Rec. zool. Surv. India, 83 (3 & 4) : 175-180, 1986

CHANGES IN POPULATION STRUCTURE OF COLLEMBOLA AND ACARINA IN AN AGRICULTURAL ECOSYSTEM

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Introduction

The agricultural ecosystem is intermediate between natural ecosystems, such as grasslands and forests and man-made ecosystems, such as cities, industrial complexes and so on. Various factors, affecting the faunal distribution in such fabricated ecosystems, being rather harsh, drastically reduce the density and diversity of the species.

Experimental Sites and Methods

324 soil samples were drawn monthly from adequately replicated experimental plots at the Jute Agricultural Research Institute, Barrackpore, West Bengal (India) where long-term fertilizer experiments are being conducted since 1971 with rotation of three crops, *viz.*, wheat, jute and paddy with the application of various doses of N. P. K. and F. Y. M., adoption of plant protection measures, periodic irrigation, etc. (Table-I).

TABLE—I

Treatments	Jute	Paddy	Wheat
T_1	$N_{30}P_{15}K_{30}$+H.W.	*$N_{60}P_{30}K_{30}$	*$N_{60}P_{30}K_{30}$
T_2	$N_{90}P_{45}K_{30}$+H.W.	*$N_{180}P_{90}K_{90}$	*$N_{180}P_{90}K_{90}$
T_4	$N_{60}P_{30}K_{60}$+H.W.	*$N_{120}P_{60}K_{60}$+H.W.	*$N_{120}P_{60}K_{60}$+H.W.
T_6	$N_{60}P_{30}K_0$ +H.W.	*$N_{120}P_{60}K_0$	*$N_{120}P_{60}K_0$
T_7	$N_{60}P_0$ K_0 +H.W.	*$N_{120}P_0$ K_0	*$N_{120}P_0$ K_0
T_8	$N_{60}P_{30}K_{60}$+H.W.+ F.Y.N. @10t/ha	*$N_{120}P_{60}K_{60}$	*$N_{120}P_{60}K_{60}$
T_9	$N_{60}P_{30}K_{60}$+C.W.	$N_{120}P_{60}K_{60}$+C.W.	$N_{120}P_{60}K_{60}$+C.W.
T_{10}	Control+H.W.	*Control	*Control
F			

*Hoeing

Quantitative Analysis

An overall analysis of data shows that Acarina quantitatively dominated over Collembola during all the months and in all the plots.

Population maxima for Acarina was observed during January (wheat cultivation) followed by another during November (paddy cultivation) while, for Collembola, the highest peak was observed during April (jute cultivation) and another moderate peak during January (wheat cultivation).

Lowest population of Collembola was observed during May (jute cultivation) while no population was obtained from soil samples, drawn during July, August and December. Acarina exhibited lowest population during August (paddy cultivation) (Figs. 1, 2).

