

Biology of the Groundnut Sucking Bug (*Rhyparochromus Littoralis* Dist.) (Heteroptera: Lygaeidae) On Groundnut in Yola, Adamawa State – Nigeria

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Abstract: Groundnut sucking bug, *Rhyparochromus littoralis* (Dist.), is one of the most important post-harvest field insect pests of groundnut in Northern Nigeria. The biology of *R. littoralis* was studied under laboratory conditions at temperature range of 30 – 33°C on freshly harvested groundnut with its leaves and haulms while making notable observations as well on the groundnut fields. This study was conducted in Yola, Adamawa State during 2010 and 2011 seasons to investigate the insect life history and damage caused by *R. littoralis* on groundnut. Duration of each of the developmental stages of the pest was determined in laboratory. The results indicated that egg incubation period was 4.0 ± 0.15 days, while the respective nymphal duration from the 1st, to the 6th instar were 1.65 ± 0.11 , 5.3 ± 0.18 , 5.25 ± 0.14 , 5.0 ± 0.25 , 4.35 ± 0.26 and 4.0 ± 0.18 days, respectively. The developmental period from egg to adult stage was 30.1 ± 0.42 days. The lifespan of adult female and male was 18.2 ± 0.38 and 8.80 ± 0.36 days, respectively. The lifespan from egg to adult death was 48.0 and 39.4 days for female and male, respectively. The male to female sex ratio was 1:1. Oviposition period was 4.9 ± 0.05 days and the peak laying period was on the third day. The results showed that the insect caused losses in seed weight from 4 to 45%, reduction in oil content from 8 to 70%, increases in free fatty acids and causes kernel to shrivel in comparison with the control.

Key Words: Groundnut, Sucking bug, incubation, lifespan, developmental

I. Introduction

On a global scale the most important insect pests include aphids (*Aphis craccivora*), thrips (*Frankliniella* spp.), jassids (*Empoasca dolichi*), white grubs (larvae of various beetles), termites (mainly *Microtermes* sp.) and the red tea bug *Hilda patruelis*. False wireworms and millipedes seem to occur less frequently. In general, soil pests cause more damage than foliage feeders or sucking pests. However, aphids are particularly harmful because they transmit groundnut rosette virus (Shankarapa, *et al.*, 2009 and Singh, 1955). In Asia and Africa white grubs, termites, millipedes and ants are important pests; in the United States the lesser cornstalk borer (*Elasmopalpus lignosellus*) and the southern corn rootworm (*Diabrotica undecimpunctata*) are the main insect pests of groundnut. Pests attacking stored groundnut pods and seeds include bruchids (*Caryedon serratus*, *Callosobruchus* spp., *Acanthoscelides* spp.) and flour beetles (*Tribolium* spp.). (Purseglove, 1968; Knauff and Ozias-Akins, 1995).

The groundnut pod sucking bugs (*R. littoralis*) occurs in all groundnut areas in India and Nigeria (Malgwi and Onu, 2004; ICRISAT, 2008). In the field, the females lay their eggs in the soil or in groundnut haulms. In storage, eggs are laid loosely among the groundnuts or on sacks. All stages of this insect attack pods as well as kernels (seeds) (ICRISAT, 2008). ICRISAT further stated; that the bug feeds on pods left in the field to dry or on stored pods. In storage the bug feeds on seeds perforating the pod with their rostrum. This causes the seeds to shrivel and increases the free fatty acid content of the oil, producing a rancid flavor. Thus the quality of kernels and also the keeping quality of groundnuts are affected. Malagwi and Onu (2004) reported that, the detailed life history of this pest is not known, in spite of the fact that they are found in large numbers under harvested groundnuts in the field.

Rhyparochromus littoralis commonly known as Lygaeid bug, or groundnut pod sucking bug, which belongs to the order Heteroptera and family Lygaeidae is found in all groundnut growing areas in India and in large clusters in the Northeastern part of Nigeria, where it is known to cause serious damage to groundnut during harvest, but detailed record on history, biology and it's life cycle is lacking in Nigeria. However, the closest member of the Heteroptera family to this bug based on close observation is the groundnut hopper (*Hilda patruelis*) [Heteroptera: Tettigometridae].

