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Studies on the Population Structure of the Tree Locust, *Anacridium melanorhodon melanorhodon* at Ennohoud Locality, West Kordofan State, Sudan

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Abstract

During the seasons 2012/2013 and 2013/2014 at Ennohoud Locality, West Kordofan State, this study was conducted and dealt with the structure of the tree locust, *Anacridium melanorhodon melanorhodon* (Orthoptera: Acrididae) the most harsh insect pest of *Acacia senegal*, the main source of Gum Arabic production. Three sites, 10,000 M² each, dominated with natural stands of *A. senegal* were randomly chosen at Abumariga Wad Doomi village in the vicinity of Ennohoud town. Each site was checked once every five days starting from the beginning of May to the end of October, and at ten days intervals from the beginning of November to the end of April throughout the study course. The population structure was achieved by determining the ratio of each of the different stages and was taken from 100 nymphs or locusts randomly and then the ratio of each stage registered. Data were statistically analysed using IBM-SPSS (version 20) software package. Descriptive and inferential statistics were followed for data manipulation. Results of the study revealed that six nymphal instars were detected during the tree locust development with the 1st, 2nd and 3rd nymphs dominating the population in August-Sept. and the later instars nymphs, 4th, 5th and the 6th were noticed during September and October. In September most of the stages were observed. Fledgling was occurred in October, while the 1st nymphal stage was not observed (Vanished).

Keywords

Population Structure, Anacridium, *Acacia senegal*, West Kordofan

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1. Introduction

Natural stands of the *Acacia senegal* trees were dominating, what is commonly known as, the Gum Arabic belt which is stretching, across short grass savannah, from extreme east to the extreme west of the Sudan, occupying the area between latitudes 10°–14°N, [1].

a map for the Gum Arabic belt in the Sudan indicated were gum arabic is located, in which west Kordofan is in the middle of this belt, that give the important of the area in producing gum arabic, as shown on (Figure 1) which was developed [2].

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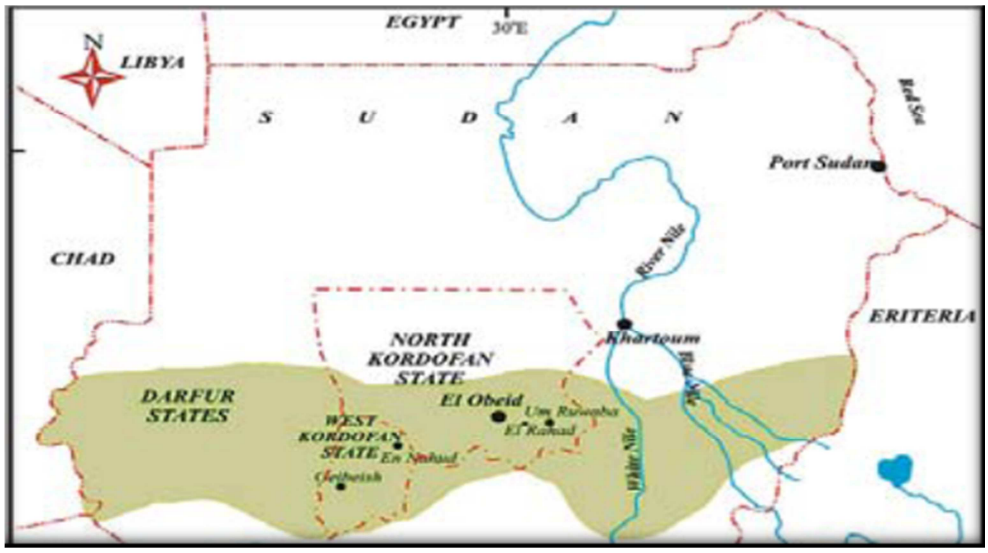


Figure 1. Gum Arabic belt in Sudan (Source: adapted from Mahmoud, 2004).

Gum Arabic is the most important product of this low input production system, which significantly contributes to domestic income and hard currency earnings for the Sudan. The country is accounted for production of more than 70% from the globally marketable Gum Arabic [3, 4, 5, 6 and 7]. In Sudan, Kordofan region is historically very famous for the production of Gum Arabic [5].

In this context, the economic importance of this locust has been increasingly recognized in many areas especially in countries like Sudan, where serious damage was reported [8]. The tree locust, *Anacridium melanorhodon melanorhodon* was reported as the most destructive pest of *Acacia senegal* [9].

