

OBSERVATIONS ON THE FIELD BIOLOGY AND  
ECOLOGY OF SOME GRASSHOPPERS  
(ORTHOPTERA : ACRIDOIDEA)  
NEAR CALCUTTA

*By*

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INTRODUCTION

Grasshoppers and locusts are the oldest and most serious enemies of agriculture, probably from the time when cultivation was first practiced about 10,000 years ago in the middle east. For any meaningful control measures it is essential to have a base line data on the ecology and biology of target species. Ecological and biological studies on Indian grasshoppers mainly limited to the works of Coleman (1911), Coleman and Kannan (1911), Pruthi and Nigam (1939), Roonwal (1945, 1976), Agarwal (1955), Katiyar (1955, 1956, 1961), Banu and Kushwaha (1974), Hazra *et. al* (1981), Julka *et al* (1982). The present study was initiated in a predominantly paddy growing area near calcutta in gangetic West Bengal in order to determine the incidence, seasonal activity, and habitat preference of some grasshoppers in relation to paddy and other cultivated grasses which act as alternate host-plants. The efforts have also been made to study the migration of grasshoppers from uncultivated zones to cultivated zones and vice versa. The habitat described for each species is that in which adults and nymphs were found. The classification used was that of Dirsh (1961).

MATERIAL AND METHODS

The samples of grasshoppers were collected from August 1976 to July 1977 from following selected habitats :—a

cultivated field, uncultivated area, comprising open grass land (inhabited by long and short grasses) and short bushy vegetation. The collections were made once a week between 08.00 hrs to 10.00 hrs, using an insect net of conventional design of 30 cm. diameter. In order to standardise the sampling technique the collections were made by sweeping each site for half an hour on every occasion, grasshoppers were collected by sweeping the nets following the catch count method. Although the method might not have given a precise numerical estimates of absolute abundance, it was considered adequate for the present study. The temperature and relative humidity data were collected from the experimental site while the rainfall data was collected from the Meteorological office, Calcutta.

#### DESCRIPTION OF HABITATS

*Cultivated field* : The field was 100 × 75 meters in area, located in south of Calcutta. The paddy crop was sown towards the end of August and harvested in late December. From January to May, the vegetation consisted of dried stubbles of harvest paddy and patches of short brown grass which turns green with the onset of premonsoons or local showers.

#### Uncultivated field :

(a) *Open grassland* : The selected plot was about 25 × 75 meters by the side of the cultivated field and bushy area. It was covered with green grass with the onset of premonsoon showers, which grew to a maximum height of about 35 to 40 cm. towards the end of October. The grasses start turning dry from mid November and by the end of May the field is covered with short, dry brown grasses.

(b) *Bushy area* : This area is located by the side of uncultivated zone near a pond. The study area was roughly 100 m. × 20 m. and major vegetation in the area was as follows : *Reailanthus tithymaloides*, *Xanthium strumarium*, *Antigonon* sp., *Andropogon* sp. and *Lippia* sp. etc. There was

an under growth of grasses also. The grasses remained green from middle of May to middle of November and became dry and pale during December to May and part of June.

#### CLIMATE

The climate of experimental site in Garia (about 20 Km. from Calcutta) is same as that of Calcutta city (West Bengal); and can be divided into four distinct seasons : spring (February-March), summer (April-June), rainy (July-middle to September), autumn (middle of September-November), winter (December-January). Most rainfall was received during the monsoons from late June to middle of September. Due to north-west wind some rain also occurred in April and May, often accompanied by high speed winds. Temperature increased gradually from February and reached the maximum of 36.75°C during the month of May (Fig. 1). It then steadily