The infested pods are discolored and show oily spots on the outside. In case of severe infestation, the produce is unfit for seed as well as human consumption. This causes seed shrivelling and increases the free fatty acid content of the oil, producing a rancid flavor (Ranga Rao, *et al.*, 2010). The seed feeding lygaeid bug, *E.*

sordidus Fabricius is a pest on groundnut (Slater, 1972) and Sesame (Sharma, *et al.*, 1990). This bug was also reported to attack safflower (Deshpande and Rama Rao, 1915), Millets (Ghosh, 1924, Soybean (Ali, 1988) and a weed plant *Cleome viscosa* (Sanjayan and Ananthakrishnan, 1987).

II. Materials And Methods

Biology of *Rhyparochromus littoralis*

Adult insects were collected from the field using an improvised rearing cage and were kept and allowed to lay eggs, after which the insects were removed in order to appropriate the age of the bugs and to remove biasness. Nine (9) wooden screen cages of 30 cm x 15 cm x 10 cm was constructed and field condition was mimicked by collecting soil or earth from the groundnut field, with groundnuts that were matured with their leaves and pods while still fresh. The biology of *Rhyparochromus littoralis* was then studied under laboratory conditions at temperature range of 30 – 33°C on freshly harvested groundnut with its leaves and haulms while making notable observations as well as on the groundnut fields. Freshly harvested groundnut (local variety) were selected and used from the trial farm. The groundnut and haulms was placed in the screened wooden cages with five (5) pairs of *R. littoralis* male and female collected from groundnut field were introduced in the cages lined with filter paper spread with soil of 1 cm thickness moisten with distilled water every 24 hours for 2 – 3 weeks, to see if any nymph or adult will emerge.

Notable observations such as number of eggs, nymphal instars and adult were recorded. Freshly groundnut haulms were added after every 2 weeks to allow for space for the nuts and haulms to have contact with the soil surface in the cage. After 4 weeks, groundnuts and haulms were removed to observe the number of eggs, nymphal instars and adults and then recorded appropriately.

The same experiment was repeated three times to ensure accuracy of data collated.

Experimental Layout of the Laboratory

The experiment was set as a Completely Randomized Design (CRD) with initial pest density on groundnut, haulms/leaves and groundnuts + haulms/leaves as treatments. Treatments were replicated three (3) times.

Data Collated

The data collated included the following:

- a. Number of days it takes to lay eggs
- b. The mean number of eggs laid/female
- c. Oviposition per female per day
- d. The mean number of emerged nymphs
- e. The mean number of emerged adults
- f. Mean number of dead adult
- g. The number of days it takes for each experiment to terminate

Statistical analysis for laboratory experiment

Data obtained from the rearing of the insect was subjected to the analysis of variance (ANOVA) appropriate to Completely Randomized Design (CRD) according to Gomez and Gomez (1984). The means were separated using the Student-Newman Keuls (SNK) at 0.05 level of probability according to Fisher and Hedge (1935).

III. Results

Biology of *R. littoralis* on Groundnut

The biology of *R. littoralis* was studied under laboratory conditions at temperatures of 32 – 34°C, on groundnut haulms and pods, while making notable observations as well on the groundnut field and the surrounding crop fields. Freshly harvested/uprooted groundnut (haulms and pods) were selected from the harvested experimental field. The groundnut pods and haulms were placed in an improvised rearing cage made up of wood with dimensions 30 cm x 20 cm x 15 cm, when five (5) pairs of *Rhyparochromus littoralis* male and female were collected from the groundnut field and introduced into the cages lined with filter paper spread with soil of 1 cm thickness moistened with water after 72 hours, the *R. littoralis* were removed from the cages. Observations were made every 48 hours for the first two weeks and 24 hours thereafter, to see if any nymph or adult would emerge. Notable observations such as the number of eggs, nymphs and adult emergence if any were recorded.

The first part of the experiment was conducted in late September 2010, which was subsequently repeated in late October and in late November following the termination of the proceeding experiments. Emergence of adults and their mortalities were observed. At the termination of each experiment, the process of rearing and observations were repeated all over again. After 1 week, groundnut haulms/leaves and pods were removed and

the number of eggs were observed with the aid of a hand lens, while the number of nymphs were recorded as well. The same experiment was repeated three (3) times. A pair of *R. littoralis* freshly emerged from the rearing cage were placed in another cage. Eggs were examined daily and carefully examining them with the aid of a hand magnifying hand lens. The number of days it took a bug to complete its life cycle was noted and recorded. The experiment was terminated in each case after the death of the last adult *R. littoralis* which took a total of 36 – 38 days.