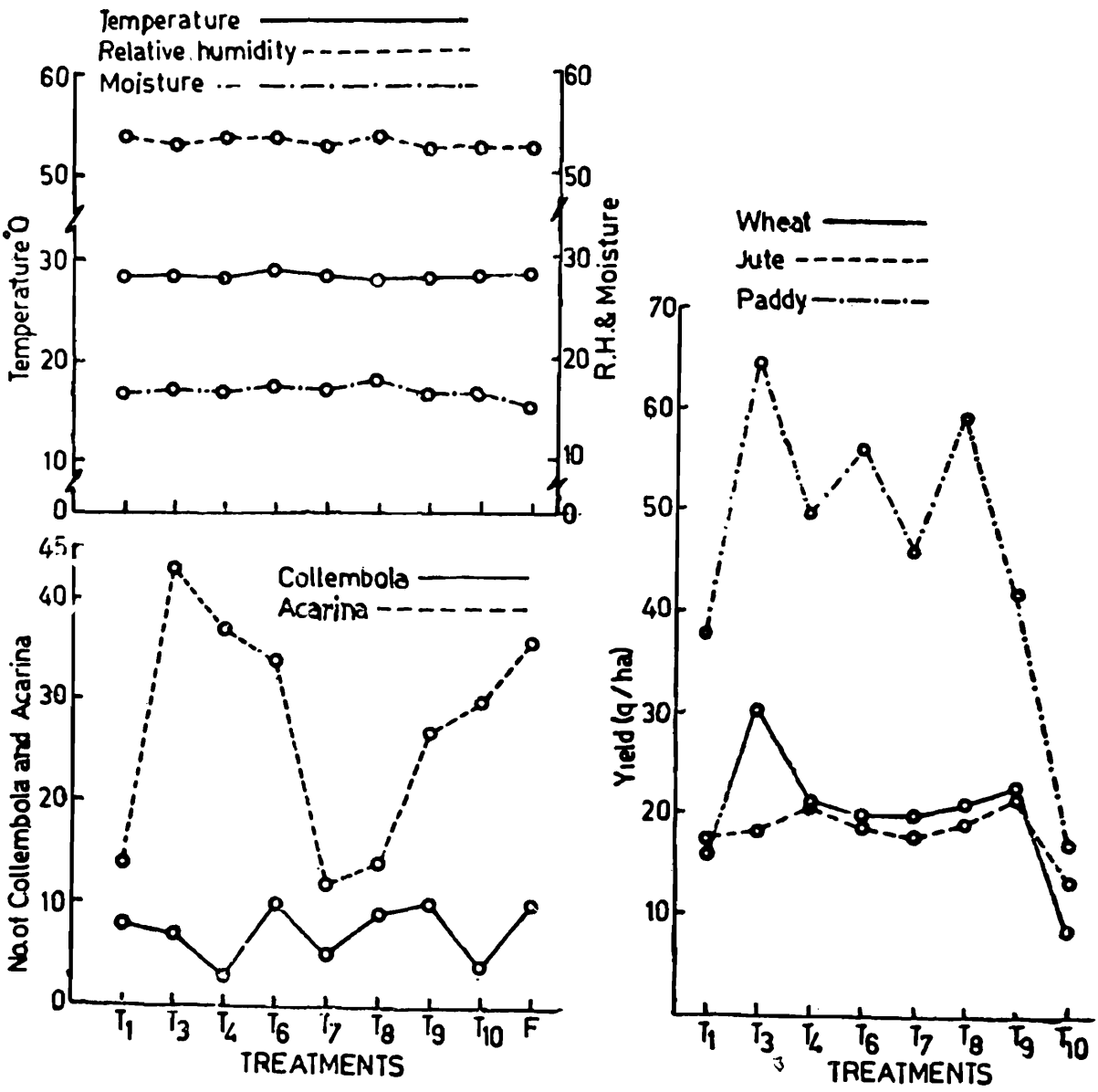

Fig. 1. Dynamics of Collembola and Acarina in fertilizer treated plots with reference to crop yield, temperature, relative humidity and moisture.