Acridoids are insects that pass through three stages: egg, nymph and adult. The nymphs and adults of hemi-metabolic insects are usually similar in shape and habits. Number of nymphal instars is different between acridoids, depending on the species, sex and in some cases the individuals [10].

All locusts and grasshoppers have the same three-stage life cycle: egg, nymph, and adult. Most crop and pasture damage is caused by late hopper stages. [11].

Tree locust *Anacridium melanorhodon melanorhodon* female lays its eggs 10-20 days after the rain. It lays 1-3 egg pods containing 150-200 eggs. The incubation period is 15-65 days [12]. Eggs of the locusts were laid in the ground, usually where it is free from plant cover [13]. The eggs laid in moist soil during rainy season around mid-July and the estimated average incubation period was 40 days [14].

Nymphs or hoppers of the solitary phase are mainly green with white and black dots. Crowded hoppers have a greenish-yellow ground colour and blackish antennae ([15]. The rate of hopper development, as with the rate of egg development, is a function of temperature. The correlation with air temperatures is less clear than with eggs because the hoppers can control their body temperature to a considerable extent by basking or seeking shade [16]. The hatching hoppers climb the nearest bush or tree and may form groups [12]. Eggs hatched giving nymphal stages that develop during August and early September, while the last nymphal stages which moult into fledgling adult in late September to October towards the end of the rainy season [14].

Studies on the tree locust population structure were meagre, and scanty. The hoppers of tree locust, pass through five instars (sometimes six in the solitary phase), shedding a skin (moulting) between each. At the final moult (or fledgling), the young adult (called a fledgling) emerges. The hopper stages are often denoted as L1, L2, L3 and so [16]. After hatching, nymphs (hoppers) develop through five growth stages. Wing buds become progressively more noticeable through each stage until at the final moult (fledgling) a young adult emerges with fully developed wings. Hoppers complete development to adult stage in four to eight weeks, but more rapidly at warmer temperatures. During the first week the bodies and wings of newly fledgling adults were hardened before they are capable of sustained flight [17].

2. Materials and Methods

The study was conducted in Ennohoud Locality, West Kordofan state within the Gum Arabic belt of the Sudan. The area is climatically described as semi-desert to Acacia-bush savannah. Sandy soils and sand dunes are dominating the area. However, some buckets of clay soil are scattered here and there in the area.

The study was conducted in season 2012 -2013 and 2013-2014. Three Sites were randomly selected in Abumarega Wad Doomi, village in the vicinity Ennohoud town. The sites were

named (A, B, C). The size of each site was one (1) hectare (100 × 100 M). Demarcation of the boundaries was done with red flags of cloth. *Acacia senegal* trees were natural stands and at the same age (ten years old), same size (4-5 meters), same soil type (sandy-clay soil), and the same environment (temperature, humidity).

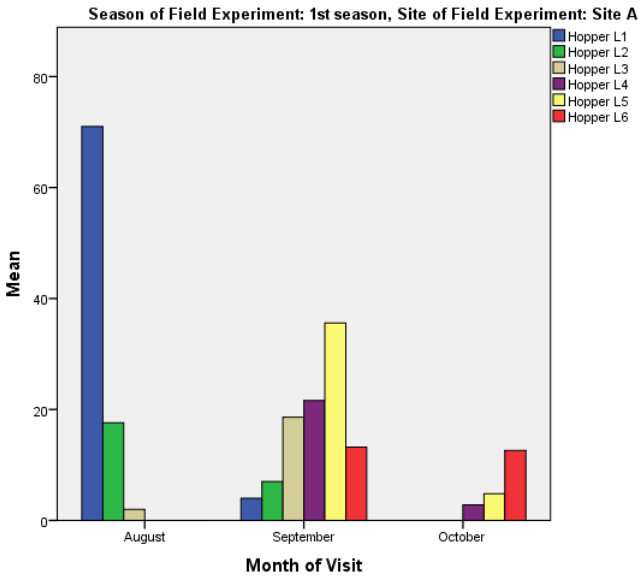
Comprehensive and regular surveys targeting the selected sites (A, B, and C) were conducted, for observation of the locust structure.

