Bull. zool. Surv. India, 8 (1-3) : 187-195, 1987

DYNAMICS OF COLLEMBOLA AND ACARINA IN A GRASSLAND AREA OF CALCUTTA

By

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ABSTRACT

Soil microarthropods, specially Collembola, play key role in the mineralisation process in the soil ecosystem. Collembolans being extremely sensitive to changes in the soil conditions are used as indicators of soil conditions and environmental changes. In India, observations on ecological aspects of Collembola have been sporadically published (Choudhury *et al*, 1971a, b, 1972, 1975 ; Mitra *et al*, 1977, 1981, 1983a, b, 1986 ; Singh *et al*, 1971) owing to the difficulties involved in the taxonomy of Collembola.

METHODS

The grassy plot of land is situated at Calcutta in the vicinity of Eden Gardens. The plot, throughout the years of sampling, sustained grassy vegetation belonging to *Cynodon dactylon* Pers. Twelve soil samples were drawn monthly from this plot by using stainless steel samplers having an inner cross sectional area of 8.55 cm^2 and length of 3 cm. During last three years, altogether 432 samples were drawn for this investigation. For measuring temperature, a soil thermometer and for relative humidity, a dial hair hygrometer were used. Soil samples were extracted in the laboratory by using a modified Tullgren apparatus by using 40W electric bulb generating about 39°C temperature within the apparatus.

RESULTS

The grassy site has a rich collembolan community, represented by about 21 species, viz., *Megalothorax minimus* Willem, *Cyphoderus albinus* Nicolet, *Lepidocyrtus* (*Lepidocyrtus*) *medius*, *Lepidocyrtus* (*Ascocyrtus*) sp., *Folsomides parvulus* Stach, *Isotomina thermophila* (Axelson), *Arrhopalites* sp., *Pseudosinella* sp., *Sphaeridia* sp., *Stenognathellus* sp., *Entomobrya* sp., *Isotomurus ciliatus* Stach, *Isotomiella minor* (Schaeffer), *Sminthurus* sp., *Sinella* (*Sinella*) sp., *Katianna* sp., *Brachystomella* cf. *curvula* Gisin, *Pseudachorutes* sp., *Tullbergia* (*Stenaphorura*) sp., *Salina bengalensis* Mitra.

During first year, Collembola quantitatively dominated over Acarina (Fig. 1). Highest peak of population of Collembola

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was observed during June, representing monsoon peak, followed by winter peak during October and summer one during March.

Winter peak of Collembola coincides with the highest peak population of Acarina, occurring from January to April followed by three medium peaks during June, August and September, while higher temperature coupled with very high relative humidity encourages the growth of Collembola, for Acarina, however, low R/H and temperature appeared as favourable factors.

During second year, highest peak of population was observed during November (winter peak) preceded by two medium peaks during March (summer) and May (premonsoon). Absence of a monsoon peak is characteristic for this year presumably for low soil temperature during monsoon months specially in July this year (Fig. 2.).

