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ECOLOGY OF GRASSHOPPERS IN TWO GRASSLANDS OF WEST BENGAL IN RELATION TO SOME PHYSICAL FACTORS

A. K. Hazra, R. S. Barman, T. K. Mukherjee, A. Dey and S. K. Mandal

Zoological Survey of India, Calcutta

ABSTRACT

This observation presents the results of distribution of grasshoppers in two grasslands of West Bengal during the period from May—December, 1979. Higher population of grasshoppers were observed in Botanics grassland (72.7%). The number of species occured from both the sites were also varied (16 species from Bethuadohari and 9 species from Botanics).

Fluctuations of pupulation per month showed two Peaks one in October and other in August at Botanics grassland and during August and September at Bethuadohari. Monthly fluctuations of Male, Female and nymph showed that female population was nil during July-August from both the sites and maximum nymph yielded in August.

A regression and correlation-coefficient analysis was done between physical factors and abundance of grasshoppers and their inter-relationships are discussed.

Introduction

Workers like Isely (1937), Cantrall (1943), Merton (1959), Roonwal (1976), Uvarov (1977) and Dwivedi (1977) have studied the qualitative and quantitative ecology of Orthopteran population in different parts of the world. However, the grasshopper population in the grassland of West Bengal has not been studied so far. These grasshoppers are of great economic importance as most of them are either pests or potential pests of different crops of West Bengal. Therefore, their time of emergence as hoppers and the time when they become adults may help us to forecast their outbreaks in West Bengal. For this, the present observations dealing with the effect of temperature and relative humidity on the population of grasshoppers and their distribution in two different grasslands of West Bengal has been discussed.

Materials and Methods

During the survey period random-sampling was carried out once in a month from both the plots during the period from May 1979 to December 1979. Catchcount method (Andrewartha 1970) was employed for collecting the grasshoppers from the field. Temperature and relative humidity were recorded by a mercury thermometer (with stainless steel coverings) and a dial hygrometer respectively.

Location and Characteristics of Sampling Sites

Two sites were selected. One at Bethuadahari Grassland (75 m×60 m) is located near Bethuadahari reserve forest area in Nadia district. The other at the Botanics Grassland (55 m×45 m), is located at the Botanics Garden in Howrah district. These sites,

though about 95 km apart, contained more or less the same ecological conditions, except some differences in vegetations, e.g. the grass *Dichanthium annulatum* Stap. is present only at the Bethuadohari site. Soils of these sites were alluvium, grey in colour and clay-loam in texture.

Results

A comparison of total number of grasshoppers collected from both the sites shows that the Botanics grasslands yielded the higher number (72.7%) of the total individuals collected than the Bethuadohari grassland (27.3%), although the number of species occurring in Bethuadohari was higher (16 species) Botanics grasslands, (9 species). In the monthly fluctuations of total population of grasshoppers obtained from both the plots, two clear peaks occured in the Botanics grassland one in October and other in August and in the Bethuadohari grassland in August and September (Fig. 1).

The faunal composition is given in Table 1. Altogether 18 species occured from both the

TABLE 1. Characteristics of two grasslands.

	Bethuadahari grassland	Botanics grassland
Mean Temperature (oC)		
Air	31.81	33.03
Soil	30.44	31.75
Mean relative humidity (%)	77.13	71.5
Vegetations : (grasses and sedges)	*Sporobolus diander* Beauv. *Arundinella* sp. *Dichanthium annulatum* Stapf. *Eragrostis brachyphylla* Stapf. *Digitaria marginata* Linn. *D. royleana*	*Sporobolus diander* Beauv., *Arundinella* sp. *Eragrostis brachyphylla* Stapf. *Commelina obliqua* Ham., *Vernonia cenerea* Less., *Panicum* sp., *Echinochloa colonum* (Lin.) Link., *Digitaria idscendens, Cynodon dactylon* Pers., *Eupatorium odoratum* Linn., *Digitaria marginata* Lin and *D. royleana.*
Grasshoppers :	*Aiolopus thalassinus tamulus* (Fabr.) *Spathosternum prasiniferum prasiniferum* (Walk.) *Phlaeoba infumata* Brunner *Oxya fuscovittata* (Marschall), *O. hyla hyla* Serv., *Atractomorpha crenulata* (Fabr.), *Trilophidia annulata* (Thumb.), *Aulacobothrus luteipes* Walk., *Aulacobothrus* sp., *Acrida exaltata* (Walk.), *Chorthippus indus* Uvarov, *Acrotylus humbertianus* Saussure, *Tristria pulvinata* (Uvarov), *Hieroglyphus banian* (F.), *Leva cruciata* Bolivar, *Gelastorrhinus semipictus* (Walk.)	*Aiolopus thalassinus tamulus* (Fabr.), *Spathosternum pr. prasiniferum* (Walk.) *Epistaurus sinetyi* Bolivar, *Phlaeoba infumata* Brunner, *Oxya fuscovittata* (Marschall), *O. hyla hyla* Serv., *Atractomorpha crenulata* (F.), *Gesonula punctifrons* (Stal), *Tristria pulvinata* (Uvarov)

