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PERFORMANCE OF COTTON STAINER DYSDERCUS SUPERSTITIOSUS (HETEROPTERA:PYRRHOCORIDAE) ON SOME CULTIVATED AND WILD HOSTS

I. B. IGBINOSA

Zoology Department,
University of Nigeria,
Nsukka, Nigeria.

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ABSTRACT

The cotton stainer, Dysdercus superstitiosus (Heteroptera: Pyrrhocoridae) was reared separately on diets of dry and fresh seeds of cotton, Gossypium hirstrutum, Okro, Abelmoschus esculentus, Cadillor Urena lobata and the broom weed Sida acuta. Nymphal development was significantly affected by diet, being shorter on dry cotton seeds (18.4 $\pm$ 2.06 days) and longest on dry Urena seeds (25.8 $\pm$ 5.04 days). Nymphs reared on dry or fresh seeds of Sida acuta did not complete their development. Survivorship of the nymphs was also dependent on diet with dry cotton seeds being more superior (42%) while fresh Urena seeds were poorest (28.0%). Adult longevity and fecundity were also influenced by diet. LT50-value was 19.5 days for dry cotton seeds while it was only 10.0 days for those insects fed dry okro seeds. Insects fed dry okro seeds also produced the least (41 $\pm$ 1.8 eggs/female) number of eggs while those fed dry cotton seeds produced the highest (100 $\pm$ 11.8 eggs/female). The difference was statistically significant when the ANOVA test was applied at $P \geq 0.05$ ($F^{30}_5 = 2.55 < Fcal = 54.55$). Other population parameters such as the net reproductive rate R_0, intrinsic rate of increase T_c, and finite rate of increase, Λ, followed a similar trend with insects fed dry okro seeds giving the least values. Thus, on the basis of the population parameters, the diets, can be arranged in a descending order as follows: dry cotton seeds, fresh cotton seeds, fresh okro seeds, fresh Urena seeds, dry Urena seeds and dry okro seeds.

INTRODUCTION

Dysdercus spp (Heteroptera: Pyrrhocoridae) are wide spread and are key pests of cotton. Other host plants are mostly members of the family Malvaceae Observations reveals that D. superstitiosus is the most abundant Dysdercus sp

in West Africa (Libby, 1968). The relationship between other species of Dysdercus and host plants have been reported by Afzal et al (1986), Ahmad and Perveen (1986), Ahmad and Zaidi (1986) and Ahmad (1979, 1983). These studies reveal that the numphs of Dysdercus species need to feed on seeds of host plants to produce viable adults.

Geering and Coaker (1960) compared the development of D. superstitiosus on cotton seeds on Sorghum and reported that the speed of development and survival were higher on nymphs fed cotton seeds. Similarly, nymphs fed cotton seeds also produced larger adults. Since the type of food, plays an important role in the building up of the population of an insect, the present study was undertaken, to determine, the possible effects on nymphal and post nymphal development, of D. superstitiosus fed on different diets of wild and cultivated crops. For this reason, fresh and dry seeds of cotton, Gossypium hirstrutum, okra, Abelmoshus esculentus, cadillor, Urena lobata and the broomed Sida acuta were fed singly to nymphs of D. superstitiosus. Urena lobata and Sida acuta are common weds often found in farm lands including cotton plots as well as hedge rows, while okra is a vegetable crop commonly inter-cropped with other arable crops.

MATERIALS AND METHODS

D. superstitiosus nymphs used for the study were raised in a laboratory culture maintained on dry cotton seeds. Fresh and dry seeds of cotton, okro, U. lobata and S. acuta served as diets for the nymphs and adult. Prior to the experiments, dry seeds were soaked in water for 12 hours to ease the piercing of the seed coat by the insects, according to Hodjat (1968).

