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PRELIMINARY OBSERVATIONS ON THE ECOLOGY OF SOME GRASSHOPPERS IN TRIPURA WITH SPECIAL REFERENCE TO *OXYA HYLA HYLA* SERV. (ORTHOPTERA : ACRIDIDAE)

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INTRODUCTION

Grasshoppers are polyphagous in nature and cause varying amount of damage all over the world in agriculture and grassland ecosystems. Their populations are affected by a host of factors, both external and internal. In case of few species of grasshoppers and locusts ecological relationships have been worked out. Katiyar (1960) reported the effect of soil on the population structure of *Schistocerca gregaria*. Pradhan and Peswani (1961) studied the ecological aspects of *Hieroglyphus nigrorepletus*. Anderson (1964) showed that the vegetation exerts a definite influence on the selection of areas of occupancy by grasshoppers. Hazra *et al.* (1981, 1984) studied population ecology of grasshoppers inhabiting cultivated and natural grassland ecosystems.

In recent times, the seasonal incidence and biology have assumed much importance due to the fact that these provide information on population dynamics, nature and extent of damage, and relationship with various biotic and abiotic factors which facilitate in formulating sound pest management programmes.

In Tripura, a State adjoining Bangaldesh, an ecological survey revealed that there are a number of species of grasshoppers which cause economic damage to several crops and at times the damage caused by them is alarming. Practically nothing is knwon about this group of insects in North-Eastern Region of India in general and of Tripura in particular. A study was therefore undertaken on the seasonal abundance of five commonly available species, *viz., Oxya hyla hyla, O. fuscovittata, Xiphidiopsis straminula, Atractomorpha crenulata and Euconocephalus pallidus*. An attempt was also made to include biological observations on some of them. The essential results of the study are presented here.

MATERIAL AND METHODS

Five sites included in the present study were located in the vicinity of Agartala. In each site paddy cultivated area of 50 × 50 m was chosen and fortnightly observations were undertaken to count the nymphs of all the species together and species-wise adults. The population was counted by sampling, using 1 m^2 field cage which was bottomless

and the top covered with muslin cloth, expansible half metre. Each observation comprised 3 samples in each locality and thus 15 m^2 area was examined early in the morning during August, 1984 - July, 1985. The data on biological studies are based both on field observations and laboratory rearing in cages.

RESULTS AND DISCUSSION

Seasonal incidence

All the five species of grasshoppers included in the present study showed strong seasonal population fluctuations and the trend was almost similar in all the species (Table 1). The most abundant species was *O. hyla hyla* followed by *A. crenulata* and *O. fuscovittata*. Genus *Oxya* accounted for 42.6% of the total grasshopper population. During December-June the population of grasshoppers remained at a low level. It

TABLE 1

Multiple correlation among population of various species of grasshoppers, average temperature and total rainfall.

Month	Average population/m^2						Av. Temp. (°C)	Total rainfall (mm)
	O. hyla hyla	O. fusco-vittata	A. cre-nulata	E. palli-dus	X. stra-minula	Nymphs		
1984								
August	23.3	17.0	14.5	2.5	11.83	3.16	29.7	278.2
September	26.0	16.3	10.83	1.16	8.5	7.0	29.0	292.0
October	47.0	28.0	19.0	3.83	14.83	9.0	28.6	85.0
November	20.33	18.16	22.0	4.16	14.0	17.83	26.2	0
December	3.5	15.0	16.0	6.5	16.83	10.66	22.2	3.8
1985								
January	0	0	9.0	1.0	5.0	9.16	21.12	2.0
February	0	0	3.33	0.33	6.33	8.5	23.33	26.9
March	2.83	2.5	0.66	0.66	4.16	6.6	27.9	49.8
April	1.33	1.0	1.0	0.66	1.16	1.8	29.2	396.9
May	1:0	0	0.66	1.5	0.83	0.7	29.1	301.7
June	0	0.3	0.33	0.0	0.5	0.6	29.6	461.8
July	0.1	0	6.66	1.0	10.66	5.8	30.2	129.8
Calculated 'F'	1.178	0.729	2.026	4.5*	3.089	9.004*		

* Significant at 5% level.

started increasing after June when 'aman' crop was transplanted and touched its peak in October. Thereafter it started declining and with the approach of maturity of the crop in December it touched a low level. The nymphal population comprised much less (15.4%) as compared to adults. This low number is because nymphal duration is of much shorter duration than the adult stage. A multiple correlation analysis revealed a significant relationship between the numphal population and the prevailing temperature and rainfall. This relationship, barring *E. pallidus* could not prove true in the adult stage. However, the adult population of *E. pallidus* remained low throughout the year and, therefore, much importance cannot be attached to this significance. It is, therefore, reasonable to put forward that the food is more important than the abiotic factors to the adults which are stout and long-lived than the nymphs which are weak physically and remain in this stage for only few weeks.