sites of which 7 are predominant and occur from both the sites except *Aulacobothrus luteipes* which occured only in the Bethuadohari grassland. Monthly fluctuations of the sexes, nymphs and total population of these predominant species are given in figures 2 and 3. It is clear that the predominant species are much more frequent in the Botanics glassland than in Bethuadohari. The maximum and minimum population of each of these species are variable.

Spathosternum prasiniferum prasiniferum (Walk.) is the most predominant species (24.37%) in both the plots combined. *Aulacobothrus luteipes* Walk. (23.53%) is the most

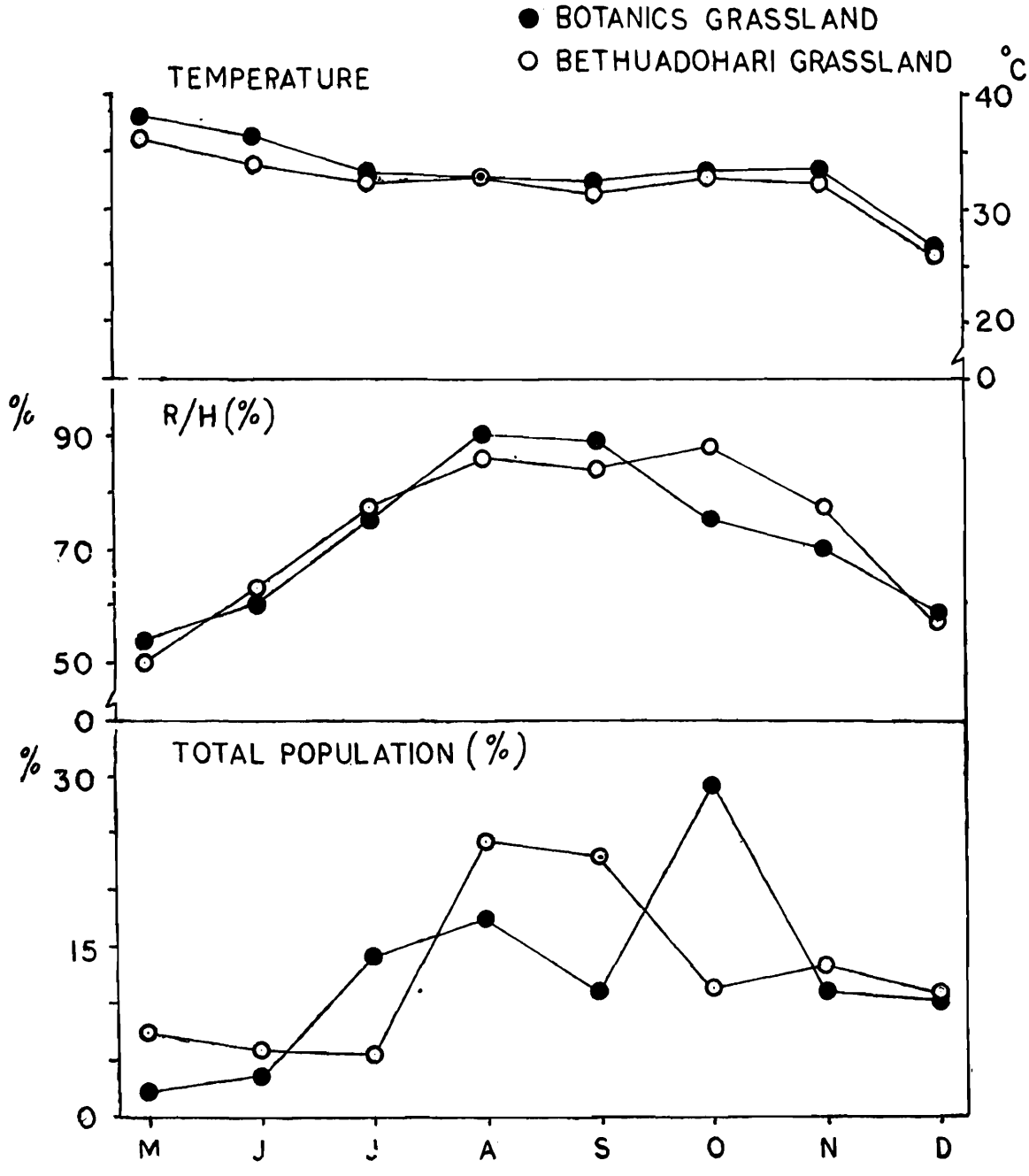

Fig. 1. Showing fluctuations of total population of grasshoppers, relative humidity and temperature in two grasslands.

dominant species in the Bethuadohari grassland. *Spathosternum* shows two peaks (in August and November) and minimum number in June in Bethuadohari grassland. In the Botanics grasslands the maximum occurs in August and October and the minimum in May. Similarly, the majority of species shows two peaks (Fig. 2 and 3). Male, female and nymph population of each species also fluctuate from one month to another. Male (2.36%), female (1.79%) and nymph (6.18%) shows the highest peak during the month of November, May, and August respectively in the Bethuadohari grassland. The corresponding highest percentage of male (2.96%) ; female (4.08%) and nymph (5.05%) occur during August, November and August respectively in the Botanics grassland. The female population is completely absent during July and August in both in fields. When the total male, female and nymph population of both sites are considered, it is seen that nymphs constitute the major portion of the total population (32.94%), then comes males (26.23%) ; and minimum population is that of female (13.54%) (Table 2).