The different seeds were each placed into individual jam jars in lots of five, thus giving replicates for each type of diet. Thereafter, ten newly hatched nymphs (about 12 hours old) of D. superstitiosus were placed with the aid of a carmel hair brush into each jam jar containing the appropriate test diet and laid in groups in cabinets in a laboratory having room temperatures of 24.0-320^{0}c (mean 27.5 $\pm$ 1.2^{0}c) and relative humidities of 60-80%. The openings of the jam jars were then covered with nylon netting material and fastened with rubber band. A small quantity of cotton wool soaked in water was placed at one corner of each jar to provide drinking water for the insects. The seeds were changed once in the course of the experiment while the cotton wool was moistened twice daily. Records

of nympha development and survivorship were kept.

As soon as adults emerged, the males and females were separated and paired singly in fresh jam jars. A small quantity of wet soil was placed at the bottom of each jar to provide oviposition substratum. Each pait of D. superstitiosus was provided the same king of diet on which the nymps had developed. Daily records of oviposition and adult survivorship were kept. Each experiment was terminated with the death of the female. Any dead male was replaced from the stock maintained on the appropriate diet. Egg batches were picked up by means of soft Carmel hair brush and placed in Petri dishes and counted under a dissecting microscope with the aid of a tally counter. Indices of growth, survival, adult and oviposition were calculated using the formular of Tripathi and Sharma (1985).

RESULTS AND DISCUSSION

Dietary effects in nymphal development:

Table 1 summarises the nymphal developmental period of D. superstitiosus fed diets of different host plants. Dry Urena seeds substantially delayed nymphal period (25.8 $\pm$ 5.04 days) whereas development was fastest in those nymphs fed dry cotton seeds (18.4 $\pm$ 2.06 days). Statistical analysis by ANOVA showed that the difference in nymphal period was significant ($F^{25}_{5} = 2.63 < Fcal = 3.74$) at $P \geq 0.05$. However, nypmhs fed dry or fresh seeds of S. acuta did not survive beyond the second instar. The percentage survivorship from instar to instar and to adult emergence is shown in Fig. 1. The proportion of adults emerging was generally low in all test diets. The highest survivorship of 42% was recorded on nymphs fed dry seeds of cotton. These were closely followed by those fed fresh seeds of cotton and dry okro seeds each with 40% survivors. The least survivorship of 28% was recorded in those insects fed fresh seeds of U. lobata. The survivorship curves (Fig 1) generally approximated to the type II described by Slobodkin (1962), indicating that mortality rate was uniform in all the age intervals. Data on development are in conformity with those of Geering and Coaker (1960) who had remarked that diets other than mature seeds of cotton were less suitable for breeding D. superstitiosus. However, it is observed from this study that D. superstitiosus can be bred on seeds of okro and U. lobata.