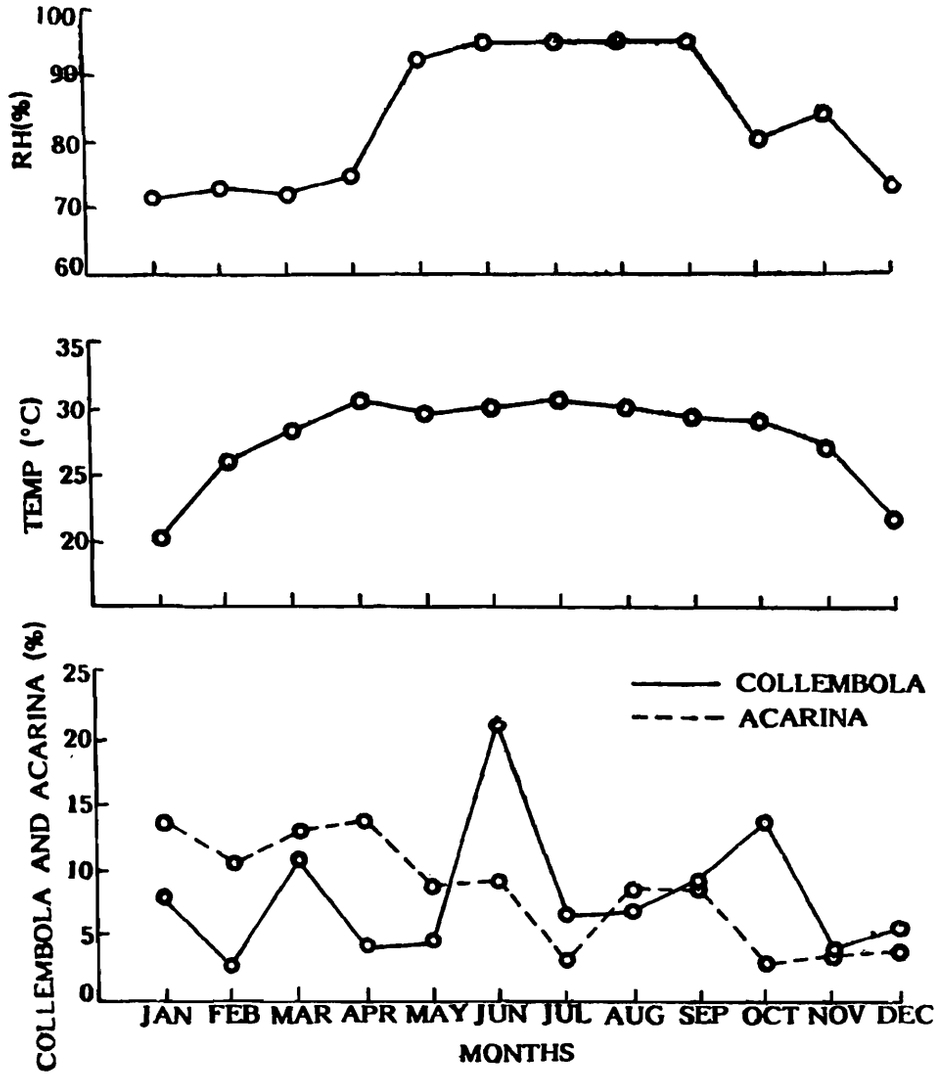

Fig. 1. Monthly changes in the population of Collembola and Acarina with reference to relative humidity and temperature during first year.

The peak of collembolan population during third year was very pronounced during July coinciding with the highest R/H level and very high temperature of the soil, representing the monsoon peak. Premonsoon peak occurred during May preceded by

summer peak during March. Winter peaks were observed during October, December and January of which peak in December was quite pronounced coinciding with moderately low R/H and temperature. For Acarina, the highest peak in population was observed during January followed by intermittent medium peaks during March, April, July, September and November (Fig. 3).

peak of Collembola occurred during March followed by the monsoon peak in June and winter peak during December with an intermediate moderate prewinter peak in October. Acarina exhibited a pronounced summer peak during March followed by almost uniform mean population during other months with smaller peaks (Fig. 4).