From figure 1 it is clear that in both the sites the lowest population is associated with the low relative humidity, higher air and soil temperature during May, but the highest population in Bethuadohari is associated with high relative humidity (92%) and moderate air and soil temperature in August. Corresponding higher population in the Botanics grassland in October when the relative humidity (74.1%), and air and soil temperatures are moderate. This higher peak may be due to sudden large catch of *Spathosternum* and *Oxya* in this month.

An attempt has been made to find out the relationship between the population of grasshoppers and the physical factors and also between some other parameters considered in this study. For this correlation coefficients and regression equations were done. From Table 3, it is clear that only the relative humidity shows a positive correlations (Column 3, Table 3) with the total populations and individual species populations, but even this is not significant. The other two factors (air and soil temperatures) show a negetive correlation. Column 4 of Table 3 shows the regression values of above parameters. The correlation between the population of two grasslands shows a positive insignificant relationship. The population of male and female shows a

TABLE 2. Showing monthly fluctuations of adult Male, Female and Nymphal populations in two grasslands (in percentage).

	Bethuadohari grassland			*Botanics grassland*		
Months	Male	Female	Nymph	Male	Female	Nymph
M	—	1.77	0.21	0.43	0.43	0.43
J	1.07	0.48	—	0.75	0.43	0.43
J	0.54	—	0.91	1.88	—	4.62
A	0.38	—	6.18	2.96	—	5.05
S	0.7	0.48	5.00	1.61	0.38	3.01
O	1.13	1.72	0.21	1.83	4.08	1.99
N	2.36	0.7	0.51	2.53	1.72	0.64
D	0.97	0.05	1.88	1.72	1.29	1.83

positive correlation (significant at 5% level), but the correlation between adult and nymph population is negetive and not significant. When relationship in between the species are calculated it is seen that there exists a positive correlation between them but this is not significant except between *Spathosternum* and *Oxya* and between *Spathosternum* and *Atractomorpha*, which shows positive correlation and significant at 5% level. The impact of relative humidity, air and soil temperature on male, female and nymph population shows that the relative humidity is positively correlated with the male and nymph population