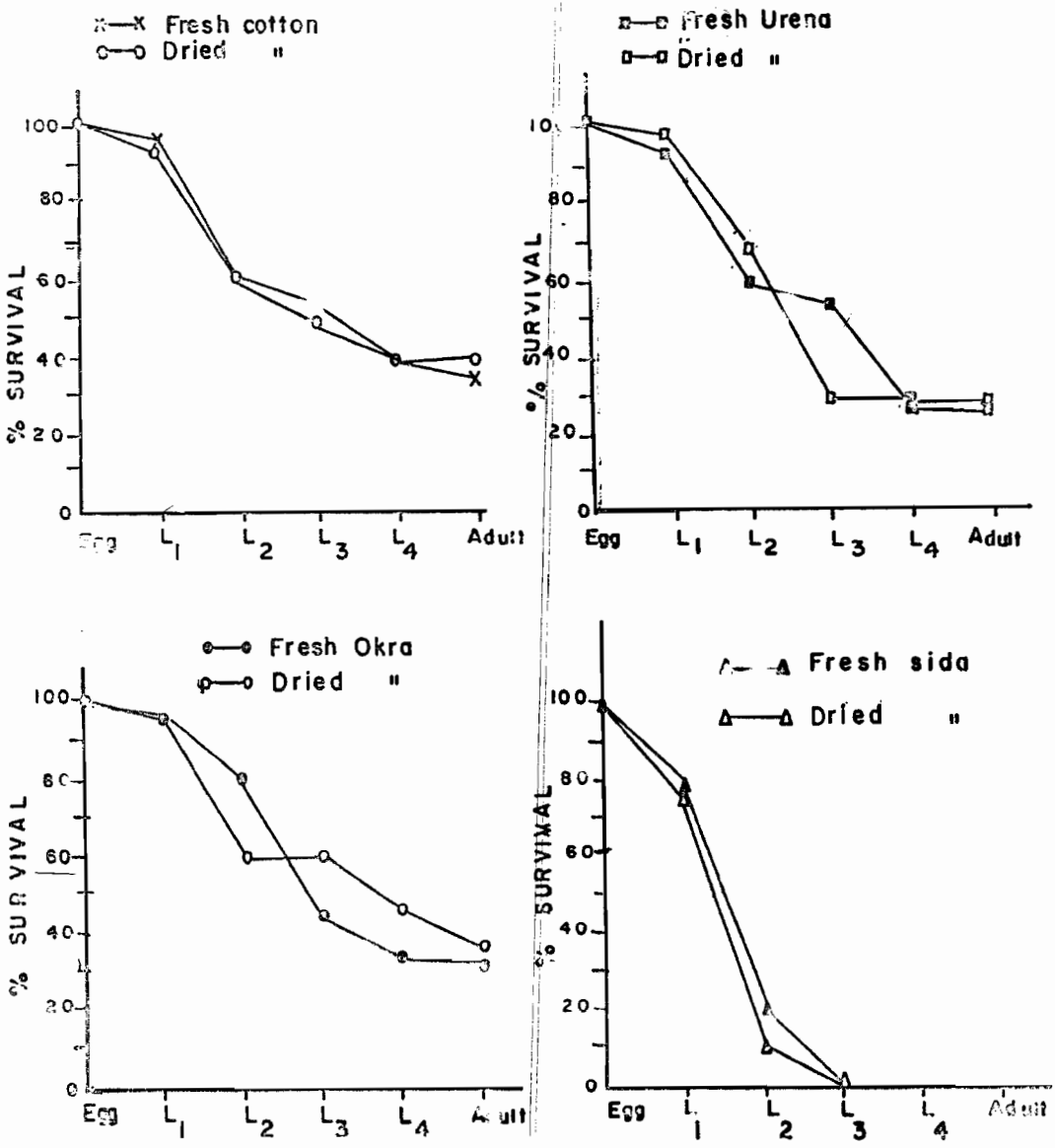

Fig 1: Percentage survival of different instars of nymph of <u>Dysdercus superstitions;</u> fed on different hosts

Table 1: Effect of some cultivated and wild hosts on nymphal development of *Dysdercus superstitiosus* in the laboratory

Hosts	Duration (in days) of development of instars. L1	L2	L3	L4	
Dry cotton seeds	5.0 ± 0.63	3.8 ± 0.98	4.6 ± 0.8	5.0 ± 0.4	18.4 ± 0.7
Fresh cotton seeds	5.2 ± 1.33	5.0 ± 1.2	7.4 ± 2.04	5.2 ± 0.75	22.8 ± 1.33
Dry okro seeds	4.8 ± 0.75	4.6 ± 0.8	6.0 ± 1.41	6.0 ± 0.89	21.4 ± 0.96
Fresh okro seeds	5.0 ± 1.10	4.8 ± 1.17	4.8 ± 1.02	4.6 ± 0.49	19.2 ± 0.95
Dry *Urena* seeds	6.0 ± 1.10	6.6 ± 2.73	5.6 ± 0.8	7.6 ± 4.72	25.8 ± 2.34
Fresh *Urena* seeds	6.0 ± 0.63	4.2 ± 0.89	5.2 ± 0.4	5.8 ± 0.75	21.2 ± 0.67
Dry Sida seeds	6.0 ± 0.74	7.0 ± 0.39	.....	.....	.....
Fresh Sida seeds	6.0 ± 0.75	6.2 ± 0.40	.....	.....	.....