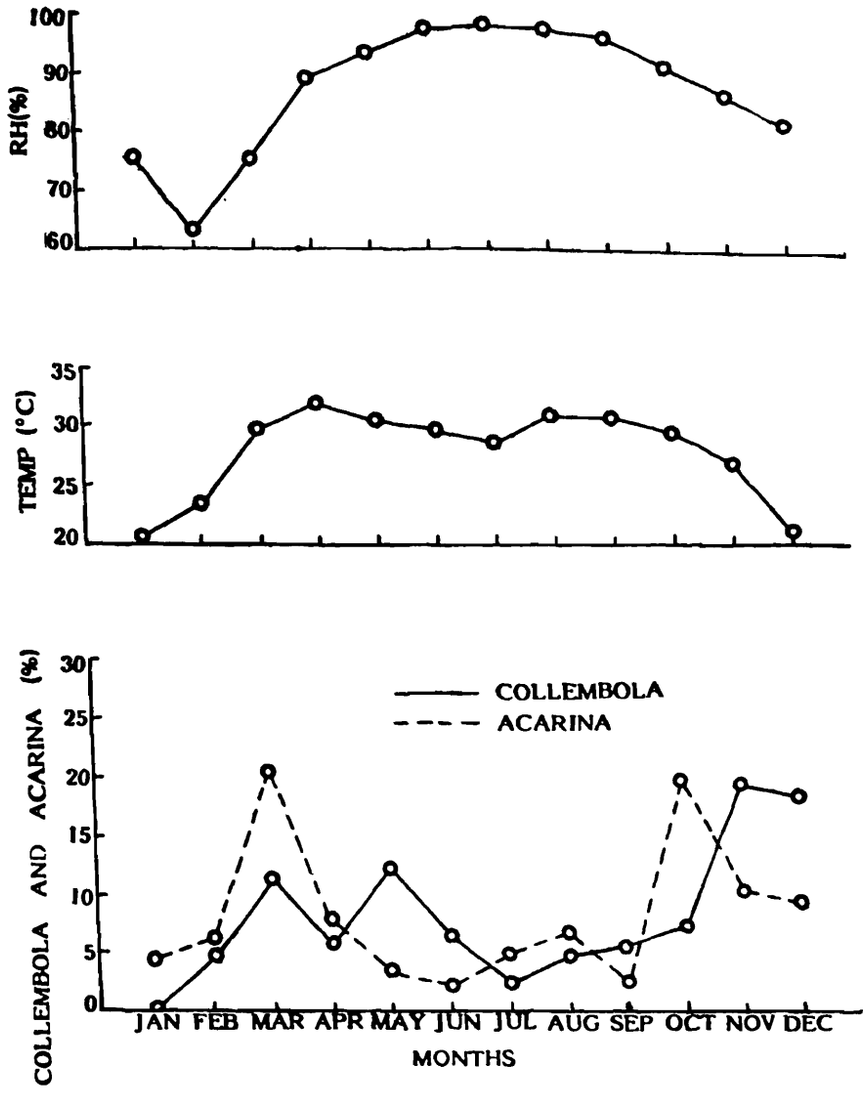

Fig. 2. Monthly changes in the population of Collembola and Acarina with reference to relative humidity and temperature during second year.

The overall mean population of Collembola for three years reveal that the summer

The mean of Collembola and Acarina population and abiotic factors is presented in Table-1 and their total number in Fig. 5.

TABLE 1. Mean of Collembola, Acarina and abiotic factors with standard deviation.

Year	Collembola	Acarina	Temp (°C)	RH (%)
1st	15.66±9.94	25.25±12.34	27.88±3.55	83.68±10.29
2nd	10.16±7.44	18.25±13.45	27.95±3.99	87.10±11.07
3rd	6.08±3.52	11.75± 8.83	28.64±4.89	82.79±10.09

TABLE 2. Correlation coefficient between Collembola and Acarina population, relative humidity and soil temperature.

X : Collembola	I yr	II yr	III yr	Mean of 3 years
Y_1 : Acarina	*0.099	*0.336	−0.172	−0.197
Y_2 : Temperature	0.120	−0.021	*0.145	*0.068
Y_3 : RH (%)	*0.240	−0.07	*0.023	*0.058

*Significant at 5% level

TABLE 3. Correlation coefficient between Acarina population *vs* Collembola, temperature and relative humidity.

X : Acarina	I yr	II yr	III yr	Mean of 3 years
Y_1 : Collembola	0.099	0.336	−0.172	−0.197
Y_2 : Temperature	−0.069	−0.042	−0.575	−0.346
Y_3 : RH (%)	−0.399	−0.281	−0.322	−0.655

Monthly relationship between Collembola and Acarina population is presented in Fig. 6.

Correlation coefficients between Collembola and Acarina population, relative humidity and soil temperature were worked out (Table-2).

From the table it appears that in the first year, the correlation is positive between Collembolan population *vs* Acarina, temperature and relative humidity. In the second year this correlation is negative for temperature and relative humidity. During the third year, while the correlation is negative between collembolan population and physical factors while it is negative for Acarina.

In Table—3, correlation coefficients between Acarina population *vs* Collembola, temperature and relative humidity are presented. It appears from the table that while correlation coefficient is positive between Acarina and Collembola during first and second years, it is negative during third year and also with the mean correlation of three years population. Correlations between Acarine population, temperature and relative humidity are negative for all the three years including three years mean population.