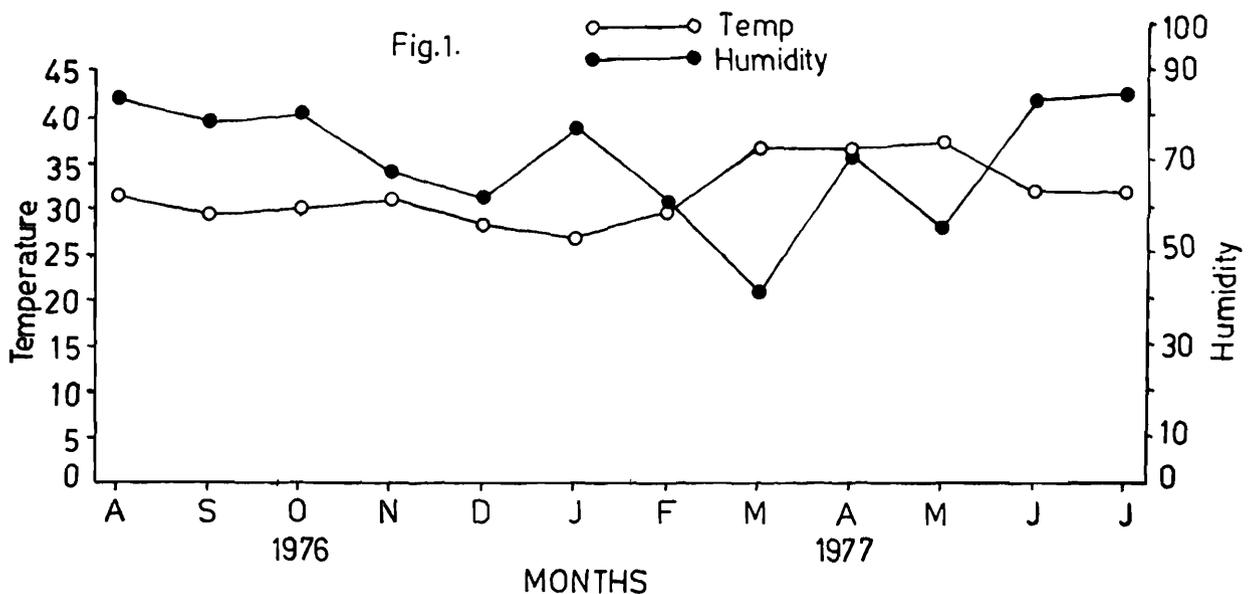


Fig. 1. Monthly Changes in climatic factors.

decreases with the onset of rains. The coldest part of the year was from middle of December to end of January with minimum temperature of 11.3°C in the month of January. The average relative humidity ranged from 35% in the month of March to 92% in the month of July-September.

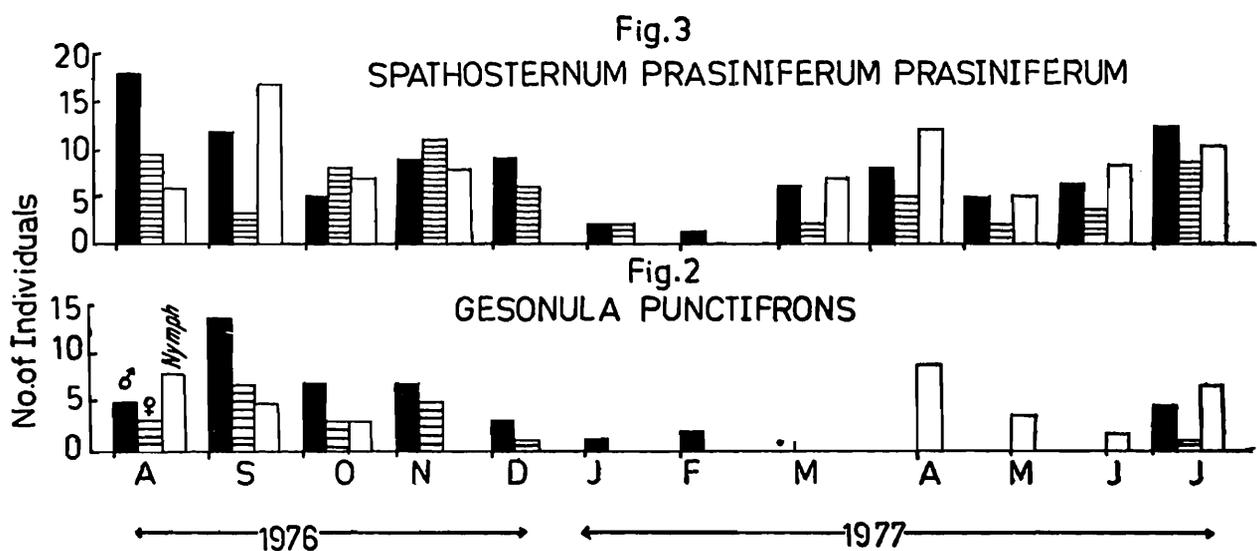
## OBSERVATION

## FAMILY ACRIDIDAE

## Subfamily : HEMIACRIDINAE

***Gesonula punctifrons* (Stal)**

This species was found consistently amongst water hyacinth and adjoining grasses and bushes, but also occurred in low numbers in the paddy fields adjoining to water hyacinth. No adults were found in paddy fields away from water hyacinth



Figs. 2-3. Seasonal fluctuations in abundance of *Gesonula punctifrons* and *Spathosternum prasiniferum prasiniferum*.

zones. The adults start appearing from July and the population increases rapidly and reaches its peak in the month of September (Fig. 2). This level was somewhat maintained till November and then gradually declines to a very low level from January to February and no adults were encountered from March to June. Nymphs of all stages occur in the same habitat as adults and start appearing from the end of April and are encountered till late October with zero Nymphal population from November to March.