Biology and Life Cycle:

Each female laid an average of 21 – 28 (24.5) eggs daily especially in September/October, while in October/November, it was 21 – 22 (21.5) eggs per female on the haulms of the groundnut, however, there was no significant difference between the two timings. Each female search out for suitable oviposition site to lay its eggs. The insect does not survive on an environment free of plant debris.

The Eggs:

The eggs are cylindrical in shape, creamy/brownish in colour and covered with a faecal plug which appeared grayish in colour at first and later turns brown. The eggs range in size from (0.4 – 0.6mm) in diameter and 0.5 – 0.6 mm long). On the field, the eggs are laid on the groundnut haulms laying close to the soil surface or the shell of the pod. Average number of eggs laid per female was 22.8 – 23.6 in the 7th, 2nd, 9th and 1st boxes respectively, which are not significantly different, while 24.4 – 27.3 in the 8th, 6th, 4th, 3rd and 5th boxes which are also not statistically significant from each other but were significantly different statistically from the former.

The Nymphs:

It took 4 – 5 days after oviposition for the nymphs to emerge. A fully matured nymph is about 3 – 5 mm long. It has roundish abdomen even when it were laid in the field. It took 7 – 14 days for the neonate nymph to develop into a fully matured adult. The nymph appears grayish and darkens to dark brown adult. It measures 6 – 10 mm just like the adult.

Adult:

It took about 3 – 6 days from young adult to fully matured adult with a range between 30 – 34 days as the total developmental period. On emergence, adults look grayish brown, which later turns into a complete but spotted brownish bug. The adult male bugs are cylindrical and smaller in shape than their female counterparts, but females are more robust at the abdomen. Average size of male is 4.5 – 6 mm while females 6 – 8 mm and its abdomen but inward with sharp ovipositor. However, it was observed in the field that *R. littoralis* does not complete its life cycle on groundnut plant, since it migrates as soon as it sucks all available oil within the kernel and flies away. But it was observed that thrashes and other crop residues/stalks and piles of cowpea, maize, guinea corn and other wild species of weeds.

Generally, the adult is dark brown, approximately 10 mm long and 2 mm wide (Plate 10). Each female lays an average of 115 eggs in its lifespan of about 35 - 38 days. In the field, the females lay their eggs in the soil or on groundnut haulms, The first instars nymphs have a bright red abdomen; later instars become progressively darker. All stages of the pest feed on seeds, perforating the pod with their rostrum. On groundnut, the initial infestation starts when the harvested plants are placed for drying in the field. The infested pods are discolored and show oily spots on the outside. In case of severe infestation, the produce is unfit for seed as well as human consumption. This causes seed shrivelling (Plates 3 and 4) and increases the free fatty acid content of the oil, producing a rancid flavor which is in agreement with the report of Malgwi and Onu (2004).



Fig. 1: Life cycle of the groundnut sucking bug (Offa) *Rhyparochromus littoralis*.

Table 1: Parameters on the Biology of *Rhyparochromus littoralis* Dist

Box	Mean Number of Days taken to lay eggs	Mean Number of eggs/Female	Mean Oviposition /Female/Day	Mean Number of Emerged Nymphs	Mean Number of Emerged Adults	Mean Number of Dead Adults	Mean Number of Days it took to Terminate
1	4.7 ^a	108.3 ^c	23.6 ^{cd}	594.6 ^a	553.2 ^b	240.9 ^a	33.6 ^b
2	4.9	111.0 ^c	23.0 ^d	603.4 ^a	566.9 ^{ab}	268.0 ^a	35.8 ^{ab}
3	4.1 ^a	136.9 ^b	26.9 ^a	612.0 ^a	570.8 ^{ab}	256.3 ^a	36.2 ^a
4	4.7 ^a	112.0 ^c	26.3 ^{ab}	610.3 ^a	541.2 ^b	281.7 ^a	24.6 ^{ab}
5	4.2 ^a	148.9 ^a	27.3 ^a	611.2 ^a	560.6 ^{ab}	291.8 ^a	33.6 ^b
6	5.1 ^a	131.2 ^b	251. ^{bc}	611.1 ^a	592.1 ^a	252.1 ^a	34.7 ^{ab}
7	4.6 ^a	120.3 ^c	22.8 ^d	562.6 ^a	568.6 ^{ab}	249.2 ^a	36.1 ^a
8	4.9 ^a	136.3 ^b	24.4 ^{cd}	616.3 ^a	557.2 ^{ab}	285.8 ^a	35.2 ^{ab}
9	4.7 ^a	112.9 ^c	23.3 ^d	595.4 ^a	559.0 ^{ab}	289.2 ^a	34.8 ^{ab}

Means within a column followed by different letters are significantly different at $P \leq 0.05$ while means in the same column followed by the same letters are not significant at $P \leq 0.05$.

