

Records of the Zoological Survey of India

**Ecology of subterrenean macro and micro
arthropod fauna in different degraded
and polluted soil environment of
West Bengal, India**

**A. K. Hazra
D. K. Choudhuri**

Zoological Survey of India

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OF THE
ZOOLOGICAL SURVEY OF INDIA

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Ecology of subterranean macro and micro
arthropod fauna in different degraded
and polluted soil environment of
West Bengal, India

By

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सत्यमेव जयते

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FOREWORD

Soil represents an entire ecosystem comprising of air, water, solid as well as dissolved minerals, organic matter and a vast community of living organisms. The living community of the soil, millions of tiny organisms, are involved in the modification of the soil environment or the soil building processes, all are valuable resources. This building up process also involves considerable enriching of the soil in nature, but this is a continuous process of increasing productivity, providing human food that makes the soil fertile. To day the greatest threat posed to the soil-ecosystem caused by industrial wastes, pesticides and fungicidal residues, throw away solid wastes etc. are changing the physico-chemical and biological equilibrium of the soil environment. The authors who are distinguished soil-zoologists of the country have investigated in great details the impact of different degradable and non-degradable pollutants on the valuable soil-micro and macroarthropod fauna with particular reference to collembola.

This book highlights some of the more important degraded and poor soil environment of this country, placing due emphasis on a study of the important component of the biosphere.

Dated January, 1990.
Calcutta

Prof. M. S. Jairajpuri
Director,
Zoological Survey of India

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Dedicated
to
the memory of my late mother
Smt. Uma Devi
who inspired me throughout
her life

A. K. Hazra

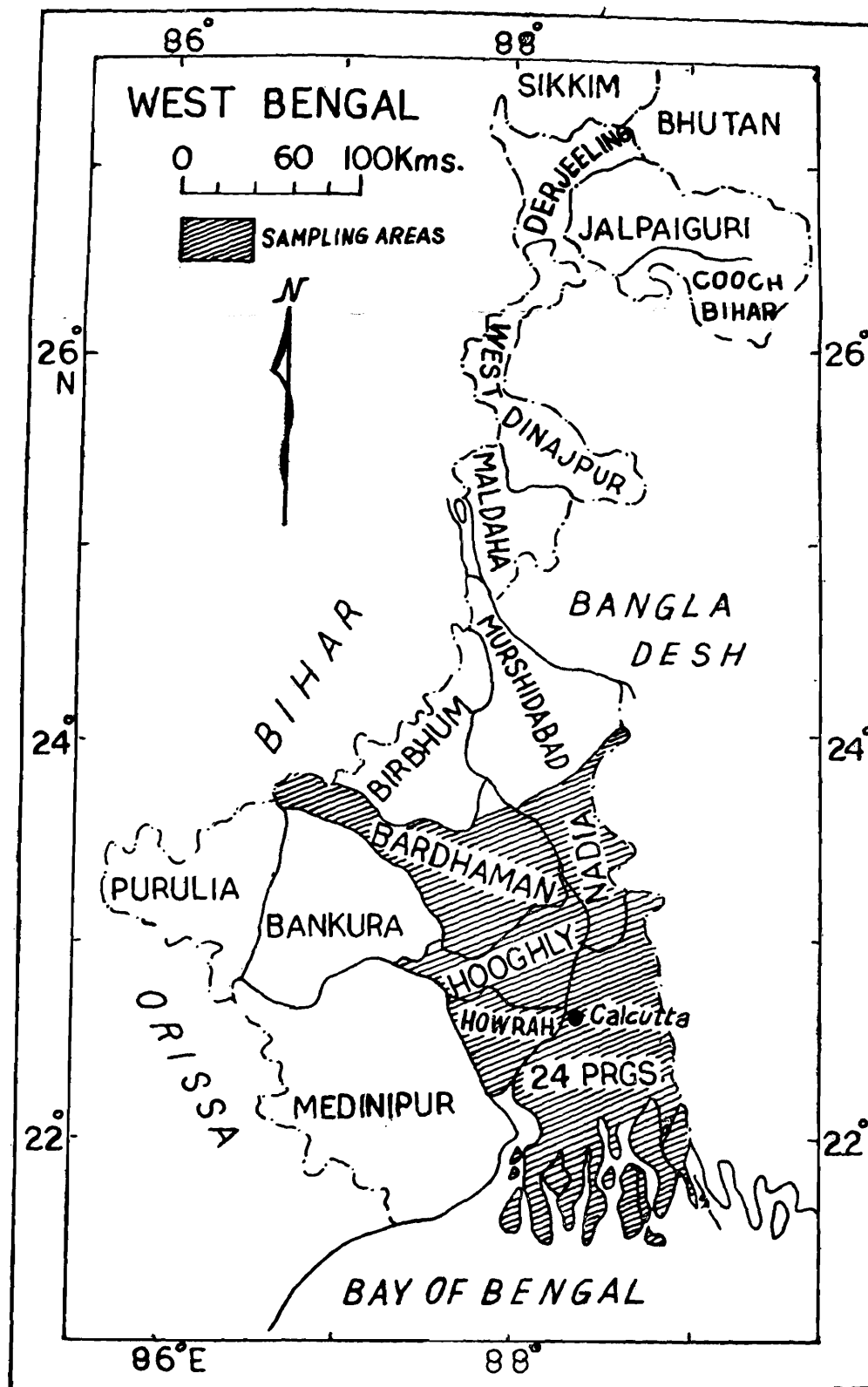


Fig. 1. Map of West Bengal showing areas of sampling.

ECOLOGY OF SUBTERRANEAN MACRO AND MICRO ARTHROPOD FAUNA IN DIFFERENT DEGRADED AND POLLUTED SOIL ENVIRONMENT OF WEST BENGAL, INDIA

By

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INTRODUCTION

In India and abroad, numerous workers like Bellinger (1954), Sheals (1957), Haarlov (1960), Christiansen (1964), Dhillon and Gibson (1962), Choudhuri and Roy (1967, '72), Prabhoo (1971), Mitra *et al* (1977), Hazra (1978a, b) and Ananthakrishna (1979) studied the qualitative and quantitative ecology of the Collembolan population in undisturbed fallow land and Choudhuri and Banerjee (1975), Joy and Bhattacharyay (1981), Sanyal (1982) and Sanyal and Sarkar (1984) have studied the ecology of soil Acarina in different uncultivated fields of West Bengal. Moreover, some workers like Ghilarov (1973), Edwards and Lofty (1973), Mitra *et al* (1981), Hazra and Choudhuri (1983) and Hazra and Chattopadhyay (1985) have studied Collembola and some microarthropod population in some cultivated and disturbed fields. However, in India no serious attempts have been made so far for the ecological behaviour of soil arthropods inhabiting in different degraded and polluted soil environment. The present investigation deals with the composition and distribution pattern of soil arthropod fauna in general and acarina and collembola in particular of 14 different kinds of degraded, disturbed, polluted, uncultivated and cultivated ecosystems in relation to some major soil factors (temperature, moisture, nitrate and organic carbon), heavy metals (Chromium, Copper and lead) and soil microflora (Fungi) in some areas of West Bengal.

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MATERIALS AND METHODS

The experimental fields were located between 22°N-24°N and 86°E-88°E in the state of West Bengal (Fig. 1). A total of 4410 soil samples were drawn from 42 plots at monthly interval from April, 1978 to December, 1980, i.e. at the rate of 21 samples per month per site. Samples were drawn at random using stainless steel corers (Cross sectional diameter 8 cm). Separate sample units were taken once a month in each site for vertical distribution study during the period from April, 1979 to March, 1980. Two samples per plot were taken to a depth of 15 cm. and sub-divided into three 5 cm. sub-samples in order to investigate vertical distribution up to this depth, as followed by Curry (1971). The extraction of soil samples were carried out by expedition funnel apparatus modified by Macfadyen (1953). A 40 watt bulb was used for heat and light source.

The fungal population was assessed by inoculating the soil solution of 1 : 100 and 1 : 1000 dilutions by collecting the soil samples from the upper 5 cm. of soil. The dilution plate method was employed, by using Waksman's medium of the following composition : Dextrose-10 gm. ; Peptose-5 gm. ; KH_2PO_4 —1gm. ; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ -0.5 gm. ; agar agar-20 gm. ; Distilled water-1000 ml. ; Rose Bengal- 1 : 15,000. The fungal population was recorded after 5 days of incubation at 25°C.

The temperature of the soil was recorded by soil thermometer and the soil moisture was estimated by using an IR moisture balance. pH was determined by using an electronic pH meter (B & L). Hygrometer method (Piper, 1942) was employed for the mechanical analysis of the soil samples. Soil nitrate was determined colorimetrically while Walkley and Black's (1934) method was followed for organic carbon determination.

The heavy metals such as Chromium, Copper and Lead were measured photometrically by setting up of Hilzer and Watt's large Quartz-glass automatic spectrograph E-742 present at the Geological Survey of India, Calcutta.

OBSERVATIONS

SITE WISE ANALYSIS OF MICRO, MACROARTHROPOD FAUNA AND SOIL FUNGI

The present investigation involves extraction of several micro and macro soil arthropod fauna from the soil samples of 42 sampling plots in fourteen

different habitats such as, I. Fallow land site (FL) ; II. Agriculture practice land site (APL) ; III. Deforested site (DS) ; IV Reserve forest floor site (RFF) ; V Anthropogenic Pressurised City Park (ACP) ; VI. Undisturbed city park site (UCP) ; VII. Irrigation canal embankment site (ICE) ; VIII. Sewage canal embankment site (SCE) ; IX. Garbage dumping dune site (GDS) ; X. Soil dune site (SDS) ; XI. Durgapur control Pasture site (DCS) ; XII. Durgapur industrial effluent sites (DIE) ; XIII. Unmetalled road way site (URS) and XIV Metalled highway site (MHS) of densely populated and highly industrialised areas of West Bengal (Fig. 1), a state in the Eastern region of the Indian Republic situated between 22°N-27°N and 86°E-89°E.

FALLOW LAND SITE

Characteristics of sampling site : This site is located within the campus of rice research station, Chinsurah, Dist. Hooghly. It includes four sampling plots each ten metre square. The plots were adjacent to the experimental field of the research station. In these plots no cultivation is being made and remained as fallow land.

Vegetation :

Above ground : The plots were covered with grasses and sedges like *Cynodon dactylon*, *Dichanthium annulatum*, *Arundinella* sp., *Panicum* sp. *Euphorbia hirta*, *Croton sparciflora* and margins of the plots were with some trees like *Accacia arabica*, *Dalbergia sissoo* etc.

Underground : Soil fungi obtained from this site belonged to 43 species under 29 genera (Table 1). Genus *Penicillium* was occurred most frequently, maximum population were found in August, 1979 (39,000/gm. soil) and in July, 1980 (41,000/gm. soil). Minimum in June (Table 2).

Soil factors : Soils of these plots were Gangetic alluvium in nature, brown in colour, clay loam in texture. pH varied from 7.00 to 7.20. In April and May moisture content of soil were 8.48% and 6.28% respectively in 1979, 7.48% and 5.28% respectively in 1980. Month of July in each sampling year showed maximum moisture content (27.18% and 23.38% respectively in 1979 and 1980). In May other soil factors such as organic carbon, nitrate and temperature were 2.28%, 1.35 ppm and 38.5°C respectively in 1979 and 2.18%, 1.30 ppm and 37.3°C respectively in 1980. Amount of organic carbon and nitrate were found to be maximum in July. However, organic carbon was maximum in August in the year 1979 (Figures 2-2c).

Table 1
Showing distribution of fungal species in different sites
April, 1979—December, 1980

Genera/Species	Sites	ACP	UCP	RFF	DS	APL	FL	DCS	DIE	SCE	ICE	SD	GDS	MHS	URS
<i>Sclerotium</i> sp.		—	+	+	—	—	+	+	—	+	+	+	+	—	—
<i>Pestalotia monorhinca</i>		—	+	+	—	+	+	+	—	+	—	—	+	—	—
<i>Epicocum</i> sp.		—	+	+	+	+	+	+	—	+	—	+	+	+	—
<i>Myrothecium</i> sp.		—	+	—	—	+	+	+	+	+	—	+	+	+	—
<i>Fusarium nitrale</i>		—	+	+	—	+	+	+	—	+	—	+	+	+	+
<i>F. oxysporum</i>		+	+	+	—	+	+	—	—	—	—	+	+	+	+
<i>F. tricinctum</i>		+	—	+	—	—	+	—	+	+	+	—	+	+	+
<i>Fusarium</i> sp.		—	—	+	+	+	—	+	—	+	+	—	+	+	—
<i>F. chlamydosporum</i>		—	+	+	+	—	—	+	—	+	+	—	+	—	—
<i>Stachybotrys aurantia</i>		+	+	+	+	+	—	+	—	—	+	+	—	—	—
<i>Memnoniella echinata</i>		+	+	—	+	—	+	—	—	—	+	+	+	+	—
<i>Phaeotrichonis</i> sp.		—	+	+	—	+	+	—	—	+	+	+	+	+	+
<i>Tetracoccosporium</i> sp.		—	+	+	+	—	+	+	—	+	+	—	+	+	—
<i>Poriconia</i> sp.		—	+	+	+	—	+	+	—	+	+	—	+	—	—
<i>Fumago</i> sp.		+	—	+	+	+	+	+	—	+	+	+	+	+	—
<i>Nigrospora sphaerica</i>		+	+	—	+	—	—	+	+	+	+	+	+	+	—
<i>Hormiscium</i> sp.		—	+	+	—	—	—	—	+	+	—	+	+	+	+
<i>Helminthosporium</i> sp.		+	+	+	+	—	+	—	+	—	+	—	+	—	—
<i>Scolecobasidium</i> sp.		—	—	+	—	+	—	+	+	—	—	+	—	—	+
<i>S. constrictum</i>		—	+	—	—	+	—	+	—	+	—	—	+	—	+

Table 1 (Ccntd.)

Genera/Species	Sites	ACP	UCP	RFF	DS	APL	FL	DCS	ME	SCE	ICE	SD	GDS	MHS	URS
<i>Humicola</i> sp.		—	—	+	—	+	+	—	—	+	—	+	+	+	+
<i>Alternaria tenuis</i>		—	—	+	+	—	+	—	—	+	+	+	+	+	+
<i>A. humicola</i>		+	+	+	+	+	+	+	—	—	+	—	+	+	+
<i>Cladosporium</i> sp.		+	+	—	+	—	—	+	—	—	+	+	+	+	—
<i>Curvularia lunata</i>		+	+	+	—	—	+	+	+	—	+	—	+	—	—
<i>C. geniculata</i>		—	+	+	—	—	+	+	+	—	+	—	+	+	—
<i>Curvularia</i> sp.		—	—	+	—	+	+	+	—	+	+	—	+	+	—
<i>Oedocephalum coprophilum</i>		—	—	+	+	—	+	—	—	+	—	—	—	—	—
<i>Gliocladium fimbriatum</i>		—	—	+	+	—	+	—	—	+	—	—	—	—	—
<i>Acrotheca</i> sp.		—	+	+	+	+	—	—	—	+	—	+	—	—	—
<i>Cephalosporium</i> sp.		—	+	—	+	+	—	—	—	—	+	+	—	—	—
<i>Acremonium</i> sp.		—	+	+	—	+	—	—	—	—	+	+	+	+	—
<i>Paecilomyces fusisporus</i>		—	+	—	+	—	+	+	—	—	—	—	+	—	+
<i>Paecilomyces</i> sp.		+	+	—	+	—	—	+	—	—	—	+	+	—	—
<i>Penicillium variabile</i>		+	—	+	—	+	+	—	+	+	+	+	+	+	+
<i>P. purpurogenum</i>		—	—	+	+	—	+	—	+	+	—	—	+	+	+
<i>Penicillium funiculosum</i>		—	+	+	+	+	+	+	—	+	—	+	+	—	—
<i>P. notatum</i>		—	+	+	+	+	+	+	—	+	—	+	+	—	—
<i>P. humicola</i>		+	+	+	—	+	+	+	+	+	+	—	+	+	—
<i>Mucor luteus</i>		+	+	+	—	—	+	+	+	—	+	—	+	+	—
<i>M. hiemalis</i>		+	+	+	+	+	—	+	—	—	+	—	+	+	+
<i>Gongronella</i> sp.		—	—	+	—	—	—	—	—	+	—	+	+	—	+
<i>Rhizopus nigricans</i>		—	—	+	—	+	—	—	—	—	—	—	+	—	+
<i>R. oryzae</i>		—	—	—	—	—	+	+	—	+	+	—	—	—	—

Table 1 (Contd.)

Genera/Species	Sites	ACP	UCP	RFF	DS	APL	FL	DCS	DIE	SCE	ICE	SD	GDS	MHS	URS
<i>Pythium debaryanum</i>	—	—	—	—	—	—	—	+	—	+	—	—	+	—	+
<i>Zygorhynchus</i> sp.	—	—	+	+	+	—	—	+	+	+	—	+	—	+	+
<i>Choanephora cucurbitarum</i>	+	—	—	—	—	—	+	+	+	+	—	+	—	—	—
<i>Choanephora</i> sp.	—	+	+	+	—	+	+	+	—	—	+	—	+	—	—
<i>Phoma humicola</i>	+	+	+	+	+	—	+	+	—	+	+	+	—	+	—
<i>Macrophoma</i> sp.	—	+	+	+	—	—	+	+	—	+	+	—	+	—	—
<i>Botryodiplodia</i> sp.	—	+	+	+	—	+	+	+	—	+	+	+	+	—	—
<i>Chaetomella raphigera</i>	—	—	+	+	—	—	—	+	+	+	—	—	—	+	—
<i>Trichoderma viride</i>	+	—	+	+	—	+	—	—	+	—	+	—	+	+	+
<i>Trichoderma</i> sp.	+	—	—	—	+	—	+	—	+	—	—	—	—	+	+
<i>Aspergillus niger</i>	+	+	+	+	—	—	—	+	—	+	—	—	+	+	—
<i>A. terreus</i>	—	+	+	+	—	+	—	—	—	+	—	+	+	+	+
<i>A. flavus</i>	—	+	+	+	+	—	+	+	+	+	—	+	+	—	—
<i>A. candidus</i>	+	+	+	+	+	+	+	—	—	—	+	+	+	—	—
<i>A. fumigatus</i>	+	+	—	—	+	+	—	+	—	+	+	+	+	—	+
<i>Syncephalastrum</i>															
<i>racemorum</i>	+	—	+	+	—	+	+	+	—	+	+	+	+		—
<i>Thielavia terricola</i>	—	+	+	+	—	—	+	+	—	+	—	—	+	+	—
<i>Chaetomium globosum</i>	—	+	+	+	—	—	+	+	+	+	—	—	+	—	—
<i>Chaetomium</i> sp.	—	+	+	+	—	—	—	—	+	—	+	—	+	—	—
<i>Melanospora</i> sp.	—	+	—	—	+	—	—	+	+	—	+	+	—	—	+
<i>Neocosmospora vasinfecta</i>	—	+	+	+	+	—	—	+	—	—	+	—	+	—	+
<i>Choetocera ostoma</i> sp.	—	+	—	—	+	—	—	+	—	+	+	—	+	+	—
<i>Aspergillus nidulans</i>	+	—	+	+	+	+	+	+	—	+	+	+	+	—	+
<i>A. montevidensis</i>	+	—	+	+	—	+	+	—	—	—	—	—	+	+	—
<i>Penicillium barefeldianum</i>	+	+	+	+	—	+	+	—	—	—	—	+	+	+	+
<i>Penicillium</i> sp.	+	+	+	+	+	+	+	—	+	+	—	+	+	+	+
<i>Phoma hibernica</i>	+	+	+	+	+	—	+	+	+	+	—	+	+	+	+

Table 2

Showing monthly population of fauna (Mean $\pm$ SE) and flora
(Fungi/gm. soil in thousand) at Fallow land site,
April, 1979—December, 1980

Date	Collembola			Other arthropods			Fungi (per gm. soil in thousand)
	Mean	±	SE	Mean	±	SE	
1979							
April	5.40	±	1.03	10.40	±	1.21	15
May	4.20	±	1.68	9.80	±	1.02	12
June	6.70	±	0.86	10.80	±	2.90	21
July	35.60	±	3.93	41.80	±	3.21	32
August	20.80	±	5.61	30.20	±	5.69	39
September	14.40	±	1.32	19.60	±	5.79	24
October	10.80	±	2.90	14.40	±	2.78	22
November	7.80	±	1.16	11.80	±	2.53	26
December	14.20	±	3.02	18.40	±	3.96	28
1980							
January	18.80	±	0.66	17.40	±	3.61	30
February	13.40	±	1.96	15.00	±	1.84	18
March	6.20	±	0.66	8.60	±	1.40	16
April	5.20	±	1.07	9.80	±	1.16	18
May	3.20	±	1.16	6.60	±	1.03	16
June	5.20	±	0.86	8.80	±	2.29	12
July	59.60	±	2.54	43.00	±	2.40	41
August	51.40	±	8.90	52.40	±	8.55	40
September	11.60	±	2.95	14.20	±	4.25	28
October	7.40	±	2.50	8.40	±	2.78	24
November	8.60	±	1.21	11.80	±	2.51	29
December	17.80	±	2.13	17.00	±	4.03	31

Mechanical analysis of soil samples showed high percentage of clay (Table 3).

Table 3

Showing mechanical analysis of soil

Sampling site	Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)
Fallow land site	1.50	7.50	32.00	59.00
Agriculture practice land site	2.00	43.5	38.00	16.50
Deforsted site	6.00	61.5	21.00	11.50
Reserve forest floor site	5.46	37.50	16.00	44.50
Undisturbed City Park site	—	28.5	34.5	37.00
Anthropogenic pressurised city park site	0.93	31.5	33.2	34.37
Irrigation canal embankment site	4.2	41.3	37.2	17.30
Sewewe canal embankment site	—	29.2	44.2	26.60
Garbage dumping site	2.2	17.5	43.5	36.80
Soil due site	2.5	37.5	11.5	47.90
Durgapur control pasture site	29.5	38.5	4.5	27.50
Durgapur industrial effluent site	25.4	41.4	8.4	24.80
Unmetalled road way site	5.2	28.3	45.2	21.3
Metalled highway site	11.5	37.2	14.5	36.80

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to fifteen genera such as *Lepidocyrtus*, *Isotomiella*, *Sinella*, *Calx*, *Megalothorax*, *Isotomurus*, *Folsomides*, *Cyphoderus*, *Subistoma*, *Proisotoma*, *Entomobrya*, *Xenylla*, *Stenacidia*, *Sphaeridia* and *Katianna* (Table 5). Species *Subisotoma fitchioides* was most dominant and being extracted from almost all the soil samples and comprising 19.37% of total population of collembola in this site. *Megalothorax minimus* and *Lepidocyrtus* (*Ascocyrtus*) *medius* comprising 18.94% and 18.03% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Isotomiella minor*, *Sinella* sp., *Calx* su., *Isotomurus ciliatus*, *Folsomides parvulus*, *Cyphoderus javanus*, *Proisotoma* sp., *Entomobrya* sp., *Xenylla* sp., *Stenacidia* sp., *Sphaeridia cornuta*, *Lepidocyrtus* sp. and *Katianna* sp. were either numerically low or irregular in distribution pattern. Number of total collembola (Mean $\pm$ SE) extracted in each month (Table 2) showed maximum population in July when soil factors like organic carbon,

Table 4

Showing species of collembola and their month-wise population number expressed in percentage at Fallow land site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Lepidocyrtus</i> (L) <i>medius</i>	0.23	—	0.37	1.38	0.92	0.64	0.69	0.46	0.55	0.87	0.41	0.28
<i>Isotomiella minor</i>	0.09	0.18	0.09	0.18	0.23	0.09	—	0.09	0.14	0.23	0.09	0.09
<i>Sinella</i> sp.	—	—	0.05	0.14	0.14	0.05	—	—	0.09	0.09	0.05	0.05
<i>Calx</i> sp.	—	—	0.05	0.09	0.09	0.14	0.09	—	0.09	0.09	0.05	0.09
<i>Megalothorax minimus</i>	0.18	—	0.28	1.84	0.60	0.41	0.46	0.41	0.73	0.78	0.60	0.37
<i>Isotomurus ciliatus</i>	—	—	0.05	0.14	0.18	0.09	—	—	0.14	0.14	0.09	0.09
<i>Folsomides parvulus</i>	0.05	—	0.05	0.18	0.23	0.09	0.09	0.05	0.09	0.18	0.09	—
<i>Cyphoderus javanus</i>	0.28	—	0.14	1.61	0.73	0.87	0.55	0.23	0.41	0.69	0.78	—
<i>Proisotoma</i> sp.	—	—	0.05	0.23	0.14	0.05	—	0.05	0.09	0.14	0.05	—
<i>Subisotoma fitchioides</i>	0.18	0.55	0.18	1.28	0.69	0.46	0.23	0.23	0.32	0.64	0.46	0.09
<i>Entomobrya</i> sp.	0.09	—	—	0.23	0.09	0.14	0.05	0.09	0.09	—	0.09	10.09
<i>Xenylla</i> sp.	0.05	—	0.05	0.18	0.82	—	0.05	0.05	0.09	0.09	0.09	—
<i>Stenacidia</i> sp.	—	0.23	0.05	—	—	0.09	0.09	0.05	0.14	0.18	0.05	0.09
<i>Sphaeridia cornuta</i>	0.05	—	—	0.28	0.23	0.09	0.05	0.05	0.05	0.09	0.09	—
<i>Lepidocyrtus</i> sp.	0.05	—	0.09	0.23	0.23	0.05	—	—	0.09	0.09	0.09	0.05
<i>Katianna</i> sp.	—	—	0.09	0.18	—	0.05	0.14	0.05	0.14	—	—	0.05
Total	1.24	0.96	1.56	8.17	4.77	3.30	2.48	1.79	3.26	4.41	3.07	1.42

Table 4 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage of
Fallow land site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Lepidocyrtus (L) Medius</i>	0.18	—	0.18	2.75	1.38	0.41	0.37	0.60	0.92
<i>Isotomiella minor</i>	0.09	—	0.09	0.23	0.14	0.09	—	0.14	0.14
<i>Sinella</i>	—	—	0.05	0.37	0.28	0.09	—	—	0.18
<i>Culx</i> sp.	—	—	0.05	0.28	0.18	0.05	0.14	—	0.14
<i>Megalothorax minimus</i>	0.28	0.18	0.14	2.71	2.29	0.50	0.46	0.28	0.78
<i>Isotomurus ciliatus</i>	—	—	0.05	0.18	0.23	0.05	—	—	0.14
<i>Folsomides parvulus</i>	0.09	—	0.05	0.23	0.28	—	—	0.09	0.09
<i>Cyphoderus javanus</i>	0.23	—	0.18	2.25	1.38	0.60	—	0.37	0.64
<i>Proisotoma</i> sp.	—	—	0.05	0.32	0.09	0.09	0.18	—	—
<i>Subisotoma fitchioides</i>	0.18	0.41	0.14	3.03	4.31	0.32	—	0.32	0.46
<i>Entomobrya</i> sp.	—	—	0.05	0.14	0.18	0.09	0.14	0.09	0.18
<i>Xenylla</i> sp.	0.05	—	0.05	0.28	0.14	0.14	—	0.09	0.14
<i>Stenacidia</i> sp.	—	0.14	0.05	0.23	—	0.05	0.14	—	0.09
<i>Sphaeridia cornuta</i>	—	—	—	0.41	0.28	0.09	0.14	—	—
<i>Lepidocyrtus</i> sp.	0.09	—	0.05	0.09	0.41	0.09	—	—	0.18
<i>Katianna</i> sp.	—	—	0.05	0.18	0.23	—	0.14	—	—
Total	1.19	0.73	1.19	13.68	11.79	2.66	1.70	1.97	4.08

Table 5

Showing groups of other arthropod and their month-wise population number expressed in percentage at
Fallow land site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.55	0.43	0.82	1.92	1.18	1.57	0.71	0.47	1.10	0.75	0.78	0.31
Mesostigmata	0.30	0.51	0.39	1.79	1.96	0.75	0.78	0.51	0.86	1.18	0.59	0.47
Cryptostigmata	0.47	0.35	0.43	1.77	1.22	0.86	0.63	0.75	0.71	0.67	0.39	0.16
COLEOPTERA												
Ptiliidae	0.20	0.31	0.35	0.98	0.59	0.20	0.31	0.20	0.59	0.51	0.47	0.27
Staphylinidae	0.12	0.20	0.08	0.55	0.47	0.12	0.27	—	—	—	0.24	0.12
Larvae	—	—	0.04	0.31	0.20	0.08	—	—	—	—	0.35	—
DIPTERA												
Larvae	—	—	—	0.31	0.08	0.12	0.12	0.12	0.24	0.16	0.08	0.20
DIPLURA												
	—	—	—	0.08	0.12	4.04	—	0.08	—	—	—	—
PROTURA												
	—	—	—	—	0.04	—	—	—	—	—	—	—
Other unidentified	0.31	0.12	—	0.71	0.08	0.12	—	0.08	0.12	0.16	0.04	0.16
Total	2.04	1.62	2.12	8.20	5.93	3.85	2.83	2.20	3.61	3.41	2.94	1.69

Table 5 (Contd.)

Showing groups of other arthropod and their month-wise population number expressed in percentage at
Fallow land site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.47	0.35	0.67	1.81	2.04	1.14	0.71	0.75	1.18
Mesostigmata	0.31	0.31	0.31	1.96	3.14	0.59	0.39	0.82	0.50
Cryptostigmata	0.51	0.24	0.35	1.57	2.12	0.39	0.16	0.47	0.67
COLEOPTERA									
Ptiliidae	0.20	0.12	0.12	0.98	0.78	0.27	0.08	0.12	0.47
Staphylinidae	0.27	0.27	0.16	0.18	0.59	0.20	0.04	—	—
Larvae	—	—	0.08	0.20	0.27	0.08	0.12	—	—
DIPTERA									
Larvae	—	—	—	0.27	0.20	0.08	0.04	0.08	0.24
DIPLURA									
	—	—	—	0.04	0.08	0.04	0.04	0.04	—
PROTURA									
	—	—	—	—	—	—	—	—	—
Other unidentified	0.16	—	0.04	0.43	0.06	—	0.08	0.04	0.24
Total	1.92	1.30	1.73	8.44	10.28	2.79	1.65	2.32	3.34

nitrate and moisture were also maximum in July-August. Partial Increase in December-January may be due to prevalence of winter maxima of some species of collembola (Table 4).

Other arthropod population : Microarthropod extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina), Diptera and Protura and macroarthropods extracted were Ptiliidae, Staphylinidae and larvae (Coleoptera), larvae of Diptera and other unidentified groups (Table 5). Sub-order Prostigmata was most dominant and were found in all soil samples and comprising 26.39% of total other arthropod population in this plot. Mesostigmata comprising 24.82%, Cryptostigmata comprising 19.93%, Ptiliidae comprising 10.88% and Staphylinidae comprising 6.25% occupied second, third, fourth and fifth position respectively in order of dominance. Population of other groups extracted were very low in number and highly irregular in distribution pattern. Number of other arthropod fauna (Table 2) showed maximum in July-August when soil factors and soil fungi population were also showed maximum (Figures 2-2c). Partial

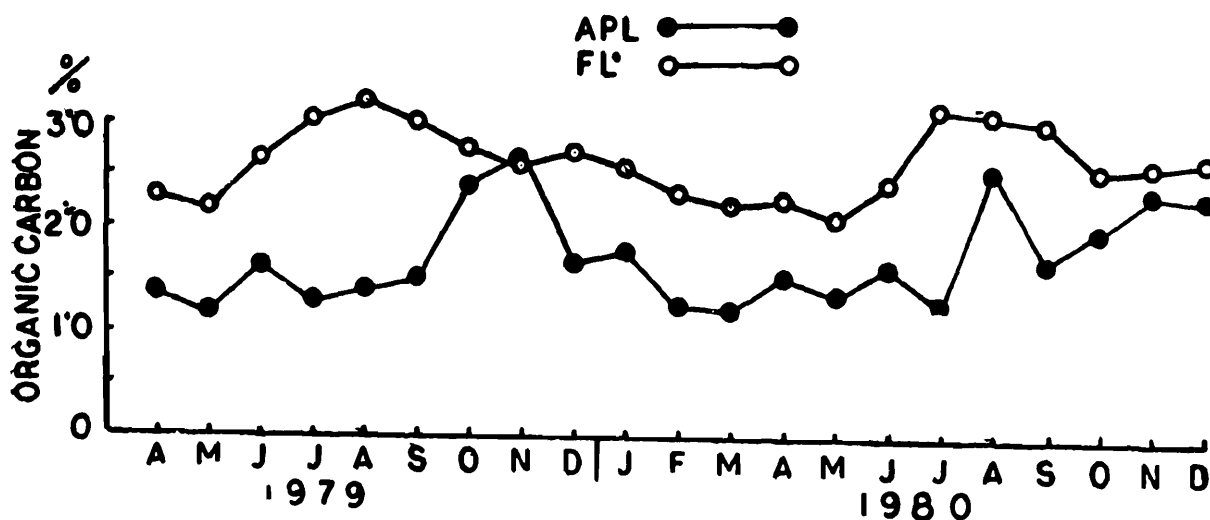


Fig. 2. Showing monthly fluctuations of organic Carbon (%) in APL and FL sites.

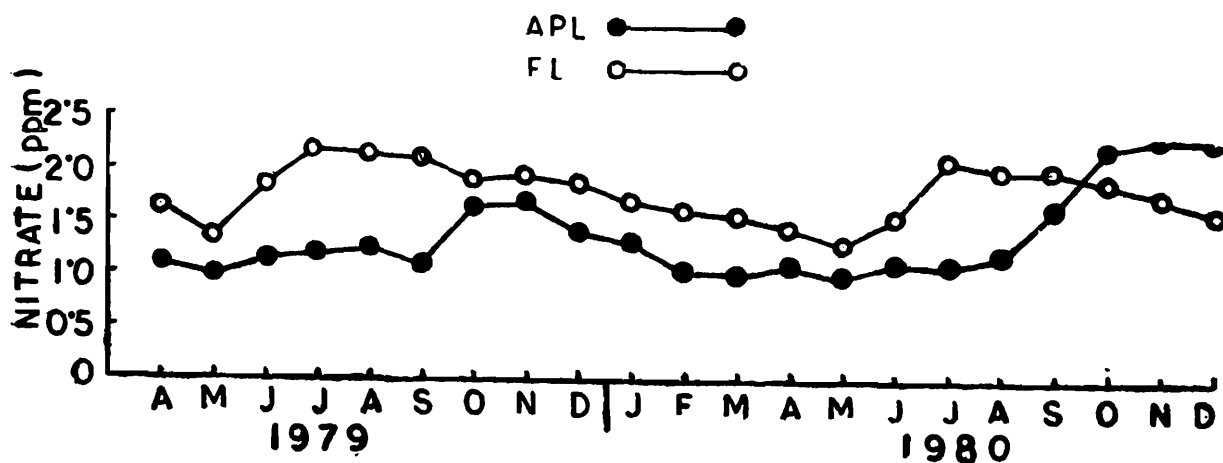


Fig. 2a. Showing monthly fluctuations of nitrate (ppm) in APL and FL sites.

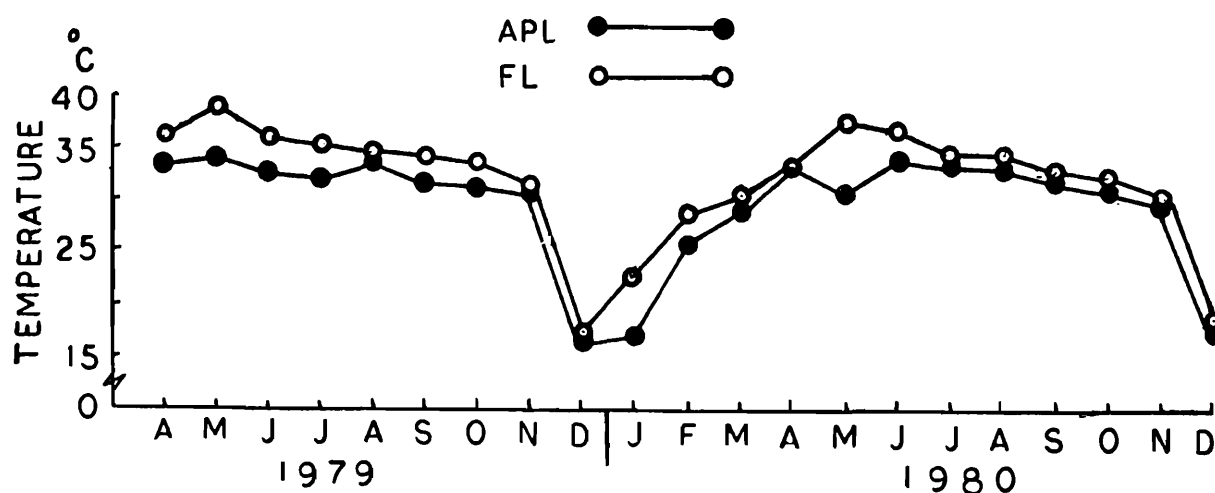


Fig. 2b. Showing monthly fluctuations of temperature (°C) in APL and FL sites.

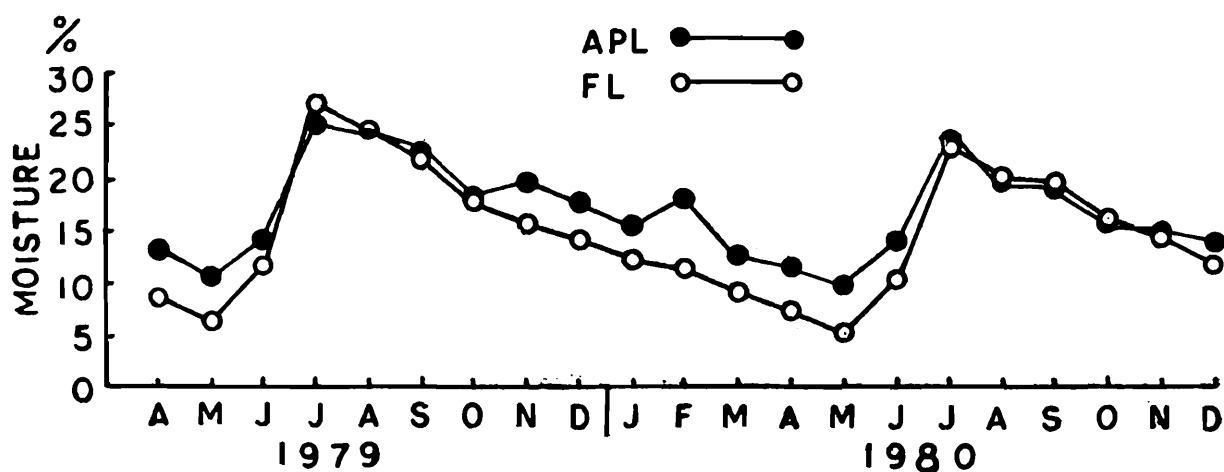


Fig. 2c. Showing monthly fluctuations of moisture (%) in APL and FL sites.

increase in December-January may be due to prevalence of winter maxima of some groups (Table 5).

AGRICULTURE PRACTICE LAND SITE

Characteristics of sampling site: This site was chosen in the experimental crop fields of rice research station, Chinsurah, Dist. Hooghly. Cultivation of Paddy is the usual practice followed by wheat. Four plots were selected from this campus for sampling each 12 metre square.

Vegetation :

Above ground : The main vegetation were Paddy and wheat, besides, the boundary of mud wall of each plot were covered with grasses like *Arundinella* sp. and *Cynodon dactylon*.

Underground : Soil fungi obtained from this site belonged to 34 species under 22 genera (Table 1). Genus *Penicillium* was most frequently

occurred. Maximum population were found in November, 1979 (29,000/gm. soil) and in October, 1980 (31,000/gm. soil), minimum in May (Table 6).

Table 6

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at Agriculture practice land site.

April, 1979—December, 1980

1979 Date	Collembola Mean $\pm$ SE			Other arthropods Mean $\pm$ SE			Fungi (per gm. soil in thousand)
April	4.20	$\pm$	0.66	4.00	$\pm$	0.71	9
May	4.00	$\pm$	0.71	4.20	$\pm$	0.66	7
June	3.00	$\pm$	1.58	2.60	$\pm$	1.66	12
July	2.20	$\pm$	0.66	3.00	$\pm$	1.58	14
August	1.80	$\pm$	0.80	2.40	$\pm$	1.29	11
September	2.00	$\pm$	0.71	2.20	$\pm$	1.02	13
October	8.40	$\pm$	1.50	9.80	$\pm$	0.77	17
November	10.80	$\pm$	1.39	12.40	$\pm$	2.11	29
December	7.80	$\pm$	0.66	9.00	$\pm$	0.71	23
1980							
January	6.40	$\pm$	1.43	8.40	$\pm$	1.21	20
February	5.60	$\pm$	1.03	6.80	$\pm$	1.02	18
March	5.00	$\pm$	0.84	5.40	$\pm$	1.43	15
April	5.20	$\pm$	1.02	5.80	$\pm$	1.11	11
May	4.80	$\pm$	1.16	5.20	$\pm$	0.86	9
June	4.20	$\pm$	0.86	6.40	$\pm$	1.21	12
July	3.00	$\pm$	1.38	5.00	$\pm$	1.60	14
August	3.40	$\pm$	1.63	4.60	$\pm$	0.87	13
September	2.80	$\pm$	1.02	4.00	$\pm$	0.84	12
October	6.80	$\pm$	1.11	8.60	$\pm$	1.29	31
November	10.00	$\pm$	1.14	11.20	$\pm$	2.70	24
December	7.00	$\pm$	1.00	8.20	$\pm$	1.16	29

Soil factors : Soils of these plots were Gangetic alluvium in nature brownish in colour clay-loam in texture. pH varies from 7.22 to 7.46. In April and May moisture content of soil was 13.20% and 10.50% respectively in 1979. 11.50% and 9.20% respectively in 1980. Month of

July in both the sampling year showed maximum moisture content (25.20% and 23.5% respectively in 1979 and 1980). In May other soil factors such as organic carbon, nitrate and temperature were 1.20%, 1 ppm and 34.2°C respectively in 1979, 1.30%, 1 ppm and 33.5°C respectively in 1980. Amount of organic carbon and nitrate were found to be maximum in November (Table 8 and Figures 2-2c). Mechanical analysis of soil sampled showed equal percentage of fine sand and silt (Table 3).

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to ten genera such as *Sminthurides*, *Sphaeridia*, *Folsomides*, *Seira*, *Subisotoma*, *Xenylla*, *Cyphoderus*, *Entomobrya*, *Lepidocyrtus* and *Isotomurus* (Table 7). Species *Lepidocyrtus suborientalis* was most dominant and being extracted from almost all the soil samples and comprising 20.3% of total population of collembola in this site. *Cyphoderus javanus* comprising 18.62% and *Subisotoma fitchioides* comprising 16.57% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Sminthurides* sp., *Sphaeridia* sp., *Folsomides parvulus*, *Seira* sp., *Xenylla welchi*, *Cyphoderus albinus*, *Entomobrya* sp., *Lepidocyrtus* sp. and *Isotomurus* sp. were numerically low and irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 6) showed maximum population in November when soil factors like organic carbon, nitrate and number of fungi were also maximum. Partial increase in December—January may be due to the prevalence of winter maxima of some species of collembola (Table 7).

Other arthropod population : Microarthropods extracted from the site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina) and macroarthropod extracted belonged to Ptiliidae, Staphylinidae and larvae (Coleoptera), larvae of Diptera and some other unidentified groups (Table 8). Sub-order prostigmata was most dominant and were found in all soil samples and comprising 27.09% of total microarthropod population in this plot. Mesostigmata comprising 22.14%, Cryptostigmata comprising 18.32%, Ptiliidae comprising 10.68%, Staphylinidae comprising 7.59% and unidentified groups comprising 6.97% occupied second, third, fourth and fifth position respectively in order of dominance. Population of coleoptera and diptera larvae were extracted very low number and highly irregular in distribution pattern. Number of other arthropod fauna (Mean $\pm$ SE) obtained in each month (Table 6) showed maximum in November when soil factors like organic carbon, nitrate and fungi population were also showed maximum (Figures 2-2c). Partial increase in November—December may be due to prevalence of winter maxima of some groups (Table 8).

Table 7

Showing species of collembola and their month-wise population number expressed in percentage at Agriculture practice land site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Sminthurides</i> sp.	0.09	—	—	—	—	—	0.14	0.18	0.14	0.14	0.09	0.09
<i>Sphaeridia</i> sp.	0.05	—	0.09	—	—	0.09	0.09	0.14	0.05	—	0.05	0.05
<i>Folsomides parvulus</i>	0.05	0.09	0.05	—	—	—	0.05	0.05	0.09	0.18	0.05	0.09
<i>Seira</i> sp.	0.09	0.05	—	—	—	0.18	0.18	0.09	0.09	0.09	0.05	0.05
<i>Subisotoma fitchioides</i>	0.14	—	0.23	—	—	—	0.37	0.46	0.46	0.37	0.23	0.18
<i>Xenylla welchi</i>	—	0.09	0.05	—	—	0.09	0.14	0.09	0.05	—	0.05	0.05
<i>Cyphoderus javanus</i>	0.18	0.23	0.14	—	0.41	—	0.23	0.41	0.37	0.23	0.28	0.23
<i>Cyphoderus albinus</i>	0.05	0.09	—	—	—	0.09	0.09	0.09	0.09	—	0.05	0.09
<i>Entomobrya</i> sp.	0.05	0.05	0.05	0.09	—	—	0.09	0.05	0.05	—	0.05	0.05
<i>Lepidocyrtus suborientalis</i>	0.14	0.18	0.05	0.32	—	—	0.32	0.50	0.28	0.28	0.32	0.14
<i>Lepidocyrtus</i> sp.	0.09	0.05	0.05	0.09	—	—	0.05	0.18	0.09	0.09	0.05	0.09
<i>Isotomurus</i> sp.	0.05	0.09	—	—	—	—	0.18	0.23	0.05	0.09	0.05	0.05
Total	0.96	0.92	0.69	0.50	0.41	0.46	1.93	2.48	1.79	1.47	1.28	1.15

Table 7 (Contd.)

Showing specits of collembola and their month-wise population number expressed in percentage at
Agriculture practice land site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Sminthurides</i> sp.	0.09	0.09	0.05	—	—	0.64	0.05	0.18	0.09
<i>Sphaeridia</i> sp.	0.05	0.05	0.05	0.23	—	—	0.05	0.14	0.09
<i>Folsomides parvulus</i>	0.05	0.09	0.05	—	—	—	0.05	0.09	0.05
<i>Seira</i> sp.	0.05	0.05	0.05	—	—	—	0.05	0.14	0.09
<i>Subisotoma fitchioides</i>	0.14	0.14	0.14	—	0.23	—	0.41	0.32	0.28
<i>Xenylla welchi</i>	0.09	—	0.05	0.14	—	—	0.05	0.18	0.05
<i>Cyphoderus javanus</i>	0.18	0.18	0.18	—	0.32	—	0.32	0.37	0.32
<i>Cyphoderus albinus</i>	0.05	—	0.05	—	—	—	0.09	0.09	0.09
<i>Entomobrya</i> sp.	0.05	0.05	—	—	—	—	0.05	0.09	0.05
<i>Lepidocyrtus suborientalis</i>	0.37	0.32	0.23	0.32	—	—	0.28	0.60	0.37
<i>Lepidocyrtus</i> sp.	0.05	0.09	0.09	—	—	—	0.09	0.05	0.05
<i>Isotomurus</i> sp.	0.05	0.05	0.05	—	—	—	0.09	0.05	0.09
Total	1.19	1.10	0.96	0.69	0.55	0.64	1.56	2.29	1.61

Table 8

Showing groups of other arthropod and their month-wise population number expressed in percentage at Agriculture practice land site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.20	0.16	0.16	0.27	0.20	0.12	0.43	0.75	0.39	0.39	0.24	0.27
Mesostigmata	0.12	0.24	0.12	0.12	0.08	0.08	0.35	0.55	0.43	0.35	0.39	0.31
Cryptostigmata	0.24	0.20	0.08	0.04	0.04	0.04	0.39	0.31	0.31	0.31	0.24	0.20
COLEOPTERA												
Ptiliidae	0.08	0.04	0.04	0.08	0.04	0.08	0.20	0.27	0.16	0.20	0.12	0.08
Staphylinidae	0.04	0.08	0.04	0.04	0.04	0.04	0.12	0.24	0.12	0.12	0.16	0.04
Larvae	0.04	—	0.04	—	—	—	0.08	0.08	0.04	0.04	0.04	0.04
DIPTERA												
Larvae	—	—	—	—	—	—	0.16	0.04	0.08	0.16	0.08	0.08
DIPLURA												
	—	—	—	—	—	—	—	—	—	—	—	—
PROTURA												
	—	—	—	—	—	—	—	—	—	—	—	—
Other unidentified	0.08	0.12	0.04	0.04	0.08	0.08	0.20	0.20	0.24	0.08	0.08	0.08
Total	0.78	0.82	0.51	0.59	0.47	0.43	1.92	2.43	1.77	1.65	1.33	1.06

Table 8 (Contd.)

Showing groups of other arthropod and their month-wise population number expressed in percentage at
Agriculture practice land site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.31	0.24	0.35	0.31	0.24	0.27	0.35	0.78	0.43
Mesostigmata	0.20	0.20	0.27	0.20	0.27	0.16	0.43	0.39	0.35
Cryptostigmata	0.24	0.16	0.24	0.24	0.16	0.16	0.31	0.47	0.31
COLEOPTERA									
Ftiliidae	0.12	0.20	0.12	0.16	0.12	0.12	0.20	0.12	0.20
Staphylinidae	0.08	0.12	0.08	0.08	0.08	0.08	0.12	0.16	0.08
Larvae	0.04	—	0.04	—	—	—	0.04	0.08	0.04
DIPTERA									
Larvae	0.08	—	0.12	—	—	—	0.20	0.12	0.08
DIPLURA	—	—	—	—	—	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—
Other unidentified	0.08	0.12	0.04	—	0.04	—	0.04	0.08	0.12
Total	1.14	1.02	1.26	0.98	0.98	0.78	1.69	2.20	1.61

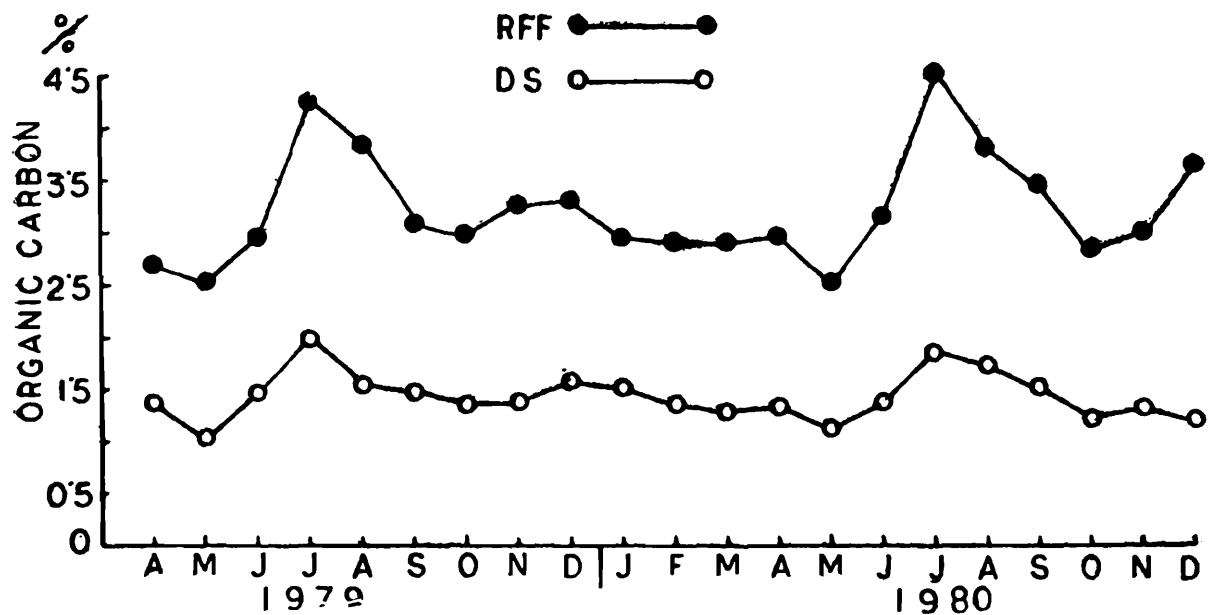


Fig. 3. Showing monthly fluctuations of organic Carbon(%) in RFF and DS sites.

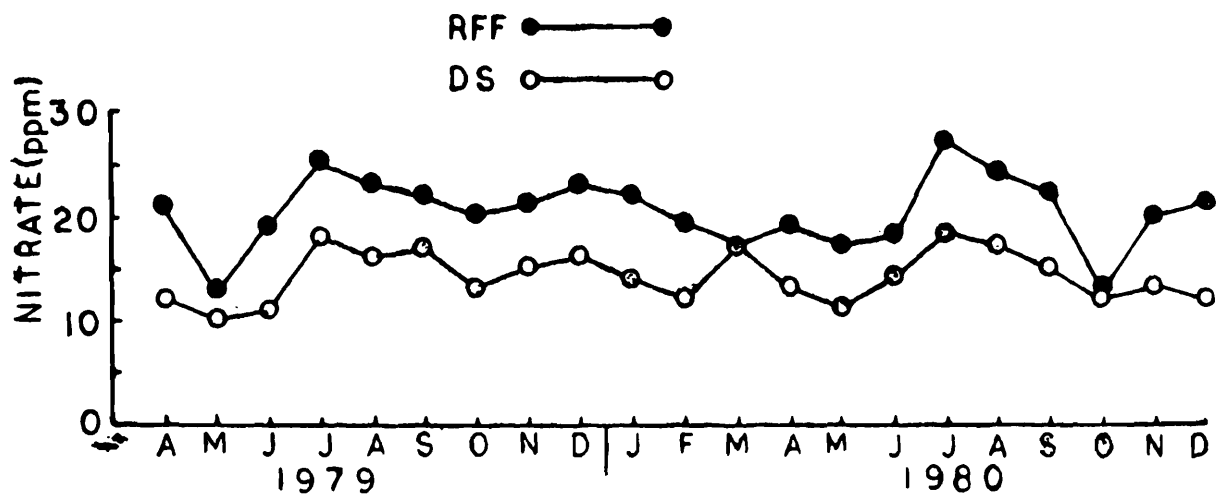


Fig. 3a. Showing monthly fluctuations of nitrate (ppm) in RFF and DS sites.

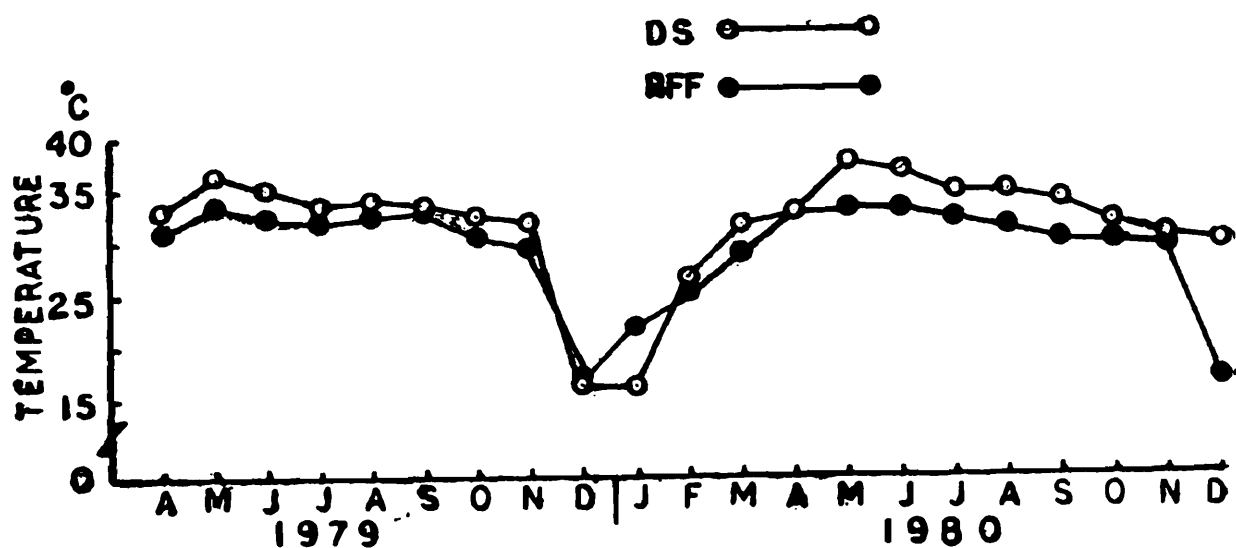


Fig. 3b. Showing monthly fluctuations of temperature (°C) in DS and RFF sites.

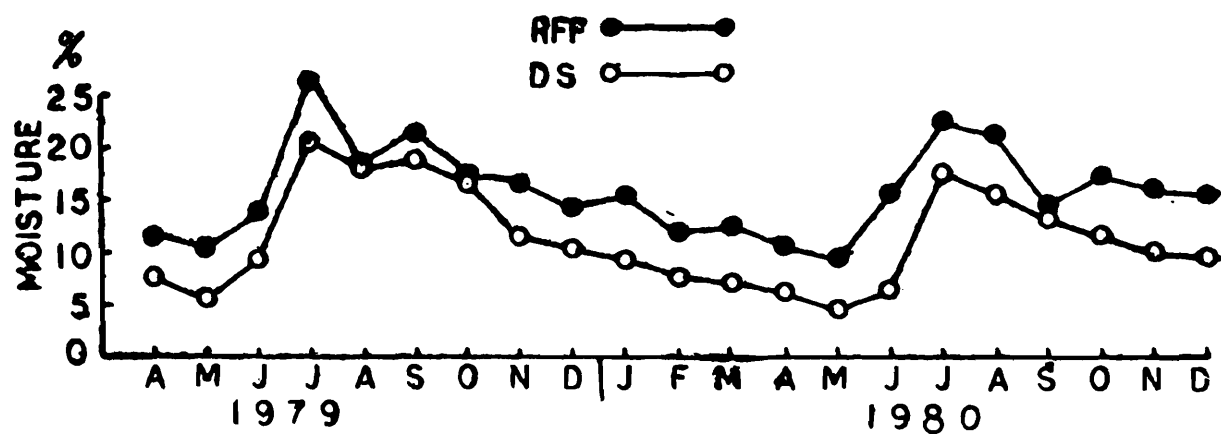


Fig. 3c. Showing monthly fluctuations of moisture (%) in RFF and DS sites.

DEFORESTED SITE

Characteristics of sampling site: This is located about 14 Kilometre away from Ranaghat town, in the district of Nadia. It was once covered with dense "Saal" (*Shorea robusta*) forest, now only few "Saal" trees are present. It includes four sampling plots, each eight metre square, partially disturbed due to occasional grazing.

Vegetation :

Above ground : Plots were covered with the under growth of grasses and sedges like *Arundinella* sp., *Vernonia unerea*, *Panicum* sp., *Cynodon dactylon*, *Digitaria royleana*, *Eragrostis viseosa*, *Paspalum flavidum*, *Setaria* sp., and legumes like *Alysicarpus monilifer* and *Desmodium triflorum*. This site also contains few trees like *Shorea robusta* and *Tectona grandis*.

Under ground : Soil fungi obtained from this site belonged to 34 species under 26 genera (Table 1). Genera *Penicillium* and *Aspergillus* were most frequently occurred. Maximum fungi population were found in August (12,000/gm. soil in 1979 and 13,000/gm. soil in 1980) and minimum in May (Table 9).

Soil factors : Soils of these plots were Gangetic alluvium in nature, brown in colour and clay-loam in texture. pH varied from 7.20-7.52. In April and May moisture content of soil were 7.50% and 5.5% respectively in 1980. Month of July in each sampling year showed maximum water content (20.5% in 1979 and 17.5% in 1980). In May other soil factors such as organic carbon, nitrate and temperature were 1.02%, 1 ppm, 36.5°C respectively in 1979 and 1%, 1.10 ppm, 37.2°C respectively in 1980. Amount of organic carbon and nitrate were found to be maximum in July (Figures 3-3c). Mechanical analysis of soil sample showed high percentage of fine sand (Table 3).

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to eleven genera such as *Isotomina*, *Lepidocyrtus*, *Cyphoderus*, *Salina Proisotoma*, *Isotomiella*, *Isotomodes*, *Willemia*, *Entomobrya*, *Arrhopalites*, *Sminthurides* (Table 10). Species *Isotomina thermophila* was most dominant and being extracted from all the soil samples and comprising 19.81% of total collembola obtained in this site. *Lepidocyrtus suborientalis* and *Proisotoma* sp. comprising 18.08% and 15.19% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Cyphoderus* sp., *Salina indica*, *Isotomiella minor*, *Isotomina* sp., *Isotomodes*

sp., *Willemia* sp., *Entomobrya* sp., *Arrhopalites* sp., *Sminthurides* sp. were numerically low and highly irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 9) showed maximum population in July—August when soil factors like organic carbon, moisture and nitrate were maximum during this period. Partial increase in December—January may be due to the prevalence of winter maxima of some species of collembola (Table 10).

Table 9

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at Deforested site.
April, 1979—December, 1980.

Date	Collembola			Other arthropods			Fungi (per gm. soil in thousand)
	Mean	±	SE	Mean	±	SE	
1979							
April	4.60	±	0.40	7.00	±	0.45	3
May	3.00	±	1.00	4.40	±	0.68	2
June	3.603	±	1.29	5.00	±	0.84	4
July	7.20	±	0.37	17.00	±	3.92	10
August	6.60	±	0.40	10.40	±	3.04	12
September	6.20	±	0.66	11.00	±	0.71	7
October	4.40	±	0.68	8.40	±	0.51	6
November	4.80	±	0.37	8.00	±	0.71	9
December	5.40	±	0.75	8.80	±	0.37	16
1980							
January	5.80	±	0.66	8.20	±	0.66	9
February	3.00	±	0.95	5.40	±	1.57	6
March	3.20	±	1.32	4.60	±	0.51	5
April	4.20	±	0.66	8.00	±	0.71	4
May	2.40	±	1.16	7.40	±	0.40	3
June	4.00	±	0.71	8.20	±	0.37	5
July	6.40	±	1.29	15.00	±	1.92	12
August	7.00	±	0.32	16.00	±	1.30	13
September	5.20	±	1.28	10.00	±	2.40	11
October	5.00	±	0.71	6.40	±	0.81	7
November	5.80	±	1.90	7.80	±	0.97	9
December	6.20	±	0.66	8.40	±	0.51	8

Table 10

Showing species of collembola and their month-wise population number expressed in percentage at Deforsted site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Isotomina thermophila</i>	0.13	0.13	0.18	0.22	0.36	0.36	0.22	0.18	0.13	—	0.13	0.13
<i>Lepidocyrtus suborientalis</i>	0.18	0.13	0.13	0.40	0.27	0.18	0.18	0.22	0.22	—	0.18	0.18
<i>Cyphoderus</i> sp.	0.09	—	0.04	0.09	0.09	0.09	0.09	—	0.04	0.18	0.04	0.09
<i>Salina indica</i>	—	—	—	0.13	0.13	0.04	—	0.09	0.09	0.09	—	—
<i>Proisotoma</i> sp.	0.18	0.13	0.13	0.31	—	0.22	0.18	0.22	0.18	0.27	0.13	0.13
<i>Isotomiella minor</i>	0.09	0.09	0.09	0.13	0.09	—	—	0.09	0.09	0.09	0.04	0.04
<i>Isotomina</i> sp.	0.09	0.09	0.04	0.04	0.04	0.04	—	0.04	0.13	0.13	0.04	0.04
<i>Isotomodes</i> sp.	0.09	0.09	0.09	—	0.13	0.09	—	0.04	0.09	0.09	—	—
<i>Willemia</i> sp.	—	—	—	0.09	0.09	0.09	0.09	—	0.13	0.13	0.04	0.04
<i>Entomobrya</i> sp.	0.09	—	0.09	0.04	0.04	0.04	0.09	0.09	—	0.09	0.04	0.04
<i>Arrhopalites</i> sp.	0.09	—	—	0.04	0.13	0.13	0.04	0.09	—	0.09	—	—
<i>Sminthurides</i> sp.	—	—	—	0.09	0.09	0.09	0.09	—	0.09	0.13	—	—
Total	1.03	0.67	0.81	1.62	1.48	1.39	0.99	1.08	1.21	1.30	0.67	0.72

Table 10 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at Deforested site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Isotomina thermophila</i>	0.13	0.13	0.18	0.31	0.31	0.31	0.31	0.36	0.36
<i>Lepidocyrtus suborientalis</i>	0.22	0.13	0.18	0.22	0.45	0.27	0.27	—	0.18
<i>Cyphoderus</i> sp.	0.09	—	0.09	0.09	0.09	0.09	0.13	0.09	0.09
<i>Salina indica</i>	—	—	0.13	0.13	0.22	0.04	—	0.04	0.04
<i>Proisotoma</i> sp.	0.18	0.09	0.13	0.31	—	0.18	—	0.31	0.22
<i>Isotomiella minor</i>	0.04	0.04	0.04	0.09	0.09	—	—	0.09	0.13
<i>Isotomina</i> sp.	0.09	0.04	0.09	0.04	0.04	0.04	—	0.09	0.09
<i>Isotomodes</i> sp.	0.09	0.04	0.09	—	0.13	0.04	—	0.13	0.04
<i>Willemia</i> sp.	—	—	—	0.09	0.04	0.04	0.09	—	0.09
<i>Entomybrya</i> sp.	0.09	0.04	0.09	0.04	0.04	0.04	0.13	0.09	—
<i>Arrhopalites</i> sp.	—	—	—	0.04	0.09	0.04	0.04	0.09	—
<i>Sminthurides</i> sp.	—	—	—	0.04	0.04	0.04	0.13	—	0.13
Total	0.94	0.54	0.90	1.44	1.57	1.17	1.12	1.30	1.39

Other arthropod population : Microarthropods extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata, and Diplura and macroarthropods belonged to Staphylinidae and larvae (Coleoptera) and other unidentified groups (Table 11). Sub-order Prostigmata was most dominant and found in all soil samples and comprising 31.28%, Mesostigmata comprising 28.05%, Cryptostigmata comprising 19.09%, Ptiliidae comprising 7.34% and other unidentified group comprising 5.20% of total other arthropod population obtained in this site site occupied second third, fourth and fifth position respectively in order of dominance. Population of other groups were extracted very low number and highly irregular in distribution pattern. Diptera larvae and protura were completely absent from this site. Number of other arthropod fauna (Mean $\pm$ SE) obtained in each month (Table 9) showed maximum in July, when soil factors like organic carbon, nitrate and moisture were also maximum (Figures 3-3c). Partial increase in number in December—January may be due to the prevalence of winter maxima of some microarthropod groups (Table 11).

RESERVE FOREST FLOOR SITE

Characteristics of sampling site : This is located at Bethuadahari reserve forest, by the side of the National high way No. 34 in Nadia district. It included four sampling plots, each ten metre square, undisturbed, forest floor is covered with under growth.

Vegetation :

Above ground : Plots were covered with the undergrowth of grasses and sedges like *Sporobolus diander*, *Arundinella* sp., *Dichanthium annulatum*, *Eragrostis brachyphylla*, *Digitaria marginata*, *Digitaria royleana*, *Cynodon dactylon* and *Euphorbia hirta* and *Lantana camara*. The forest content major trees like *Shorea robusta* and *Tectona grandis*, the litter of the forest floor contains the fallen leaves and dried twigs of the above trees and under growth.

Underground : Soil fungi obtained from this site belonged to 54 species under 35 genera (Table 1). *Fusarium*, *Aspergillus* and *Penicillium* were the most frequently occurred genera. Maximum fungi population were found 42,000/gm. soil in September, 1979 and 38,000/gm. soil in July, 1980 and minimum in May (Table 12).

Soil factor : Soils of these plots were Gangetic alluvium in nature, blackish brown in colour and clay loam in texture. pH varied from 6.95 to 7.12. In April and May moisture content of soil were 11.5% and 10.2% respectively in 1979, 10.5% and 9.5% respectively in 1980. Month of

Table 11

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Deforested site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.19	0.13	0.19	0.80	0.54	0.32	0.24	0.40	0.24	0.48	0.27	0.29
Mesostigmata	0.16	0.16	0.16	0.54	0.32	0.35	0.21	0.24	0.48	0.24	0.24	0.13
Cryptostigmata	0.21	0.13	0.13	0.46	0.24	0.27	0.32	0.21	0.24	0.21	0.08	0.05
COLEOPTERA												
Ptiliidae	0.13	0.08	0.08	0.13	0.11	0.13	0.13	0.08	0.08	0.05	0.05	0.05
Staphylinidae	0.08	0.05	0.05	0.08	0.08	0.08	0.05	0.05	0.08	0.05	0.03	0.03
Larvae	—	—	0.05	0.11	0.08	0.13	0.03	—	—	—	0.03	0.03
DIPTERA												
Larvae	—	—	—	—	—	—	—	—	—	—	—	—
DIPLURA												
	—	—	—	0.03	—	—	—	—	—	—	—	—
PROTURA												
	—	—	—	—	—	—	—	—	—	—	—	—
Other unidentified	0.16	0.03	—	0.13	0.03	0.19	0.13	0.08	0.05	0.05	0.03	0.03
Total	0.94	0.59	0.67	2.28	1.39	1.47	1.13	1.07	1.18	1.10	0.72	0.62

Table 11 (Contd.)

Showing group of other arthropods and their month-wise population expressed in percentage at
Deforested site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov	Dec.
ACARINA									
Prostigmata	0.27	0.38	0.43	0.56	0.54	0.51	0.24	0.29	0.46
Mesostigmata	0.46	0.21	0.27	0.62	0.72	0.43	0.27	0.35	0.40
Cryptostigmata	0.19	0.21	0.21	0.40	0.51	0.13	0.19	0.21	0.16
COLEOPTERA									
Ptiliidae	0.05	0.08	0.05	0.13	0.11	0.08	0.05	0.08	0.05
Staphylinidae	0.05	0.05	0.08	0.08	0.08	0.05	0.05	0.05	0.03
Larvae	—	—	0.03	0.11	0.08	0.11	0.03	—	—
DIPTERA									
Larvae	—	—	—	—	—	—	—	—	—
DIPLURA	—	—	—	0.08	0.03	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—
Other unidentified	0.05	0.05	0.03	0.08	0.08	0.03	0.03	0.05	0.03
Total	1.07	0.99	1.10	2.01	2.14	1.34	0.86	1.05	1.13

Table 12

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at Reserve forest floor site.

April, 1979—December, 1980

Date	Collembola			Other arthropods			Fungi (Per gm. soil in thousand)
	Mean	±	SE	Mean	±	SE	
1979							
April	11.00	±	2.86	15.00	±	1.00	9
May	8.40	±	2.55	11.60	±	2.87	7
June	8.80	±	0.37	12.40	±	2.87	8
July	36.40	±	2.25	60.40	±	1.16	33
August	33.00	±	2.40	68.40	±	2.42	40
September	20.40	±	2.78	31.20	±	5.39	42
October	13.80	±	1.90	21.00	±	3.31	31
November	16.40	±	1.32	23.00	±	2.70	30
December	16.80	±	4.11	25.00	±	3.25	35
1980							
January	9.20	±	0.97	17.00	±	2.23	27
February	8.00	±	1.61	14.40	±	2.01	22
March	6.60	±	1.03	12.60	±	1.50	15
April	9.20	±	0.97	12.60	±	1.50	11
May	7.00	±	1.00	10.40	±	0.93	9
June	7.60	±	0.51	11.60	±	1.09	10
July	32.40	±	2.25	56.40	±	1.72	38
August	33.00	±	2.40	57.80	±	2.35	36
September	22.40	±	1.21	33.60	±	1.32	32
October	17.60	±	1.12	22.80	±	1.65	27
November	11.20	±	0.58	21.40	±	3.00	30
December	11.60	±	0.93	22.00	±	5.08	31

July in each sampling year showed maximum water content (24.5% in 1979 and 22.5% in 1980). In May other soil factors such as organic carbon, nitrate and temperature were 2.05%, 1.80 ppm., 33.5°C respectively in 1979 and 2.25%, 1.70 ppm and 33°C respectively in 1980. Amount of Organic carbon and nitrate were found to be maximum in July (figures 3-3c).

Mechanical analysis of soil sample showed more or less equal percentage of fine sand and clay (Table 3).

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to nineteen genera such as *Megalothorax*, *Lepidocyrtus*, *Salina*, *Isotomiella*, *Folsomides*, *Xenylla*, *Pseudachorutes*, *Hypogastrura*, *Cyphoderus*, *Subisotoma*, *Isotomina*, *Dicyrtomina*, *Alloscopus*, *Sinella*, *Siera*, *Lobella*, *Sminthurides*, *Tullbergia* and *Entomobrya* (Table 13). Species *Megalothorax minimus* was most dominant and being extracted from almost all the soil samples and comprising 12.76% of the total collembola obtained in this site. *Lepidocyrtus* (*Ascocyrtus*) sp., *Cyphoderus javanus* comprising 10.7% and 10.47% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Salina* sp., *Isotomiella minor*, *Folsomides exigus*, *Xenylla obscura*, *Pseudachorutes* sp., *Hypogastrura* sp., *Subisotoma fitchioides*, *Isotomina interrupta*, *Sinella* (*Coecobrya*) sp., *Lepidocyrtus* (*Acrocyrtus*) *scaber*, *Siera* sp., *Lobella maxillaris*, *Sminthurides appendiculatus*, *Tullbergia* sp., and *Entomobrya* sp. were numerically low and highly irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 12) showed maximum population in July 1979 and in August 1980, when soil factors like organic carbon, moisture and nitrate were also maximum. Partial increase of population in December—January may be due to the prevalence of winter maxima of some species of collembola (Table 13).

Other arthropod population : Microarthropods extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina), Diplura, Protura and macroarthropods extracted belonged to Ptiliidae, Staphylinidae and larvae (Coleoptera); larvae of Diptera, and some other unidentified groups (Table 14). Sub-order Prostigmata was most dominant and were found in all the soil samples and comprising (23.54%), Mesostigmata (16.97%), Cryptostigmata (14.42%), Staphylinidae (8.07%) and Ptiliidae (7.05%) of total other arthropod population obtained in this site occupied, second, third, fourth and fifth position respectively in order to dominance. Population of other groups were extracted very low in number and highly irregular in distribution pattern. Number of other arthropods fauna (Mean $\pm$ SE) obtained in each month (Table 12) showed maximum in August, when soil factors like organic carbon, nitrate and moisture were also maximum in July—August (Figures 3-3c), partial increase in number in December may be due to the prevalence of winter maxima of some microarthropods groups (Table 14).

Table 13

Showing species of collembola and their month-wise population number expressed in percentage at Reserve forest floor.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Megalothorax minimus</i>	0.22	0.31	0.27	1.35	0.90	0.63	0.36	0.36	0.40	0.27	0.31	0.31
<i>Lepidocyrtus</i> sp.	0.31	0.22	0.31	0.90	1.21	0.67	—	0.31	0.36	0.22	0.13	0.13
<i>Salina</i> sp.	—	—	—	0.18	0.13	0.09	0.09	0.13	0.09	—	—	—
<i>Isotomiella minor</i>	0.18	0.27	0.22	1.08	0.94	0.45	—	0.40	0.27	0.18	0.22	0.22
<i>Folsomides exigus</i>	0.09	—	0.04	0.13	0.18	0.04	0.13	0.18	0.13	0.04	0.09	—
<i>Xenylla obscura</i>	0.09	0.09	0.04	0.09	0.09	0.09	0.09	0.09	0.18	0.04	0.04	0.04
<i>Pseudachorutes</i> sp.	—	—	0.04	0.22	0.09	0.04	—	0.22	0.09	0.04	—	—
<i>Hypogastrura</i> sp.	0.09	0.04	0.04	0.18	0.04	0.09	0.13	0.09	0.09	0.04	0.09	0.04
<i>Cyphoderus javanus</i>	0.27	0.40	0.27	0.67	0.85	0.58	—	0.45	0.45	0.18	0.18	0.13
<i>Subisotoma fitchioides</i>	0.58	0.22	0.18	0.58	0.67	0.54	0.85	0.31	0.36	0.27	0.13	0.13
<i>Isotomina interrupta</i>	0.22	0.13	0.18	0.31	0.36	0.40	0.67	—	0.40	0.18	0.13	0.13
<i>Dicyrtomina</i> sp.	—	—	0.04	0.09	0.18	0.04	0.09	—	0.04	0.04	0.04	0.04
<i>Alloscopus tetracantha</i>	—	—	0.04	0.22	0.22	0.09	—	—	—	0.04	0.09	0.04
<i>Sinella (Coecobrya)</i> sp.	—	—	0.04	0.22	0.09	0.09	—	—	0.09	0.04	0.04	0.04
<i>Lepidocyrtus (Acrocyrtus)</i> <i>scaber</i>	0.31	0.13	0.18	0.94	0.63	0.40	0.40	—	0.36	0.18	0.13	0.13
<i>Siera</i> sp.	0.09	0.04	0.04	0.18	0.27	0.04	—	—	0.09	0.09	0.09	0.04
<i>Lobella siva</i>	—	—	—	0.09	0.09	0.04	0.13	—	—	—	—	—
<i>Lobella (L.) maxillaris</i>	—	—	—	0.27	0.22	0.04	—	—	0.18	0.04	—	—
<i>Sminthurides appendiculatus</i>	—	—	—	0.13	0.09	0.09	—	—	0.09	0.04	—	—
<i>Tullbergia</i> sp.	—	—	—	0.22	0.04	0.04	0.13	—	—	0.04	—	—
<i>Entomobrya</i> sp.	—	—	—	0.09	0.09	0.04	—	—	0.09	0.04	0.04	—
Total	2.47	1.88	1.97	8.17	7.40	4.58	3.10	3.68	3.77	2.06	1.79	1.48

Table 13 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at Reserve forest floor.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Megalothorax minimus</i>	0.22	0.18	0.18	1.12	0.67	0.40	0.58	0.31	0.40
<i>Lepidocyrtus</i> sp.	0.18	0.27	0.18	0.90	0.58	0.54	—	0.22	0.36
<i>Salina</i> sp.	—	—	—	0.13	0.18	0.09	0.22	0.13	0.09
<i>Isotomiella minor</i>	0.22	0.22	0.22	0.58	0.36	—	—	0.40	0.31
<i>Folsomides exigus</i>	0.09	—	0.04	0.18	0.13	0.18	—	—	0.13
<i>Xenylla obscura</i>	—	0.09	0.04	0.13	0.09	0.13	0.27	0.13	0.09
<i>Pseudachorutes</i> sp.	—	0.13	0.04	0.22	0.09	0.04	—	—	0.09
<i>Hypogastrura</i> sp.	—	0.09	0.04	0.27	0.04	0.09	0.22	—	0.04
<i>Cyphoderus javanus</i>	0.31	0.13	0.13	0.49	0.81	0.49	0.63	0.31	0.27
<i>Subisotoma fitchioides</i>	0.31	0.13	0.13	0.40	0.85	0.31	0.45	0.27	0.22
<i>Isotomina interrupta</i>	0.27	0.18	0.13	0.76	0.49	0.40	0.40	0.31	0.09
<i>Dicyrtomina</i> sp.	—	—	0.04	0.09	0.45	0.22	0.18	—	0.04
<i>Alloscopus tetracantha</i>	—	—	0.04	0.18	0.13	0.13	—	0.09	0.09
<i>Lepidocyrtus (Acrocyrtus)</i> <i>scaber</i>	0.31	0.13	0.18	0.67	0.72	0.58	0.31	—	0.18
<i>Siera</i> sp.	0.03	—	0.04	0.13	0.09	0.13	—	0.18	0.04
<i>Lobella siva</i>	—	—	—	0.09	0.22	0.09	—	—	—
<i>Lobella (L.) maxillaris</i>	—	—	0.04	0.18	0.31	0.18	0.22	—	—
<i>Sminthurides appendiculatus</i>	—	—	0.09	0.22	0.18	0.13	—	—	0.04
<i>Tullbergia</i> sp.	—	—	—	0.09	0.13	0.18	0.18	—	—
<i>Entomobrya</i> sp.	—	—	0.04	0.09	0.22	0.13	—	—	0.04
Total	2.06	1.57	1.70	7.27	7.40	5.02	3.95	2.51	2.60

Table 14

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Reserve forest floor

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.43	0.54	0.38	1.72	1.88	0.88	0.67	0.83	0.91	0.64	0.56	0.35
Mesostigmata	0.48	0.29	0.56	1.55	2.01	1.29	0.80	0.70	0.80	0.40	0.43	0.48
Cryptostigmata	0.38	0.35	0.32	1.61	1.82	0.83	0.54	0.62	0.67	0.43	0.32	0.29
COLEOPTERA												
Ptiliidae	0.21	0.13	0.16	0.46	0.80	0.32	0.19	0.27	0.40	0.29	0.19	0.16
Staphylinidae	0.24	0.19	0.16	0.75	0.86	0.27	0.13	0.32	0.46	0.38	0.19	0.13
Larvae	—	—	0.08	0.67	0.75	0.13	0.24	—	—	—	—	0.13
DIPTERA												
Larvae	—	—	—	1.13	0.80	0.21	—	—	—	—	—	—
DIPLURA												
	—	—	0.08	0.13	0.11	0.19	0.05	0.08	—	—	—	—
PROTURA												
	—	—	0.03	—	0.03	0.05	—	—	—	—	—	—
Other unidentified	0.27	0.05	—	0.08	0.11	—	0.19	0.27	0.11	0.05	0.24	0.13
Total	2.01	1.55	1.66	8.09	9.17	4.18	2.81	3.08	3.35	2.28	1.93	1.69

Table 14 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at Reserve forest floor.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec
ACARINA									
Prostigmata	0.48	0.35	0.38	1.61	1.53	1.02	0.78	0.78	0.99
Mesostigmata	0.35	0.24	0.35	1.55	1.63	0.91	0.59	0.67	0.78
Cryptostigmata	0.32	0.27	0.27	1.34	1.72	0.80	0.62	0.59	0.32
COLEOPTERA									
Ptiliidae	0.24	0.11	0.19	0.75	0.67	0.43	0.40	0.32	0.35
Staphylinidae	0.29	0.27	0.24	0.80	0.67	0.48	0.46	0.38	0.40
Larvae	—	—	—	0.72	0.59	0.35	0.19	—	0.05
DIPTERA									
Larvae	—	—	—	0.62	0.54	0.43	—	—	0.05
DIPLURA	—	—	0.05	0.08	0.11	0.05	—	0.03	—
PROTURA	—	—	—	—	0.05	0.03	—	—	—
Other unidentified	—	0.16	—	0.08	0.24	—	—	0.11	—
Total	1.69	1.39	1.47	7.56	7.75	4.50	3.06	2.87	2.95

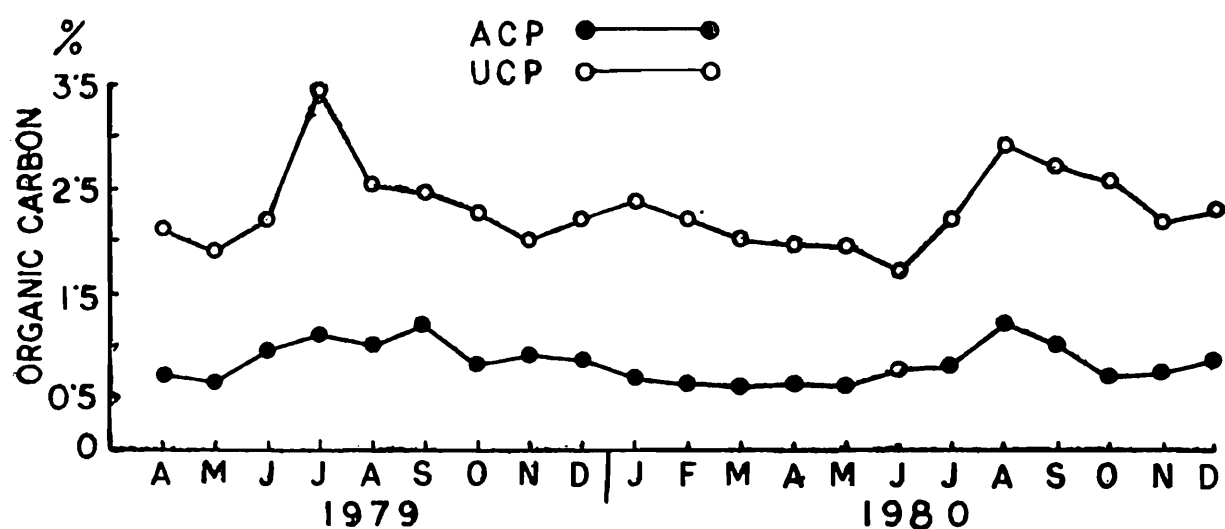


Fig. 4. Showing monthly fluctuations of Organic Carbon (%) in ACP and UCP sites.

