kernels

Harvesting	Dirma			Dumne			Suktu			Waltadi		
days	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013
0DAH	5066.66^{a}	5030.33^{a}	4966.66^{a}	4233.66^{a}	4749.66^{a}	4349.33^{a}	4235.00^{a}	5036.33^{a}	5736.00^{a}	4719.3^{a}	4650.7^{a}	4530.33^{a}
3DAH	4365.56^{b}	4749.67^{b}	4582.67^{b}	4501.33^{b}	4563.66^{b}	4337.66^{b}	3530.66^{b}	5599.67^{b}	5522.33^{b}	4247.7^{b}	3991.0^{b}	4230.67^{b}
7DAH	4196.94^{c}	3980.33^{c}	4230.33^{c}	3837.33^{c}	3924.66^{c}	3676.33^{c}	3365.33^{c}	4866.33^{c}	5346.33^{c}	3485.7^{c}	3387.3^{c}	3580.7^{c}
9DAH	4160.56^{d}	3520.67^{d}	3853.66^{d}	3445.33^{d}	3540.00^{d}	3116.66^{d}	3329.66^{d}	4534.67^{d}	4994.33^{d}	2828.7^{d}	2840.3^{d}	2826.7^{d}
14DAH	3082.66^{e}	2950.00^{e}	3200.33^{e}	2652.33^{e}	3135.33^{e}	2942.33^{e}	3082.33^{e}	3750.00^{e}	3990.33^{e}	2747.7^{e}	2232.7^{d}	2563.67^{e}
21DAH	2313.66^{f}	1779.66^{f}	2446.33^{g}	1274.00^{f}	2085.66^{f}	2603.66^{f}	2479.33^{f}	2875.33^{f}	3935.67^{g}	1040.7^{f}	1343.7^{e}	1240.7^{f}
28DAH	1533.33^{g}	1738.66^{g}	1854.66^{h}	1185.33^{g}	1935.33^{g}	2436.33^{g}	1618.33^{g}	2535.67^{g}	3425.33^{h}	1025.3^{g}	1245.3^{f}	1140.3^{g}
Mean	3531.3	3392.6	3590.6	3018.6	3419.2	3351.7	3091.5	3215.67	4215.7	2261.9	2217.9	2218.6
C.V.(%)	11.00	11.43	11.63	11.61	14.4	14.67	15.30	17.10	18.69	17.4	16.7	17.6

Means with the same letters in the same column are not significantly different at P ≤ 0.05 using student Keuls Newman (SNK) test for variables
C.V.=Coefficient of variability.
DAH=days after harvest

Table 3. Mean percentage weight (g) Loss of shelled groundnut kernels

Harvesting days	Dirma			Dumne			Suktu			Waltadi		
	2011	**2012**	**2013**	**2011**	**2012**	**2013**	**2011**	**2012**	**2013**	**2011**	**2012**	**2013**
3DAH	24.2^{e}	25.2^{e}	24.4^{e}	23.4^{e}	25.5^{d}	26.8^{d}	25.9^{d}	25.4^{d}	24.0^{d}	27.6^{d}	25.6^{d}	26.6^{d}
7DAH	40.8^{d}	41.6^{d}	44.5^{d}	43.5^{d}	40.8^{c}	42.6^{c}	38.8^{c}	38.4^{c}	38.2^{c}	44.5^{c}	42.5^{c}	43.5^{c}
9DAH	42.8^{cd}	42.4^{cd}	44.5^{cd}	44.5^{cd}	45.1^{b}	43.1^{b}	50.1^{b}	50.0^{b}	52.1^{b}	52.8^{b}	50.8^{b}	51.8^{b}
14DAH	43.8^{cd}	42.8^{cd}	47.7^{cd}	47.7^{cd}	46.2^{b}	48.2^{b}	54.2^{b}	54.6^{b}	54.8^{b}	53.4^{b}	50.4^{b}	51.4^{b}
21DAH	48.2^{c}	47.3^{c}	52.7^{c}	52.7^{c}	55.4^{b}	56.8^{b}	56.4^{b}	55.4^{b}	56.7^{b}	55.1^{b}	51.1^{b}	52.1^{b}
28DAH	59.9^{b}	58.8^{b}	62.5^{b}	62.5^{b}	65.5^{a}	67.8^{a}	67.9^{a}	66.2^{a}	65.9^{a}	65.8^{a}	63.8^{a}	64.8^{a}
Mean	38.3	43.0	46.1	38.9	46.4	47.6	41.3	48.3	48.6	41.1	47.4	48.4
C.V.(%)	12.4	12.4	12.2	12.2	13.8	13.8	13.8	13.8	13.8	13.6	13.6	13.6

Means with the same letters in the same column are not significantly different at P ≤ 0.05 using student Keuls Newman (SNK) test for variables
C.V.=Coefficient of variability.
DAH=days after harvest.

3.2 Percentage Reduction in Weight

The results on the percentage loss in weight on shelled kernels as a result of damages infected by the groundnut sucking bug *R. littoralis* on weight percentage for each of the data collected at all locations are presented in above Table 3. The results at all locations and cropping seasons showed that there was significant difference in loss of weight with increasing number of days the groundnuts were left on the field to dry.

The highest mean weight loss percentage (67.9, 66.2, 65.9) Suktu, (62.5, 65.5 and 67.8) Dumne, (65.8, 63.8 and 64.8) Waltadi and (59.9, 58.8 and 62.5) Dirma, were recorded in 2011, 2012 and 2013 respectively and these were observed on 28DAH, while the least weight loss percentage of (24.2, 25.2 and 24.4) Dirma, (23.4, 25.5 and 26.8) Dumne, (25.9, 25.4 and 24.0) Suktu and (23.6, 25.6 and 26.6) Waltadi for the same cropping seasons observed in all the field trials. However, in all the growing seasons, Suktu recorded 67.9, 66.2 and 65.9 being the highest weight loss in all the cropping seasons of 2011, 2012 and 2013 respectively.