***Spathosternum prasiniferum prasiniferum* (Walker)**

This species was one of the most common acridid and occurs throughout the year on grasses, paddy, pulses and in bushes adjoining to cultivated fields. The population builds up towards the end of June and reaches its peak by August

(Fig. 3). The peak level attained during this period was maintained till December with slight low level in October end. Thereafter the number decreases suddenly and reaches the lowest level in February. From March onwards the population again built up but did not reach the previous level. Nymphs were found almost throughout the year except from December to February. The trend of population pattern suggests more than one generation in a year. This species showed seasonal changes in colouration in which most individuals were lush green in colour in the rainy season. During drier parts of the year a large portion of the population was brown. It has been observed that during monsoons major part of the population starts migrating from bushes and grasses towards newly growing lush green paddy fields and feeds voraciously on emerging paddy plants causing extensive damage. During this period the adults were found copulating in the fields. With the maturation of paddy in November/December the population starts moving near the green grasses along the sides of ponds and irrigation canals.

### **Hieroglyphus banian** (Fabricius)

Uncommon and was found only once in September and in November, however few nymphs were found in August. Both adults and nymphs were found in paddy fields. This species is a major pest of paddy in India especially in southern, western and north-eastern part of the country but in the present study, surprisingly, we have not come across this pest in the experimental area.

### Subfamily OXYINAE

### **Oxya fuscovittata** (Marschall)

Found almost throughout the year and is associated with grasses and paddy. Adults recorded from August to December are generally confined to paddy whereas in the rest of the month they were consequently collected from grasses and bushy zones adjoining water ponds.

Beginning in early July, the population on paddy gradually builds up towards the end of the month. (Fig. 4). In early August the number rise steadily and reaches its peak in early September, coinciding with growth of paddy plants. The population slightly decreases but the general infestation pattern is maintained till early December which decreases to near zero level in January and February when only aged females were found in the collection. Towards late march the population again increases and reaches its peak in May with a sharp decline in June. The trend of population suggests more than two generations per annum.

Nymphs in all stages of development were found in the same habitat as that of adults, almost throughout the year except in January-February when very small nymphs, probably first instar was seen.

This species causes considerable damage to paddy plants by eating voraciously on stem of young plants and on leaves at latter stages.