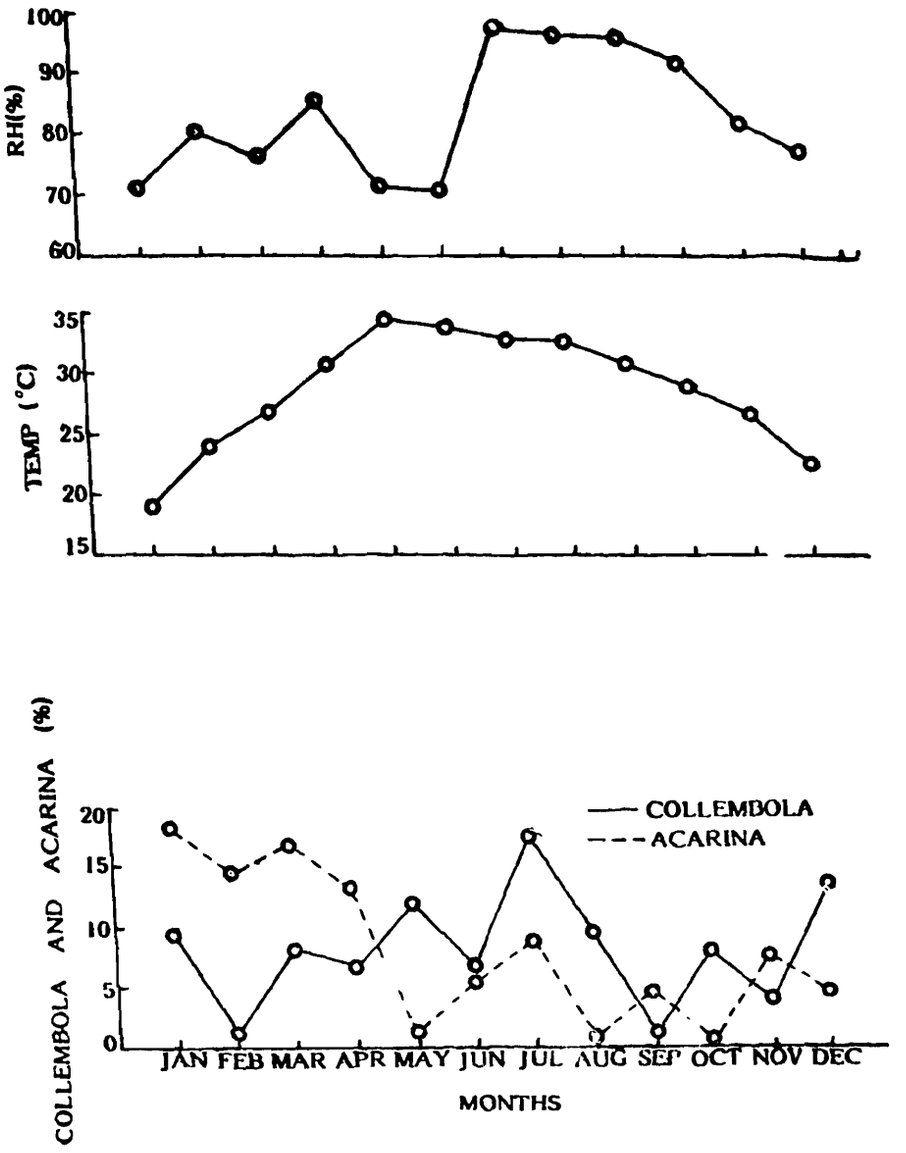

Fig. 3. Monthly changes in the population of Collembola and Acarina with reference to relative humidity and temperature during third year.