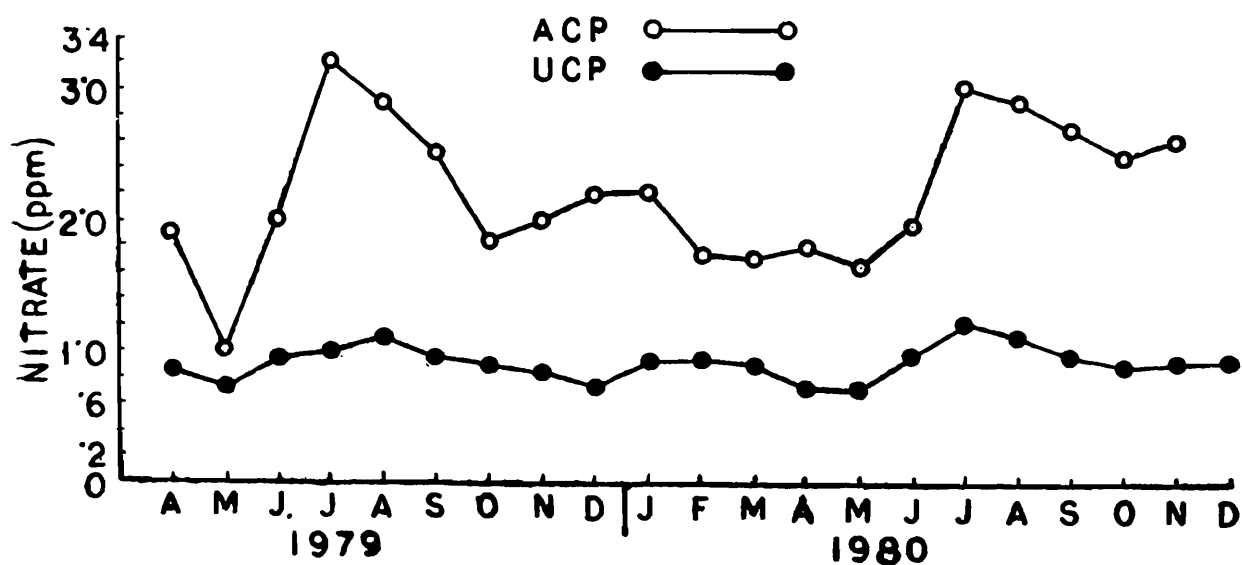


Fig. 4a. Showing monthly fluctuations of nitrate (ppm) in ACP and UCP sites.

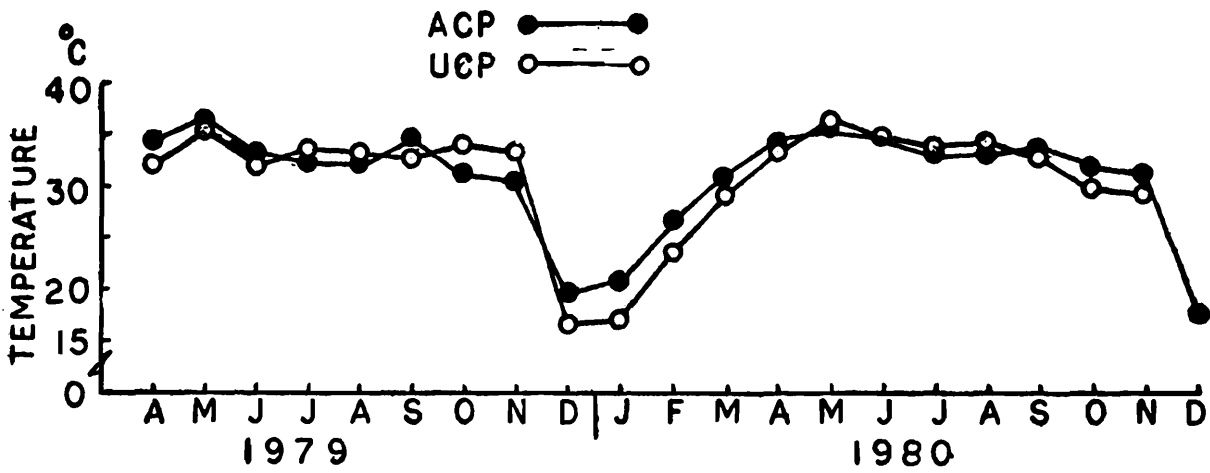


Fig. 4b. Showing monthly fluctuations of temperature (°C) in ACP and UCP sites.

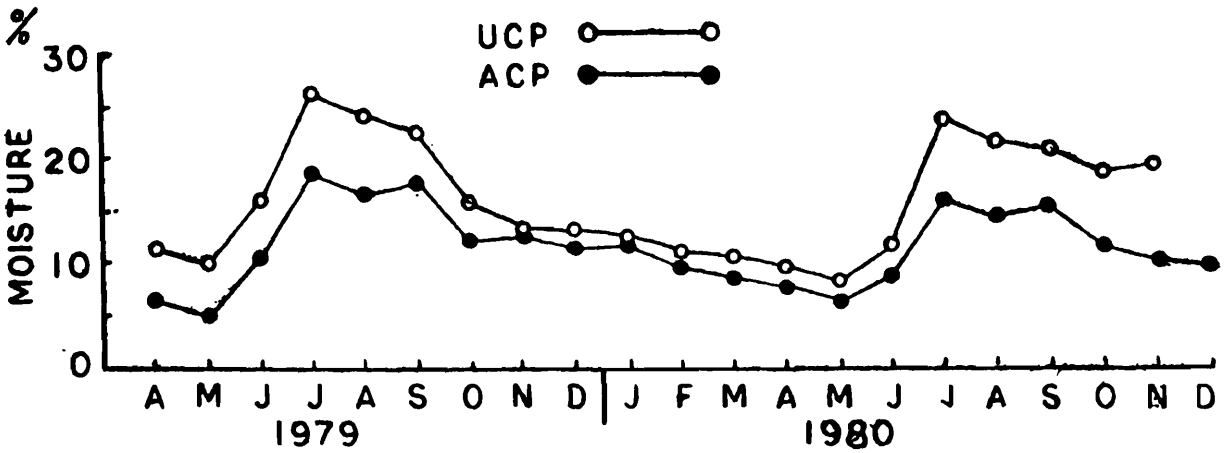


Fig. 4c. Showing monthly fluctuations of moisture (%) in UCP and ACP sites.

UNDISTURBED CITY PARK SITE

Characteristics of sampling site : This is located at Botanic Garden, district Howrah and it included four sampling plots, each eight metre square, undisturbed, thickly vegetated. The site is shady due to the presence of some tall trees.

Vegetation :

Above ground : Plots were covered with grasses and sedges like *Commelina obliqua*, *Vernonia cinerea*, *Eupatorium odoratum*, *Digitaria adscendens*, *Cynodon dactylon*, *Echinochloa colonum*, *Typhonium* sp., *Euphorbia hirta*, *Amaranthus viridis*, *Eclipta alba*, *Panicum* sp., *Ageratum conyzoides* some oriental plants like *Ixora* sp., *Sansiviera* sp. The plots also contained some trees like *Polyalthia longifolia* and *Casurina* sp.

Under ground : Soil fungi obtained from this site belonged to 45 species under 34 genera (Table 1). Genus *Aspergillus* was most frequently occurred. Maximum fungi population were found in the month of July (44,000/gm. soil in 1979 and 42,000/gm. soil in 1980) and minimum in May (Table 15).

Soil factors : Soils of these plots were Gangetic alluvium in nature, pH varied from 7.00 to 7.25. In April and May moisture content of soil was 11.5% and 10.00% respectively in 1979, 9.5% and 8.2% respectively in 1980. Month of July in both the sampling year showed maximum moisture content (26.5% in 1979 and 23.5% in 1980). In May other soil factors such as organic carbon, nitrate and temperature were 1.90%, 1.00 ppm and 35.5°C respectively in 1979 and 1.70%, 1.65 ppm and 36.2°C respectively in 1980. Amount of organic carbon and nitrate were found to be maximum in July (Figures 4-4c). Mechanical analysis of soil sampled showed more or less equal percentage of silt and clay (Table 3).

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to fifteen genera such as *Folsomides*, *Megalothorax*, *Lepidocyrtus*, *Cyphoderus*, *Isotomina*, *Calx*, *Sinella*, *Entomobrya*, *Isotomiella*, *Tullbergia*, *Arrhopalites*, *Sphaeridia*, *Sminthurus*, *Pseudosinella* and *Lobella* (Table 16). Species *Megalothorax minimus* was most dominant and being extracted from almost all the soil samples and comprising 20.38% of total population of collembola in this site. *Isotomina thermophila*, *Entomobrya* sp. and *Isotomiella minor* comprising 15.72%, 13.23% and 13.23% occupied second and third position respectively in order of dominance. Population of other genera species such as *Folsomides parvulus*, *Lepidocyrtus* sp., *Cyphoderus albinus*, *Calx* sp., *Sinella* sp., *Tullbergia* sp., *Lepidocyrtus medius*, *Arrhopalites*

sp., *Sphaeridia* sp., *Sminthurus* sp., *Cyphoderus* sp., *Pseudosinella* sp. and *Lobella maxilaris* were numerically low and highly irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 15) showed maximum population in July when soil factors like organic carbon, moisture and nitrate were also maximum. Partial increase in December—January may be due to the prevalence of winter maxima of some species of collembola (Table 16).

Table 15

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at undisturbed city park site.

April, 1979—December, 1980.

Date	Collembola			Other arthropod			Fungi
	Mean	$\pm$	SE	Mean	$\pm$	SE	(per gm. soil in thousand)
1979							
April	5.40	$\pm$	0.93	11.60	$\pm$	2.15	9
May	4.40	$\pm$	0.51	8.40	$\pm$	1.21	7
June	5.00	$\pm$	1.51	10.40	$\pm$	1.03	11
July	59.40	$\pm$	3.96	85.00	$\pm$	2.47	44
August	33.40	$\pm$	1.86	65.80	$\pm$	2.87	41
September	19.60	$\pm$	0.87	54.20	$\pm$	1.85	35
October	15.00	$\pm$	2.00	24.40	$\pm$	1.50	31
November	13.80	$\pm$	1.90	19.60	$\pm$	3.70	22
December	14.40	$\pm$	2.18	22.00	$\pm$	5.72	25
1980							
January	13.60	$\pm$	2.44	21.00	$\pm$	5.80	21
February	10.20	$\pm$	1.16	10.00	$\pm$	1.22	18
March	8.80	$\pm$	0.86	9.40	$\pm$	1.21	12
April	5.80	$\pm$	1.24	12.40	$\pm$	1.72	11
May	5.00	$\pm$	1.51	7.60	$\pm$	1.57	9
June	6.60	$\pm$	0.87	11.80	$\pm$	1.68	10
July	37.80	$\pm$	2.35	64.20	$\pm$	1.59	42
August	25.00	$\pm$	2.02	50.40	$\pm$	3.50	38
September	21.00	$\pm$	2.00	40.60	$\pm$	6.34	29
October	12.40	$\pm$	7.72	17.40	$\pm$	1.32	26
November	13.00	$\pm$	2.09	18.40	$\pm$	2.92	30
December		*			*		*

*Not sampled

Table 16

Showing species of collembola and their month-wise population number expressed in percentage at undisturbed city park site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Folsomides parvulus</i>	0.04	—	0.09	0.21	0.13	0.09	0.09	0.17	0.04	—	0.09	0.09
<i>Megalothorax minimus</i>	0.17	0.21	0.17	2.98	1.53	0.89	1.32	0.60	0.81	0.38	0.30	0.64
<i>Lepidocyrtus</i> sp.	0.04	—	0.04	0.26	0.17	0.04	0.04	0.13	—	0.09	0.04	—
<i>Cyphoderus albinus</i>	—	—	0.09	0.21	0.09	0.04	0.13	0.17	0.04	0.13	0.13	0.13
<i>Isotomina thermophila</i>	0.13	0.17	0.13	2.08	1.28	0.81	—	—	0.38	0.47	0.30	0.30
<i>Calx</i> sp.	0.04	—	0.04	0.26	0.13	0.09	—	0.13	0.04	0.09	0.09	—
<i>Sinella</i> sp.	0.04	—	0.04	0.17	—	0.04	—	0.13	0.04	0.04	0.04	0.09
<i>Entomobrya</i> sp.	0.21	0.13	0.26	2.04	1.23	0.51	—	—	0.55	0.43	0.38	—
<i>Isotomiella minor</i>	0.21	0.34	0.13	1.28	0.85	0.72	—	0.55	0.47	0.38	0.30	0.38
<i>Tullbergia</i> sp.	—	—	0.04	0.30	0.17	0.04	0.09	0.09	0.04	0.13	—	—
<i>Lepidocyrtus medius</i>	0.17	—	0.04	1.74	0.81	0.43	1.11	—	0.30	0.38	0.26	0.09
<i>Arrhopalites</i> sp.	—	—	0.04	0.26	0.09	0.09	0.09	0.13	0.04	0.09	0.09	—
<i>Sphaeridia</i> sp.	—	—	—	0.21	0.13	0.04	0.04	0.21	0.04	0.17	—	—
<i>Sminthurus</i> sp.	—	—	—	0.13	0.09	0.04	0.13	0.30	0.04	—	—	—
<i>Cyphoderus</i> sp.	0.04	0.09	—	—	0.13	0.13	0.09	0.26	0.09	0.09	0.09	0.09
<i>Pseudosinella</i> sp.	0.04	—	—	0.30	0.17	—	—	—	0.04	0.04	0.09	—
<i>Lobella maxillaris</i>	—	—	—	0.21	0.13	0.17	0.09	0.09	0.09	—	—	0.09
Total	1.15	0.94	1.06	12.63	7.10	4.17	3.19	2.93	3.06	2.89	2.17	1.87

Table 16 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at undisturbed city park site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Folsomides parvulus</i>	0.09	—	0.04	0.17	0.09	0.09	0.09	—	*
<i>Megalothorax minimus</i>	0.21	0.55	0.17	1.28	0.89	0.64	0.60	—	—
<i>Lepidocyrtus</i> sp.	0.09	—	0.04	0.21	0.04	0.13	0.04	0.13	—
<i>Cyphoderus albinus</i>	0.09	—	0.04	0.13	0.09	0.17	—	—	—
<i>Isotomina thermophila</i>	0.21	0.17	0.26	1.74	1.23	0.86	—	0.51	—
<i>Calx</i> sp.	—	—	0.04	0.17	0.04	0.13	—	0.09	—
<i>Sinella</i> sp.	0.0	—	0.04	0.09	0.09	0.21	—	0.04	—
<i>Entomobrya</i> sp.	0.21	0.17	0.26	0.81	0.64	0.72	0.72	—	—
<i>Isotomiella minor</i>	0.13	0.17	0.21	0.89	0.64	0.43	—	1.19	—
<i>Tullbergia</i> sp.	—	—	—	0.09	0.09	0.09	0.09	0.13	—
<i>Lepidocyrtus medius</i>	0.17	—	0.17	1.32	0.72	0.43	0.81	—	—
<i>Arrhopalites</i> sp.	—	—	—	0.21	0.13	0.09	0.09	0.09	—
<i>Sphaeridia</i> sp.	—	—	—	0.26	0.13	0.13	0.04	0.09	—
<i>Sminthurus</i> sp.	—	—	—	0.30	0.09	0.09	—	0.13	—
<i>Cyphoderus</i> sp.	—	—	0.04	0.17	0.09	0.04	0.09	0.09	—
<i>Pseudosinella</i> sp.	—	—	0.09	0.09	0.17	0.17	0.09	0.21	—
<i>Lobella maxillaris</i>	—	—	—	0.09	0.17	0.09	—	0.09	—
Total	1.23	1.06	1.40	8.04	5.82	4.47	2.64	2.76	—

Other arthropod population : Microarthropods extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina), Diplura, Protura and macroarthropod extracted belonged to Ptiliidae, Staphylinidae and larvae (Coleoptera), larvae of Diptera and other unidentified groups (Table 17). Sub-order Prostigmata was most dominant and were found in all soil samples and comprising 21.67%, Mesostigmata comprising 21.45%, and Cryptostigmata comprising 19.55%, Staphylinidae comprising 10.16%, Ptiliidae comprising 9.67% and coleoptera larvae comprising 6.37% of total other arthropod population in this plot occupied second, third, fourth and fifth position respectively in order of dominance. Population of other groups were extracted very low number, highly irregular in distribution pattern. Number of other arthropod fauna (Mean $\pm$ SE) obtained in each month (Table 15) showed maximum in July when soil factors like organic carbon, nitrate and moisture content were maximum (Figures 4-4c). Partial increase in number during December—January may be due to the prevalence of winter maxima of some microarthropod groups (Table 17).

ANTHROPOGENIC PRESSURISED CITY PARK

Characteristics of sampling site : This is located at the eastern side of Calcutta city the Children's Park situated on the southern bank of Subash Sarobar (lake) and it included four sampling plots each eight metre square, disturbed by the human activities.

Vegetation :

Above ground : Plots contained good number of grasses and sedges like *Panicum* sp., *Echinochloa colonum*, *Cynodon dactylon*, *Trema orientalis*, *Codiaeum variegatum*, *Amaranthus viridis*, *Vernonia cineria*, *Achyranthes aspera*, *Fleurya interrupta*, *Eclipta alba*, *Digitaria adscendens*. Besides a row of *Polyalthia longifolia* trees on southern part of the site were also present.

Underground : Soil fungi obtained from this site belonged to 25 species under 16 genera (Table 4). Genus *Aspergillus* was frequent in this site. Maximum fungi population were found in July (14,000/gm. soil in 1979 and 1800/gm. soil in 1980) and minimum in May (Table 18).

Soil factors : Soils of these plots were Gangetic alluvium in nature, brownish in colour, clay-loam in texture pH varied from 7.00 to 7.30. In April and May moisture content of soil was 6.5% and 5.2% respectively in 1979, 7.5% and 6.2% respectively in 1980. Month of September in 1979 (17.3%) and July in 1980 (15.5%) showed maximum moisture content. In May other soil factors such as organic carbon, nitrate and temperature

Table 17

Showing groups of other arthropods and their month-wise population number expressed in percentage at undisturbed city park site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.32	0.29	0.73	2.41	1.72	1.32	0.77	0.50	0.63	0.45	0.37	0.29
Mesostigmata	0.26	0.24	0.26	2.25	1.82	1.45	0.61	0.85	0.56	1.06	0.26	0.21
Cryptostigmata	0.37	0.21	0.24	2.38	1.61	1.08	0.53	0.45	0.58	0.53	0.29	0.34
COLEOPTERA												
Ptiliidae	0.21	0.11	0.16	9.93	0.79	0.85	0.37	0.13	0.32	0.26	0.11	0.08
Staphylinidae	0.21	0.13	0.08	1.06	0.77	0.53	0.26	0.26	0.45	0.32	0.13	0.11
Larvae	—	—	0.13	0.79	0.74	0.69	0.32	—	—	0.11	0.08	0.13
DIPTERA												
Larvae	—	—	0.08	0.93	0.79	0.85	0.26	—	—	—	—	—
DIPLURA												
	—	—	—	0.13	0.19	0.08	—	—	—	—	—	—
PROTURA												
	—	—	—	—	—	—	—	—	—	—	—	—
Other unidentified	0.16	0.13	0.05	0.37	0.26	0.32	0.11	0.40	0.37	0.05	0.08	0.08
Total	1.53	1.11	1.37	11.24	8.70	7.17	3.23	2.59	2.91	2.78	1.32	1.24

Table 17 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at undisturbed city parks site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.42	0.34	0.42	1.69	1.61	1.06	0.45	0.74	*
Mesostigmata	0.37	0.24	0.32	1.82	1.32	1.14	0.50	0.48	
Cryptostigmata	0.32	0.16	0.37	1.72	1.37	1.06	0.56	0.42	—
COLEOPTERA									
Ptiliidae	0.21	0.11	0.19	0.71	0.66	0.53	0.26	0.24	—
Staphylinidae	0.32	0.16	0.13	0.82	0.69	0.53	0.34	0.29	—
Larvae	—	—	0.08	0.87	0.42	0.30	—	—	—
DIPTERA									
Larvae	—	—	—	0.66	0.53	0.58	—	—	—
DIPLURA	—	—	0.05	0.08	0.03	—	—	—	—
PROTURA	—	—	—	—	0.03	—	—	—	—
Other unidentified	—	—	—	0.11	—	0.08	0.19	0.26	—
Total	1.64	1.00	1.56	8.49	6.66	5.37	2.30	2.30	—

Table 18

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at Anthropogenic pressurised city park site.

April, 1979—December, 1980.

Date	Collembola Mean $\pm$ SE			Other arthropods Mean $\pm$ SE			Fungi (per gm. soil in thousand)
1979							
April	2.40	$\pm$	0.68	5.00	$\pm$	1.00	3
May	2.00	$\pm$	0.95	4.40	$\pm$	1.03	2
June	3.00	$\pm$	1.26	5.80	$\pm$	0.86	4
July	11.60	$\pm$	1.29	18.40	$\pm$	0.93	16
August	10.40	$\pm$	1.21	14.20	$\pm$	1.98	14
September	9.80	$\pm$	2.70	11.60	$\pm$	1.29	12
October	9.00	$\pm$	1.14	10.40	$\pm$	2.31	8
November	8.20	$\pm$	0.37	8.00	$\pm$	1.51	13
December	8.00	$\pm$	1.51	9.80	$\pm$	2.70	11
1980							
January	7.60	$\pm$	0.87	9.00	$\pm$	1.14	9
February	5.80	$\pm$	1.59	7.60	$\pm$	0.87	7
March	4.80	$\pm$	1.07	6.20	$\pm$	0.86	5
April	3.00	$\pm$	1.14	5.60	$\pm$	1.69	4
May	2.40	$\pm$	1.16	5.00	$\pm$	1.14	3
June	4.40	$\pm$	0.93	6.20	$\pm$	1.20	5
July	10.40	$\pm$	2.54	17.80	$\pm$	1.59	18
August	9.60	$\pm$	0.87	13.00	$\pm$	2.55	15
September	7.60	$\pm$	0.87	9.80	$\pm$	2.70	13
October	7.80	$\pm$	0.86	9.20	$\pm$	0.86	12
November	6.20	$\pm$	0.86	7.00	$\pm$	0.71	11
December	6.60	$\pm$	1.03	7.60	$\pm$	0.87	14

were 0.65%, 0.78 ppm and 36.5°C respectively in 1980. Amount of organic carbon was found to be maximum in September and August respectively in 1979 and 1980. Values of other soil factors (figures 4-4c) revealed more or less identical edaphological characteristics of plots concerned. Mechanical analysis of soil sampled showed slightly higher percentage of clay (Table 3).

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to ten genera such as *Lepidocyrtus*, *Folsomides*, *Sphaeridia*, *Isotomina*, *Sminthurus*, *Dicyrtoma*, *Calx*, *Proisotoma*, *Cyphoderus*, *Entomobrya*, (Table 19). Species *Isotomina minor* was most dominant and being extracted from almost all the soil samples and comprising 21.19% of total population of collembola in this site. *Isotomina thermophila*, *Lepidocyrtus* (*Ascocyrtus*) sp. comprising 21.05% and 19.63% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Folsomides parvulus*, *Sphaeridia* sp., *Sminthurus* sp., *Dicyrtoma* sp., *Calx* sp., *Proisotoma* sp., *Cyphoderus albinus* and *Entomobrya* sp. were numerically low and highly irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 18) showed maximum population in July when soil factors like nitrate and moisture content were maximum in 1980. Partial increase in December—January may be due to the prevalence of winter maxima of some species of collembola (Table 19).

Other arthropod population : Microarthropods extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina) and macroarthropod belong to Ptiliidae, Staphylinidae and its larvae (Coleoptera), larvae of Diptera and some other unidentified groups. Diplura and Protura were completely absent from this site (Table 20). Sub-order Prostigmata was most dominant and were found in all soil samples and comprising (23.59%), Mesostigmata comprising (21.71%), Cryptostigmata comprising (18.89%), Ptiliidae (10.33%) and Staphylinidae comprising (9.60%) of total other arthropod population in this site occupied second, third, fourth and fifth position respectively in order of dominance. Population of other groups were extracted very low in number and highly irregular in distribution pattern. Number of other arthropod fauna (Mean $\pm$ SE) obtained in each month (Table 18), showed maximum in July when soil factors like nitrate and moisture content were also high (Figures 4-4c). Very slight higher peak in December—January may be due to the prevalence of winter maxima of some microarthropod groups (Table 20).

IRRIGATION CANAL EMBANKMENT SITE

Characteristics of the sampling site : The canal is located at Baidyabati, by the side of Calcutta—Delhi road in the district of Hooghly, about 25 km west of Calcutta. The width of the canal is about 25 metre and have an embankment of about 8 metre and height of the embankment is 15 metre. The embankment was divided into three parallel horizontal rows namely upper, middle and lower, three sampling plots were selected from

Table 19
Showing species of collembola and their month-wise population number expressed in percentage at
Anthropogenic city park.
April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Lepidocyrtus (Ascocyrtus)</i> sp.	0.13	0.26	0.13	0.34	0.34	0.38	—	0.34	0.43	0.38	0.34	0.34
<i>Folsomides parvulus</i>	—	—	0.04	0.13	0.09	0.13	—	0.09	0.13	0.09	0.17	—
<i>Sphaeridia</i> sp.	—	—	—	0.17	0.13	0.09	0.38	0.09	0.09	0.13	—	—
<i>Isotomina thermophila</i>	0.13	—	0.13	0.30	0.30	0.34	0.77	0.68	0.34	—	—	—
<i>Sminthurus</i> sp.	—	—	—	0.13	0.13	0.13	0.34	0.04	0.04	0.04	0.13	0.13
<i>Dicyrtoma</i> sp.	—	—	0.04	0.09	0.09	0.09	—	0.09	0.09	0.09	—	—
<i>Calx</i> sp.	—	—	0.04	0.17	0.13	0.09	0.26	—	0.04	0.04	0.09	—
<i>Proisotoma</i> sp.	0.04	—	0.04	0.13	0.09	0.13	0.17	0.04	0.04	0.09	0.09	—
<i>Cyphoderus albinus</i>	0.04	—	0.04	0.09	0.13	0.17	—	0.04	0.09	0.09	0.09	0.17
<i>Isotomiella minor</i>	0.13	0.17	0.13	0.77	0.64	0.43	—	0.30	0.30	0.51	0.21	0.38
<i>Entomobrya</i> sp.	0.04	—	0.04	0.17	0.17	0.13	—	0.04	0.13	0.17	0.13	—
Total	0.51	0.43	0.64	2.47	2.21	2.08	1.91	1.74	1.70	1.62	1.23	1.02

Table 19 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at
Anthropogenic city park site.

April, 1980--December, 1980.

Species	Apr.	May	Jun.	Jul.	Aug.	Sept	Oct.	Nov.	Dec.
<i>Lepidocyrtus (Ascocyrtus) sp.</i>	0.30	—	0.26	0.47	0.38	0.30	0.43	—	0.34
<i>Folsomides parvulus</i>	—	—	0.04	0.09	0.13	0.09	0.13	—	0.09
<i>Sphaeridia sp.</i>	—	—	—	0.04	0.09	0.09	0.17	0.04	0.09
<i>Isotomina thermophila</i>	0.21	0.26	0.21	0.64	0.30	0.38	0.51	0.55	0.26
<i>Sminthurus sp.</i>	—	—	—	0.09	0.09	0.04	0.09	0.09	0.04
<i>Dicyrtoma sp.</i>	—	—	—	0.04	0.04	0.13	0.04	—	0.13
<i>Calx sp.</i>	—	—	0.09	0.04	0.09	0.09	0.13	—	0.04
<i>Proisotoma sp.</i>	0.04	—	0.04	0.04	0.13	0.13	—	0.13	0.04
<i>Cyphoderus albinus</i>	—	—	0.09	0.09	0.21	0.04	0.17	0.09	0.04
<i>Isotomiella minor</i>	0.09	0.26	0.17	0.55	0.47	0.21	—	0.34	0.30
<i>Entomobrya sp.</i>	—	—	0.04	0.13	0.13	0.13	—	0.09	0.04
Total	0.64	0.51	0.94	2.21	2.04	1.62	1.66	1.32	1.40

Table 20

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Anthropogenic pressurised city park site.

April, 1979—March, 1980.

Group	Aug.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.11	0.19	0.16	0.48	0.37	0.21	0.40	0.26	0.42	0.32	0.26	0.21
Mesostigmata	0.05	0.13	0.13	0.53	0.40	0.37	0.21	0.32	0.40	0.29	0.13	0.19
Cryptostigmata	0.13	0.05	0.19	0.40	0.32	0.26	0.34	0.08	0.24	0.16	0.19	0.08
COLEOPTERA												
Ptiliidae	0.08	0.05	0.08	0.13	0.16	0.13	0.13	0.08	0.05	0.13	0.21	0.16
Staphylinidae	0.13	0.11	0.11	0.26	0.21	0.16	0.11	0.13	0.08	0.11	0.16	0.11
Larvae	—	—	0.05	0.26	0.19	0.11	0.05	0.05	—	—	—	0.08
DIPTERA												
Larvae	—	—	—	0.11	0.13	0.19	0.08	—	—	—	—	—
DIPLURA												
	—	—	—	—	—	—	—	—	—	—	—	—
PROTURA												
	—	—	—	—	—	—	—	—	—	—	—	—
Other unidentified	0.16	0.05	0.05	0.26	0.11	0.11	0.05	0.13	0.11	0.19	0.05	—
Total	0.66	0.58	0.77	2.43	1.88	1.53	1.37	1.06	1.30	1.19	1.00	0.82

Table 20 (Contd)

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Anthropogenic pressurised city park site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.13	0.08	0.24	0.56	0.45	0.34	0.32	0.21	0.26
Mesostigmata	0.21	0.19	0.16	0.53	0.34	0.24	0.26	0.24	0.19
Cryptostigmata	0.26	0.21	0.21	0.50	0.53	0.19	0.19	0.13	0.13
COLEOPTERA									
Ptiliidae	0.08	0.13	0.11	0.21	0.13	0.19	0.13	0.11	0.13
Staphylinidae	0.05	0.05	0.05	0.13	0.11	0.13	0.08	0.05	0.11
Larvae	—	—	0.05	0.21	0.08	0.05	0.05	0.08	—
DIPTERA									
Larvae	—	—	—	0.21	0.08	0.11	—	—	—
DIPLURA	—	—	—	—	—	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—
Other unidentified	—	—	—	—	—	0.05	0.19	0.11	0.19
Total	0.74	0.66	0.82	2.35	1.72	1.30	1.22	0.93	1.00

each row, one was chosen on the top of the embankment, each plot measured 10 m. $\times$ 1.5 m. The canal carrying only fresh irrigation water for the purpose of paddy cultivation. It is therefore, full of water in rainy season (July—September) and during “Boro-Paddy season” (March—April). And rest of the period of the year the water level remains very low or dried.

Vegetation :

Above ground : The top of the embankment contains some grasses and sedges like *Cynodon dactylon*, *Eragrostis pilosa*, *Dichanthium annulatum*, and *Arundinella* sp. and few trees of *Accacia arabica*. The upper slope of the embankment contains few creepers of *Ipomia* sp. and rest of the slope of the embankment devoid of any vegetation.

Underground : Soil fungi obtained from this site belonged to 26 species under 29 genera (Table 1). Genus *Aspergillus* was occurred most frequently. Maximum population were found in the month of September (16,000/gm. soil in 1979 and 18,000/gm. soil in 1980) and minimum in May (Table 21).

Soil factors and heavy metal contents : Soils of these plots were Gangetic alluvium in nature brown in colour, clay-loam in texture pH varied from 7.02 to 7.42. In April and May moisture content of soil was 10.50% and 10.20% respectively in 1979, 11.25% and 11.00% respectively in 1980. Month of July in each sampling year showed maximum moisture content (28.5% and 28.9% respectively in 1979 and 1980). In May other soil factors and heavy metal contents such as organic carbon, nitrate, temperature, chromium, copper and lead were 2.60%, 1.26 ppm, 36°C, 10.20%, 8.55 ppm, 14.63 ppm and 10.2 ppm in 1979 and 2.73%, 1 ppm, 35.75°C, 11%, 11.55 ppm, 10.10 ppm and 12.50 ppm respectively in 1980. Amount of organic carbon and nitrate were found to be maximum in July (except during 1980 when nitrate was maximum in September). Values of soil factors in other month showed in figures 5-5f. Mechanical analysis of soil sampled showed higher percentage of fine sand (Table 3).

Faunal make up :

Collembola population : Collembolan extracted from this site belonged to twelve genera as *Cyphoderus*, *Lepidocyrtus*, *Sinella*, *Hypogastrura*, *Lobelia*, *Isotomina*, *Subisotoma*, *Sminthuridae*, *Sphaeridia*, *Entomobrya*, *Pseudosinella* and *Willemia* (Table 22). Species *Lepidocyrtus* (*Acrocyrtus*) *heterolepis* was most dominant and being extracted from almost all the soil samples and comprising 19.40% of the total population of collembola in this site. *Hypogastrura* sp. and *Isotomina interrupta* comprising 17.44% and 16.19% occupied second and third position respectively in order of

Table 21

Showing monthly population of fauna (Mean $\pm$ SE) and
flora (Fungi/gm. soil in thousand) at
Irrigation canal embankment site.

April, 1979—December, 1980

Date	Collembola			Other arthropods			Fungi (per gm. soil in thousand)
	Mean	$\pm$	SE	Mean	$\pm$	SE	
1979							
April	5.80	$\pm$	1.02	8.08	$\pm$	0.86	4
May	4.40	$\pm$	0.75	6.40	$\pm$	0.24	2
June	4.00	$\pm$	0.45	6.60	$\pm$	0.51	5
July	8.40	$\pm$	0.51	13.00	$\pm$	1.05	8
August	8.00	$\pm$	0.71	13.80	$\pm$	0.60	12
September	9.80	$\pm$	0.66	19.60	$\pm$	0.51	16
October	8.20	$\pm$	0.58	11.00	$\pm$	0.55	11
November	3.60	$\pm$	1.86	5.20	$\pm$	0.37	13
December	3.40	$\pm$	1.43	5.60	$\pm$	0.75	14
1980							
January	4.00	$\pm$	1.14	6.00	$\pm$	1.00	10
February	2.40	$\pm$	1.12	4.60	$\pm$	0.51	8
March	2.00	$\pm$	0.71	4.00	$\pm$	0.71	7
April	5.20	$\pm$	1.62	7.60	$\pm$	0.51	5
May	4.20	$\pm$	0.66	5.80	$\pm$	0.66	3
June	3.80	$\pm$	1.07	6.20	$\pm$	0.66	7
July	7.80	$\pm$	0.38	11.20	$\pm$	0.37	12
August	6.60	$\pm$	0.51	13.60	$\pm$	1.12	15
September	7.20	$\pm$	0.38	16.40	$\pm$	4.27	18
October	5.80	$\pm$	0.97	9.80	$\pm$	1.28	10
November	3.40	$\pm$	0.24	6.80	$\pm$	0.37	7
December	4.40	$\pm$	0.51	6.40	$\pm$	0.68	9

dominance. Population of other genera/species such as *Cyphoderus albinus*, *Sinella* (*Sinella*) sp., *Lobella maxillaris*, *Subisotoma fitchioides*, *Sminuthurides* sp., *Sphaeridia* sp., *Entomobrya* sp., *Pseudosinella* sp., *Willemia* sp. and *Sinella* (*Coecobrya*) sp. were numerically low and irregular in distribution

pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 21) showed maximum population in September. Partial increase of population during April-May might be due to the population spurt of some forms just after receded water level of the canal (Table 22).

Other arthropod population : Microarthropod extracted from this site belonged to prostigmata, Mesostigmata, Cryptostigmata (Acarina); Diplura, Protura and other macroarthropod belonged to Ptiliidae, Staphylinidae, larvae (Coleoptera); larvae of Diptera, and other unidentified groups (Table 23). Sub-order Prostigmata comprising 37.05% was most dominant and were found in all soil samples. Mesostigmata comprising 23.89% Cryptostigmata comprising 19.85%, Ptiliidae comprising 6.05% and Staphylinidae comprising 4.78% of the total other arthropod population in this plot occupied second, third, fourth and fifth position respectively in order of dominance. Population of other groups were extracted very low in distribution pattern. Number of other arthropod fauna (Mean $\pm$ SE) obtained in each month (Table 21) showed maximum in September the soil factors and heavy metal contents like organic carbon, nitrate, moisture, chromium copper and lead were as presented in figures 5-5f. Partial increase of population in April-May might be due to the population spurt just after receded water level of the Canal (Table 23).

SEWAGE CANAL EMBANKMENT SITE

Characteristics of the sampling site : The Beliaghata canal is located on the eastern part of Calcutta. The total length of the canal is about 12 km. and width 18 metre and have an embankment of 4 metre width and c 20 metre high. The embankment was divided into three parallel horizontal rows, namely upper, middle and lower, three sampling plots were randomly selected from each row and one plot was selected on the top of the embankment, each measured 15 m. $\times$ 1.5 m. The canal carries a substantial amount of city sewage effluents and some amount of industrial effluents.

Vegetation :

Above ground : Only the upper slope and top of the embankment were covered with grasses and sedges like, *Digitaria adscendens*, *Eupatorium* sp., *Echinochloa colonum*, *Euphorbia hirta*, *Eclipta alba*, *Panicum* sp., *Cynodon dactylon* and *Croton sparciflours*.

Underground : Soil fungi obtained from this site belonged to 46 species under 33 genera (Table 1). Genus *Penicillium* was most frequently occurred. Maximum population were found in the month of August (34,000/gm. soil in 1979 and 38,000/gm. soil in 1980) and minimum in May (Table 24).

Table 22

Showing species of collembola and their month-wise population number expressed in percentage at
Irrigation canal embankment site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Cyphoderus albinus</i>	—	—	0.10	0.19	0.19	0.29	0.19	0.10	0.10	0.19	0.10	—
<i>Lepidocyrtus (Acrocyrtus) heterolepis</i>	0.78	0.68	0.49	0.68	0.58	0.88	0.88	0.29	0.29	0.29	0.19	0.19
<i>Sinella (Sinella) sp.</i>	0.39	0.19	0.10	0.10	0.10	—	—	0.10	0.10	0.10	0.10	0.10
<i>Hypogastrura sp.</i>	0.58	0.49	0.39	0.88	0.68	0.78	0.68	0.29	0.19	0.29	0.19	—
<i>Lobella maxillaris</i>	—	—	—	0.19	0.29	0.19	0.19	—	0.10	—	—	—
<i>Isotomina interrupta</i>	0.58	0.39	0.29	0.68	0.58	0.68	0.58	0.29	—	0.19	0.19	0.19
<i>Subisotoma fitchioides</i>	0.29	0.19	0.19	0.10	0.10	0.10	—	—	0.10	0.19	0.10	0.10
<i>Sminthurides sp.</i>	—	—	—	0.10	0.19	0.19	0.29	0.10	0.10	—	—	—
<i>Sphaeridia sp.</i>	—	—	—	0.19	0.10	0.10	0.19	0.10	0.10	—	—	—
<i>Entomobrya sp.</i>	—	—	0.29	0.68	0.78	1.07	0.49	0.19	0.29	0.39	0.19	0.19
<i>Pseudosinella sp.</i>	0.19	0.19	0.10	0.10	0.10	0.19	0.10	0.10	0.10	0.10	—	—
<i>Willemia sp.</i>	—	—	—	0.10	0.10	0.10	0.29	0.10	0.10	0.10	0.10	0.19
<i>Sinella (Coecobrya) sp.</i>	—	—	—	0.10	0.10	0.19	0.10	0.10	0.10	0.10	—	—
Total	2.83	2.14	1.95	4.09	3.90	4.78	4.00	1.75	1.66	1.95	1.17	0.97

Table 22 (Contd.)

Showing species of other collmbola and their month-wise population number expressed in percentage at
Irrigation canal embankment site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Cyphoderus albinus</i>	—	—	0.10	0.19	0.19	0.10	0.10	0.10	0.10
<i>Lepidocyrtus (Acrocyrtus) heterolepis</i>	0.49	0.39	0.29	0.68	0.49	0.58	0.48	0.29	0.58
<i>Sinella (Sinella) sp.</i>	0.19	0.19	0.19	0.10	0.10	0.10	—	0.10	0.10
<i>Hypogastrura sp.</i>	0.58	0.49	0.29	0.58	0.39	0.68	0.29	0.29	0.49
<i>Lobella maxillaris</i>	—	—	—	0.19	0.19	0.19	—	0.10	0.10
<i>Isotomina interrupta</i>	0.68	0.29	0.19	0.49	0.58	0.68	0.78	0.19	0.29
<i>Subisotoma fitchioides</i>	0.19	0.19	0.10	0.10	0.10	0.10	—	—	0.10
<i>Sminthurides sp.</i>	—	—	0.10	0.19	0.10	0.19	0.10	0.10	—
<i>Sphaeridia sp.</i>	0.29	0.29	0.19	0.10	0.19	0.10	0.10	0.10	0.10
<i>Entomobrya sp.</i>	—	—	—	0.58	0.49	0.49	0.39	0.19	0.19
<i>Pseudosinella sp.</i>	0.10	0.19	0.19	0.19	0.10	0.10	0.10	—	—
<i>Willemia sp.</i>	—	—	—	0.19	0.10	0.10	0.10	0.10	0.10
<i>Sinella (Coecobrya) sp.</i>	—	—	0.19	0.19	0.19	0.10	0.19	0.10	—
Total	2.58	2.05	1.85	3.80	3.22	3.51	2.83	1.66	2.14

Table 23

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Irrigation canal embankment site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.58	0.35	0.81	0.63	1.61	2.19	1.32	0.58	0.69	0.92	0.46	0.46
Mesostigmata	0.63	0.58	0.40	1.67	0.98	1.15	0.89	0.29	0.40	0.46	0.35	0.17
Cryptostigmata	0.86	0.58	0.29	0.58	0.89	1.67	0.51	0.29	0.17	0.12	0.24	0.23
COLEOPTERA												
Ptiliidae	0.29	0.12	0.12	0.29	0.17	0.12	0.24	0.12	0.06	0.17	0.12	0.12
Staphylinidae	0.12	0.12	0.12	0.17	0.12	0.17	0.12	0.17	0.12	0.06	0.12	0.12
Larvae	—	—	—	0.12	0.06	0.06	0.12	—	—	—	0.06	—
DIPTERA												
Larvae	—	—	—	0.06	0.12	0.12	—	—	—	—	—	—
DIPLURA												
	—	—	0.06	—	0.06	0.06	—	—	—	—	—	—
PROTURA												
	—	—	—	0.06	—	—	—	—	—	—	—	—
Other unidentified	0.06	0.12	0.12	0.17	0.17	0.12	0.17	0.06	0.17	—	—	0.06
Total	2.53	1.84	1.90	3.74	3.97	5.65	3.17	1.50	1.61	1.73	1.32	1.15

Table 23 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Irrigation canal embankment site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.81	0.75	0.75	1.27	1.38	1.90	1.15	0.81	0.69
Mesostigmata	0.52	0.35	0.46	0.58	0.98	0.92	0.58	0.40	0.40
Cryptostigmata	0.40	0.23	0.23	0.40	0.81	1.04	0.69	0.35	0.40
COLEOPTERA									
Ptiliidae	0.17	0.12	0.12	0.29	0.17	0.12	0.17	0.12	0.12
Staphylinidae	0.12	0.06	0.12	0.17	0.12	0.17	0.12	0.12	0.12
Larvae	—	—	0.06	0.12	0.06	0.12	—	0.06	—
DIPTERA									
Larvae	—	—	—	0.06	0.12	0.06	—	—	—
DIPLURA	0.06	—	—	0.12	0.06	—	—	—	—
PROTURA	—	—	0.06	—	—	—	—	—	—
Other unidentified	0.12	0.17	—	0.23	0.23	0.40	0.12	0.12	0.12
Total	2.19	1.67	1.79	3.23	3.92	4.72	2.82	1.96	1.84

Table 24

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at sewage canal embankment site.

April, 1979—December 1980.

Date	Collembola			Other arthropods			Fungi
	Mean	±	SE	Mean	±	SE	(per gm. soil in thousand)'
1979							
April	6.60	±	1.03	12.40	±	0.51	21
May	5.20	±	0.66	11.00	±	0.71	20
June	4.40	±	1.50	8.40	±	1.03	22
July	3.00	±	1.00	5.80	±	0.86	33
August	2.00	±	0.71	4.40	±	1.36	34
September	1.80	±	0.80	3.60	±	1.50	26
October	2.40	±	0.87	3.80	±	1.77	24
November	2.80	±	0.66	4.20	±	0.66	26
Decemmer	3.20	±	1.16	5.80	±	0.86	39
1980							
January	3.80	±	0.66	6.20	±	1.59	31
February	9.80	±	0.58	17.60	±	0.75	36
March	8.60	±	0.51	16.40	±	1.03	25
April	8.20	±	1.20	13.20	±	1.02	23
May	7.60	±	0.51	11.60	±	0.81	18
June	5.20	±	0.58	10.00	±	0.71	21
July	3.40	±	1.50	5.40	±	1.88	36
August	2.20	±	0.73	4.40	±	1.21	38
September	2.40	±	0.75	4.60	±	1.86	33
October	3.60	±	1.60	5.20	±	0.37	31
November	3.00	±	1.45	4.00	±	1.41	32
December	3.60	±	1.21	6.00	±	1.00	37

Soil factors and heavy metal content : Soil of these plots were alluvium in nature, blackish brown in colour, clay loam in texture. pH varied from 7.00 to 7.2. Month of April showed minimum contents of heavy metals like chromium and lead (125.22 ppm and 116.30 ppm) respectively in

1980 the minimum chromium content was in February (136.22 ppm). The amount of chromium and lead were found maximum in September in 1979 (220.33 ppm and 156.46 ppm respectively) and in 1980 the amount of copper content was maximum in August (171.11 ppm). In April other soil factors such as organic carbon, nitrate, moisture, temperature and copper were 2.50%, 1.66 ppm, 33.5°C, 15.75% and 42.26 ppm respectively in 1979, on the other hand in February the contents of the above factors 2.66%, 1.80 ppm, 24.5°C, 17%, 160.52 ppm and 141.22 ppm (lead) respectively in 1980. Values of these soil factors in other months of the year showed in figures 5-5f. Mechanical analysis of soil sampled showed high percentage of silt (Table 3).

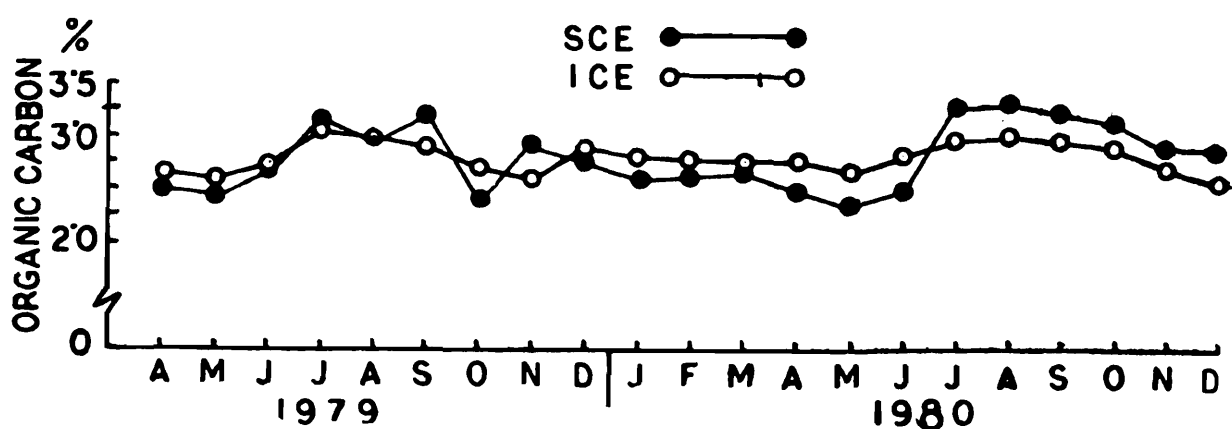


Fig. 5. Showing monthly fluctuations of Organic Carbon (%) in SCE and ICE sites

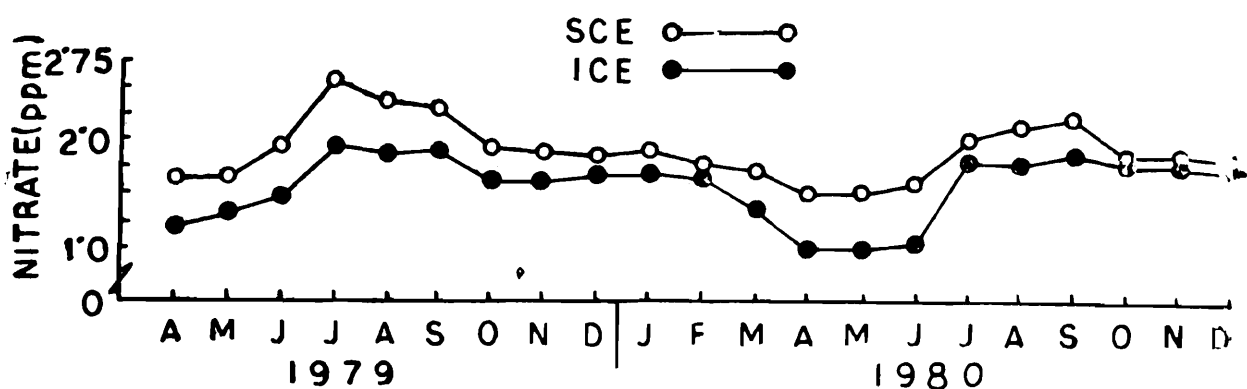


Fig. 5a. Showing monthly fluctuations of nitrate (ppm) in SCE and ICE sites

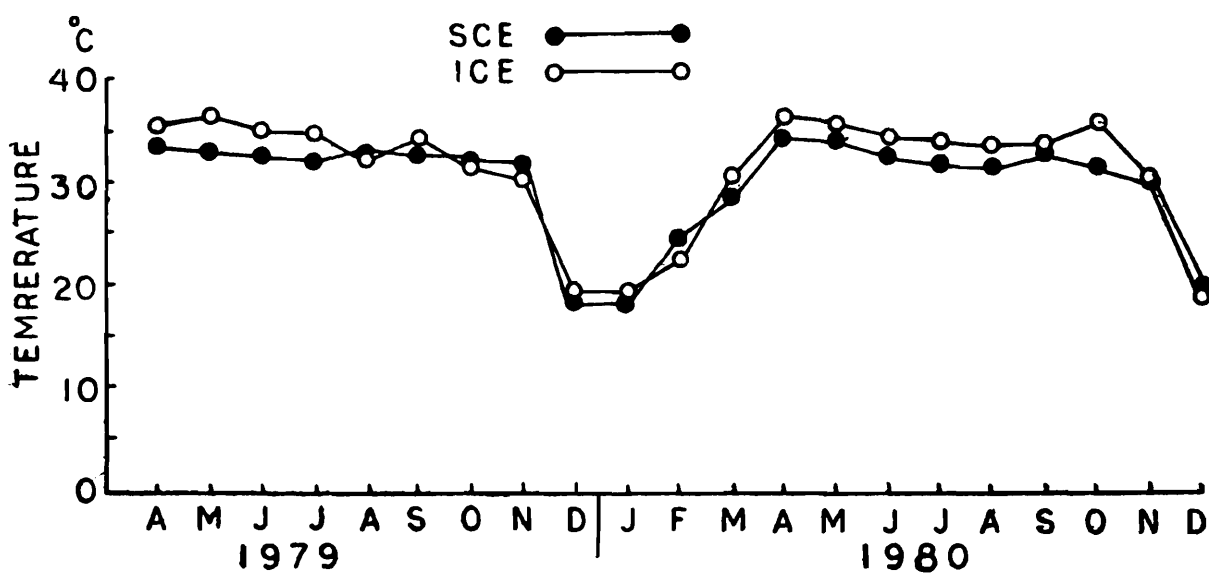


Fig. 5b. Showing monthly fluctuations of temperature (°C) in SCE and ICE sites.

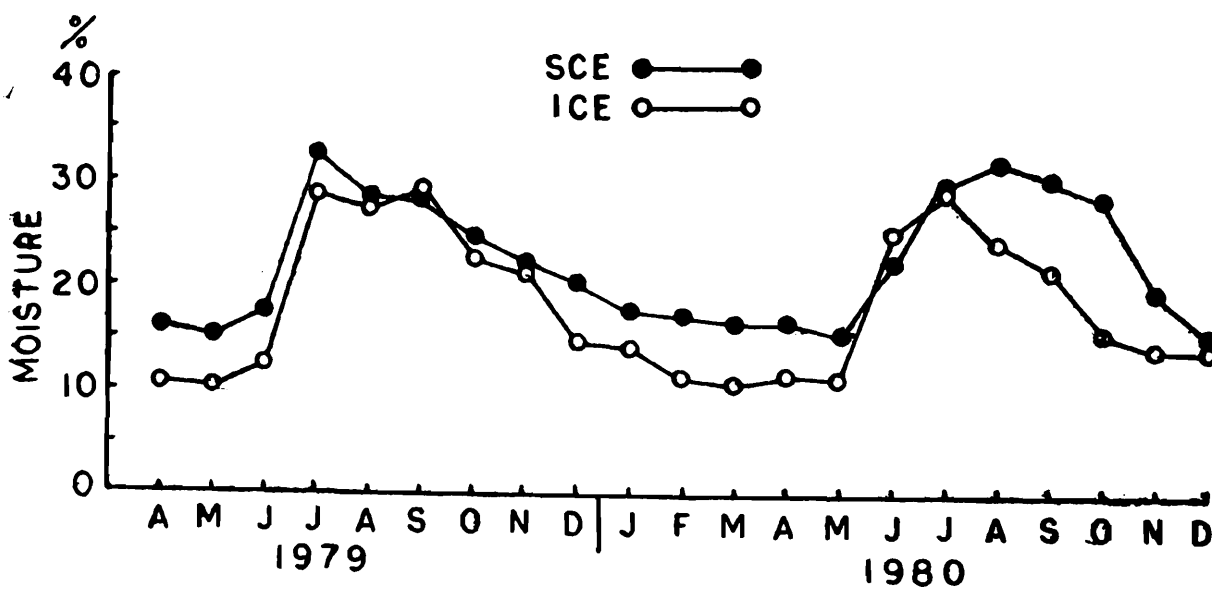


Fig. 5c. Showing monthly fluctuations of moisture (%) in SCE and ICE sites.

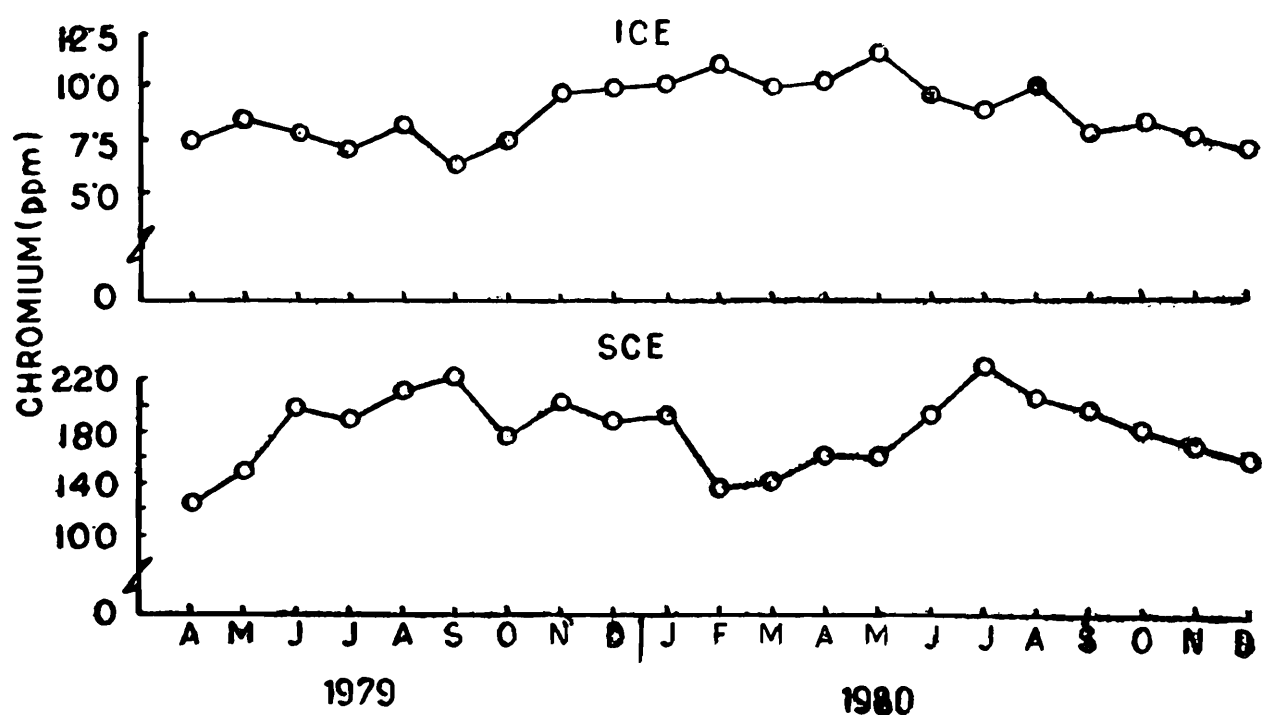


Fig. 5d. Showing monthly fluctuations of Chromium (ppm) in SCE and ICE sites.

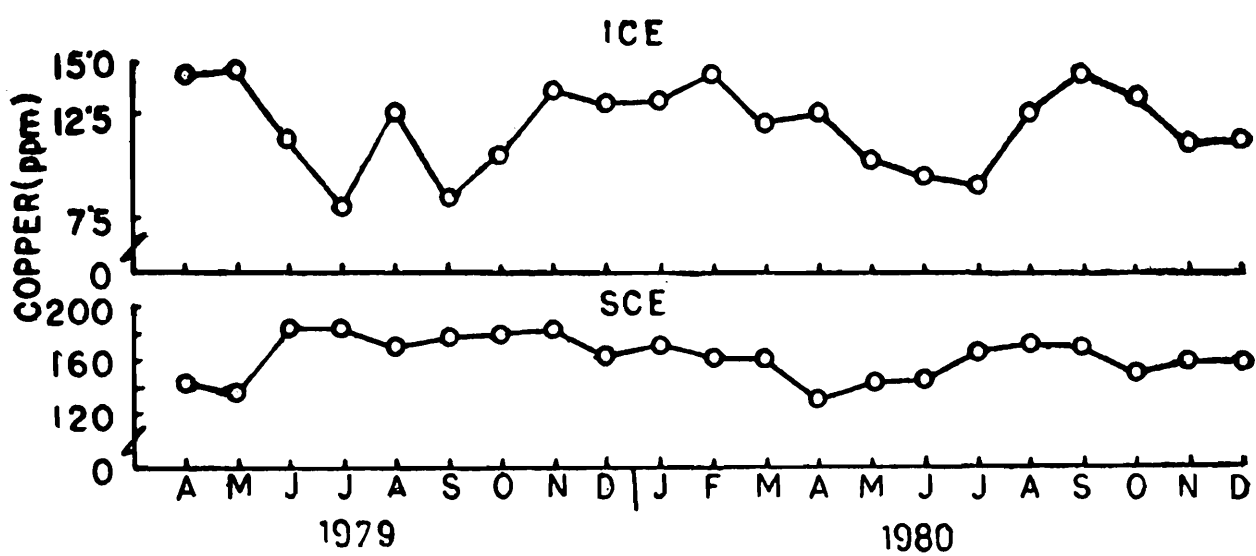


Fig. 5e. Showing monthly fluctuations of Copper (ppm) in ICE and SCE sites.

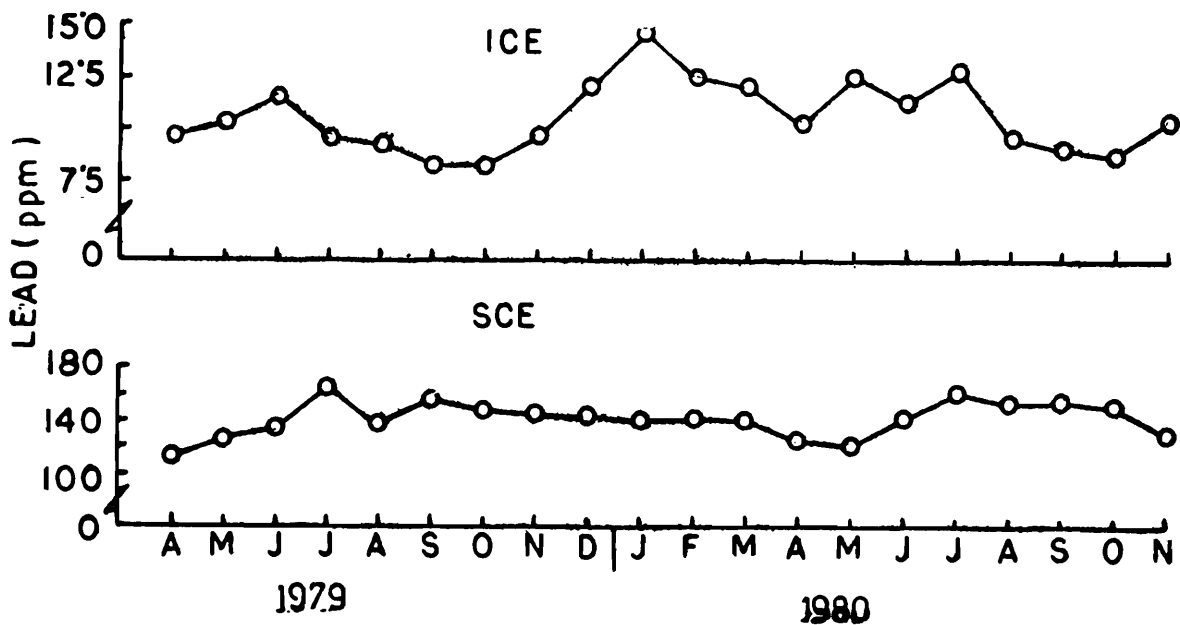


Fig. 5f. Showing monthly fluctuations of Lead (ppm) in ICE and SCE sites.

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to nine genera such as *Isotomiella*, *Subisotoma*, *Isotomina*, *Folsomides*, *Isotomurus*, *Cyphoderus*, *Lepidocyrtus*, *Folsomina* and *Brachystomella* (Table 25). Species *Isotomina thermophila* was most dominant and being extracted from almost all the soil samples and comprising 19.18% of total population of collembola in this site. *Subisotoma fitchioides* and *Folsomides purvulus* comprising 18.32% and 17.46% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Isotomiella minor*, *Isotomurus ciliatus*, *Cyphoderus assimilis*, *Lepidocyrtus (Acrocyrtus) scaber*, *Folsomina* sp. and *Brachystomella* sp. were numerically low and irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 24) showed maximum population in April and February respectively in 1979 and 1980.

Other arthropod population : Microarthropod extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina), Diplura and macroarthropod belonged to Staphylinidae, larvae, Ptiliidae (Coleoptera), Diptera larvae, and other unidentified groups (Table 26). Sub-order Mesostigmata was most dominant and were found in all soil samples and comprising 34.5%, Cryptostigmata comprising 33.63%, Prostigmata comprising 10.83% and Staphylinidae comprising 4.66% of total other arthropod population obtained in this plot occupied second third and

fourth position respectively in order of dominance. Population of other groups were extracted very low in number and highly irregular in distribution pattern or completely absent from this site. Number of other arthropod fauna (Mean $\pm$ SE) obtained in each month showed maximum in April during 1979 and in February during 1980 (Table 26).

GARBAGE DUMPING DUNE SITE

Characteristics of sampling site: This is located at Kadapara, north-east corner of Subash Sarobar (Lake) of Calcutta. It was a garbage dumping ground, now not in use since 1973. Besides the high concentration of organic and inorganic nutrients, these contain organic (Phenoles) and inorganic (heavy metals) pollutants. From 1977 onwards the plantation by the Forest Department has been initiated in order to find a basis for ecological recultivation measure on garbage tips. The dumping dune is about 30-40 metre high and it includes four sampling plots each measuring 12 metre square. Samples have been taken from the foot, middle and top of the dune in all directions (south, north, east, west).

Vegetation :

Above ground : The plots were thickly covered with grasses, sedges, shrubs and herbs like *Cynodon dactylon*, *Echinochloa colonum*, *Panicum* sp., *Boerhaavia repens*, *Achyranthes aspera*, *Rcinus communis*, *Commelina bengalensis*, *Cyperus rotundus*, *Eragrostis cynosuroides* and *Digitaria sanguinalis* and planted trees like *Acacia moniliformis* and *Caesalpinia pulcherrima*.

Underground : Fungi obtained from this site belonged to 57 species under 37 genera (Table 1). Genus *Aspergillus* was the most dominant. Maximum fungi population were found in the month of July (39,000/gm. soil in 1979 and 41,000/gm. soil in 1980) and minimum in the month of May (Table 27).

Soil factors and heavy metal content : Soils of these plots were Gangetic alluvium in nature, blackish in colour, clay-loam in texture with well developed humus. pH varied from 7.03 to 7.45. In April and May moisture content of soil were 16.20% and 12.30% respectively in 1979, 15.5% respectively in 1980. During July in each sampling year moisture content in the soil was maximum (26.5% in 1979 and 22.5% in 1980). In May other soil factors like organic carbon, nitrate and temperature were 2%, 1.88 ppm and 35.2°C respectively in 1979, 2.10%, 1.87 ppm and 36.25°C respectively in 1980. The contents of metal pollutants such as chromium, copper and lead in May were 76.43 ppm, 145.20 ppm and 68.98 ppm respectively in

Table 25

Showing species of collembola and their month-wise population number expressed in percentage at sewage canal embankment site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Isotomiella minor</i>	0.58	0.49	0.29	—	0.29	0.29	0.19	0.29	—	—	0.88	0.88
<i>Subisotoma fitchioides</i>	0.49	0.58	0.39	0.49	—	0.19	0.19	0.19	0.29	0.29	0.68	0.68
<i>Isotomina thermophila</i>	0.68	0.39	0.39	0.49	0.49	—	0.19	0.19	0.19	0.39	0.78	0.68
<i>Folsomides parvulus</i>	0.58	0.39	0.49	0.29	—	0.19	0.19	0.19	0.29	0.39	1.27	0.58
<i>Isotomurus ciliatus</i>	0.19	0.10	0.19	—	0.19	0.10	0.10	0.10	0.19	0.19	0.19	0.29
<i>Cyphoderus assimilis</i>	0.10	0.10	—	—	—	—	0.10	0.10	0.10	0.10	0.19	0.19
<i>Lepidocyrtus (Acrocyrtus) scaber</i>	0.19	0.19	—	—	—	—	—	0.10	0.19	0.19	0.29	0.29
<i>Folsomina sp.</i>	0.19	0.19	0.19	0.19	—	—	0.10	0.10	0.10	0.10	0.29	0.39
<i>Brachystomella sp.</i>	0.19	0.10	0.19	—	—	0.10	0.10	0.10	0.19	0.19	0.19	0.19
Total	3.22	2.53	2.14	1.46	0.97	0.88	1.17	1.36	1.56	1.85	4.78	4.19

Table 25 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at sewage canal embankment site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept	Oct.	Nov.	Dec.
<i>Isotomiella minor</i>	0.78	0.78	0.39	—	0.29	0.29	0.29	0.19	0.29
<i>Subisotoma fitchioides</i>	0.68	0.78	0.68	0.29	—	0.29	0.39	0.39	0.29
<i>Isotomina thermophila</i>	0.88	0.39	0.39	0.49	0.58	—	0.39	0.29	0.39
<i>Folsomides parvulus</i>	0.49	0.68	0.39	0.58	—	0.29	0.19	0.19	0.19
<i>Isotomurus ciliatus</i>	0.19	0.19	0.10	—	0.19	0.10	0.10	0.10	0.10
<i>Cyphoderus assimilis</i>	0.19	0.29	—	—	—	—	0.10	0.10	0.10
<i>Lepidocyrtus (Acrocyrtus) scaber</i>	0.29	0.19	0.19	—	—	—	0.10	—	0.10
<i>Folsomina</i> sp.	0.29	0.19	0.19	0.29	—	—	0.10	0.10	0.10
<i>Brachystomella</i> sp.	0.19	0.19	0.19	—	—	0.19	0.10	0.10	0.10
Total	4.00	3.70	2.53	1.66	1.07	1.17	1.70	1.46	1.75

Table 26

Showing groups of other arthropods and their month-wise population number expressed in percentage at sewage canal embankment site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.12	0.35	0.46	0.23	0.29	0.17	0.23	0.29	0.35	—	0.35	0.23
Mesostigmata	1.15	1.09	0.58	0.46	0.29	0.23	0.46	0.23	0.51	0.86	1.73	1.84
Cryptostigmata	1.61	1.15	0.92	0.69	0.40	0.35	0.23	0.40	0.35	0.51	2.19	1.73
COLEOPTERA												
Ptiliidae	0.17	0.12	0.12	0.17	0.06	0.12	0.06	0.12	0.12	0.12	0.29	0.29
Staphylinidae	0.12	0.17	0.12	0.12	0.06	0.06	0.06	0.06	0.12	0.06	0.17	0.17
Larvae	0.06	0.06	0.06	—	0.06	0.06	0.06	0.06	—	—	0.12	0.12
DIPTERA												
Larvae	0.12	0.12	0.12	—	—	—	—	0.06	—	—	0.06	0.23
DIPLURA	—	—	—	—	0.12	0.06	—	—	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—	—	—	—
Other unidentified	0.23	0.12	0.06	—	—	—	—	—	0.23	0.23	0.17	0.12
Total	3.57	3.17	2.42	1.67	1.27	1.04	1.09	1.21	1.67	1.79	5.07	4.72

Table 26 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at sewage canal embankment site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.35	0.29	0.35	—	0.23	0.17	0.23	0.17	0.12
Mesostigmata	1.73	1.15	0.81	0.75	0.35	0.29	0.40	0.29	0.58
Cryptostigmata	1.15	1.27	1.21	0.69	0.40	0.58	0.23	0.35	0.51
COLEOPTERA									
Ptiliidae	0.17	0.12	0.12	0.06	0.12	0.17	0.17	0.06	0.12
Staphylinidae	0.12	0.17	0.06	0.06	0.06	0.06	0.06	0.12	0.06
Larvae	0.06	0.06	0.12	—	—	—	—	—	—
DIPTERA									
Larvae	0.12	0.12	0.06	—	—	—	0.12	0.06	—
DIPLURA	0.06	—	0.12	—	0.12	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—
Other unidentified	0.06	0.17	0.12	—	—	0.06	0.06	—	0.12
Total	3.80	3.34	2.88	1.56	1.27	1.32	1.50	1.15	1.73

Table 27

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at Garbage dumping June site.

April, 1979—December, 1980

Date	Collembola			Other arthropods			Fungi (per gm soil in thousand)
	Mean	$\pm$	SE	Mean	$\pm$	SE	
1979							
April	10.40	$\pm$	2.31	14.80	$\pm$	1.65	15
May	9.60	$\pm$	0.87	14.40	$\pm$	2.01	12
June	11.80	$\pm$	0.68	13.40	$\pm$	2.11	17
July	63.80	$\pm$	6.29	73.60	$\pm$	1.40	39
August	51.60	$\pm$	4.80	39.40	$\pm$	2.87	31
September	22.40	$\pm$	2.48	40.80	$\pm$	6.39	29
October	18.80	$\pm$	0.66	23.60	$\pm$	4.60	25
November	19.40	$\pm$	3.07	31.50	$\pm$	1.02	21
December	29.40	$\pm$	6.66	32.20	$\pm$	1.24	24
1980							
January	27.60	$\pm$	1.50	31.80	$\pm$	5.76	23
February	15.80	$\pm$	2.22	19.60	$\pm$	3.39	17
March	9.80	$\pm$	0.97	13.40	$\pm$	1.96	14
April	13.00	$\pm$	1.64	17.60	$\pm$	1.03	18
May	8.60	$\pm$	1.40	13.00	$\pm$	1.64	14
June	9.00	$\pm$	1.67	13.80	$\pm$	2.31	15
July	59.60	$\pm$	2.40	76.40	$\pm$	1.63	41
August	43.60	$\pm$	5.00	50.40	$\pm$	4.47	39
September	41.40	$\pm$	3.54	47.00	$\pm$	3.36	35
October	17.60	$\pm$	1.03	36.40	$\pm$	1.94	27
November	15.00	$\pm$	2.02	38.00	$\pm$	2.45	28
December	23.00	$\pm$	1.14	40.00	$\pm$	9.79	30

1979, 69.75 ppm, 124 ppm, 60.54 ppm respectively in 1980. Amount of organic carbon contain was maximum in July, pollutants were more or less minimum during this month (Figures 6-6f). Mechanical analysis of soil sampled showed high percentage of silt and clay (Table 3).

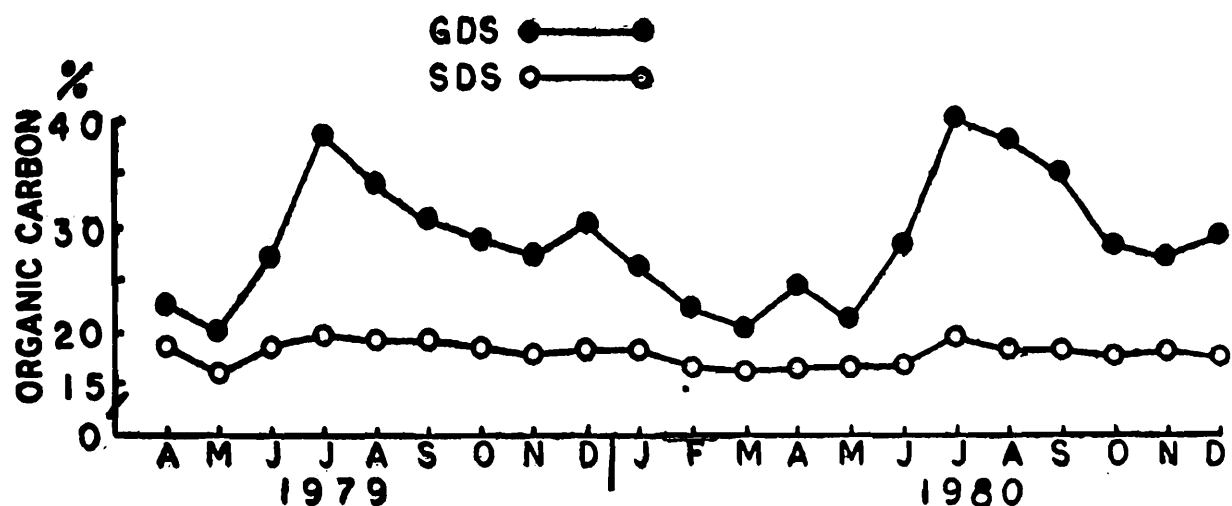


Fig. 6. Showing monthly fluctuations of Organic Carbon (%) in GDS and SDS sites.