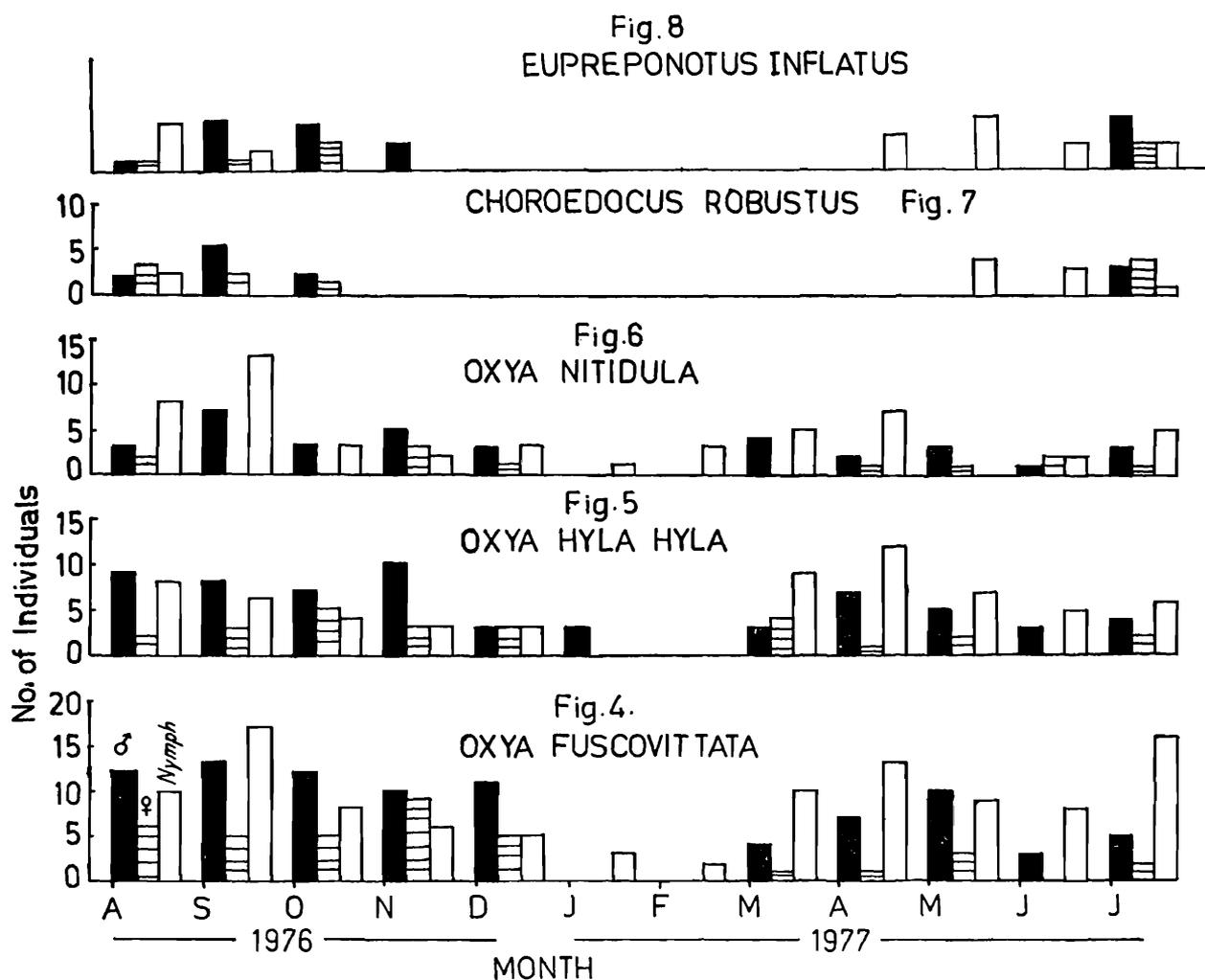
### ***Oxya hyla hyla* Serville**

Wide spread and locally common and occurs in the same habitat as that of *Oxya fuscovittata*. Beginning in July the population gradually increased to a maximum in early November then gradually decreases to lowest level by end of January. From early March the population increased again and reaches its maximum in April but did not reach the previous level and low level is maintained till May. Nymphs in all stages of development were found in the same habitat throughout the year except January and February (Fig. 5). This species also causes damage to paddy by eating on stem of young plants and on leaves at the latter stages.

### ***Oxya nitidula* (Walker)**

Locally common and occurs in low numbers in the same habitat as that of preceding two species of *Oxya*. Adults recorded throughout the year except January and February and follows the same seasonal pattern as of *O. fuscovittata*

and *O. hyla hyla* (Fig. 6). This species also causes damage to growing paddy plants.



Figs. 4-8. Seasonal fluctuations in abundance of *Oxya fuscovittata*, *Oxya hyla hyla*, *Oxya nitidula*, *Choroedocus robustus*, *Eupreponotus inflatus*.

#### Subfamily EYPREPOCNEMIDINAE

#### *Choroedocus robustus* (Serville)

This species was encountered in low number in bushy areas with mixed vegetation. The nymphs appear towards the end of May and the adults start appearing only in July. The population reaches its peak in September and disappears by October (Fig. 7). No adults and nymphs were found till next May. This is a large grasshopper and prefers mixed vegetation zone and moves to paddy fields once it starts growing towards maturity.

**Eupreponotus inflatus** Uvarov

Nymphs and adults occur amongst long coarse grass with bushes ; sometime on edges of paths and migrate to paddy fields once it starts maturing. Nymphs start appearing from April and the adults were encountered only from July (Fig. 8). This species is also found in low number till November and then it suddenly disappears till next April.

**Heteracris pulcher** (Bolivar)

It was one of the rarest species. A single female was captured in September from the bush during the entire study period.

## Subfamily CYRTACANTHACRIDINAE

**Cyrtacanthacris tatarica** (Linnaeus)

Not common, or at least not often seen during the entire sampling period. Two females were caught in September from bushes in the study area.