IV. Discussion

Biology and Life Cycle

The biology of *R. littoralis* has not been studied extremely to a large extent. However, a sister bug *Elasmolomus sordidus* Fabricius was studied by quite a number of researchers (Slater, 1972; Sanyangan and Ananthakrishnan, 1987; Sharma, *et al.*, 1990; Wood and Ambridge, 1996; Kalaiyarasan and Palanisamy, 2002; NAERLS, 2006; Osman, *et al.*, 2009 and Ranga Rao, *et al.*, 2010). There is very scanty/no information on the biology of this specific lygaeid bug (*R. littoralis*) either on groundnut or its alternate hosts in Nigeria, since most of the researchers above worked in Asia and North Africa.. The biology of *R. littoralis* on groundnut in the laboratory as well as the observations made under field conditions are reported in this study.

It was consistently observed that adult *R. littoralis* males are relatively smaller than the females and also moves faster than the female. The results obtained on biology showed that it took 33-36 days as developmental period, whereas Osman *et al.*, (2009) reported that *Elasmolomus sordidus* a sister bug that devastates sesame in India and groundnut Sudan took 38-40 days, which is in proximity of what was obtained in this study. The sex ratio is still the same 1:1 number eggs laid per female, which was recorded, compared to what was obtained in this study at a lesser temperature. So it could be that, temperature could be a major contributing factor in the biology and life cycle of *R. littoralis*.

However, all effort made to observe *R. littoralis* complete its life cycle on groundnut above the ground level and on debris free environments was negative. The most important thing is that it feeds on groundnut pods as well as

sucks saps from other grain crops and legumes. For example, *R. littoralis* from wide observations attack crops such as, cowpea, maize, sorghum, sesame, millet, etc whether in the presence or complete absence of groundnut after which the insects disappears completely till another season of harvest.

Generally, the adult is dark brown, approximately 10 mm long and 2 mm wide. Each female lays an average of 115 eggs in its lifespan of about 35 - 38 days. In the field, the females lay their eggs in the soil or on groundnut haulms. The first instars nymphs have a bright red abdomen; later instars become progressively darker. All stages of the pest feed on seeds, perforating the pod with their rostrum. On groundnut, the initial infestation starts when the harvested plants are placed for drying in the field. The infested pods are discolored and show oily spots on the outside. In case of severe infestation, the produce is unfit for seed as well as human consumption. This causes the kernel shriveling and increases the free fatty acid content of the oil, producing a rancid flavor which is in agreement with the report of Malgwi and Onu (2004).

Behaviour, Movement and Survival Strategy of *R. littoralis*

It was difficult to monitor this bug sucking groundnut during the day, however, a silent/quiet visit at night gave an insight into their operation, but it was not possible to take a snap shot as the insect is very sensitive to sound and flies away on any disturbance of movement or sound and quickly crawls and hides in debris. This therefore proved that the insect is nocturnal in nature, since most of its activities were done at night time. It was very difficult to catch the insect both in the daytime and at night at a sound or disturbance, *R. littoralis* will pause just within some seconds, probably to note the direction of disturbance and continuous disturbance makes them crawl quickly or hide under groundnut haulms or flies away to related closer debris or weeds.

V. Conclusion

In conclusion, the study showed that *R. littoralis* has a life span of 35 – 38 days in which it completes its life cycle and that it is a major pest of groundnut, which constitutes serious threat to groundnut production in the major groundnut growing areas of Adamawa State, Nigeria. The management practices such as digging, hanging of harvested groundnuts and decorticing (picking) of pods same day or within three days will assist in avoiding the bug. Alternatively, getting rid of the alternate host plants, clean farm sanitation practice and proper chemical control is suggested to be first step in managing this devastating post harvest field insect pest of groundnut, which is capable of causing yield reduction of upto 90% loss in oil content.

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