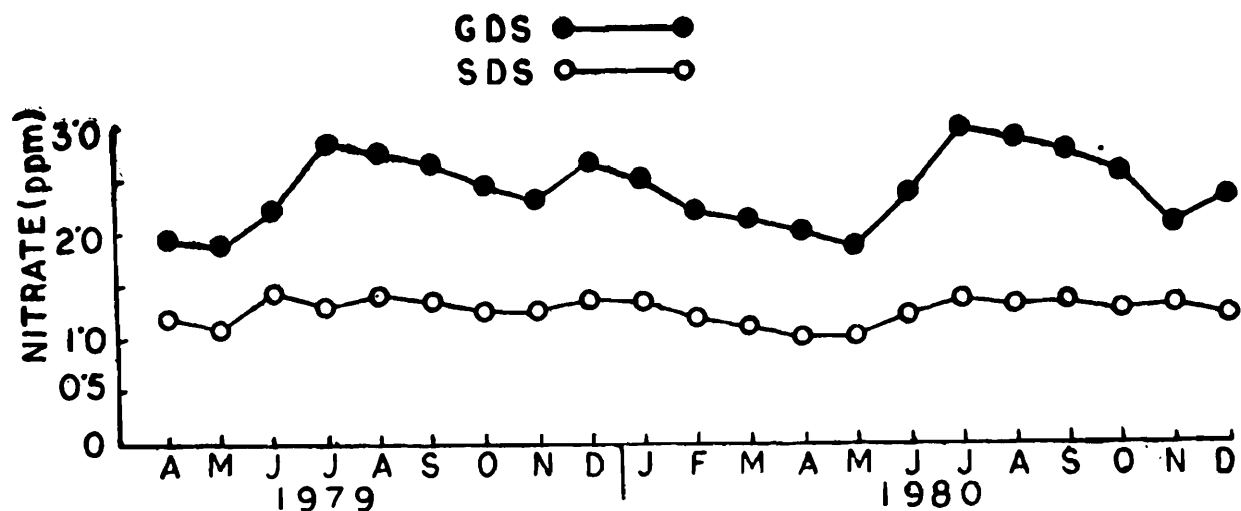


Fig. 6a. Showing monthly fluctuations of nitrate (ppm) in GDS and SDS sites.

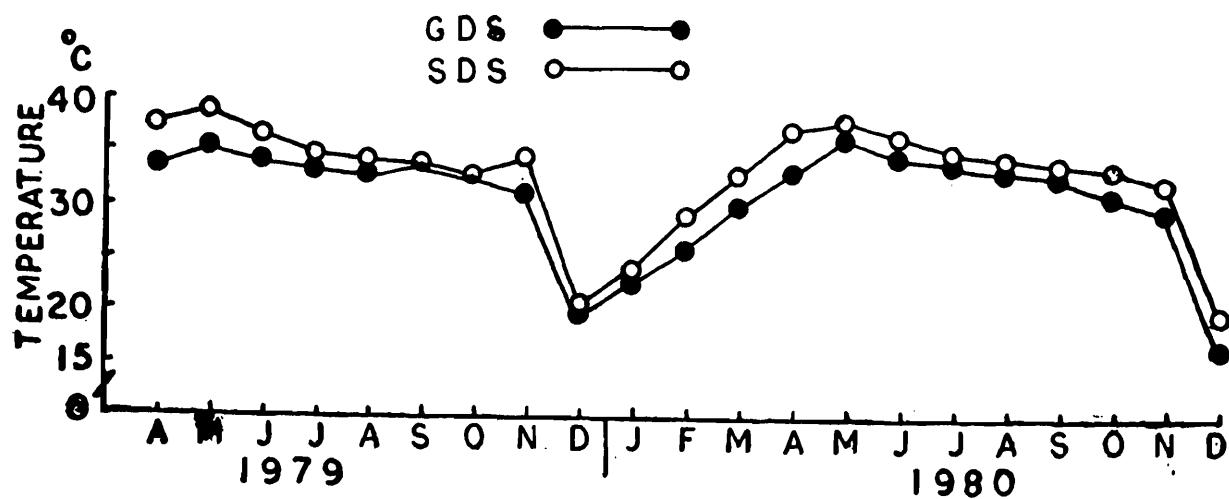


Fig. 6b. Showing monthly fluctuations of temperature (°C) in GDS and SDS sites.

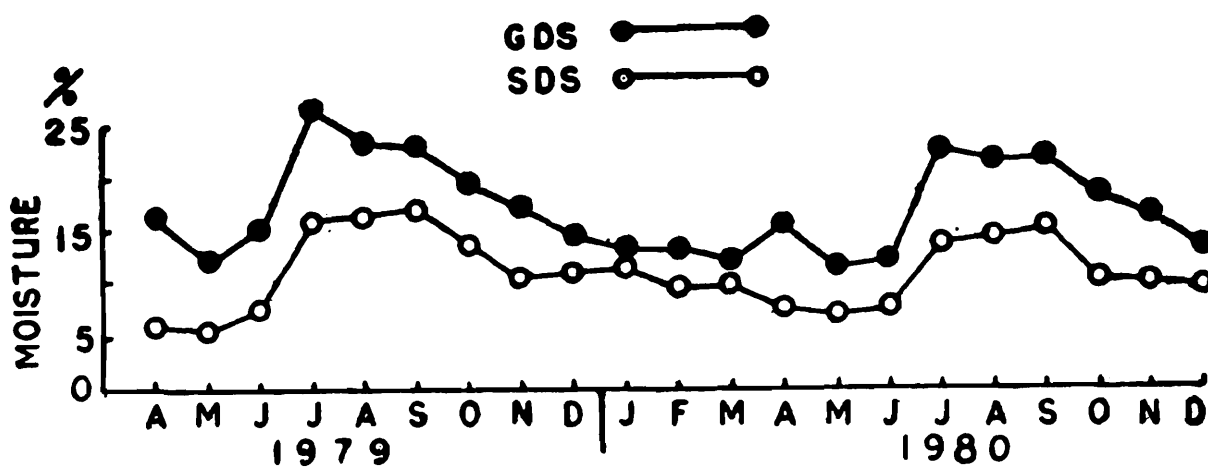


Fig. 6c. Showing monthly fluctuations of moisture (%) in GDS and SDS sites.

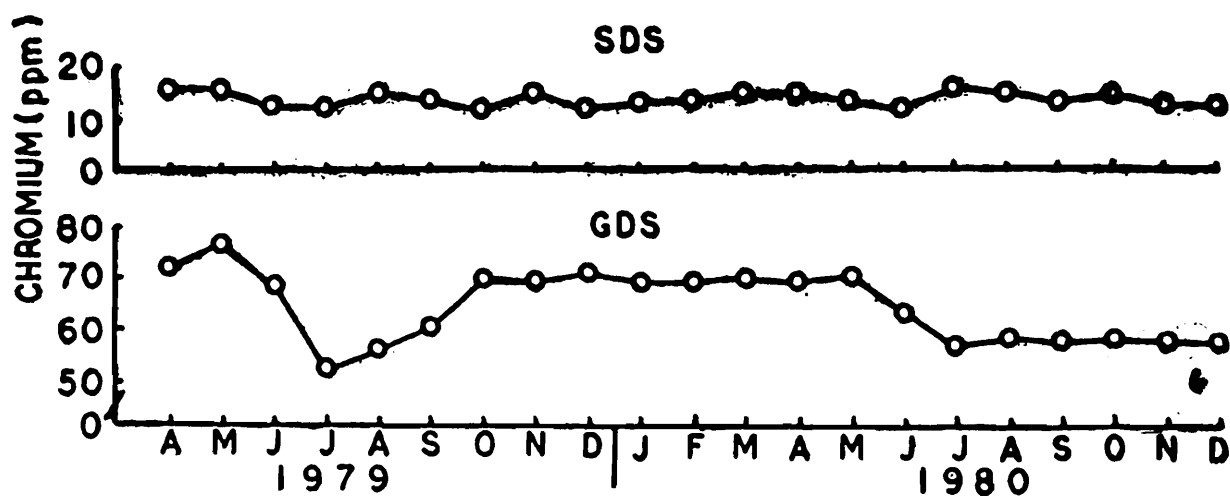


Fig. 6d. Showing monthly fluctuations of Chromium (ppm) in SDS and GDS sites.

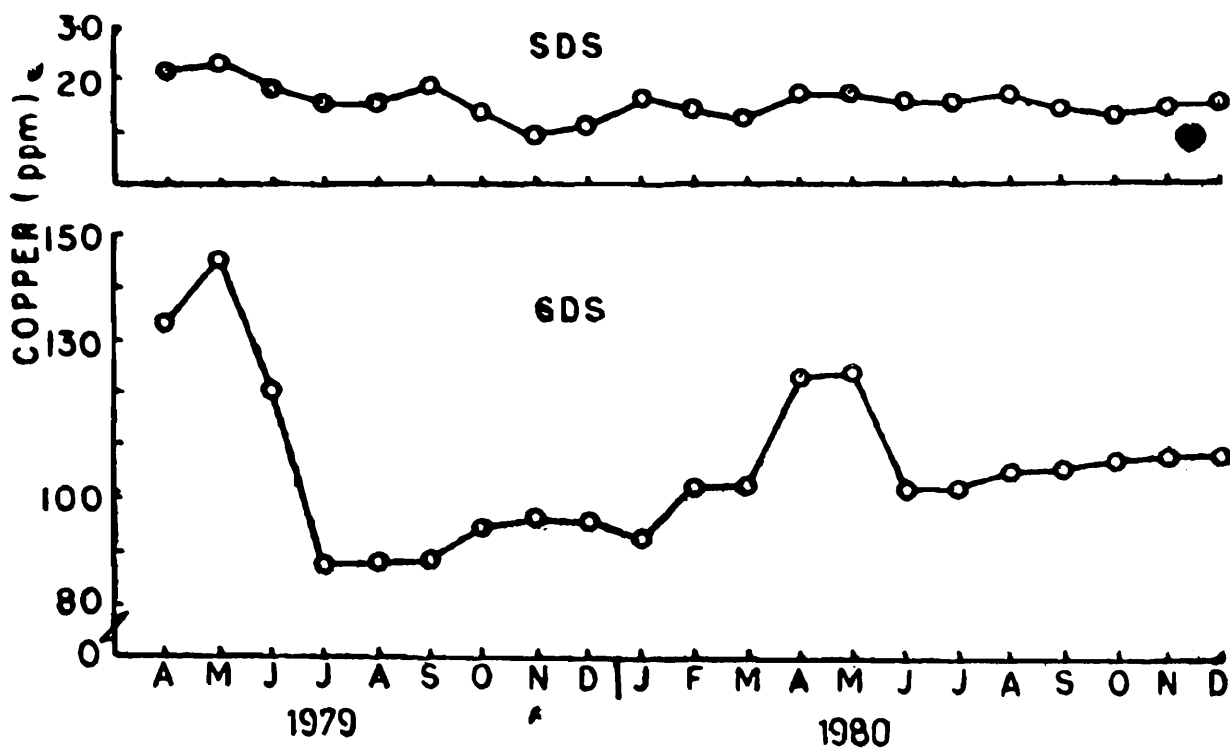


Fig. 6e. Showing monthly fluctuations of Copper (ppm) in SDS and GDS sites.

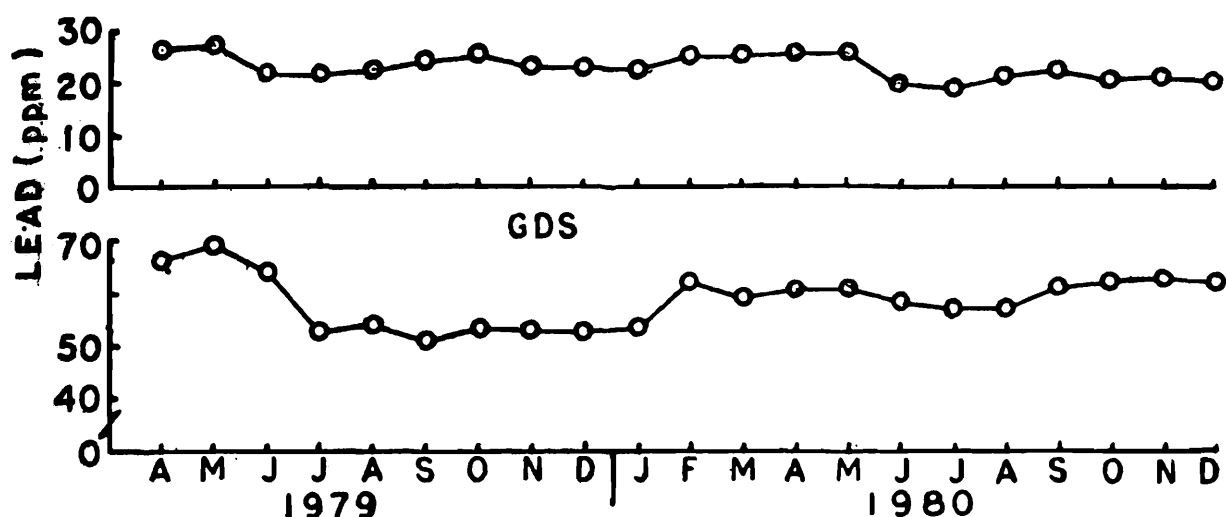


Fig. 6f. Showing monthly fluctuations of Lead (PPm) in SDS and GDS sites.

Faunal make up :

Collembola population : The collembolans extracted from this site belonged to ten genera such as *Isotomiella*, *Megalothorax*, *Cyphoderus*, *Sphaeridia*, *Drepanura*, *Lepidocyrtus*, *Isotomina*, *Brachystomella*, *Stenognathellus* and *Isotomurus* (Table 28). The species *Isotomiella minor* was the most dominant form being extracted from almost all the soil samples and comprising 25.74% of total population collected from this site. *Megalothorax minimus* and *Lepidocyrtus (Ascocyrtus) medius* comprising 21.74% and 16.4% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Cyphoderus albinus*, *Sphaeridia* sp., *Isotomina thermophila*, *Isotomiella* sp., *Brachystomella* cf. *curvula*, *Stenognathellus* sp. and *Isotomurus ciliatus* were numerically low and irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 27) showed maximum population usually in July when soil factors like moisture, organic carbon and nitrate were all at higher levels. Partial increase of population in December and January was found, might be due to the prevalence of winter maxima of some species of collembola (Table 28).

Other arthropod population : The microarthropods extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina), Diplura and Protura and the macroarthropods belonged to Ptiliidae, Staphylinidae and larvae (Coleoptera), larvae of Diptera and other unidentified groups (Table 29). Suborder Prostigmata was the most dominant being found in all samples and comprising 30.68% of total population of other arthropod in this plot. Cryptostigmata comprising 25.99%, Mesostigmata comprising 16.79%, other unidentified groups comprising 7.65% and Staphy-

Table 28

Showing species of collembola and their month-wise population number expressed in percentage at
Garbage dumping dune site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Isotomiella minor</i>	0.23	0.26	0.41	1.74	3.01	1.22	1.16	0.87	—	1.51	0.84	0.29
<i>Megalothorax minimus</i>	0.29	0.32	0.23	3.19	1.13	0.52	—	0.64	1.74	0.58	0.55	0.20
<i>Cyphoderus albinus</i>	0.23	—	0.26	1.45	0.87	0.58	0.48	0.23	0.78	0.84	0.43	—
<i>Sphaeridia</i> sp.	—	—	0.06	0.26	0.20	0.14	0.14	0.09	0.27	0.12	—	—
<i>Drepanura</i> sp.	—	—	0.09	0.23	0.23	0.12	0.20	0.14	0.14	—	—	—
<i>Lepidocyrtus</i> (L) <i>medius</i>	0.46	0.35	0.35	1.13	0.99	—	0.29	0.43	0.84	0.49	0.20	0.55
<i>Isotomina thermophila</i>	0.09	0.14	—	0.49	0.20	0.09	0.14	0.14	0.12	0.09	0.09	0.09
<i>Isotomiella</i> sp.	0.06	0.17	0.09	0.32	0.23	0.12	—	0.06	—	0.14	0.06	0.20
<i>Brachystomella</i> cf. <i>curvula</i>	—	—	0.06	0.14	0.17	0.14	0.17	0.12	0.20	0.12	—	—
<i>Stenognothellus</i> sp.	—	—	0.12	0.23	0.26	0.20	0.12	0.09	0.17	—	—	—
<i>Isotomurus ciliatus</i>	0.14	0.14	0.06	0.06	0.17	0.12	—	—	0.09	0.12	0.12	0.09
Total	1.51	1.39	1.71	9.24	7.48	3.25	2.72	2.81	4.26	4.00	2.29	1.42

Table 28 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at
Garbage dumping dune site

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Isotomiella minor</i>	0.26	0.23	0.32	3.07	0.84	1.25	1.04	0.87	—
<i>Megalothorax minimus</i>	0.29	0.35	0.26	1.42	2.17	1.19	—	—	1.33
<i>Cyphoderus albinus</i>	4.35	—	0.20	0.90	0.72	1.48	0.43	0.43	0.61
<i>Sphaeridia</i> sp.	—	—	0.03	0.20	0.17	0.12	0.20	0.09	0.06
<i>Drepanura</i> sp.	—	—	0.06	0.23	0.14	0.14	0.26	0.12	0.09
<i>Lepidocyrtus</i> (L) <i>medius</i>	0.46	0.23	0.23	1.71	1.30	1.23	—	0.38	0.72
<i>Isotomina thermophila</i>	0.09	0.14	0.06	0.17	0.26	0.12	—	—	0.12
<i>Isotomiella</i> sp.	0.12	0.12	0.03	0.26	0.20	—	0.26	—	0.14
<i>Brachystomella</i> cf. <i>curvula</i>	0.14	—	0.03	0.23	0.17	0.14	0.14	0.12	0.06
<i>Stenognathellus</i> sp.	0.09	0.12	0.06	0.17	0.14	0.09	—	0.06	0.12
<i>Isotomurus ciliatus</i>	0.09	0.06	0.03	0.17	0.17	0.23	0.20	—	0.09
Total	1.88	1.25	1.30	8.55	6.32	6.00	2.55	2.17	3.33

linidae comprising 7.38% occupied second, third, fourth and fifth position respectively in order of dominance. Population of other groups particularly Diplura and Protura as extracted here were numerically low and highly irregular in distribution pattern. Number of other arthropod (Mean $\pm$ SE) obtained in each month (Table 27) revealed maximum population usually in July when soil factors like moisture, organic carbon and nitrate were also maximum. These fauna also showed partial increase of their population in December—January like collembola (Table 29).

SOIL DUNE SITE

Characteristics of sampling site : This artificial isolated soil dune is located at the junction of Bombay and Delhi road at Dankuni, about 20 km. west from Calcutta. It is about 20 metre high and included four sampling plots each 10 metre square. Soil samples were taken from all directions (East, West, South and North) and also the foot, middle and the top, of this dune.

Vegetation :

Above ground : All the plots were thickly covered with good number of herbs, shrubs, grasses and sedges viz., *Echinochloa* sp., *Digitaria adscendens*, *Cyperus rotundus*, *Eclipta alba*, *Ageratum conyzoides*, *Sporobolus diander*, *Arundinella* sp., and *Heliotropium indicum* and trees planted by Forest Department viz., *Peltophorum* sp., *poinciana regia* and *Acacia moniliformis* were also present.

Underground : Soil fungi obtained from this site belonged to 37 species under 27 genera (Table 1). Genus *Aspergillus* was most dominant and occurred frequently. Maximum fungi population were found in the month of July in 1979 (9,000/gm. soil) and in December, 1980 (20,000/gm. soil) and minimum in May (Table 30).

Soil factors and heavy metal content : Soils of these plots were alluvium in nature, dark brown in colour and clay loam in texture. pH varied from 7.00 to 7.25. In April and May moisture content of soil was 6.3% and 5.50% respectively in 1979, 7.6% and 7% respectively in 1980. Month of August in each sampling year showed maximum water content (16.12% in 1979 and 14.3% in 1980). In May heavy metals like chromium, copper and lead content of soil was maximum except copper in 1980, which showed maximum in April (chromium 15.35 ppm and 14.75 ppm. respectively in 1979 and 1980, copper 23.54 ppm in 1979, lead 27.53 ppm and 26 ppm respectively in 1979 and 1980). In May other edaphic factors such as organic carbon, nitrate and temperature were 1.62%, 1.10 ppm, 33.2°C respectively in 1979, 1.69%,

Table 29

Showing groups of other arthropods and their month-wise population number expressed in percentage at Garbage dumping dune site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.52	0.45	0.61	2.70	1.12	1.26	0.92	—	1.35	1.24	0.47	0.34
Mesostigmata	0.40	0.22	0.16	0.63	0.22	0.40	0.34	0.20	0.27	0.45	0.16	0.09
Cryptostigmata	0.47	0.34	0.25	2.47	1.84	1.53	1.06	0.61	1.12	1.28	0.63	0.45
COLEOPTERA												
Ptiliidae	—	0.02	0.04	0.16	0.20	0.18	0.04	0.07	0.11	0.22	0.27	0.18
Staphylinidae	0.09	0.04	0.13	0.34	0.49	0.27	0.07	0.22	0.31	0.34	0.38	0.27
Larvae	0.02	0.11	0.07	0.49	0.25	0.34	—	0.13	—	—	0.04	0.09
DIPTERA												
Larvae	0.04	0.09	0.09	0.34	0.07	0.09	0.07	0.13	—	—	—	—
DIPLURA												
	—	—	0.07	0.09	0.04	0.02	0.04	0.02	—	—	—	—
PROTURA												
	—	—	—	—	0.02	0.04	—	—	—	—	—	—
Other unidentified	0.11	0.11	0.09	1.06	0.16	0.45	0.11	0.27	0.45	0.04	0.25	0.90
Total	1.66	1.39	1.51	8.28	4.43	4.59	2.65	2.45	3.62	3.58	2.20	1.51

Table 29 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Garbage dumping dune site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.38	0.34	0.31	1.78	2.29	1.87	1.66	1.12	1.57
Mesostigmata	0.27	0.13	0.20	1.84	1.55	1.33	0.88	1.53	1.17
Cryptostigmata	0.49	0.40	0.43	1.66	0.74	1.21	0.61	1.10	0.85
COLEOPTERA									
Ptiliidae	0.09	0.04	0.16	0.67	0.47	0.29	0.38	0.16	0.29
Staphylinidae	0.16	0.22	0.20	0.88	0.34	0.22	0.29	0.11	0.16
Larvae	0.04	0.04	0.04	0.09	0.04	0.04	0.04	0.09	0.13
DIPTERA									
Larvae	0.09	0.04	0.09	0.16	0.11	0.20	0.09	0.04	0.11
DIPLURA	—	—	0.02	0.04	0.02	0.04	—	—	—
PROTURA	—	—	—	0.02	—	0.02	—	—	—
Other unidentified	0.45	0.04	0.09	1.44	0.09	0.04	0.11	0.11	0.18
Total	1.98	1.46	1.55	8.59	5.67	5.29	4.09	4.27	4.50

Table 30

Showing monthly population of fauna (Mean $\pm$ SE) and flora
flora (Fungi/gm. soil in thousand) at soil dune site.

April, 1979—December, 1980

Date	Collembola			Other arthropods			Fungi (per gm. soil in thousand)
	Mean	±	SE	Mean	±	SE	
1979							
April	2.80	±	1.38	4.60	±	1.57	2
May	2.40	±	0.81	3.80	±	1.68	1
June	3.40	±	1.72	4.80	±	1.48	3
July	21.40	±	3.04	19.40	±	0.93	9
August	17.80	±	2.08	16.80	±	1.65	7
September	13.40	±	2.42	13.80	±	2.35	4
October	10.40	±	2.31	11.20	±	4.92	3
November	8.20	±	0.66	8.00	±	0.71	5
December	8.60	±	0.93	10.40	±	3.07	6
1980							
January	7.60	±	0.87	8.80	±	2.76	4
February	4.40	±	1.75	6.20	±	1.16	3
March	3.60	±	1.75	5.40	±	1.50	3
April	4.00	±	1.58	5.50	±	1.21	4
May	3.40	±	1.21	5.00	±	1.22	3
June	5.40	±	1.50	6.40	±	1.32	5
July	11.80	±	1.68	26.40	±	1.72	17
August	10.40	±	3.13	17.80	±	1.59	16
September	9.60	±	2.50	14.40	±	1.32	13
October	6.40	±	1.32	9.80	±	0.86	17
November	6.80	±	3.30	10.20	±	2.81	18
December	7.80	±	2.76	11.00	±	2.81	20

1 ppm and 37.5°C respectively in 1980. Organic carbon content was found to be maximum in July. Values of soil factors during other months have been presented in figures 6-6f. Mechanical analysis of soil sample showed high percentage of clay and fine sand (Table 3).

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to fourteen genera such as *Lepidocyrtus*, *Subisotoma*, *Isotoma*, *Isotomurus*, *Isotomina*, *Cyphoderus*, *Proisotoma*, *Xenylla*, *Hypogastrura*, *Sphaeridia*, *Calx*, *Tullbergia*, *Brachystomella* and *Entomobrya* (Table 31). Species *Isotomina thermophila* was most dominant and being extracted from almost all the soil samples and comprising 21.11% of total population of collembola in this site. *Subisotoma fitchioides*, *Isotomurus ciliatus* comprising 18.75% and 18.28% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Lepidocyrtus* (*Acrocyrtus*) *scaber*, *Isotoma* sp., *Cyphoderus* sp., *Proisotoma* sp., *Xenylla* sp., *Hypogastrura* sp., *Calx* sp., *Tullbergia* sp., *Brachystomella* cf. *curvula* and *Entomobrya* sp. were numerically low and highly irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 30) showed maximum population in July when soil factors like organic carbon, moisture, nitrate were all in higher level in July—August and the amount of lead was in low level in July. Partial increase of population in December—January may be due to the prevalence of winter maxima of some species of collembola (Table 41).

Other arthropod population : Microarthropods extracted from this site belong to Prostigmata, Mesostigmata, Cryptostigmata (Acarina), Diplura and Protura and macroarthropod belonged to Ptiliidae, Staphylinidae and larvae (Coleoptera), larvae of Diptera and other unidentified groups (Table 32). Sub-order Prostigmata was most dominant were found in all soil samples and comprising (29.05%). Mesostigmata comprising (23.86%) and Cryptostigmata comprising 19.22%. Ptiliidae comprising 8.74% and Staphylinidae comprising 6.29% of total other arthropod population in this plot occupied second, third, fourth and fifth position respectively in order of dominance. Population of other groups particularly Protura and Diplura were extracted very low in number, obtained twice and six times respectively throughout period of sampling. Number of these fauna (Mean $\pm$ SE) obtained in each month (Table 30) showed maximum in July when soil factors like organic carbon, nitrate and moisture were in higher level and the amount of lead was in low in July (Figures 6-6f). Partial increase of population in December—January may be due to prevalence of winter maxima of some microarthropod groups (Table 32).

DURGAPUR CONTROL PASTURE SITE

Characteristics of sampling site: The site is located at Shyampur, in Durgapur Steel Plant complex. The locality has a large mango orchard,

Table 31

Showing species of collembola and their month-wise population number expressed in percentage at soil dune site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Lepidocyrtus (Acrocyrtus) scaber</i>	0.12	—	—	0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.03	0.06
<i>Subisotoma fitchioides</i>	—	0.06	0.14	0.84	0.61	0.38	—	0.23	0.20	0.26	0.12	0.17
<i>Isotoma</i> sp.	0.09	—	—	0.09	0.06	0.09	0.29	0.09	0.03	0.06	0.06	—
<i>Isotomurus ciliatus</i>	—	0.14	0.12	0.55	0.58	0.43	—	0.17	0.17	0.20	0.17	0.14
<i>Isotomina thermophila</i>	0.20	0.14	0.09	0.78	0.49	0.35	—	0.26	0.32	0.14	0.12	0.12
<i>Cyphoderus</i> sp.	—	—	0.03	0.06	0.03	0.09	0.23	—	0.06	0.06	0.03	—
<i>Proisotoma</i> sp.	—	—	—	0.03	0.09	0.06	0.29	0.09	0.09	—	—	0.03
<i>Xenylla</i> sp.	—	—	0.06	0.09	0.06	0.03	—	0.06	0.03	0.09	0.06	—
<i>Hypogastrura</i> sp.	—	—	0.03	0.06	0.14	0.09	0.20	0.03	0.06	0.12	0.03	—
<i>Sphaeridia</i> sp.	—	—	—	0.14	0.06	0.12	—	—	—	—	—	—
<i>Calx</i> sp.	—	—	—	0.12	0.09	0.06	0.09	0.06	0.06	—	—	—
<i>Tullbergia</i> sp.	—	—	—	0.09	0.12	0.03	0.06	0.09	0.03	—	—	—
<i>Brachystomella</i> cf. <i>curvula</i>	—	—	0.03	0.14	0.06	0.09	0.17	—	0.06	0.12	0.03	—
<i>Entomobrya</i> sp.	—	—	—	0.06	0.14	0.09	0.06	0.06	0.09	—	—	—
Total	0.41	0.35	0.49	3.10	2.58	1.94	1.51	1.19	1.25	1.10	0.64	0.52

Table 31 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at soil dune site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Lepidocyrtus (Acrocyrtus) scaber</i>	—	—	0.29	0.09	0.06	0.06	0.12	0.06	0.03
<i>Subisotoma fitchioides</i>	—	0.29	0.14	0.29	0.20	0.29	—	0.17	0.20
<i>Isotoma</i> sp.	0.12	—	—	0.06	0.09	0.06	0.14	0.06	0.06
<i>Isotomurus ciliatus</i>	0.17	—	0.17	0.52	0.29	0.20	—	0.20	0.23
<i>Isotomina thermophila</i>	0.14	0.14	0.20	0.23	0.35	0.26	0.52	0.14	0.17
<i>Cyphoderus</i> sp.	0.09	—	—	0.06	0.06	0.06	0.09	—	0.03
<i>Proisotoma</i> sp.	0.06	0.06	0.06	0.09	0.09	0.03	0.06	0.09	0.03
<i>Xenylla</i> sp.	—	—	0.06	0.06	0.03	0.09	—	0.03	0.06
<i>Hypogastrura</i> sp.	—	—	0.03	0.03	0.03	0.06	—	0.06	0.03
<i>Sphaeridia</i> sp.	—	—	—	0.03	0.06	0.03	—	—	0.06
<i>Calx</i> sp.	—	—	—	0.06	0.09	0.09	—	0.09	0.06
<i>Tullbergia</i> sp.	—	—	—	0.03	0.03	0.06	—	—	0.03
<i>Brachystomella</i> cf. <i>curvula</i>	—	—	—	0.09	0.09	0.09	—	0.03	0.09
<i>Entomobrya</i> sp.	—	—	0.06	0.09	0.06	0.03	—	0.06	0.06
Total	0.58	0.49	0.78	1.71	1.51	1.39	0.93	1.07	1.13

Table 32

Showing groups of other arthropods and their month-wise population number expressed in percentage at soil dune site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.20	0.18	0.20	0.49	0.45	0.47	0.65	0.20	0.47	0.43	0.20	0.16
Mesostigmata	0.13	0.09	0.13	0.40	0.70	0.38	0.27	0.22	0.27	0.20	0.16	0.20
Cryptostigmata	0.04	0.07	0.07	0.47	0.34	0.38	0.27	0.22	0.27	0.20	0.16	0.20
COLEOPTERA												
Ptiliidae	0.04	0.04	0.04	0.20	0.16	0.29	0.20	0.18	0.20	0.18	0.13	0.07
Staphylinidae	0.02	0.02	0.02	0.22	0.07	0.16	0.04	0.07	—	—	0.11	—
Larvae	—	—	0.02	0.04	0.04	0.07	—	0.04	0.07	0.09	0.02	0.07
DIPTERA												
Larvae	—	—	—	0.16	0.04	0.02	0.02	—	—	—	—	—
DIPLURA												
	—	—	—	0.07	0.02	0.02	0.02	0.09	0.02	0.04	0.02	0.04
PROTURA												
	—	—	—	—	0.02	—	0.04	—	—	—	—	—
Other unidentified	0.07	0.02	0.02	0.11	0.04	—	—	—	—	—	—	—
Total	0.52	0.43	0.54	2.18	1.89	1.55	1.26	0.94	1.17	0.99	0.70	0.61

Table 32 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at soil dune site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct	Nov.	Dec.
ACARINA									
Prostigmata	0.20	0.13	0.22	0.63	0.43	0.40	0.25	0.45	0.34
Mesostigmata	0.16	0.20	0.13	0.67	0.47	0.36	0.20	0.22	0.29
Cryptostigmata	0.11	0.07	0.18	0.58	0.45	0.31	0.22	0.16	0.40
COLEOPTERA									
Ptiliidae	0.09	0.07	0.09	0.29	0.20	0.11	0.16	0.16	0.11
Staphylinidae	0.07	0.04	0.04	0.34	0.16	0.16	0.07	0.07	0.04
Larvae	—	—	—	0.11	0.07	0.07	—	—	—
DIPTERA									
Larvae	—	—	—	0.07	0.04	0.04	—	—	—
DIPLURA	—	—	—	0.04	0.02	—	0.02	—	—
PROTURA	—	—	—	—	—	—	—	—	—
Other unidentified	—	0.04	0.04	0.20	0.16	0.16	0.18	0.09	0.04
Total	0.63	0.56	0.72	2.97	2.00	1.62	1.10	1.15	1.24

undisturbed and with thick under growth and it included four sampling plots, each 20 metre square.

Vegetation :

Above ground : The area was covered with sedges and grasses like *Echinochloa colonum*, *Digitaria adscendens*, *Eupatorium odoratum*, *Lantana camara*, *Cynodon dactylon*, *Achranthus aspera*, *Trema orientalis*, and *Ageratum conyzoides*. The plots were shaded by trees like *Mangifera indica*.

Underground : Soil fungi obtained from this site belonged to 33 genera distributed over 44 species. Genus *Aspergillus* was frequently occurred. Maximum population was found to occur in the month of August (42,000/gm. soil in 1979 and 39,000/gm. soil in 1980) and minimum in May (Table 33).

Soil factors and heavy metal content : Soils of these plots were slightly reddish brown in colour and sandy loam in texture. pH varied from 7.00 to 7.20. In April and May moisture content of soil was 10.5% and 9.2% respectively in 1979, 12.20% and 11.50% respectively in 1980. Month of July in each sampling year showed maximum moisture content (26.5% and 24.50% respectively in 1979 and 1980). In May other soil factors such as organic carbon, nitrate, temperature, chromium, copper and lead were 1.90%, 1.20 ppm, 38.5°C, 11.33 ppm, 9.20 ppm and 19.12 ppm respectively in 1979, 1.91%, 1.10 ppm, 39.5°C, 11.67 ppm, 9.33 ppm and 17.16 ppm respectively in 1980. Amount of organic carbon and nitrate were found to be maximum in July and chromium, copper and lead content were minimum in July (Figures 7-7f). Mechanical analysis of soil sample showed high percentage of fine sand (Table 3).

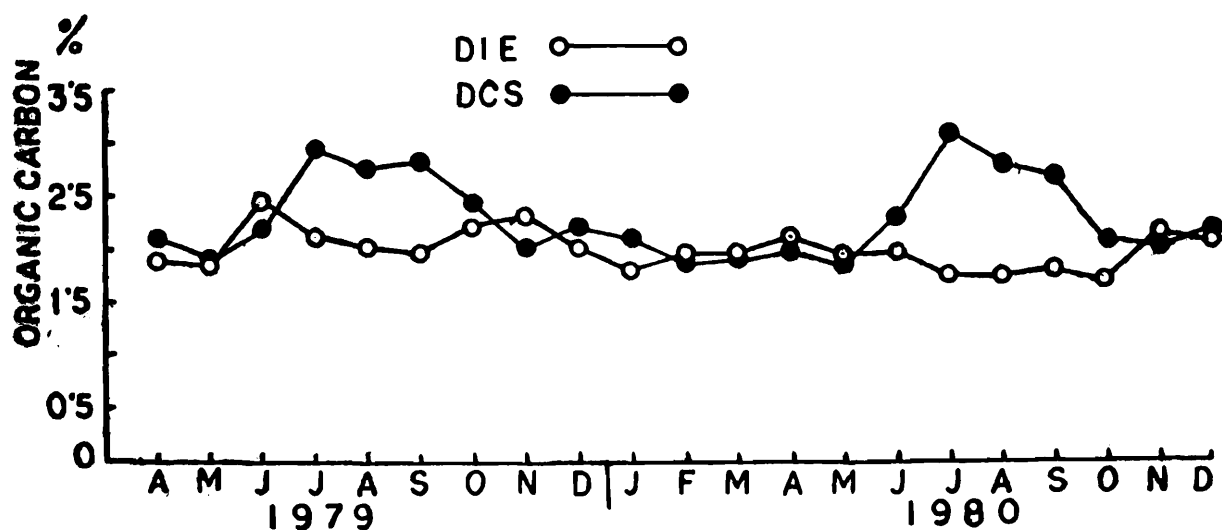


Fig. 7. Showing monthly fluctuations of Organic Carbon DIE and DCS (%) sites.

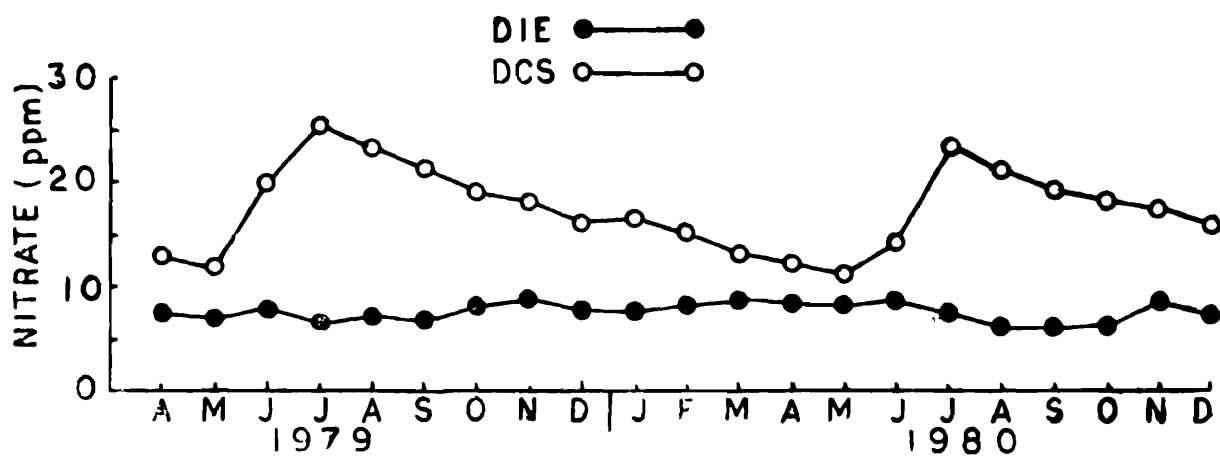


Fig. 7a. Showing monthly fluctuations of nitrate (ppm) in DIE and DCS sites.

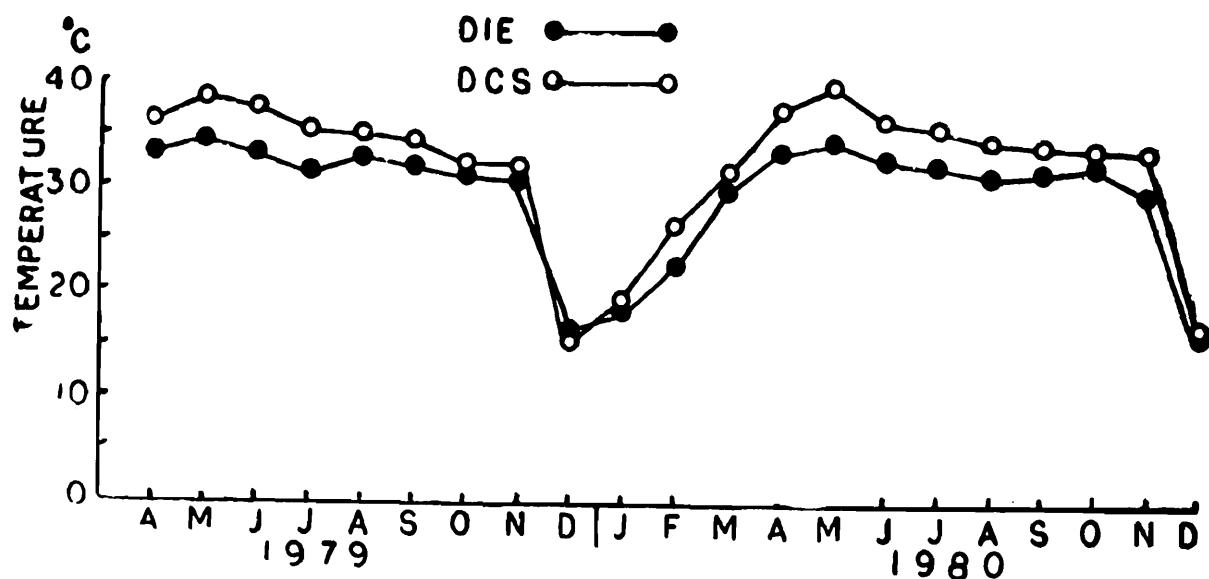


Fig. 7b. Showing monthly fluctuations of temperature (°C) in DIE and DCS sites.

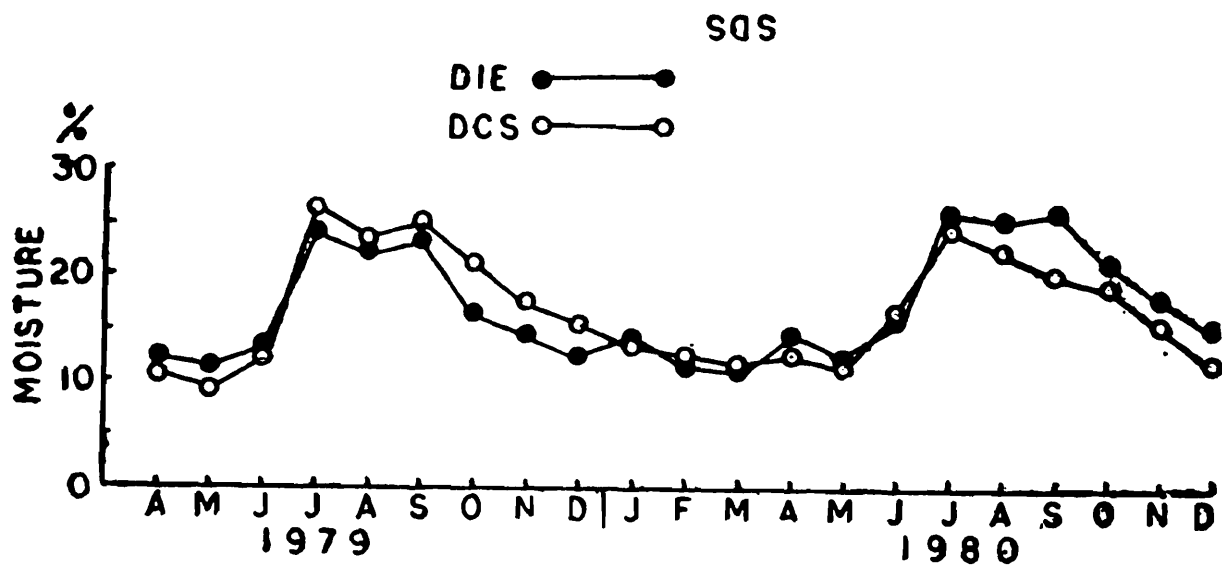


Fig. 7c. Showing monthly fluctuations of moisture (%) in DIE and DCS sites.

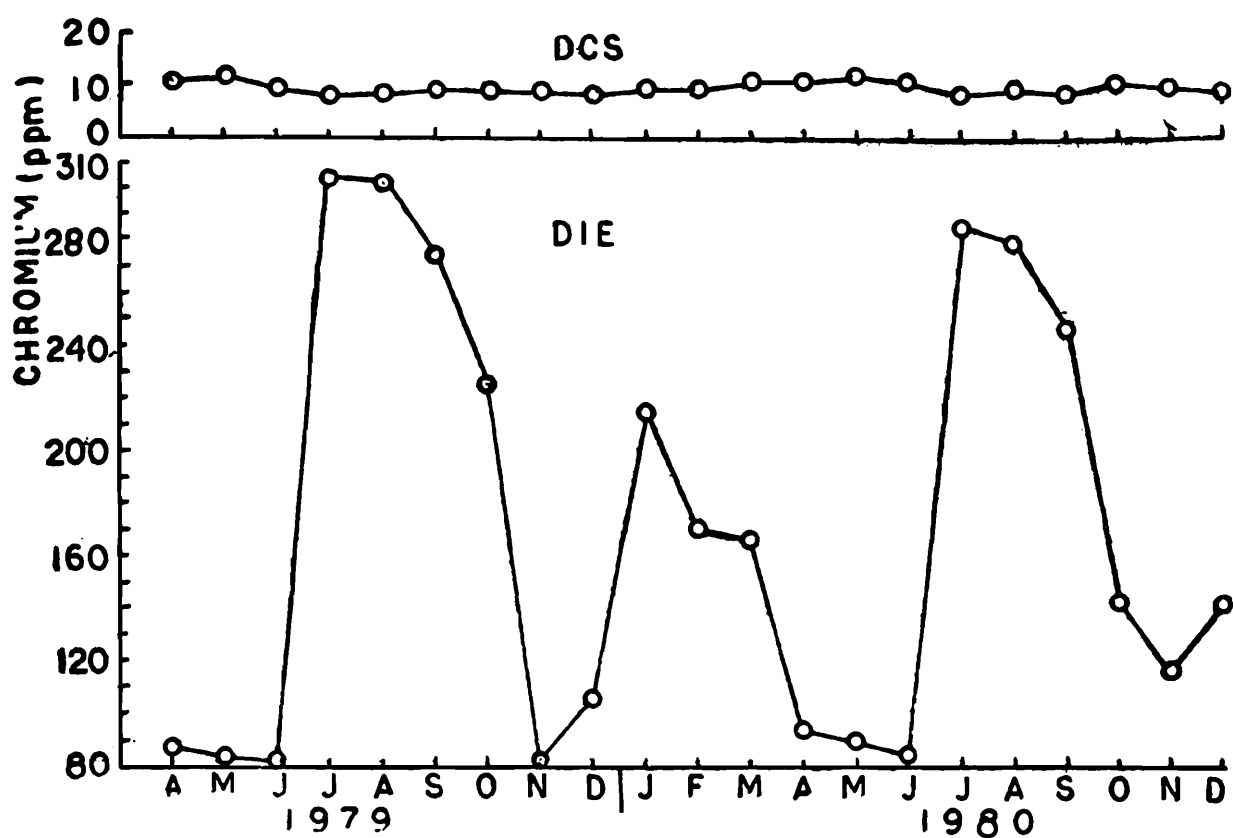


Fig. 7d. Showing monthly fluctuations of Chromium (ppm) in DCS and DIE sites.

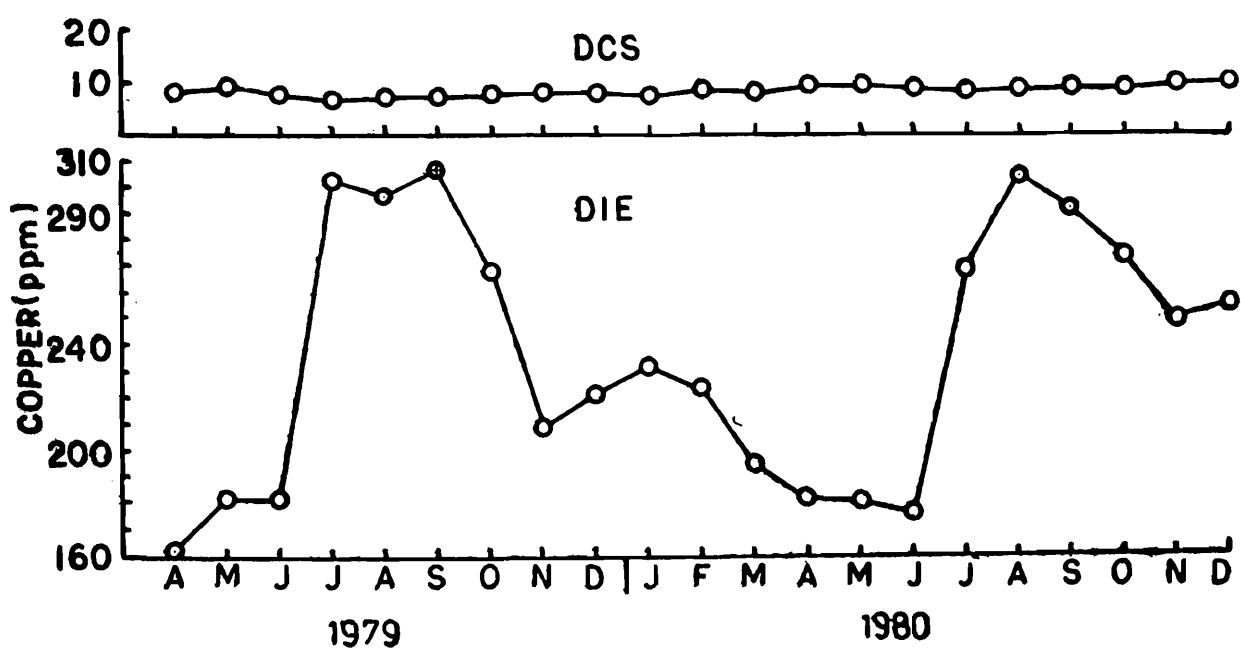


Fig. 7e. Showing monthly fluctuations of Copper (ppm) in DCS and DIE sites.

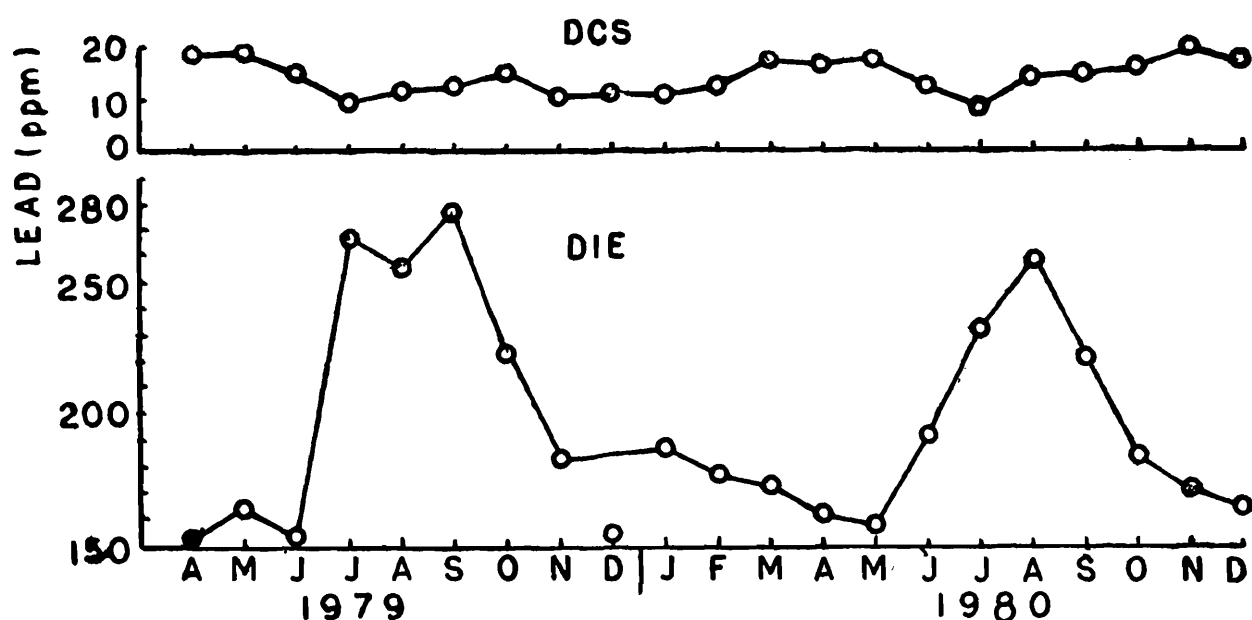


Fig. 7f. Showing monthly fluctuations of Lead (ppm) in DCS and DIE sites.

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to eleven genera as *Lepidocyrtus*, *Isotomina*, *Folsomides*, *Cyphoderus*, *Sminthurides*, *Sphaeridia*, *Xenylla*, *Subisotoma*, *Isotomiella*, *Stenognathellus* and *Entomobrya* (Table 34). Species *Lepidocyrtus* (*Acrocyrtus*) *scaber* was most dominant and being extracted from all the soil samples and comprising 25.52% of total collembola population and occupied first position in this site. *Isotomina interrupta* and *Isotomina thermophila* comprising 21.01% and 19.69% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Lepidocyrtus* (*Discoeyrtus*) *magnificus*, *Folsomides parvulus*, *Cyproderus albinus*, *Sminthurides appendiculatus*, *Sphaeridia* sp., *Xenylla* sp., *Subisotoma filchioides*, *Isotomiella minor*, *Stenognathellus* sp. and *Entomobrya* sp., were numerically low and highly irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 34) showed maximum population in July when soil factors like organic carbon and nitrate were also maximum and heavy metals chromium, copper and lead were minimum and soil fungi population were also maximum in July.

Partial increase of population in December—January may be due to prevalence of winter maxima of some species of collembola (Table 34).

Table 33

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at Durgapur control Pasture site.

April, 1979—December, 1980

Date	Collembola Mean $\pm$ SE			Other arthropod Mean $\pm$ SE			Fungi (per gm. soil in in thousand)
1979							
April	3.20	$\pm$	1.07	8.40	$\pm$	1.03	7
May	2.80	$\pm$	0.80	7.20	$\pm$	0.80	5
June	3.80	$\pm$	1.59	8.80	$\pm$	1.28	15
July	19.40	$\pm$	5.77	22.80	$\pm$	5.46	42
August	12.40	$\pm$	2.31	19.60	$\pm$	5.23	38
September	8.60	$\pm$	1.29	16.80	$\pm$	2.35	31
October	7.20	$\pm$	1.68	14.80	$\pm$	4.49	28
November	5.20	$\pm$	0.86	13.40	$\pm$	1.96	22
December	13.40	$\pm$	1.96	15.80	$\pm$	4.02	25
1980							
January	10.20	$\pm$	2.39	12.40	$\pm$	2.54	27
February	10.00	$\pm$	2.41	12.60	$\pm$	2.21	17
March	8.20	$\pm$	1.07	10.80	$\pm$	3.12	11
April	4.20	$\pm$	1.16	9.40	$\pm$	0.93	10
May	3.00	$\pm$	1.14	6.60	$\pm$	1.25	7
June	4.00	$\pm$	1.18	7.80	$\pm$	1.16	17
July	16.40	$\pm$	3.86	29.80	$\pm$	2.81	39
August	11.80	$\pm$	2.81	17.40	$\pm$	2.01	32
September	7.00	$\pm$	1.51	14.40	$\pm$	3.36	26
October	6.60	$\pm$	1.25	13.60	$\pm$	2.40	26
November	10.40	$\pm$	2.42	15.00	$\pm$	2.47	27
December	14.00	$\pm$	2.28	15.60	$\pm$	4.12	26

Table 34

Showing species of collembola and their month wise population number expressed in percentage at Durgapur control Pasture site.

April, 1979—March 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Lepidocyrtus (Discocyrtus) magnificus</i>	0.09	—	0.17	0.17	0.35	0.17	—	—	0.17	0.17	0.26	—
<i>Lepidocyrtus (Acrocyrtus) scaber</i>	0.26	0.35	0.26	1.74	2.26	1.13	0.96	0.61	1.31	1.57	0.87	1.83
<i>Isotomina thermophila</i>	0.26	0.35	0.44	1.66	0.87	1.05	—	0.52	0.87	0.78	1.57	1.05
<i>Isotomina interrupta</i>	0.26	0.35	0.26	1.48	0.70	0.87	1.48	0.52	1.13	0.96	0.70	—
<i>Folsomides parvulus</i>	—	—	0.09	0.44	0.17	—	—	0.17	0.17	0.09	0.17	—
<i>Cyphoderus albinus</i>	—	—	0.09	0.61	0.09	0.09	—	—	0.09	0.17	0.09	0.44
<i>sminthurides appendiculatus</i>	—	—	—	0.78	0.17	0.09	—	—	0.35	0.26	—	—
<i>Sphaeridia</i> sp.	—	—	—	0.35	0.17	0.09	0.26	—	0.26	—	—	—
<i>Xenylla</i> sp.	0.09	—	0.09	—	0.09	0.09	—	—	0.17	0.09	0.26	0.26
<i>Subisotoma fitchioides</i>	0.17	—	0.09	0.35	0.09	—	0.35	0.17	0.26	0.09	—	—
<i>Isotomiella minor</i>	0.09	0.17	0.09	0.44	—	0.17	—	0.09	0.35	0.09	0.17	—
<i>Stenognathellus</i> sp.	—	—	—	0.26	0.17	—	0.09	0.09	0.44	0.09	0.09	—
<i>Entomobrya</i> sp.	0.17	—	0.09	0.17	0.26	—	—	0.09	0.26	0.09	0.17	—
Total	1.39	1.22	1.66	8.45	5.40	3.75	3.14	2.26	5.84	4.44	4.36	3.57

Table 34 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at Durgapur control Pasture site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Lepidocyrtus (Discocyrtus) magnificus</i>	0.17	—	0.17	0.44	0.26	0.17	0.52	0.26	0.44
<i>Lepidocyrtus (Acrocyrtus) scaber</i>	0.44	0.26	0.26	2.18	1.83	0.52	—	—	1.57
<i>Isotomina thermophila</i>	0.35	0.35	0.44	1.13	0.87	0.78	—	1.57	0.70
<i>Isotomina interrupta</i>	0.26	0.44	0.26	1.74	0.61	0.61	1.48	1.05	1.48
<i>Folsomides parvulus</i>	—	—	0.17	0.17	0.17	0.17	—	0.35	0.17
<i>Cyphoderus albinus</i>	—	—	0.09	0.17	0.17	0.09	—	—	0.26
<i>Sminthurides appendiculatus</i>	—	—	—	0.17	0.09	0.09	—	—	0.26
<i>Sphaeridia</i> sp.	—	—	—	0.26	0.26	0.17	—	0.26	—
<i>Xenylla</i> sp.	0.17	0.17	0.09	0.17	0.09	0.09	0.26	0.17	0.17
<i>Subisotoma fitchioides</i>	0.17	0.09	0.09	0.17	0.17	0.17	0.35	0.17	0.26
<i>Isotomiella minor</i>	0.09	—	0.09	0.26	0.17	0.09	—	0.26	0.35
<i>Stenognathellus</i> sp.	—	—	—	0.09	0.17	—	0.26	0.09	0.17
<i>Entomobrya</i> sp.	0.17	—	0.09	0.17	0.26	0.09	—	0.35	0.26
Total	1.83	1.31	1.74	7.14	5.14	3.05	2.87	4.53	6.10

Table 35

Showing groups of other arthropods and their month-wise population number expressed in percentage at Durgapur control Pasture site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.48	0.58	0.63	2.11	2.01	1.00	1.58	1.06	1.53	1.11	0.74	1.16
Mesostigmata	0.95	0.37	0.48	1.37	1.00	1.11	0.74	0.69	1.00	0.74	1.00	0.53
Cryptostigmata	0.37	0.48	0.58	1.16	1.16	1.06	0.95	0.79	0.58	0.63	0.63	0.42
COLEOPTERA												
Ptiliidae	0.21	0.16	0.21	0.26	0.37	0.48	0.26	0.53	0.63	0.32	0.32	0.37
Staphylinidae	0.11	0.11	0.16	0.37	0.11	0.16	—	—	—	—	0.16	0.11
Larvae	—	—	0.11	0.21	0.16	0.21	—	—	—	—	0.11	—
DIPTERA												
Larvae	—	—	—	0.11	0.16	0.11	0.16	0.11	0.21	0.26	0.21	0.11
DIPLURA												
	—	—	0.11	4.16	0.11	0.11	0.05	0.05	—	—	—	—
PROTURA												
	—	—	0.05	0.05	—	0.11	0.05	—	—	—	—	—
Other unidentified	0.11	0.21	—	0.21	0.11	0.11	0.11	0.37	0.21	0.21	—	0.16
Total	2.22	1.90	2.32	6.02	5.17	4.44	3.91	3.54	4.17	3.27	3.17	2.85

Table 35 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at Durgapur control Pasture site.

April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.63	0.42	0.58	1.95	1.00	1.16	1.06	1.11	0.84
Mesostigmata	0.48	0.32	0.42	1.58	1.16	0.74	0.69	0.79	0.74
Cryptostigmata	0.58	0.48	0.48	1.74	0.53	0.84	0.53	1.06	1.64
COLEOPTERA									
Ptiliidae	0.32	0.37	0.26	0.63	0.69	0.37	0.48	0.37	0.58
Staphylinidae	0.21	0.11	0.16	0.79	0.48	0.16	—	—	—
Larvae	—	—	—	0.38	0.53	0.11	—	—	—
DIPTERA									
Larvae	—	—	—	0.48	0.05	0.11	0.11	0.11	0.11
DIPLURA	—	—	0.05	0.21	0.11	0.16	0.05	0.11	—
PROTURA	—	—	—	0.05	—	0.05	—	—	—
Other unidentified	0.26	0.05	0.11	0.05	0.05	0.11	0.53	0.42	0.21
Total	2.48	1.74	2.06	7.87	4.59	3.80	3.43	3.96	4.12

Other arthropod population : Microarthropod extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina), Diptera, Protura and macroarthropod belonged to Ptiliidae, Staphylinidae, larvae (Coleoptera), larvae of Diptera and other unidentified groups (Table 35). Sub-order Prostigmata was most dominant and found in all soil samples and comprising 29.52%, Mesostigmata comprising 21.92%, Cryptostigmata comprising 21.64%, Ptiliidae comprising 10.62% and Staphylinidae comprising 4.11% respectively, occupied first, second, third, fourth and fifth position in order of dominance of total other arthropod population. Population of other groups were extracted very low in number and highly irregular in distribution pattern. Total number of other arthropod fauna (Mean $\pm$ SE) obtained in each month (Table 33) showed maximum in July when soil factors like organic carbon and nitrate were also maximum in July.

Soil fungi population was also maximum in this month (Table 33). Partial increase in December—January may be due to prevalence of winter maxima of some groups (Table 35).

DURGAPUR INDUSTRIAL EFFLUENT SITE

Characteristics of sampling site : This site is located at Durgapur Steel Plant complex, near Durgapur Barrage on the Damador river. The area is an open large field, where the industrial effluents are continuously discharged from the Steel Plant through a canal. Four plots were selected for sampling, each plot was 22 metre square in measurement.

Vegetation :

Above ground : The area was covered mainly with *Ipomia* sp., *Cynodon dactylon* and *Panicum* sp. and few scattered trees like *Accacia arabica*.

Underground : Soil fungi obtained from this site belonged to twenty genera distributed over twenty-four species. Genus *Penicillium* was occurred most frequently. Maximum population was found in the month of December, 1979 (18,000/gm. soil) and in February in 1980 (17,000/gm. soil) and minimum in May (Table 36).

Soil factors and heavy metal content : Soils of these plots were black in colour (due to industrial pollutants) sandy loam in texture. pH varied from 6.63 to 6.94. In September maximum copper and lead content of soil were 307.46 ppm and 277.44 ppm respectively in 1979 and in 1980, These two factors were minimum in August and the amount were 304.11 ppm and 259.15 ppm respectively. The chromium content of soil was

Table 36

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at Durgapur industrial effluent site.

April, 1979—December, 1980

Date	Collembola			Other arthropods			Fungi (per gm. soil in thousand)
	Mean	±	SE	Mean	±	SE	
1979							
April	2.00	±	0.95	5.00	±	1.14	2
May	1.80	±	0.80	4.20	±	1.39	1
June	2.40	±	0.68	5.80	±	1.16	4
July	1.00	±	0.63	3.40	±	1.21	6
August	1.40	±	0.60	2.40	±	1.12	9
September	1.20	±	0.49	2.00	±	0.84	11
October	1.60	±	0.68	2.80	±	1.32	13
November	3.00	±	0.89	6.40	±	1.21	16
December	1.80	±	0.58	3.20	±	1.46	18
1980							
January	1.20	±	0.58	2.20	±	0.97	12
February	2.20	±	1.02	3.60	±	1.75	17
March	2.60	±	1.16	4.40	±	1.63	10
April	2.80	±	1.20	5.60	±	1.03	4
May	2.20	±	0.86	4.60	±	1.25	3
June	3.00	±	0.89	6.45	±	1.21	5
July	2.00	±	0.84	3.00	±	1.26	7
August	1.80	±	0.91	2.60	±	1.16	8
September	2.40	±	1.03	3.20	±	0.80	10
October	3.20	±	1.82	3.60	±	1.86	9
November	4.20	±	1.46	7.60	±	1.77	14
December	4.00	±	1.51	4.80	±	0.86	16

maximum in July in 1979 (304.11 ppm) and in August in 1980 (286.14 ppm). In September other soil factors such as organic carbon, nitrate and moisture were 1.95%, 0.68 ppm and 23.20% respectively in 1979, the content of these factors in August, 1980 were 1.75%, 0.63 ppm and 25.20% respectively. Month of April, May and November in both the

sampling year showed minimum chromium, copper and lead content and the values of other soil factors in different month of sampling period are presented in figures 7-7f. Mechanical analysis of soil sampled showed high percentage of silt (Table 3).

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to eight genera such as *Cyphoderus*, *Sphaeridia*, *Bourletiella*, *Entomobrya*, *Lepidocyrtus*, *Isotomina*, *Sminthurinus* and *Folsomides* (Table 37). Species *Isotomina thermophila* was most dominant and being extracted from almost all the soil samples and comprising 20.92% of the total population of collembola in this site. *Entomobrya* sp. and *Cyphoderus assimilis* comprising 20.50% and 19.67% respectively occupied second and third position in order of dominance. Population of other genera/species such as *Sphaeridia cornuta*, *Bourletiella* sp., *Lepidocyrtus* sp., *Sminthurinus* sp., and *Folsomides parvulus* were numerically low and irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 36) showed maximum population in November when soil factors like organic carbon and nitrate were also maximum. Partial increase of population in April and June may be due to low content of heavy metals during these months as evident from table 37.

Other arthropod population : Microarthropod extracted from this site belonged to Mesostigmata, Cryptostigmata (Acarina) and macroarthropod belonged to Ptiliidae, Staphylinidae, larvae (Coleoptera), larvae of Diptera and other unidentified groups (Table 38). Sub-order Mesostigmata was most dominant and was found in all soil samples, comprising 34.79%, Cryptostigmata comprising 32.49%, Ptiliidae comprising 11.06% and Staphylinidae comprising 8.06% of the total other arthropod population in this plot and occupied first, second, third and fourth position respectively in order of dominance. Population of Prostigmata, Diptera and Protura were completely absent from this plots and other groups were numerically very low in number and highly irregular in distribution pattern. Number of other arthropod fauna (Mean $\pm$ SE) in each month (Table 36) showed maximum in November, when soil factors like organic carbon and nitrate were also maximum (except organic carbon in 1979) (Figures 7-7f). Partial increase of population in April and June may be due to low content of heavy meals in these soil (Table 38).

UNMETALLED ROAD WAY SIDE

Characteristics of sampling site : This site is located at Bethuadohari, district Nadia, the unmetalled road originates from the national high way No. 34 and leads to Bethuadohari reserve forest. This road is unmetalled, only

Table 37

Showing species of collembola and their month-wise population number expressed in percentage at Durgapur industrial effluent site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Cyphoderus assimilis</i>	0.17	0.35	0.26	—	—	—	0.17	0.35	0.17	0.17	0.17	0.17
<i>Sphaeridia cornuta</i>	0.09	0.09	—	—	—	—	—	0.17	0.09	—	0.09	0.09
<i>Bourletiella</i> sp.	0.09	0.09	0.09	—	—	0.17	0.09	—	0.09	0.09	0.09	0.09
<i>Entomobrya</i> sp.	0.17	0.17	0.17	—	0.26	—	0.09	0.44	0.09	0.17	0.17	0.26
<i>Lepidocyrtus</i> sp.	0.09	—	0.09	—	—	—	0.09	0.17	0.09	—	0.09	0.09
<i>Isotomina thermophila</i>	0.09	0.09	0.26	—	0.35	0.26	0.09	0.09	0.09	—	0.17	0.17
<i>Sminthurinus</i> sp.	0.09	—	0.09	0.44	—	0.09	0.09	—	0.09	0.09	0.09	0.09
<i>Folsomides parvulus</i>	0.09	—	0.09	—	—	—	0.09	0.09	0.09	—	0.09	0.17
Total	0.87	0.78	1.05	0.44	0.61	0.52	0.70	1.31	0.78	0.52	0.96	1.13

Table 37 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at
Durgapur industrial effluents site.

Durgapur industrial effluent site.

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Cyphoderus assimilis</i>	0.17	0.26	0.26	—	0.35	—	0.52	0.26	0.26
<i>Sphaeridia cornuta</i>	0.09	0.09	0.17	—	—	—	—	0.17	0.09
<i>Bourletiella</i> sp.	0.09	0.09	0.09	—	—	—	0.17	0.17	0.17
<i>Entomobrya</i> sp.	0.26	0.26	0.26	—	0.44	—	0.26	0.44	0.35
<i>Lepidocyrtus</i> sp.	0.17	0.09	0.09	—	—	—	0.09	0.09	0.17
<i>Isotomina thermophila</i>	0.26	0.17	0.26	—	—	0.87	0.17	0.52	0.44
<i>Sminthurinus</i> sp.	0.09	—	0.09	0.87	—	0.17	0.09	0.09	0.17
<i>Folsomides parvulus</i>	0.09	—	0.09	—	—	—	0.09	0.09	0.17
Total	1.22	0.96	1.31	0.78	0.78	1.05	1.39	1.83	1.74

Table 38

Showing groups of other arthropods and their month-wise population number expressed in percentage at Durgapur industrial effluent site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	—	—	—	—	—	—	—	—	—	—	—	—
Mesostigmata	0.37	0.53	0.42	0.32	0.16	0.16	0.42	0.63	0.42	0.11	0.16	0.53
Cryptostigmata	0.42	0.32	0.63	0.26	0.26	0.21	0.11	0.53	0.11	0.26	0.42	0.32
COLEOPTERA												
Ptiliidae	0.16	0.05	0.16	0.16	0.11	0.11	0.05	0.16	0.11	0.11	0.11	0.11
Staphylinidae	0.11	0.11	0.11	0.05	0.11	0.05	0.05	0.11	0.11	0.05	0.11	0.05
Larvae	0.05	0.05	0.11	—	—	—	0.05	0.05	—	—	0.05	0.05
DIPTERA												
Larvae	0.16	0.05	0.05	—	—	—	0.05	0.05	—	—	0.11	0.11
DIPLURA	—	—	—	—	—	—	—	—	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—	—	—	—
Other unidentified	0.05	—	0.05	0.11	—	—	—	0.16	0.11	0.05	—	—
Total	1.32	1.11	1.53	0.90	0.63	0.53	0.74	1.69	0.84	0.58	0.95	1.16

Table 39 (Contd.)
 Showing groups of other arthropods and their month-wise population number expressed in percentage at
 Durgapur industrial effluent site.
 April, 1980—December, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	—	—	—	—	—	—	—	—	—
Mesostigmata	0.37	0.42	0.63	0.32	0.26	0.37	0.26	0.74	0.37
Cryptostigmata	0.58	0.48	0.53	0.11	0.16	0.26	0.21	0.84	0.42
COLEOPTERA									
Ptiliidae	0.16	0.11	0.16	0.16	0.11	0.11	0.11	0.11	0.16
Staphylinidae	0.11	0.11	0.11	0.11	0.11	0.05	0.11	0.05	0.11
Larvae	0.05	0.05	0.05	—	—	—	0.05	0.05	0.05
DIPTERA									
Larvae	0.11	0.05	0.11	—	—	—	0.05	0.16	0.11
DIPLURA	—	—	—	—	—	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—
Other unidentified	0.11	—	0.11	0.11	0.05	0.05	0.16	0.05	0.05
Total	1.48	1.21	1.69	0.78	0.69	0.84	0.95	2.01	1.27

carts and light vehicles are plying through this road. It included four sampling plots, each measured 12 m. $\times$ 5 m. parallel to the lower side of the road.

Vegetation :

Above ground : Plots were covered with grasses and sedges like *Echinochloa colonum*, *Cynodon dactylon*, *Dichanthium annulatum*, and *Digitaria adscendens* and also contains some scattered trees like *Shorea robusta*, and *Mangifera indica*.

Underground : Soil fungi obtained from this site belonged to 28 species distributed over 18 genera (Table 1). Genus *Penicillium* was most frequently occurred. Maximum population was found to occur in the month of July 12,000/gm. soil and 15,000/gm. soil in 1979 and 1980 respectively (Table 39).

Table 39

Showing monthly population of fauna (Mean $\pm$ SE) and flora (Fungi/gm. soil in thousand) at unmetalled road way site.
April, 1979—December, 1980

Date	Collembola			Other arthropods			Fungi
	Mean	$\pm$	SE	Mean	$\pm$	SE	(per gm. soil in thousand)
1979							
April	2.40	$\pm$	0.66	4.20	$\pm$	0.66	6
May	1.60	$\pm$	0.68	3.40	$\pm$	1.08	2
June	2.00	$\pm$	0.95	3.80	$\pm$	0.66	5
July	13.80	$\pm$	1.68	16.60	$\pm$	2.42	12
August	12.40	$\pm$	1.94	13.60	$\pm$	2.01	10
September	11.60	$\pm$	2.76	8.80	$\pm$	0.97	8
October	6.40	$\pm$	1.32	8.00	$\pm$	0.71	6
November	5.80	$\pm$	1.24	6.40	$\pm$	1.21	7
December	6.40	$\pm$	1.12	6.20	$\pm$	1.07	9
1980							
January	5.60	$\pm$	1.57	4.80	$\pm$	1.62	5
February	5.20	$\pm$	1.16	4.00	$\pm$	1.87	4
March	3.20	$\pm$	1.82	3.60	$\pm$	1.47	2
April	3.00	$\pm$	1.30	5.20	$\pm$	1.85	4
May	2.80	$\pm$	1.39	4.40	$\pm$	1.50	3
June	3.40	$\pm$	1.63	5.00	$\pm$	1.84	5
July	12.40	$\pm$	1.16	15.00	$\pm$	2.00	15
August	10.40	$\pm$	2.31	13.20	$\pm$	3.73	12
September	8.40	$\pm$	1.43	10.20	$\pm$	2.70	12
October	7.00	$\pm$	1.14	8.60	$\pm$	1.43	14
November	4.60	$\pm$	1.53	5.60	$\pm$	0.87	10
December	5.00	$\pm$	1.84	6.20	$\pm$	1.65	11

Soil factors : Soils of these plots were Gangetic alluvium in nature, brown in colour and clay loam in texture. pH varied from 7.00 to 7.45. In April and May moisture content of soil was 7.32% and 6.5% respectively in 1979, 8.5% and 5.30% respectively in 1980. Month of July in each sampling year showed maximum moisture content (18.5% and 16.33% respectively in 1979 and 1980). In May other soil factors such as organic carbon, nitrate and temperature were 1.10%, 0.48 ppm and 37.5°C respectively in 1979, 1.19%, 0.5 ppm and 36°C respectively in 1980. Amount of organic carbon was found to be maximum in July-August. Values of soil factors in other months are shown in figures 8-8d. Mechanical analysis of soil sampled showed high percentage of clay (Table 3).

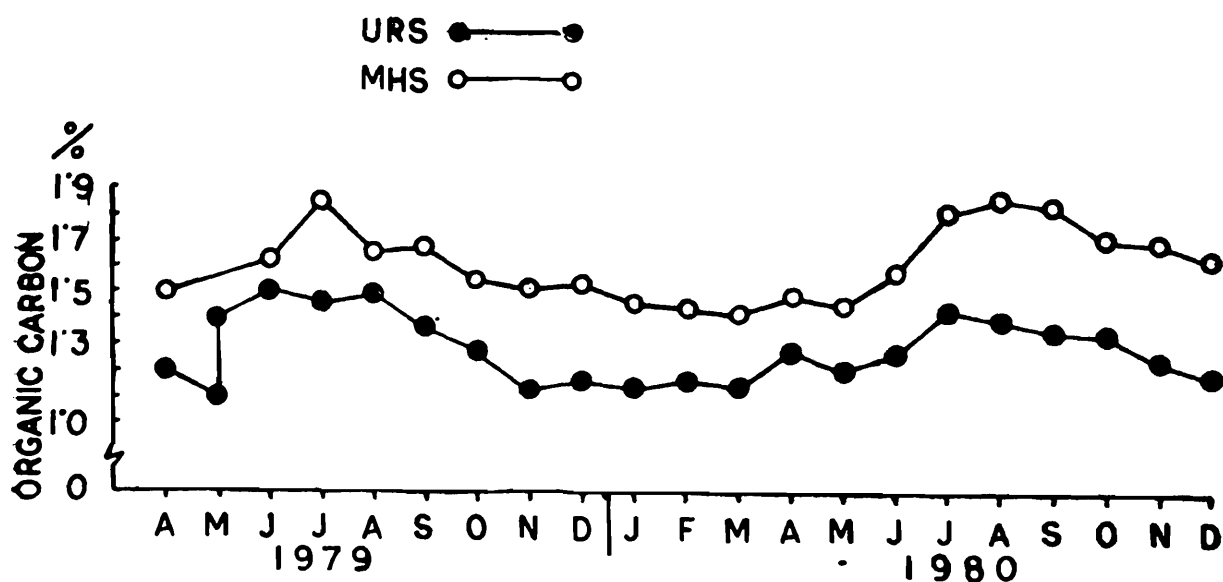


Fig. 8. Showing monthly fluctuations of Organic Carbon(%) in URS and MHS sites.

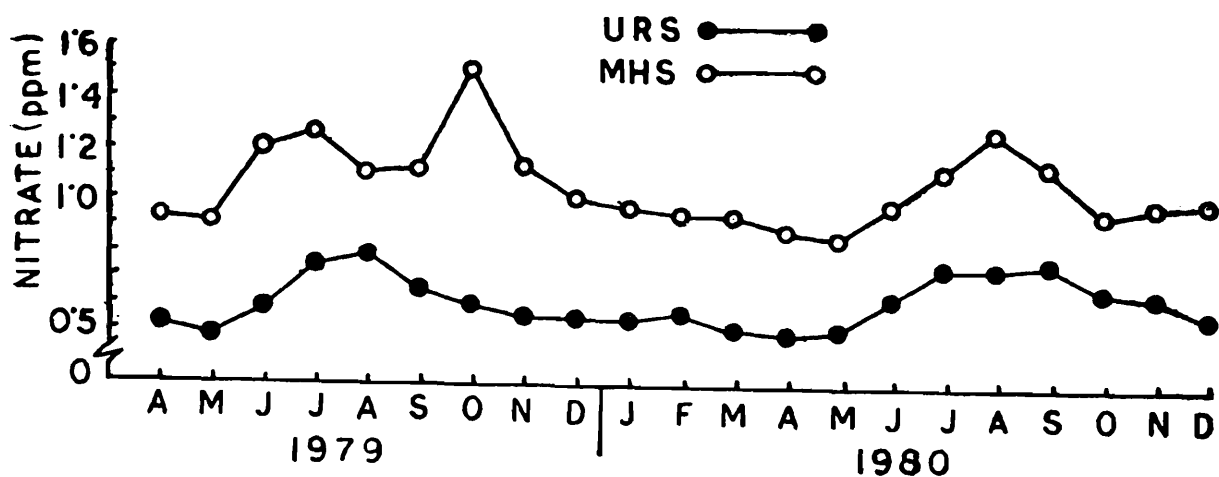


Fig. 8a. Showing monthly fluctuations of nitrate(ppm) in URS and MHS sites.

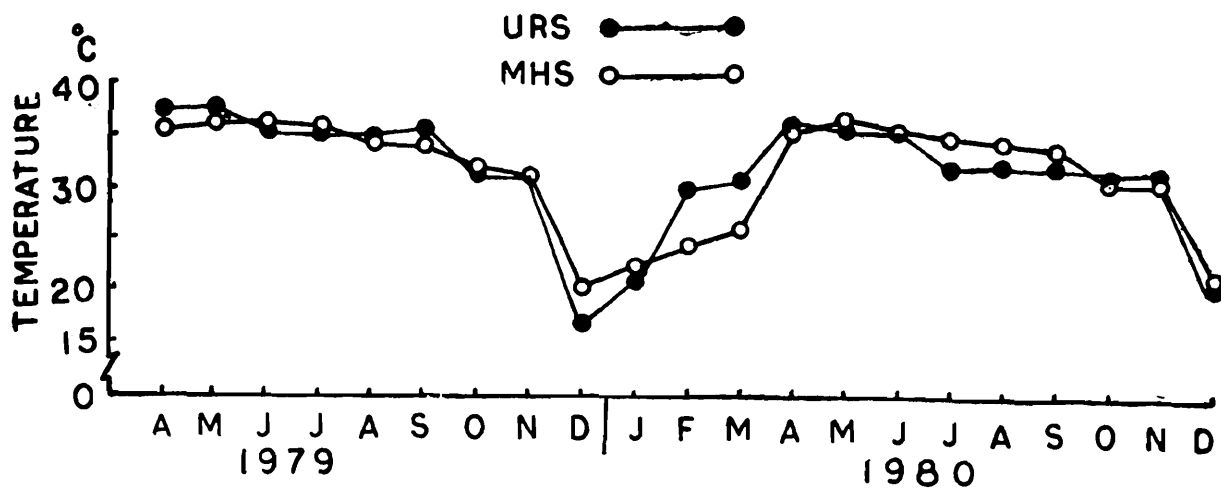


Fig. 8b. Showing monthly fluctuations of temperature (oc) in URS and MHS sites.