## Subfamily ACRIDINAE

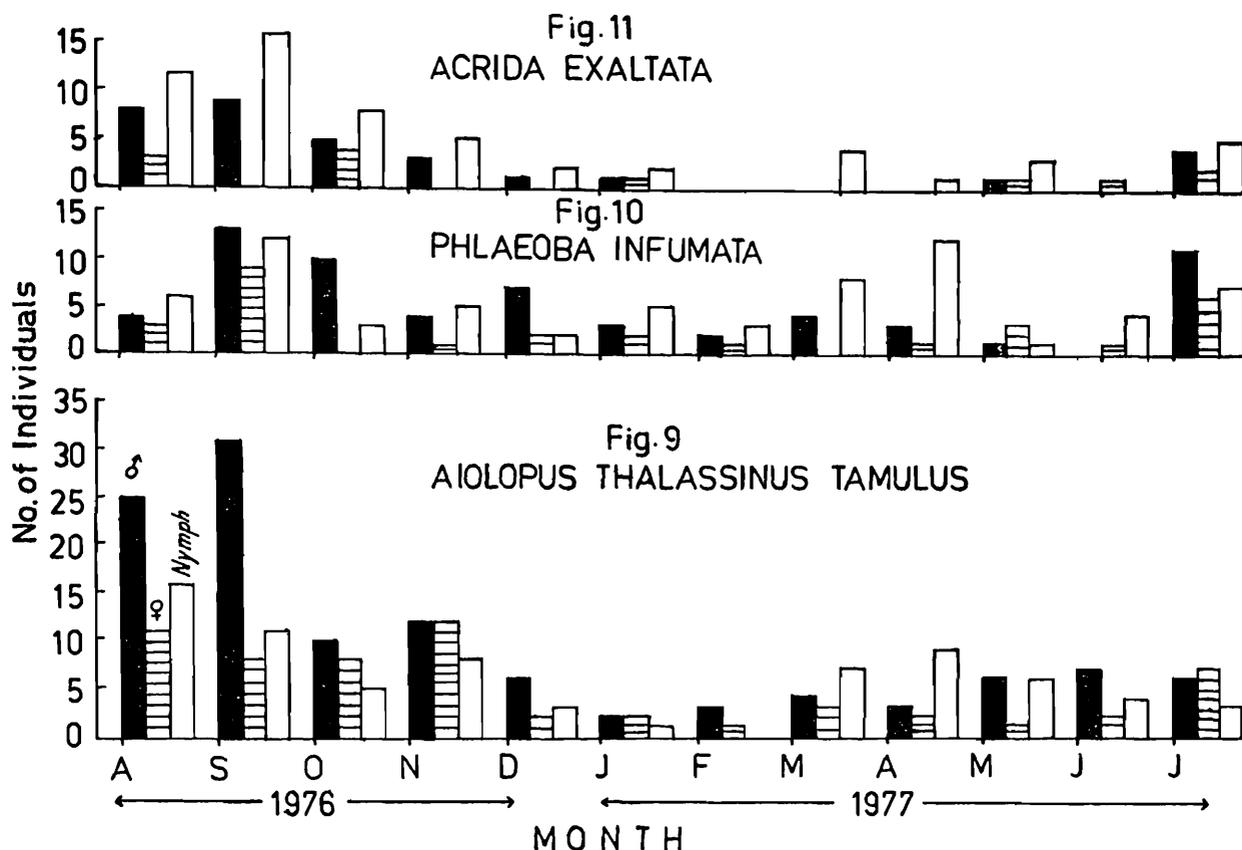
**Aiolopus thalassinus tamulus** (Fabricius)

This acridid was the most abundant species and was found in cultivated as well as natural grass field and bushes. Adults any nymphs are found throughout the year with highest peak in the month of August and September (Fig. 9). This species also migrates from its natural habitat i.e. wild grasses and bushes to cultivated fields of paddy once the paddy is replanted. It also occurs in two colour forms, the greenish-brown during rainy season and the dull brown when the vegetation starts drying up. This species breeds throughout the year.

**Phlaeoba infumata** (Brunner)

This species also breeds throughout the year and reaches its peak in the month of September. Maximum population

was during rainy season while minimum in dry months of May and June (Fig. 10).



Figs. 9-11. Seasonal fluctuations in abundance of *Aiolopus thalassinus tamulus*, *Phlaeoba infumata*, *Acrida exaltata*.

*P. infumata* is associated with crops of paddy and bushes and natural grasses. The adults prefer long and hard grasses while nymphs were found in swampy areas.

#### ***Trilophidia annulata* (Thunberg)**

This species was mainly found on bare ground by the side of pond or Kacha road along with green grasses. It breeds continuously throughout the year but occurs in low numbers. The highest average population was in the month of August and minimum in February (Fig. 12).

#### ***Acrida exaltata* (Walker)**

This species was very common and occurs wherever there were suitable patches of grasses, rarely occurring in the bushy zone. Nymph and adults were found throughout the year except late January to middle of March. The population

starts building towards end of June, gradually reaches its peak in September and then gradually declines and disappears by middle of January. Nymphs were far more abundant during the rainy season and breeding was at its peak during this period (Fig. 11).

