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Full Length Research Paper

Preference of food plants by adult of the desert locust schistocerca gregaria (forsk.) (orthoptera: acrididae)

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A study on Desert locust (*Schistocerca gregaria*) was conducted to find out the preference values for ten different food plants belonging to five different families by adult of *S. gregaria* around Usmanu Danfodio University, Sokoto main campus. Grasshoppers (*Schistocerca gregaria*) were collected in the field and starved for 24 hours period after which different types of food plants were introduced to the cage and preference value of each plant by *Schistocerca* was examined. Based on the preference values, the plants were categorized into four, *Vigna unguiculata* showing the highest average preference value (40.9 %) constituted category A. The food plants in the second category B were *Lactuca sativa* (14.5%) and *Zea mays* (186.5%). The third category, C include *C. dactylon*, *A. hyviridus*, *A. gayanus*, and *O. sativa* with 92.5, 99.5, 100 and 110 percent average preference values, respectively. The fourth category D comprised of plants with least average preference values such as *S. occidentalis* (71.0 %), *S. bicolar* (71.5%) and *S. officinarum* (73.0%). This study suggest that this grasshopper being primarily a grass feeder preferred plants belonging to family leguminosae when mixed with other plants families i.e. Compositae, Poaceae, Amaranthaceae, Papilionaceae, which may be affected by their succulence and palatability apart from their nutritive values and the presence of odd substances. Therefore, there is need for adequate control of this pest against damage caused to crop plants in future.

Keywords: Food plants, *S. gregaria,* preference, leguminosae, locust.

INTRODUCTION

The desert locust (*Schistocerca gregaria*) is a wide spread pest that cause untold and terrible damages to our crop plants in the field. *S. gregaria* is a species of locust discovered by Forskal in 1775 and considered to be *S. Americana gregaria* (Dirsh, 1974). *S. gregaria* was generally recognized as polyphytophagos acridid that causes damage to pastures and crops during the desert locust upsurge in 2004 (Trai and Doumandji, 2009). The hopper is a great herbivore that includes both grasses and forbs in its diet (Rauben and Simpson, 2003). The preference of food by grasshoppers is determined by many factors such as toughness of the leaf hairness and water content frequently are believed to influence feeding behavior, chemical differences are also vital, sugars phospholipids, organic nitrogen compound, tannins, and others influence host preference; generally feeding is

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Table 1. Leaves of ten different food plants used.

S/N	Common Names	Botanical/Scientific Names	Family
1	Amaranthus	*Amaranthus hybridus L.*	Amaranthaceae
2	Gamba Grass	*Andrapogon gayanus L.*	Poaceae
3	Bermuda Grass	*Cyanadon dactylon L.*	Poaceae
4	Lettuce	*Latucca sativa L.*	Compositae
5	Rice	*Oryza sativa L.*	Poaceae
6	Guineacorn	*Sorghum bicolor L.*	Poaceae
7	Sugar Cane	*Saccharum officinarum*	Poaceae
8	Senna Tea	*Senna occidentalis L.*	Papilionaceae
9	Cowpea	*Vigna unguiculata W.*	Leguminoseae
10	Maize	*Zea mays L.*	Poaceae

limited to temperature between 15oC and 30oC and little time is spent in feeding approximately 15 % (Uvarov,1977). Bernays and Chapman (1970) concluded that while physical features may be important selection is largely based on the chemical characteristics of the food. In arid and tropical environments hopper population density increases in proportion to rainfall band plat biomass (Capinera and Horton, 1989; Fielding and Brusven, 1990; Joern and Gaines,1990). Desert locust feed on all sort of plants; consuming approximately equivalent of their body mass each day. Nearly all crops and non-crops plants are at risk including millet, rice, sorghum, maize, sugar cane, badly, cotton, fruit trees, vegetable, grasses, alacia pines and banana (OECD,2004).

Desert Locust has been reported to feed on more than 400 species of plants (Uvarov, 1977). From 2003 – 2005, west African countries faced the largest desert locust outbreak during the upsurge harvest losses were valued at up to US $2.5 billion which disastrously threatened food security situation in west Africa (Cressman, 1996); The severity of the damage caused leads to the formation of strategies to control the pest, among which is the biological control of pest used by LUBILOSA program, locust are killed also in many ways including trapping in trenches, poisoning with baits, by insecticidal dusts and sprays.

The preference of food plant by an acridid pest hoppers have extensively been studied more than any other insect pests due to the fact that they are widely spread and can be maintained in the laboratory condition. The preference of food plant by *S. gregaria* was studied to find the order of preference out of the ten local varieties of plants so that the preferred food plant cultivated by farmers can easily be saved. The objective of the study therefore, is to find out the order of preference of food plant of the local flora by Desert Locust so as to find out strategies for the protection of the preferred plant species against damage caused by *S. gregaria* in future.

MATERIALS AND METHODS

Specimens collection

One hundred and fifty adult locust (*Schistocerca gregaria)* were collected from the field and kept in a rearing cage. In order to find out the preference of food plants by the locust, leaves of ten (10) different plants (Table 1) were selected and fed to the hoppers. Before the beginning of the experiment, the grasshoppers were starved for 24 hours, after which fresh leaves of four different plants leaves were double cut and made in to small bundles. These leave bundles were then placed in four glass beakers of 50 ml, and put in four corners of the experimental cage. The number of locusts feeding on each plant leaves for 5, 10, 15 and 20 minutes, respectively was recorded. The hoppers will be fed for some days and where then starved for 24 hours again for the second trial.