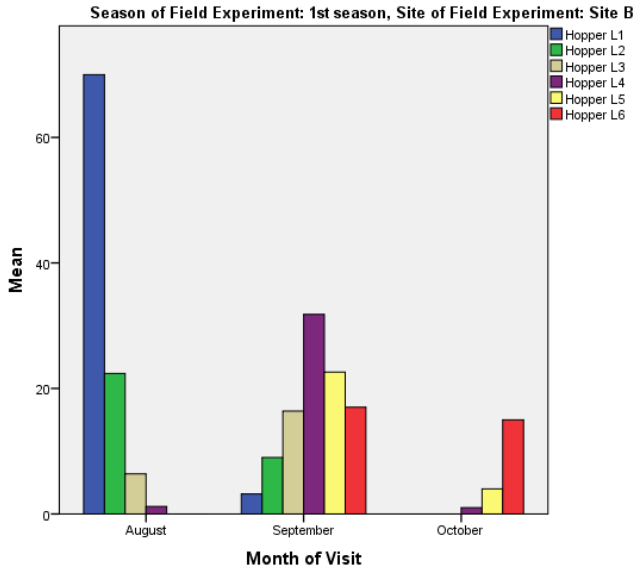
The population structure was achieved by determining the ratio of each different stage and was taken from 100 nymphs or locusts randomly and then the ratio of each stage registered. The survey was conducted in five days interval from May to October and at ten days interval from November to April.

3. Results

3.1. The Tree Locust Population Structure Per Month and Site in Season 2012/2013

Figure 2 shows the structure of the tree locust *Anacridium melanorhodon melanorhodon* at three sites per month in season 2012/2013. In August, the hatching occurred and the first nymphal stage (L1) was the highest among the nymphal stages, it was followed by the second and third nymphal stages (L2 and L3) at the three sites. In site B, the fourth nymphal stage was highest. In September, all nymphal stages were observed but the fourth and fifth (L4 and L5) were the highest. In October, the fourth, fifth, and the sixth nymphal stages were reported and the highest one was the sixth nymphal stage, it was followed by the fifth and the fourth stages.





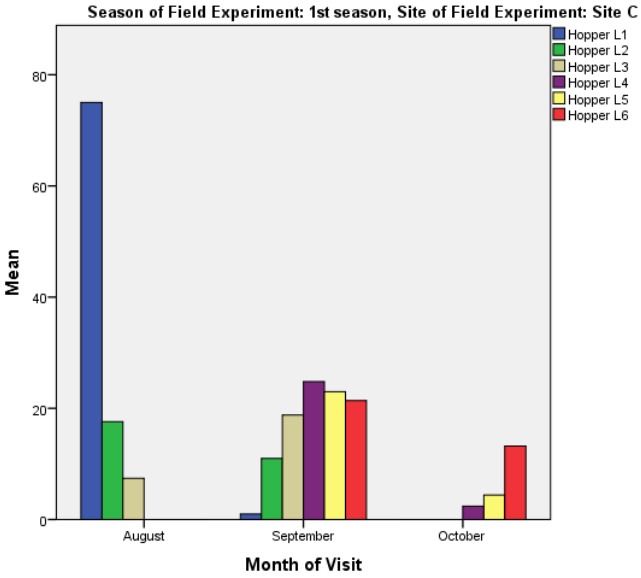


Figure 2. The tree locust population structure per month and site in season 2012/2013.

3.2. Tree Locust Population Structure Per Month and Site in season 2013/2014

Figure 3 showed that in August, The only stage that was reported at sites A and B was the first nymphal stage (L1) and in site C, was no hatching during August.

In September, at all sites, first nymphal stage dominated the other stages, it was followed by, second, third and fourth nymphal stages. Site C showed the fifth nymphal stage.

In October, all sites showed that the sixth nymphal stage (L6), the fledgling, was the main stage, it was followed by fifth and fourth nymphal stages. Nevertheless, in site A the third nymphal stage was seen. In site B, the second and third (L2 and L3) nymphal stage were observed.