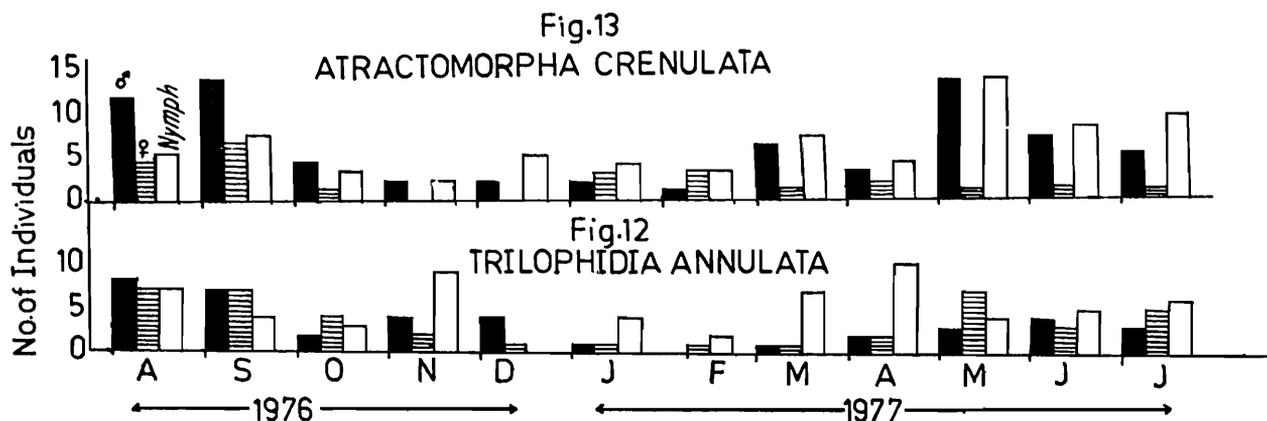
*Acrida exaltata* was found in lush green colour during rainy season while in other parts of the year, the green forms are found in association with green vegetation while brown form with drier vegetables, matured paddy fields and dry grasses. The adults of the species migrates from grasses to lush green paddy fields in September and October cause considerable damage to growing plants.

Family : PYRGOMORPHIDAE

Subfamily : PYRGOMORPHINAE

#### *Atractomorpha crenulata* (Fabricius)

Adults and nymphs of this species were found throughout the year. The population pattern suggests that it has an active period from May to September then there is a gradual decline and the level is maintained till the end of May. Peak of nymphal activity was in the month of May and minimum during November. (Fig. 13).



Figs 12-13 Seasonal fluctuations in abundance of *Trilophidia annulata* and *Atractomorpha crenulata*.

Adults recorded from August to November are generally confined to paddy where as during rest of the months they were consequently collected from grasses and bushy zones.

## DISCUSSION

The results presented in this study were based on collections of grasshoppers in a field near Calcutta. Grasshoppers collected in this study belonged to thirteen genera of the families Acrididae and Pyrgomorphidae. It is clear from the present investigation that during the period of low incidence of grasshoppers (December to February) these species took shelter on different herbs. Maximum migration of these grasshoppers from wild vegetation to the adjoining paddy fields were noticed when the latter is at flowering stage (October to November).

The study of data on population (Figs. 2-13) of different species reveals that *Aiolopus th. tamulus* was the most dominant species and represents 14.36% of total population followed by *Oxya fuscovittata* (13.55%), *Spathosternum pr. prasiniferum* (13.44%), *Atractomorpha crenulata* (9.42%), *Phlaeoba infumata* (9.24%), and *Oxya hyla hyla* (8.55%), population of other species such as *Trilophidia annulata* (8.24%), *Acrida exaltata* (6.95%), *Oxya nitidula* (5.67%), *Gesonula punctifrons* (5.61%), *Eupreponotus inflatus* (2.69%), *Choroedocus robustus* (2.16%), were numerically low but occurred throughout the year and the species like *Hieroglyphus banian* (0.82%), *Cyrtacanthacris tatarica* (0.29%), and *Heteracris pulcher* (0.05%), occurred very rarely during the period of observation.

An attempt has been made to find out the relationship between the population of grasshoppers and the environmental factors and also between some other parameters considered in this study. For this correlation coefficient and regression analysis were made. From table 1, it is seen that the relative humidity shows a positive correlation (column 3 of table 1) with the grasshoppers population but showed significant relationship only with the population of total number of male, total number of *Trilophidia annulata*, total number of *Eupreponotus inflatus* and total number of *Choroedocus robustus*. Temperature shows negative correlation with the total number of male, female, *Oxya fuscovittata*

*phlaeoba infumata*, *Aiolopus th. tamulus*, *Acrida exaltata* and *Gesonula punctifrons*, and with other population it shows a positive but not significant correlations (Table 1).

\* Significant at 5% level.

TABLE 1

Showing relationship between grasshoppers species and environmental factors.