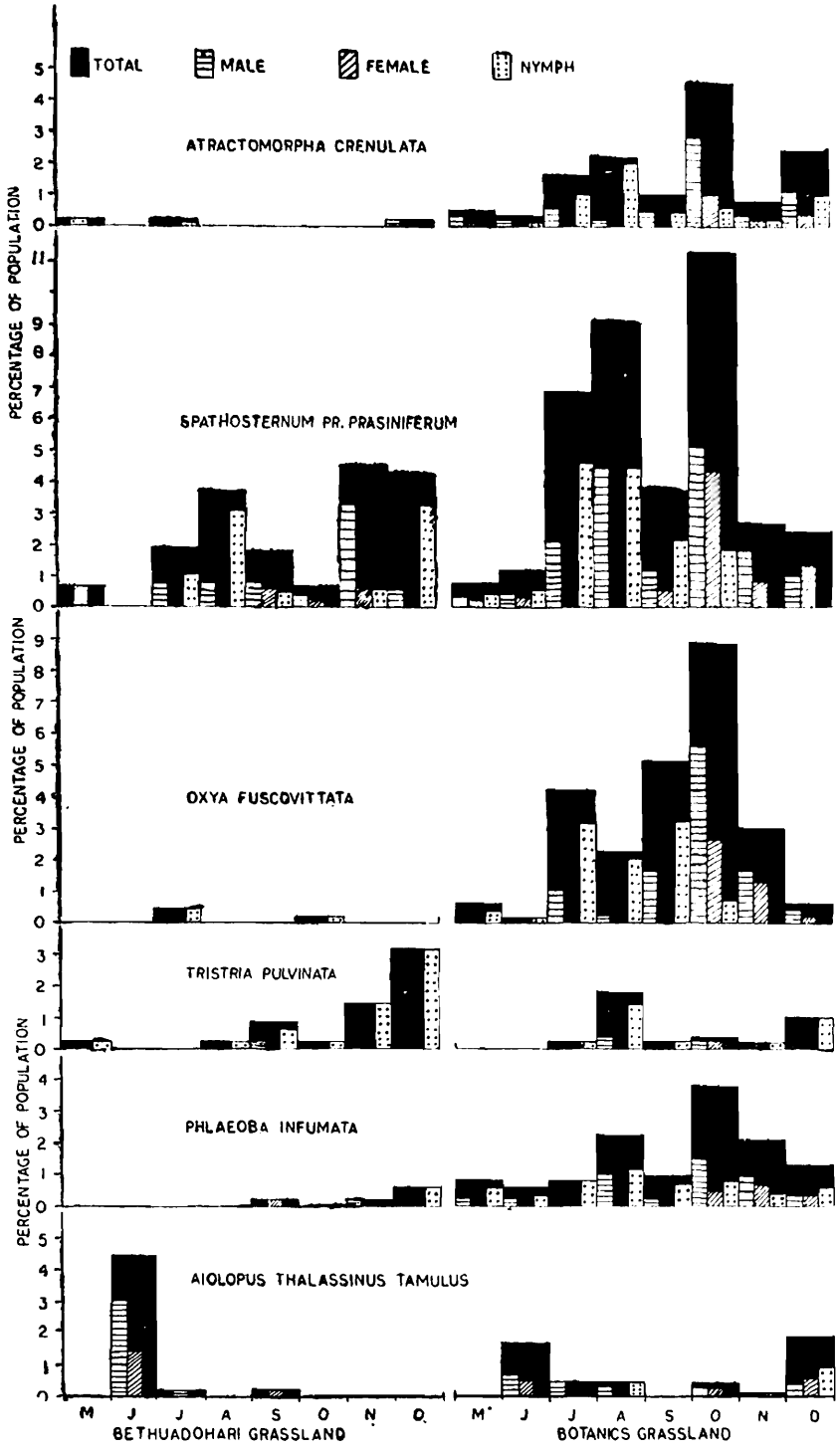

Fig. 2. Showing fluctuations of dominant grasshopper species per month in two grasslands.

and other two factors like air and soil temperature are negetively correlated. In case of female population relative humidity and soil temperature are negetively correlated and air temperature is positively correlated. This relationship is unique in case of female population in this study.

Discussion

The present investigation is a part of a long term project on the ecology of grasshoppers and on ecological energetics in some grasslands of West Bengal.

The present observation exhibits two peaks during August and September in one site