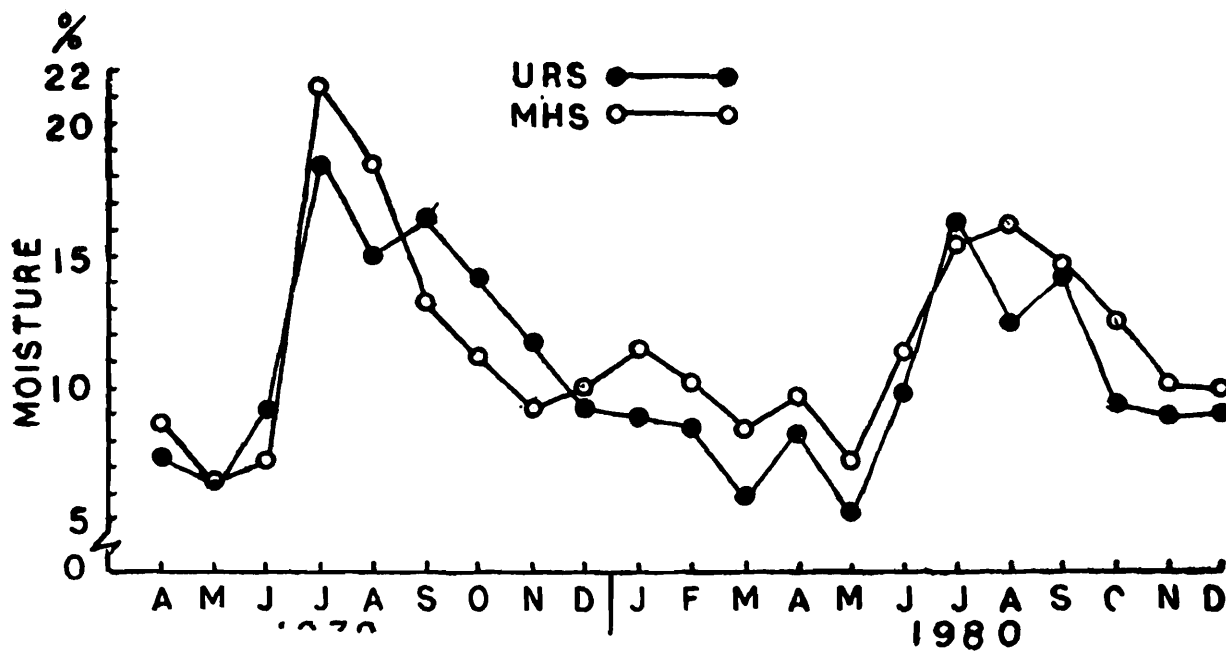


Fig. 8c. Showing monthly fluctuations of moisture(%) in URS and MHS sites.

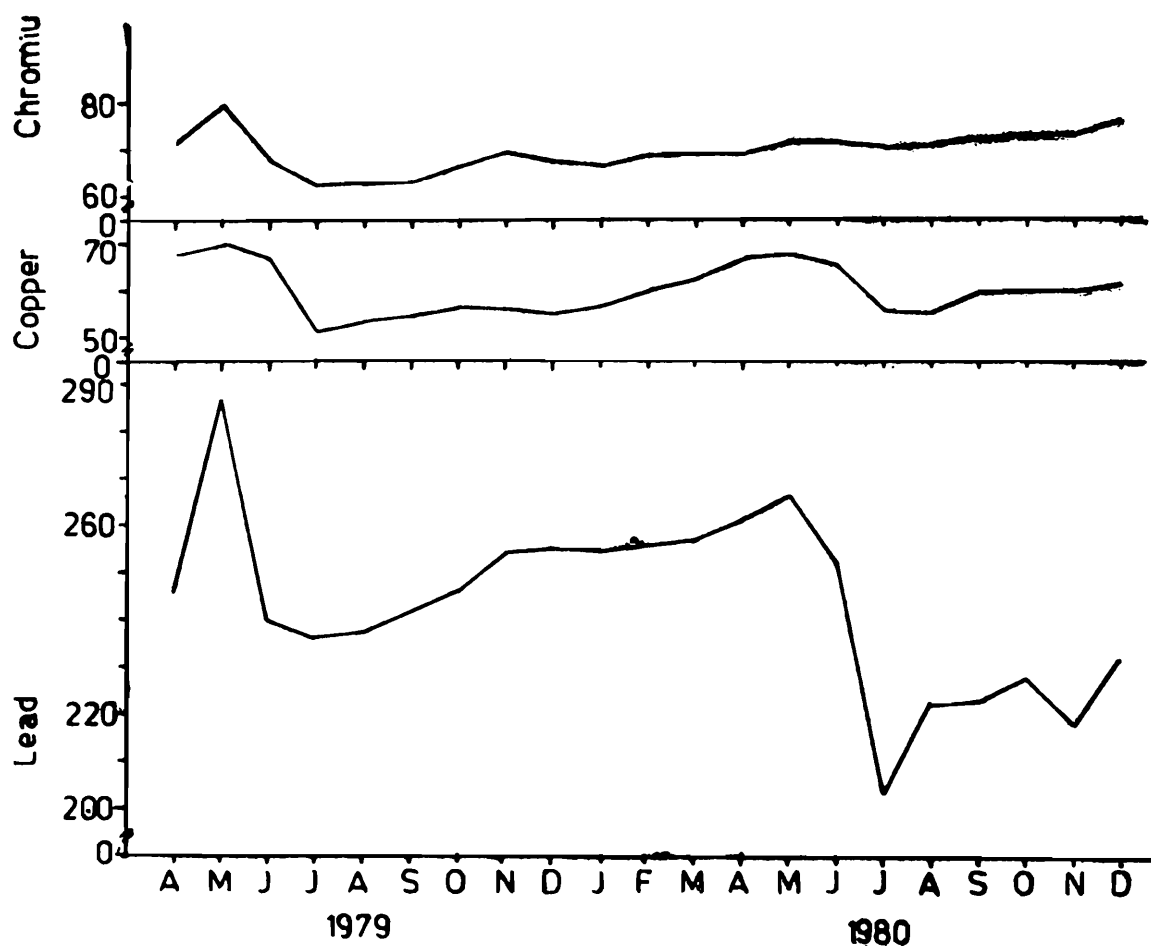


Fig. 8d. Showing monthly fluctuations of Chromium(ppm) Copper(ppm) and Lead(ppm) in MHS site.

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to nine genera such as *Cyphoderus*, *Sinella*, *Proistoma*, *Entomobrya*, *Isotomiella*, *Isotomina*, *Calx*, *Isotomodes* and *Lepidocyrtus* (Table 53). Species *Isotomina thermophila* was dominant and being extracted from all soil samples (except once) and comprising 23.09% of total population of collembola in this site. *Proisotoma* sp. and *Cyphoderus assimilis* comprising 21.44% and 20.09% occupied second and third position respectively in order of dominance. Population of other genera/species *Sinella* sp., *Entomobrya* sp., *Isotomiella minor*, *Calx* sp., *Isotomodes* sp. and *Lepidocyrtus* (*Ascocyrtus*) *heterolepis* were numerically low and irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 39) showed maximum population in July when factors like organic carbon and nitrate were also higher. Partial increase of population in November-December may be due to the prevalence of winter maxima of some species (Table 40).

Table 40

Showing species of collembola and their month-wise population number expressed in percentage at unmetalled road way site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
<i>Cyphoderus assimilis</i>	0.26	—	0.20	0.79	1.25	1.12	—	0.53	0.66	0.39	0.46	0.39
<i>Sinella (Sinella) sp.</i>	0.07	—	—	0.33	0.20	0.20	0.39	—	0.07	0.13	0.13	—
<i>Proisotoma sp.</i>	—	0.20	—	0.99	0.66	0.53	—	0.46	0.59	0.33	—	0.33
<i>Entomobrya sp.</i>	0.13	—	—	0.26	0.13	0.26	0.53	0.26	0.07	0.20	0.07	—
<i>Isotomiella minor</i>	0.07	—	0.13	0.20	0.33	0.13	—	—	0.13	0.13	0.13	0.07
<i>Isotomina thermophila</i>	0.13	0.33	0.20	0.66	1.12	1.18	1.18	0.20	0.39	0.33	0.59	0.20
<i>Calx sp.</i>	—	—	—	0.39	0.13	0.20	—	—	—	0.07	0.13	—
<i>Isotomodes sp.</i>	0.07	—	—	0.46	0.13	0.07	—	0.33	0.07	0.13	—	—
<i>Lepidocyrtus (Acrocyrtus) heterolepis</i>	0.07	—	0.13	0.46	0.13	0.13	—	0.13	0.13	0.13	0.20	0.07
Total	0.79	0.53	0.66	4.54	4.08	3.82	2.11	1.91	2.11	1.84	1.71	1.05

Table 40 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at unmetalled road way site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Cyphoderus assimilis</i>	0.33	—	0.33	0.66	0.79	0.66	—	—	—
<i>Sinella</i> (<i>Sinella</i>) sp.	—	—	0.07	0.26	0.33	0.13	0.26	0.13	0.13
<i>Proisotoma</i> sp.	0.20	0.33	0.26	1.05	0.66	0.92	0.99	0.39	0.53
<i>Entomobrya</i> sp.	0.07	—	—	0.33	0.20	0.13	0.59	0.20	0.07
<i>Isotomiella minor</i>	0.07	—	0.07	0.20	0.26	0.07	—	0.13	0.13
<i>Isotomina thermophila</i>	0.13	0.59	0.26	0.79	0.53	0.53	—	0.33	0.46
<i>Calx</i> sp.	0.07	—	—	0.33	0.20	0.13	—	—	0.13
<i>Isotomodes</i> sp.	0.07	—	—	0.20	0.33	0.07	—	0.20	0.13
<i>Lepidocyrtus</i> (<i>Acrocyrtus</i>) <i>heterolepis</i>	0.07	—	0.13	0.26	0.13	0.13	0.46	—	0.07
Total	0.99	0.92	1.12	4.08	3.42	2.76	2.30	1.51	1.65

Table 41

Showing groups of other arthropods and their month-wise population number expressed in percentage at unmetalled road way site.

April, 1979—December, 1979

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.42	0.26	0.42	1.82	1.51	0.94	0.83	0.68	0.57
Mesostigmata	0.25	0.21	0.21	1.04	0.52	0.47	0.31	0.26	0.16
Cryptostigmata	0.16	0.16	0.10	0.78	0.83	0.47	0.52	0.31	0.42
COLEOPTERA									
Ptiliidae	0.16	0.10	0.05	0.16	0.26	0.10	0.10	0.05	0.16
Staphylinidae	0.10	0.10	0.10	0.10	0.16	0.05	0.10	0.10	0.10
Larvae	—	—	0.05	0.05	0.05	0.05	0.05	0.05	—
DIPTERA									
Larvae	—	—	—	0.10	0.10	0.05	—	0.10	—
DIPLURA	—	—	—	—	—	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—
Other unidentified	—	0.05	0.05	0.26	0.10	0.16	0.16	0.10	0.21
Total	1.09	0.88	0.99	4.32	3.54	2.29	2.08	1.66	1.61

Table 41 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at unmetalled road way site.

January, 1980—December, 1980

Group	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec
ACARINA												
Prostigmata	0.42	0.26	0.42	0.42	0.36	0.52	1.56	1.51	1.09	1.04	.062	0.47
Mesostigmata	0.21	0.16	0.21	0.31	0.42	0.26	1.04	1.04	0.47	0.36	0.16	0.36
Cryptostigmata	0.21	0.36	0.10	0.26	0.10	0.16	0.78	0.36	0.52	0.36	0.42	0.31
COLEOPTERA												
Ptiliidae	0.16	0.10	0.10	0.16	0.10	0.10	0.16	0.10	0.10	0.16	0.10	0.16
Staphylinidae	0.10	0.05	0.05	0.10	0.10	0.05	0.10	0.05	0.05	0.10	0.10	0.16
Larvae	—	0.05	0.05	—	—	0.10	0.05	0.10	0.10	0.10	—	—
DIPTERA												
Larvae	—	0.05	—	—	—	0.05	0.10	0.10	0.05	—	—	—
DIPLURA												
	—	—	—	—	—	—	—	—	—	—	—	—
PROTURA												
	—	—	—	—	—	—	—	—	—	—	—	—
Other unidentified	0.16	—	—	0.10	0.05	0.05	0.10	0.16	0.26	0.10	0.05	0.21
Total	1.25	1.04	0.94	1.35	1.14	1.30	3.90	3.43	2.65	2.24	1.46	1.61

Other arthropod population : Microarthropod extracted from this site belonged to Prostigmata, Mesostigmata and Cryptostigmata (Acarina) and macroarthropod belonged to Ptiliidae comprising 6.51% and Staphylinidae comprising 4.72% of total other arthropod population in this plot, occupied first, second, third and fourth position respectively in order of dominance. Population of other groups were extracted very low number and highly irregular in distribution pattern. Diplura and Protura were totally absent from these soil samples. Number of other arthropod fauna (Mean $\pm$ SE) obtained in each month (Table 39) showed maximum in July when soil factors like organic carbon and nitrate were also in higher amount (Figures 8-8d). Partial increase of population in December may be due to the prevalence of winter maxima of some forms of other arthropods (Table 41).

METALLED HIGH WAY SITE

Characteristics of the sampling site This is on the Bombay road near Dankuni, District Hooghly and it includes four sampling plots, each measured 9 m $\times$ 5 m. (samples were taken from both side of the unmetalled portion) disturbed by different types of heavy vehicles and sparsely vegetated.

Vegetation :

Above ground : Plots were covered with grasses and sedges like *Panicum* sp., *Cynodon dactylon*, *Echinochloa colonum*, *Euphorbia hirta*, *Croton sparciflorus* and *Andropogon aciculatus* and few small trees like *Dalbergia sisoo*, *Albizia lebbek* and *Caesalpinia palcherrima*.

Underground : Soil fungi obtained from this site belonged to 36 species under 26 genera (Table 1). Genus *Penicillium* was most frequently occurred. Maximum population was found in the month of July (2,900/gm. soil in 1979 and 2,600/gm. soil in 1980) and minimum in May (Table 42).

Soil factors and heavy metal content : Soil of these plots were alluvium in nature, brownish in colour and sandy loam in texture. pH varied from 7.12 to 7.40. In May copper, lead and chromium content of soil were maximum and the levels were 69.22 ppm, 286.22 ppm and 79.42 ppm respectively. The levels of lead in soil was highest in comparison to other two heavy metals in this site. In April and May moisture content of soil was 9.75% and 6.50% respectively in 1979, 9.75% and 7.25% respectively in 1980. Month of July and August in each sampling year showed maximum moisture content (21.50% in July, 1979 and 16.25% in August 1980). In May other soil factors such as organic carbon, nitrate and temperature were 1.40%, 0.91 ppm and 37.5°C respectively in 1979, and 1.41%, 0.85 ppm and 36.25°C respectively in 1980. Amount of organic carbon

Table 42

Showing monthly population of fauna (Mean $\pm$ SE) and
flora (Fungi/gm. soil in thousand) at
Metalled highway site.

April, 1979—December, 1980

Date	Collembola Mean $\pm$ SE			Other arthropods Mean $\pm$ SE			Fungi (per gm. soil in thousand)
1979							
April	4.20	$\pm$	1.39	7.80	$\pm$	2.01	9
May	2.80	$\pm$	0.86	5.80	$\pm$	1.77	5
June	3.60	$\pm$	1.50	8.40	$\pm$	0.51	7
July	19.60	$\pm$	1.66	25.80	$\pm$	1.65	29
August	17.40	$\pm$	4.12	14.40	$\pm$	1.84	23
September	13.60	$\pm$	2.23	14.00	$\pm$	1.67	20
October	7.40	$\pm$	1.03	9.80	$\pm$	0.58	15
November	8.20	$\pm$	0.37	7.60	$\pm$	2.01	16
December	8.60	$\pm$	0.75	9.00	$\pm$	0.63	19
1980							
January	7.80	$\pm$	1.49	8.40	$\pm$	0.51	17
February	5.40	$\pm$	1.50	6.60	$\pm$	1.40	11
March	4.80	$\pm$	1.98	6.20	$\pm$	3.91	10
April	5.20	$\pm$	1.28	8.80	$\pm$	0.86	12
May	4.40	$\pm$	1.56	5.40	$\pm$	1.50	9
June	6.20	$\pm$	3.39	9.80	$\pm$	0.58	10
July	11.80	$\pm$	2.70	24.40	$\pm$	1.72	26
August	10.60	$\pm$	2.73	15.60	$\pm$	1.50	21
September	10.00	$\pm$	0.71	13.00	$\pm$	2.12	19
October	6.60	$\pm$	1.40	9.00	$\pm$	0.71	17
November	5.80	$\pm$	1.77	8.00	$\pm$	1.92	15
December	6.40	$\pm$	1.50	9.80	$\pm$	2.90	16

and nitrate were found to be maximum in July-August. Values of soil factors and levels of heavy metals in other months are presented in Figures 8-8d. Mechanical analysis of soil sampled showed about equal percentage of fine sand and clay (Table 3).

Faunal make up :

Collembola population : Collembolans extracted from this site belonged to eleven genera such as *Subisotoma*, *Isotomiella*, *Entomobrya*, *Cryptopygus*, *Cyphoderus*, *Lepidocyrtus*, *Xenylla*, *Folsomides*, *Isotomina*, *Pseudosinella* and *Megalothorax* (Table 43). Species *Isotomiella minor* was most dominant and being extracted from almost all the soil samples and comprising 21.83% of total population of collembola obtained in this site. *Isotomina thermophila* and *Megalothorax minimus* comprising 21.24% and 16.55% occupied second and third position respectively in order of dominance. Population of other genera/species such as *Subisotoma fitchioides*, *Entomobrya* sp., *Cryptopygus thermophilus*, *Cyphoderus javanus*, *Lepidocyrtus* (L) *medius*, *Xenylla* sp., *Lepidocyrtus* sp., *Pseudosinella* sp., and *Folsomides parvulus* were numerically low and highly irregular in distribution pattern. Number of collembola (Mean $\pm$ SE) extracted in each month (Table 42) showed maximum population in July when soil factors like organic carbon, nitrate and moisture were also maximum (except in 1980 when these factors were maximum in August) and soil fungi population were also maximum, partial increase in December—January may be due to prevalence of winter maxima of some species of collembola (Table 43).

Other arthropod population : Microarthropods extracted from this site belonged to Prostigmata, Mesostigmata, Cryptostigmata (Acarina) and macroarthropods belonged to Staphylinidae and larvae of Coleoptera, larvae of Diptera and other unidentified groups (Table 44). Sub-order Prostigmata was most dominant and were found in all soil samples and comprising 37.79%, Mesostigmata comprising 29.70%, Cryptostigmata comprising 19.77% and Staphylinidae comprising 7.91% of total other arthropod population in this plot, occupied second, third and fourth position respectively in order of dominance. Population of other groups were extracted very low number and highly irregular in distribution pattern, number of other arthropod fauna (Mean $\pm$ SE) obtained in each month (Table 42) showed maximum in July when soil fungi population were also maximum, and soil factors like organic carbon, nitrate and moisture were maximum in 1979 and in August, 1980 (Figures 8-8d). Partial increase in December—January may be due to prevalence of winter maxima of some groups (Table 44).

Table 43

Showing species of collembola and their month-wise population number expressed in percentage at
Metalled highway site.

April, 1979—March, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan	Feb.	Mar.
<i>Subisotoma fitchioides</i>	—	—	0.07	0.20	0.20	0.26	0.33	0.33	0.20	0.13	0.07	—
<i>Isotomiella minor</i>	0.33	0.26	—	1.51	1.97	0.92	—	0.53	0.72	0.46	0.39	0.46
<i>Entomobrya</i> sp.	0.13	—	0.07	0.33	0.13	0.20	—	—	0.26	0.07	0.07	0.13
<i>Cryptopygus thermophilus</i>	0.07	0.13	0.13	0.26	0.20	0.33	—	—	0.13	0.20	0.07	0.07
<i>Cyphoderus javanus</i>	0.13	—	0.07	0.20	0.20	0.13	—	0.26	0.13	0.13	0.07	0.07
<i>Lepidocyrtus (L) medius</i>	—	0.13	0.07	0.13	0.13	0.26	0.39	—	0.20	0.07	0.07	0.07
<i>Xenylla</i> sp.	0.07	—	0.07	0.33	0.20	0.13	0.46	—	0.13	0.20	0.07	0.07
<i>Lepidocyrtus</i> sp.	—	0.07	0.07	0.20	0.13	0.20	—	0.39	0.26	0.07	0.07	0.07
<i>Isotomina thermophila</i>	0.26	0.20	0.26	1.12	1.25	1.38	0.33	0.59	0.59	0.59	0.46	0.33
<i>Pseudosinella</i> sp.	0.07	—	0.07	0.13	0.26	—	—	0.39	0.13	0.13	0.07	0.07
<i>Megalothorax minimus</i>	0.33	—	0.26	1.78	0.86	0.46	0.92	—	—	0.46	0.33	0.20
<i>Folsomides parvulus</i>	—	0.13	0.07	0.26	0.20	0.20	—	0.20	0.07	0.07	0.07	0.07
Total	1.38	0.92	1.18	6.45	5.73	4.48	2.44	2.70	2.83	2.57	1.78	1.58

Table 43 (Contd.)

Showing species of collembola and their month-wise population number expressed in percentage at
Metalled highway site.

April, 1980—December, 1980

Species	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Subisotoma fitchioides</i>	—	0.13	—	0.20	0.13	0.13	0.20	0.13	0.07
<i>Isotomiella minor</i>	0.39	—	0.46	0.86	1.12	0.79	—	0.46	0.59
<i>Entomobrya</i> sp.	0.13	—	0.13	0.20	0.07	0.20	—	—	0.07
<i>Cryptopygus thermophilus</i>	0.07	0.26	0.07	0.26	0.13	0.13	—	0.07	0.07
<i>Cyphoderus javanus</i>	0.20	—	0.07	0.20	0.13	0.13	0.26	0.07	0.13
<i>Lepidocyrtus</i> (L) <i>medius</i>	—	—	0.13	0.33	0.13	0.07	0.26	0.13	0.07
<i>Xenylla</i> sp.	0.13	—	—	0.20	0.20	0.07	0.33	0.07	0.07
<i>Lepidocyrtus</i> sp.	—	0.26	0.07	0.26	0.13	0.20	—	0.13	0.13
<i>Isotomina thermophila</i>	0.33	0.46	0.59	0.59	0.53	0.53	0.99	0.26	0.26
<i>Pseudosinella</i> sp.	0.13	—	0.07	0.13	0.13	0.13	0.13	0.07	0.07
<i>Megalothorax minimus</i>	0.33	0.33	0.33	0.46	0.59	0.72	—	0.46	0.46
<i>Folsomides parvulus</i>	—	—	0.07	0.20	0.20	0.20	—	—	0.13
Total	1.71	1.45	2.04	3.88	3.49	3.29	2.17	1.91	2.11

Table 44

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Metalled highway site.

April, 1979—March, 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
ACARINA												
Prostigmata	0.57	0.57	0.88	1.56	1.46	1.56	0.99	0.88	1.04	0.94	0.62	0.78
Mesostigmata	0.52	0.62	0.47	2.34	1.30	0.94	1.04	0.57	0.47	0.47	0.31	0.31
Cryptostigmata	0.62	0.21	0.52	2.08	0.47	0.73	0.26	0.16	0.62	0.52	0.47	0.36
COLEOPTERA												
Ptiliidae	—	—	—	—	—	—	—	—	—	—	—	—
Staphylinidae	0.26	0.10	0.16	0.36	0.26	0.21	0.16	0.26	0.21	0.16	0.26	0.16
Larvae	—	—	0.05	0.05	0.10	0.05	—	0.05	—	—	—	—
DIPTERA												
Larvae	—	—	—	0.16	0.05	0.10	—	—	—	—	—	—
DIPLURA												
	—	—	—	—	—	—	—	—	—	—	—	—
PROTURA												
	—	—	—	—	—	—	—	—	—	—	—	—
Other unidentified	0.05	—	0.10	0.16	0.10	0.05	0.10	0.05	—	0.10	—	—
Total	2.03	1.51	2.19	6.71	3.75	3.64	2.55	1.98	2.34	2.19	1.72	1.61

Table 44 (Contd.)

Showing groups of other arthropods and their month-wise population number expressed in percentage at
Metalled highway site.

April, 1980—December 1980

Group	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ACARINA									
Prostigmata	0.62	0.36	1.09	2.60	1.56	1.35	0.94	0.83	1.14
Mesostigmata	0.78	0.47	0.57	2.08	1.30	1.04	0.52	0.52	0.94
Cryptostigmata	0.52	0.26	0.47	1.09	0.78	0.47	0.47	0.36	0.26
COLEOPTERA									
Ptiliidae	—	—	—	—	—	—	—	—	—
Staphylinidae	0.26	0.21	0.26	0.26	0.21	0.26	0.21	0.26	0.21
Larvae	—	—	0.10	0.05	0.05	0.10	0.05	—	—
DIPTERA									
Larvae	—	—	—	0.10	0.05	0.10	—	—	—
DIPLURA	—	—	—	—	0.05	—	—	—	—
PROTURA	—	—	—	—	—	—	—	—	—
Other unidentified	0.10	0.10	0.05	0.16	0.05	0.05	0.16	0.10	—
Total	2.29	1.40	2.55	6.35	0.06	3.38	2.34	2.08	2.55

SEASONAL FLUCTUATIONS

Collembola and other arthropod fauna: The total population of collembola and other arthropods obtained from all the sampling sites showed an irregular trend of fluctuations during the sampling period ranging from April, 1979 to December, 1980. The population in majority of non-polluted sites were maximum in July and minimum in May but in case of polluted sites the population maxima and minima were shifted to some other months, it was also true in case of predominant collembolan species and predominant sub-orders of acarina as would be evident from the figures (9/10 and 11/12 for Fallow land site); (13/14 and 15/15 for Agriculture practice land site); (17/18 and 19/20 for Deforested site); 21/22 and 23/24 for Reserve forest floor site); (25/26 and 27/28 for Undisturbed city park site); (29/30 and 31/32 for Anthropogenic Pressurised city park site); (33/34 and 35/36 for irrigation canal embankment site); (37/38 and 39/40 for Sewage canal embankment site); 41/42 and 43/44 for Garbage dumping dune site); (45/46 and 47/48 for soil dune site); (49/50 and 51/52 for Durgapur control Pasture site); (53/54 and 55/56 for Durgapur industrial effluent site); (57/58 and 59/60 for unmetalled road way site) and (61/62 and 63/64 for Metalled highway site).

Fungi flora: The total population of fungi obtained from the sampling sites also showed an irregular trend of fluctuations during the sampling period. Here also the fungi population in all cases of non-polluted sites showed their maxima in July—August and minima in May but in polluted and disturbed sites the population maxima and minima changes to some other seasons as would be evident in figures (65 for Fallow land site and Agriculture practice land site); (66 for Deforested site and Reserve forest floor site); (67 for Undisturbed city park site and Anthropogenic city park site); (68 for Irrigation canal embankment site and Sewage canal embankment site); (69 for Garbage dumping dune site and Soil dune site); (70 for Durgapur control Pasture and Durgapur industrial effluent site) and (71 for Unmetalled road way site and Metalled highway site).

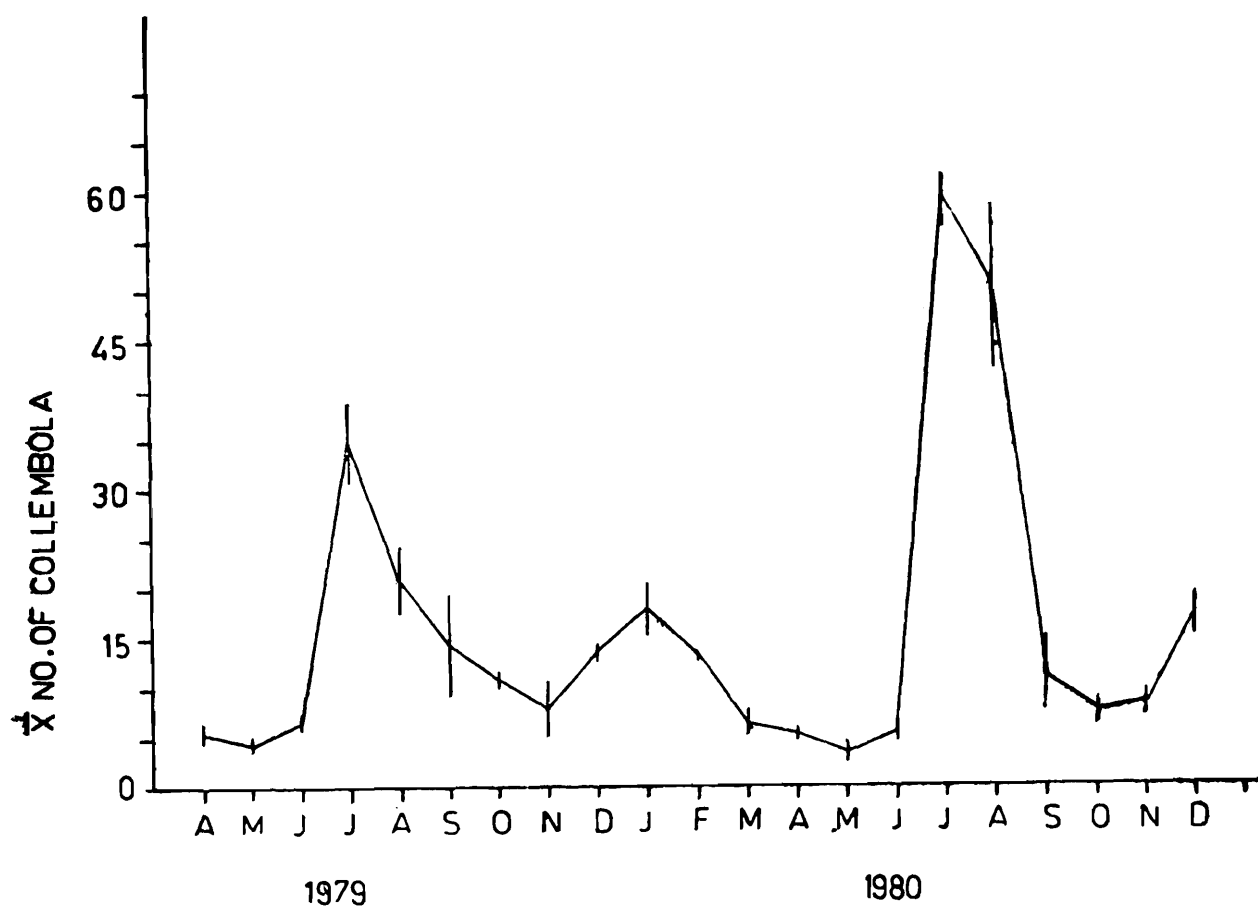


Fig. 9. Showing monthly fluctuations of total number of collembola in FL site. (Mean $\pm$ SE).

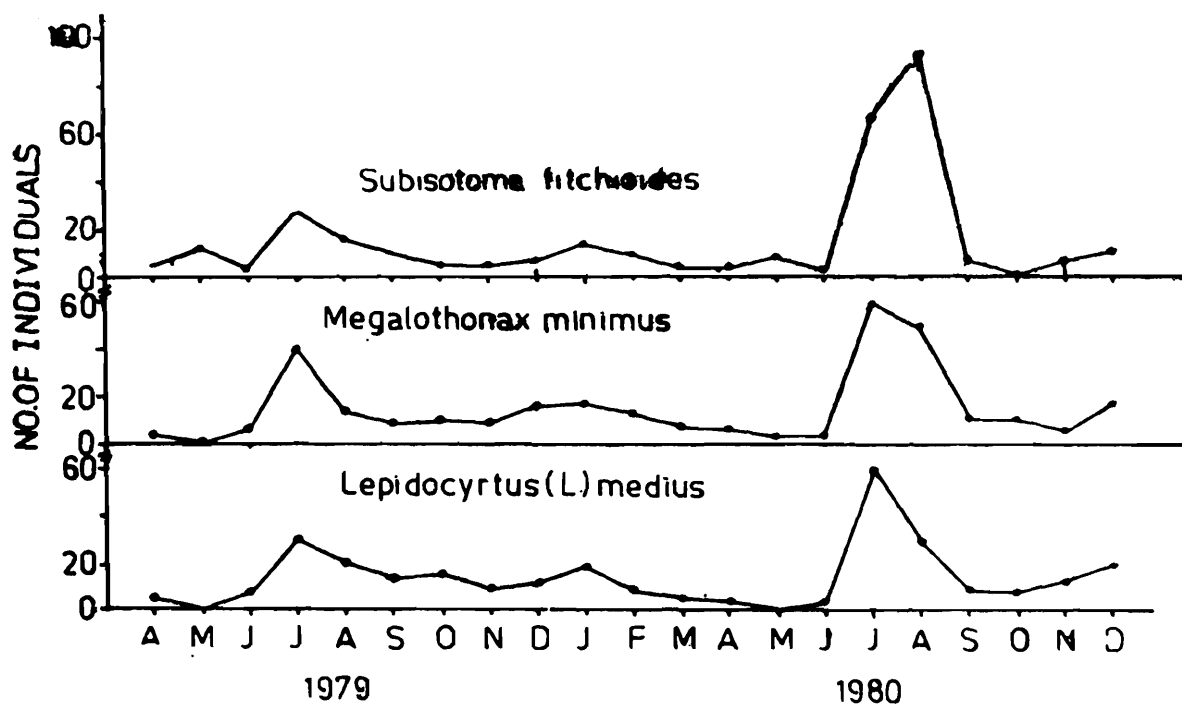


Fig. 10. Showing monthly fluctuations in number of dominant species of collembola in FL site.

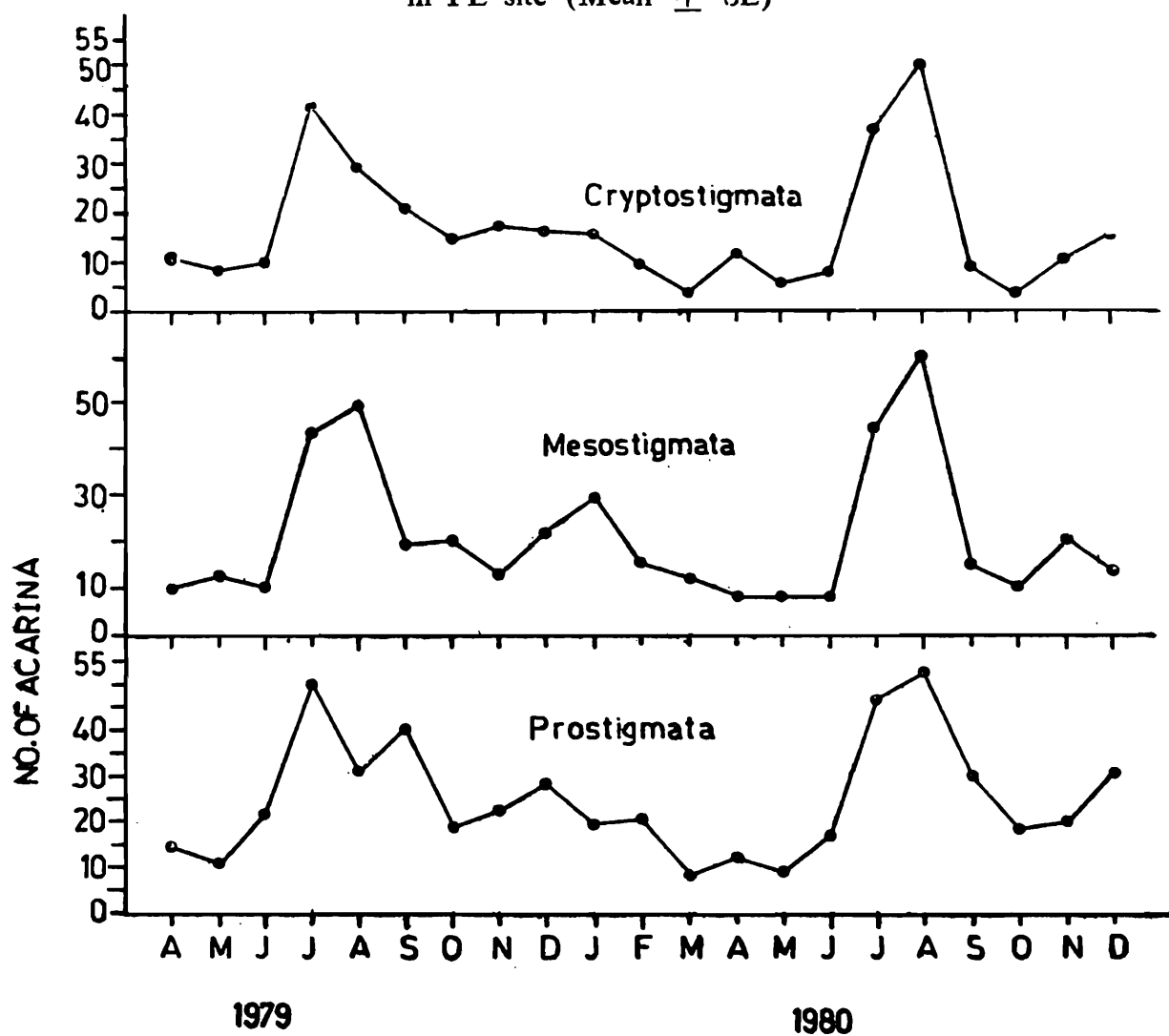
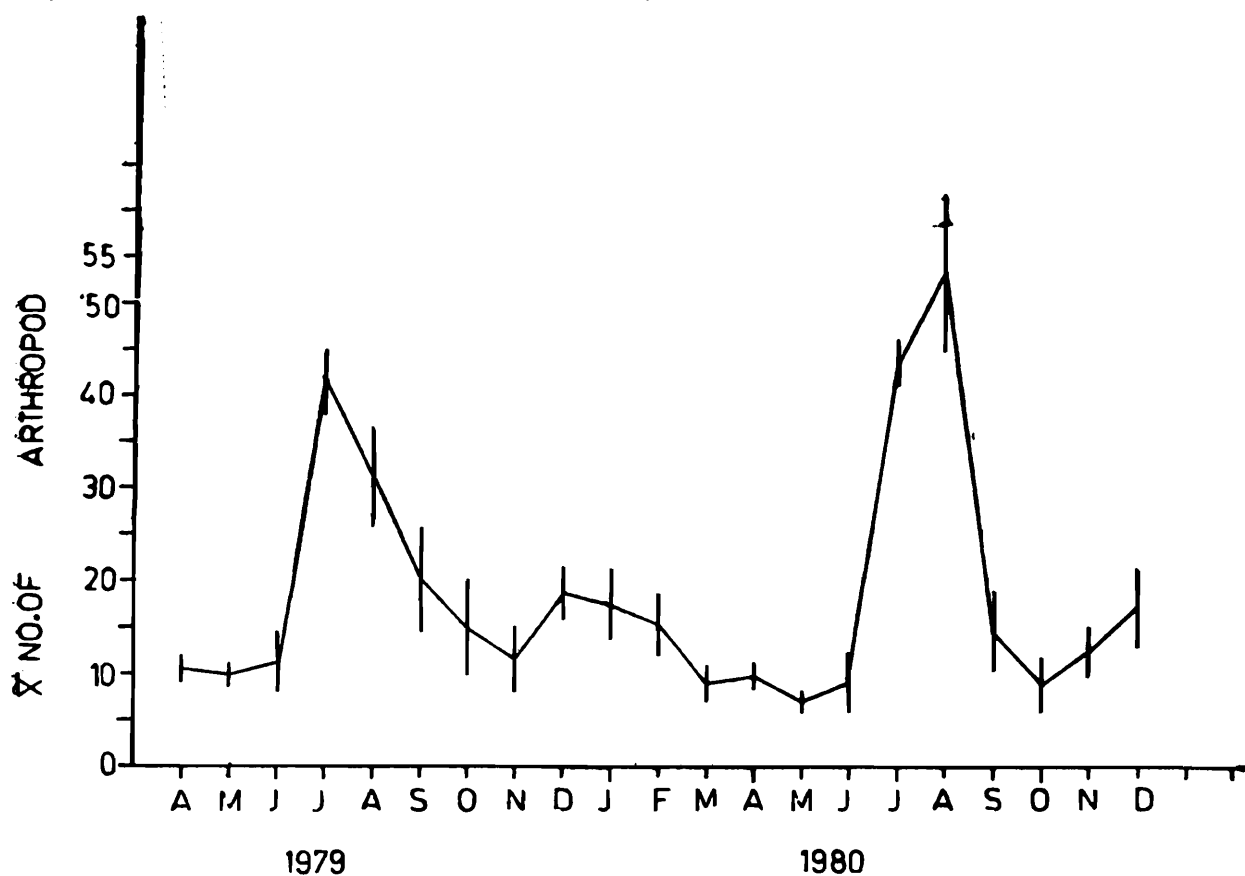


Fig. 12. Showing monthly fluctuation in number of dominant sub-orders of acarina in FL site.

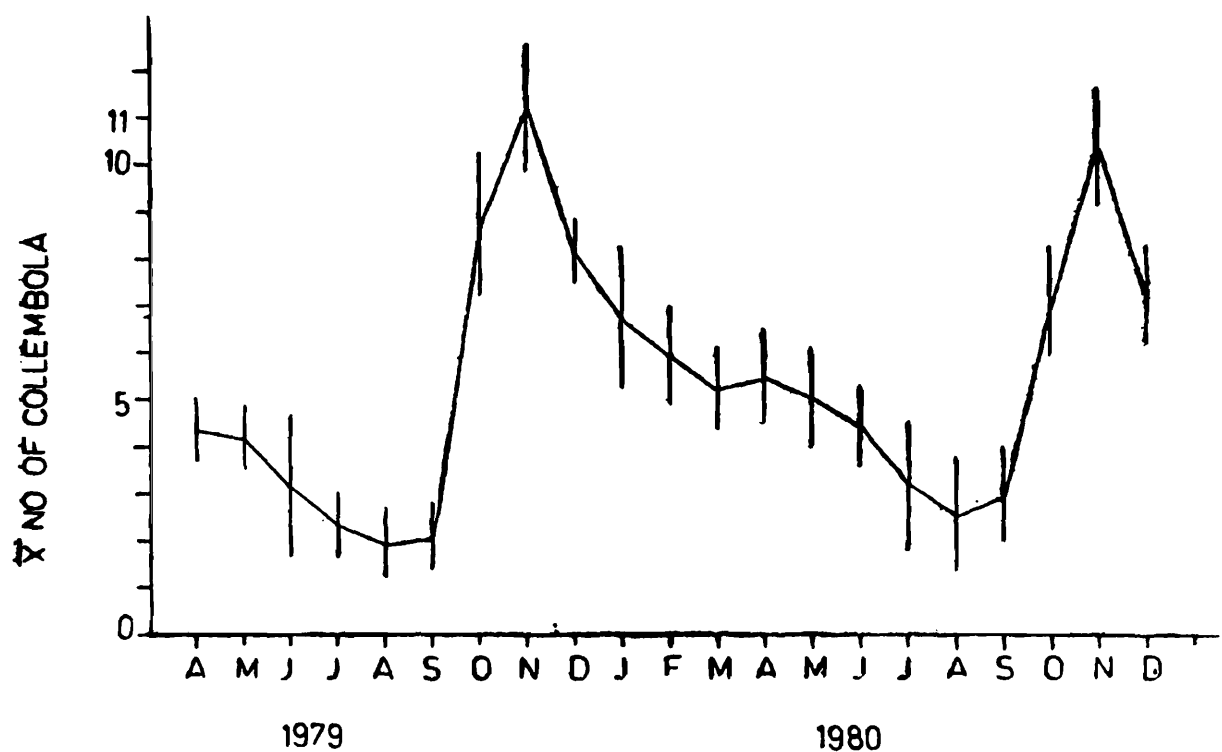


Fig. 13. Showing monthly fluctuations of total number of collembola in APL site (Mean $\pm$ SE).

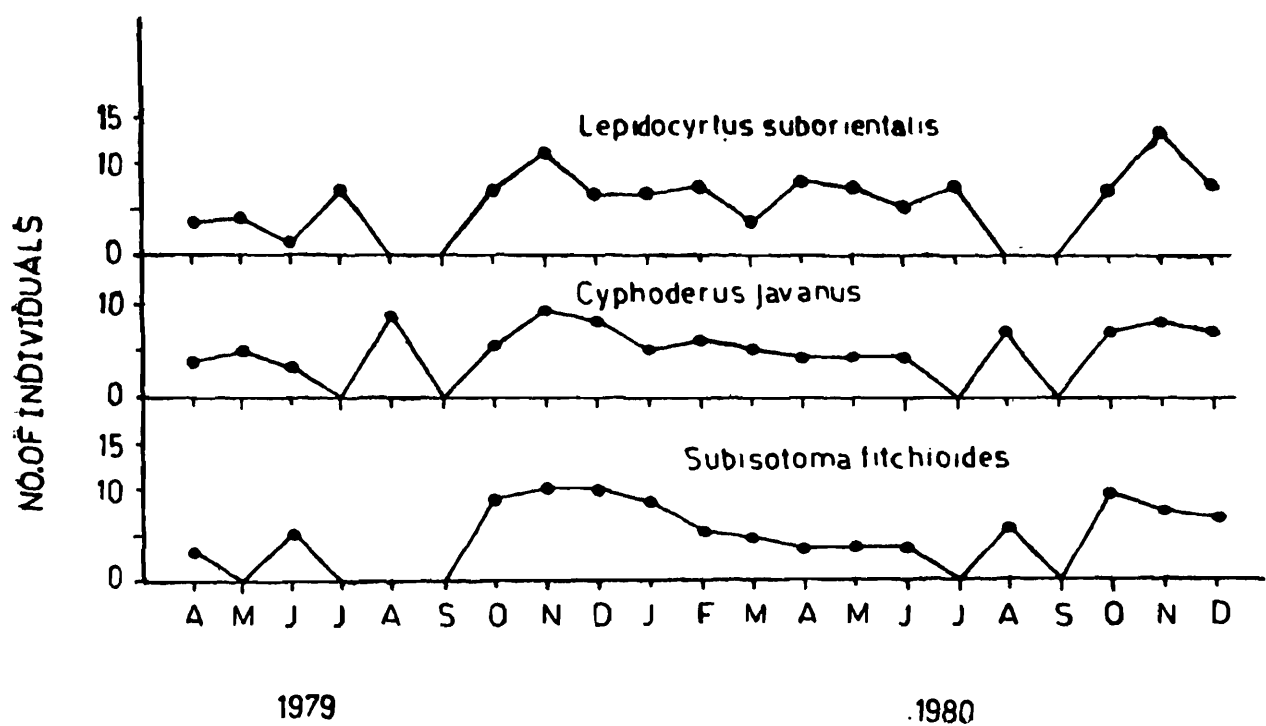


Fig. 14. Showing monthly fluctuations of dominant species of collembola in APL site.

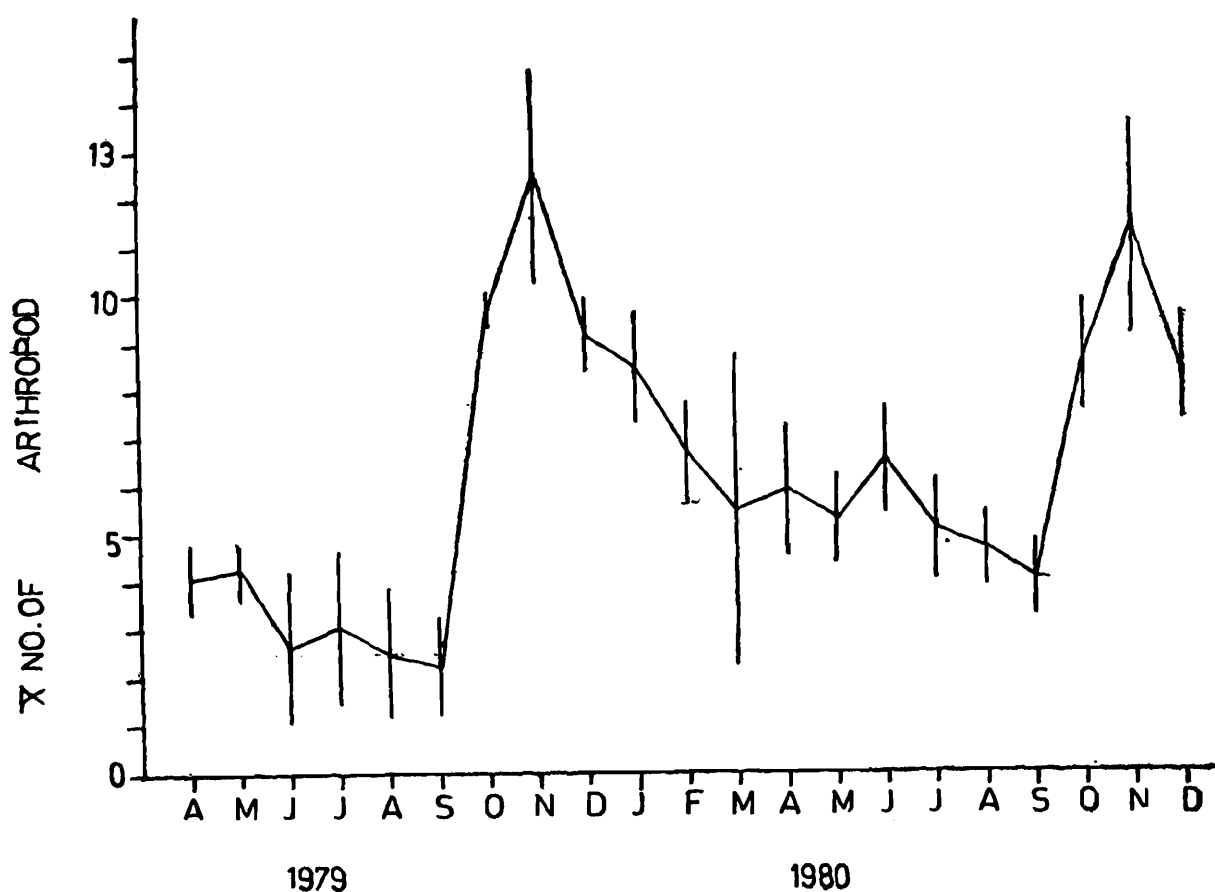


Fig. 15. Showing monthly fluctuations of total number of arthropod in APL site (Mean $\pm$ SE).

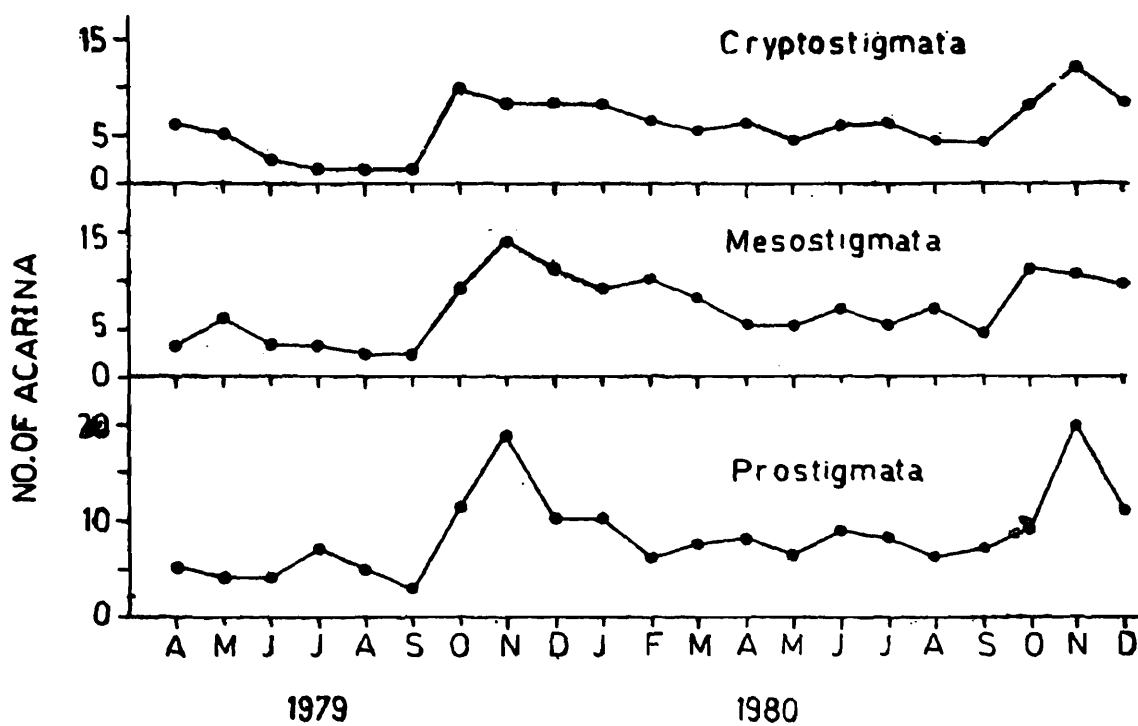


Fig. 16. Showing monthly fluctuations of dominant sub-orders of acarina in APL site.

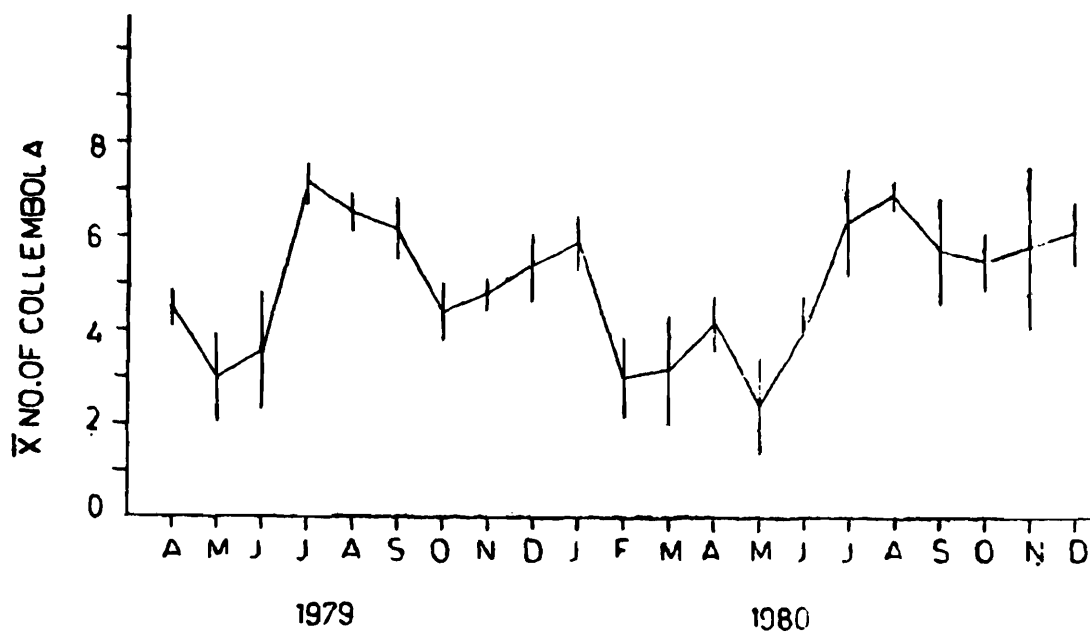


Fig. 17. Showing monthly fluctuations of total number of collembola in DS site (Mean $\pm$ SE).

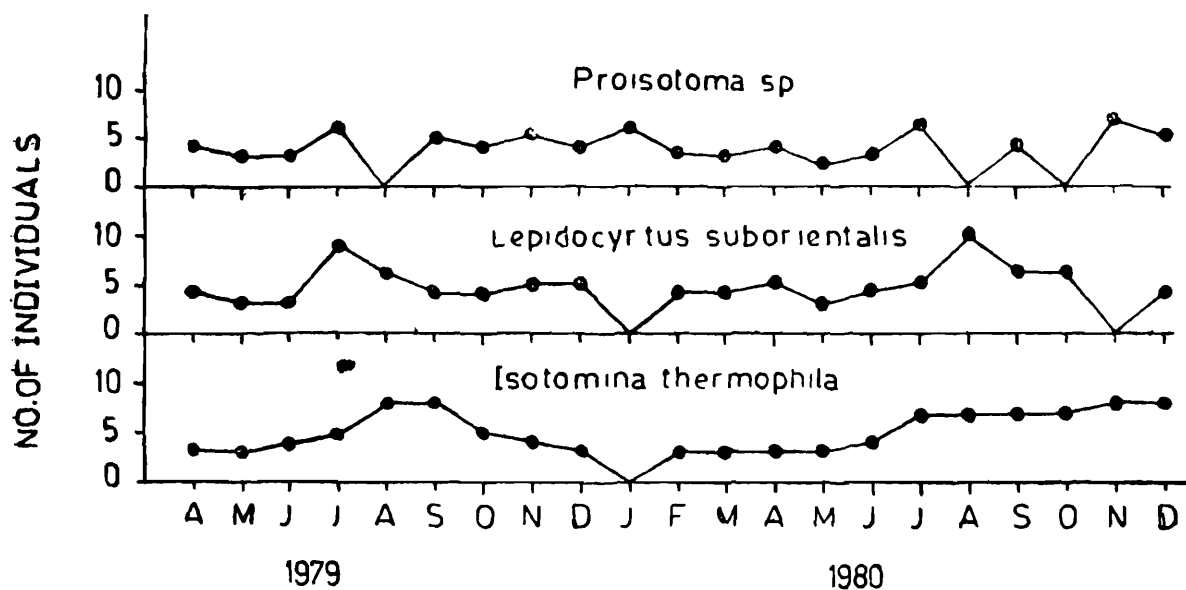


Fig. 18. Showing monthly fluctuations of dominant species of collembola in DS site.

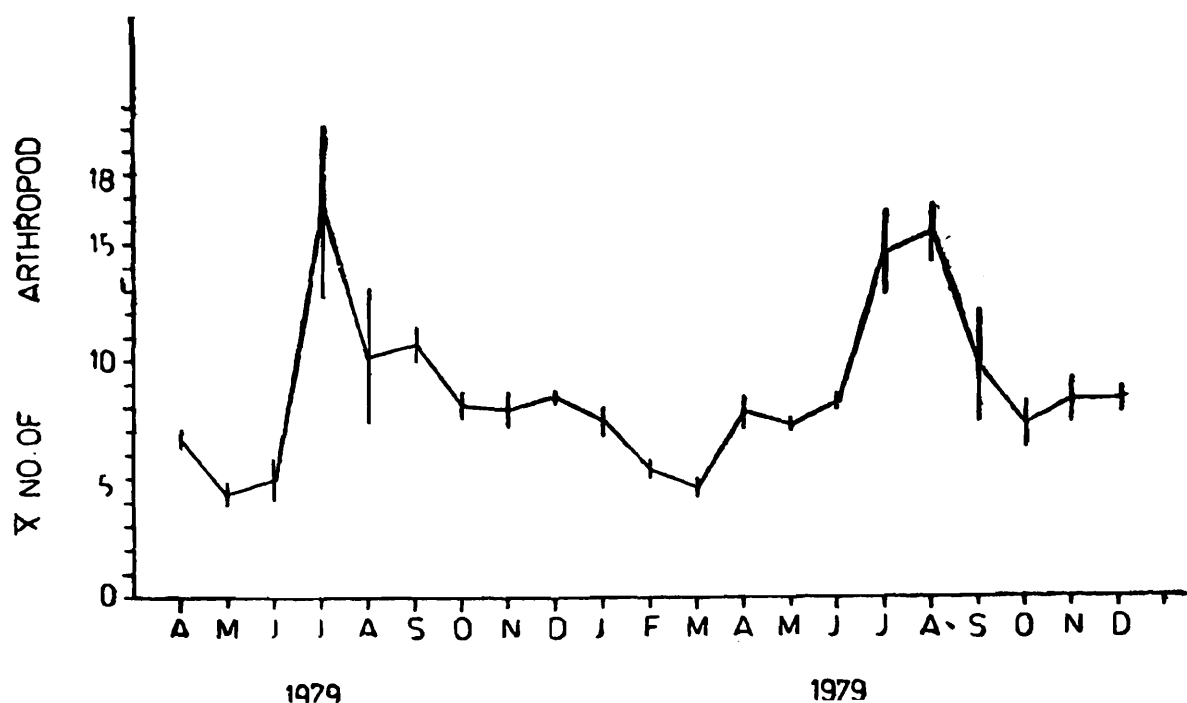


Fig. 19. Showing monthly fluctuations of total number of arthropod in DS site (Mean $\pm$ SE).

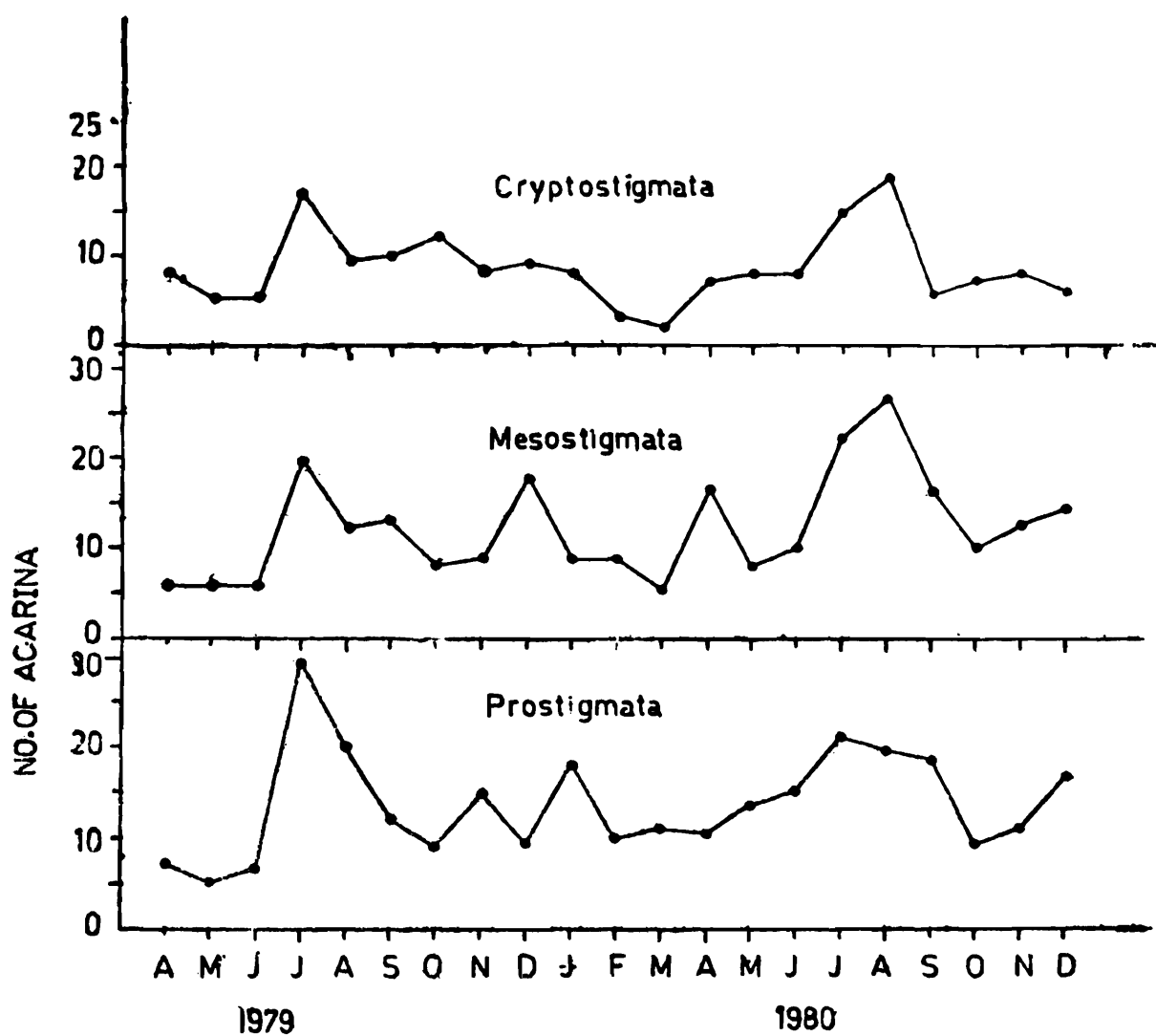


Fig. 20. Showing monthly fluctuations of dominant sub-orders of acarina in DS site.

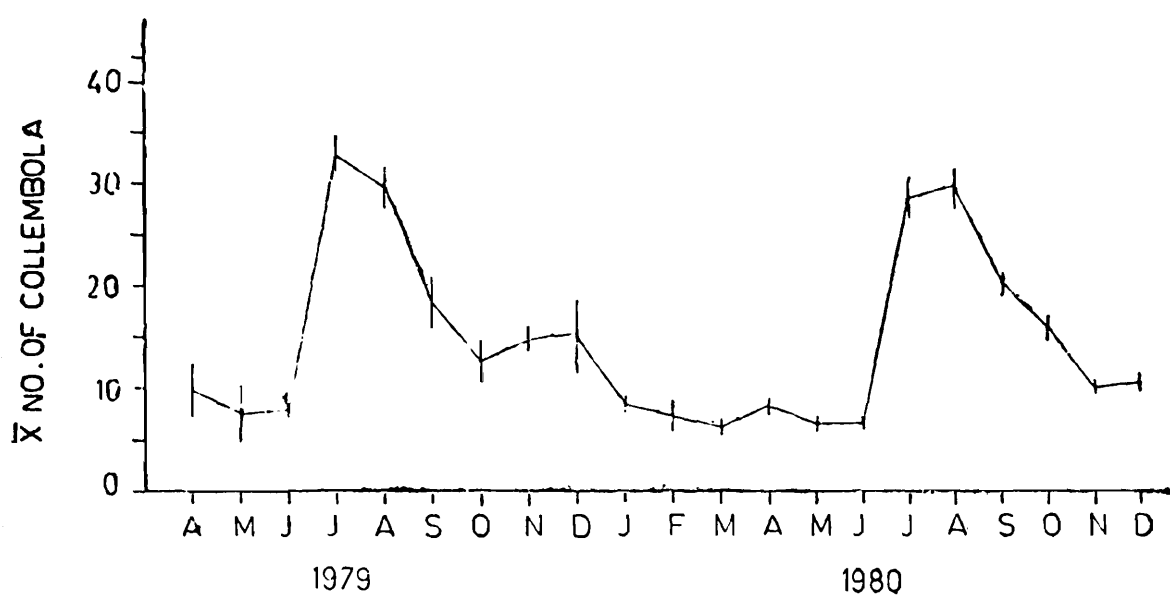


Fig. 21. Showing monthly fluctuations of total number of collembola in RFF site (Mean $\pm$ SE).

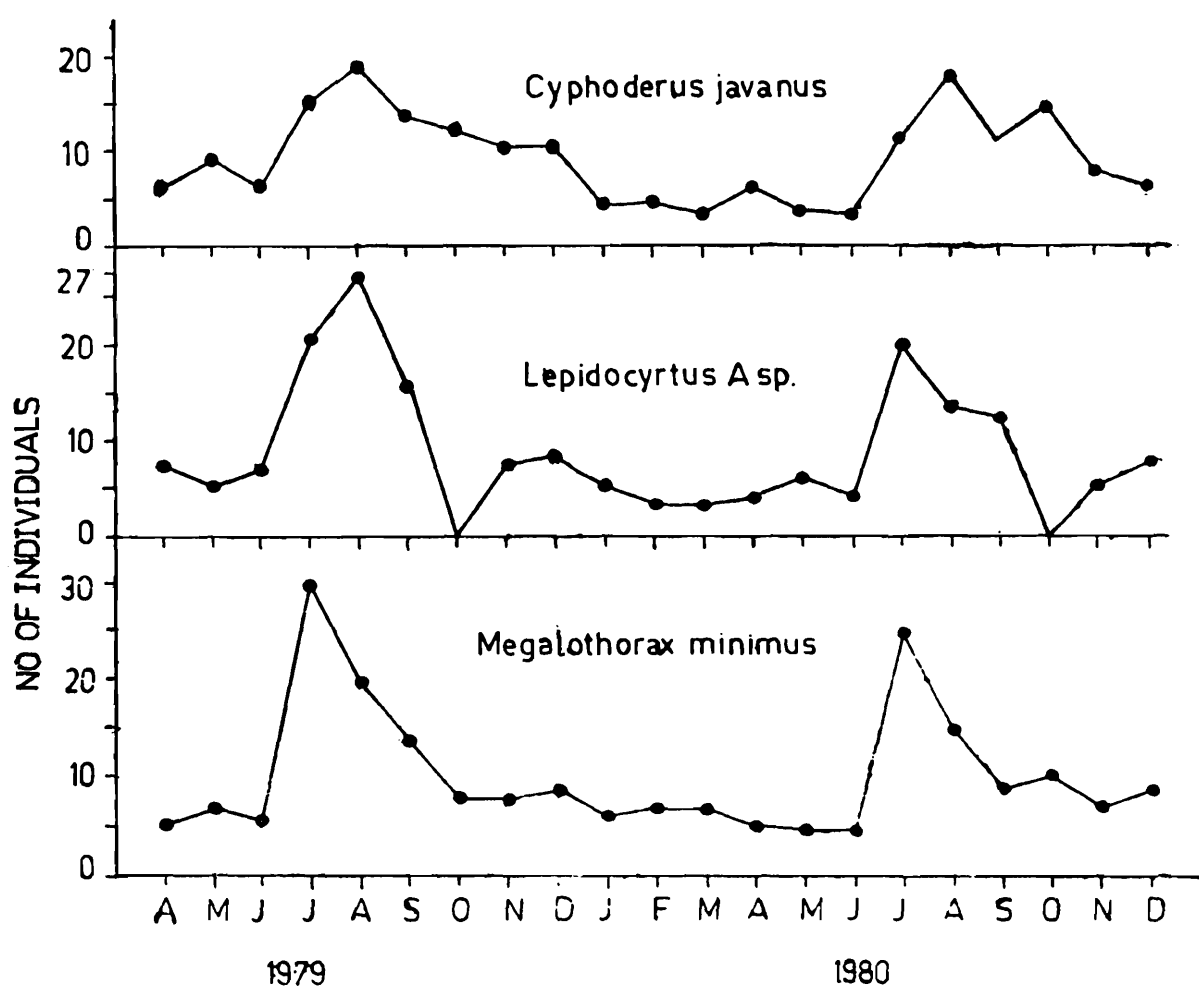


Fig. 22. Showing monthly fluctuations of dominant species of collembola in RFF site.

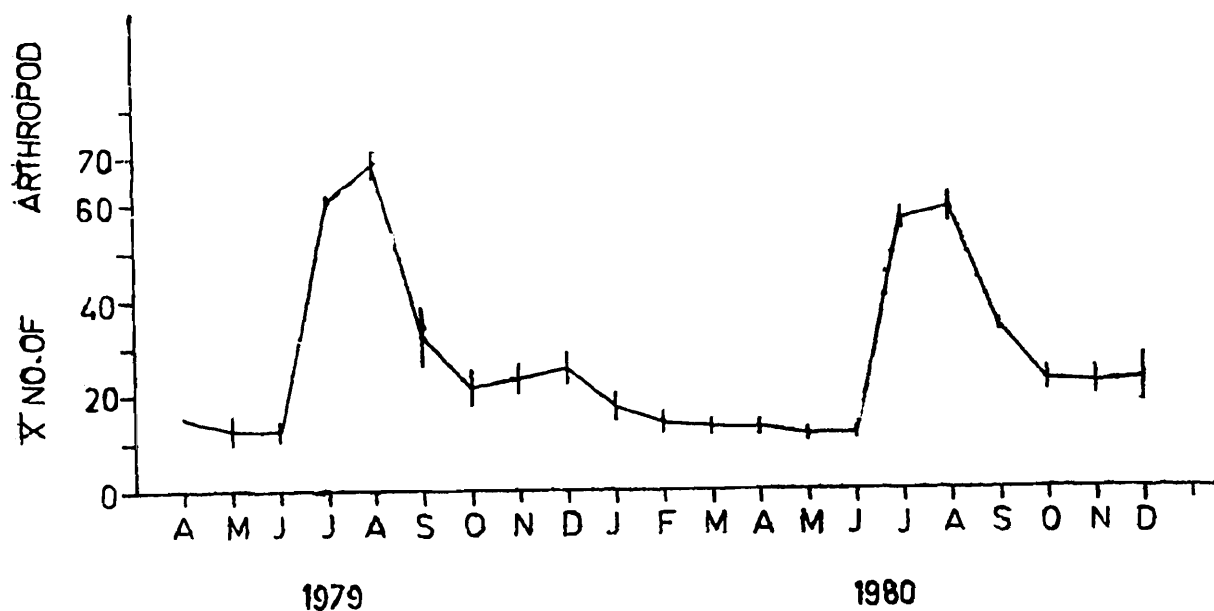


Fig. 23. Showing monthly fluctuations of total number of arthropod in RFF site (Mean $\pm$ SE).

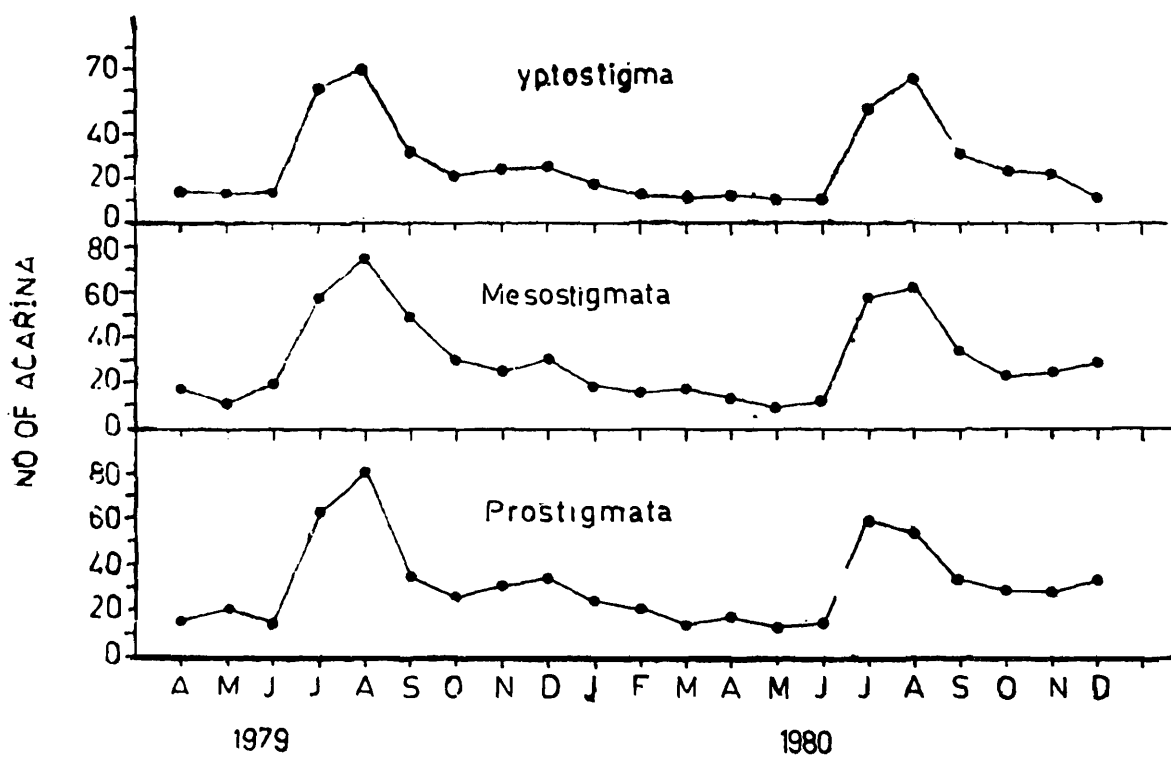


Fig. 24. Showing monthly fluctuations of dominant sub-orders of acarina in RFF site.

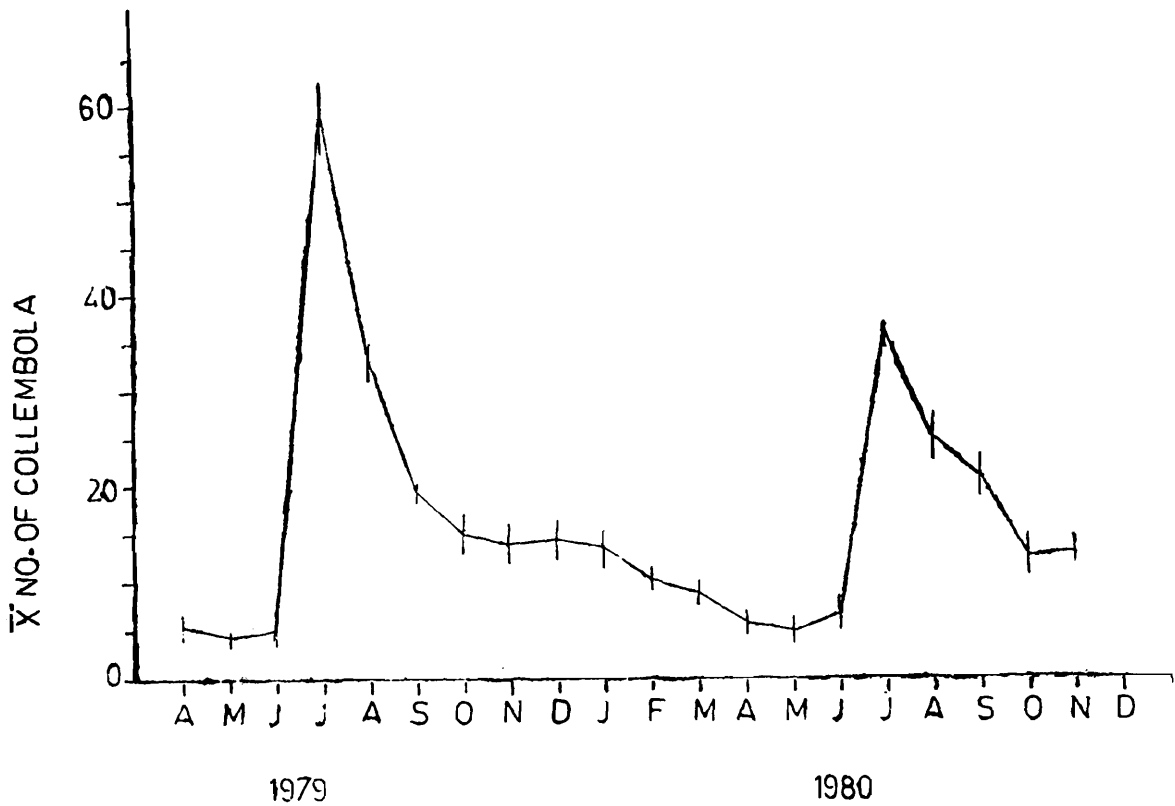


Fig. 25. Showing monthly fluctuations of total number of collembola in UCP site (Mean $\pm$ SE).