Parameters	Mean $\pm$ S.D.	'r' value	Y=a+bx
Y : No. of <i>phlaeoba</i>			
<i>infumata</i>	13.25 $\pm$ 8.37		
Relative humidity	70.46 $\pm$ 13.50	0.37	Y = - 2.86 + 0.23X
Temperature	31.68 $\pm$ 3.22	-0.16	Y = 25.98 - 0.40X
Y : No. of <i>Aiolopus th.</i>			
<i>tamulus</i>	19.75 $\pm$ 14.41		
Relative humidity	70.46 $\pm$ 13.50	0.38	Y = - 8.94 + 0.41X
Temperature	31.68 $\pm$ 3.21	-0.04	Y = 24.92 - 0.04X
Y : No. of <i>Acrida exaltata</i>			
	8.58 $\pm$ 8.60		
Relative humidity	70.46 $\pm$ 13.50	0.50*	Y = -14.26 + 0.32X
Temperature	31.68 $\pm$ 3.22	-0.21	Y = 26.32 - 0.56X
Y : No. of <i>Trilophidia</i>			
<i>annulata</i>	11.75 $\pm$ 5.56		
Relative humidity	70.46 $\pm$ 13.50	0.41	Y = - 0.22 + 0.17X
Temperature	31.68 $\pm$ 3.22	-0.32	Y = 6.03 - 0.56X
Y : No. of <i>Gesonula</i>			
<i>punctifrons</i>	8.50 $\pm$ 7.80		
Relative humidity	70.46 $\pm$ 13.50	0.55*	Y = -13.98 + 0.32X
Temperature	31.68 $\pm$ 3.22	-0.14	Y = 19.37 - 0.34X
Y : No. of <i>Eupreponotus</i>			
<i>inflatus</i>	3.83 $\pm$ 3.66		
Relative humidity	70.46 $\pm$ 13.50	0.55*	Y = - 6.79 + 0.15X
Temperature	31.68 $\pm$ 3.22	0.23	Y = - 4.46 + 0.26X
Y : No. of <i>Choroedocus</i>			
<i>robustus</i>	2.83 $\pm$ 3.13		
Relative humidity	70.46 $\pm$ 13.50	0.69*	Y = - 9.33 + 0.17X
Temperature	31.68 $\pm$ 3.22	0.01	Y = 3.25 + 0.01X
Y : No. of total			
Grasshopper	142.75 $\pm$ 79.14		
Relative humidity	70.46 $\pm$ 13.50	0.43	Y = -36.93 + 2.55X
Temperature	31.68 $\pm$ 3.22	0.11	Y = 55.82 + 2.74X

Parameters	Mean $\pm$ S.D.	'r' value	Y=a+bx
Y : No. of Male			
Grasshopper	55.50 $\pm$ 37.40		
Relative humidity	70.46 $\pm$ 13.50	0.43	Y = -29.28 + 1.20X
Temperature	31.68 $\pm$ 3.22	+0.08	Y = 85.43 - 0.94X
Y : No. of ♀			
Grasshopper	27.92 $\pm$ 18.01		
Relative humidity	70.46 $\pm$ 13.50	0.52*	Y = -20.77 + 0.69X
Temperature	31.68 $\pm$ 3.22	-0.11	Y = 48.29 - 0.64X
Y : No of Nymph	58.33 $\pm$ 32.23		
Relative humidity	70.46 $\pm$ 13.50	0.27	Y = 12.91 + 0.64X
Temperature	31.68 $\pm$ 3.22	0.47	Y = -90.88 + 4.71Y
Y : of <i>Atractomorpha</i>			
<i>crenulata</i>	13.50 $\pm$ 7.60		
Relative humidity	70.46 $\pm$ 13.50	0.08	Y = 10.54 + 0.04Y
Temperature	31.68 $\pm$ 3.22	0.32	Y = -10.12 + 0.75X
Y : No. of <i>Oxya</i>			
<i>fuscovittata</i>	17.67 $\pm$ 11.18		
Relative humidity	70.46 $\pm$ 13.50	0.23	Y = 4.06 + 0.19X
Temperature	31.68 $\pm$ 3.22	-0.04	Y = 22.24 - 0.4 X
Y : No. of <i>Oxya hyla hyla</i>	12.25 $\pm$ 6.76		
Relative humidity	70.46 $\pm$ 13.50	0.02	Y = 11.38 + 0.01X
Temperature	31.68 $\pm$ 3.32	0.57*	Y = 25.59 + 1.10X
Y : No. of <i>Oxya nitidula</i>	8.08 $\pm$ 5.07		
Relative humidity	70.46 $\pm$ 13.50	0.18	Y = 3.28 + 0.07X
Temperature	31.68 $\pm$ 3.22	0.13	Y = 1.79 + 0.20X
Y : No. of <i>Spathosternum</i> sp.	19.33 $\pm$ 10.60		
Relative humidity	70.46 $\pm$ 13.50	0.47	Y = - 6.90 + 0.37H
Temperature	3168 $\pm$ 3.22	0.18	Y = 0.26 + 0.60X

From figure 14 it is evident that the population of total grasshoppers attained its peak period of activity in September and lowest activity in February. The nymphal population were highest (42.17%) in comparison to total male and total female followed by male population (37.27%). The nymphal population of four species viz. *Atractomorpha crenulata*, *Oxya nitidula*, *Oxya fuscovittata* and *Phlaeoba*

*infumata* were found in every month throughout the sampling period in the field, which indicate that these species were multivoltine, i.e., more than one generation a year. This may be due to the influences of factors like moisture, temperature,