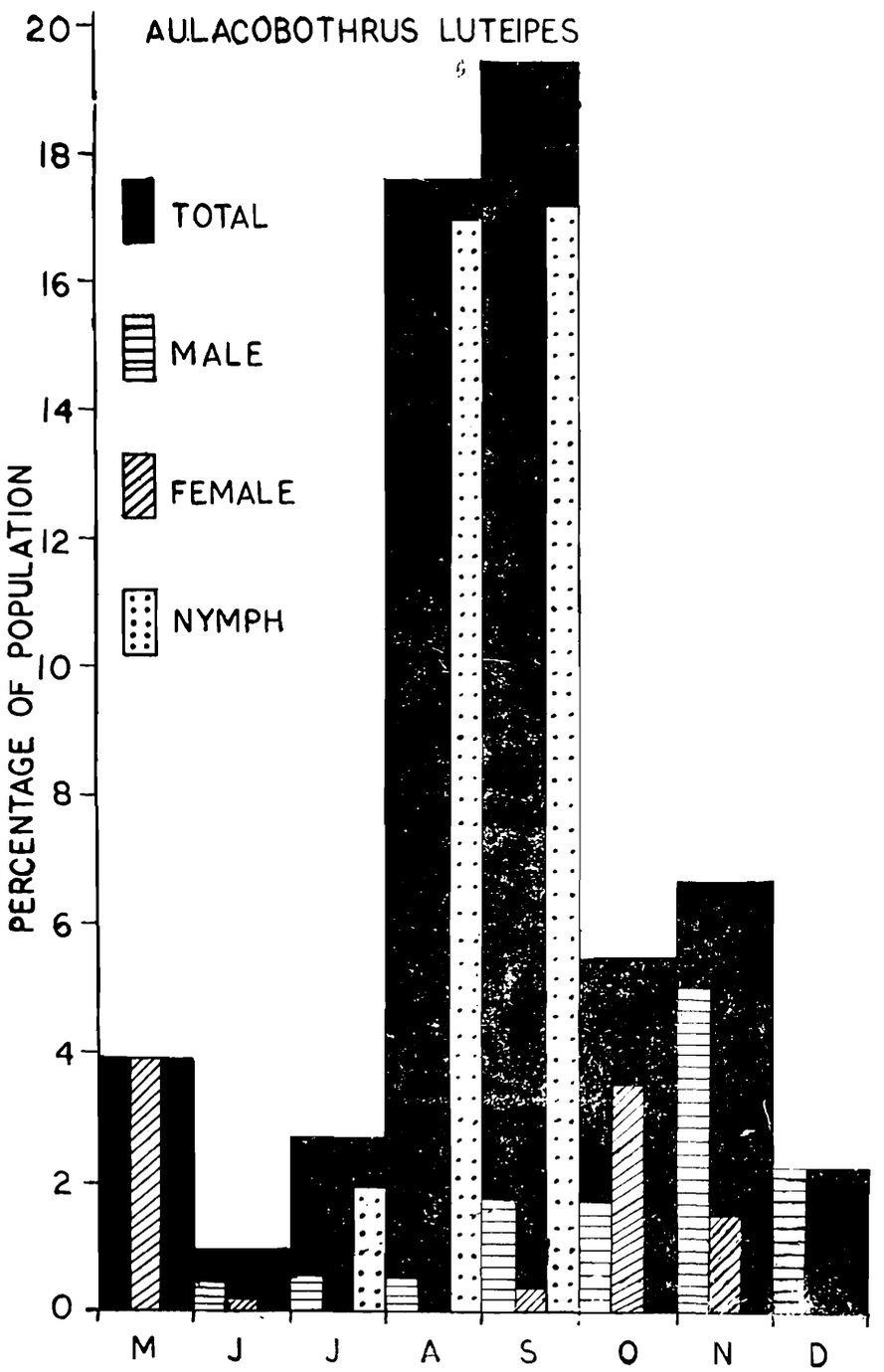

Fig. 3. Showing fluctuations of *Aulacobothrus luteipes* per month in Bethuadohari grassland.

TABLE 8. Showing relationship between grasshoppers population and different parameters.