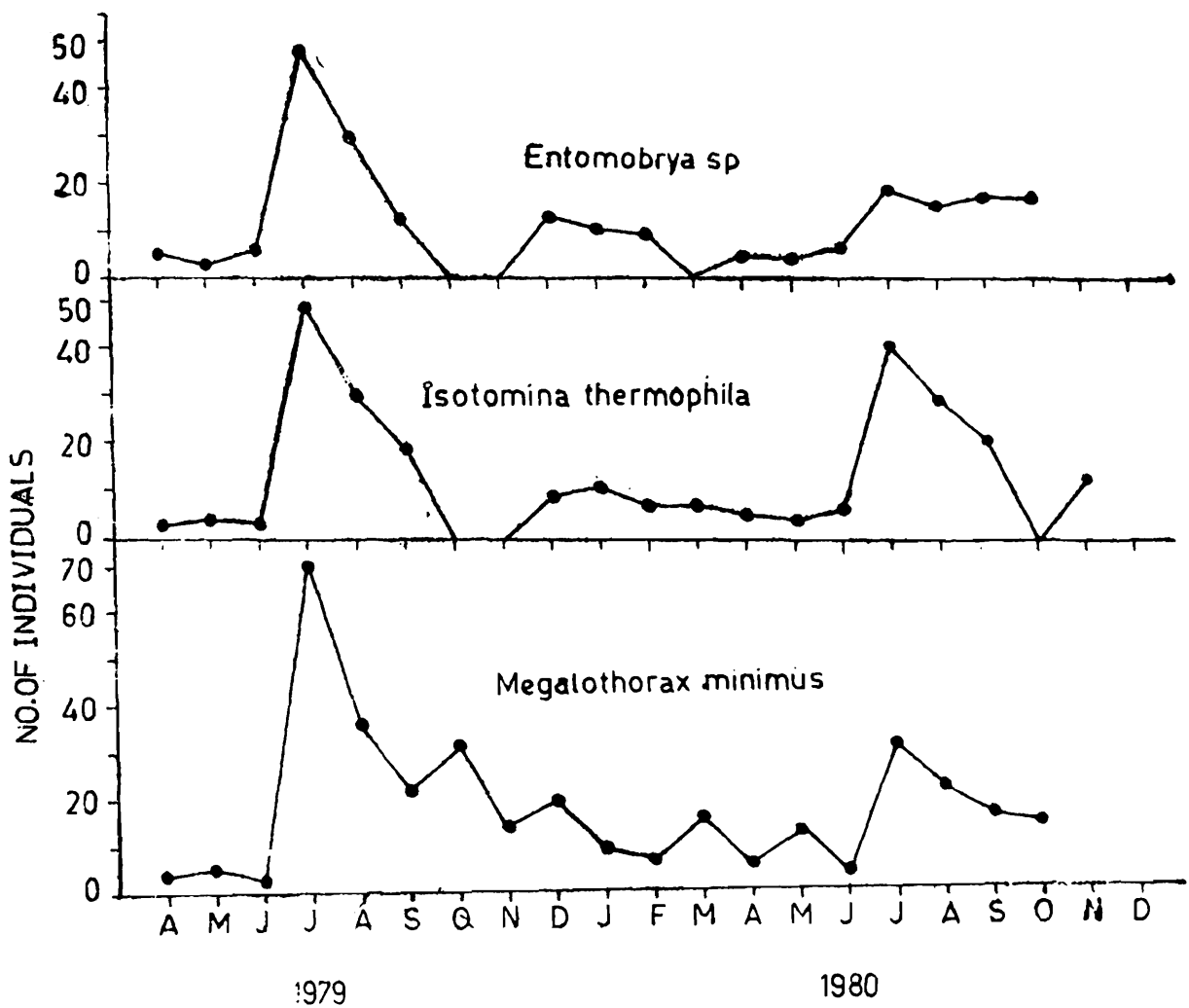


Fig. 26. Showing monthly fluctuations of dominant species of collembola in UCP site.

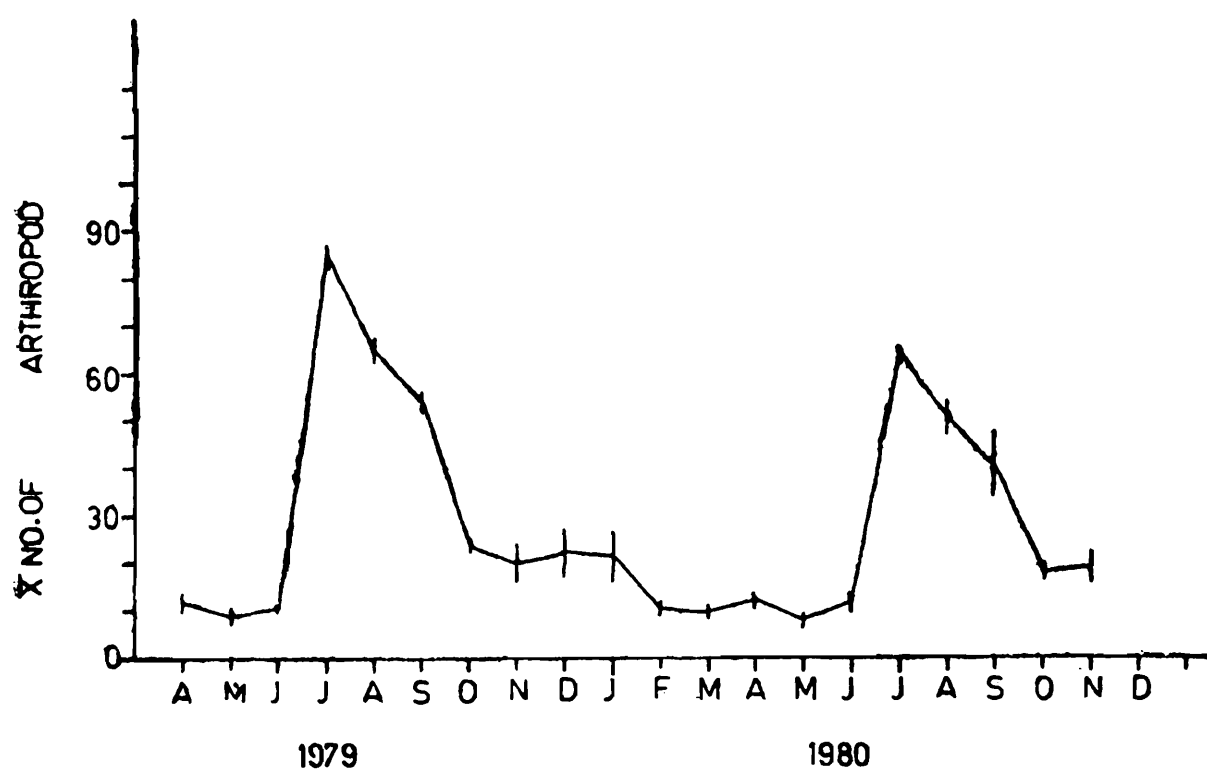


Fig. 27. Showing monthly fluctuations of total number of arthropod in UCP site (Mean $\pm$ SE).

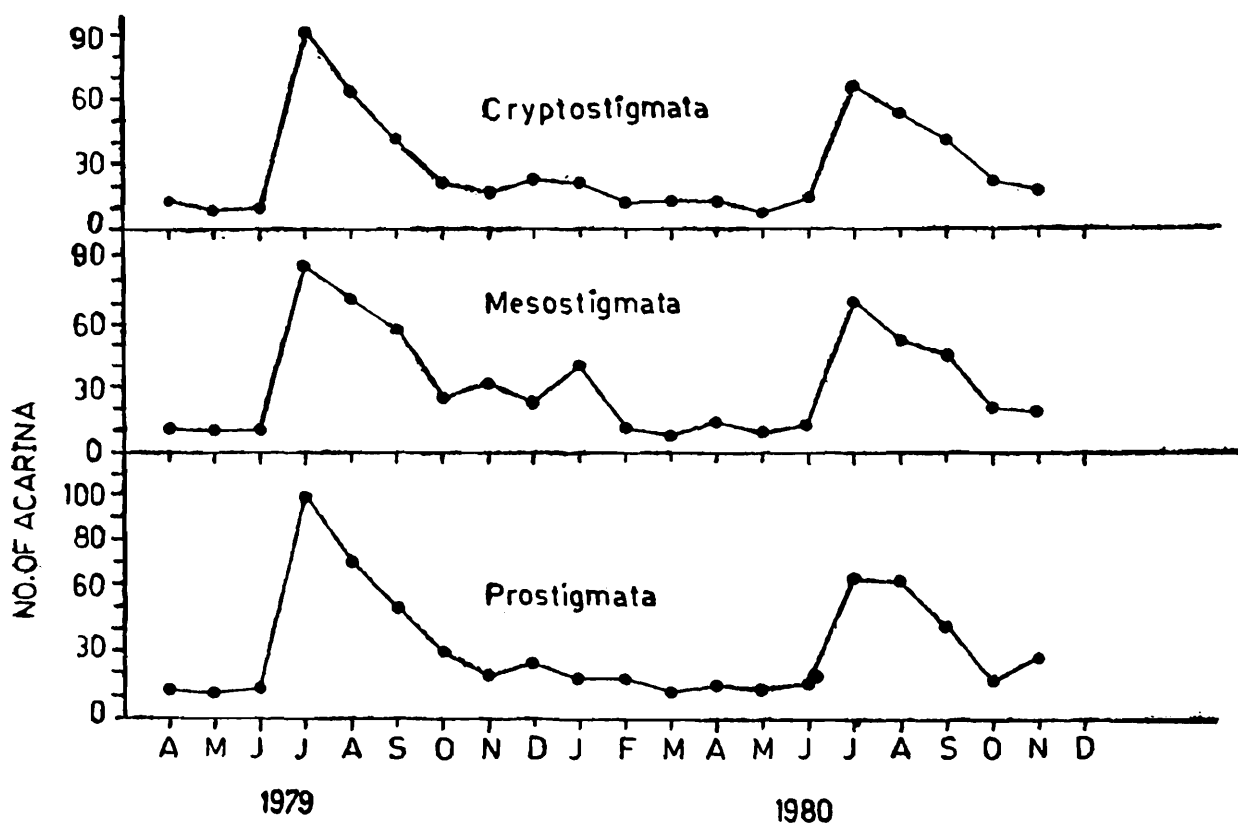


Fig. 28. Showing monthly fluctuations of dominant sub-orders of acarina in UCP site.

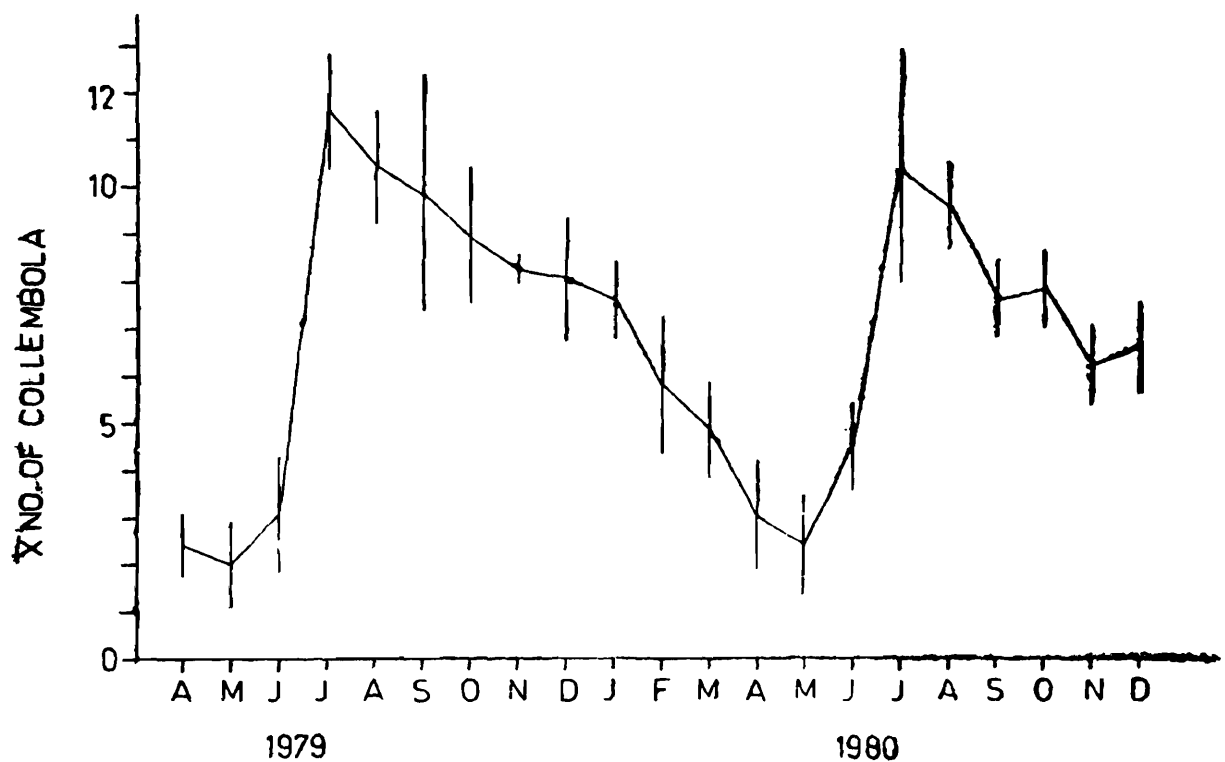


Fig. 29. Showing monthly fluctuations of total number of collembola in ACP site (Mean $\pm$ SE).

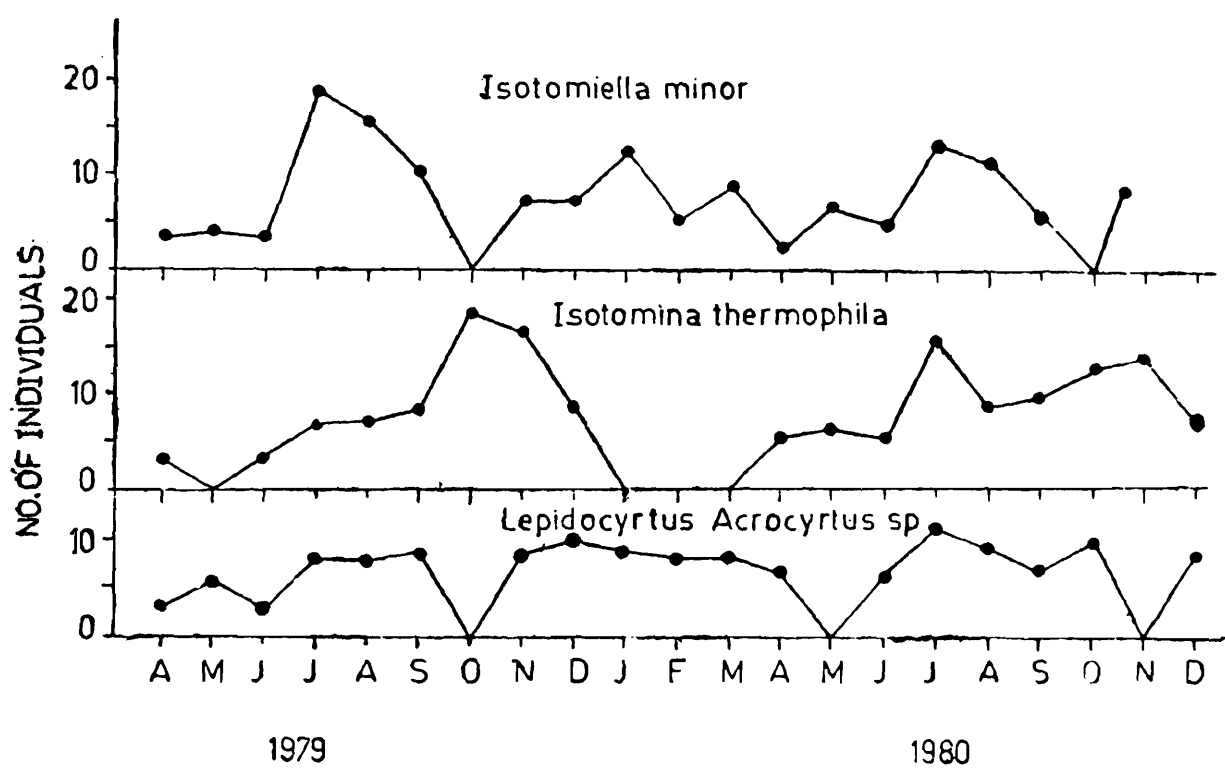


Fig. 30. Showing monthly fluctuations of dominant species of collembola in ACP site.

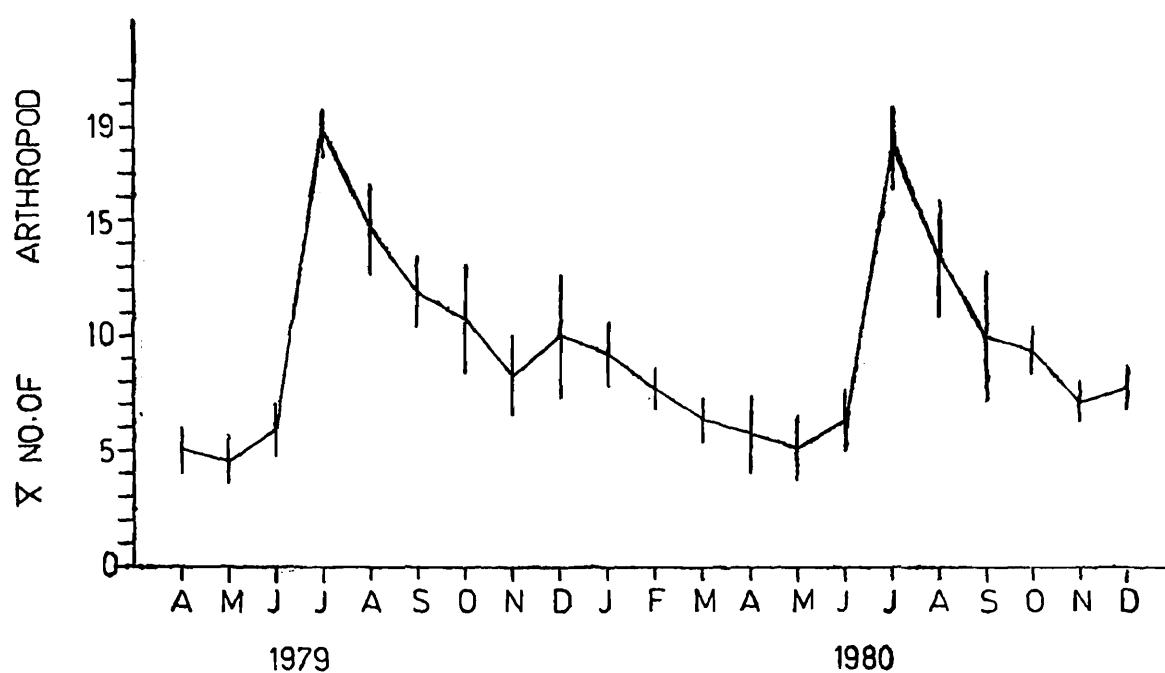


Fig. 31. Showing monthly fluctuations of total number of arthropod in ACP site (Mean $\pm$ SE).

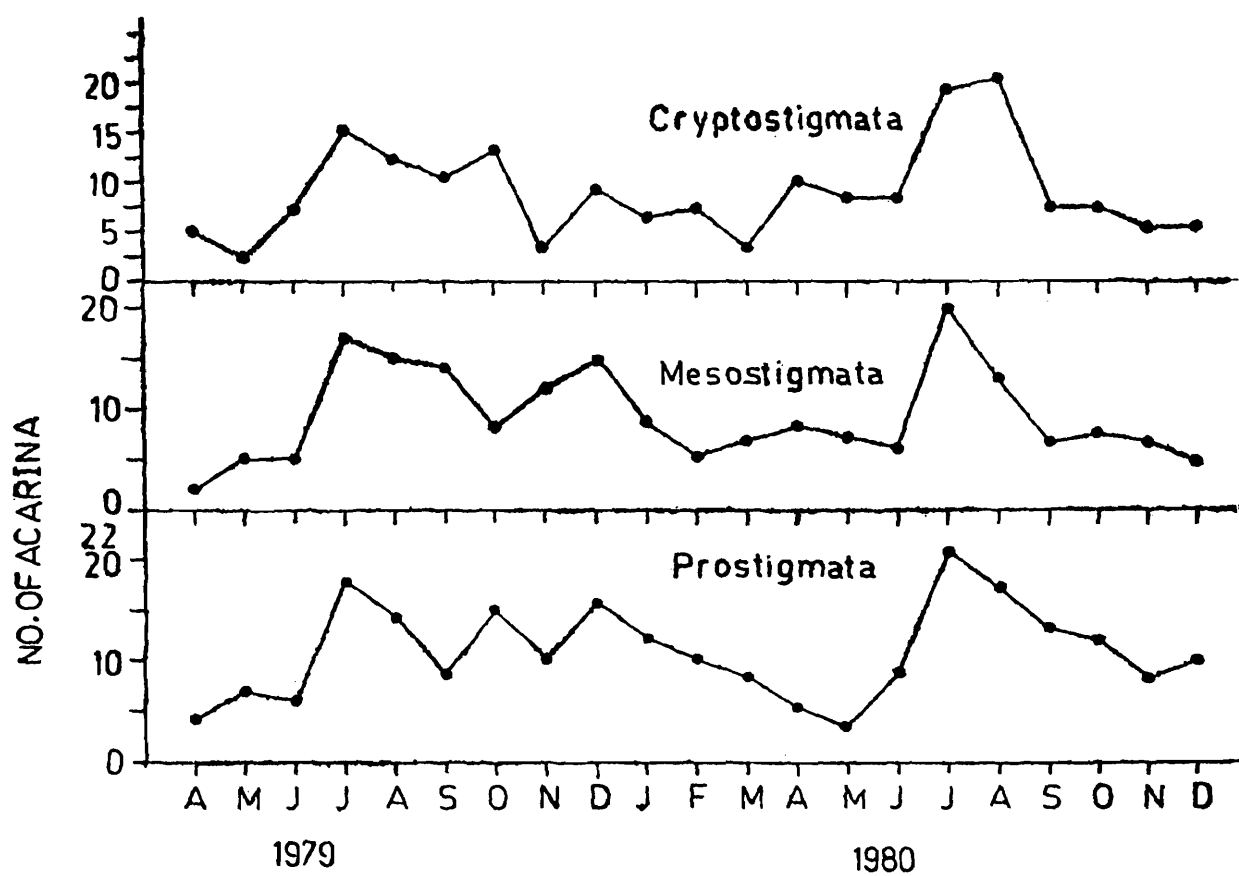


Fig. 32. Showing monthly fluctuations of dominant sub-orders of acarina in ACP site.

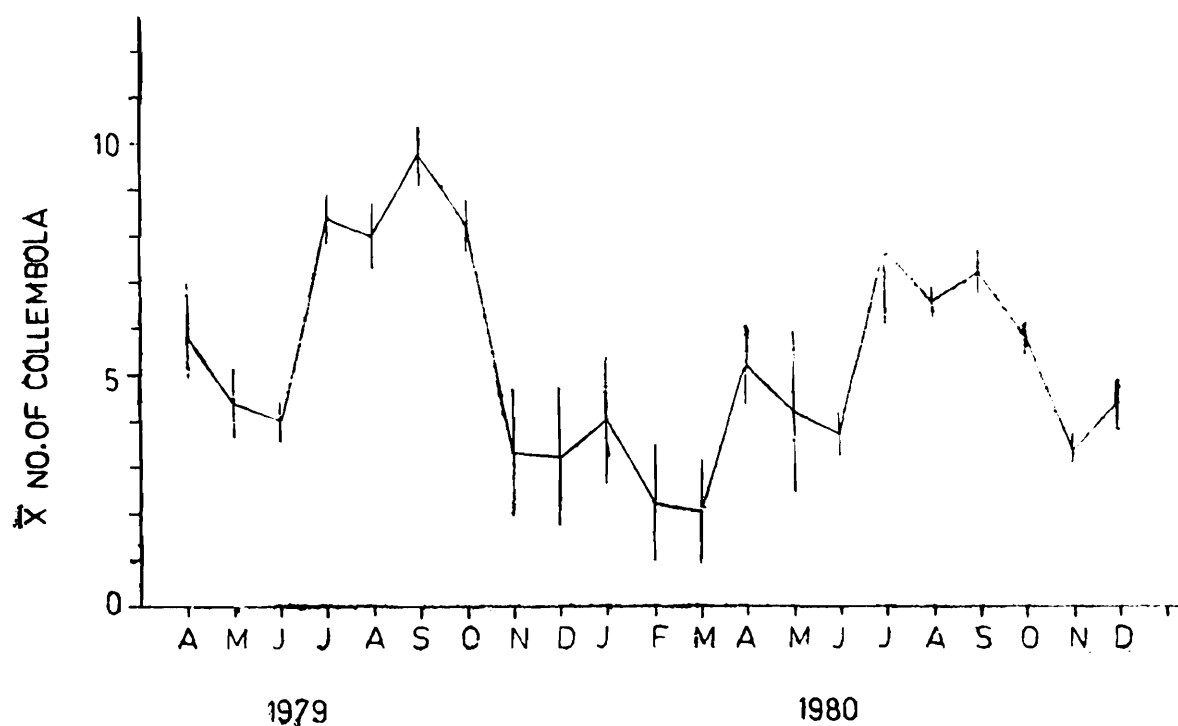


Fig. 33. Showing monthly fluctuations of total number of collembola in ICE site (Mean $\pm$ SE).

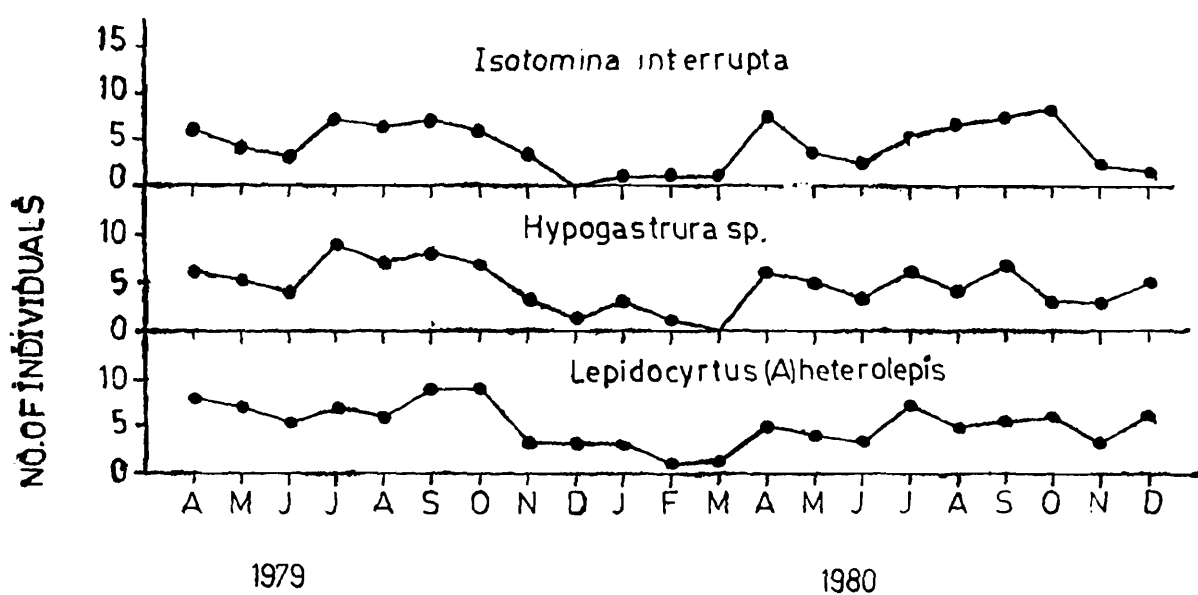


Fig. 34. Showing monthly fluctuations of dominant species of collembola in ICE site.

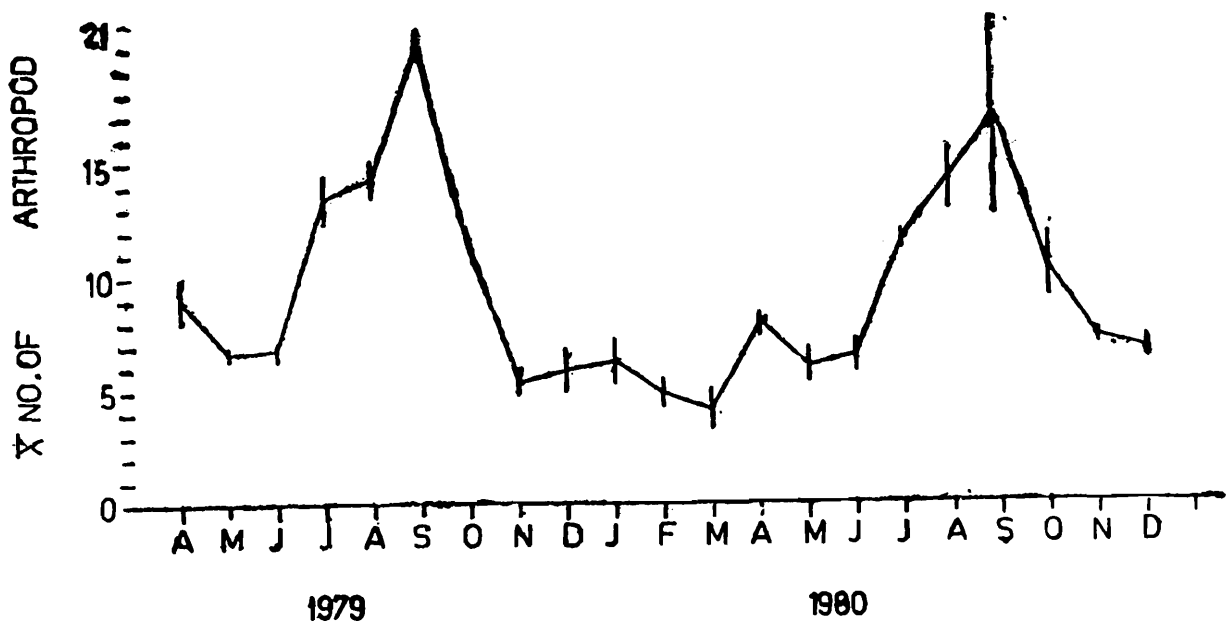


Fig. 35. Showing monthly fluctuations of total number of arthropod in ICE site (Mean $\pm$ SE).

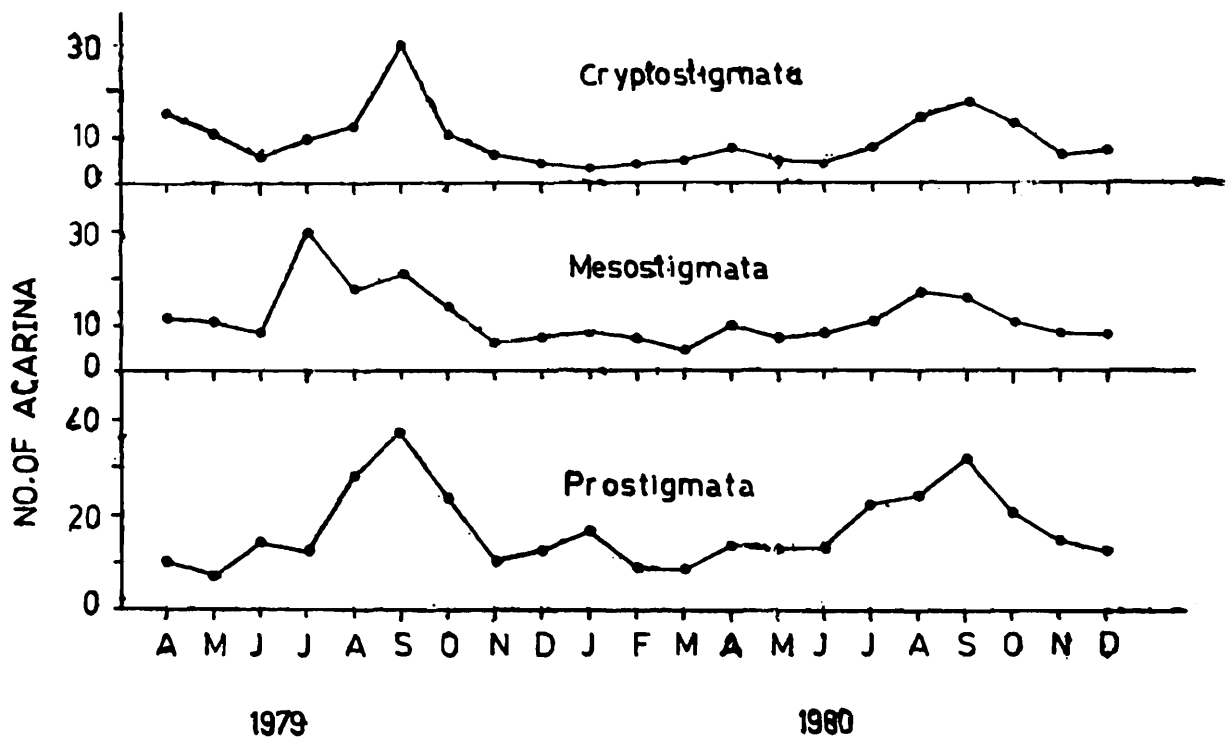


Fig. 36. Showing monthly fluctuations of dominant sub-orders of acarina in ICE site.

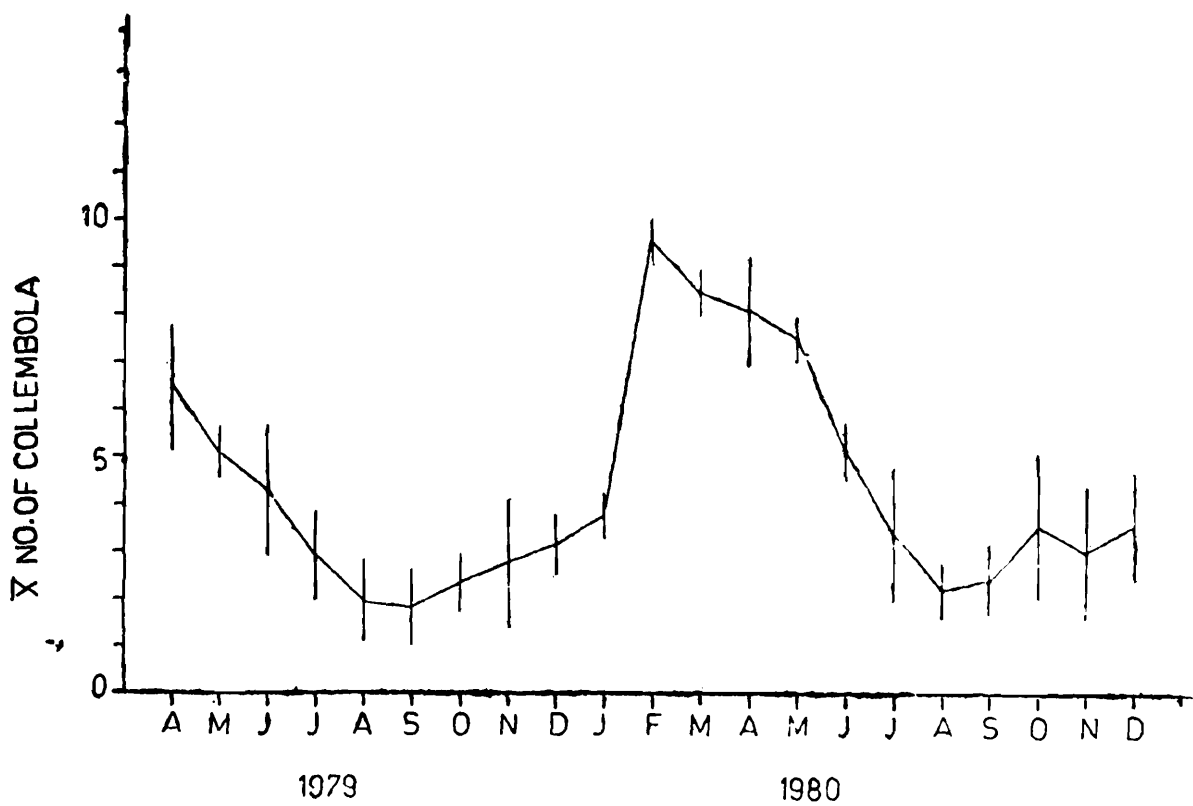


Fig. 37. Showing monthly fluctuations of total number of collembola in SCE site (Mean $\pm$ SE).

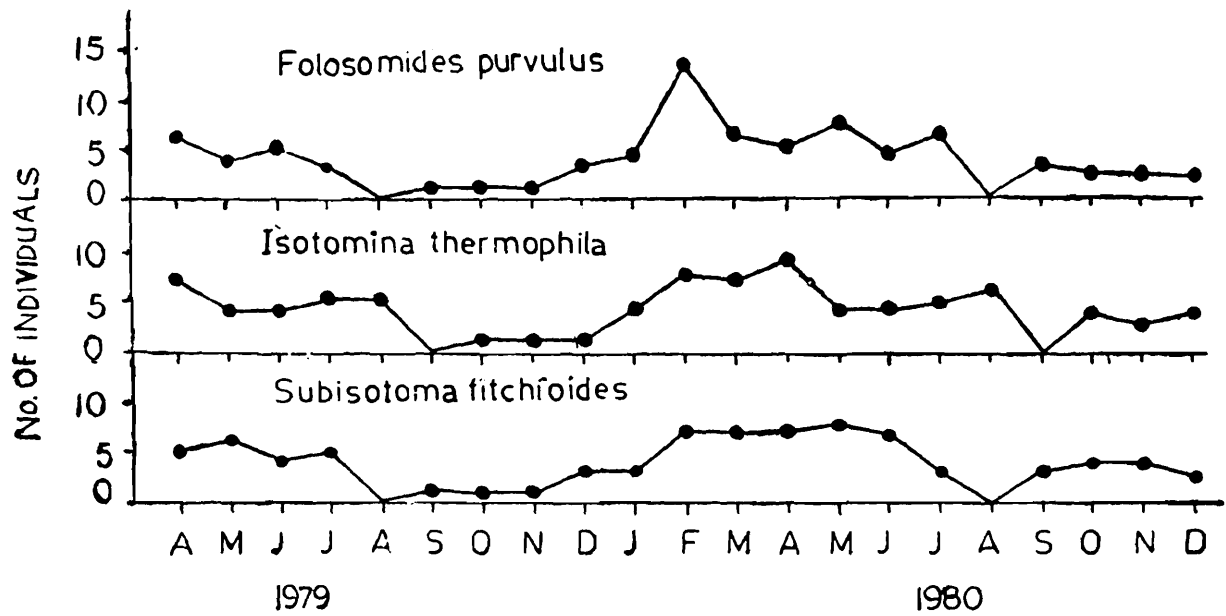


Fig. 38. Showing monthly fluctuations of dominant species of collembola in site.

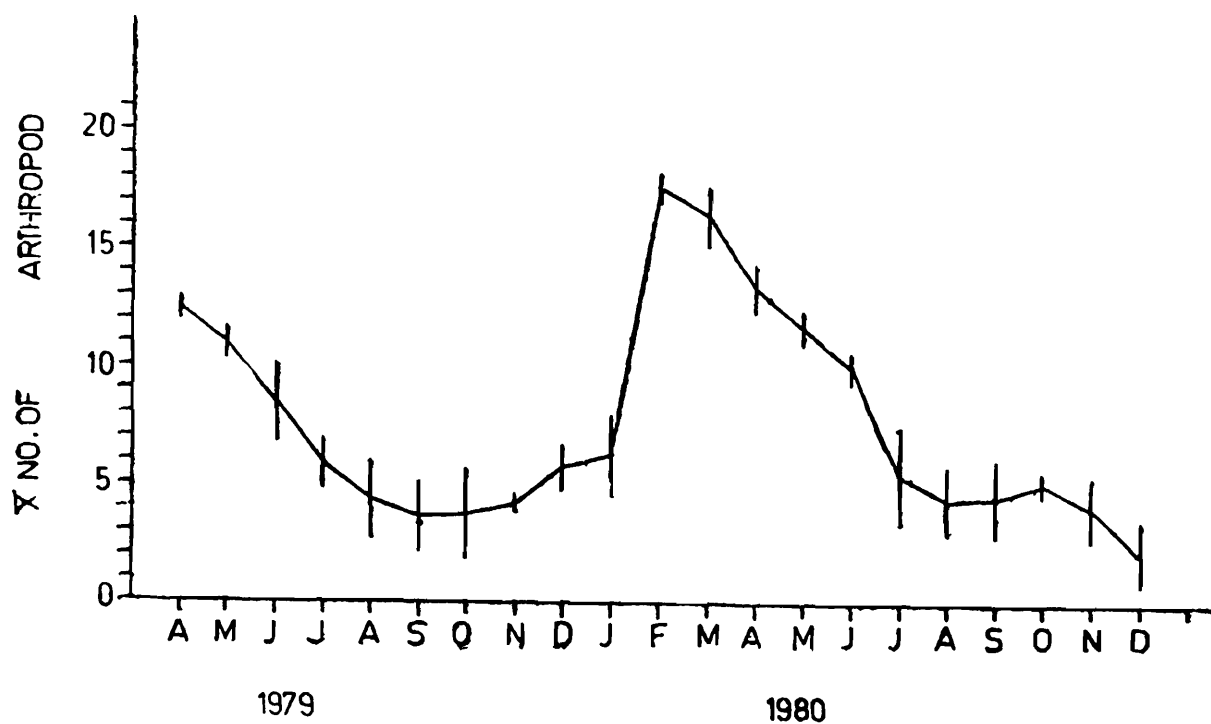


Fig. 39. Showing monthly fluctuations of total number of arthropod in SCE site (Mean $\pm$ SE).

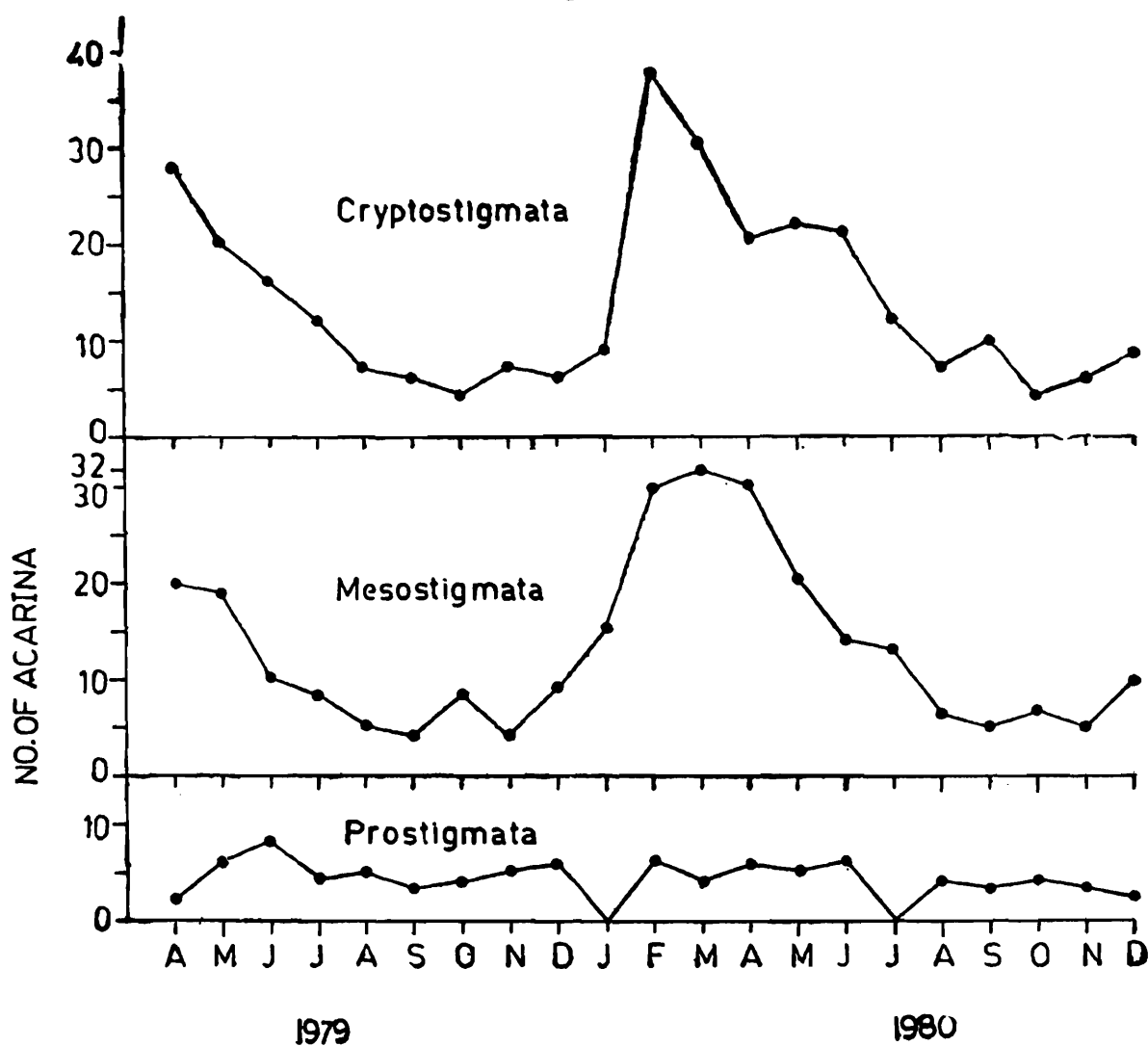


Fig. 40 Showing monthly fluctuations of dominant sub-orders of acarina in SCE site

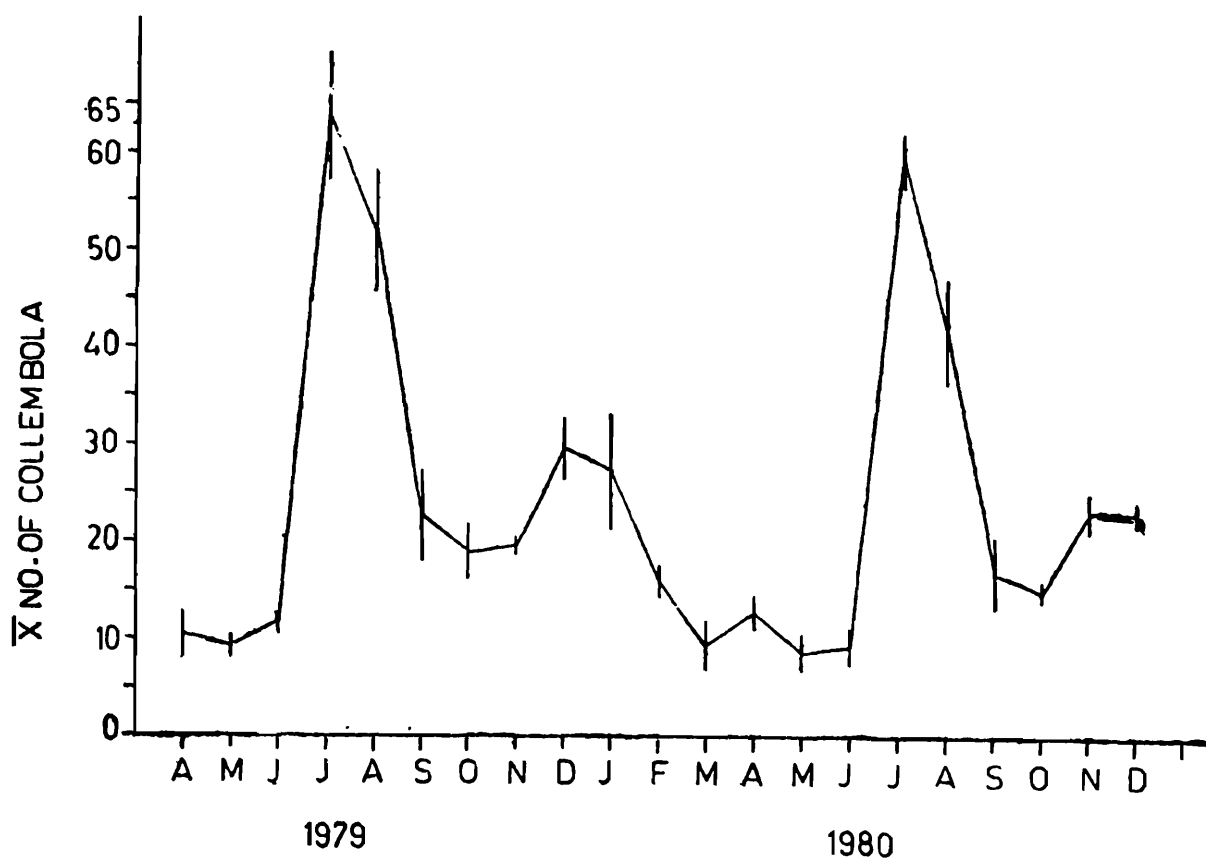


Fig. 41. Showing monthly fluctuations of total number of collembola in GDS site (Mean $\pm$ SE)

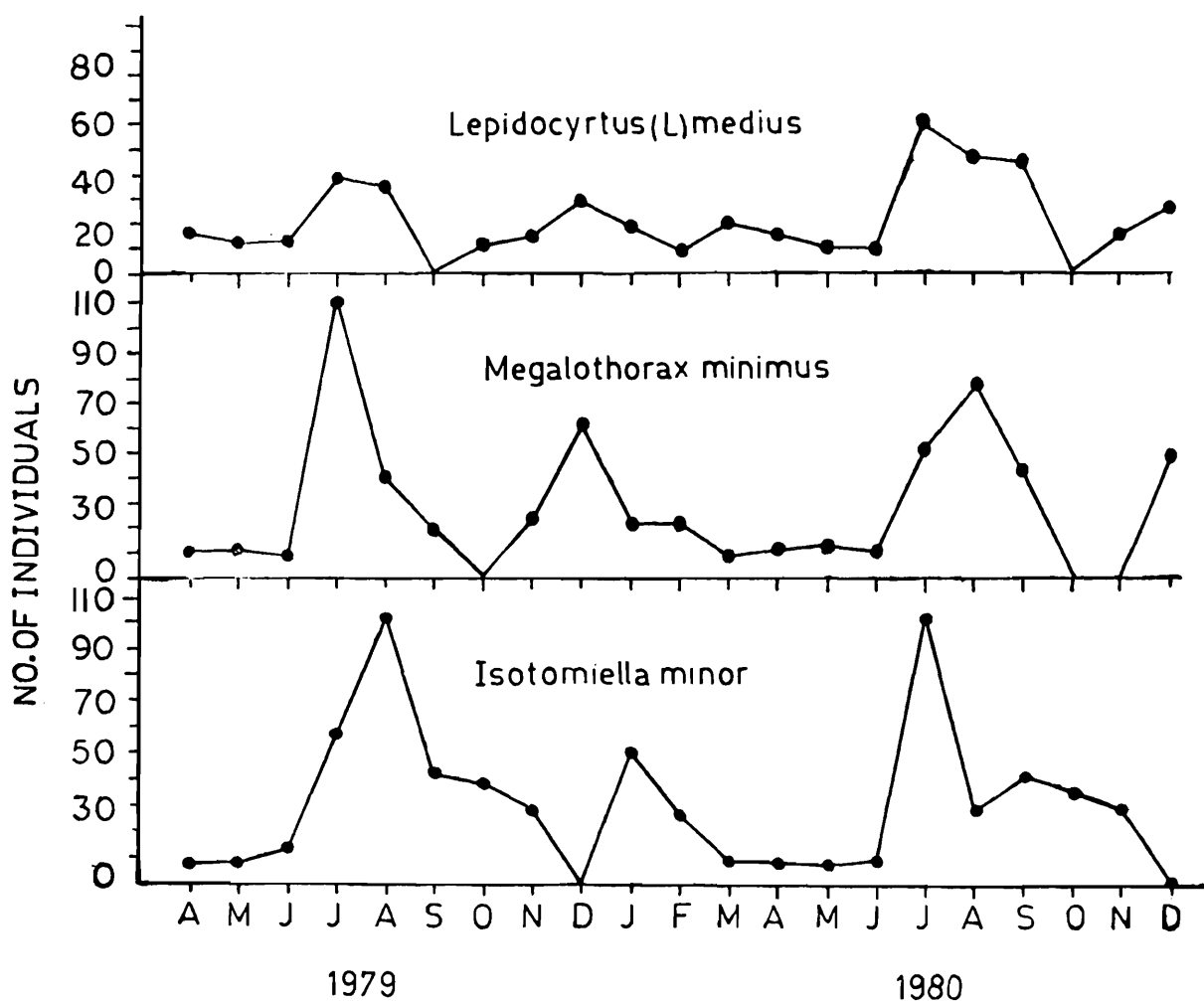


Fig. 42. Showing monthly fluctuations of dominant species of collembola in GDS site.

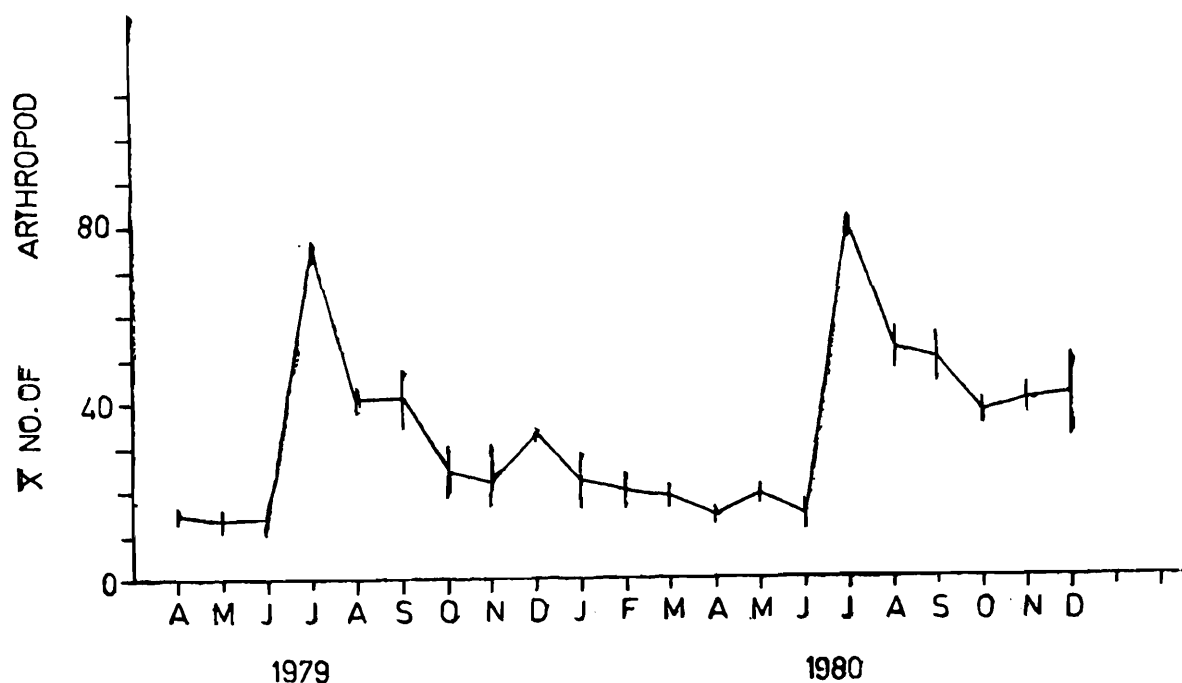


Fig. 43. Showing monthly fluctuations of total number of arthropod in GDS site (Mean $\pm$ SE)

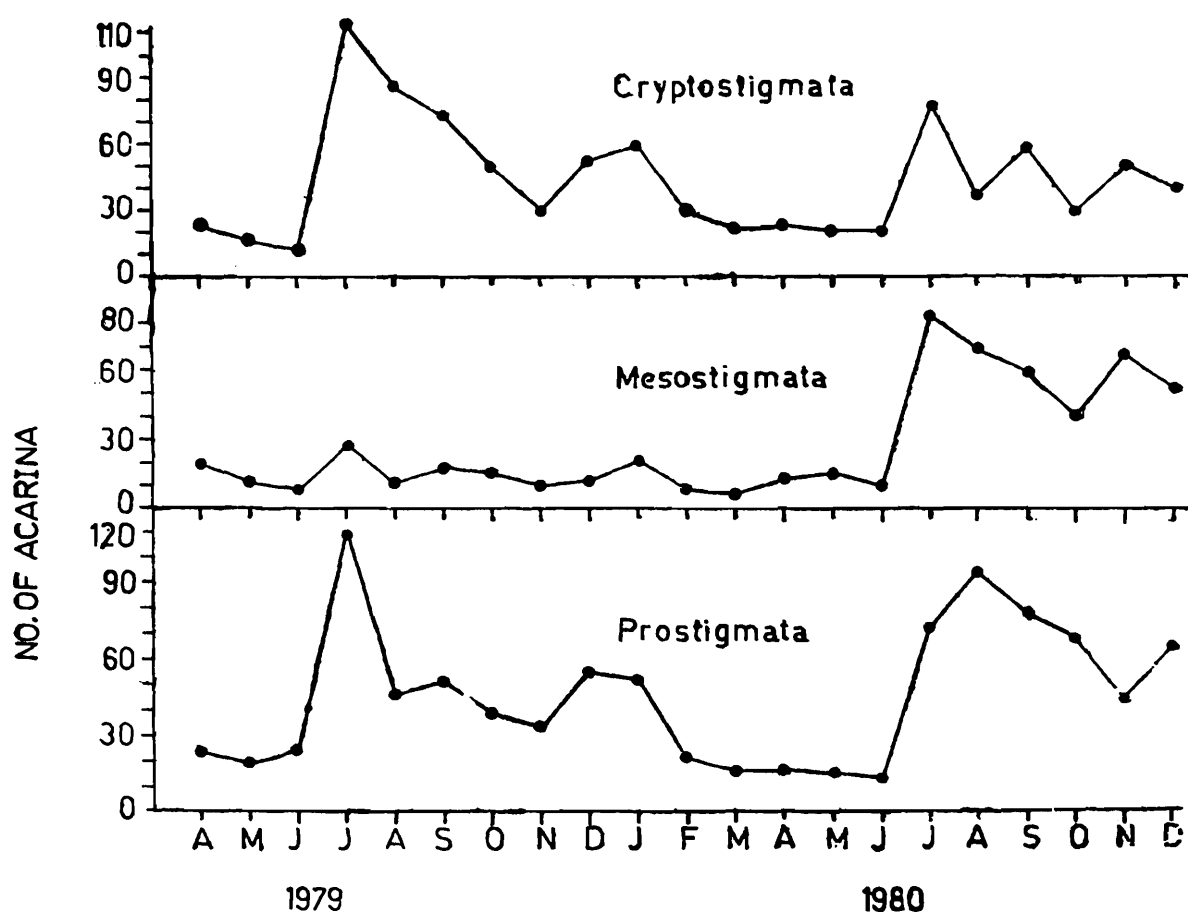


Fig. 44. Showing monthly fluctuations of dominant sub-orders of acarina in GDS site.

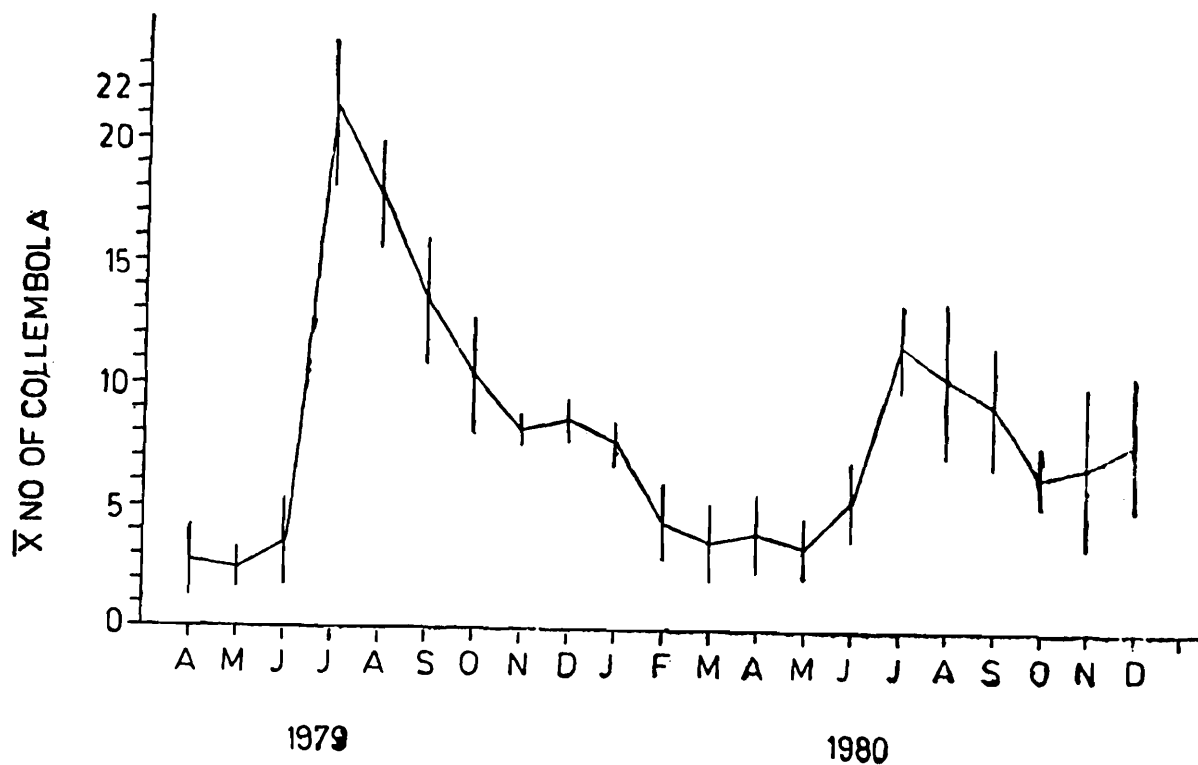


Fig. 45. Showing monthly fluctuations of total number of collembola in SDS site (Mean $\pm$ SE)

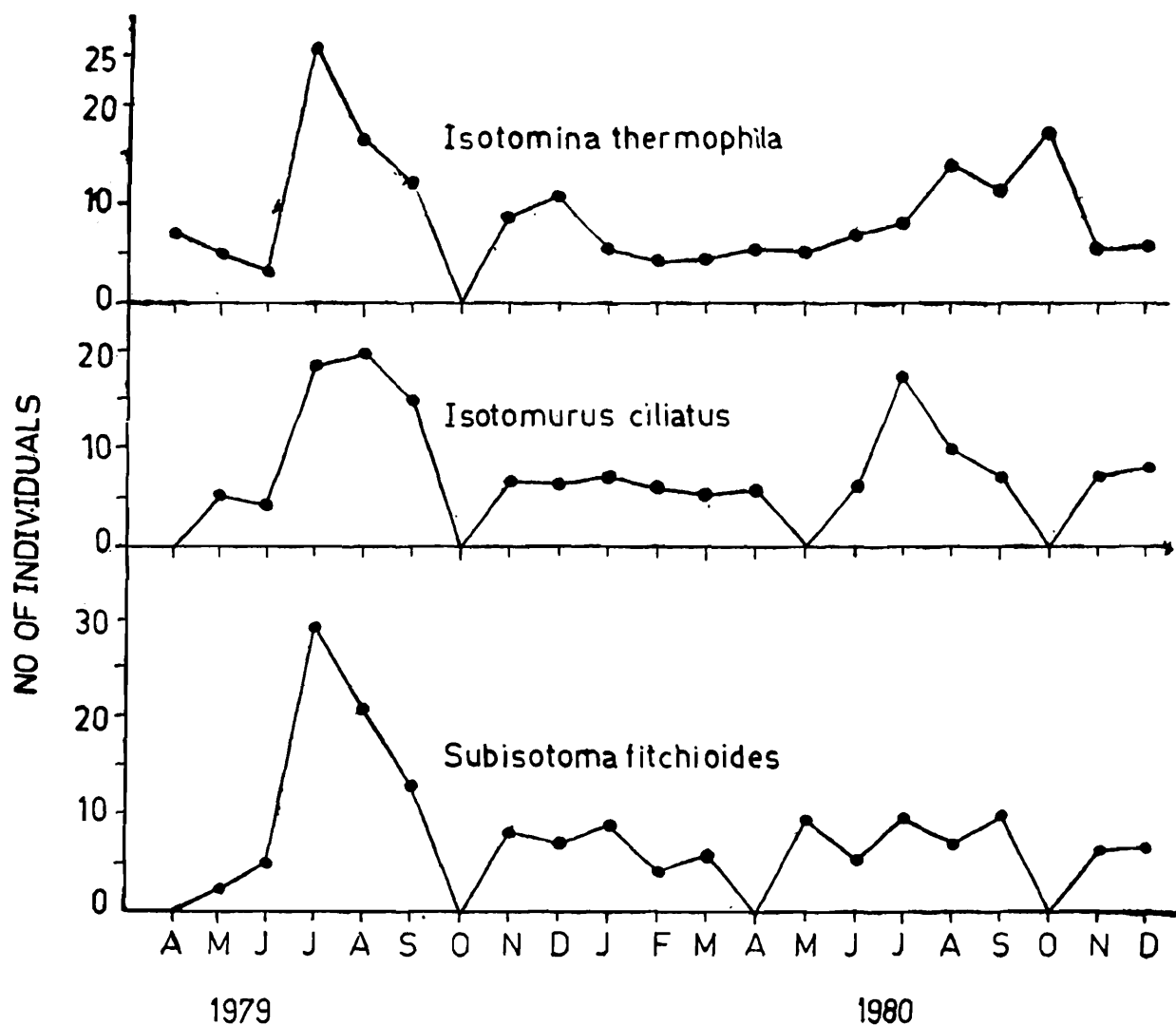


Fig. 46. Showing monthly fluctuations of dominant species of collembola in SDS site.

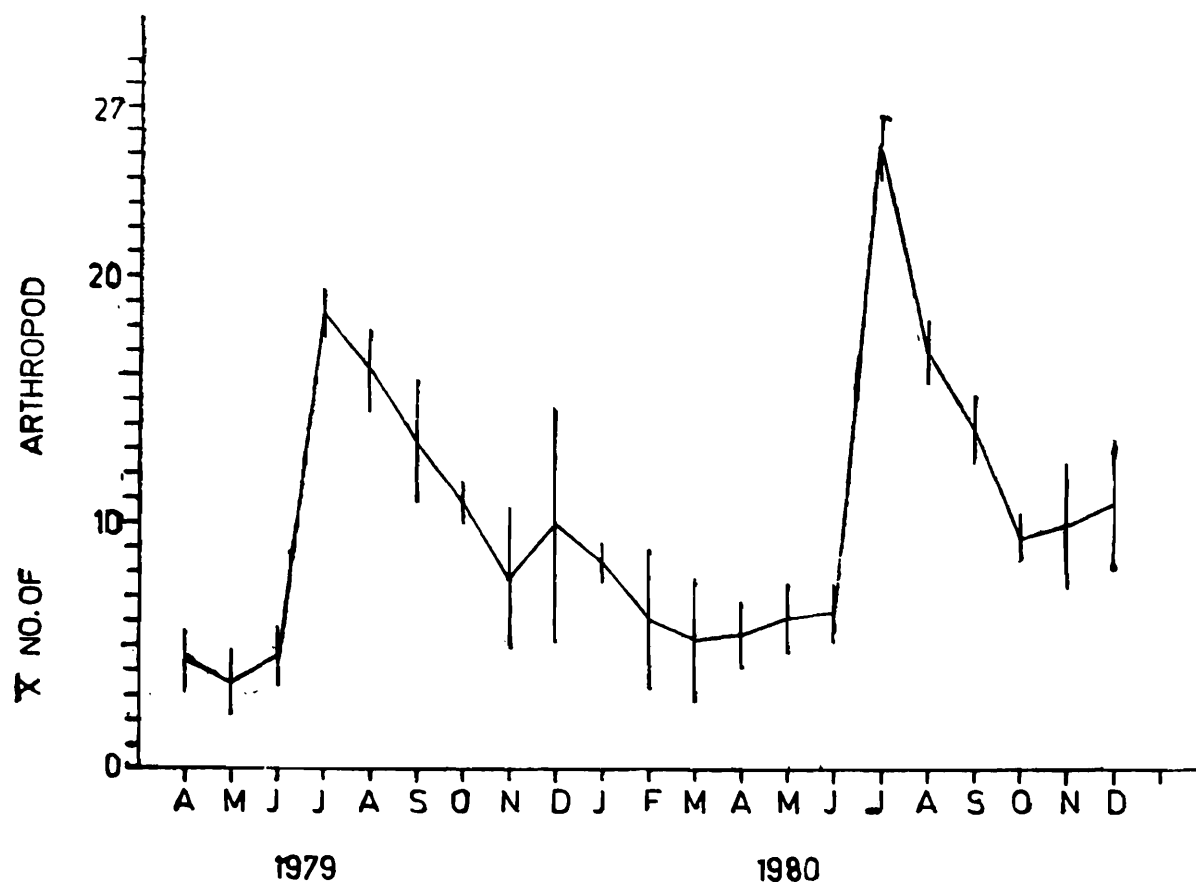


Fig. 47. Showing monthly fluctuations of total number of arthropod in SDS site (Mean $\pm$ SE)

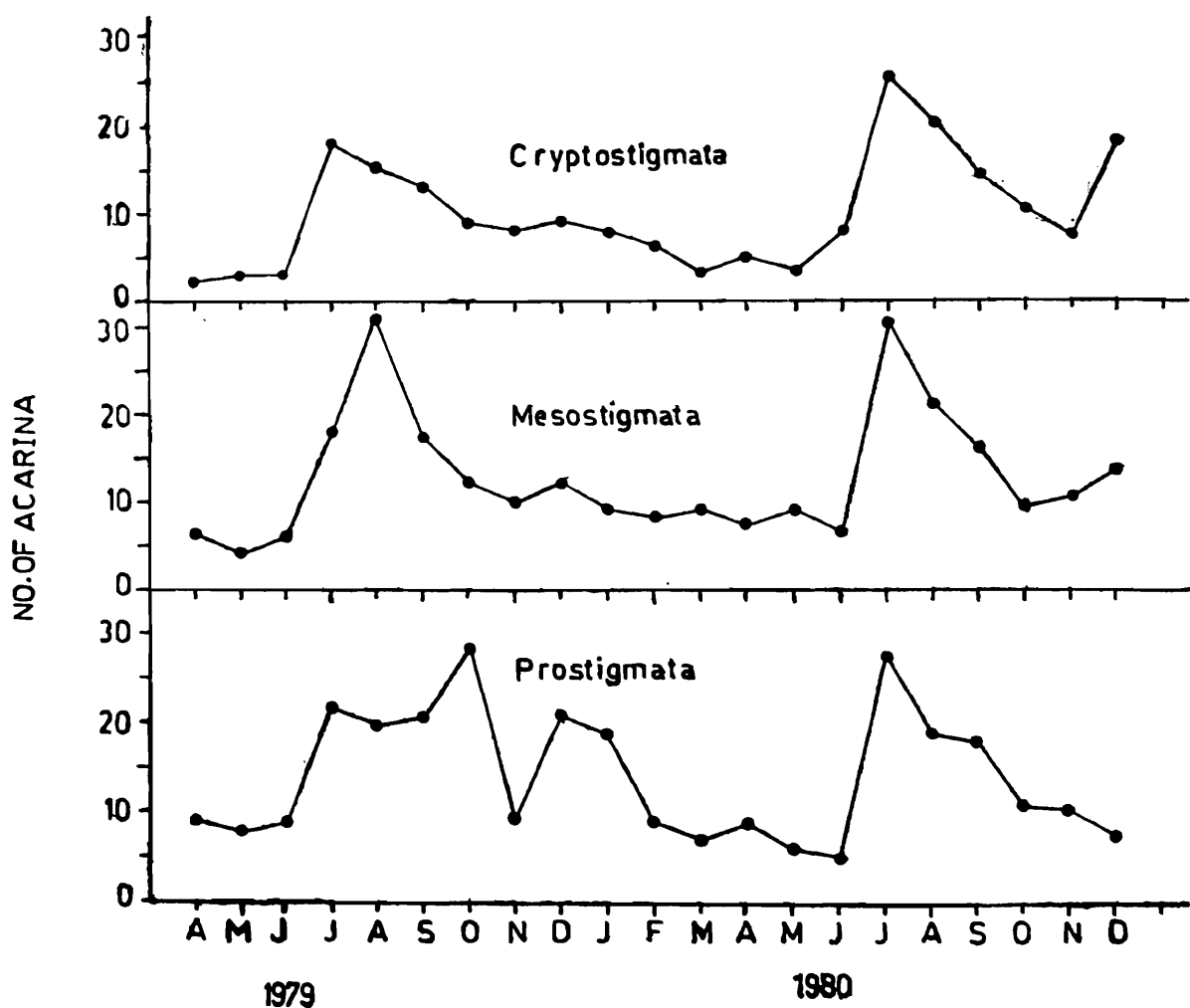


Fig. 48. Showing monthly fluctuations of dominant sub-orders of acarina in SDS site.

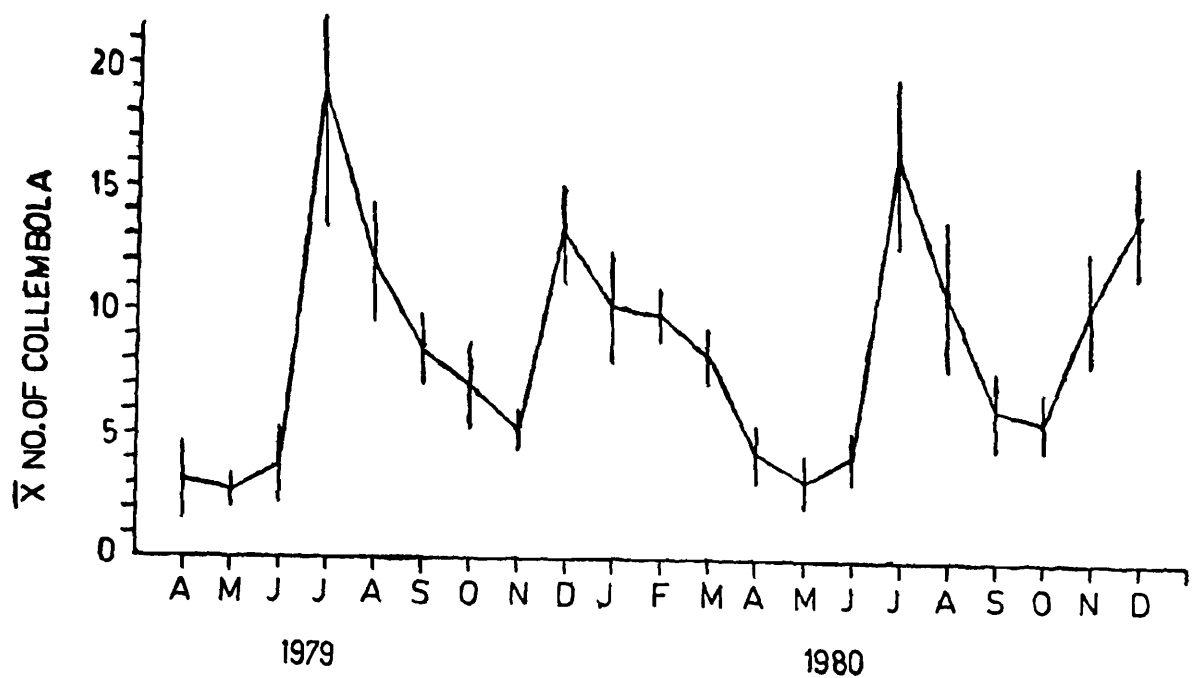


Fig. 49. Showing monthly fluctuations of total number of collembola in DSC site (Mean $\pm$ SE)

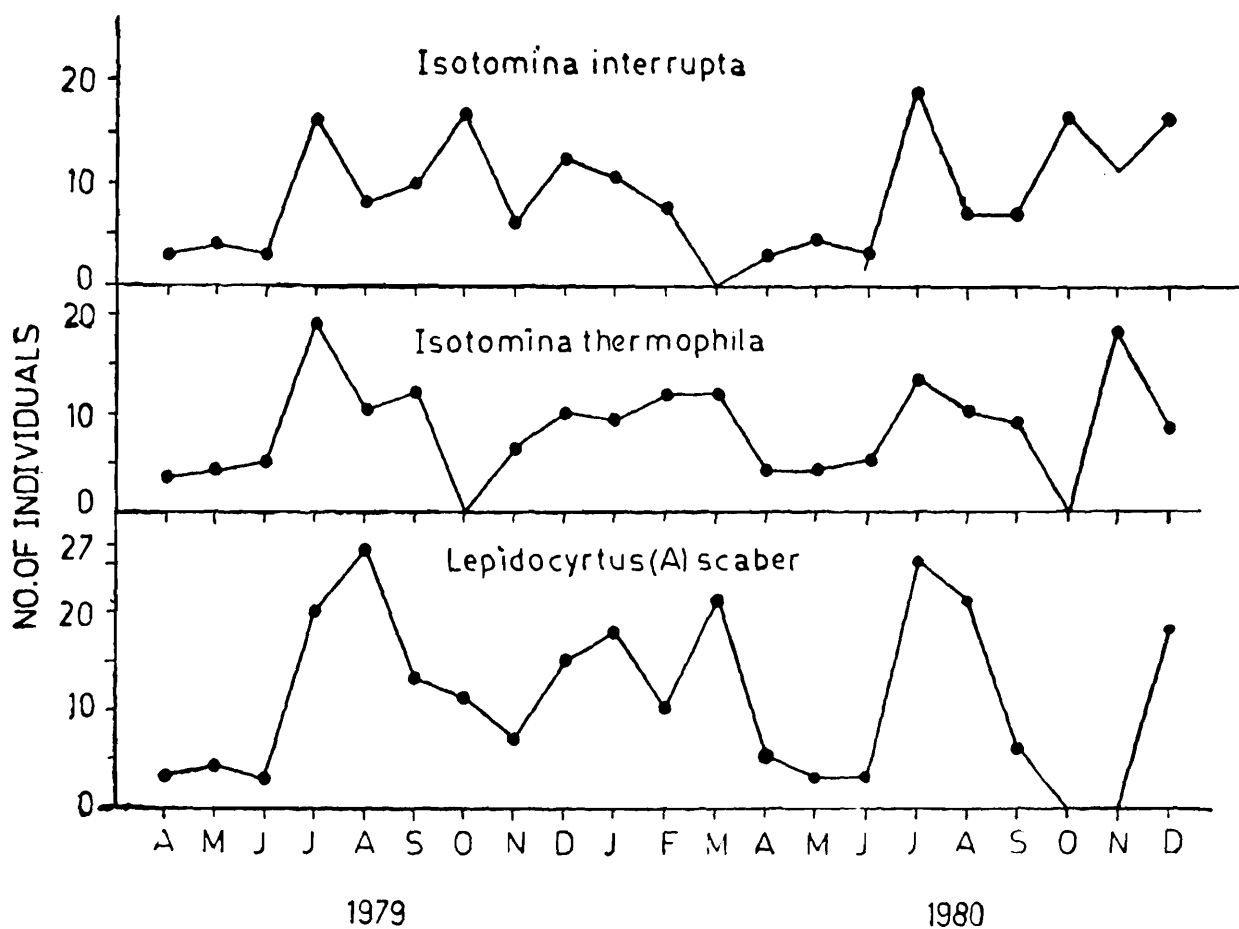


Fig. 50. Showing monthly fluctuations of dominant species of collembola in DCS site.