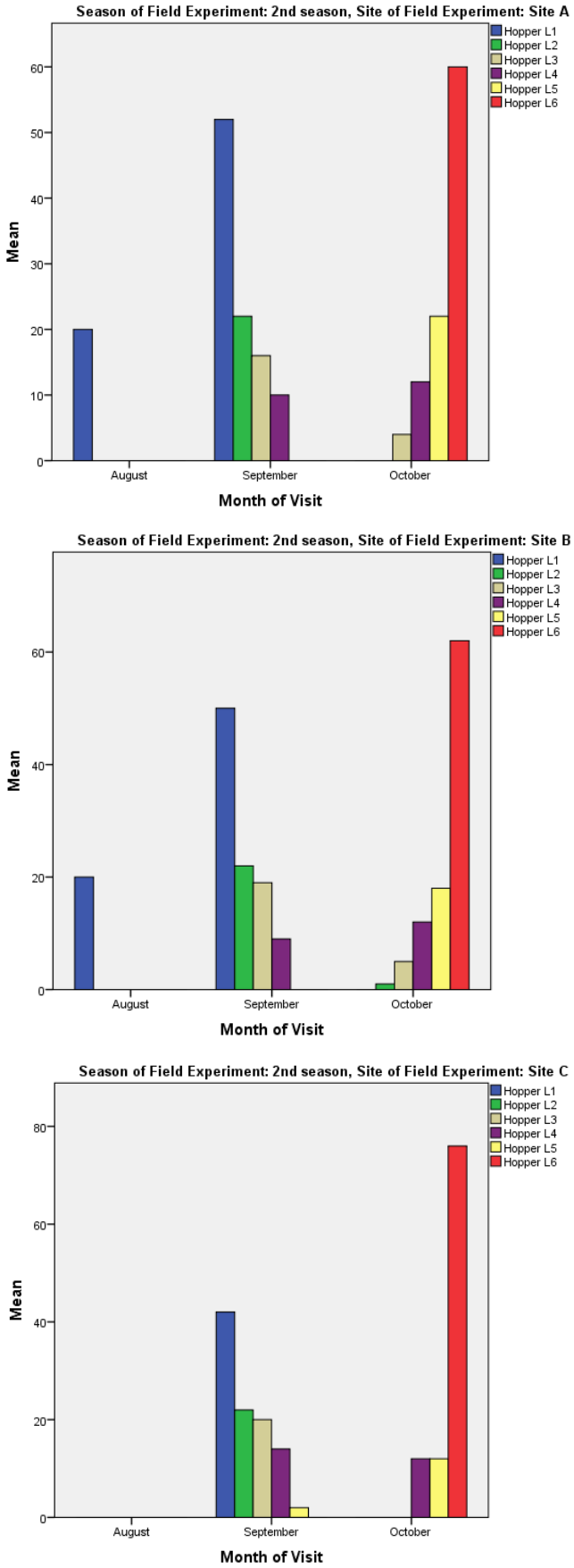


Figure 3. Tree locust population structure per month and site in season 2013/2014.

3.3. The Tree Locust Population Structure Per Month in Season 2012/2013

In season 2012/2013 as shown in Table 1 the major nymphal stage in August was the first stage L1, and followed by L2 and L3.

In September, all the nymphal stages were seen (L1, L2, L3, L4, L5, L6), and their numbers decreased from previous stage and increased in the subsequent stage. In October the first, second and third nymphal stages were not observed. The sixth nymphal stage was the highest observed, followed by L5 and L4.

Table 1. The tree locust population structure per month in Ennohoud season 2012/2013.

	June	July	August	September	October
L1	0	0	74.67±1.91	2.73±1.20	0
L2	0	0	19.67±2.66	9.00±2.07	0
L3	0	0	5.27±1.76	17.93±1.56	0
L4	0	0	0.40±0.47	26.07±1.10	2.07±1.09
L5	0	0	0	27.07±1.92	4.40±1.67
L6	0	0	0	17.20±2.46	13.60±3.13

3.4. The Tree Locust Population Structure Per Month in Season 2013/2014

In season 2013/2014, as shown in (Table 2), hatching occurred in August, so the only nymphal stage seen is the first (L1). In September, L1, L2, L3, L4 and L5 were observed and the stages were built up. In October L1 disappeared, and the most observed stages were L6, followed by L5, L4, L3 and L2.

Table 2. The tree locust population structure per month in season 2013/2014.

	June	July	August	September	October
L1	0	0	13.33±3.28	48.00±3.23	0
L2	0	0	0	22.00±1.98	0.33±0.42
L3	0	0	0	18.33±2.38	3.00±1.44
L4	0	0	0	11.00±2.27	12.00±2.45
L5	0	0	0	0.67±0.65	17.33±2.61
L6	0	0	0	0	66.00±2.91

4. Discussion

Population structure of the tree locust was studied by several authors. They stated that Acridoids insects pass through three stages, egg, nymphs, and adult. All locust and grasshoppers have the same three-stage life cycle; egg, nymph (hopper) and winged adult [10-11]. The hoppers pass through five instars, shedding the skin (moulting) between each. The final moult (fledgling) emerges. The hopper stages are often denoted as L1, L2, and L3 and so on. The results of these authors are in line with the results of this study, in which tree locust have three main observed stages, egg, hopper and adult. Hoppers of the tree locust have six nymphal stages ended by the fledgling. [16].