Parameters	Mean	'r' value	Regression equation Y = a + bx
Bethuadohari Reserve Forest	57.25		
Y : *Total population*			
Air temp.	31.75	−0.2	Y = 32.9 − 0.02 x
Soil temp.	30.44	0.27	Y = 28.15 + 0.04 x
Relative humidity	77.13	0.38	Y = 13.01 + 1.12 x
Y : *Aulacobothrus* sp.	37.5		
Air temp.	31.75	0.05	Y = 31.75 + 0.004 x
Soil temp.	30.44	−0.05	Y = 30.82 − 0.01 x
R/H	77.13	0.5	Y = 69.25 + 0.21 x
Y : *Spathosternum* sp.	10.75		
Air tem.	31.75	—0.68	Y = 28.85 − 0.27 x
Soil temp.	26.38	—0.2	Y = 25.84 − 0.05 x
R/H	65.88	0.58	Y = 61.02 + 1.98 x
BG/Botanics			
Y : *Total population*	101.75		
Air temp.	32.96	—0.29	Y = 33.98 − 0.01 x
Soil temp.	31.81	—0.03	Y = 34.86 − 0.03 x
R/H	71.5	0.29	Y = 57.25 + 0.14 x
Y : *Atractomorpha* sp.	14.25		
Air temp.	32.96	—0.45	Y = 30.96 − 0.14 x
Soil temp.	31.81	—0.61	Y = 28.25 − 0.25 x
R/H	71.5	0.08	Y = 69.93 + 0.11 x
Y : *Oxya* sp.	26.13		
Air temp.	32.96	−0.08	Y = 37.93 − 0.01 x
Soil temp.	31.81	−0.19	Y = 32.86 − 0.04 x
R/H	71.5	0.49	Y = 63.66 + 0.3 x
Y : *Phlaeoba* sp.	13.88		
Air temp.	32.96	−0.25	Y = 34.76 − 0.13 x
Soil temp.	31.81	−0.19	Y = 33.2 − 1 x
R/H	71.5	0.44	Y = 60.95 + 0.76 x
Y : *Spathosternum* sp.	38.75		
Air temp.	32.96	−0.18	Y = 33.74 − 0.02 x
Soil temp.	31.81	−0.31	Y = 33.75 − 0.05 x
R/H	71.5	0.43	Y = 63.36 + 0.21 x
Correlation between population of two sites			
Y : No. of specimen in Bethuadohari grassland	63.5		
No. of specimen in Botanical Garden Grassland	105.5	0.22	Y = 70 + 0.56 x

TABLE 8. *Concluded.*

Parameters	Mean	'r' value	Regression equation Y=a+bx
Correlation between Male & female			
Y : Total no. of male	61.00		
Total no. of female	31.00	0.78	Y=—6.21+0.61 x
Correlation between Adult and Nymph Population			
Y : Total no. of adult	98.38		
Total no. of Nymph	75.63	—0.17	Y=59.89—0.16 x
Correlation between Aulacobothrus sp. and *Spathosternum* sp. & others			
Y : Total no. of *Aulocobothrus* sp.	37.5		
Total *Spathosternum* sp. population	38.75	0.17	Y=27.87+0.29 x
Total *Phlaeoba* population	13.88	0.11	Y=12.75+0.03 x
Total *Oxya* sy. population	26.13	0.21	Y=20.88+0.14 x
Total Atractomorpha sp. population	14.25	0.03	Y=13.12+0.01 x
Correlation between Spathosternum sp. with others			
Y : Total no. of *Spathosternum* sp.	38.75		
Total no. of *Phlaeoba* sp.	13.88	0.29	Y=11.94+0.05 x
Total no. of *Oxya* sp.	26.13	0.77	Y= —3.17+0.77 x
Total no. of *Atractomorpha* sp.	14.25	0.78	Y=2.62+0.3 x
Correlation between Male population and physical factors			
Y : No. of Male	61.13		
Air temp.	32.45	—0.2	Y=44.46—0.02 x
Soil temp.	31.09	—0.48	Y=34.15—0.05 x
R/H	74.31	0.39	Y=66.36+0.13 x
Correlation between Female population and physical factors			
Y : No. of Female	31.5		
Air temp.	32.45	0.1	Y=32.13+0.01 x
Soil temp.	31.13	—0.01	
R/H	74.31	—0.14	Y=76.2—0.06 x
Correlation between Nymph population and Physical factors			
Y : No. of Nymph	76.63		
Air temp.	32.45	—0.3	Y=31.68—0.01 x
Soil temp.	31.13	—0.27	Y=32.69—0.02 x
R/H	74.31	0.44	Y=67.41+0.09 x

* Significant at 5% level

and August and October in other site. It agrees with the observation of Dwivedi (1977) where he also obtained in a grassland of Madhya Pradesh early August and late September peaks. Littlevariation in the second plot may be due to climatological and vegetational differences of the two places. From the present study it is clear that the female population does not tolerate excessive humidity as is evidenced from Table 3. All the female population disappeared from both the field during July and August when, maximum relative humidity was present in the atmosphere. This inference is also supported by Statistical analysis (Table 3). Vegetation exerts a greater role in the distribution of grasshoppers. It is seen from the present investigations that *Aulacobothrus luteipes* is associated only with the grass *Dichanthium annulatum* (Table 1). It agrees with the observations of Bailey and Mukherjee (1976) in the case of *Melanoplus bivittatus*.

Dwivedi (1977) observed that the population density and climatic factors like temperature and relative humidity show a significant correlations. But in the present study these parameters are not statistically significant. The cause of this differences can not be explained at present unless more data are obtained. But it is clear that temperature and relative humidity exerts a notable influence upon the limits of population as is evidenced from Table 3.

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