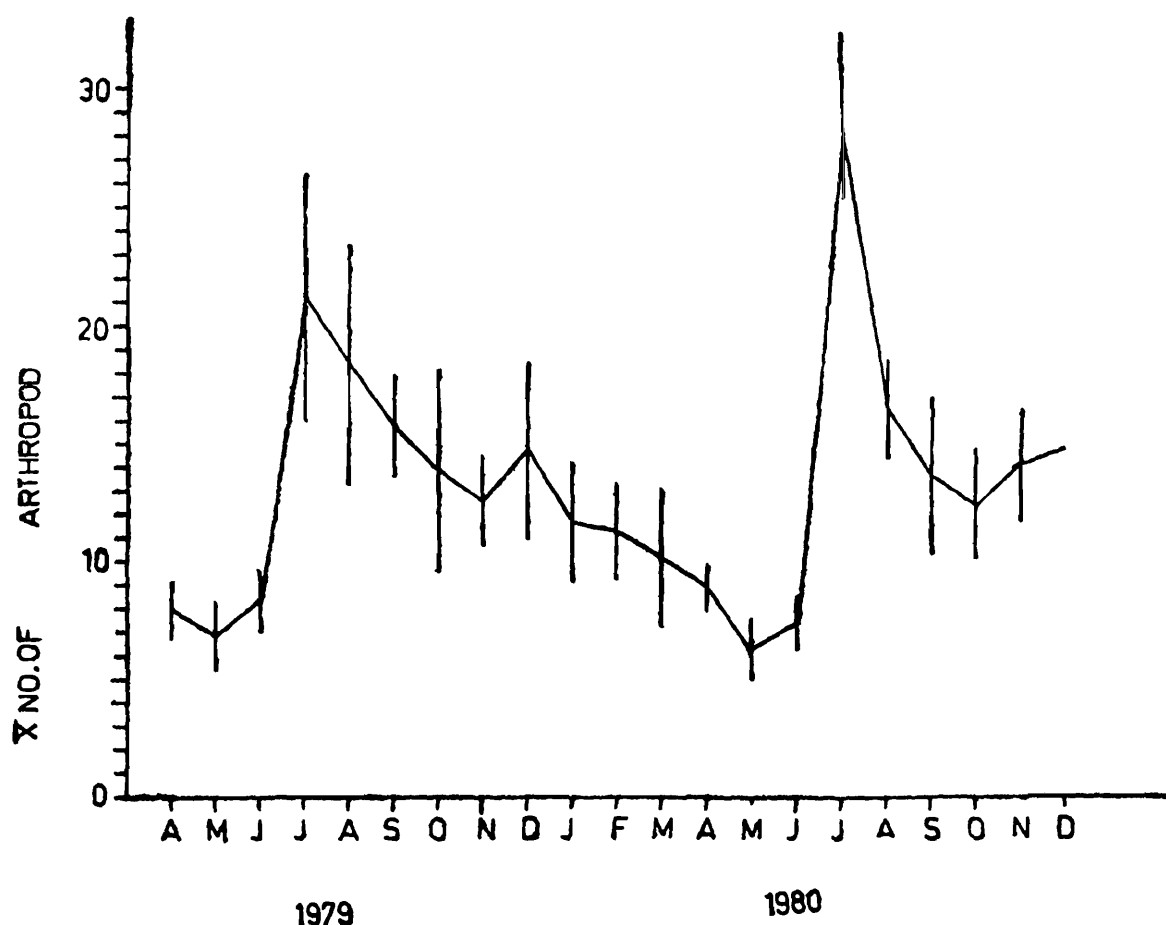


Fig. 51. Showing monthly fluctuations of total number of arthropod in DCS site (Mean $\pm$ SE)

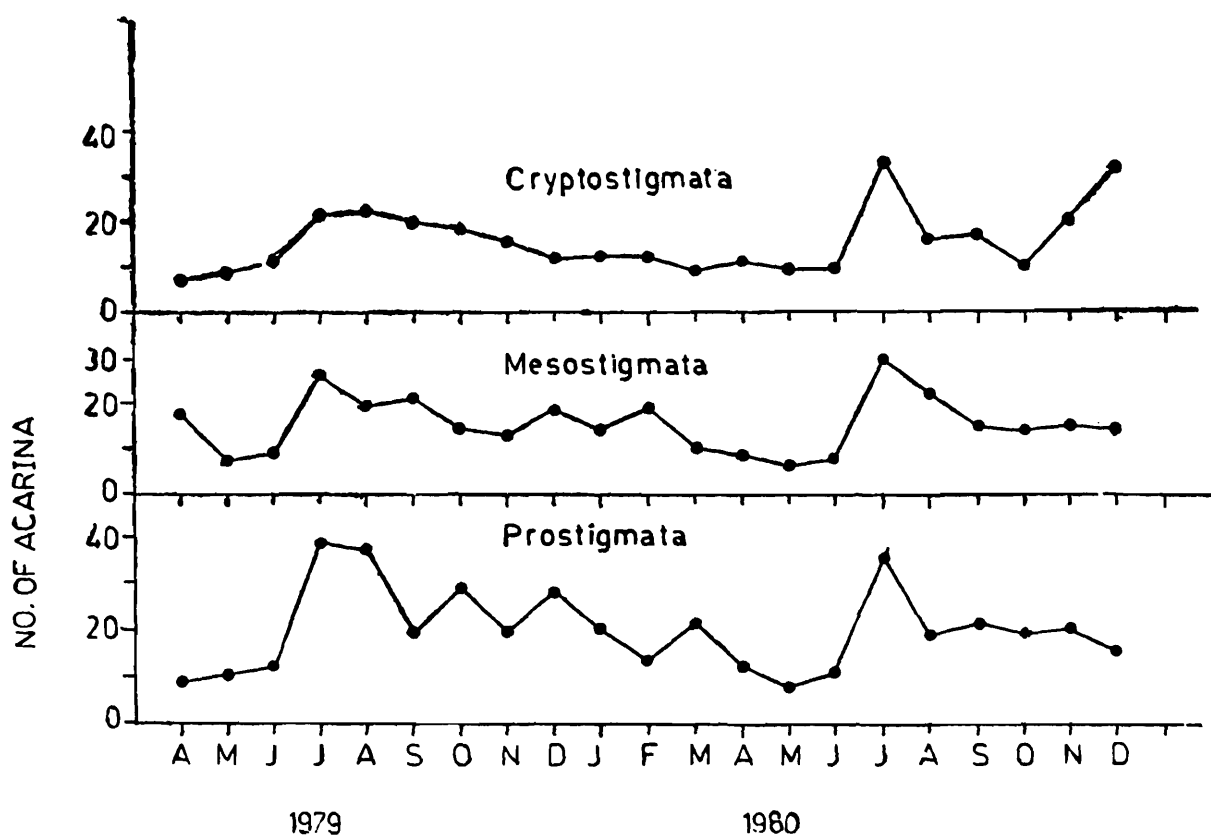


Fig. 52. Showing monthly fluctuations of dominant sub-orders of acarina in DCS site.

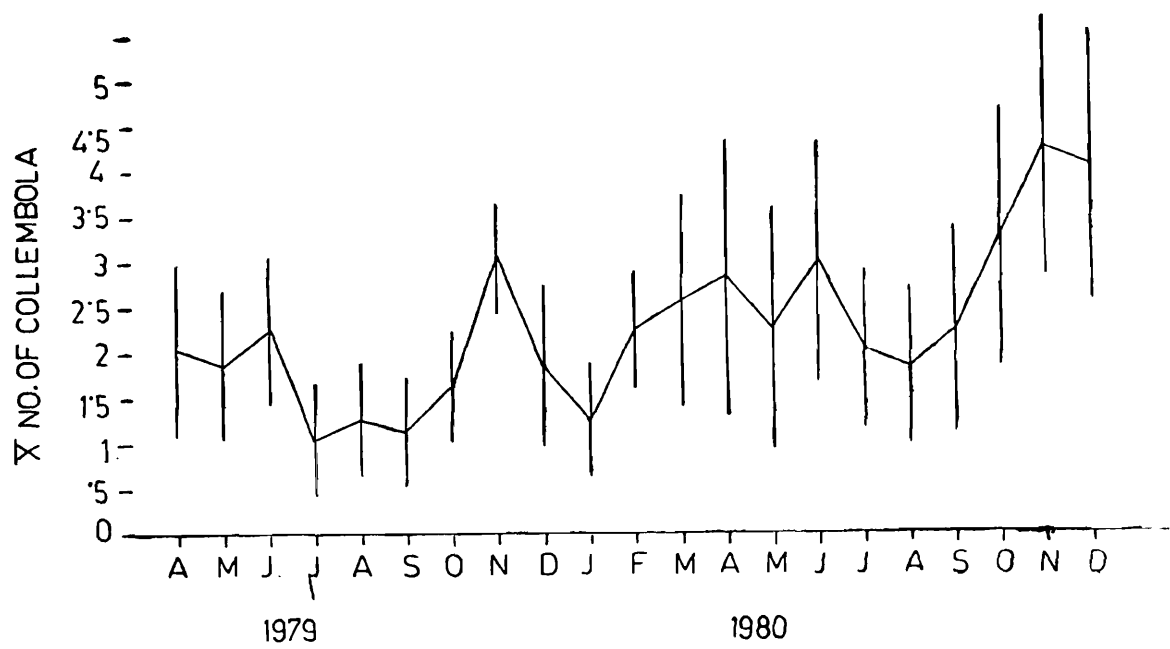


Fig. 53. Showing monthly fluctuations of total number of collembola in DIE site (Mean $\pm$ SE)

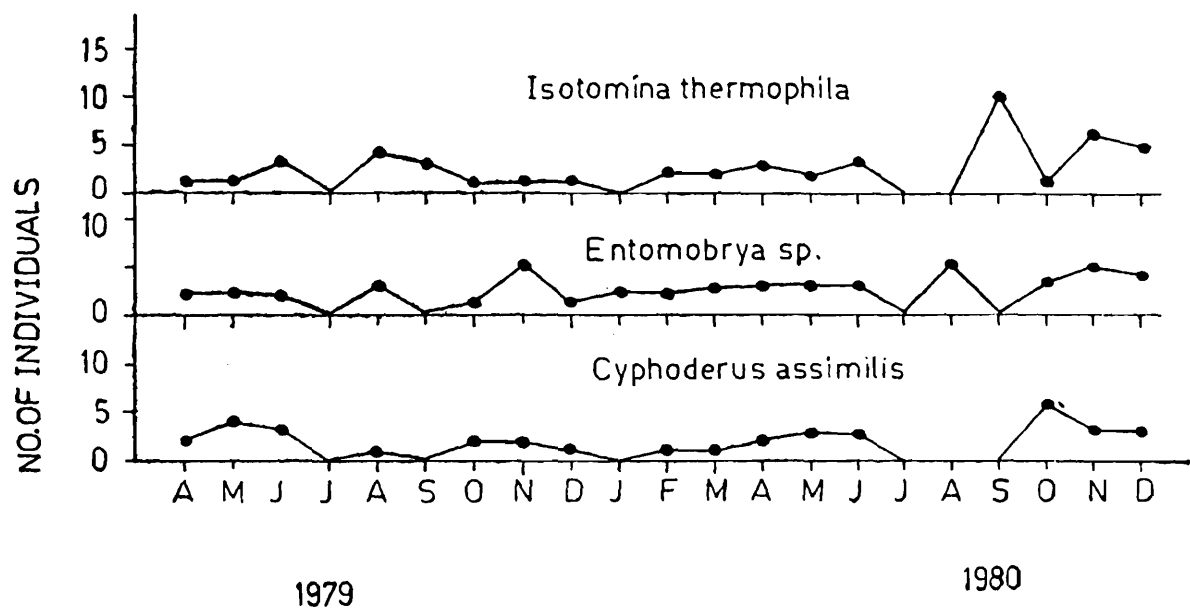


Fig. 54. Showing monthly fluctuations of dominant species of collembola in DIE site.

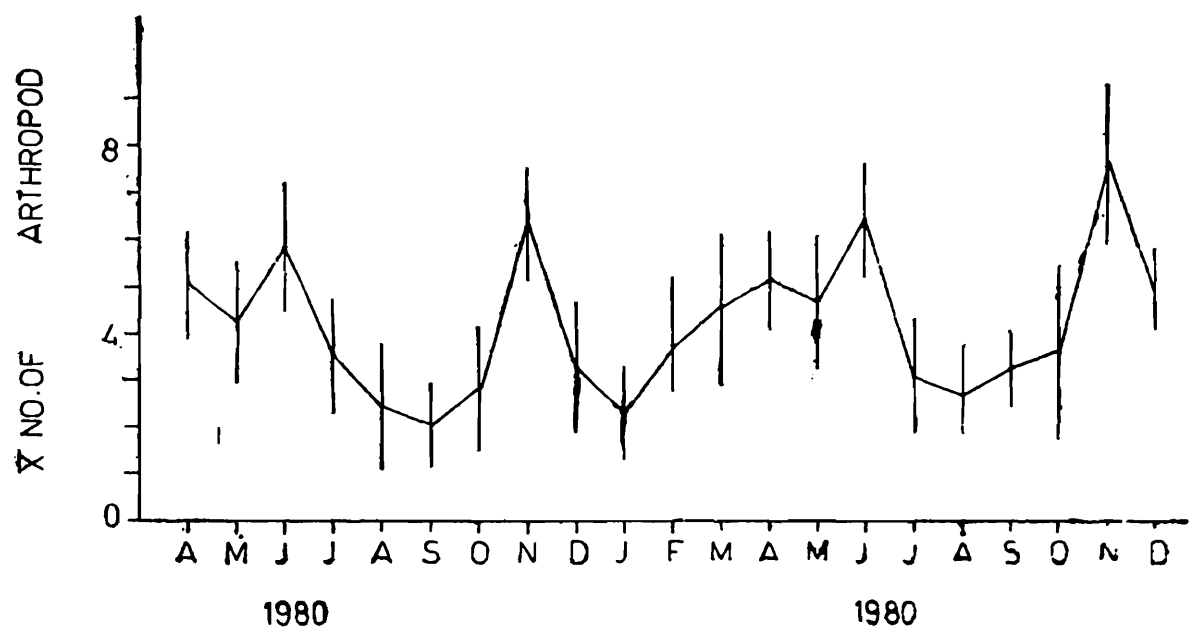


Fig. 55. Showing monthly fluctuations of total number of arthropod in DIE site (Mean $\pm$ SE)

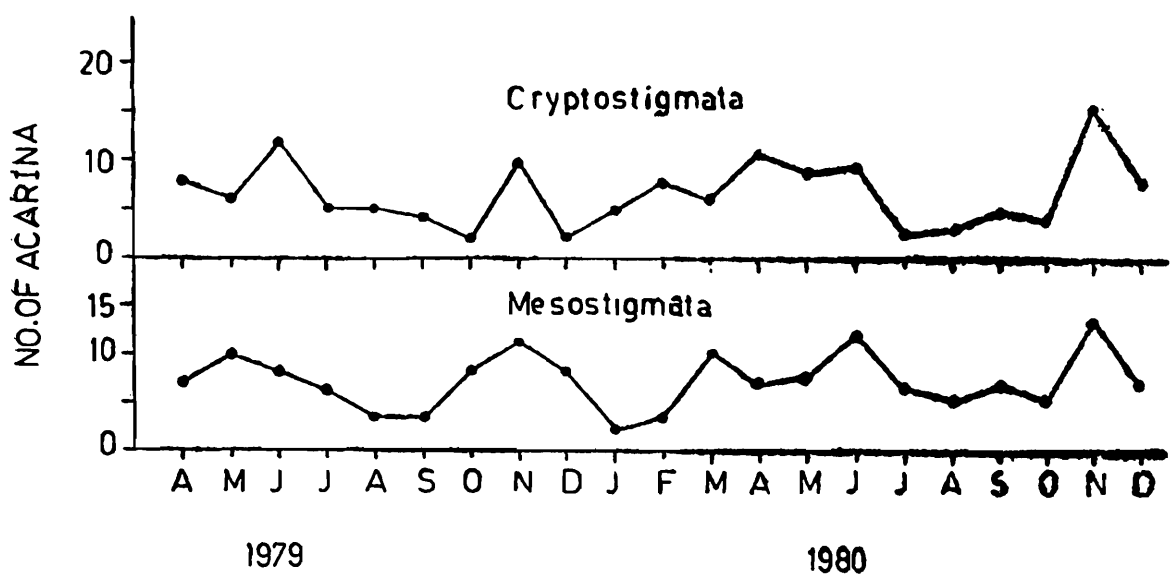


Fig. 56. Showing monthly fluctuations of dominant sub-orders of acarina in DIE site.



Fig. 57. Showing monthly fluctuations of total number of collembola in URS site (Mean $\pm$ SE)

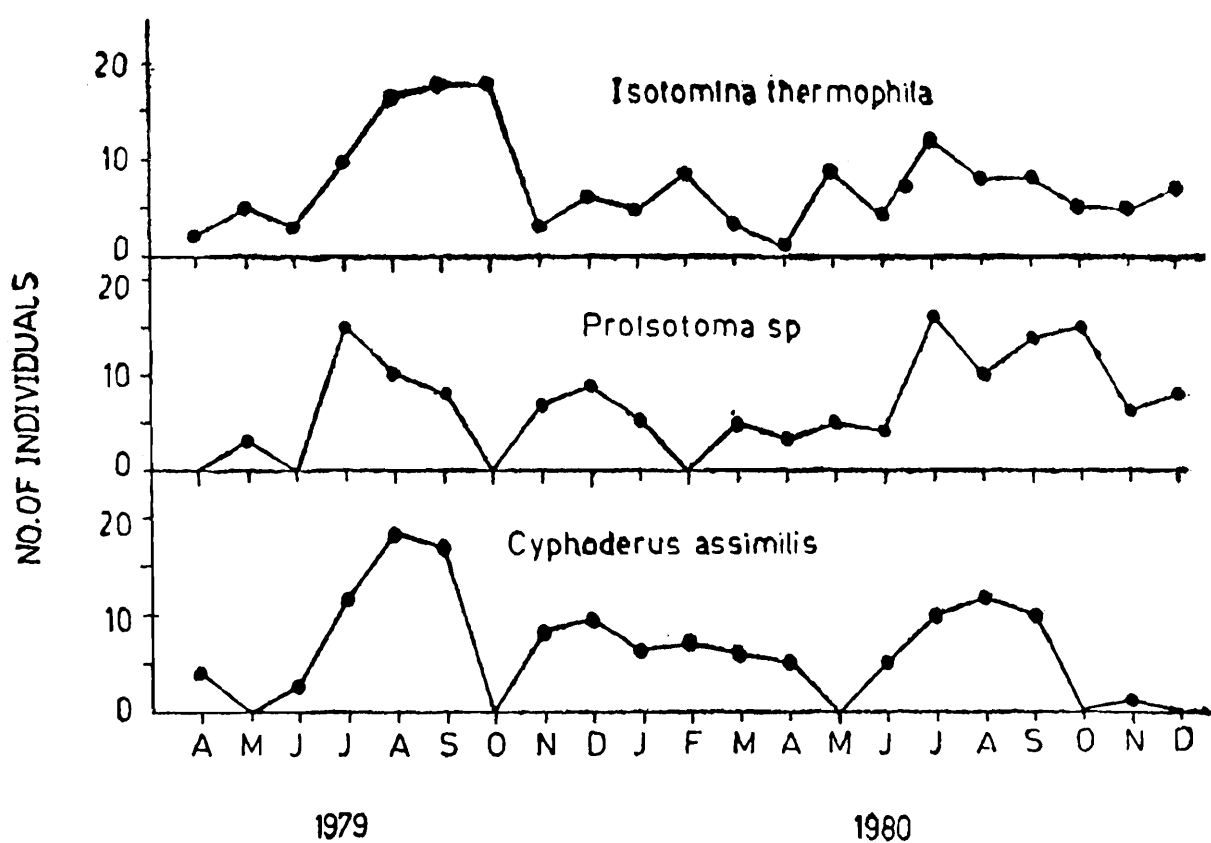


Fig. 58. Showing monthly fluctuations of dominant species of collembola in URS site.

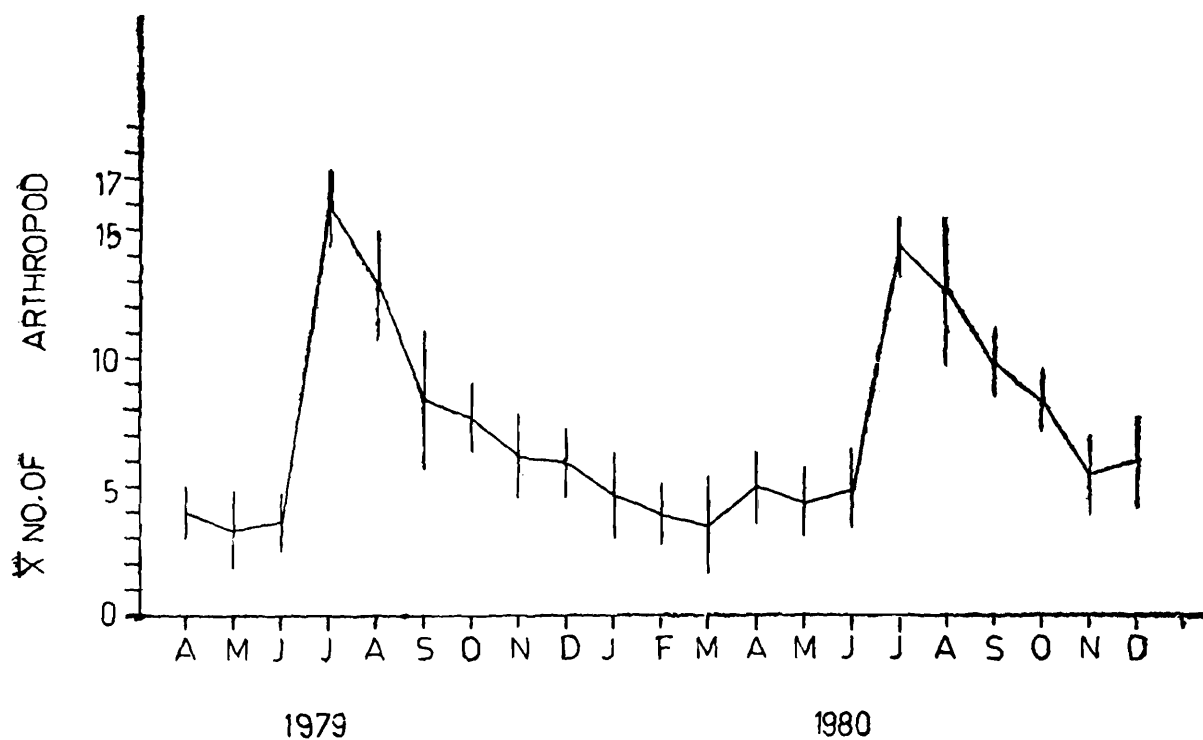


Fig. 59. Showing monthly fluctuations of total number of arthropod in URS site (Mean $\pm$ SE)

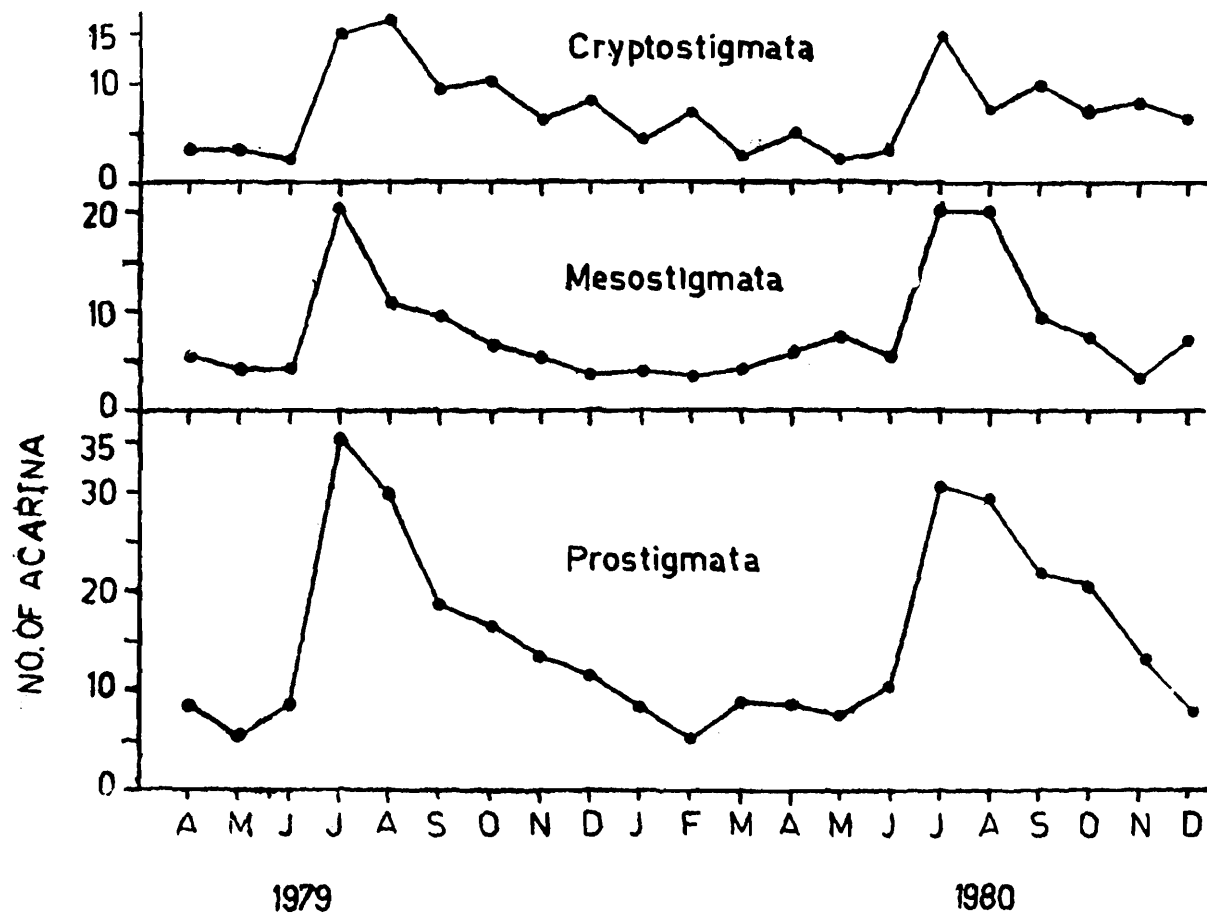


Fig. 60. Showing monthly fluctuations of dominant sub-orders of acarina in URS site.

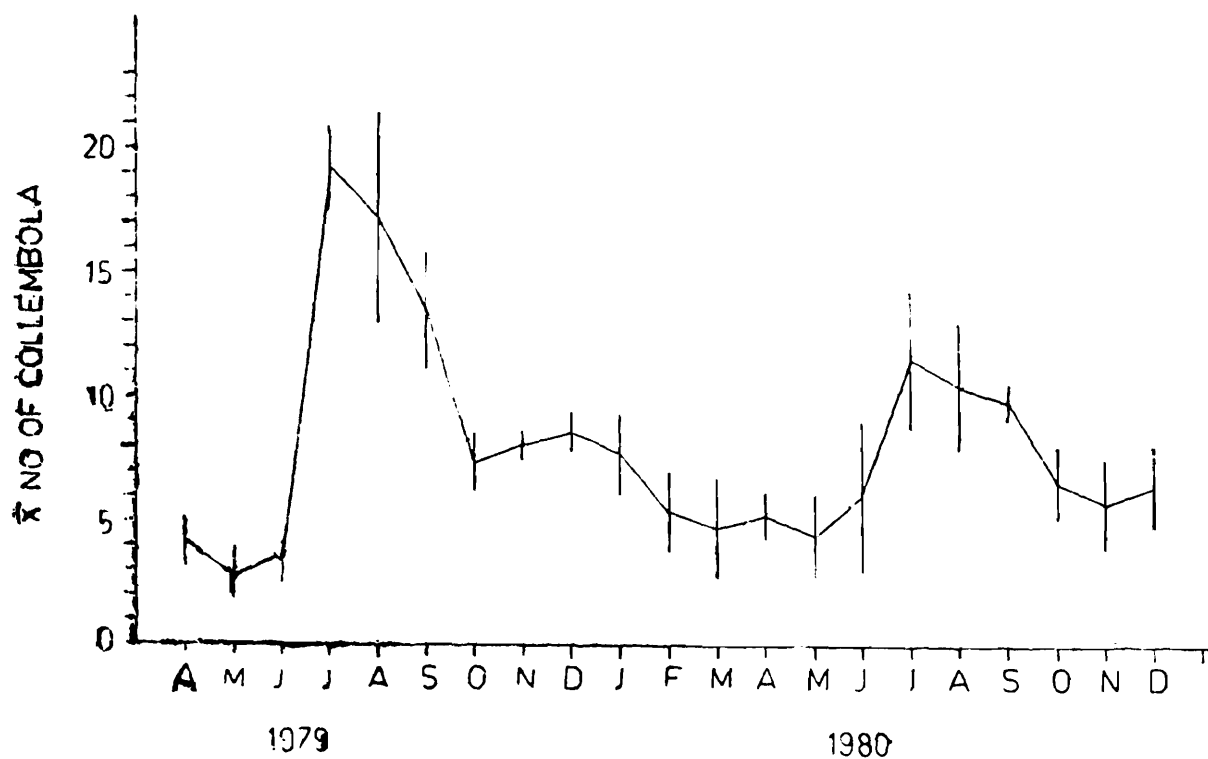


Fig. 61. Showing monthly fluctuations of total number of collembola in MHS site (Mean $\pm$ SE)

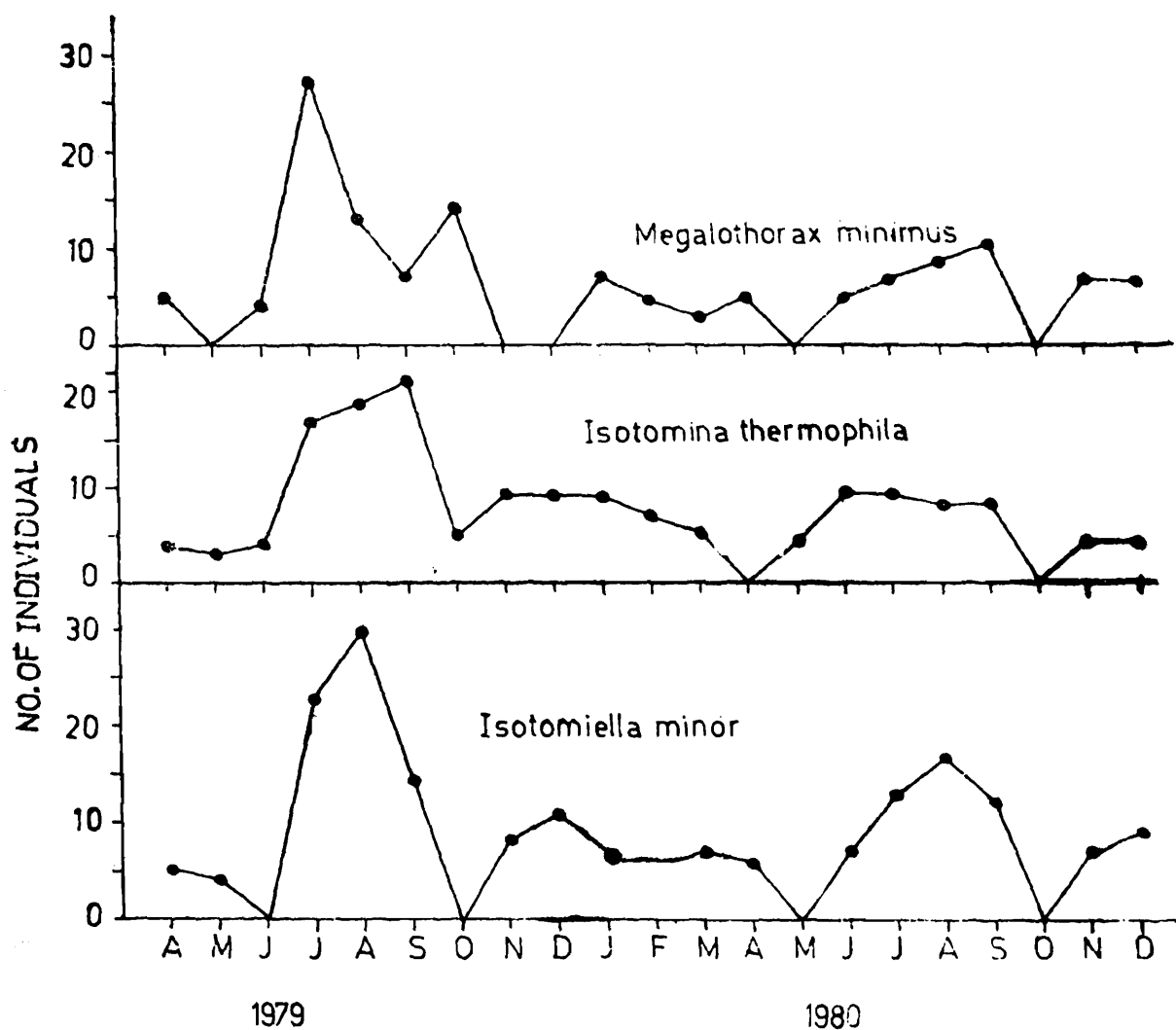


Fig. 62. Showing monthly fluctuations of dominant species of collembola in MHS site.

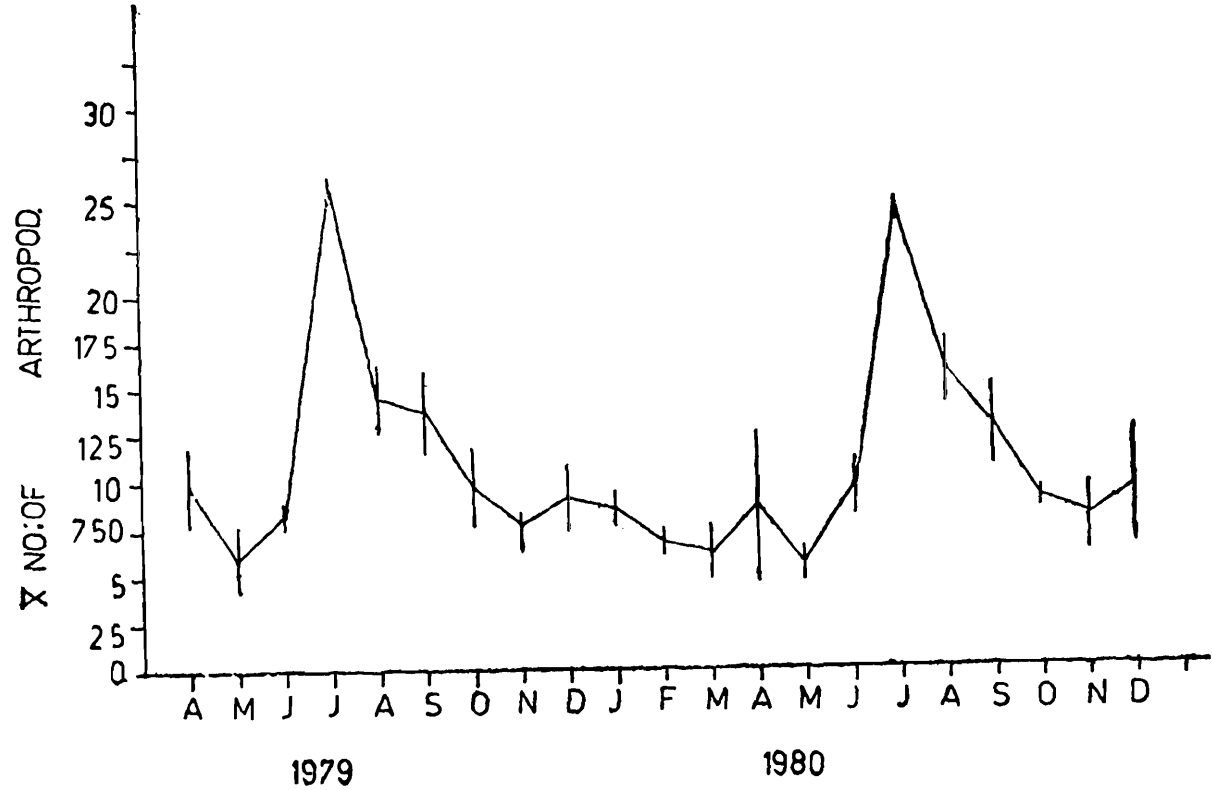


Fig. 63. Showing monthly fluctuations of total number of arthropod in MHS site (Mean $\pm$ SE)

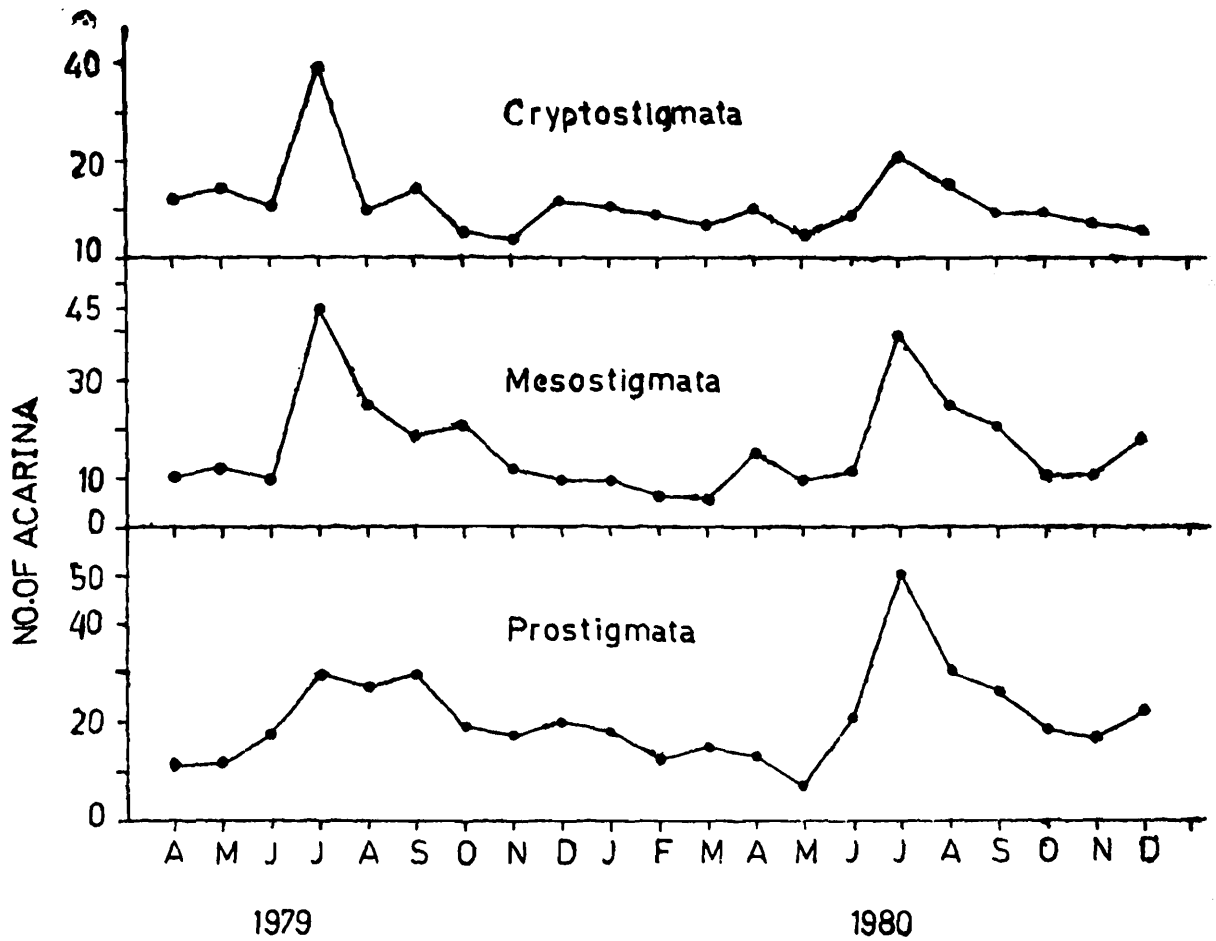


Fig. 64. Showing monthly fluctuations of dominant sub-orders of acarina in MHS site.

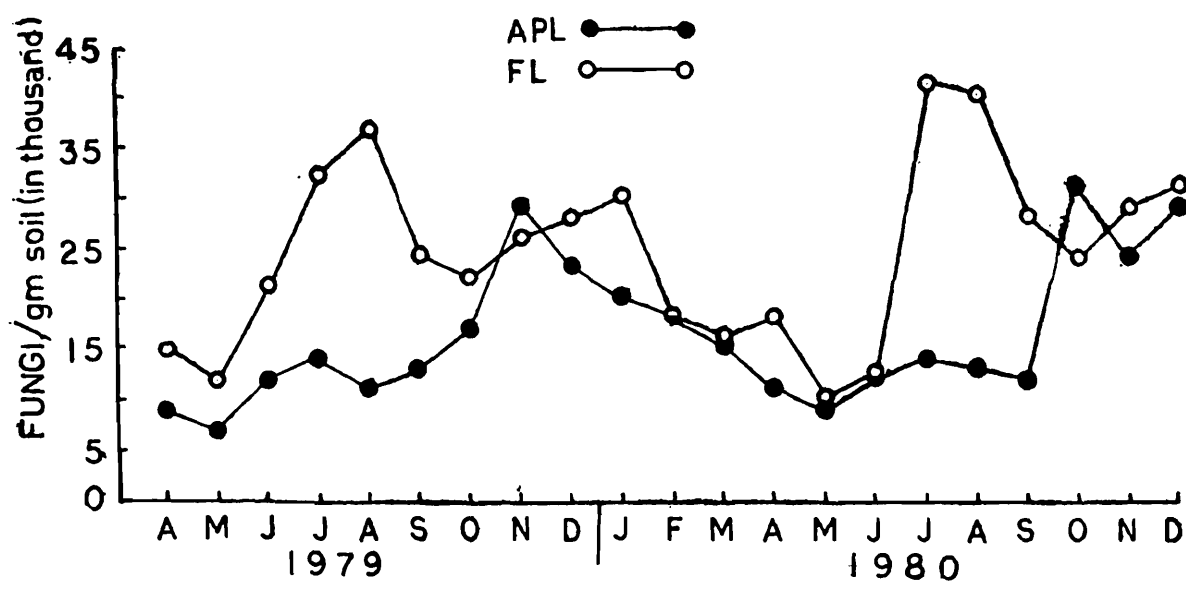


Fig. 65. Showing monthly fluctuations of fungi/gm. soil in thousand in APL and FL sites.

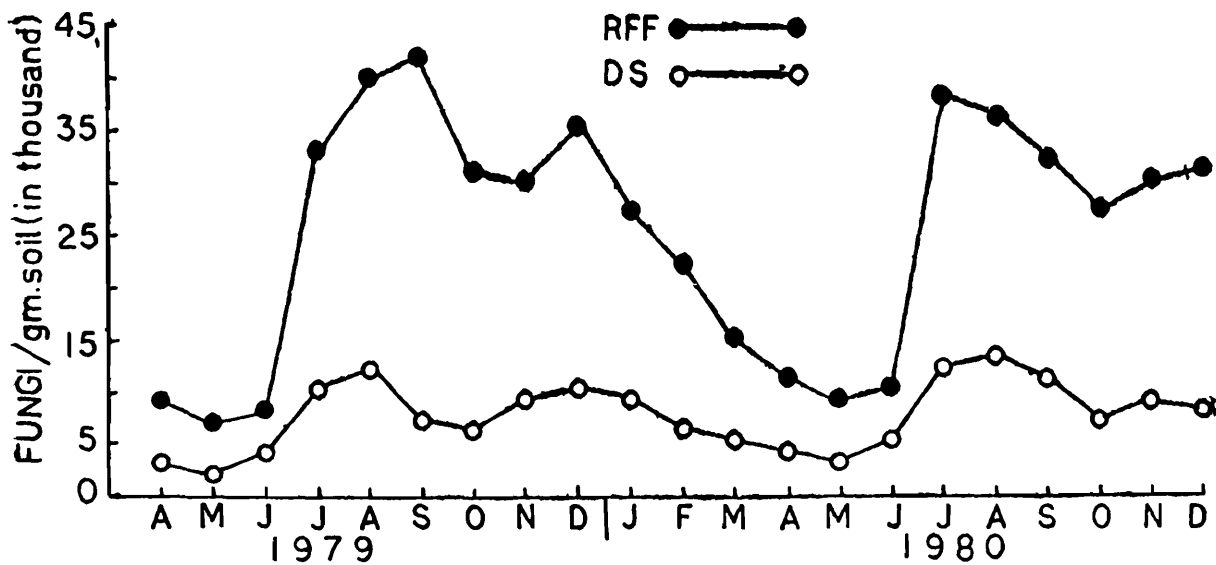


Fig. 66. Showing monthly fluctuations of fungi/gm. soil in thousand in RFF and DS sites.

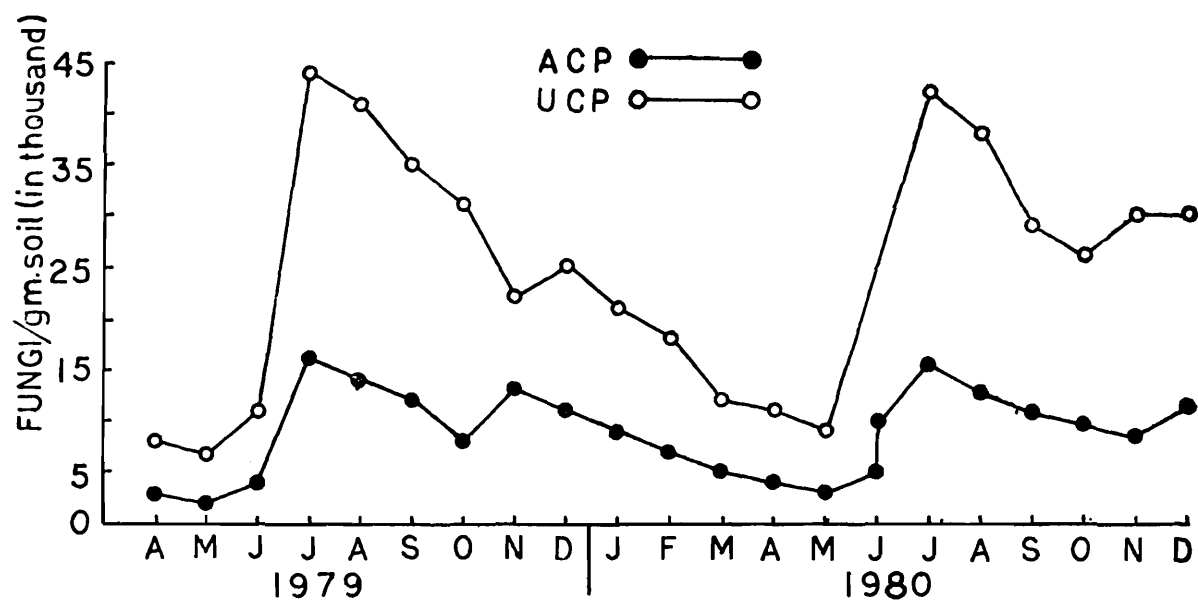


Fig. 67. Showing monthly fluctuations of fungi/gm. soil in thousand in ACP and UCP sites.

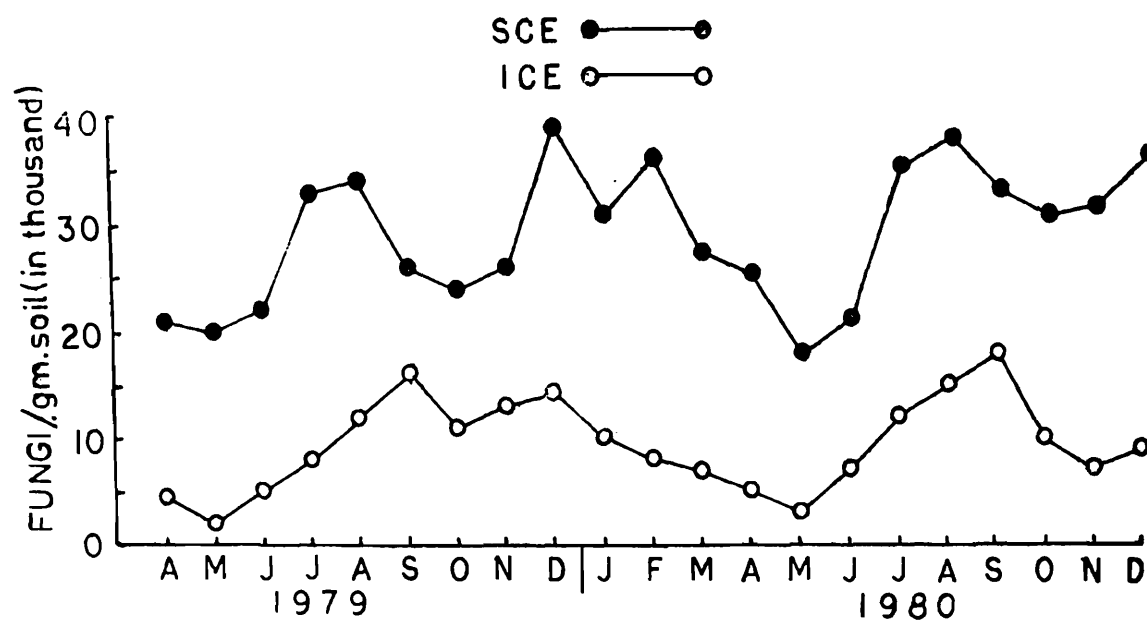


Fig. 68. Showing monthly fluctuations of fungi/gm. soil in thousand in SCE and ICE sites.

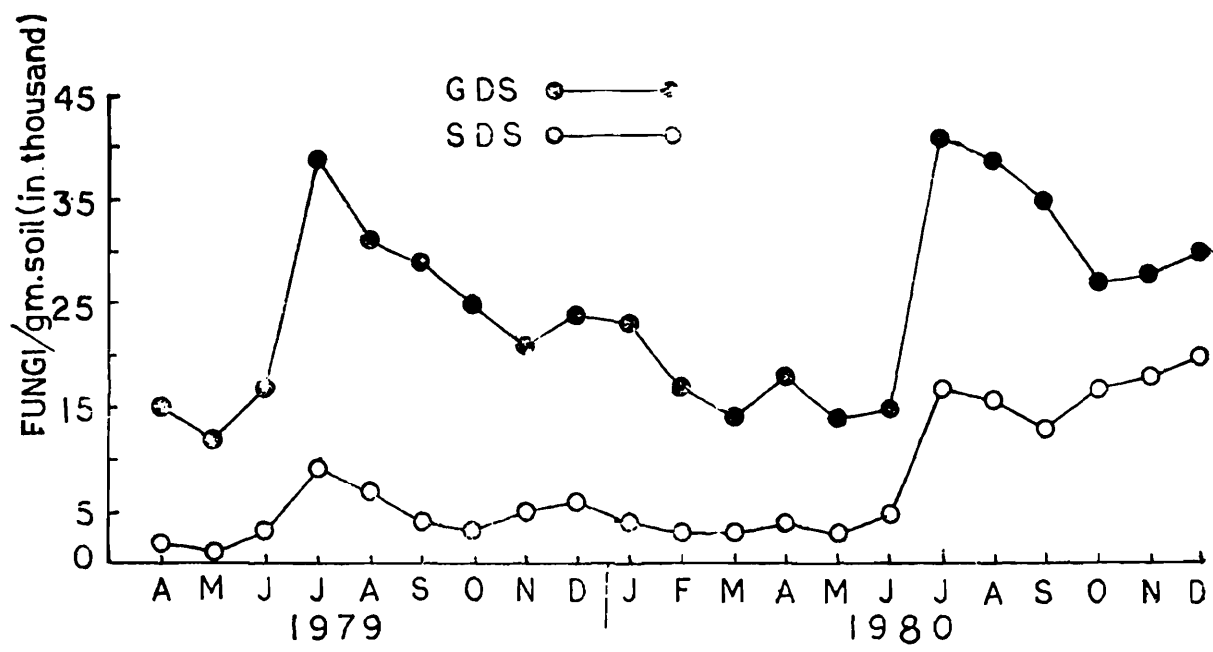


Fig. 69. Showing monthly fluctuations of fungi/gm. soil in thousand in GDS and SDS sites.

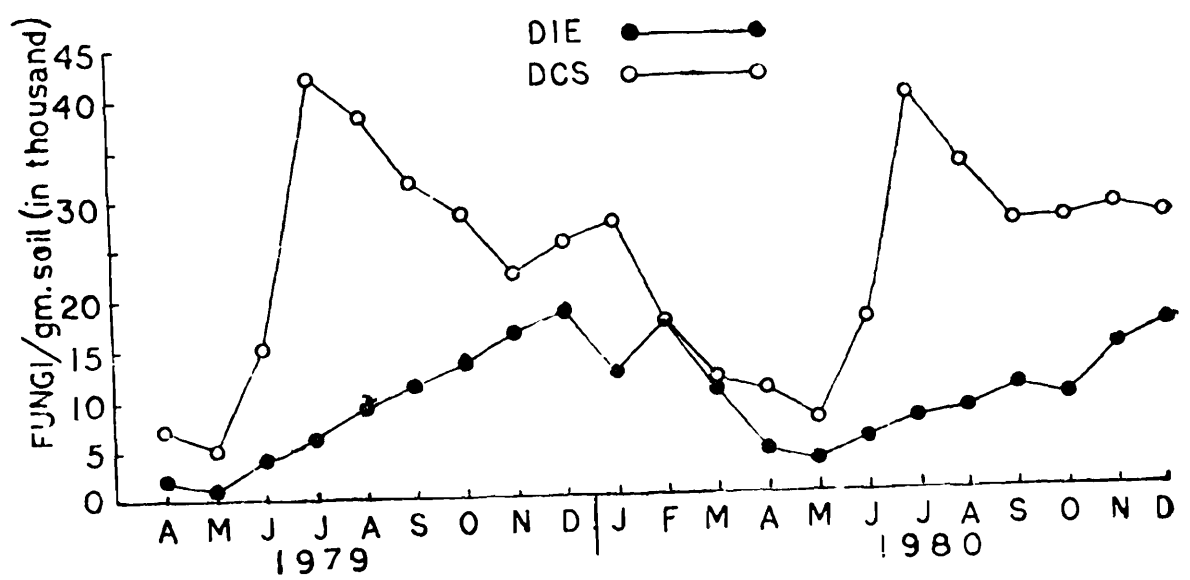


Fig. 70. Showing monthly fluctuations of fungi/gm. soil in thousand in DIE and DCS site.

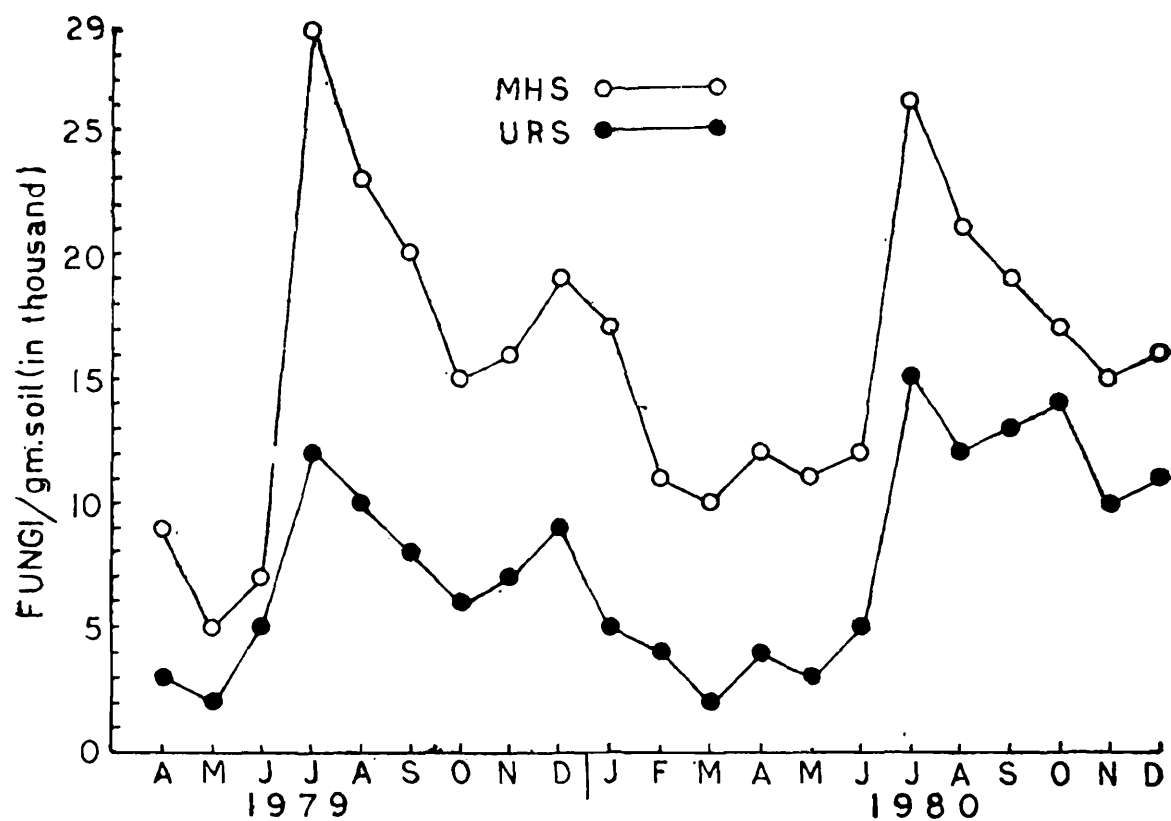


Fig 71. Showing monthly fluctuations of fungi/gm. soil in thousand in MHS and URS sites.

VERTICAL DISTRIBUTION

The depthwise population of acarina, collembola and fungi obtained from three different depths (0-5 cm., 5-10 cm. and 10-15 cm.) are stated in the tables 45 to 59, which revealed that both the microflora and fauna inhabiting maximum number in the topmost layers (0-5 cm.).

Acarina and Collembola: Constituting respectively 1.22% and 1.79% (in Fallow land site) of total funal population collected for vertical distribution study, 1.58% and 1.18% (in Agriculture practice land), 3.45% and 2.69% (in Deforested site); 2.11% and 1.74% (in Reserve forest floor), 1.96% and 1.45% (in Undisturbed city park site), 0.70% and 0.42% (in Anthroop-genic pressurised city park site); 1.06% and .90% (in Irrigation canal

embankment site) ; 1.46% and .95% (in Sewage canal embankment 7.30% and 5.65% (Garbage dumping dune site) ; 1.30 and 9.11 (in soil dunes site) ; 2.82% and 1.86% (in Durgapur control Pasture site) ; 0.95% and 83% (in Durgapur industrial effluent site) ; 1.05% and .81% (in Unmetalled road way site) and 1.52% and 1.18% (in Metalled highway site). The minimum number were recorded from the lower most layer (10-15 cm. depth) in each site. (But the sites viz. Anthropogenic pressurised city park site, Metalled highway site, where highest percentage were obtained from 5-10 cm. depth for acarina and collembola where as Agriculture practice land site showed maximum collembola from 10-15 cm. depth). The vertical distribution of acarina and collembola throughout twelve occasions were indicated in figures 72 to 90. The maximum population peaks varied from site to site. It was shown that the fauna aggregated in maximum number in upper most layer. It was however interesting to record that the greater abundance of both acarina and collembola were in 0-5 cm. layer with the phenomenon of juvenile aggregation.

Fungi: Constituting 3.75% (in Fallow land site), 2.46% (in Agriculture practice land site) ; 2.22% (in Deforested site) ; 4.92% (in Reserve forest floor site) ; 3.86% (in Undisturbed city park site) ; 1.76% (in Anthropogenic pressurised city park site) ; 3.28% (in Irrigation canal embankment site) ; 3.86% (in Sewage canal embankment site) ; 5.27% (in Garbage dumping dune site) ; 3.98% (in Soil dune site) ; 3.40% (in Durgapur control Pasture site) ; 1.05% (in Durgapur industrial effluent site) ; 1.87% (in Unmetalled road way site) and 2.58% (in Metalled highway site) of total population of of fungi also out numbered the other two layers namely middle and lower (except in Agriculture practice land site where highest percentage were obtained from middle layer). The minimum number were recorded from the lower most (10-15 cm.) layer like the microfaunal population. This results agreed with the finding of Behara and Dash 1981, they have reported that the fungal population decreased with the increase depth of soil. This might be according to Wood (1960) that the organic matter with the help of moisture present in the soil makes a condition highly favourable for the growths of the fungi. Wallwork (1970) reported the largest population at the level of which active decomposition of organic material was occurred. Similar results were also reported by Choudhuri and Banerjee (1975). Recently Parkinson (1983) reported that the fungal activity in the decomposing upper layer will be determined by moisture and temperature condition of the soil.

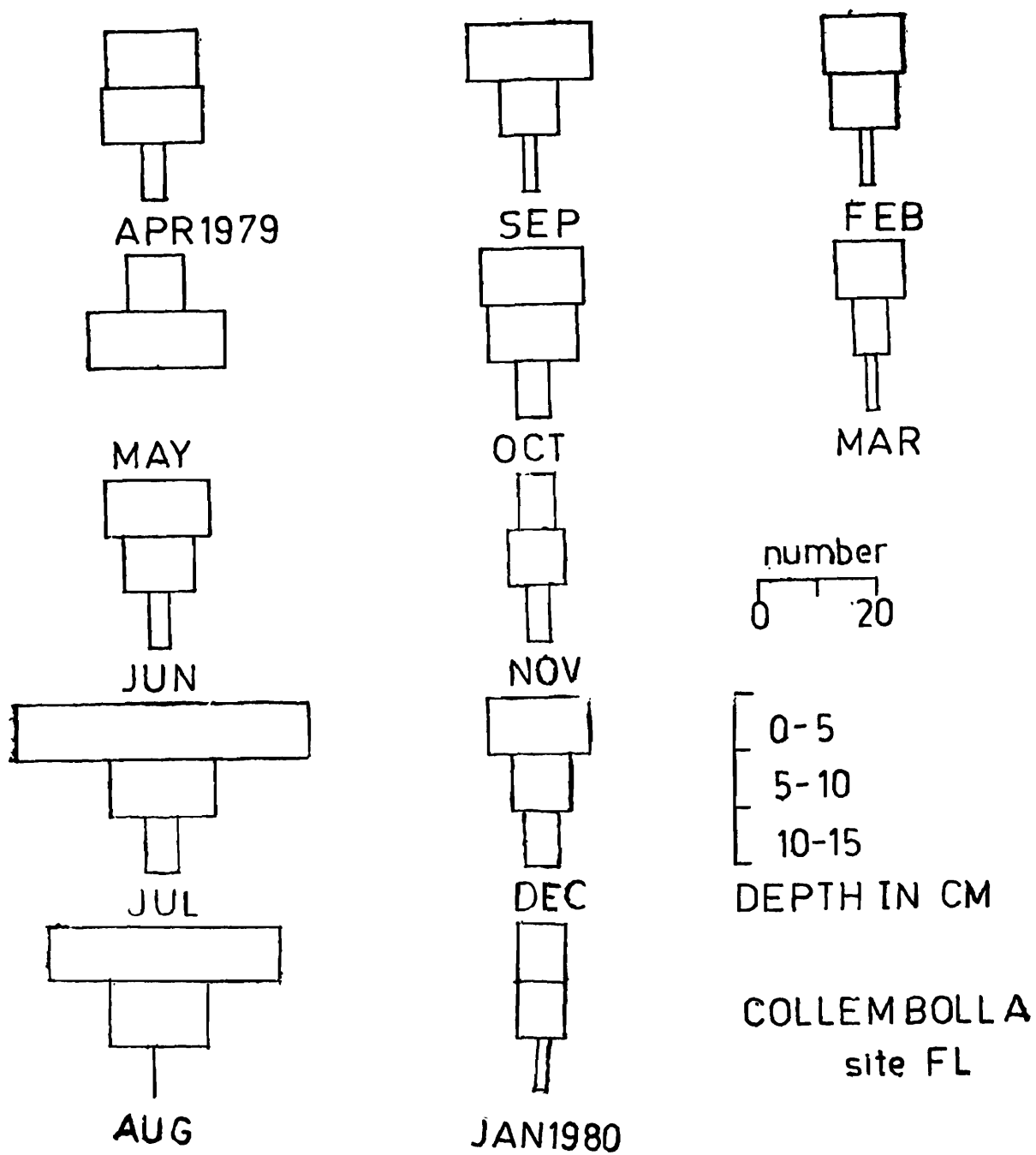


Fig. 72. Showing monthwise vertical distribution of total collembola in FL site.

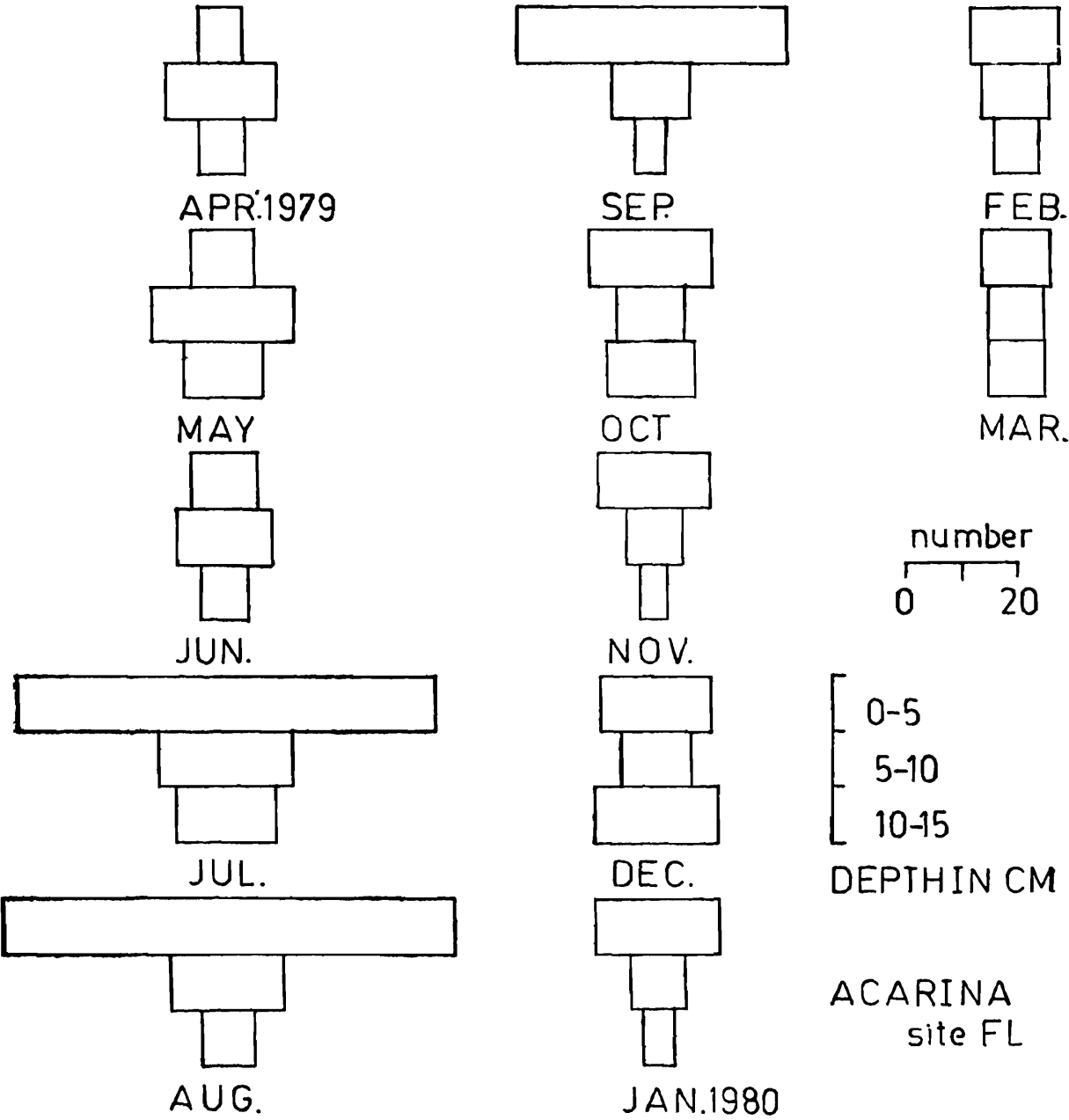


Fig. 73. Showing monthwise vertical distribution of total acarina in FL site.

Table 45
Showing monthly changes in vertical distribution of
acarina and collembola at Fallow land site.
April, 1979—March, 1980

Depth in cm.				0—5					5—10								10—15							
Order		Acarina			Collembola				Acarina			Collembola					Acarina				Collembola			
Family	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																								
April	—	2	2	4	4	2	2	8	5	3	2	10	3	4	2	9	—	3	1	4	—	2	—	2
May	2	3	1	6	3	2	—	5	4	6	3	13	5	5	2	12	3	2	2	7	—	—	—	—
June	4	2	—	6	5	3	1	9	3	4	2	9	3	2	—	6	2	1	1	4	1	1	—	2
July	12	15	11	38	9	12	5	26	5	3	4	12	4	3	2	9	4	3	2	9	1	2	—	3
August	11	16	14	41	7	10	4	21	3	4	3	10	3	2	1	6	3	1	1	5	—	—	—	—
September	7	9	8	24	5	6	—	11	—	5	2	7	—	3	2	5	2	—	1	3	—	1	—	1
October	5	—	6	11	3	4	2	9	2	—	4	6	5	2	1	8	2	4	2	8	1	2	—	3
November	3	4	3	10	2	—	1	3	3	1	2	6	4	—	1	5	2	3	2	7	1	1	—	2
December	6	4	—	10	5	2	2	9	4	2	1	7	3	1	1	5	1	2	—	3	2	1	—	3
1980																								
January	5	4	2	11	—	3	1	4	2	—	3	5	2	—	2	4	2	1	—	3	1	—	—	1
February	4	3	1	8	2	5	—	7	23	1	2	6	2	3	1	6	1	2	1	4	—	1	—	1
March	3	2	1	6	2	3	1	6	2	1	2	5	1	2	—	3	2	2	1	5	—	1	—	1
Total	62	62	49	173	47	52	19	118	36	30	30	96	35	27	15	77	24	24	14	62	7	12	—	19

Pro. = Prostigmata; Mes = Mesostigmata; Cry. = Cryptostigmata; T = Total; Ent. = Entomobryidae; Iso. = Isotomidae,
Hyp. = Hypogastruridae

Table 46
Showing monthly changes in vertical distribution of
acarina and collembola at Agriculture practice land site.
April, 1979—March, 1979

Depth in cm.		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April		6	9	5	20	4	8	3	15	5	5	3	13	3	2	2	7	2	2	1	5	—	—	—	—
May		4	5	3	12	4	6	2	12	4	3	6	13	2	3	1	6	3	1	1	5	—	—	—	—
June		—	8	4	12	6	5	—	11	6	4	5	15	4	2	8	2	2	2	6	—	—	—	—	—
July		2	3	—	5	2	1	—	3	2	1	2	5	2	2	—	4	—	—	—	—	—	—	—	—
August		1	—	2	3	1	—	2	3	1	2	—	3	1	1	—	2	—	—	—	—	—	—	—	—
September		2	1	—	3	1	1	—	2	2	—	2	4	2	—	1	3	—	2	—	2	—	—	—	—
October		3	2	1	6	2	2	1	5	1	2	2	5	1	2	1	4	1	1	2	3	—	—	—	—
November		10	7	5	22	8	6	3	17	7	5	4	16	4	3	2	9	2	3	1	6	—	1	—	1
December		8	11	4	23	5	7	4	16	—	6	2	8	2	4	2	8	3	4	2	9	—	2	—	2
1980																									
January		7	4	6	17	3	9	2	14	2	5	1	8	2	3	1	6	2	3	—	5	—	—	—	—
February		5	2	3	10	2	4	3	9	3	2	2	7	1	2	1	4	3	1	2	6	—	1	—	1
March		6	3	5	14	—	5	2	7	2	1	3	6	2	1	3	6	4	2	3	9	—	2	—	2
Total		54	55	38	147	38	54	22	114	35	36	32	103	26	25	16	67	22	21	14	57	—	6	—	6

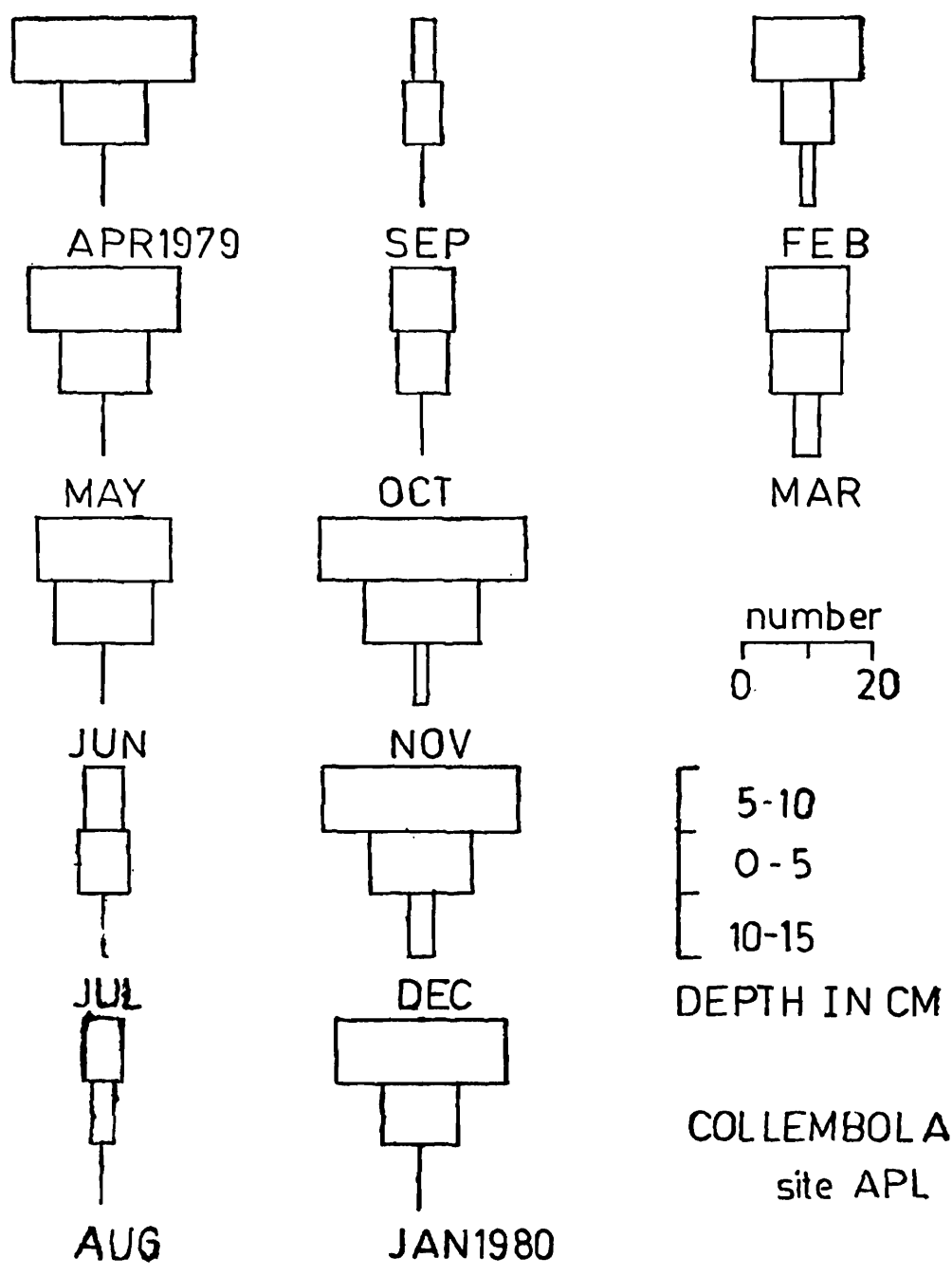


Fig. 74. Showing monthwise vertical distribution of total collembola in APL site.

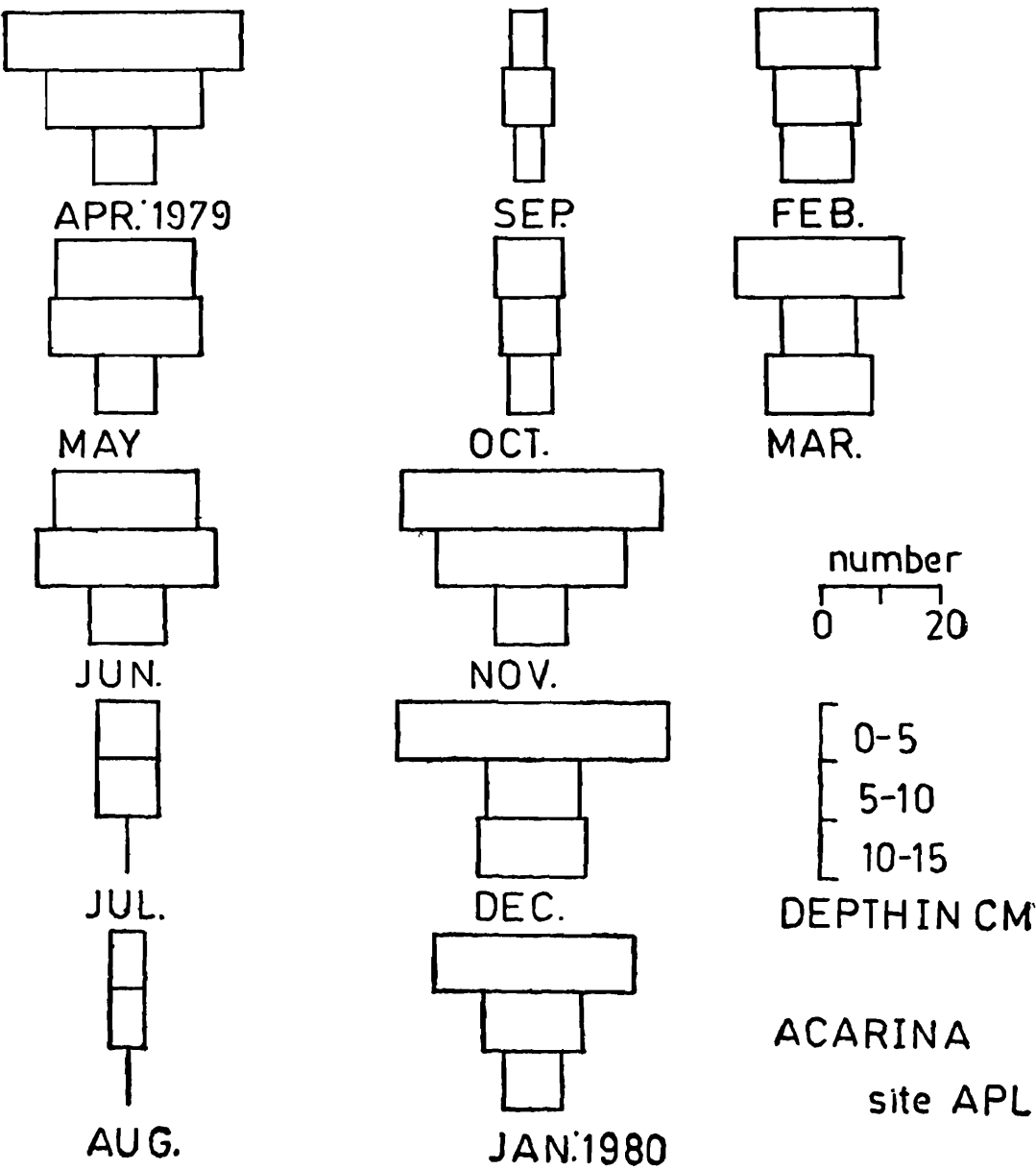


Fig. 75. Showing monthwise vertical distribution of total acarina in APL site.

Table 47

Showing monthly changes in vertical distribution of
acarina and collembola at Deforested site.

April, 1979—March, 1980

Depth in cm.		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April		6	5	4	15	4	3	—	7	8	7	6	21	6	9	2	17	3	3	2	8	—	4	—	4
May		—	4	2	6	—	2	1	3	5	5	4	14	4	5	1	10	2	1	1	4	—	3	—	3
June		5	4	—	9	2	3	2	7	—	3	5	8	—	6	2	8	3	2	—	5	—	3	—	3
July		25	20	15	60	22	18	17	57	20	17	15	52	15	14	11	40	2	1	1	4	1	4	—	5
August		23	17	16	56	21	15	14	50	17	14	12	43	13	11	12	36	1	2	1	4	—	2	—	2
September		20	14	11	45	17	13	9	39	9	12	8	29	7	12	5	24	2	—	1	3	—	1	—	1
October		9	8	10	27	7	—	7	14	5	—	6	11	4	6	3	13	—	1	2	3	—	—	—	—
November		12	14	9	35	8	5	8	21	7	6	5	18	5	4	12	12	1	2	4	—	—	—	—	—
December		—	11	12	23	7	8	9	24	5	8	6	19	4	—	5	9	1	2	—	3	1	2	—	3
1980																									
January		10	12	14	36	9	5	7	21	6	5	9	20	5	4	—	9	2	3	1	6	—	1	—	1
February		7	—	5	12	5	4	—	9	4	4	—	8	4	3	2	9	1	1	—	2	—	2	—	2
March		5	3	2	10	4	2	2	8	6	4	4	14	5	3	4	12	2	1	—	3	—	2	—	2
Total		122	112	100	334	106	78	76	260	92	85	80	257	57	76	51	199	20	18	11	49	2	24	—	26

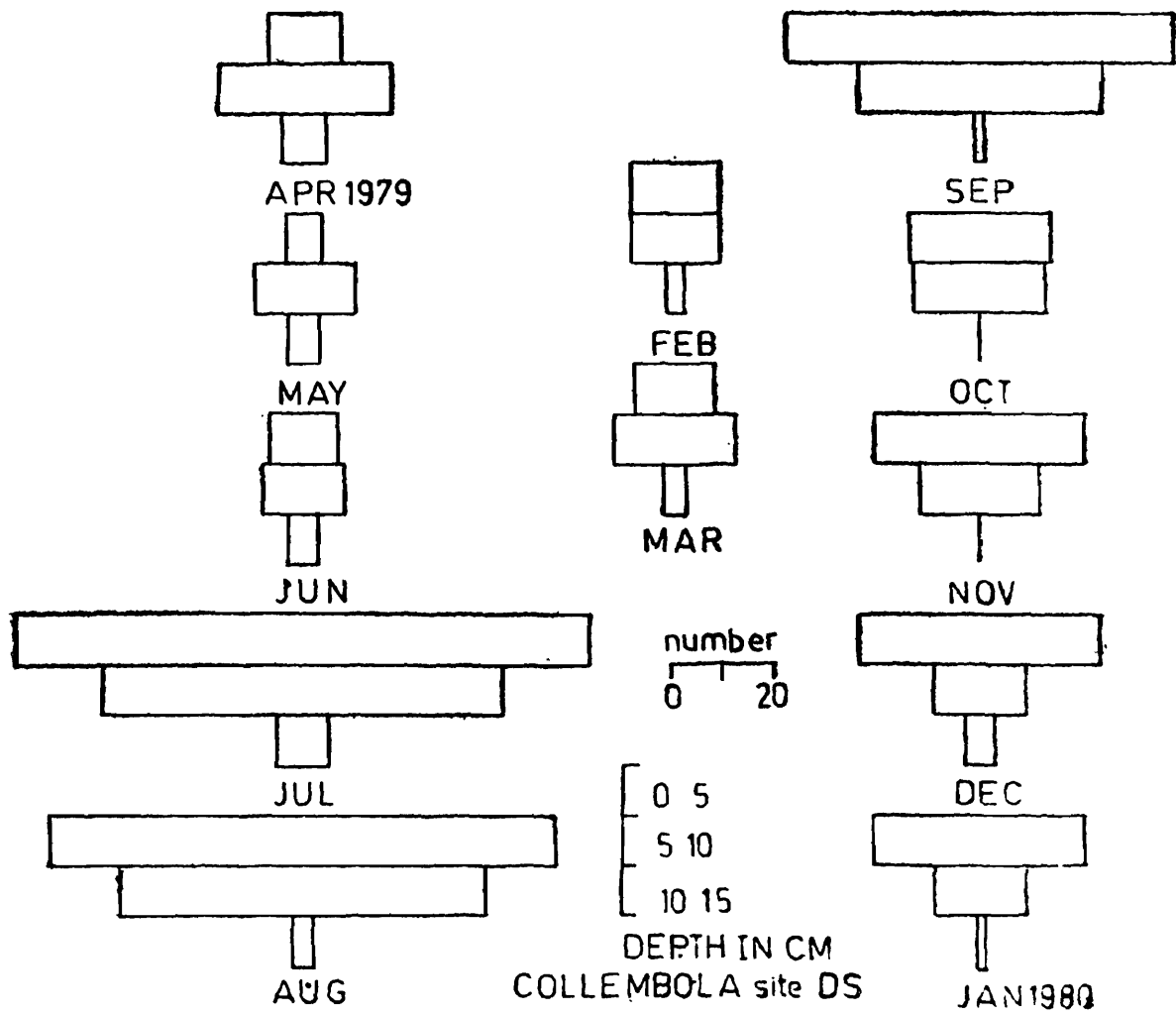


Fig. 76. Showing monthwise vertical distribution of total collembola in DS site.