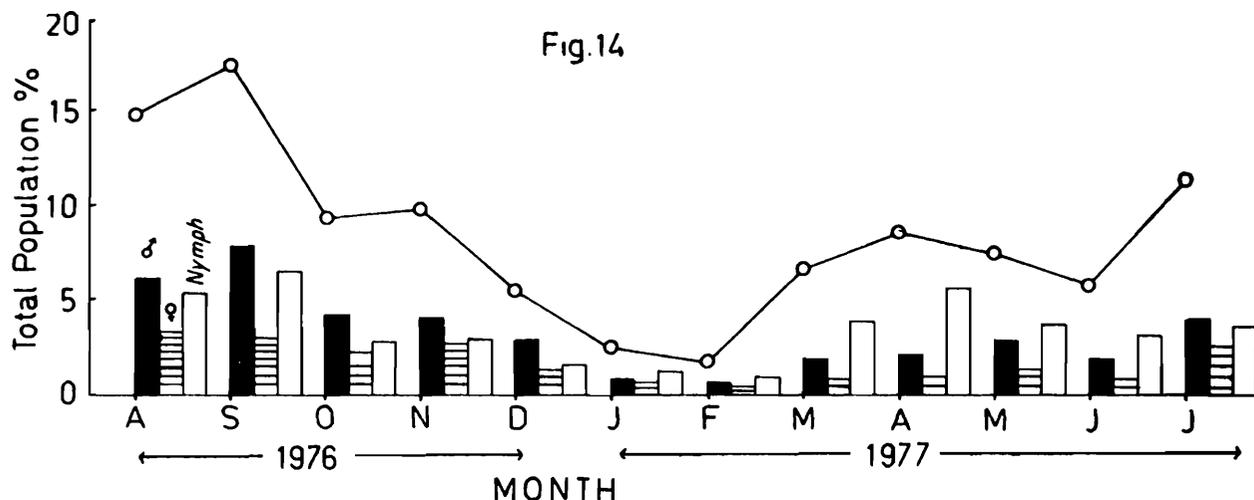


Fig. 14. Total population of acridids in the study area.

soil conditions and food on these species in the study field. It agrees well with the observations of Isely (1937) and Uvarov (1977). The absence of nymphal population from the field of some predominant species have been summerised in table 2. It can be concluded from the present study that the physical factors like temperature, relative humidity and the biotic factors like vegetations are mainly responsible for the population fluctuations and distribution of the major grasshoppers in this study as evident from the statistical analysis (Table 1).

TABLE 2.

Showing months when Nymphs of Predominant grasshopper species not occurred in the field.

#### Nymph not found

Species	Months
1. <i>Spathosternum pr. prasiniferum</i>	Dec., Jan., Feb.
2. <i>Oxya hyla hyla</i>	Jan., Feb.
3. <i>Acrida exaltata</i>	Feb., Jun.
4. <i>Eupreponotus inflatus</i>	Oct., Nov., Dec., Jan., Feb. and Mar.

<i>Species</i>	<i>Months</i>
5. <i>Trilophidia annulata</i>	Dec.
6. <i>Gesonula punctifrons</i>	Nov., Dec., Jan., Feb., and March.
7. <i>Choroedocus robustus</i>	Sept., Nov., Dec., Jan., Feb. Mar. and Apr.
8. <i>Aiolopus th. tamulus</i>	Feb.

### SUMMARY

Certain seasonal fluctuations in the population of short-horned grasshoppers from three distinct vegetational sites, namely cultivation, grass-land and bushy zone at Garia near Calcutta, West Bengal have been reported. Grasshopper were collected at weekly interval using an insect net of conventional design of 30 cm. diameter.

The study of date on population fluctuations of different species reveals that *Aiolopus thalassinus tamulus* was the most dominant species and represents 14.36% of total population followed by *Oxya fuscovittata* 13.55% *Spathosternum prasinerum* Pr. (13.44%), *Atractomorpha crenulata* (9.12%), *Phlaeoba infumata* (9.24%) and *Oxya hyla hyla* (8.55%). Population of other species such as *Trilophidia annulata* (8.24%), *Acrida exaltata* (6.95%), *Oxya nitidula* (5.61%), *Gesonula punctifrons* (5.61%) were numerically low but occurs throughout the year and species like *Eupreponotus inflatus* (2.69%), *Choroedocus robustus* (2.16%), *Heiroglyphus banian* (0.82%), *Cyrtacanthacris tatarica* (0.29%) and *Heteracris pulcher* (0.05%) occurred very rarely during the period of study.

Monthwise analysis of male, female and nymph population shows maximum during monsoon and minimum during winter months. The regression and co-relations study was done between different environmental factors and grasshoppers population and their interrelationship are discussed.

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