$F = 3.74 > F^{25}_{5}$ = *Significant at* $P \geq 0.05$

Dietary effects on adult survivorship and fecundity:

Fig. 2 shows the age-specific survivorship and age-specific fecundity rate while Table 2 summarises some population parameters of D. superstitiosus fed different diets. The LD50 (i.e. time required for the population to be reduced to 50%) was longest (19.5 days) on the insects fed dry cotton seeds while it was only 10 days for the insects reared on dry okro seeds. Dry cotton seeds also supported the greatest production of eggs (100 ± 10.97 eggs per female) while the insects fed dry okro seeds had a mean of only 41.0 ± 1.58 eggs per female. ANOVA test confirmed that the observed differences in egg laying of insects fed different diets were statistically significant at $P \geq 0.05$ ($F^{30}_{5} = 2.55 < Fcal = 54.55$). Thus, on the basis of egg production dry seeds of okro appear to be the least efficient diet of D. superstitiosus.

A pre-oviposition period of 4-7 days was observed in insects reared in all the test diets. Maximum egg numbers was attained on day 9 of adult life on insects reared on both dry and fresh seeds of cotton but oviposition spanned through to day 16. On Urena seeds, maximum

egg production occurred on the 7th and 10th day of adult life on the insects fed the dry and fresh seeds respectively, but the performances of insects fed fresh seeds was superior to those fed the dry seeds. Maximum egg numbers was recorded on days 7 and 8 on insects fed dry and fresh seeds of okro respectively (Fig. 2). Other population parameters such as net reproductive rate, R_0, intrinsic rate of increase, r_c, and finite rate of increase, Λ, were consistently high on insects fed dry seeds of cotton while those fed dry okro seeds gave the lowest values. However, only difference in R_0 values were statistically significant when the Chi-Square statistic was applied at 5% probability level (X^2cal = 107.93 > X^2Tab = 5.99; d.f. = 2) (Table 2). Thus, on the basis of oviposition, the diets can be arranged in a descending order of performance as dry cotton, fresh cotton, fresh okro, fresh Urena, dry Urena and dry okro seeds.

In a wide range of insects, diet has been shown to profoundly influence the rate of development, survival, longevity and fecundity (Iheagwam 1979 1981; Lai and Mukherji, 1978; Srivastava, 1959; and Basu, 1944). Although the net reproductive rate (R_0) was appreciably affected by diet, D. superstitiosus was able to deposit most of the egg complement early in the reproductive life before any significant mortality could set in. This ensures that the female insects deposited their egg complement while they were still in a most viable state. It also ensured that those with shorter life span such as those fed dry okro and Urena seeds, deposited their eggs during their short life time. It is generally known that the earlier a population reaches its maximum fecundity, the greater is its capacity for increase. Thus it could be concluded that the favoured test diets have a high potential for the rapid increase of population of D. superstitiosus under favourable field conditions.

Table 2: Demographic and biological statistics of female D. superstitiosus reared on different diets

	Cotton Seeds		Urena Seeds		Okro Seeds		Test calculated value	Statistic Tabulated value
	Dry	Fresh	Dry	Fresh	Dry	Fresh		
No of observations	50	50	50	50	50	50	.....	.....
X Longevity (in days)	42.4 ± 1.9	33.6 ± 2.7	14.6 ± 3.2	31.6 ± 2.4	11.5 ± 2.0	19.4 ± 2.7	F = 23.75	$F^{0.5}_{5-250}$
x Reproductive period (in days)	12.5 ± 2.5	9.2 ± 0.8	9.4 ± 1.2	11.6 ± 1.4	6.7 ± 1.6	8.5 ± 2.2		
X Fecundity / ♀	100. ± 11.8	805. ± 6.5	44.6 ± 4.5	60 ± 5.8	41.8 ± 1.8	66.1 ± 5.5	F = 54.55	$F^{0.5}_{5}$ = 2.55
LT50 (in days)	19.5	15.0	11.0	17.5	10.0	15.5		
R_0	319.2	117.76	47.38	72.66	38.75	78.91	X^2 =107.93	X^2 =5.99
r_c (weekly) = $\frac{\log_e R_e}{T_c}$	1.163	0.821	0.880	0.867	0.792	0.930	X^2 = 0.06	X^2 = 5.99*
T_c (in days)	33.4	37.8	37.8	36.2	31.4	31.2	X^2 = 0.77	X^2 = 5.99*
λ (weekly)	14.54	6.62	7.60	7.36	6.21	8.58		
Period (in weeks) for population to double $\log_e 2$ / r_c	6.35	9.00	8.39	8.52	9.33	7.94		