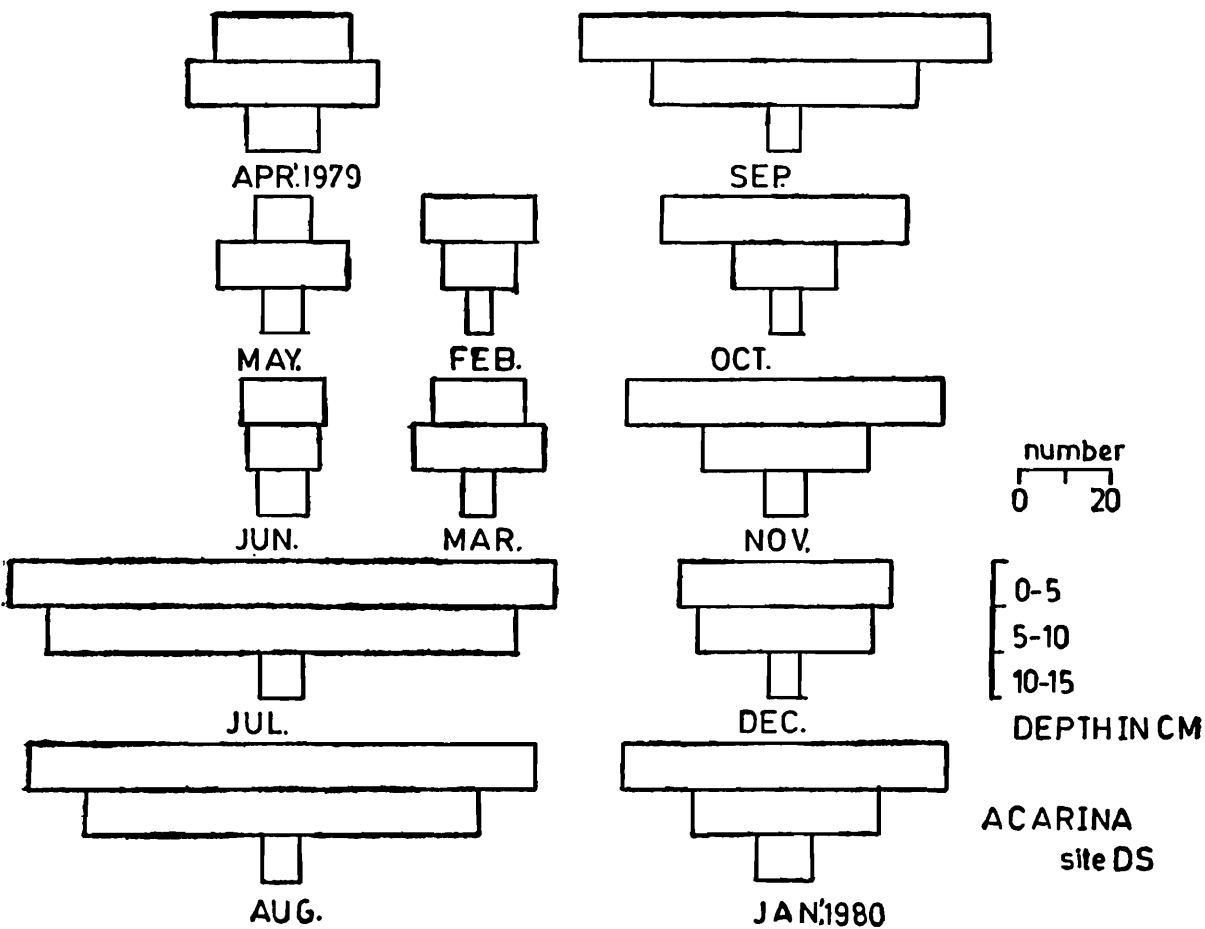


Fig. 77. Showing monthwise vertical distribution of total acarina in DS site.

Table 48

Showing monthly changes in vertical distribution of
acarina and collembola at Reserve forest floor site

April, 1979—March, 1980

Depth in cm		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April		11	10	7	28	8	7	6	21	15	12	7	34	12	14	7	33	—	5	3	8	—	2	—	2
May		7	9	5	21	7	5	4	16	13	11	5	29	10	12	5	27	2	4	1	7	—	3	—	3
June		8	11	—	19	10	—	3	13	7	6	4	17	8	11	—	19	3	2	1	6	—	2	—	2
July		17	15	10	42	14	11	7	32	5	4	3	12	4	5	2	8	—	2	1	3	—	3	—	3
August		8	10	11	29	12	8	5	25	6	3	5	14	2	6	2	10	3	2	3	8	—	2	—	2
September		7	6	4	17	6	5	3	14	4	2	2	8	—	3	2	5	2	1	1	4	—	1	—	1
October		4	2	1	7	3	3	2	8	3	1	2	6	2	—	1	3	1	2	—	3	—	—	—	—
November		5	—	1	6	—	1	2	3	4	—	1	5	2	3	—	5	2	3	1	6	—	1	—	1
December		7	4	3	14	5	3	1	9	—	5	2	7	1	4	2	7	2	1	—	3	—	—	—	—
1980																									
January		5	3	2	10	3	2	—	5	2	4	1	7	2	3	1	6	2	—	1	3	—	2	—	2
February		4	2	1	7	5	2	1	8	6	3	2	11	3	5	2	10	1	—	2	3	—	—	—	—
March		—	2	2	4	4	3	7	14	9	7	5	21	6	8	3	17	2	3	1	6	—	2	—	2
Total		83	74	47	204	177	50	41	168	74	58	39	171	52	74	27	150	20	25	15	60	—	18	—	18

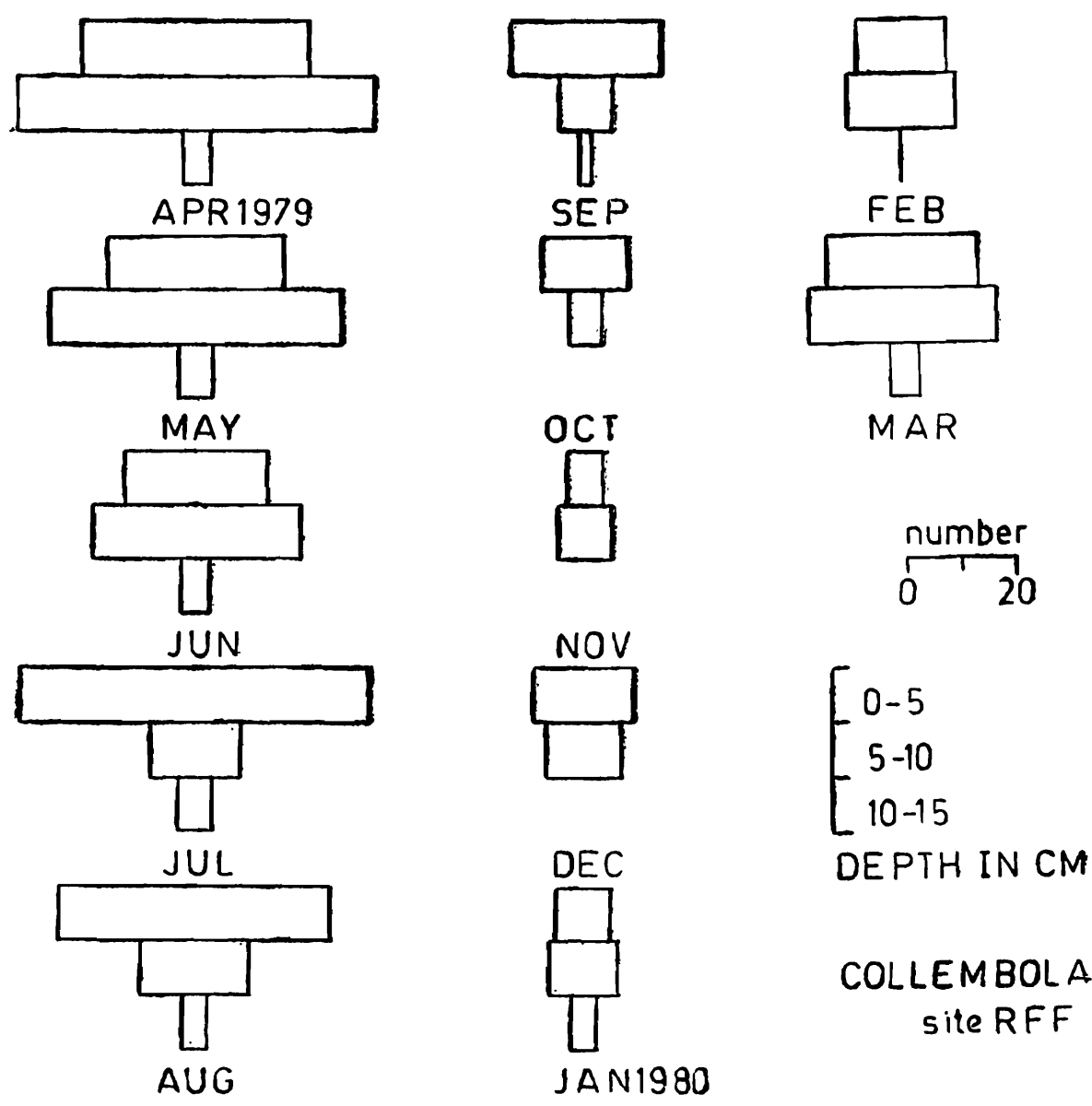


Fig. 78. Showing monthwise vertical distribution of total collembola in RFF site.

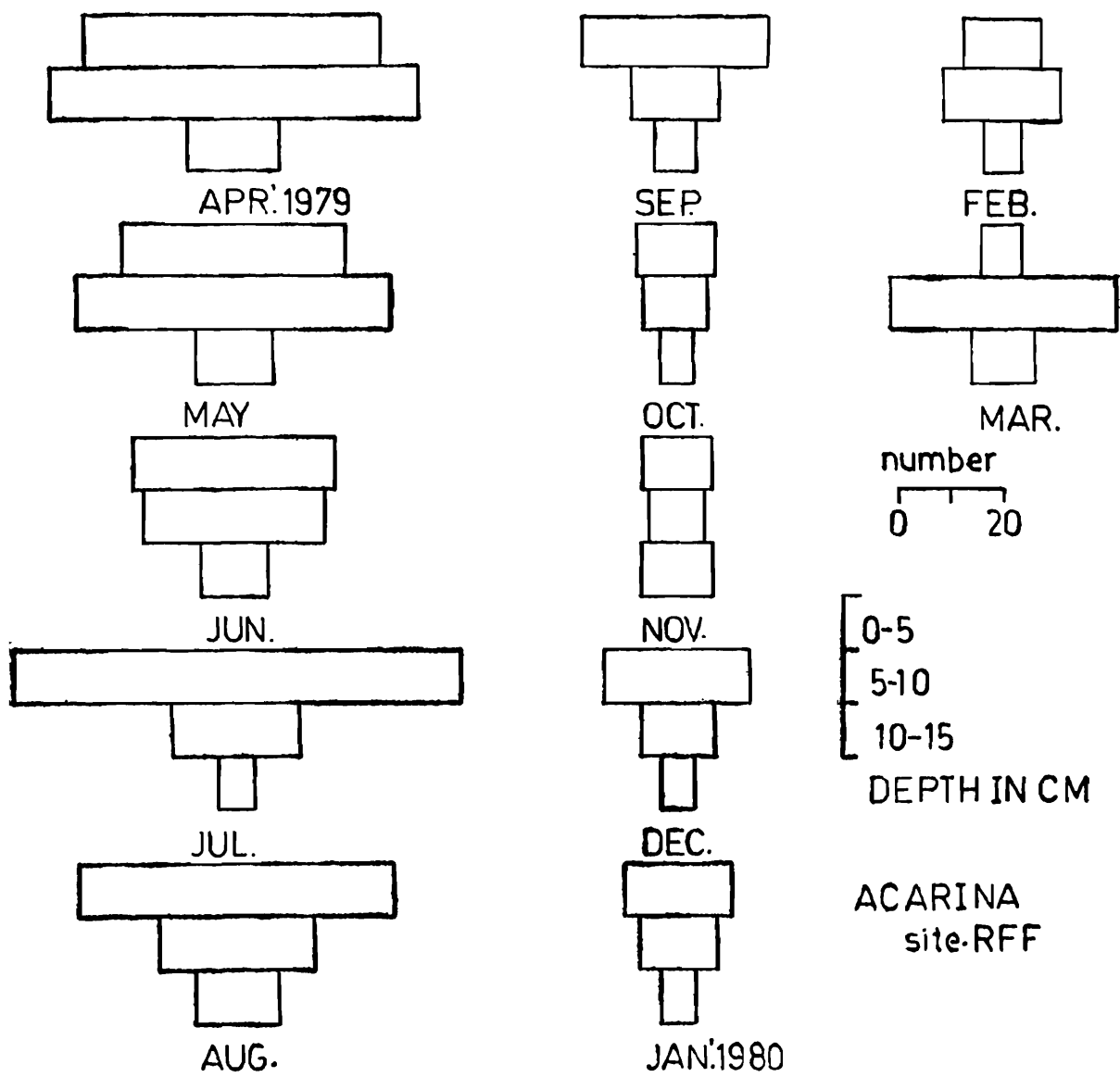


Fig. 79. Showing monthwise vertical distribution of total acarina in RFF site.

Table 49

Showing monthly changes in vertical distribution of
acarina and collembola at undisturbed city park site.

April, 1979—March, 1980

Depth in cm.		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April		7	5	5	17	5	4	3	12	5	9	7	21	6	7	5	18	3	5	2	10	1	2	—	3
May		6	—	3	9	3	5	2	10	8	7	9	24	4	5	3	12	—	3	2	5	—	2	—	2
June		5	8	2	15	4	—	3	7	7	—	3	28	4	8	3	15	3	2	2	7	—	1	—	1
July		12	17	15	44	14	11	7	32	10	11	7	10	3	—	2	5	2	4	3	9	—	—	—	—
August		9	15	12	36	11	6	5	22	6	4	5	15	—	7	3	10	1	4	1	6	—	—	—	—
September		5	6	4	15	5	4	—	9	5	2	6	13	2	9	2	13	2	3	—	5	—	—	—	—
October		3	5	2	10	3	3	1	7	4	5	4	13	3	5	—	8	2	1	1	4	—	1	—	1
November		4	3	—	7	2	3	1	6	—	3	1	4	2	3	1	6	3	2	—	5	—	—	—	—
December		6	4	2	12	5	4	2	11	4	4	—	8	3	5	1	9	4	3	2	9	—	1	—	1
1980																									
January		5	3	1	9	—	3	2	5	3	2	2	7	2	3	—	5	3	5	1	9	—	2	—	2
February		4	2	2	8	3	4	3	10	5	3	1	9	2	6	2	10	4	—	1	5	—	—	—	—
March		—	5	3	8	2	5	2	9	6	4	5	15	—	9	2	11	5	2	1	8	—	1	—	1
Total		66	73	51	190	57	52	31	140	53	54	50	57	31	67	24	122	32	34	16	82	1	10	—	11

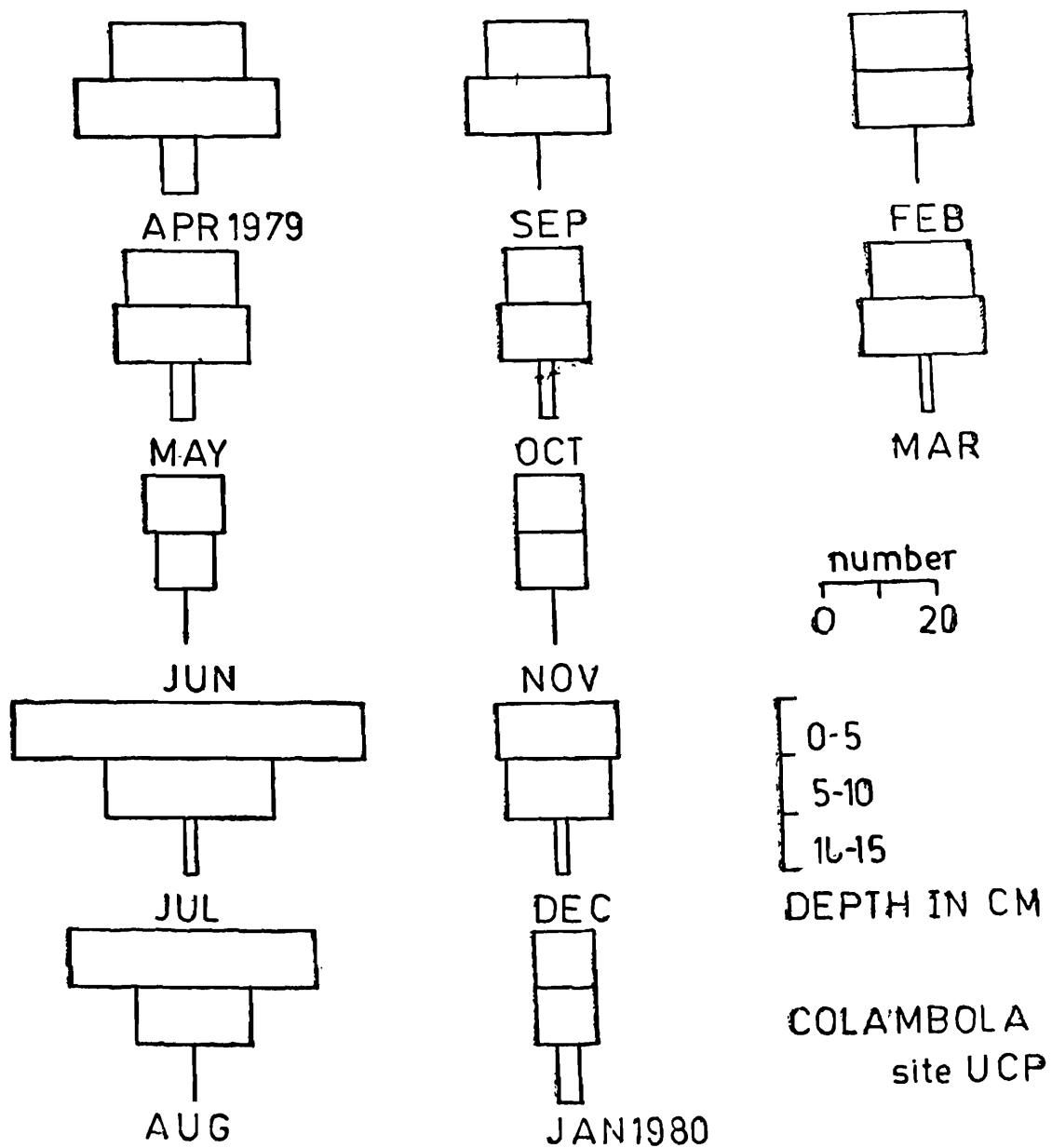


Fig. 80. Showing monthwise vertical distribution of total collembola in UCP site.

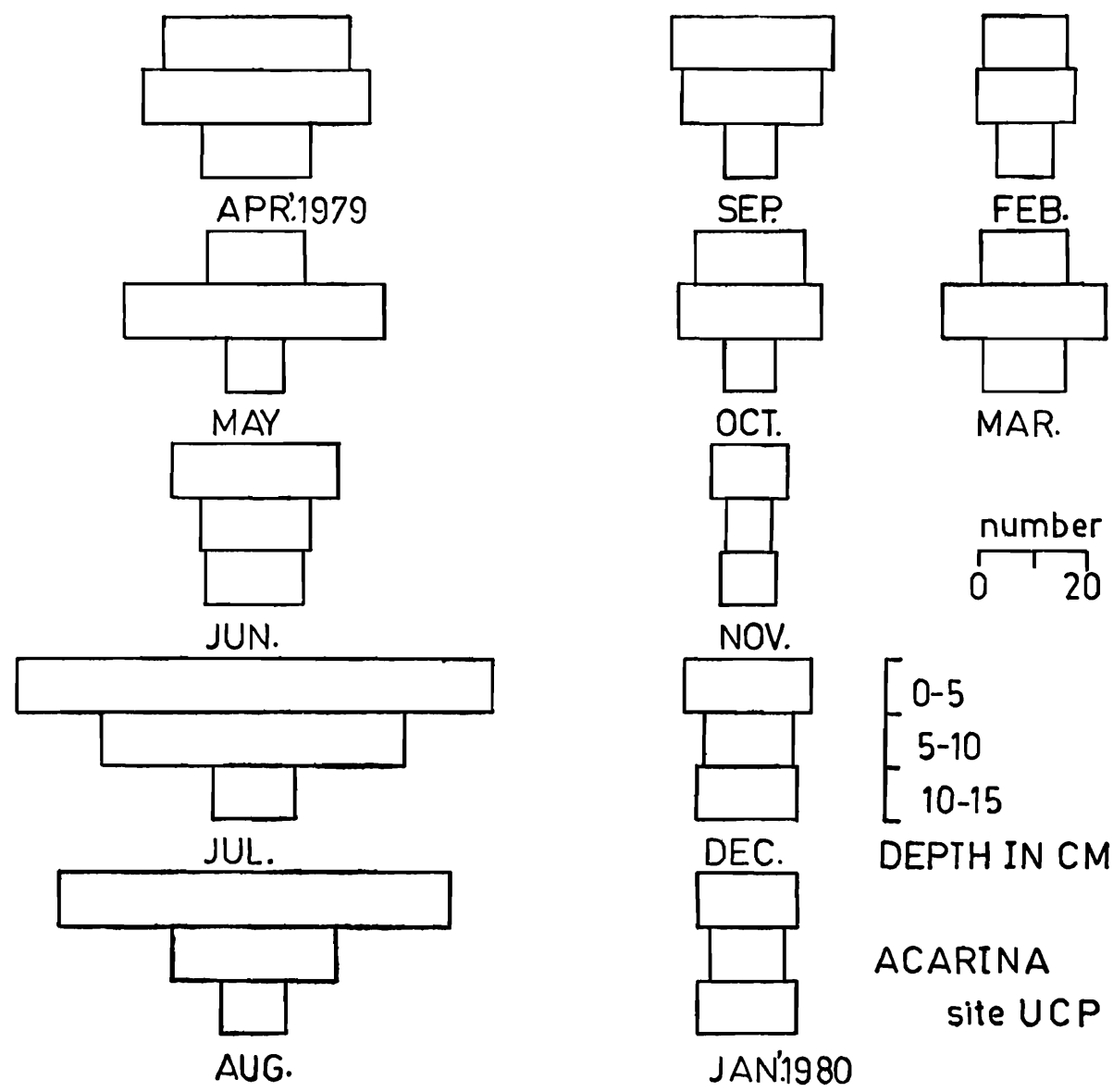


Fig. 81. Showing monthwise vertical distribution of total acarina in UCP site.

Table 50
 Showing monthly changes in vertical distribution of
 acarina and collembola at Anthropogenic pressurised city park
 April, 1979—March, 1980

Depth in cm.				0—5					5—10								10—15							
Order	Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																								
April	—	3	2	5	2	1	—	3	2	4	3	9	1	3	2	6	2	1	—	3	—	—	—	—
May	—	2	1	3	—	2	—	2	3	2	1	6	—	3	1	4	—	2	3	5	—	—	—	—
June	2	3	—	5	1	1	—	2	2	1	—	3	3	2	2	7	1	1	2	4	—	—	—	—
July	4	3	2	9	2	3	1	6	5	2	2	9	2	5	3	10	2	3	1	6	—	2	—	2
August	3	5	2	10	2	2	1	5	3	4	2	9	1	4	1	6	3	1	1	5	—	1	—	1
September	2	4	1	7	3	1	1	5	—	3	1	4	2	3	1	6	2	2	1	5	—	—	—	—
October	3	2	1	6	1	1	—	2	2	1	1	4	1	2	—	3	3	1	1	5	—	—	—	—
November	2	2	1	5	2	1	—	3	2	—	2	4	1	3	—	4	4	2	1	7	—	—	—	—
December	3	1	2	6	2	3	1	6	3	1	1	5	2	2	—	4	2	1	—	3	—	—	—	—
1980																								
January	2	—	1	3	—	2	—	2	2	1	1	4	1	1	—	2	1	3	1	5	—	—	—	—
February	3	2	1	6	2	1	—	3	3	1	—	4	1	2	—	3	2	1	1	4	—	—	—	—
March	2	1	—	3	1	1	—	2	2	2	—	4	—	2	—	2	3	—	2	5	—	—	—	—
Total	26	28	14	68	18	19	4	41	29	22	14	65	15	32	10	57	25	18	14	57	—	3	—	3

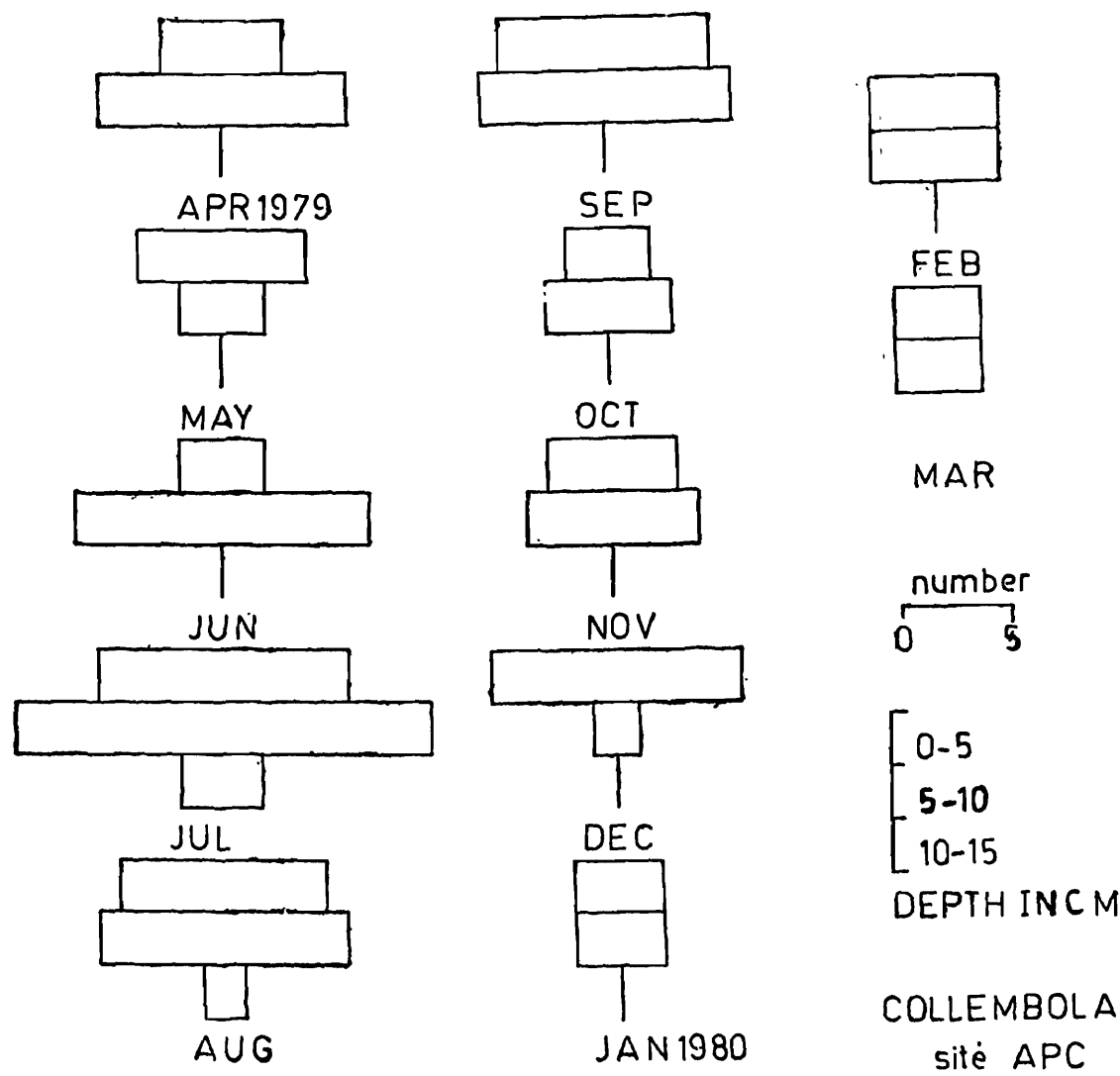


Fig. 82. Showing monthwise vertical distribution of total collembola in ACP site.

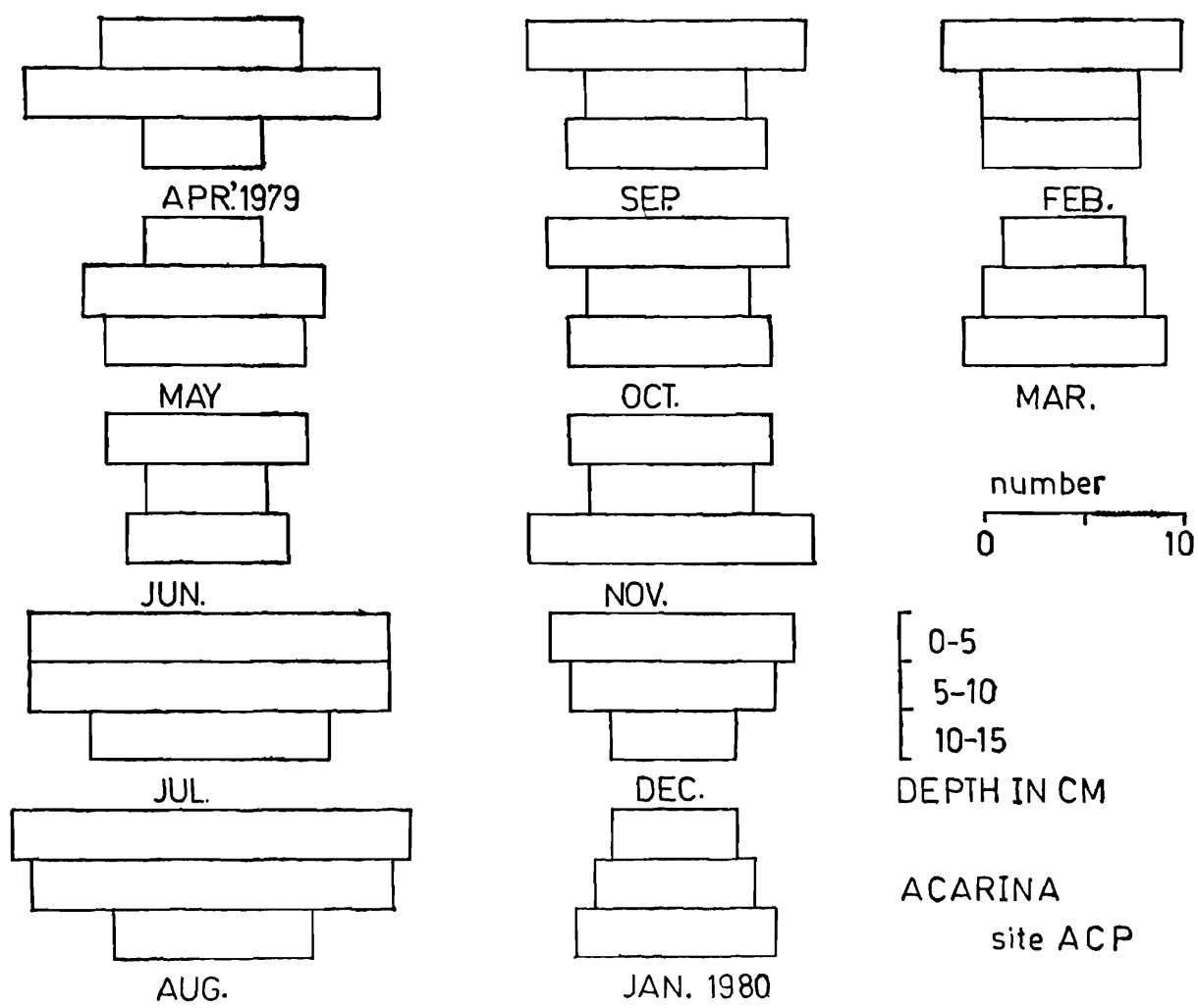


Fig. 83. Showing monthwise vertical distribution of total acarina in ACP site.

Table 51

Showing monthly changes in vertical distribution of
acarina and collembola at Irrigation canal embankment site.

April, 1979—March, 1980

Depth in cm.		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April		2	1	2	5	3	2	1	6	5	6	4	15	2	5	1	8	2	3	1	6	-	3	-	3
May		-	2	1	3	2	1	1	4	3	4	1	8	-	4	2	6	1	2	1	4	-	1	-	1
June		3	4	2	9	3	2	2	7	2	3	1	6	4	3	-	7	3	1	1	5	-	-	-	-
July		2	1	1	4	2	1	-	3	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
August		1	1	-	2	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
September		-	3	-	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
October		1	2	2	5	3	2	2	7	4	3	2	9	2	3	1	6	2	1	1	4	-	-	-	-
November		3	1	4	8	5	3	2	10	6	4	5	15	3	7	2	12	4	2	1	7	-	2	-	2
December		5	7	9	21	9	5	3	17	5	7	4	16	4	9	3	16	5	3	2	10	-	1	1	1
1980																									
January		4	11	8	23	8	7	2	17	4	5	3	12	3	4	2	9	3	1	3	7	-	-	-	-
February		3	7	2	12	4	2	1	7	5	4	2	11	2	6	1	9	2	-	1	3	-	-	-	-
March		2	4	2	8	2	2	2	7	4	3	1	8	3	5	1	9	3	2	1	6	-	-	-	-
Total		26	44	33	103	45	27	16	88	38	41	23	102	23	46	13	82	25	15	12	52	-	7	-	7

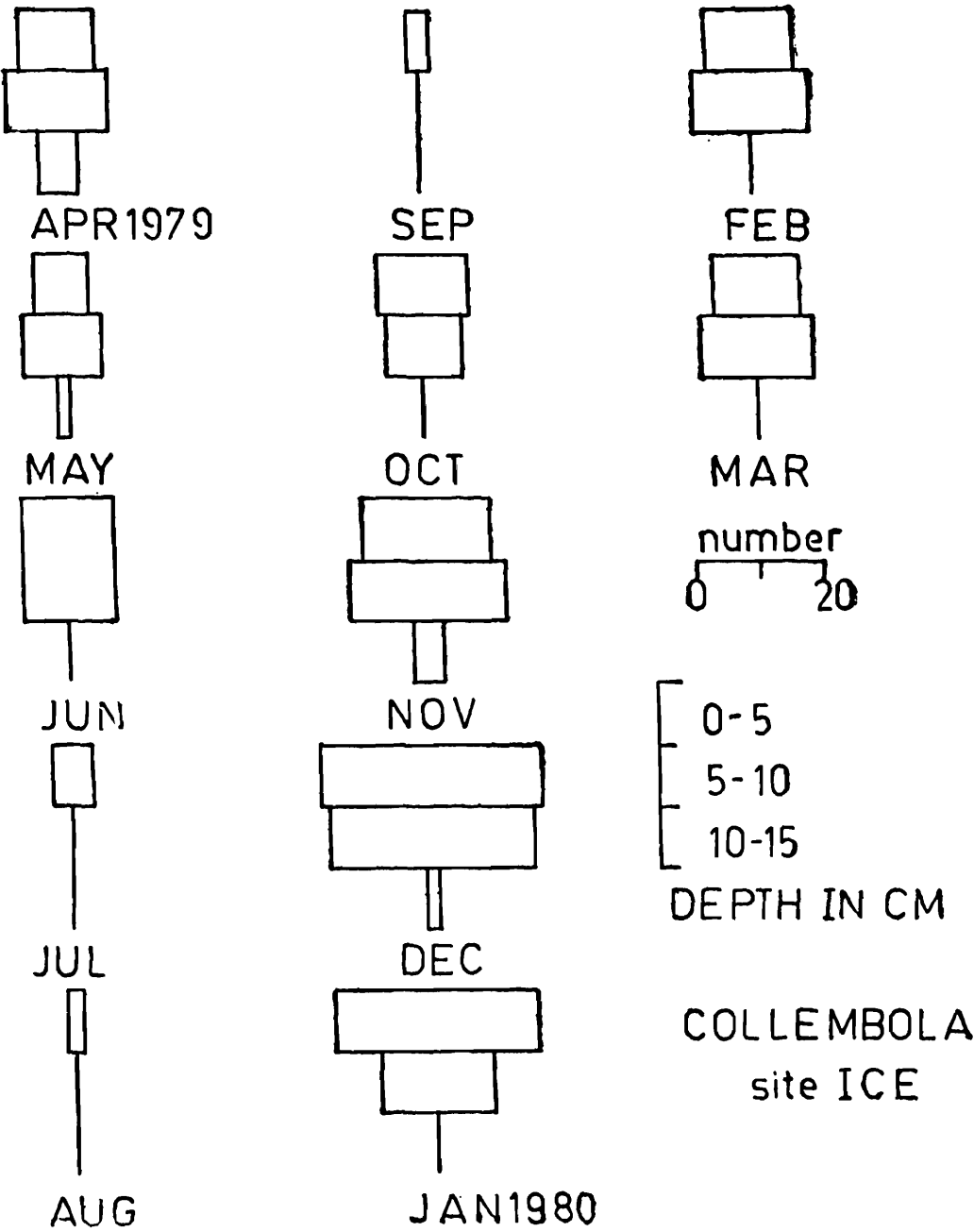


Fig. 84. Showing monthwise vertical distribution of total collembola in ICE site.

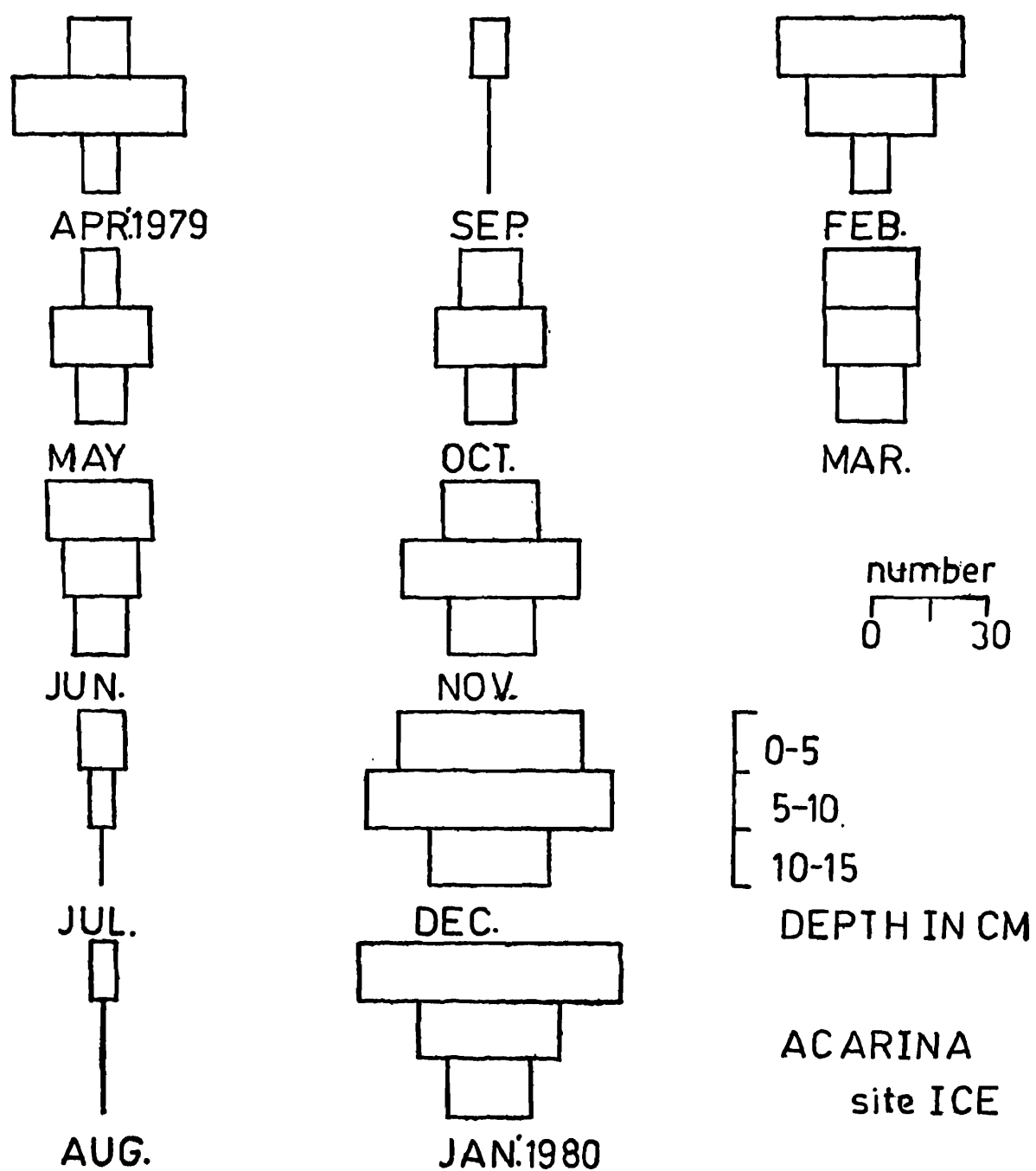


Fig. 85. Showing monthwise vertical distribution of total acarina in ICE site.

Table 52
Showing monthly changes in vertical distribution of
acarina and collembola at sewage canal embankment site.

April, 1979—March, 1980

Depth in cm.		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April		5	4	2	12	6	3	2	11	4	3	2	9	2	3	1	6	3	2	1	6	2	2	-	4
May		6	2	1	9	-	3	1	4	5	4	3	12	2	4	2	8	2	1	1	4	1	2	-	3
June		5	4	4	13	5	2	4	11	3	7	4	14	2	5	3	10	3	2	1	6	-	-	-	-
July		2	-	1	3	1	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
August		3	1	1	5	1	1	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
September		-	3	1	4	2	-	1	3	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
October		4	2	5	11	3	1	1	5	2	1	1	4	-	2	-	2	-	2	-	2	-	-	-	-
November		7	9	11	27	6	3	2	11	3	2	5	10	2	3	1	6	2	1	2	5	-	-	-	-
December		5	12	8	25	8	5	3	16	6	5	8	19	3	3	1	7	3	2	1	6	-	-	-	-
1980																									
January		7	4	-	11	6	3	-	9	4	3	2	9	3	2	1	6	4	1	1	6	-	-	-	-
February		6	3	4	13	5	2	1	8	5	2	3	10	-	2	1	3	3	1	1	5	-	2	-	2
March		5	2	1	8	4	3	1	8	3	1	1	5	-	1	3	4	2	3	4	9	1	3	-	4
Total		55	46	40	141	47	26	19	92	35	30	29	94	14	25	13	52	22	15	12	49	4	9	-	13

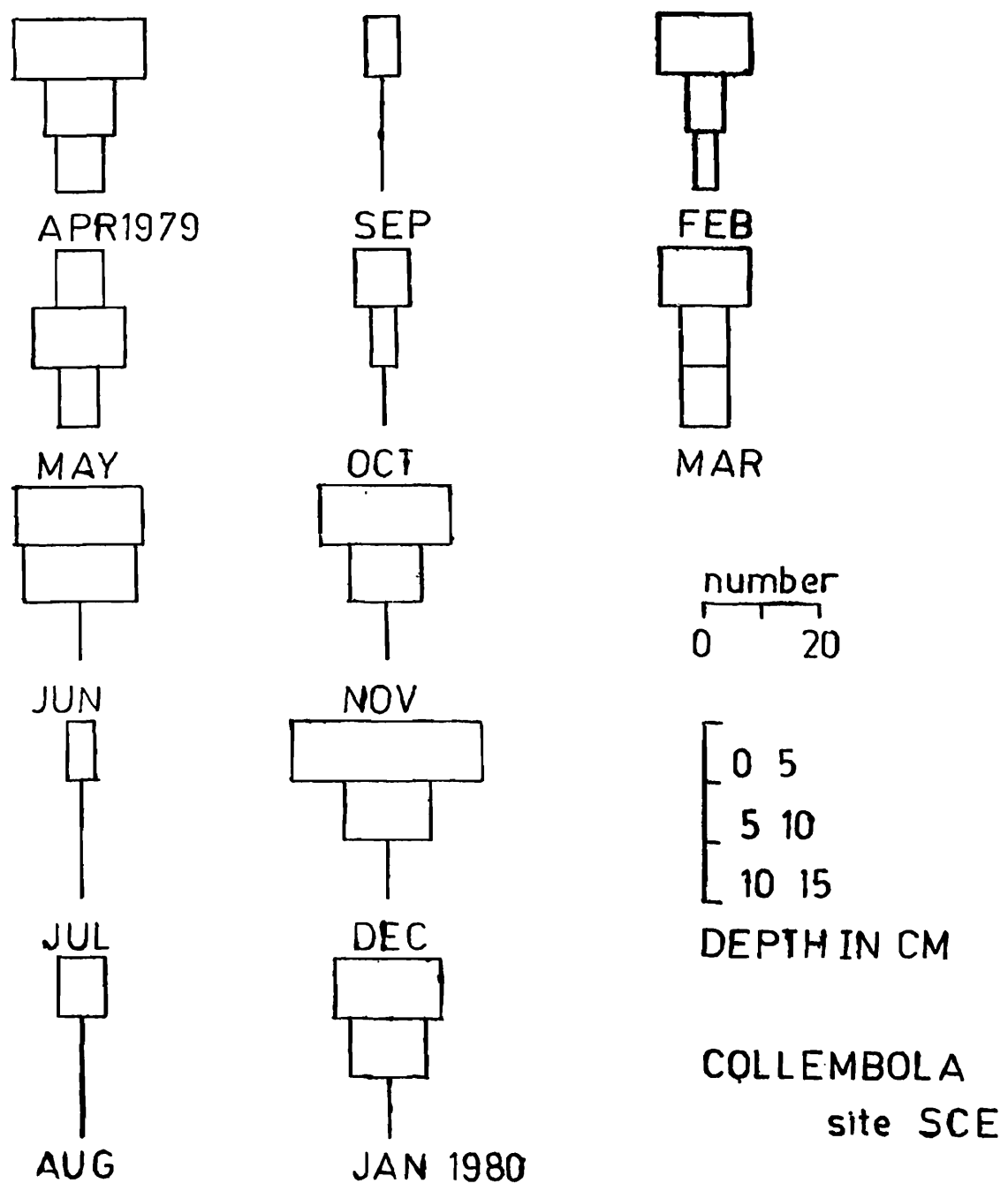


Fig. 86. Showing monthwise vertical distribution of total collembola in SCE site.

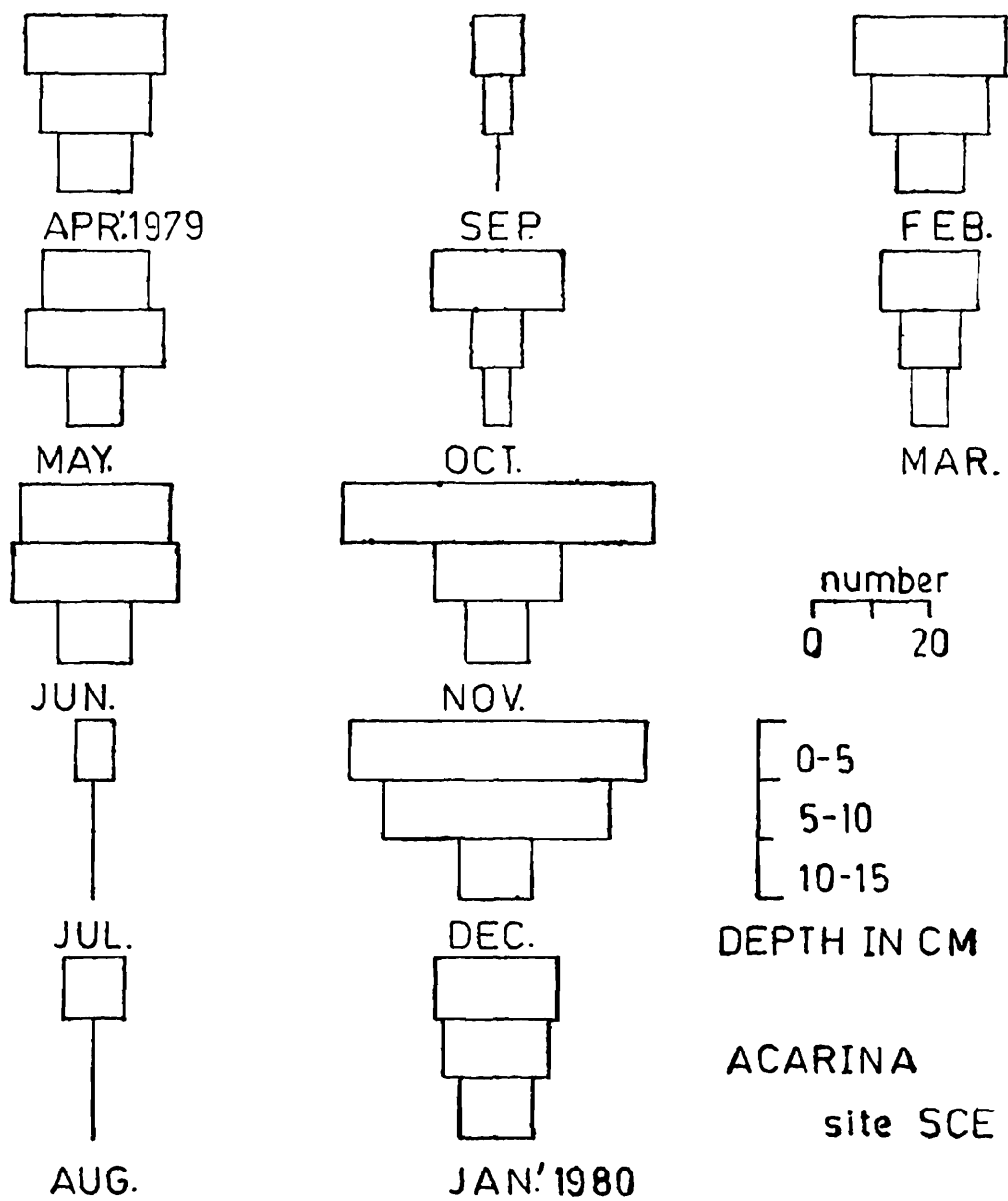


Fig. 87. Showing monthwise vertical distribution of total acarina in SCE site.

Table 53

Showing monthly changes in vertical distribution of
acarina and collembola at Garbage dumping dune site

April, 1979—March, 1980

Depth in cm.				0—5					5—10								10—15							
Order	Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																								
April	21	17	20	58	16	14	8	38	23	19	22	64	19	18	12	49	3	5	2	10	—	—	—	—
May	16	12	11	39	14	12	6	32	22	15	13	50	15	17	8	40	2	4	3	9	—	—	—	—
June	24	26	22	72	20	18	10	48	17	18	15	50	16	18	9	43	3	2	4	9	—	—	—	—
July	38	27	32	97	31	29	30	90	25	22	19	66	12	16	7	35	4	3	2	9	1	3	—	4
August	36	33	29	98	35	26	28	89	23	18	14	55	10	15	9	34	2	3	1	6	1	2	—	3
September	27	25	22	74	24	21	17	62	15	17	20	52	11	13	8	32	1	2	1	4	1	1	—	2
October	22	20	19	61	16	14	12	42	10	11	14	35	7	9	10	26	2	1	1	4	—	1	—	1
November	15	17	11	43	12	7	9	28	8	9	7	20	5	11	4	20	1	1	2	4	—	—	—	—
December	19	16	15	49	10	9	12	31	7	4	8	19	7	9	3	19	1	2	—	3	—	—	—	—
1980																								
January	17	14	12	43	13	14	5	32	5	3	6	14	3	2	2	7	1	1	—	2				
February	16	12	9	37	12	11	9	32	4	3	5	12	4	1	2	7	1	2	—	3	—	1	—	1
March	14	10	11	35	9	8	6	23	8	16	0	34	7	11	5	23	2	2	1	5	—	2	—	2
Total	265	228	212	706	212	183	152	547	167	151	153	471	115	140	79	335	23	28	17	68	3	10	—	13

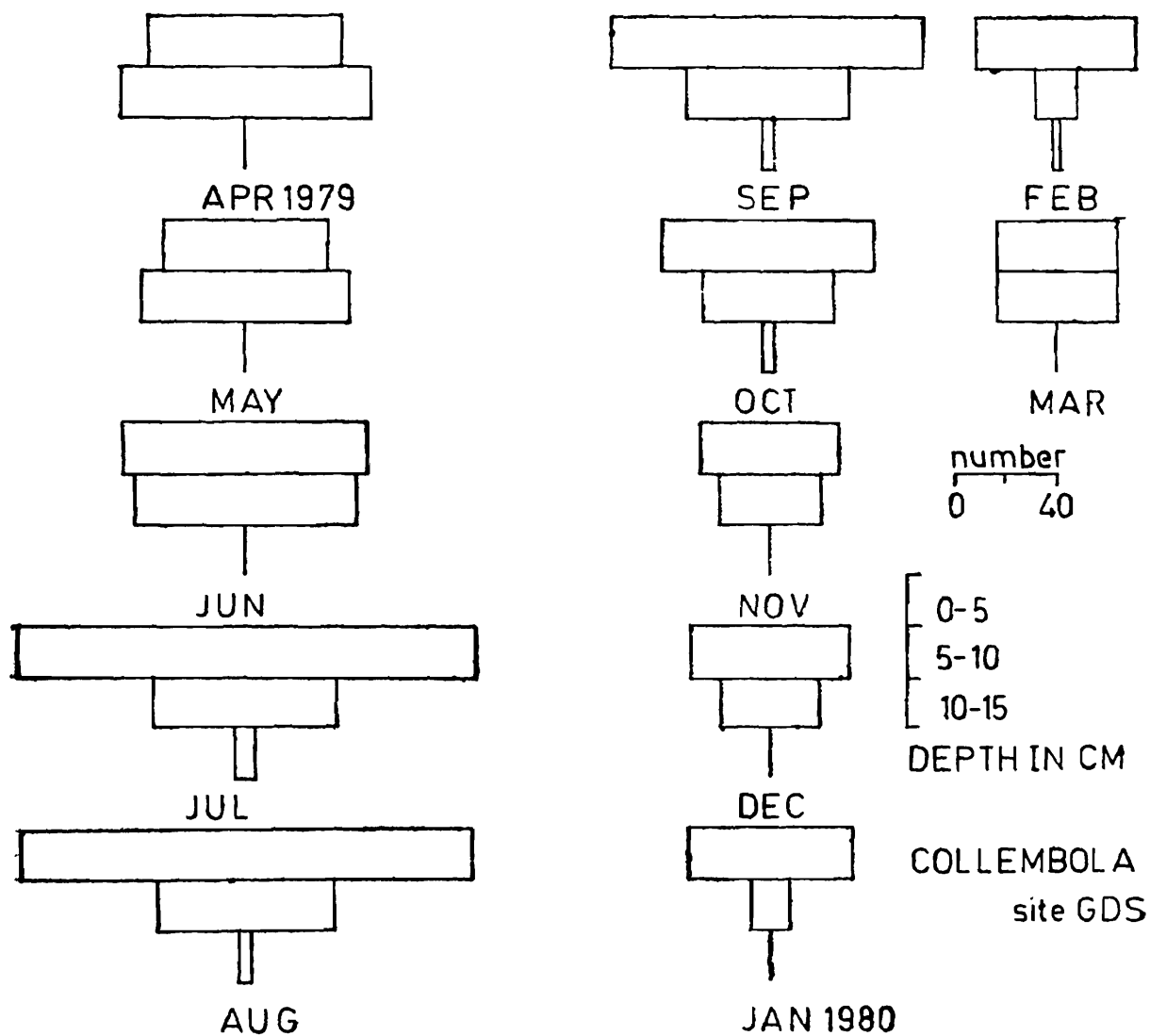


Fig. 88. Showing monthwise vertical distribution of total collembola in GDS site.

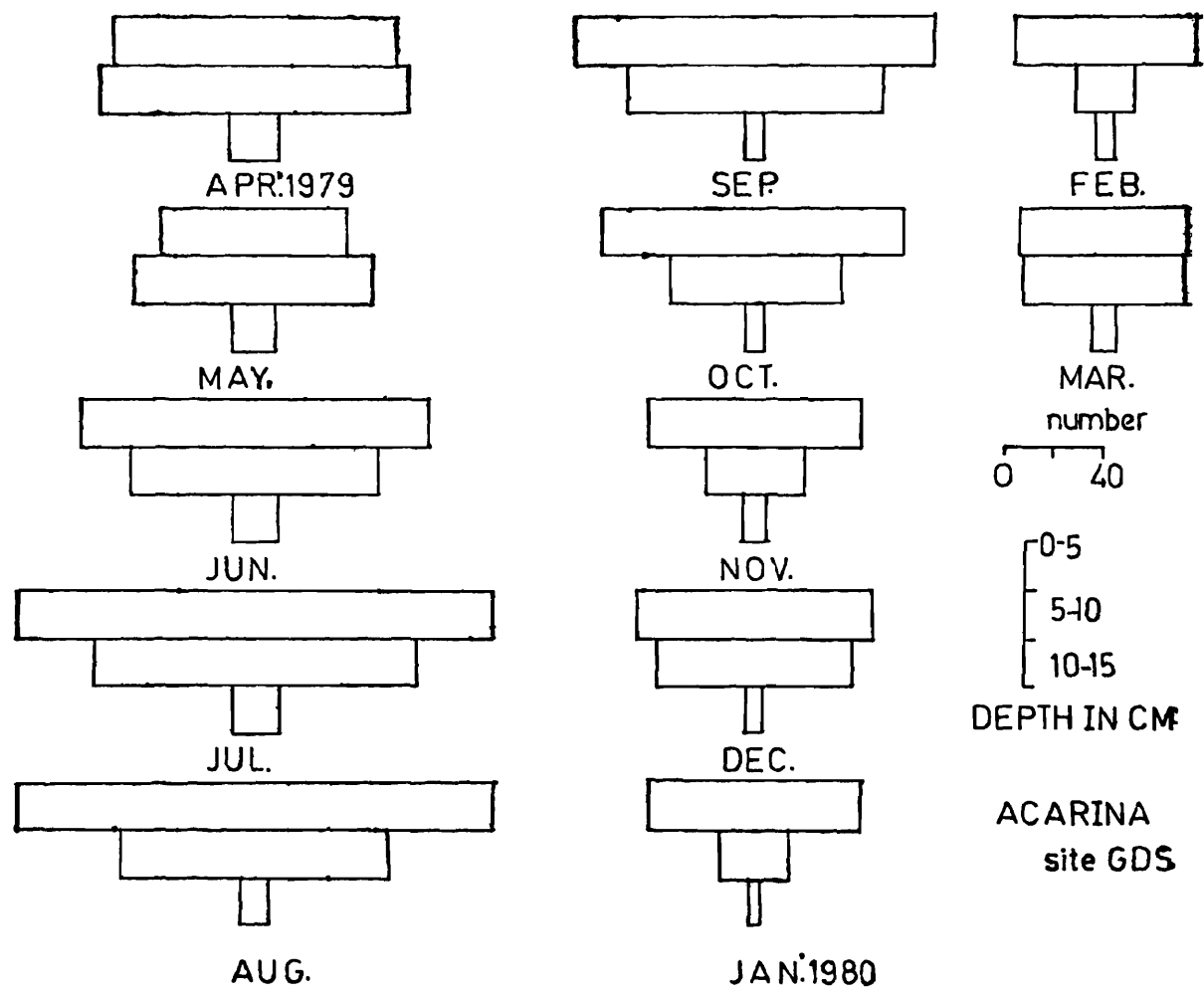


Fig. 89. Showing monthwise vertical distribution of total acarina in GDS site.

Table 54

Showing changes in vertical distribution of
acarina and collembola at soil dune site.

April, 1979—March, 1980

Depth in cm.		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes	Cry	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April		5	..	2	7	3	4	2	9	4	2	1	7	2	3	2	7	3	2	1	6	—	2	—	2
May		4	2	2	8	2	3	2	7	5	3	3	11	3	5	1	9	2	1	2	5	—	1	—	1
June		3	4	3	10	3	2	—	5	4	2	2	8	2	2	1	5	1	1	2	4	—	1	—	1
July		7	9	5	21	6	4	4	14	5	3	4	12	4	3	—	7	2	3	2	7	—	3	—	3
August		6	5	4	15	4	3	3	10	—	5	2	7	5	4	—	9	3	2	1	6	—	2	—	2
September		5	4	2	11	3	2	2	7	3	4	2	9	3	2	1	6	2	2	1	5	—	—	—	—
October		4	3	1	8	2	3	1	6	2	—	3	5	—	3	2	5	2	—	1	3	—	—	—	—
November		5	2	3	10	4	2	—	6	3	2	2	7	2	2	1	5	3	4	2	9	—	—	—	—
December		6	3	2	11	5	3	1	9	2	3	1	6	—	3	2	5	—	5	3	8	—	2	—	2
1980																									
January		5	4	3	12	3	2	2	7	3	2	—	5	3	2	1	6	4	2	—	6	1	1	—	2
February		3	2	1	6	2	1	2	5	2	1	—	3	2	1	—	3	3	1	—	4	—	—	—	—
March		3	2	2	7	1	2	1	4	3	1	2	6	1	2	2	5	2	2	1	5	—	2	—	2
Total		56	40	30	126	38	31	20	89	36	28	22	86	27	32	13	72	21	25	16	68	1	14	—	15

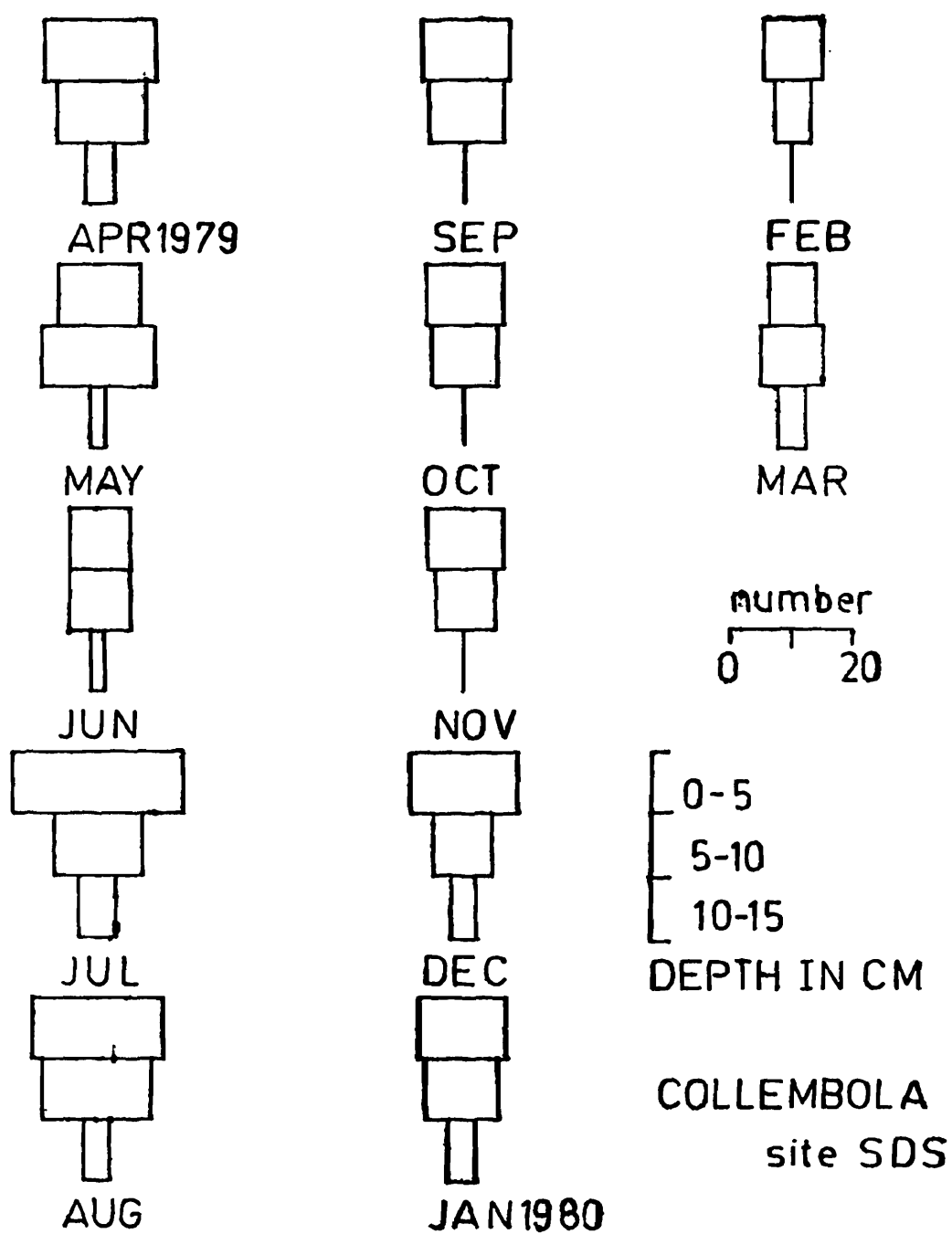


Fig. 90. Showing monthwise vertical distribution of total collembola in GDS site.

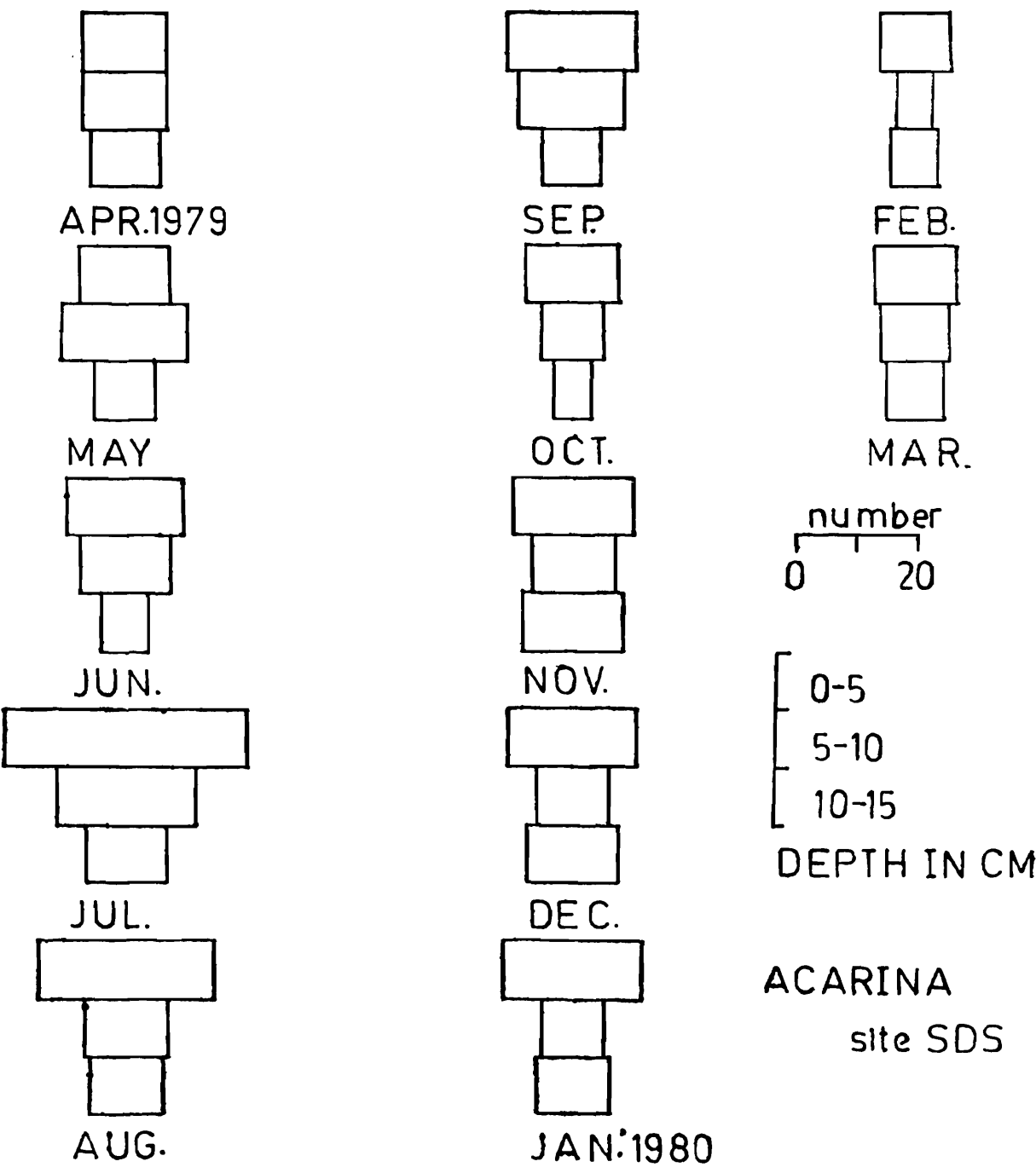


Fig. 91. Showing monthwise vertical distribution of total acarina in SDS site.

Table 55
Showing monthly changes in vertical distribution of
acarina and collembola at Durgapur control Pasture site.

April, 1979—March, 1980

Depth in cm.				0—5					5—10								10—15							
Order	Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																								
April	9	7	6	22	5	8	7	20	12	15	11	38	6	10	5	21	3	2	4	9	—	3	—	3
May	6	5	3	14	4	6	3	13	10	8	9	27	5	8	4	17	2	4	3	9	—	2	—	2
June	5	9	7	21	9	5	4	18	7	6	8	21	4	7	3	14	1	3	5	9	—	2	—	2
July	12	14	9	35	14	8	7	29	6	4	5	15	5	6	4	15	2	2	—	4	—	3	—	3
August	17	9	11	37	12	5	4	21	5	6	3	14	4	5	3	12	3	2	—	5	—	1	—	1
September	12	5	6	23	7	6	3	16	4	5	2	11	3	7	2	12	—	4	2	6	—	—	—	—
October	8	4	5	17	5	4	2	11	3	4	2	9	2	5	1	8	2	3	2	7	—	—	—	—
November	5	3	6	14	6	5	3	14	5	3	3	11	2	4	2	8	3	2	1	6	—	2	—	2
December	6	5	5	16	8	5	—	13	6	4	2	12	3	2	2	7	2	—	1	3	—	1	—	1
1980																								
January	5	5	4	15	7	5	2	14	5	3	2	10	2	4	1	7	3	1	—	4	—	—	—	—
February	3	5	6	14	4	3	—	7	4	6	7	17	3	6	3	12	4	2	1	7	—	2	—	2
March	2	4	3	9	2	1	1	4	3	2	1	6	2	5	2	9	2	1	—	3	—	1	—	1
Total	90	76	71	237	83	61	36	180	70	66	55	191	41	69	32	142	27	26	19	72	—	17	—	17

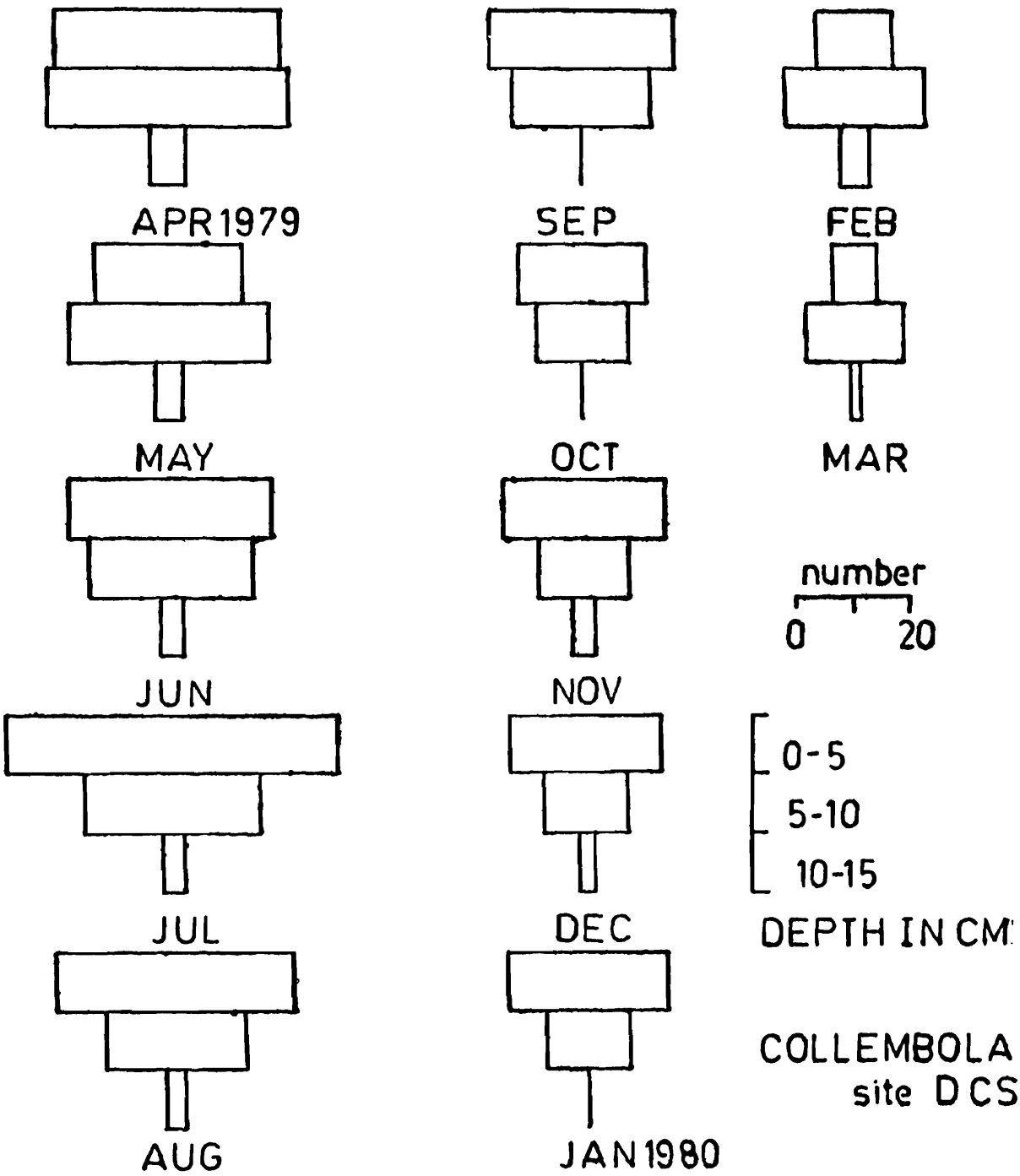


Fig. 92. Showing monthwise vertical distribution of total collembola in DCS site.

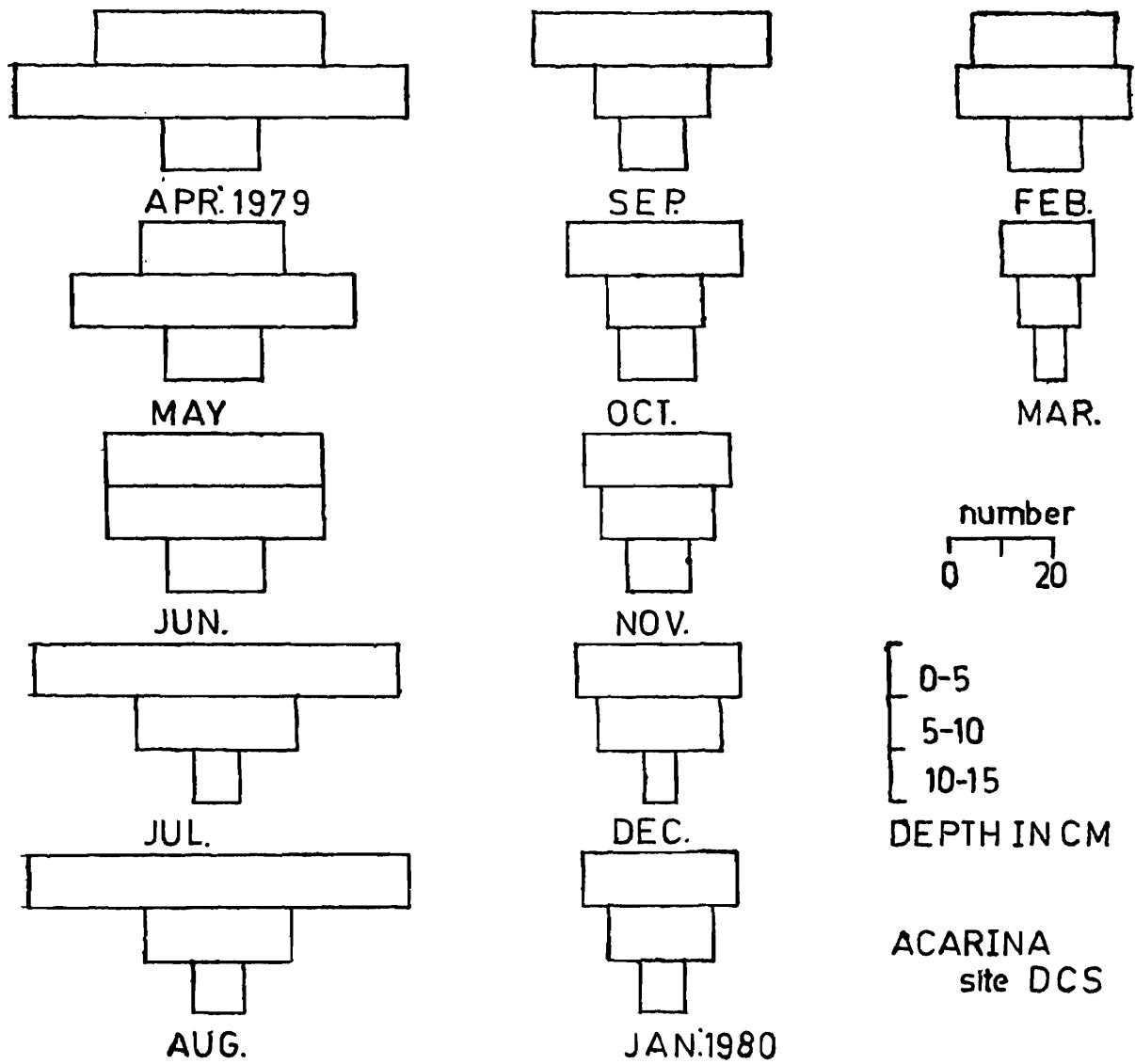


Fig. 93. Showing monthwise vertical distribution of total acarina in DCS site.