In the second trial, three other different leaves and the highest preferred food plant in the first trial each was put in to the experimental cage situated in the four corners of the cage after which hoppers were put in to the cage. It was observed that they feed voraciously for 5 minutes and the number of hoppers feeding on each plant species was recorded. The same applied after 10, 15, and 20 minutes, respectively. The same procedure was also applied to the rest of the trials.

The preference values of each plants used was determined by taking the highest preferred plant in the first trial as standard i.e. (100%) and preference of the other plants were found by multiplying the preference number of

Table 2. Food Preference by Adults of the Desert Locust, *S. gregaria*

S/N	Food Plants Used	Botanical Names	Family of Food Plants	Average Preference Values	Categories Based on Preference Values
1	Cowpea	*Vigna unguiculata*	Leguminoseae	409	A
2	Lettuce	*Latucca sativa*	Compositae	145	
3	Maize	*Zea mays*	Poaceae	186.5	B
4	Bermuda Grass	*Cyanadon dactylon*	Poaceae	92.5	
5	Amaranthus	*Amaranthus hybridus*	Amaranthaceae	99.5	
6	Gamba Grass	*Andrapogon gayanus*	Poaceae	100	C
7	Rice	*Oryza sativa*	Poaceae	110	
8	Sennatea	*Senna occidentalis*	Papilionaceae	71	
9	Guinea corn	*Sorghum bicolor*	Poaceae	71.5	D
10	Sugar cane	*Saccharum officinarum*	Poaceae	73	

the other three plant by 100 and then divided by the preference number of the standard. The first and second trials for each plant were added together and divided by 2 so as to get the average preference values, as seen below for the first four food plants used.

1st trial

A- Gamba Grass – 10
B- Amaranthus – 9
C- Sugar Corn – 9
D- Guinea Corn – 7

Above is the total preference values after 20 minutes

A. = 100 % (Standard)
B. = $\frac{9 \times 100}{10}$ = 90
C. = $\frac{9 \times 100}{10}$ = 90
D. = $\frac{7 \times 100}{10}$ = 70

2nd trial

A. Amaranthus - 12
B. Gamba - 11
C. Gunie Corn - 8
D. Sugarcane - 6

Above is the total preference values after 20 minutes.

A. = $\frac{12 \times 100}{11}$ = 109
B. = 100%
C. = $\frac{8 \times 100}{11}$ = 73
D. = $\frac{6 \times 100}{11}$ =56

Then the first and the second trials are added together to find the average preference values of each:

- Gamba Grass = $\frac{100 + 100}{2}$ = 100
- Amaranthus = $\frac{90 + 109}{2}$ = 99.5
- Sugarcane = $\frac{90 + 56}{2}$ = 73
- Guinea Corn = $\frac{70 + 73}{2}$ = 71.5

RESULTS

It was observed that food preference values for adults of *Schistocerca gregaria* varied from plant to plant. Out of the 10 local varieties of plants used, cowpea (*Vigna unguiculata*) (leguminoseae) was found to be the highest preferred food plant with the average preference value of 409% followed by lettuce (*Latucca sativa* L.) and maize (*zea mays* L.) with 145 and 186.5 percent average preference values; Bermuda grass (*Cyanadon dactylon* L.), Amaranthus (Amaranthus hyviridus L.) Gamba grass (*Andrapogon gayanus* L.) and rice (*Oryza sativa* L.) were the third categories of preferred food plants by *Schistocerca gregaria* with 92.5, 99.5, 100 and 110 percent average preference values respectively. Sennatea (*Senna occidentalis*), guinea corn (*Sorghum bicolor L.*), and Sugar cane (*Saccharum officinarum*) were observed and found to be the least preferred plants with 71.0, 71.5 and 73.0 percent average preference values. (Table 2).

DISCUSSION

The result of this study shows that the Desert Locust *S. gregaria* prefer plants in the family leguminosae when mixed with other plants belonging to different families. The highest preference of cowpea (*Vigna unguicullata*) with the

average preference values of 409% may be is due to its nutritive quality, water content, succulence and palatability as well as specific substances termed phagostimulants. It was observed that the sensilla on the maxilla and its labial palps function in mediating responses in feeding and rejection of unpalatable food prior to feeding, the more succulent and food containing palatable chemicals are being preferred. This observation demonstrated findings similar to this work by other researchers/scientists such as Blaney and Chapman (1969) who conducted the research on locust and found that the locust selects its food in preference to others by moving over the leaf surface of the food with the tips of their palps; this enables them to differentiate between favorable and unfavorable food plants. Barnays (1990) noted that in every dry years lack of water in plants may explain the hoppers mortality better than low food plants availability. (Behmer and Joern 1993) reported that chemicals such as specific amino acids act as phagostimulants and hoppers choose diets with higher concentration of these amino acids. (Simpson and Simpson 1990) added that the internal control such as fluxes in amino acid concentration in the hem lymph can regulate feeding based on nitrogen needs.

The different preference values in Table 2 based on categories suggest that lettuce and maize plants in category B are preferred next to cowpea may be as a result of in sufficient phagostimulating substances; food plants in category C were consumed not as higher as that of plants in category A and B by *S. gregaria*, is due to the fact that the phagostimulants, nutrients, water content and palatability of the plants are sufficient in the other plants offered together in the same cage as such they preferred the later first. In the case of plants in category D which were found to have a least average preference values is due to the little or lack of substances that stimulate feeding; or the presence of deterrent chemicals in the plants which make the hoppers to reject them.

CONCLUSION

The present study has vindicated the fact that desert locust, *S. gregaria* is a serious pest that affect and damage the cultivated crop plants in the study area particularly legumes. There is therefore need for government, agricultural organizations, farmers and gardeners to provide appropriate control measures in the area to prevent the cultivated crop plants against the damage caused by *Schistocerca gregaria*.

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