Damage

The hoppers and adults damaged the foliage and in 1985 the damage was widespread and so conspicuous that almost the entire foliage of the crop was eaten up in certain fields. 'Aman' crop was attacked more as compared to 'aus' and 'boro' crops. The ripening ears of paddy were also severely damaged which impaired the grain formation to a great extent. The crop in nursery stage received very light infestation of grasshoppers.

Alternate hosts

When paddy was harvested, grasshoppers migrated to nearby bushes and grasses but their population remained at a low level. Water hyacinth *(Eichhornia crassipes)*, a very common aquatic weed in the region, was recorded to be an alternate host. In laboratory, when paddy was not available, culture was maintained on water hyacinth.

Biological enemies

Under field conditions mynah *(Acridotheres tristis)*, squirrel *(Funambulus pennanti)* and toad *(Bufo melanostictus)* were recorded to be common predators but were able to reduce the grasshopper population to a minor extent only. In the laboratory ant *(Oligosita brevicilice)*, spider *(Heteropoda venatoria)*, lizard *(Hemidactylus sp.)*, fungus *(Aspergillus sp.)* and an unidentified mite species caused mortality to the hoppers and adults. Cannibalism was noted, under stress conditions, in case of *X. straminula* which fed on *A. crenulata* and *Oxya* spp.

Oviposition

In field, eggs were generally laid in moderately hard soil about 3 cm deep, preferably along the areas nearer to the boundaries of the paddy fields. In laboratory, moist soil was the preferred site although some egg-pods were also found on mesh of the cages. Oviposition was more during March and October.

Eggs of *O. hyla hyla* were cylindrical, light whitish or foggy in colour with a dark blue spot on the lateral side of the anterior portion. An egg-pod measured, on an average, 4.5 mm in length, 1.1 mm in width and 2.5 mg in weight. The egg stage varied from 8 to 12 days.

Developmental stages

The duration of various nymphal instars are presented in Table 2. The development was comparatively faster in the males as compared to the females.

TABLE 2

The duration of developmental stages (mean ± S.D. days) of *O. hyla hyla*.

Developmental stage	Female	Male
First instar	3.9 ± 0.4	3.7 ± 0.42
Second instar	4.9 ± 0.3	4.5 ± 0.35
Third instar	4.4 ± 0.24	3.8 ± 0.25
Fourth instar	6.6 ± 0.27	5.9 ± 0.26
Fifth instar	8.1 ± 0.46	7.5 ± 0.35
Wing development	20.1 ± 1.04	18.1 ± 0.18

TABLE 3

Effect of various feeding and non-feeding conditions on the longevity (based on 10 replications for each treatment) of *O. hyla hyla*.

Treatment	Longevity in days	
	Female	Male
With food and water	138.7 ± 1.82	125.6 ± 2.87
With food and without water	102.5 ± 2.65	98.8 ± 0.38
Without food and with water	55.4 ± 1.12	56.4 ± 0.66
Without food and water	32.0 ± 1.22	38.4 ± 1.65
SEm ±	1.82	2.88
CD at 5%	65.78	4.43
CD at 1%	88.83	5.98

Ratio of male and female and their longevity

Regular collection of the adults of *O. hyla hyla* all over the year revealed that the

females always outnumbered the males and the overall ratio between male ane female was worked out to be 1:1.4. The females outlived the males when food and water was available under laboratory conditions while the reverse was true when they were devoid of food and water (Table 3).

The maximum population of grasshoppers recorded in the month of October more or less confirms the earlier findings of Dwivedi (1977) and Hazra *et al.*, (1981) who reported peak in August and November. The seasonal population fulctuations according to the present investigation is more influenced by food than the abiotic factors is in conformity with the earlier findings of Hazra *et al.*, (1984) who reported that the quality and distribution of grasshoppers are dependent upon vegetation. Oviposition details recorded here are consistent with the observations of a number of earlier workers (Katiyar, 1960; Pradhan and Peswani, 1961; Chapman, 1960; Kushwaha and Bharadwaj, 1977). Observations on the sex ratio and longevity of male and female recorded here are more or less similar to those reported earlier by Hazra *et al.* (1981).

SUMMARY

Observations on the seasonal incidence of five species of grasshoppers, *viz.*, *Oxya hyla hyla*, *O. fuscovittata*, *Xiphidiopsis straminula*, *Atractomorpha crenulata* and *Euconocephalus pallidus*, recorded during 1984-85 in Tripura revealed *O. hyla hyla* to be the most common species followed by *A. crenulata* and *O. fuscovittata*. In general, grasshoppers were more abundant during July-December with a peak in October. A positive significant correlation was established between nymphal stage of grasshoppers and prevailing temperature and total rainfall. This relationship did not, however, prove significant in the adults except in case of *E. pallidus*. Notes on the biology of some species are presented.

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