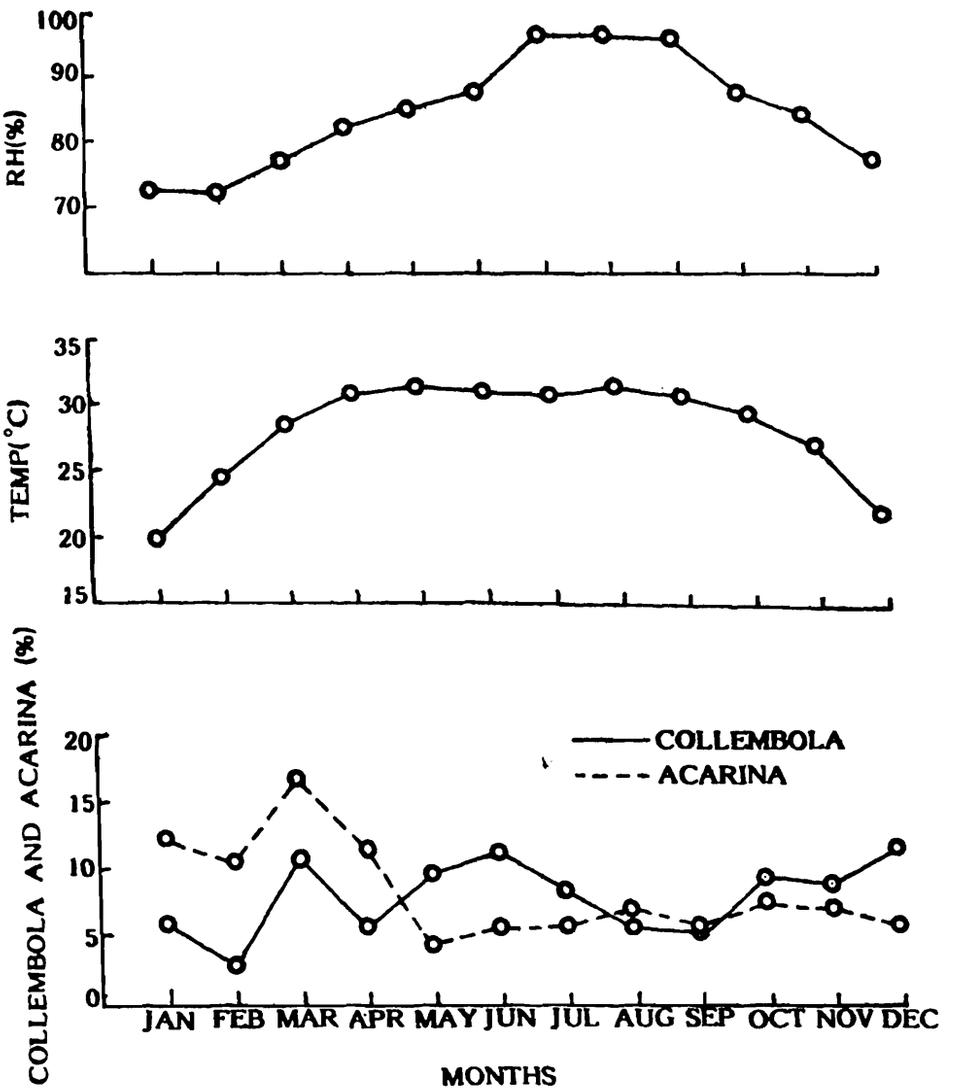

Fig. 4. Monthly changes in the population of Collembola and Acarina with reference to relative humidity and temperature during three-year period.