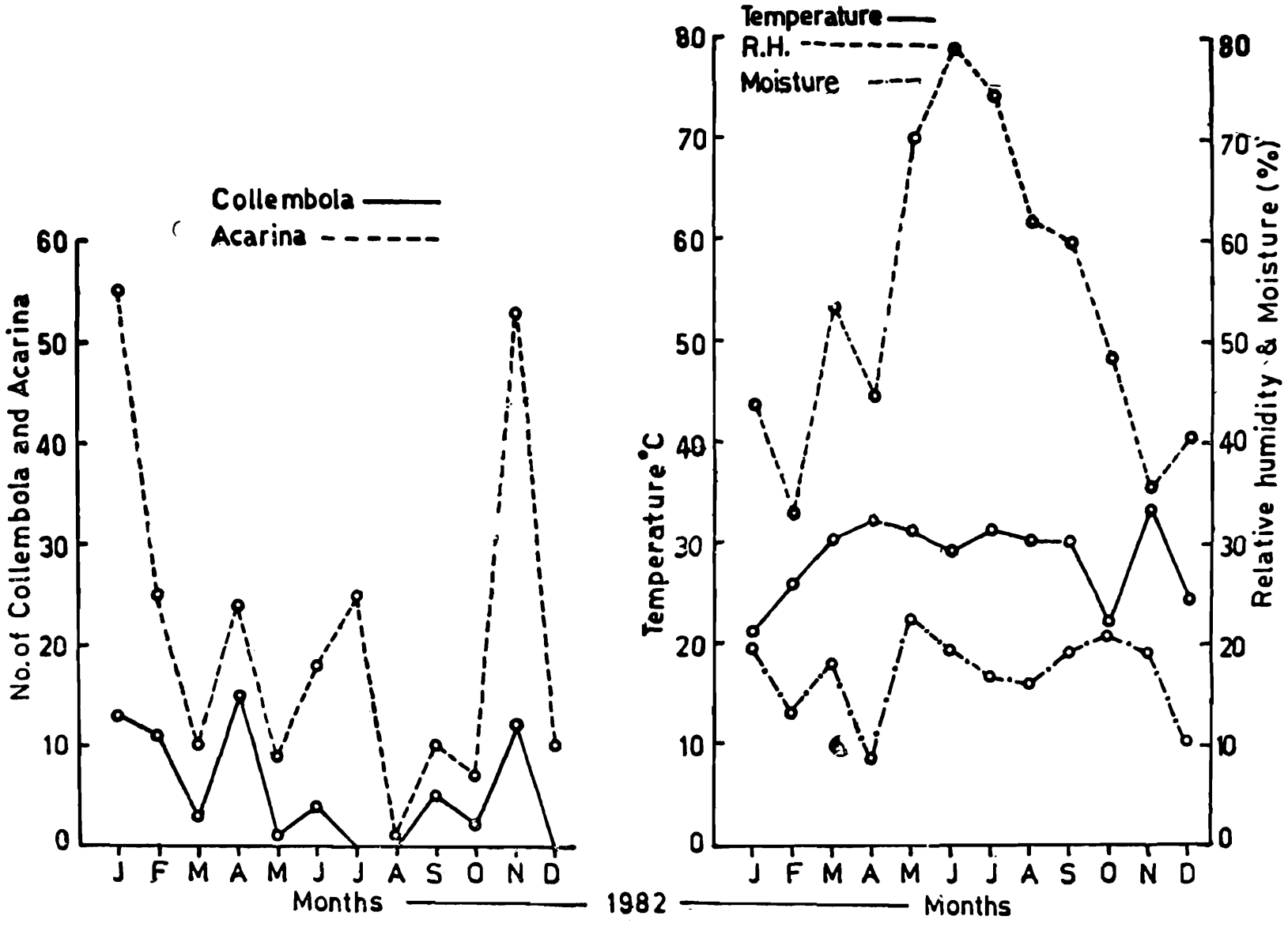

Fig. 2. Monthly changes in the population of Collembola and Acarina in agro-ecosystem with reference to three physical parametres.

The highest build-up of both Collembola and Acarina populations were observed during wheat cultivation (December-March) [40.90% *vs.* 40.48%] followed by jute (April-July) [30.30% *vs.* 30.76%] and paddy [28.78% *vs.* 28.74%].

Plot-wise analysis of collembolan population shows that T_6, T_9 supported the highest population (15.1%) followed by T_8 (13.59%), T_1 (12.08%), T_3 (10.57%), T_7 (7.55%), T_{10} (6.04%), and T_4 (4.53%). Similarly, T_3 exhibited highest population of Acarina (17.37%) followed by T_4 (14.94%), T_6 (13.73%), T_{10} (12.12%), T_9 (10.90%). It is seen that T_1 and T_8 supported the same Acarina population (5.65%) followed by T_7 (4.84%).