**Not significant at P≥ 0.05*

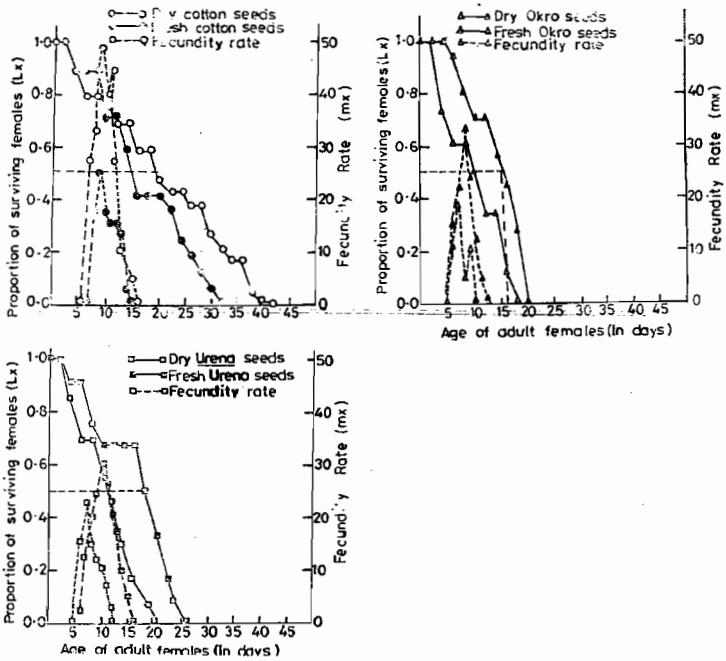

Fig 2: Age specific mortality and Fecundity of Dysdercus superstitiosus on seeds of (a) Cotton, (b) Urena lobata and (c. okra

Indices of Performance:

From the biological data collected, values of growth index, survival index, adult index and oviposition index were determined for each diet using the dry cotton seeds as the standard diet (Table 3). The growth index value for dry cotton seeds was the highest (2.283) while dry Urena seeds gave the lest value (1.163). With regard to adult index and oviposition index, the values for dry Urena and dry okro seeds were lower than those of other diets. It therefore appears that in the case of diets where the insect showed a higher percentage nymphal survival and shorter developmental period, the growth index values were generally higher. Pande et al (1968) and Tripathi and Sharma (1985) had made similar observation on Diacrisia obliqua and Heliothis armigera respectively. The data in this study further suggest that both dry and fresh seeds of cotton, okro and U. lobata are capable of sustaining differing levels of D. superstitiosus populations.

The agronomic implications of the findings in this study is that U. lobata is a potentially important alternate host of D. superstitiosus, since it supports development and oviposition of the pest as does cotton and okro (Libby, 1976; Onolemhemhen, et al 1991).

Efforts should be made to promptly control U. lobata, which is usually a common weed in and around farm lands whenever okro or cotton are being grown as it could serve as source of infestation of the crops of D. superstitiosus.

Table 3: Growth index values for *D. superstitosus* fed different diets of dry and fresh seed of cotton, okra and *Urena blasta*

Diet	Growth Index	Oviposition Index	Adult Index	Survival Index
Dry cotton seeds	2.283	1.000	1.000	1.000
Fresh cotton seeds	1.754	0.800	0.762	0.947
Dry okro seeds	1.869	0.410	0.262	0.947
Fresh okro seeds	1.979	0.661	0.452	0.842
Dry *Urena* seeds	1.163	0.440	0.333	0.684
Fresh *Urena* seeds	1.321	0.600	0.738	0.632

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