5. Conclusions

1. The tree locust, *Anacridium melanorhodon melanorhodon* (Orthoptera: Acrididae) is a serious pest of *Acacia senegal* which seriously influence the process of Gum Arabic production.
2. The tree locust life cycle passes through three stages, egg, nymph and adult. The nymphal stage passes through six nymphal stages; the last stage moult into a fledgling adult.

References

[1] Vogt, K. (1995): A field Workers Guide to the Identification, Propagation and Uses of Common Trees and Shrubs of Dry land Sudan. SOS Sahel International, London. Khartoum, Sudan.

[2] Mahmoud, T. E. (2004): The adequacy of price Incentives on production, processing and marketing of Gum Arabic in Sudan: A case Study North and West Kordofan. PhD Thesis Submitted to Institute for International Forest and Forest Economics. Technical University, Dresden, Tharandt 2004.

[3] Mohammed Abdullah (1961): Behavioral Effects of Temperature Insects. Ohio Journal of Science: Volume 61, issue 4 (July 1961).

[4] Sara, S, A., Rabah, A., Ali H. I. & Mahmoud, T. E. (2016). Acacia seyal Gums in the Sudan: A review. The seventh graduate studies and scientific research conference, University of Khartoum, 20-23 February 2016.

[5] Jamal A. and L. Huntsinger (1993). Deterioration of a sustainable agro-silvo-pastoral system in the Sudan/ the Gum gardens of Kordofan. Agro-forestry Systems. Volume 123: 1, 23-38

[6] Berry La Verle (2015): Area handbook Series: Sudan- a country study. Fedral Research Division. Library of Congress. Fifth edation, First printing 2015. ISBN 978-0-8444-0750-0.

[7] Yasseen A. M., ADIL, Yousif Eljack and Mohammed, Elawad Dafa Ella Ahmed (2015): Sudan Gum Arabic Export Performance during (2000-2014). International Journal of Chemical, Environmental & Biological Sciences (IJCEBS) Volume 3, Issue 5, pp 260-263, (2015) ISSN 2320–4087 (Online).

[8] Popov G. & Ratcliffe M. (1968): The Sahelian Tree Locust Anacridium Melanorhodon (Walker); Anti- Locust Memoir 9. Ministry of Overseas Development. Anti-Locust Research Centre, College House, Wrights Lane, London, W.8 1968.

[9] Ballal E. M., E. A. El Siddig, M. A. Elfadl, and Luukkanen (2005): Relationship between Environmental Factors, Tapping Dates, Tapping intensity and Gum Arabic Yield of An Acacia senegal Plantation in Western Sudan. Journal of Arid Environments 63: 379-389.

[10] Hernández-Zul (2012): María Irene Hernández-Zul, Juan AngelQuijano-Carranza, Ricardo Yañez-López, Irineo Torres-Pacheco, Ramón Guevara-Gónzalez, Enrique Rico-García, Adriana Elena Castro-Ramírez and Rosalía Virginia Ocampo Velázquez. Elements for the sustainable management of acridoids of importance in agriculture. African Journal of Agricultural Research Vol. 7 (2), pp. 142-152, 12 January, 2012.

[11] Walton, C. S, L. Hardwick and J. Hanson (2003): Pest Status Review Series – plant Protection. Department of Natural Resources and Mines. ISBN 073452453 6.

[12] Meinzingen W. F. (1993): A Guide To Migrant Pest Management In Africa. Food and Agriculture Organization of United Nation (FAO).

[13] Uvarov B. P. (1955): The Aridity Factor in the Ecology of Locust and Grasshoppers of the Old world. Arid Zone Programme. Anti-locust Research centre. London. United Nations Educational, Scientific and Culture Organization.

[14] Ibrahim, M. and, Abdalla M. Abdalla (2015): Bio-ecology of Anacridium Melanorhodon Melanorhodon, (Orthoptera: Acrididae) on Acacia Senegal in North Kordofan State, Sudan. Tropentag, September 16-18, 2015, Berlin, Germany

[15] Schmutterer, H. (1969). Pests of crops in Northeast and Central Africa. Gustarv Fisher Verlag. Stuttgard, Portland, USA.

[16] Symmons P. M and K. Cressman (2001): Desert locust guidelines, Biology and Behaviour. Food and Agriculture Organization of the United Nations (FAO). Second edition 2001.

[17] Anonymous, 2013: Adult Locust Behaviour: Biosecurity SA., available at http://www.pir.sa.gov.au/locust/fact_sheet_adult_locust_behavior.