Qualitative Analysis

In the experimental plots, altogether 5 species of Collembola occurred during the period of this investigation of which the most dominants were *Isotomurus balteatus* (Reuter) [33.33%] and *Cryptopygus thermophilus* (Axelson) [33.33%] followed by *Lepidocyrtus* (*Lepidocyrtus*) sp. [15.15%], *Cyphoderus javanus* Boerner [12.12%] and *Entomobrya* sp. [6.06%].

I. balteatus and *Entomobrya* sp. were most predominant during wheat cultivation, *C. thermophilus* during jute cultivation, *C. javanus* and *Lepidocyrtus* (*Lepidocyrtus*) sp. during paddy cultivation.

Other species were moderately predominant, infrequent or absent during cultivation of all the three crops (Table-II).

TABLE—II

Occurrence of the species of Collembola according to vegetation types

Species	Vegetation		
	Wheat	Jute	Paddy
Isotomurus balteatus (Reuter)	+++	+	++
Cryptopygus thermophilus (Axelson)	++	+++	+
Lepidocyrtus (*Lepidocyrtus*) sp.	+	++	+++
Cyphoderus javanus Boerner	++	++	+++
Entomobrya sp.	+++	–	–

+++ Predominant; ++ Moderately predominans;
\+ Infrequent; – Absent

A plot-wise analysis of the species of Collembola indicates that the maximum population build up of *I. balteatus* was in T_1 and T_7 while minimum in T_3, T_4, T_8 and Fallow. It occurred in moderate numbers in T_6, and T_9. *Cryptopygus thermophilus* exhibited highest population in Fallow followed by T_8. It was absent in T_4, T_7 but seldom found in T_1. T_3 mostly supported the population of *Lepidocyrtus* (*Lepidocyrtus*) sp. followed by T_6 where it occurred in moderate numbers. Its minimum population was observed in T_1 while T_4, T_7, T_8, T_9 and T_{10} were completely devoid of this species. Maximum population of *C. javanus* was noticed in T_8 and T_9 which supported a moderate population. T_3, T_6, T_7, T_{10} and Fallow supported no population of the species and its minimum population was observed in T_1.

TABLE—III

Correlation coefficient between Collembola and Acarina populations, relative humidity, soil temperature and moisture.

	Y : Collembola	Y : Acarina
X : — Relative humidity	0.036*	— 0.365
— Temperature	0.323*	0.209*
— Moisture	—0.032	—0.330
— Acarina	—0.050	

* Significant at 5% level

Relationship between population and Physical factors

The correlation coefficient between Collembola-Acarina and physical factors and also between Collembola and Acarina was analysed (Table-III). It is seen that a positive correlation exists between relative humidity and temperature and Collembola while for Acarina though the correlation is positive for temperature, it is negative for relative humidity. Correlation between both Collembolan and acarine populations with moisture is negative and so also between Collembola and Acarina populations.

DISCUSSION

Round the year cultivation, at the studied agro-ecosystem, is found to reduce the population of both Collembola and Acarina. Effect, however, is found to be more drastic on Collembola than Acarina.

Great reduction in species-diversity of Collembola has been observed. Mitra *et al* (1983) recorded fourteen species of Collembola from the

same agro-ecosystem as compared to give species, recorded in the present observation.

Highest population build-up of Collembola during wheat cultivation may be ascribed to the application of least pesticides during this period.

Summary

Effects of agronomic practices and crop-rotation on Collembola are presented. It is seen that continuous cultivation affects collembolan population both qualitatively and quantitatively.

Acknowledgemetts

We are grateful to the Director, Jute Research Institute, Barrackpore, West Bengal and specially to Mr. B. C. Mandal of the same institute for providing us facilities for sampling from the experimental plots. Our thanks are due to the Director, Zoological Survey of India, Calcutta, for providing facilities and to M/S. S. B. Mandal, B. K. Halder and A. L. Dutta for technical assistance and cooperation.

References

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