On the whole, the mean as shown in Table 3 confirmed the increasing losses with increase number of days groundnut was left on the field to dry. These trends are consistent all locations from the highest number of days groundnut was left to dry on the field to the least number of days (28 DAH to 3DAH).

4. DISCUSSION

4.1 Damage Potential of *Rhyparochromus littoralis* on Groundnut

There is paucity on literature particularly in Nigeria even as a checklist that mentioned *R. littoralis* as a minor/major pest of groundnut prior to this present investigation. *R. littoralis* no doubt is a devastating pest in groundnut fields and just a small population would multiply within a week and cause great damage of up to 80 percent or more loss in yield of groundnut [3].

Results obtained from this study confirmed that *R. littoralis* is a potential economic pest, emerging as a serious threat to the harvesting of quality and healthy groundnut pods, as opined by [6].

The results obtained from the four trial fields showed little or no significant difference from each other. High percentage of damage done to groundnut resulting in huge losses in yield for upto 68% as recorded in the present study point to the fact that *R. littoralis* has also become a major pest of groundnut in Song Local Government Area in Adamawa State, Nigeria which also agree with the findings of [3] on their studies on the groundnut sucking bug *R. littoralis* in Northern Nigeria. The damage potential determined on groundnut in this study poses a serious threat in term of its damage percentage of above 20%, that agrees with the findings of Malgwi and Onu (2004). This further proves that *R. littoralis* is a true pest of groundnut as earlier reported by other researchers [11,12,13,3].

The present study identified *R. littoralis* as a seriously emerging threat to groundnut farming in the study areas and by extension other groundnut producing areas within the same agroecological zones in Nigeria, which is in conformity with the survey conducted by [3].

Up to 58.8 – 67.9% loss in weight/yield of groundnut was recorded. The least loss in weight of 24.0 – 26.8 was observed in all the locations is pointer to the fact that this pest is an emerging threat to groundnut production.

5. CONCLUSION

In conclusion, the damage caused by *R. littoralis* as observed on the groundnut kernels includes, kernel shriveling, which increases the free fatty acid content of the oil, producing a rancid flavor, while the percentage loss in yield of the groundnut within the time frame that it was exposed to the insect pest amounted to approximately 68%. There's therefore the need to work towards the identification of its alternate host in order to understand it's over seasoning strategy, behaviour, dispersal and other knowledge of its possible habitat or niches will help towards the understanding of the complexity of the insect pests.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Conway JA. Notes on the biology and ecology of the groundnut seed – beetle *Caryedon serratus* (Ol) under field conditions in Senegambia. Trop. Stored Prod. 1983;54:11-13.
2. Samaila AE. The Groundnut Sucking Bug Life Cycle and Biology on Groundnut. LAP Lambert Academic Publishing, ISBN 978-3-659-31125-3 Germany; 2012.
3. Samaila AE, Malgwi AM. Biology of the Groundnut Sucking Bug (Rhyparochromus Littoralis Dist.) (Heteroptera: Lygaeidae) On Groundnut in Yola, Adamawa State – Nigeria. IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 2012;1(6):53-57. Available: www.iosrjournals.org
4. Samaila AE, Malgwi AM, Oaya CS. Survey of The Abundance of 'Offa' The Groundnut Sucking Bug (Rhyparochromus littoralis Dist) An Emerging Field Insect Pest of Groundnut in Adamawa Central Senatorial District, Adamawa State Nigeria. Journal of Biology, Agriculture and Healthcare. 2013;3(5):110-114.
5. Malgwi AM, Onu JI. Insect pests of cowpea and groundnut in Girei Local Government Area, Adamawa State. Nigeria Journal of Entomology. 2004;21:137–151.
6. Malgwi AM, Samaila AE, Ilesanmi JOY, Oaya CS. Effect of the Groundnut Sucking Bug (Rhyparochromus littoralis Dist) on the Oil Content of Groundnut kernels of two Cultivars in Northern Nigeria. IISTE – Food Science and Quality Management. 2013;11:70–76. Available: www.iiste.org/fsqm
7. Shankarappa T, Robert ER, Virginia N. World Geography of Groundnut: Distribution, production, use and trade. 2009;1-11. U.S.A. Available: www.worldgeography/peanut
8. SAS. Statistical Analysis with SAS/STAT Software for windows 7 server, 2003. Microsoft word, Inc; 2003.
9. Dick KM. Losses caused by insects to groundnuts stored in a warehouse in India. Trop. Sci. 1987;27:65-75.
10. Kalaiyarasan S, Palanisamy S. Screening Sesame Germplasm against Sesame Pod bugs (*Elasmolomus sordidus* Fabricius) for resistance. Madras Agric. J. 2004;89(7-9):407–409.

11. Osman AK, Abdalla AM, Elblaa TA. Biology and damage inflicted by the sesame seed bug, Elasmolomus sordidus (Hemiptera: Lygaeidae) on groundnut Sudan Journal of Agricultural Research. 2009;14:69-80.
12. Adebayo AA. Climate II. In Adebayo AA and Tukur AL, Eds (1999) Adamawa State in Maps. Paraclete Publishers, Yola; 1999.
13. Ranga Rao GV, Ramashwar Rao S, Nyam SN. Post-harvest Insect pests of groundnut and their Management. Information Bulletin No. Patencharu 502 324, Andhra Pradesh, India. International Crops Research Institute for the Semi Arid Tropics. 2010;84:20.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=586&id=2&aid=5419