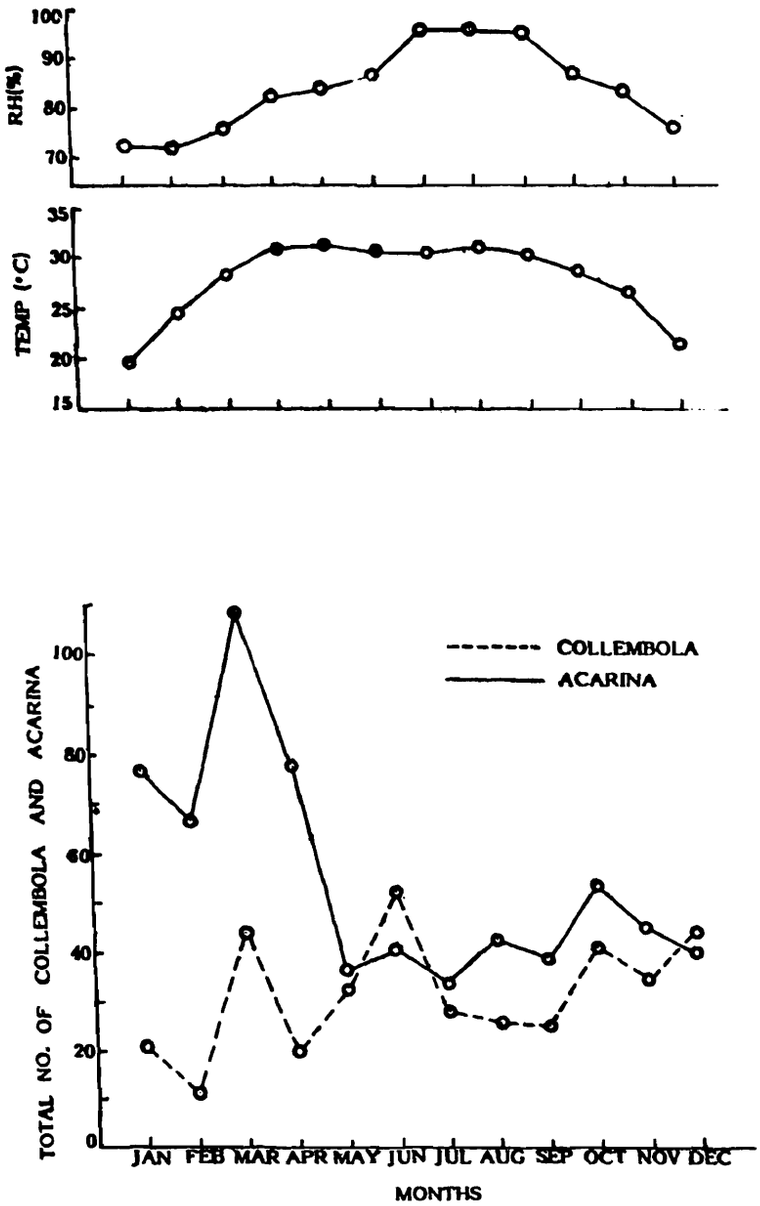

Fig. 5. Monthly changes in the population of Collembola and Acarina during three-year period with reference to relative humidity and temperature.

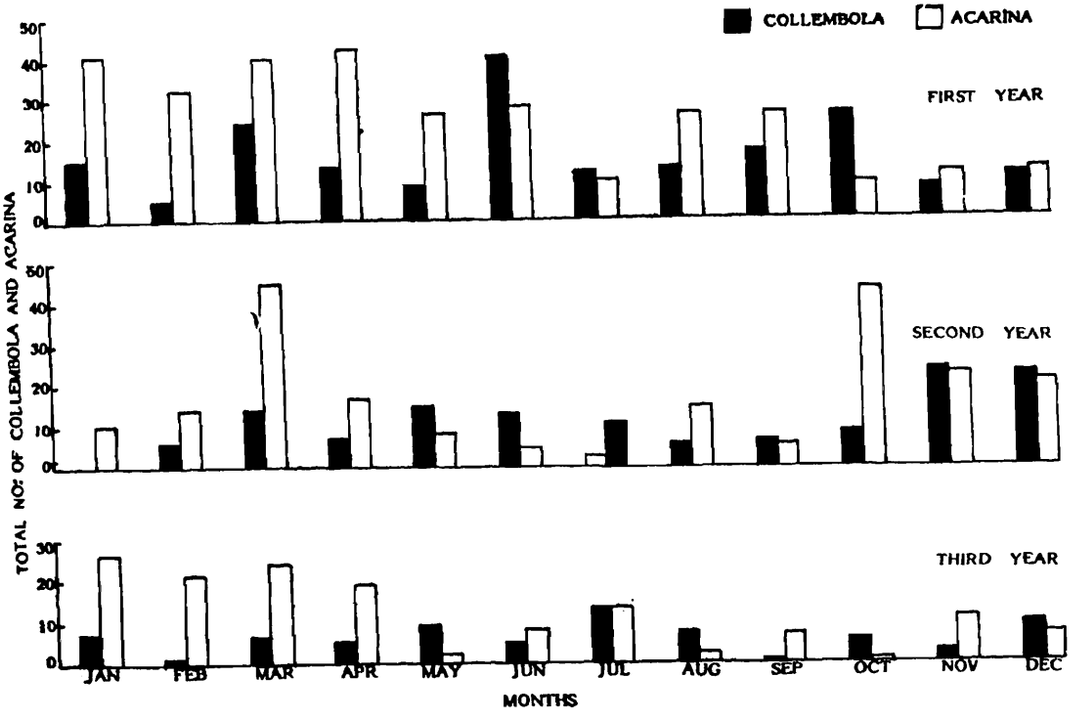

Fig. 6. Relationship between Collembolan and Acarine populations during first, second and third years.

Discussion

At the grassy site the correlation between Collembola and Acarina, through significant for first two years, it is negatively correlated during third year presumably due to over-saturated condition of soil during this year. Collembolans being extremely sensitive to changes in temperature and relative humidity exhibit positivc correlations in most of the cases. In the present study, the grassy site exhibited premonsoon and winter peaks, as characteristic of the gangetic alluvim, except during second year, when the monsoon peak was inconspicuous owing to low soil temperature, specially during July of this year.

Summary

In the present investigation, population dynamics of Collembola and Acarina in a grassland ecosystem at Calcutta is given with reference to the biotic relationship between Collembola and Acarina and two abiotic factors, viz., temperature and relative humidity on the basis of three years data.

Acknowledgement

Grateful thanks are due to the Director, Zoological Survey of India for facilities.

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