Table 56
Showing monthly changes in vertical distribution of
acarina and collembola at Durgapur industrial effluent site.
April, 1979—March, 1980

Depth in cm.		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April	—	4	5	9	2	3	1	6	—	5	3	8	—	3	1	4	—	2	2	4	—	—	—	—	—
May	—	3	2	5	4	1	—	5	—	4	2	6	—	2	1	3	—	2	1	3	—	—	—	—	—
June	—	2	6	8	5	2	2	9	—	3	1	5	—	3	1	4	—	—	4	4	—	—	—	—	—
July	—	7	5	12	3	7	2	12	—	—	6	6	2	4	1	7	—	4	2	6	—	—	—	—	—
August	—	9	11	20	—	9	3	12	—	1	2	3	1	2	—	3	—	3	1	4	—	—	—	—	—
September	—	—	7	7	2	3	2	7	—	2	1	3	—	1	—	1	—	2	—	2	—	—	—	—	—
October	—	3	2	5	3	1	1	5	—	1	4	5	—	3	1	4	—	3	1	4	—	—	—	—	—
November	—	2	1	3	4	—	—	4	—	3	1	4	—	2	2	4	—	4	—	4	—	—	—	—	—
December	—	4	3	7	3	2	2	7	—	7	4	11	1	—	2	3	—	3	—	3	—	—	—	—	—
1980																									
January	—	5	2	7	2	1	—	3	—	5	3	8	1	3	—	4	—	4	—	4	—	—	—	—	—
February	—	4	—	4	1	1	—	2	—	6	—	6	—	2	—	2	—	3	1	4	—	—	—	—	—
March	—	4	2	6	6	2	1	9	—	3	1	4	2	4	1	7	—	5	3	8	—	—	—	—	—
Total	—	47	46	93	35	32	14	81	—	40	28	68	7	29	10	46	—	35	15	50	—	—	—	—	—

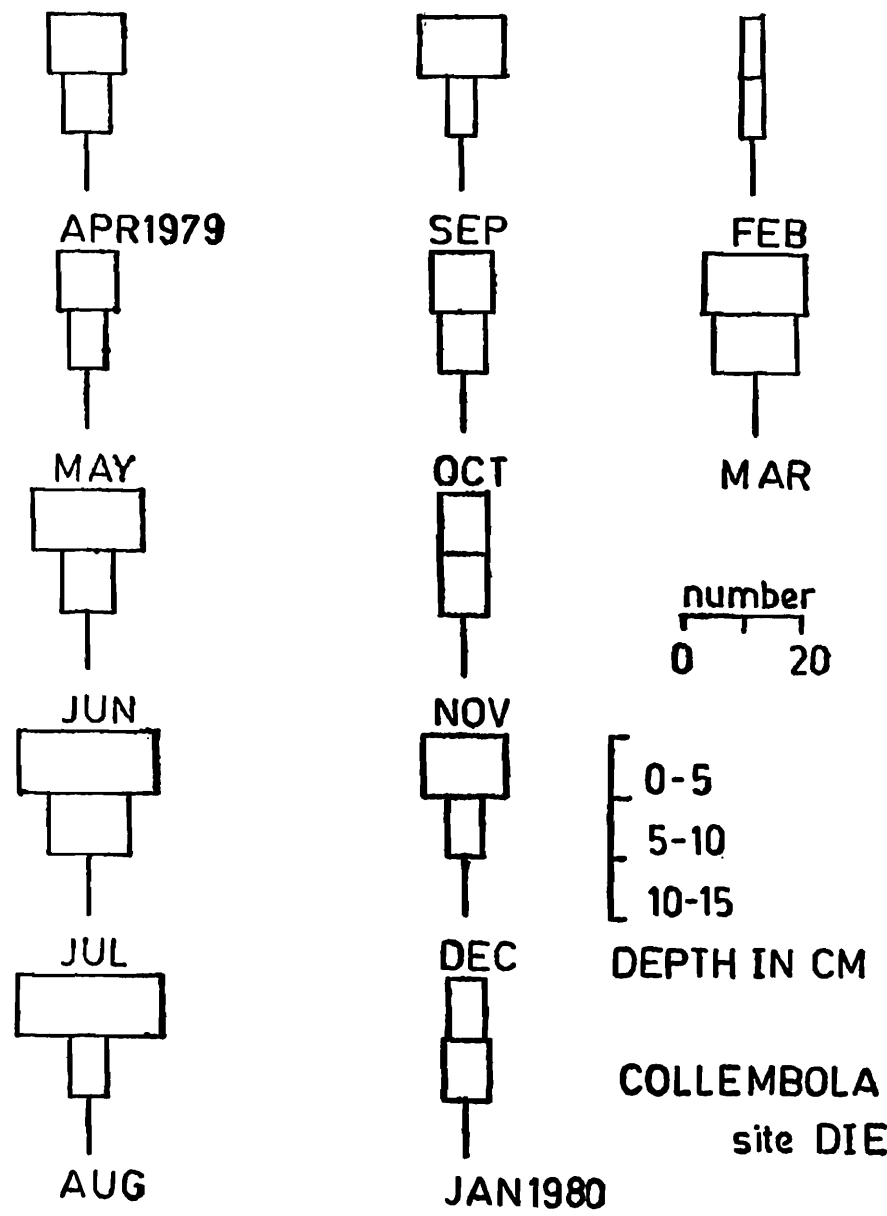


Fig. 94. Showing monthwise vertical distribution of total collembola in DIE site.

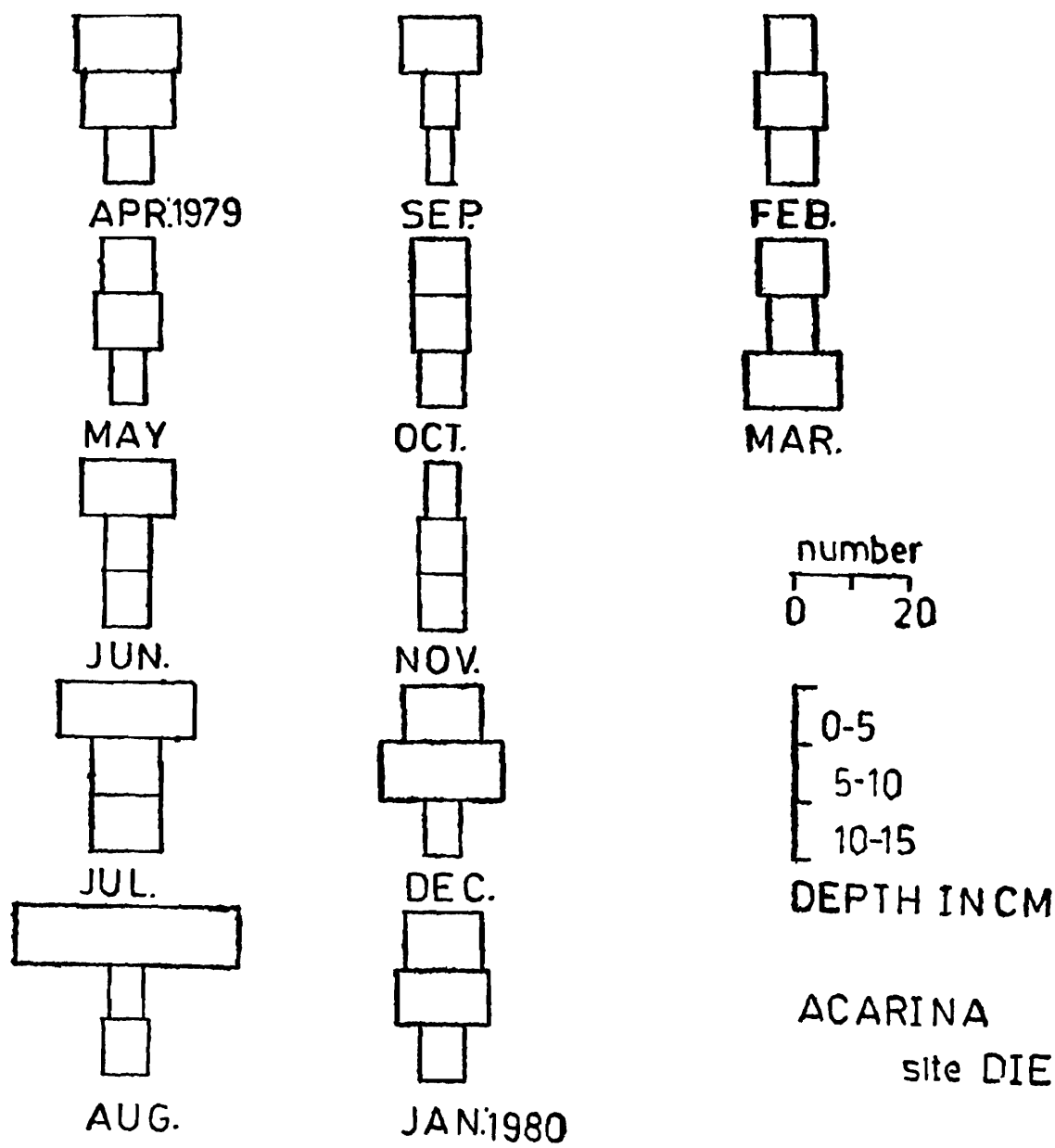


Fig. 95. Showing monthwise vertical distribution of total acarina in DIE site.

Table 57
Showing monthly changes in vertical distribution of
acarina and collembola at unmetalled road way site
April, 1979—March, 1980

Depth in cm.				0—5					5—10								10—15							
Order	Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																								
April	—	2	—	2	—	1	—	1	2	1	3	6	2	3	1	6	2	—	—	2	—	—	—	—
May	2	1	—	3	—	2	1	3	3	—	—	3	—	2	—	2	2	1	—	3	—	—	—	—
June	1	3	1	5	2	1	1	4	—	3	—	3	1	3	—	4	3	2	—	5	—	—	—	—
July	4	6	2	12	3	2	2	7	4	2	3	9	2	1	1	4	1	3	1	5	—	—	—	—
August	3	4	1	8	2	1	1	4	3	1	2	6	1	2	—	3	—	2	1	3	—	—	—	—
September	5	3	2	10	3	4	2	9	5	2	1	8	2	1	1	4	1	3	2	6	—	—	—	—
October	4	2	1	7	2	2	1	5	3	1	—	4	1	—	—	1	2	—	1	3	—	—	—	—
November	5	3	1	9	4	—	3	7	2	2	1	5	1	2	—	3	3	2	1	6	—	—	—	—
December	7	4	3	14	5	4	4	13	3	4	1	8	2	4	3	9	2	1	1	4	—	1	—	1
1980																								
January	5	2	—	7	4	2	1	7	2	3	—	5	2	1	—	3	3	1	1	5	—	—	—	—
February	6	5	4	15	5	4	3	12	1	2	—	3	1	1	1	3	1	—	2	3	—	1	—	1
March	5	3	2	10	4	2	1	7	2	1	1	4	—	2	1	3	2	—	3	5	—	—	—	—
Total	47	38	17	102	34	25	20	79	30	22	12	64	15	22	8	45	15	13	50	—	2	—	2	—

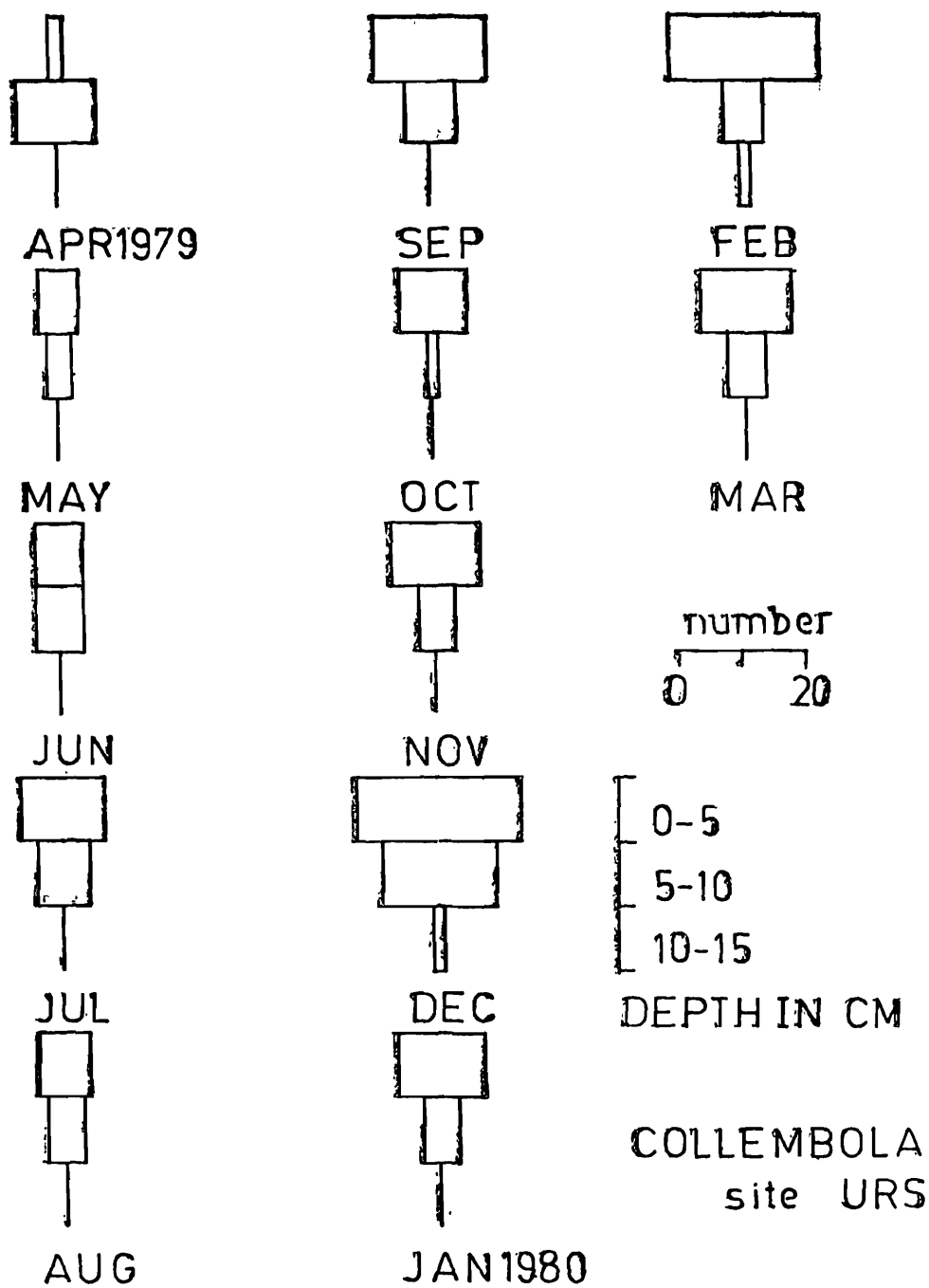


Fig. 96. Showing monthwise vertical distribution of total collembola in URS site.

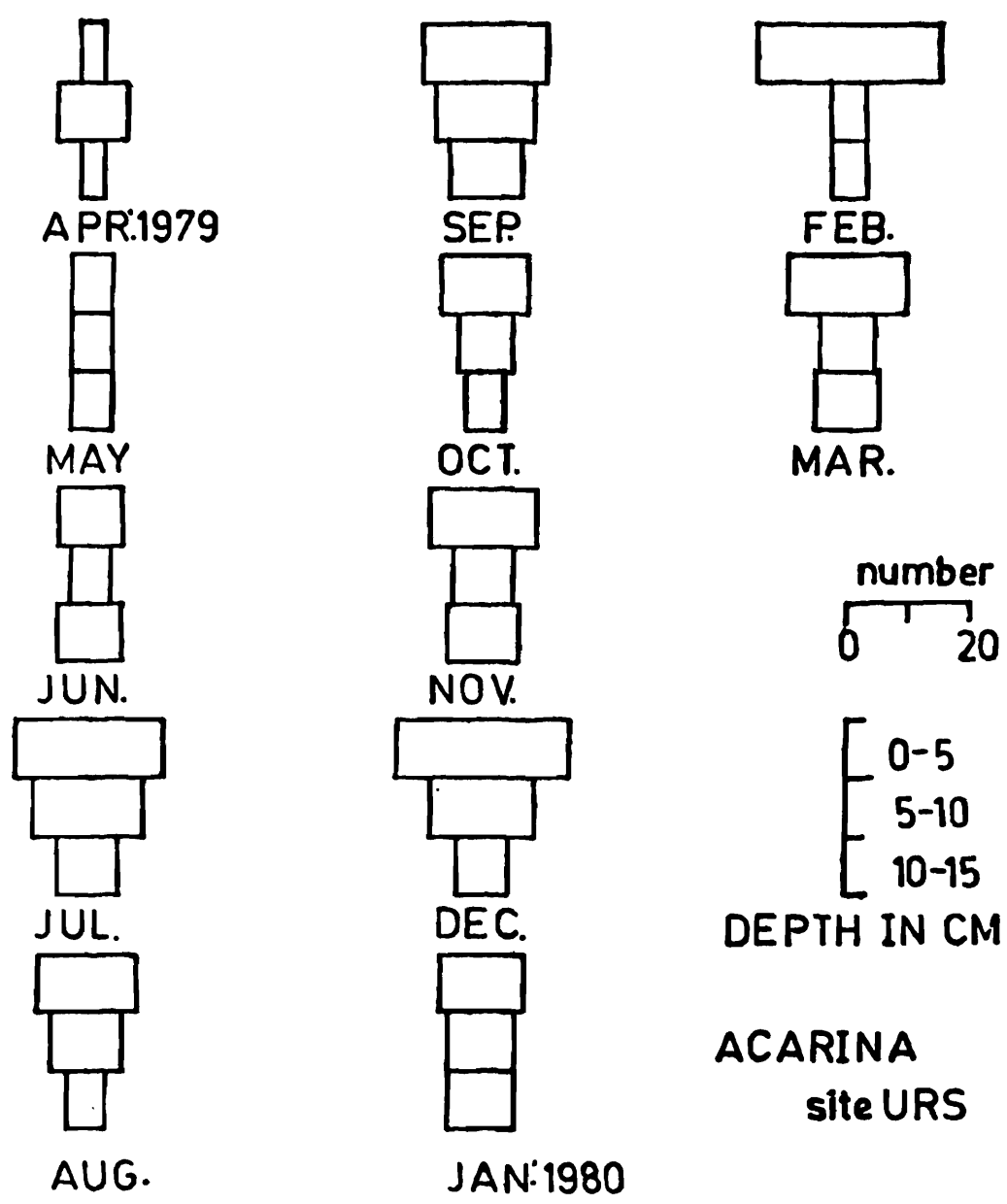


Fig. 97. Showing monthwise vertical distribution of total acarina in URS site.

Table 58
Showing monthly changes in vertical distribution of
acarina and collembola at Metalled highway site
April, 1979—March, 1980

Depth in cm.		0—5								5—10								10—15							
Order		Acarina				Collembola				Acarina				Collembola				Acarina				Collembola			
Family		Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.	Pro.	Mes.	Cry.	T.	Ent.	Iso.	Hyp.	T.
1979																									
April		5	4	3	12	3	2	2	7	11	10	12	33	8	5	6	19	3	2	4	9	-	2	-	2
May		-	1	2	3	-	1	2	3	7	5	8	20	6	4	5	15	-	1	2	3	-	1	-	1
June		2	6	5	13	5	3	4	12	-	9	7	16	7	-	9	16	1	2	-	3	-	-	-	-
July		8	11	10	28	7	6	8	21	12	16	14	42	12	9	-	21	2	3	3	8	1	1	-	2
August		7	8	6	21	5	4	3	12	9	11	10	29	7	6	9	22	1	1	-	2	-	-	-	-
September		9	5	4	18	6	8	4	18	10	9	8	27	8	9	4	21	2	1	-	3	-	-	-	-
October		7	4	3	14	5	7	3	15	9	11	-	20	6	8	3	17	1	1	1	3	-	1	-	1
November		5	3	4	12	3	5	2	10	7	8	6	21	5	7	4	16	1	-	-	1	-	-	-	-
December		0	2	-	6	2	3	-	5	6	5	4	15	-	5	2	7	1	2	-	3	-	-	-	-
1980																									
January		5	-	2	7	5	-	2	7	8	-	5	13	5	4	5	14	2	-	-	2	-	-	-	-
February		4	2	1	7	2	1	1	4	6	4	3	13	4	3	3	10	1	-	-	1	-	-	-	-
March		3	1	1	5	1	2	1	4	4	3	2	9	3	4	1	8	2	1	-	3	-	-	-	-
Total		59	47	41	147	44	42	28	114	89	91	78	259	71	64	51	186	17	14	10	41	1	5	-	6

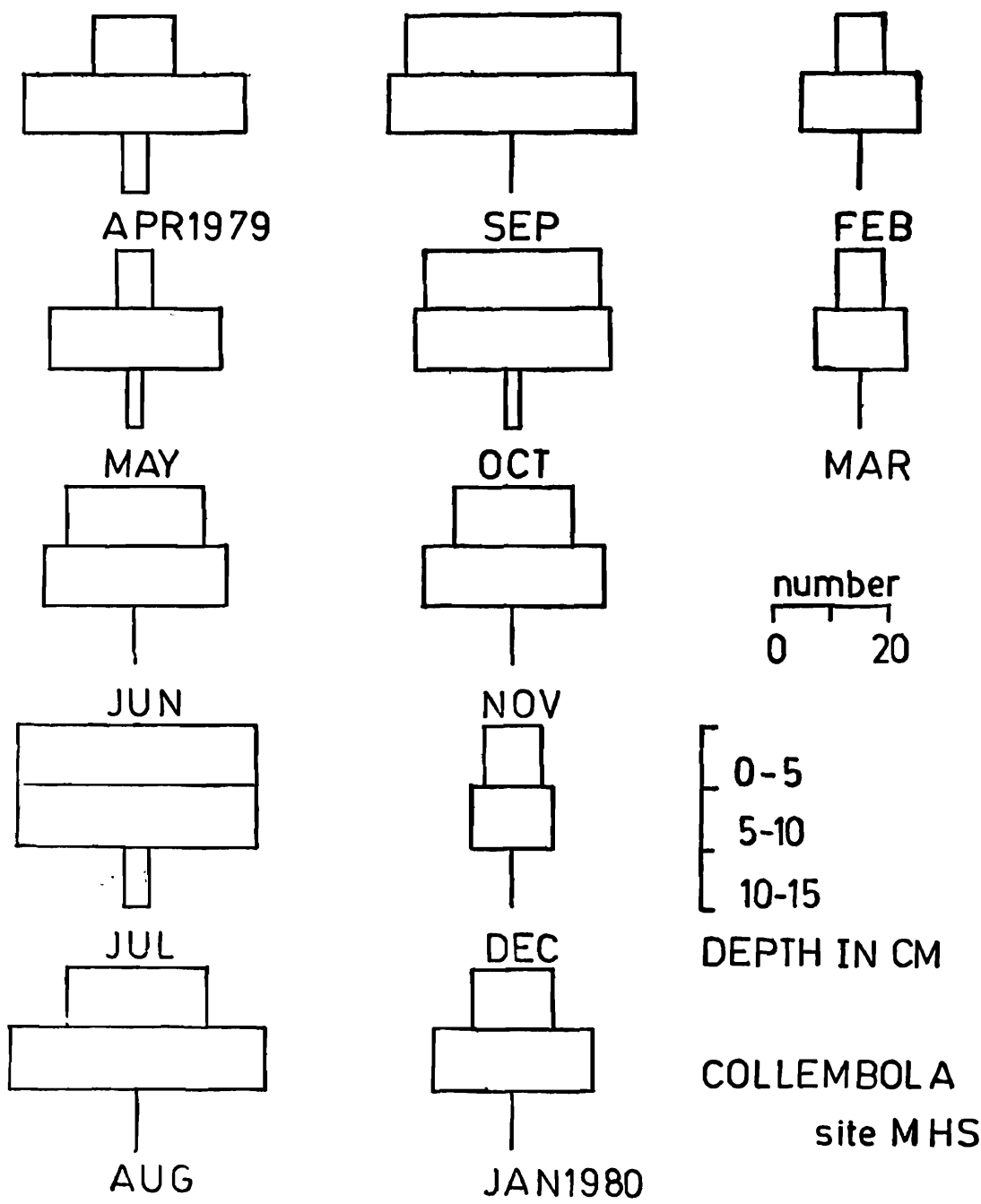


Fig. 98. Showing monthwise vertical distribution of total collembola in MHS site,

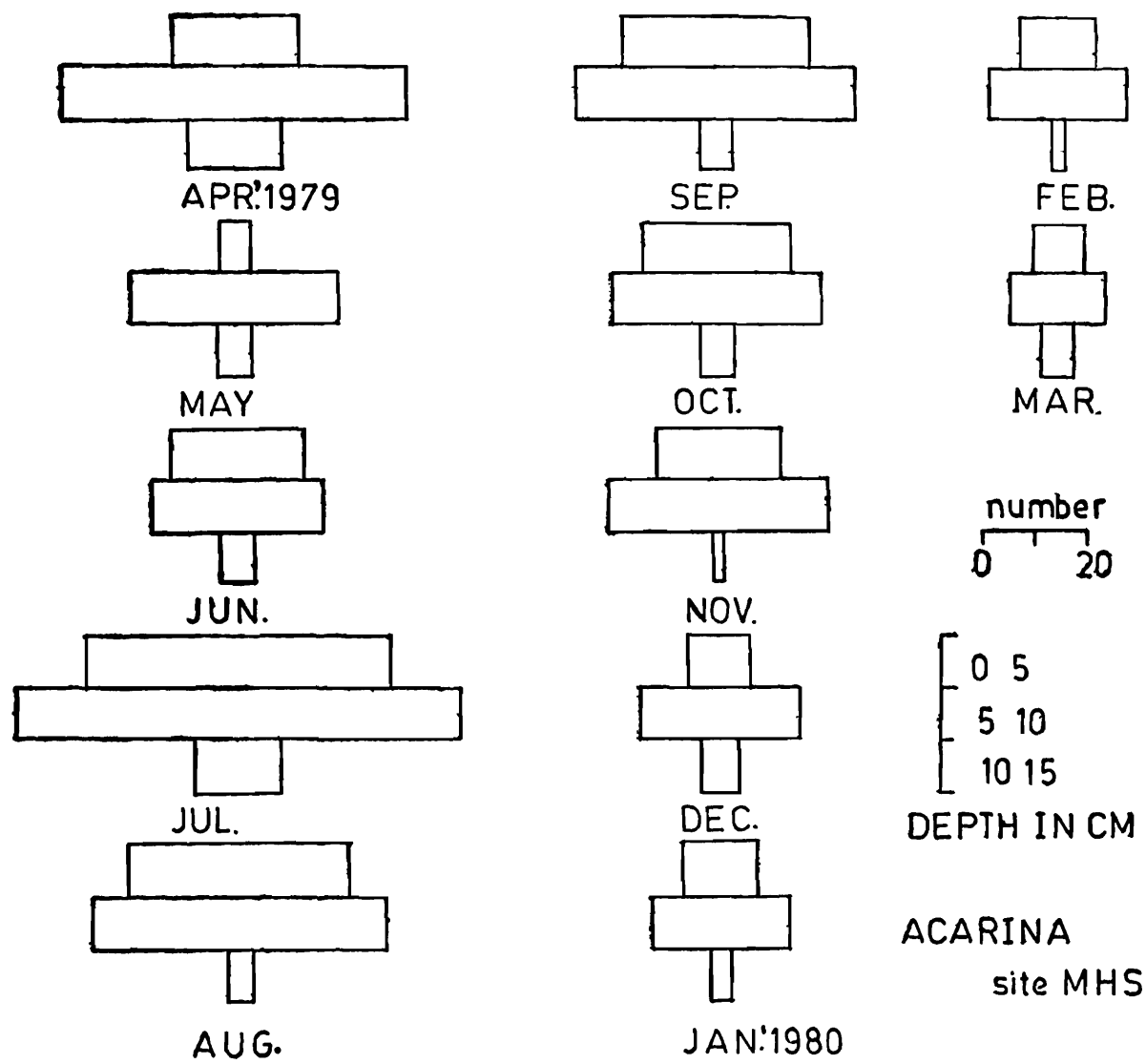


Fig. 99. Showing monthwise vertical distribution of total acarina in MHS site.

Table 59

Showing vertical distribution of Fungi population in different sites
(number in thousand/gm. soil) percentages are given in parenthesis

Sampling Sites	Depth in cm.		
	0—5	5—10	10—15
Fallow land site	32 (3.75)	26 (3.04)	14 (1.64)
Agriculture practice land site	21 (2.46)	25 (2.93)	11 (1.29)
Deforested site	19 (2.22)	16 (1.87)	9 (1.05)
Reserve forest floor site	42 (4.92)	36 (4.22)	27 (3.15)
Undisturbed city park site	33 (3.86)	29 (2.58)	15 (1.76)
Anthropogenic pressurised city park	15 (1.76)	18 (2.11)	10 (1.17)
Irrigation canal embankment site	28 (3.28)	17 (1.99)	9 (1.05)
Sewage canal embankment site	33 (3.86)	13 (1.52)	12 (1.41)
Garbage dumping dune site	45 (5.27)	38 (4.45)	26 (3.04)
Soil dune site	34 (3.98)	23 (2.69)	15 (1.76)
Durgapur control Pasture site	29 (3.40)	21 (2.46)	12 (1.41)
Durgapur industrial effluent site	9 (1.05)	7 (0.82)	3 (0.35)
Unmetalled road way site	16 (1.87)	13 (1.52)	7 (0.82)
Metalled highway site	22 (2.58)	16 (1.87)	8 (0.94)
Total	378 (44.26)	279 (34.89)	178 (20.84)

REGRESSION AND CORRELATION

The data involving soil factors, heavy metals and the densities of faunal population were subjected to the statistical analysis separately for each site in order to find out the regression and correlation. The dependence of number of total arthropod/predominant suborders of acarina and total collembola/predominant species of collembola (Y) on each of the nine vari-

ables (including fungi) considered here were studied. First, by means of a statistical test it was verified whether the relationships between the number of arthropod and collembola fauna (Y) and 9 different variables and also between total collembola number (Y) and total other arthropod population in 14 different sites remained the same throughout the experimental period or not. The results of such tests are shown in the tables : (60 and 61 for Fallow land site); (62 and 63 Agriculture practice land site); (64 and 65 for Deforested site); (66 and 67 for Reserve forest floor site); (68 and 69 for undisturbed city park site); (70 and 71 for Anthropogenic city park site); (72 and 73 for Irrigation canal embankment site); (74 and 75 for Sewage canal embankment site); (76 and 77 for Garbage dumping dune site); (78 and 79 for Soil dune site); (80 and 81 for Durgapur control Pasture site); (82 and 83 for Durgapur industrial effluent site); (84 and 85 for unmetalled road way site); (86 and 87 for metalled highway site) and 88 for 14 different sites). The above referred tables revealed identical relationships in the sampling periods in respect to each site.

Again the data involving soil factors/heavy metals and the densities of population of fungi were also subjected to statistical analysis separately for each site in order to find out regression and correlation. The dependence of number of fungi (Y) on each of the eight variables considered here was studied. The results of such test are given in the tables : (89 for Fallow land site); (90 for Agriculture practice land site); (91 for Deforested site); (92 for Reserve forest floor site); (93 for undisturbed city park site); (94 for Anthropogenic city park site); (95 for Irrigation canal embankment site); (96 for sewage canal embankment site); (97 for Garbage dumping dune site); (98 for soil dune site); (99 for Durgapur control Pasture site); (100 for Durgapur industrial effluent site); (101 for unmetalled road way site) and (102 for Metalled highway site).

The correlation coefficient data mentioned in the above tables broadly indicated that of the soil factors like organic carbon, nitrate, moisture and fungi were significant and positively correlated with the arthropod and collembola (including their species) population in almost all the sites (except sewage canal embankment site where it showed negative correlative with the population). Whereas in case of the three heavy metals like lead, chromium and copper showed significant and negatively correlated with all the faunal as well as fungi floral population. In respect to other variables, however the relationship varied from one sampling site to the other.

Table 60

Showing relationship between total arthropod (micro-macro) population including their two dominant sub-order population and soil factors/fungi population at Fallow land site

Parameters	Mean $\pm$ S.D.	'r' value	Regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)	18.08 $\pm$ 12.82		
Organic carbon	2.61 $\pm$ 0.36	0.79**	$Y = -57.08 + 28.67x$
Nitrate	1.81 $\pm$ 0.36	0.68**	$Y = -34.95 + 29.38x$
Soil temperature	27.30 $\pm$ 9.76	0.03	$Y = 16.20 + 0.06x$
pH	7.07 $\pm$ 0.06	-0.22-	$Y = 363.63 - 48.9x$
Fungi	24.43 $\pm$ 9.15	0.46*	$Y = -9.61 + 1.13x$
Y : Prostigmata population	17.00 $\pm$ 13.99		
Organic carbon	2.61 $\pm$ 0.36	0.86**	$Y = -60.27 + 32.16x$
Nitrate	1.81 $\pm$ 0.30	0.73**	$Y = -37.69 + 33.85x$
Soil temperature	27.30 $\pm$ 9.76	-0.05	$Y = 27.60 + 0.13x$
Moisture	14.76 $\pm$ 6.27	0.81**	$Y = -2.00 + 1.73x$
pH	7.07 $\pm$ 0.06	-0.14	$Y = 265.25 - 34.19x$
Fungi	24.43 $\pm$ 9.15	0.75**	$Y = -3.40 + 1.10x$
Y : Mesostigmata population	15.61 $\pm$ 13.78		
Organic carbon	2.61 $\pm$ 0.36	0.75**	$Y = -79.13 + 38.97x$
Nitrate	1.81 $\pm$ 0.30	0.62**	$Y = -48.15 + 39.12x$
Soil temperature	27.30 $\pm$ 9.76	0.02	$Y = 20.01 + 0.08x$
Moisture	14.76 $\pm$ 6.27	0.67**	$Y = -7.20 + 2.01x$
pH	7.07 $\pm$ 0.06	-0.22	$Y = 516.60 - 69.87x$
Fungi	24.43 $\pm$ 9.15	0.81**	$Y = -17.74 + 1.64x$

** Significant at 1% level

* Significant at 5% level

Table 61

Showing relationship between total collembola population including their three dominant species population and soil factors/fungi population at Fallow land site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	15.64 $\pm$ 15.25		
Organic carbon	2.61 $\pm$ 0.36	0.74**	$Y = -66.19 + 31.39x$
Nitrate	1.81 $\pm$ 0.30	0.58**	$Y = -38.20 + 29.82x$
Soil temperature	27.3 $\pm$ 0.76	-0.03	$Y = 18.42 - 0.09x$
Moisture	14.76 $\pm$ 6.27	0.67**	$Y = -8.47 + 1.63x$
pH	7.07 $\pm$ 0.06	-0.23	$Y = 451.80 + 61.72x$
Fungi	24.43 $\pm$ 9.15	0.80**	$Y = -16.91 + 1.32x$
Y : <i>Subisotoma fitchioides</i> population	15.90 $\pm$ 23.5		
Organic carbon	2.61 $\pm$ 0.36	0.57**	$Y = -80.24 + 36.59x$
Nitrate	1.81 $\pm$ 0.30	0.35	$Y = -33.98 + 27.21x$
Soil temperature	27.30 $\pm$ 3.76	0.08	$Y = 4.66 + 0.33x$
Moisture	14.76 $\pm$ 6.27	0.46*	$Y = -3.37 + 1.66x$
pH	7.07 $\pm$ 0.06	-0.21	$Y = 625.73 - 86.37x$
Fungi	24.43 $\pm$ 9.15	0.67**	$Y = -27.58 + 1.73x$
Y : <i>Megalothorax minimus</i>	15.55 $\pm$ 15.58		
Organic carbon	2.61 $\pm$ 0.36	0.69**	$Y = 62.98 + 29.84x$
Nitrate	1.81 $\pm$ 0.30	0.55**	$Y = -37.46 + 28.95x$
Soil temperature	27.30 $\pm$ 9.76	-0.07	$Y = 20.45 - 0.18x$
Moisture	14. $\pm$ 6.27	0.64**	$Y = -8.61 + 1.58x$
pH	7.07 $\pm$ 0.06	-0.26	$Y = 521.76 - 71.71x$
Fungi	24.43 $\pm$ 9.15	0.77**	$Y = -17.39 + 1.31x$
Y : <i>Lepidocyrtus medius</i>	15.58 $\pm$ 13.26		
Organic carbon	2.61 $\pm$ 0.36	0.77**	$Y = 57.28 + 27.62x$
Nitrate	1.81 $\pm$ 0.30	0.62**	$Y = -36.43 + 27.99x$
Moisture	14.76 $\pm$ 6.27	0.71**	$Y = 8.72 + 1.53x$
pH	7.07 $\pm$ 0.06	-0.28	$Y = 30.28 - 2.40x$
Fungi	24.43 $\pm$ 9.15	0.82**	$Y = -15.34 + 1.20x$

** Significant at 1% level,

* Significant at 5% level

Table 62

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-order population and soil factors/fungi population at Agriculture practice land site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)	6.15 $\pm$ 2.94		
Organic carbon	1.76 $\pm$ 0.48	0.71**	$Y = -0.92 + 4.13x$
Nitrate	1.25 $\pm$ 0.22	0.80**	$Y = -7.48 + 10.90x$
Soil temperature	28.17 $\pm$ 7.18	-0.47*	$Y = 13.39 - 0.25x$
Moisture	16.83 $\pm$ 4.62	-0.19	$Y = 8.17 - 0.12x$
pH	7.31 $\pm$ 0.08	0.02	$Y = 0.68 - 0.75x$
Fungi	16.35 $\pm$ 7.07	0.79**	$Y = 0.82 + 0.33x$
Y : Prostigmata population	7.66 $\pm$ 3.95		
Organic carbon	1.76 $\pm$ 0.48	0.73**	$Y = -3.79 + 7.19x$
Nitrate	1.25 $\pm$ 0.22	0.80**	$Y = -11.96 + 16.24x$
Soil temperature	28.17 $\pm$ 7.18	-0.29	$Y = 15.02 - 0.23x$
Moisture	16.83 $\pm$ 4.62	-0.03	$Y = 8.83 - 0.03x$
pH	7.31 $\pm$ 0.08	-0.18	$Y = 68.35 - 8.24x$
Fungi	15.00 $\pm$ 6.80	0.71**	$Y = 1.18 + 0.44x$
Y : Mesostigmata population	6.81 $\pm$ 3.40		
Organic carbon	1.76 $\pm$ 0.48	0.60**	$Y = -1.01 + 4.64x$
Nitrate	1.25 $\pm$ 0.22	0.65**	$Y = -6.09 + 10.32x$
Soil temperature	28.17 $\pm$ 7.18	-0.52*	$Y = 16.17 - 0.32x$
Moisture	16.83 $\pm$ 4.62	-0.18	$Y = 9.06 - 0.13x$
pH	7.31 $\pm$ 0.08	-0.09	$Y = 34.63 - 3.80x$
Fungi	15.00 $\pm$ 6.80	0.80**	$Y = 0.49 + 0.39x$

** Significant at 1% level

* Significant at 5% level

Table 63

Showing relationship between total collembola population including their three dominant species population and soil factors/fungi population at Agriculture practice land site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	5.11 $\pm$ 2.61		
Organic carbon	1.76 $\pm$ 0.48	0.66*	$Y = -1.49 + 3.92x$
Nitrate	1.25 $\pm$ 0.22	0.78**	$Y = -6.67 + 9.43x$
Soil temperature	28.17 $\pm$ 1.18	-0.44*	$Y = 11.22 - 0.21x$
§ Moisture	17.08 $\pm$ 4.52	0.94**	$Y = 27.52 + 3.06x$
pH	7.31 $\pm$ 0.18	-0.14	$Y = 37.79 - 4.49x$
Fungi	16.33 $\pm$ 7.07	0.72**	$Y = 0.66 + 0.27x$
Y : <i>Cyphoderus javanus</i>	5.88 $\pm$ 1.90		
Organic carbon	1.76 $\pm$ 0.48	0.34	$Y = -9.15 + 5.27x$
Nitrate	1.25 $\pm$ 0.22	0.59**	$Y = -4.98 + 7.69x$
Soil temperature	28.17 $\pm$ 7.18	-0.33	$Y = 9.90 - 0.17x$
Moisture	16.83 $\pm$ 4.62	-0.19	$Y = 6.83 - 0.12x$
pH	7.31 $\pm$ 0.08	0.3	$Y = 4.36 + 0.05x$
Fungi	15.00 $\pm$ 6.80	0.52*	$Y = 1.45 + 0.20x$
Y : <i>Subisotoma fitchioides</i>	5.93 $\pm$ 2.58		
Organic carbon	1.76 $\pm$ 0.48	0.69**	$Y = -4.91 + 5.43x$
Nitrate	1.25 $\pm$ 0.22	0.74*	$Y = -10.68 + 11.94x$
Soil temperature	28.17 $\pm$ 7.18	-0.56**	$Y = 14.60 - 0.35x$
Moisture	16.83 $\pm$ 4.62	-0.23	$Y = 7.16 - 0.17x$
pH	7.31 $\pm$ 0.08	-0.25	$Y = 81.99 - 10.62x$
Fungi	15.00 $\pm$ 6.80	0.77**	$Y = -2.00 + 0.38x$
Y : <i>Lepidocyrtus suborientalis</i>	6.44 $\pm$ 2.79		
Organic carbon	1.76 $\pm$ 0.48	0.38	$Y = -0.04 + 3.10x$
Nitrate	1.25 $\pm$ 0.22	0.55*	$Y = -6.37 + 9.25x$
Soil temperature	28.17 $\pm$ 7.18	-0.28	$Y = 10.61 - 0.18x$
Moisture	16.83 $\pm$ 4.62	-0.21	$Y = 7.94 - 0.16x$
pH	7.31 $\pm$ 0.08	0.10	$Y = -25.98 + 4.26x$
Fungi	15.00 $\pm$ 6.80	0.62**	$Y = -0.29 + 0.33x$

** Significant at 1% level

* Significant at 5% level

§ Regression not drawn

Table 64

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-orders population and soil factors/fungi population at Deforested site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (macro + micro)	8.83 $\pm$ 3.49		
Organic carbon	1.15 $\pm$ 0.27	0.77**	$Y = -6.11 + 9.86x$
Nitrate	1.40 $\pm$ 0.26	0.74**	$Y = -6.00 + 10.52x$
Soil temperatrue	22.53 $\pm$ 10.75	0.11	$Y = 6.78 + 0.07x$
Moisture	11.05 $\pm$ 4.51	0.81**	$Y = 1.89 + 0.63x$
pH	7.34 $\pm$ 0.10	-0.27	$Y = 92.78 - 11.44x$
Fungi	7.45 $\pm$ 3.22	0.75**	$Y = 3.05 + 0.78x$
Y : Prostigmata population	17.26 $\pm$ 14.91		
Organic carbon	1.51 $\pm$ 0.27	0.67**	$Y = -8.90 + 14.99x$
Nitrate	1.40 $\pm$ 0.26	0.66**	$Y = -9.15 + 16.29x$
Soil temperature	22.53 $\pm$ 10.75	0.06	$Y = 11.89 + 0.06x$
Moisture	11.05 $\pm$ 4.51	0.68**	$Y = 3.91 + 0.90x$
pH	7.34 $\pm$ 0.10	-0.33	$Y = 164.15 - 20.48x$
Fungi	7.38 $\pm$ 3.28	0.70**	$Y = 4.21 + 1.30x$
Y : Mesostigmata population	17.95 $\pm$ 16.05		
Organic carbon	1.51 $\pm$ 0.27	0.73**	$Y = -12.39 + 16.21x$
Nitrate	1.40 $\pm$ 0.26	0.62**	$Y = -8.82 + 15.04x$
Soil temperature	22.53 $\pm$ 10.75	-0.05	$Y = 14.13 - 0.06x$
Moisture	11.05 $\pm$ 4.51	0.64**	$Y = 3.68 + 0.82x$
pH	7.34 $\pm$ 0.10	-0.44*	$Y = 205.94 - 26.37x$
Fungi	7.38 $\pm$ 3.28	0.74**	$Y = 2.39 + 1.35x$

** Significant at 1% level

* Significant at 5% level

Table 65

Showing relation between total collembola population including their three dominant species population and soil factors/fungi population at Deforested site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	4.09 $\pm$ 2.19		
Organic carbon	1.51 $\pm$ 0.27	0.82**	$Y = -1.54 + 4.26x$
Nitrate	1.40 $\pm$ 0.26	0.66**	$Y = -0.34 + 3.75x$
Soil temperature	22.53 $\pm$ 10.75	-0.18	$Y = 6.41 - 0.05x$
Moisture	11.05 $\pm$ 4.51	0.82**	$Y = 2.12 + 0.26x$
pH	7.34 $\pm$ 0.10	0.35	$Y = 41.43 - 4.97x$
Fungi	7.45 $\pm$ 3.22	0.83**	$Y = 2.32 + 0.36x$
Y : <i>Proisotoma</i> sp. population	4.39 $\pm$ 1.69		
Organic carbon	1.51 $\pm$ 0.27	0.33	$Y = -0.09 + 2.55x$
Nitrate	1.40 $\pm$ 0.26	0.22	$Y = 1.05 + 1.93x$
Soil temperature	22.53 $\pm$ 10.75	-0.26	$Y = 6.88 - 0.10x$
Moisture	11.05 $\pm$ 4.51	0.16	$Y = 2.93 + 0.07x$
pH	7.34 $\pm$ 0.10	-0.04	$Y = 9.50 - 0.78x$
Fungi	7.38 $\pm$ 3.28	0.11	$Y = 3.22 + 0.07x$
Y : <i>Lepidocyrtus suborientalis</i>	4.95 $\pm$ 1.87		
Organic carbon	1.51 $\pm$ 0.27	0.47*	$Y = -1.61 + 4.01x$
Nitrate	1.40 $\pm$ 0.26	0.44*	$Y = -1.39 + 4.13x$
Soil temperature	22.53 $\pm$ 10.75	0.30	$Y = 0.54 + 0.13x$
Moisture	11.05 $\pm$ 4.51	0.02	$Y = 0.01 + 4.44x$
pH	7.34 $\pm$ 0.10	-0.29	$Y = 54.02 - 6.75x$
Fungi	7.38 $\pm$ 3.28	0.42	$Y = 2.14 + 0.31x$
Y : <i>Isotomina thermophila</i>	5.15 $\pm$ 2.09		
Organic carbon	1.51 $\pm$ 0.27	0.56**	$Y = -2.41 + 4.83x$
Nitrate	1.40 $\pm$ 0.26	0.30	$Y = 0.95 + 2.81x$
Soil temperature	22.53 $\pm$ 10.57	0.38	$Y = 1.92 + 0.16x$
Moisture	11.05 $\pm$ 4.51	0.60**	$Y = 1.48 + 0.13x$
pH	7.34 $\pm$ 0.10	-0.49	$Y = 87.37 - 11.24x$
Fungi	7.38 $\pm$ 3.28	0.52*	$Y = 2.17 + 0.37x$

** Significant at 1% level

* Significant at 5% level

Table 66

Showing relationship between total arthropod (micro + macro) population including their two dominant suborder population and soil factors/fungi population at Reserve forest floor site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)	26.67 $\pm$ 18.21		
Organic carbon	3.18 $\pm$ 0.61	0.71**	$Y = -34.98 - 19.10x$
Nitrate	2.08 $\pm$ 0.27	0.71**	$Y = -69.93 + 45.90x$
Soil temperature	27.64 $\pm$ 8.71	0.19	$Y = 7.89 + 0.65x$
Moisture	15.74 $\pm$ 4.11	0.80**	$Y = -29.13 + 3.54x$
pH	7.05 $\pm$ 0.05	-0.13	$Y = 374.79 - 49.39x$
Fungi	24.90 $\pm$ 11.84	0.74**	$Y = 1.51 + 1.13x$
Y : Mesostigmata population	19.36 $\pm$ 17.45		
Organic carbon	3.18 $\pm$ 0.61	0.84**	$Y = -58.32 + 78.08x$
Nitrate	2.08 $\pm$ 0.27	0.81**	$Y = -86.22 + 56.70x$
Soil temperature	27.64 $\pm$ 8.71	0.18	$Y = 8.62 + 0.73x$
Moisture	15.74 $\pm$ 4.11	0.82**	$Y = -28.82 + 3.72x$
pH	7.05 $\pm$ 0.05	-0.10	$Y = 307.27 - 39.29x$
Fungi	24.80 $\pm$ 12.13	0.81**	$Y = -2.48 + 1.33x$
Y : Prostigmata population	15.71 $\pm$ 15.48		
Organic carbon	3.18 $\pm$ 0.61	0.86**	$Y = -47.67 + 24.88x$
Nitrate	2.08 $\pm$ 0.27	0.84**	$Y = -83.22 + 55.22x$
Soil temperature	27.64 $\pm$ 8.71	0.06	$Y = 25.39 + 0.21x$
Moisture	15.74 $\pm$ 4.11	0.79**	$Y = -21.64 + 3.37x$
pH	7.05 $\pm$ 0.05	-0.06	$Y = 176.99 - 20.64x$
Fungi	24.80 $\pm$ 12.13	0.78**	$Y = 2.45 + 1.16x$

** Significant at 1% level

Table 67

Showing relationship between total collembola population including their three dominant species population and soil factors/fungi population at Reserve floor site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	16.23 $\pm$ 9.76		
Organic carbon	3.18 $\pm$ 0.61	0.85**	$Y = -25.36 + 13.03x$
Nitrate	2.08 $\pm$ 0.27	0.84**	$Y = -47.23 + 30.56x$
Soil temperature	27.64 $\pm$ 8.71	0.33	$Y = 0.22 + 0.57x$
Moisture	15.74 $\pm$ 4.11	0.83**	$Y = -14.86 + 1.98x$
pH	7.05 $\pm$ 0.05	-0.04	$Y = 70.96 - 7.76x$
Fungi	24.90 $\pm$ 11.84	0.77**	$Y = 1.08 + 0.63x$
Y : Cyphoderus javanus	8.52 $\pm$ 5.18		
Organic carbon	3.18 $\pm$ 0.61	0.56**	$Y = 6.83 + 4.83x$
Nitrate	2.08 $\pm$ 0.27	0.60**	$Y = -15.39 + 11.52x$
Soil temperature	27.64 $\pm$ 8.71	0.15	$Y = 1.57 + 0.24x$
Moisture	15.74 $\pm$ 4.11	0.60**	$Y = -3.47 + 0.76x$
pH	7.05 $\pm$ 0.05	-0.08	$Y = 71.30 - 8.90x$
Fungi	24.80 $\pm$ 12.13	0.59**	$Y = 2.08 + 0.26x$
Y : Lepidocyrtus (Ascochyrtus) sp.	8.52 $\pm$ 6.99		
Organic carbon	3.18 $\pm$ 0.61	0.73**	$Y = -18.27 + 8.43x$
Nitrate	2.08 $\pm$ 0.27	0.77**	$Y = -33.00 + 20.00x$
Soil temperature	27.64 $\pm$ 8.11	0.22	$Y = 0.28 + 0.29x$
Moisture	15.74 $\pm$ 4.11	0.63**	$Y = -8.28 + 1.07x$
pH	9.05 $\pm$ 0.05	-0.25	$Y = 268.81 - 36.92x$
Fungi	24.80 $\pm$ 12.13	0.58	$Y = 0.08 + 0.34x$
Y : Megalothorax minimus	10.38 $\pm$ 6.98		
Organic carbon	3.18 $\pm$ 0.61	0.80**	$Y = -18.94 + 9.22x$
Nitrate	2.08 $\pm$ 0.27	0.76**	$Y = -32.22 + 20.38x$
Soil temperature	27.64 $\pm$ 8.11	0.20	$Y = 2.99 + 0.26x$
Moisture	15.74 $\pm$ 4.11	0.84**	$Y = -12.12 + 1.43x$
pH	7.05 $\pm$ 0.05	0.09	$Y = 105.63 - 13.51x$
Fungi	24.80 $\pm$ 12.13	0.64**	$Y = 0.93 + 0.38x$

** Significant at 1% level

* Significant at 5% level

Table 68

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-order population and soil factors/fungi population at undisturbed city park site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)	28.23 $\pm$ 23.24		
Organic carbon	2.31 $\pm$ 0.39	0.61**	$Y = -50.22 + 33.49x$
Nitrate	2.22 $\pm$ 0.56	0.85**	$Y = -40.84 + 32.20x$
Soil temperature	30.46 $\pm$ 5.39	0.19	$Y = 3.75 + 0.80x$
Moisture	16.03 $\pm$ 5.70	0.90**	$Y = -27.50 + 3.79x$
pH	7.13 $\pm$ 0.08	0.34	$Y = 119.01 - 819.97x$
Fungi	23.55 $\pm$ 12.37	0.48*	$Y = -11.50 + 1.69x$
Y : Prostigmata population	19.10 $\pm$ 16.86		
Organic carbon	2.31 $\pm$ 0.39	0.91**	$Y = -96.79$
Nitrate	2.22 $\pm$ 0.56	0.84**	$Y = -47.42 + 35.14x$
Soil temperature	30.46 $\pm$ 5.39	0.18	$Y = 3.09 + 0.85x$
Moisture	16.03 $\pm$ 5.70	0.90**	$Y = -28.68 + 3.72x$
pH	7.13 $\pm$ 0.08	0.36	$Y = -870.80 + 126.48x$
Fungi	23.55 $\pm$ 12.37	0.90**	$Y = -9.13 + 1.69x$
Y : Mesistigmata population	20.45 $\pm$ 18.15		
Organic carbon	2.31 $\pm$ 0.39	0.88**	$Y = 96.06 + 54.75x$
Nitrate	2.22 $\pm$ 0.56	0.84**	$Y = -49.48 + 35.96x$
Soil temperature	30.46 $\pm$ 5.39	0.10	$Y = 17.28 + 0.43x$
Moisture	16.03 $\pm$ 5.70	0.87**	$Y = -28.79 + 3.71x$
pH	7.13 $\pm$ 0.08	0.28	$Y = -682.06 + 99.95x$
Fungi	23.55 $\pm$ 12.37	0.88*	$Y = -10.03 + 1.171x$

** Significant at 1% level

* Significant at 5% level

Table 69

Showing relationship between total collembola population including their three predominant species population and soil factors/fungi population at undisturbed city park site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	16.35 $\pm$ 11.71		
Organic carbon	2.31 $\pm$ 0.39	0.93**	$Y = -60.04 + 33.16x$
Nitrate	2.22 $\pm$ 0.56	0.82**	$Y = -27.90 + 20.00x$
Soil temperature	30.46 $\pm$ 5.39	0.10	$Y = 8.82 + 0.25x$
Moisture	16.03 $\pm$ 5.70	0.92**	$Y = -16.00 + 2.09x$
pH	7.13 $\pm$ 0.08	0.29	$Y = -405.99 + 59.28x$
Fungi	23.55 $\pm$ 12.37	0.87**	$Y = -6.03 + 0.96x$
Y : <i>Isotomina thermophila</i> population	15.24 $\pm$ 14.13		
Organic carbon	2.31 $\pm$ 0.39	0.91**	$Y = -64.02 + 33.36x$
Nitrate	2.22 $\pm$ 0.56	0.82**	$Y = -32.81 + 20.91x$
Soil temperature	30.46 $\pm$ 5.39	0.16	$Y = 0.26 + 0.42x$
Moisture	16.03 $\pm$ 5.70	0.81**	$Y = -19.41 + 2.03x$
pH	7.13 $\pm$ 0.08	0.30	$Y = -441.93 + 63.82x$
Fungi	23.55 $\pm$ 12.37	0.78**	$Y = -7.93 + 0.88x$
Y : <i>Entomobrya</i> sp.	13.63 $\pm$ 11.43		
Organic carbon	2.31 $\pm$ 0.39	0.79**	$Y = -54.21 + 28.97x$
Nitrate	2.22 $\pm$ 0.56	0.74**	$Y = -23.27 + 15.42x$
Soil temperature	30.46 $\pm$ 5.39	0.06	$Y = 6.95 + 0.13x$
Moisture	16.03 $\pm$ 5.70	0.75**	$Y = -13.67 + 1.54x$
pH	7.13 $\pm$ 0.08	0.24	$Y = -288.60 + 42.02x$
Fungi	23.55 $\pm$ 12.37	0.68**	$Y = -4.25 + 0.64x$
Y : <i>Megalothorax minimus</i>	17.68 $\pm$ 15.97		
Organic carbon	2.31 $\pm$ 0.39	0.78**	$Y = -59.26 + 33.05x$
Nitrate	2.22 $\pm$ 0.58	0.70**	$Y = -26. ? + 19.74x$
Soil temperature	30.46 $\pm$ 5.39	0.12	$Y = 5.85 + 0.36x$
Moisture	16.03 $\pm$ 5.70	0.68**	$Y = -14.17 + 1.95x$
pH	7.13 $\pm$ 0.08	0.27	$Y = -441.57 + 64.31x$
Fungi	23.55 $\pm$ 12.37	0.74**	$Y = -5.80 + 0.96x$

** Significant at 1% level

* Significant at 5% level

Table 70

Showing relationship between total arthropod (micro + macro) population in their two dominant sub-orders and soil factors/fungi population at Anthropogenic pressurised city park site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro) population	9.12 $\pm$ 3.99		
Organic carbon	0.83 $\pm$ 0.19	0.64**	$Y = -2.91 + 14.17x$
Nitrate	0.90 $\pm$ 0.12	0.76**	$Y = -13.01 + 24.58x$
Soil temperature	27.44 $\pm$ 8.87	-0.02	$Y = 9.57 - 0.01x$
Moisture	11.10 $\pm$ 3.41	0.81**	$Y = -1.32 + 0.94x$
pH	7.09 $\pm$ 0.08	-0.07	$Y = 32.20 - 3.25x$
Fungi	9.48 $\pm$ 4.88	0.342	$Y = 10.97 + 2.95x$
Y : Prostigmata population	10.76 $\pm$ 4.82		
Organic carbon	0.83 $\pm$ 0.19	0.53*	$Y = -0.21 + 13.30x$
Nitrate	0.90 $\pm$ 0.12	0.58**	$Y = -5.73 + 18.71x$
Soil temperature	27.44 $\pm$ 8.87	-0.22	$Y = 17.23 - 0.21x$
Moisture	11.10 $\pm$ 3.41	0.73**	$Y = 0.16 + 0.94x$
pH	7.09 $\pm$ 0.08	-0.15	$Y = 18.74 - 1.10x$
Fungi	9.48 $\pm$ 4.88	0.81**	$Y = 3.21 + 0.80x$
Y : Mesostigmata population	10.33 $\pm$ 4.80		
Organic carbon	0.83 $\pm$ 0.19	0.64**	$Y = -3.95 + 16.64x$
Nitrate	0.90 $\pm$ 0.12	0.55**	$Y = -9.82 + 21.85x$
Soil temperature	27.44 $\pm$ 8.87	-0.09	$Y = 12.59 - 0.09x$
Moisture	11.10 $\pm$ 3.41	0.75**	$Y = -1.93 + 1.07x$
pH	7.09 $\pm$ 0.08	0.01	$Y = 5.47 + 0.63x$
Fungi	9.48 $\pm$ 4.88	0.82**	$Y = 2.18 + 0.82x$

** Significant at 1% level

* Significant at 5% level

Table 71

Showing relationship between total collembola population including their three dominant species population and soil factors/fungi population at Anthropogenic pressurised city park site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	6.70 $\pm$ 2.98		
Organic carbon	0.83 $\pm$ 0.19	0.66**	$Y = -1.57 + 9.89x$
Nitrate	0.90 $\pm$ 0.12	0.64**	$Y = -7.42 + 15.64x$
Soil temperature	27.54 $\pm$ 8.87	-0.23	$Y = 10.71 - 0.13x$
Moisture	11.10 $\pm$ 3.41	0.91**	$Y = -1.37 + 0.72x$
pH	7.09 $\pm$ 0.08	-0.08	$Y = 25.33 - 2.63x$
Fungi	9.48 $\pm$ 4.88	0.91**	$Y = 1.45 + 0.54x$
Y : <i>Lepidocyrtus</i>			
(<i>Ascochyrtus</i>) sp.	7.67 $\pm$ 2.14		
Organic carbon	0.83 $\pm$ 0.19	0.33	$Y = 1.67 + 5.89x$
Nitrate	0.90 $\pm$ 0.12	0.40	$Y = -3.50 + 11.16x$
Soil temperature	27.44 $\pm$ 8.81	-0.34	$Y = 13.30 - 0.22x$
Moisture	11.10 $\pm$ 3.41	0.45*	$Y = 1.64 + 0.45x$
pH	7.09 $\pm$ 0.08	0.18	$Y = -42.24 + 6.88x$
Fungi	9.48 $\pm$ 4.88	0.55**	$Y = 2.80 + 0.39x$
Y : <i>Isotomina thermophila</i>	8.71 $\pm$ 4.51		
Organic carbon	0.83 $\pm$ 0.19	0.34	$Y = -0.93 + 9.58x$
Nitrate	0.90 $\pm$ 0.12	0.20	$Y = -0.53 + 8.43x$
Soil temperature	27.44 $\pm$ 8.81	0.11	$Y = 3.65 + 0.11x$
Moisture	11.10 $\pm$ 3.41	0.28	$Y = -1.42 + 0.76x$
pH	7.09 $\pm$ 0.08	0.08	$Y = -28.45 + 5.00x$
Fungi	9.48 $\pm$ 4.88	0.56**	$Y = 1.12 + 0.62x$
Y : <i>Isotomiella minor</i>	7.84 $\pm$ 4.39		
Organic carbon	0.83 $\pm$ 0.19	0.57**	$Y = -4.35 + 13.60x$
Nitrate	0.90 $\pm$ 0.12	0.60**	$Y = -15.94 + 25.66x$
Soil temperature	27.44 $\pm$ 8.81	0.14	$Y = 10.93 - 0.12x$
Moisture	11.10 $\pm$ 3.41	0.54**	$Y = -1.24 + 0.75x$
Fungi	9.48 $\pm$ 4.88	0.61**	$Y = 1.40 + 0.60x$
pH	7.09 $\pm$ 0.08	-0.59	$Y = 78.10 - 10.00x$

** Significant at 1% level

* Significant at 5% level

Table 72

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-order population and soil factors/heavy metal content/fungi population at Irrigation canal embankment site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)			
Organic carbon	8.97 $\pm$ 4.27		
Nitrate	2.69 $\pm$ 0.44	0.60**	$Y = -27.99 + 13.23x$
Soil temperature	1.59 $\pm$ 0.30	0.55**	$Y = -2.44 + 7.18x$
Moisture	31.32 $\pm$ 5.59	0.03	$Y = 8.21 + 0.02x$
Cr.	16.30 $\pm$ 6.74	0.74**	$Y = 0.91 + 0.45x$
Cu.	8.93 $\pm$ 1.41	-0.36	$Y = 18.70 - 1.09x$
Pb.	11.81 $\pm$ 1.94	-0.04	$Y = 9.99 - 0.09x$
pH	10.47 $\pm$ 1.72	-0.26	$Y = 15.82 - 0.64x$
Fungi	7.25 $\pm$ 0.11	-0.12	$Y = 42.70 - 4.66x$
Y : Prostigmata population			
Organic carbon	9.38 $\pm$ 4.31	0.63**	$Y = 3.12 + 0.62x$
Nitrate	13.51 $\pm$ 7.88		
Soil temperature	2.69 $\pm$ 0.49	0.51*	$Y = -63.94 + 28.57x$
Moisture	1.59 $\pm$ 0.30	0.52*	$Y = -6.93 + 14.73x$
Cr.	31.32 $\pm$ 5.59	0.17	$Y = 8.34 + 0.26x$
Cu.	16.77 $\pm$ 5.43	0.66**	$Y = 2.03 + 0.82x$
Pb.	8.93 $\pm$ 1.41	-0.19	$Y = 26.81 - 1.14x$
pH	11.81 $\pm$ 1.94	0.01	$Y = 16.14 + 0.04x$
Fungi	10.47 $\pm$ 1.72	-0.12	$Y = 22.91 - 0.60x$
Y : Mesostigmata population			
Organic carbon	7.25 $\pm$ 0.11	-0.09	$Y = 68 - 7.09x$
Nitrate	9.38 $\pm$ 4.31	0.74**	$Y = 3.23 + 1.43x$
Soil temperature	10.55 $\pm$ 5.99		
Moisture	2.69 $\pm$ 0.49	0.50*	$Y = -45.47 + 19.98x$
Cr.	1.59 $\pm$ 0.30	0.50*	$Y = -5.27 + 10.00x$
Cu.	31.32 $\pm$ 5.59	0.30	$Y = 0.40 + 0.33x$
Pb.	16.77 $\pm$ 5.43	0.76**	$Y = -0.87 + 0.67x$
pH	8.93 $\pm$ 1.41	-0.40	$Y = 26.24 - 1.73x$
Fungi	11.81 $\pm$ 1.94	-0.23	$Y = 19.67 - 0.75x$
	10.47 $\pm$ 1.72	-0.17	$Y = 17.11 - 0.61x$
	7.25 $\pm$ 0.11	-0.13	$Y = 58.83 - 6.66x$
	9.38 $\pm$ 4.31	0.36	$Y = 6.20 + 0.49x$

** Significant at 1% level

* Significant at 5% level

Table 73

Showing relationship between total collembola population including three dominant species population and soil factors/heavy metal content/fungi population at Irrigation canal embankment site.

Parameters	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	5.34 $\pm$ 3.28		
Organic carbon	2.69 $\pm$ 0.49	0.55**	$Y = -16.94 + 7.91x$
Nitrate	1.59 $\pm$ 0.30	0.48**	$Y = -0.14 + 3.43x$
Soil temperature	31.32 $\pm$ 5.59	0.37	$Y = 0.82 + 0.14x$
Moisture	16.30 $\pm$ 6.74	0.77**	$Y = 1.02 + 0.24x$
Cr.	8.33 $\pm$ 1.41	-0.44*	$Y = 11.41 - 0.68x$
Cu.	11.81 $\pm$ 1.94	-0.17	$Y = 7.63 - 0.19x$
Pb.	10.47 $\pm$ 1.72	-0.31	$Y = 9.49 - 0.39x$
pH	7.25 $\pm$ 0.11	0.05	$Y = -19.22 + 3.40x$
Fungi	9.38 $\pm$ 4.31	0.47*	$Y = 3.18 + 0.23x$
Y : <i>Isotomina interrupta</i>	4.45 $\pm$ 2.26		
Organic carbon	2.69 $\pm$ 0.49	0.44*	$Y = -12.07 + 5.85x$
Nitrate	1.59 $\pm$ 0.30	0.15	$Y = 2.40 + 1.18x$
Soil temperature	31.32 $\pm$ 5.59	0.67**	$Y = -4.78 + 0.29x$
Moisture	16.30 $\pm$ 6.74	0.09**	$Y = 0.76 + 0.20x$
Cr.	8.93 $\pm$ 1.41	-0.27	$Y = 8.37 - 0.46x$
Cu.	11.81 $\pm$ 1.94	-0.08	$Y = 2.92 - 0.11x$
Pb.	10.47 $\pm$ 1.72	-0.17	$Y = 6.00 - 0.16x$
pH	7.25 $\pm$ 0.11	-0.10	$Y = 20.75 - 2.28x$
Fungi	13.28 $\pm$ 6.71	0.18	$Y = 3.37 + 0.10x$
Y : <i>Lepidocyrtus (Ascocyrtus)</i>			
<i>heterolepis</i>	5.19 $\pm$ 2.18		
Organic carbon	2.69 $\pm$ 0.49	0.17	$Y = -2.11 + 2.58x$

Table 73 (Contd.)

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Nitrate	1.59 $\pm$ 0.3	0.21	$Y = 2.89 + 1.45x$
Soil temperature	31.32 $\pm$ 5.59	0.38	$Y = 0.51 + 0.15x$
Moisture	16.30 $\pm$ 6.74	0.42	$Y = 2.81 + 0.13x$
Cr.	8.93 $\pm$ 1.41	-0.62**	$Y = 13.72 - 0.95x$
Cu.	11.81 $\pm$ 1.94	-0.06	$Y = 6.01 - 0.07x$
Pb.	10.47 $\pm$ 1.72	-0.43*	$Y = 10.72 - 0.51x$
pH	7.25 $\pm$ 0.11	0.28	$Y = -34.43 + 5.47x$
Fungi	13.28 $\pm$ 6.71	0.13	$Y = 4.57 + 0.08x$
Y : <i>Hypogastrura</i> sp.	4.57 $\pm$ 2.11		
Organic carbon	2.69 $\pm$ 0.49	0.40	$Y = -8.71 + 4.78x$
Nitrate	1.59 $\pm$ 0.3	0.22	$Y = 2.04 + 1.65x$
Soil temperature	31.32 $\pm$ 5.59	0.38	$Y = -0.19 + 0.16x$
Moisture	16.30 $\pm$ 6.74	0.56**	$Y = 1.39 + 0.18x$
Cr.	8.93 $\pm$ 1.41	-0.52*	$Y = 12.02 - 0.82x$
Cu.	11.81 $\pm$ 1.91	-0.21	$Y = 7.67 - 0.25x$
Pb.	10.47 $\pm$ 1.72	-0.41	$Y = 10.29 - 0.53x$
pH	7.25 $\pm$ 0.11	0.21	$Y = -24.44 + 4.02x$
Fungi	13.28 $\pm$ 6.71	0.17	$Y = 3.86 + 0.09x$

** Significant at 1% level

* Significant at 5% level

Table 74

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-orders population and soil factors/heavy metal content/fungi population at sewage canal embankment site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)	7.81 $\pm$ 4.31		
Organic carbon	2.82 $\pm$ 0.32	-0.64**	$Y = 33.04 - 9.01x$
Nitrate	1.98 $\pm$ 0.27	-0.60**	$Y = 26.04 - 9.55x$
Soil temperature	29.77 $\pm$ 5.22	0.01	$Y = 7.51 + 0.01x$
Moisture	21.86 $\pm$ 6.00	-0.65**	$Y = 17.89 - 0.46x$
Cr.	178.22 $\pm$ 27.83	-0.76**	$Y = 28.56 - 0.12x$
Cu.	161.80 $\pm$ 15.34	-0.57**	$Y = 33.82 - 0.16x$
Pb.	140.13 $\pm$ 59.69	-0.53*	$Y = 30.22 - 0.16x$
pH	7.12 $\pm$ 0.07	0.02	$Y = 0.73 + 1.00x$
Fungi	28.86 $\pm$ 6.67	-0.39	$Y = 15.05 - 0.25x$
Y : Prostigmata population	4.53 $\pm$ 1.58		
Organic carbon	2.82 $\pm$ 0.32	-0.36	$Y = 10.88 - 2.42x$
Nitrate	1.98 $\pm$ 0.27	-0.25	$Y = 7.62 - 1.85x$
Soil temperature	29.77 $\pm$ 5.22	0.25	$Y = 1.13 + 0.10x$
Moisture	21.86 $\pm$ 6.00	-0.26	$Y = 5.94 - 0.08x$
Cr.	178.22 $\pm$ 27.83	-0.15	$Y = 6.09 - 0.01x$
Cu.	161.80 $\pm$ 15.34	-0.12	$Y = 6.62 - 0.02x$
Pb.	140.13 $\pm$ 59.69	-0.28	$Y = 9.72 - 0.04x$
pH	7.12 $\pm$ 0.07	0.15	$Y = -26.12 + 4.24x$
Fungi	28.86 $\pm$ 6.67	-0.33	$Y = 6.97 - 0.10x$
Y : Mesostigmata population	13.05 $\pm$ 8.95		
Organic carbon	2.82 $\pm$ 0.32	-0.58**	$Y = 61.24 - 17.21x$
Nitrate	1.98 $\pm$ 0.27	-0.61**	$Y = 52.07 - 20.47x$
Soil temperature	29.77 $\pm$ 5.22	-0.06	$Y = 15.89 - 0.10x$
Moisture	21.86 $\pm$ 6.00	-0.67**	$Y = 35.02 - 1.01x$
Cr.	178.22 $\pm$ 27.83	-0.70**	$Y = 54.06 - 0.23x$
Cu.	161.80 $\pm$ 15.34	-0.60**	$Y = 69.76 - 0.35x$
Pb.	140.13 $\pm$ 59.69	-0.34	$Y = 41.34 - 0.20x$
pH	7.12 $\pm$ 0.07	-0.06	$Y = 68.44 - 7.78x$
Fungi	28.86 $\pm$ 6.67	-0.35	$Y = 26.57 - 0.47x$

** Significant at 1% level

* Significant at 5% level

Table 75

Showing relationship between total collembola population including their three dominant species population and soil factors/heavy metal content/fungi at sewage canal embankment site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	5.19 $\pm$ 3.16		
Organic carbon	2.82 $\pm$ 0.32	-0.67**	$Y = 19.00 - 5.20x$
Nitrate	1.98 $\pm$ 0.27	-0.63**	$Y = 12.91 - 4.34x$
Soil temperature	29.77 $\pm$ 5.22	-0.03	$Y = 4.47 - 4.79x$
Moisture	21.86 $\pm$ 6.00	-0.69**	$Y = 10.28 - 0.27x$
Cr.	178.22 $\pm$ 27.83	-0.76**	$Y = 15.93 - 0.06x$
Cu.	161.80 $\pm$ 15.34	-0.60**	$Y = 19.60 - 0.09x$
Pb.	140.13 $\pm$ 59.69	-0.55**	$Y = 17.27 - 0.09x$
pH	7.12 $\pm$ 0.07	0.06	$Y = -8.54 + 1.32x$
Fungi	28.86 $\pm$ 6.67	-0.15	$Y = 5.59 - 0.04x$
Y : <i>Subisotoma fitchioides</i>	4.47 $\pm$ 1.98		
Organic carbon	2.82 $\pm$ 0.32	-0.71**	$Y = 19.06 - 5.36x$
Nitrate	1.98 $\pm$ 0.27	-0.65**	$Y = 14.77 - 5.60x$
Soil temperature	29.77 $\pm$ 5.22	0.10	$Y = 2.76 + 0.04x$
Moisture	21.86 $\pm$ 6.00	-0.56**	$Y = 8.86 - 0.22x$
Cr.	178.22 $\pm$ 27.83	-0.67**	$Y = 13.89 - 0.06x$
Cu.	161.80 $\pm$ 15.34	-0.61**	$Y = 17.96 - 0.09x$
Pb.	140.13 $\pm$ 59.69	-0.49*	$Y = 15.12 - 0.08x$
pH	7.12 $\pm$ 0.07	-0.02	$Y = 9.29 - 0.72x$
Fungi	28.86 $\pm$ 6.67	-0.52*	$Y = 0.09 - 0.18x$
Y : <i>Isotomina theromophila</i>	4.47 $\pm$ 2.33		
Organic carbon	2.82 $\pm$ 0.32	-0.19	$Y = 7.89 - 1.29x$
Nitrate	1.98 $\pm$ 0.27	-0.26	$Y = 8.45 - 2.21x$

Table 75 (Contd.)

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a+bx$
Soil temperature	29.77 $\pm$ 5.22	0.02	$Y = 3.93 + 0.01x$
Moisture	21.86 $\pm$ 6.00	-0.34	$Y = 7.08 - 0.13x$
Cr.	178.22 $\pm$ 27.83	-0.50*	$Y = 11.67 - 0.04x$
Cu.	161.80 $\pm$ 15.34	-0.43*	$Y = 14.97 - 0.07x$
Pb.	140.13 $\pm$ 59.69	-0.37	$Y = 12.76 - 0.06x$
pH	7.12 $\pm$ 0.07	0.61**	$Y = -54.13 + 8.27x$
Fungi	28.86 $\pm$ 6.67	-0.03	$Y = 4.58 - 0.01x$
Y : <i>Folsomides purvulus</i>	4.26 $\pm$ 2.69		
Organic carbon	2.82 $\pm$ 0.32	-0.37	$Y = 13 - 3.29x$
Nitrate	1.98 $\pm$ 0.27	-0.47*	$Y = 13.26 - 4.93x$
Soil temperature	29.77 $\pm$ 5.22	-0.09	$Y = 5.36 - 0.05x$
Moisture	21.86 $\pm$ 6.00	-0.58**	$Y = 9.93 - 0.28x$
Cr.	178.22 $\pm$ 27.83	-0.54**	$Y = 13.69 - 0.05x$
Cu.	161.80 $\pm$ 15.34	-0.33	$Y = 13.92 - 0.06x$
Pb.	140.13 $\pm$ 59.69	-0.29	$Y = 11.98 - 0.06x$
pH	7.12 $\pm$ 0.07	0.07	$Y = -11.80 + 2.24x$
Fungi	28.86 $\pm$ 6.67	-0.19	$Y = 6.17 - 0.08x$

** Significant at 1% level

* Significant at 5% level

Table 76

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-order population and soil factor/heavy metal content/fungi population at Garbage dumping site.

Parameters	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)			
Organic carbon	31.88 $\pm$ 18.86	0.90**	$Y = -48.35 + 28.24x$
Nitrate	2.88 $\pm$ 0.60	0.83**	$Y = -79.07 + 46.20x$
Soil temperature	2.41 $\pm$ 0.34	-0.05	$Y = 38.04 - 0.20x$
Moisture	30.62 $\pm$ 4.94	0.79**	$Y = -24.27 + 3.28x$
Cr.	17.08 $\pm$ 4.52	-0.82**	$Y = 175.25 - 2.24x$
Cu.	64.02 $\pm$ 6.87	-0.50**	$Y = 98.52 - 0.63x$
Pb.	105.20 $\pm$ 15.15	-0.41	$Y = 128.60 - 1.65x$
pH	58.72 $\pm$ 4.88	-0.23	$Y = 196.89 - 22.89x$
Fungi	7.22 $\pm$ 0.13	0.95**	$Y = -16.71 + 1.98x$
Y : Prostigmata population			
Organic carbon	21.10 $\pm$ 19.63	0.86**	$Y = -75.78 + 43.90x$
Nitrate	2.84 $\pm$ 0.60	0.57**	$Y = -58.59 + 43.89x$
Soil temperature	2.41 $\pm$ 0.34	-0.14	$Y = 76.18 - 0.89x$
Moisture	30.62 $\pm$ 4.94	0.74**	$Y = -36.78 + 5.01x$
Cr.	17.08 $\pm$ 4.52	-0.77**	$Y = 268.10 - 3.42x$
Cu.	64.02 $\pm$ 6.87	-0.49*	$Y = 151.64 - 0.97x$
Pb.	105.20 $\pm$ 15.15	-0.39	$Y = 188.07 - 2.39x$
pH	58.72 $\pm$ 4.88	-0.10	$Y = 214.10 - 22.90x$
Fungi	7.22 $\pm$ 0.13	0.93**	$Y = -27.73 + 3.13x$
Y : Mesostigmata population			
Organic carbon	21.83 $\pm$ 15.21	0.63**	$Y = -45.73 + 25.52x$
Nitrate	2.84 $\pm$ 0.60	0.38	$Y = -41.78 + 28.01x$
Soil temperature	2.41 $\pm$ 0.34	-0.05	$Y = 33.82 - 0.23x$
Moisture	30.62 $\pm$ 4.94	0.42	$Y = -11.54 + 2.24x$
Cr.	17.08 $\pm$ 4.52	-0.67**	$Y = 179.53 - 2.39x$
Cu.	64.02 $\pm$ 6.87	-0.09	$Y = 41.04 - 0.13x$
Pb.	105.20 $\pm$ 15.15	-0.07	$Y = 7.63 - 0.33x$
pH	58.72 $\pm$ 4.88	-0.02	$Y = 55.70 - 4.01x$
Fungi	7.22 $\pm$ 0.13	0.75**	$Y = -20.71 + 1.97x$

** Significant at 1% level

* Significant at 5% level

Table 77

Showing relationship between total collembola population including their three dominant species population and soil factors/heady metal content/fungi population at Garbage dumping dune site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	16.21 $\pm$ 13.31		
Organic carbon	2.84 $\pm$ 0.60	0.90**	$Y = -48.15 + 25.72x$
§ Nitrate	2.41 $\pm$ 0.34	0.86**	$Y = -79.75 + 43.53x$
Soil temperature	30.62 $\pm$ 4.94	0.03	$Y = 25.13 - 0.01x$
Moisture	17.08 $\pm$ 4.52	0.94**	$Y = -27.52 + 3.06x$
Cr.	64.02 $\pm$ 6.87	-0.70**	$Y = 135.91 - 1.74x$
Cu.	105.20 $\pm$ 15.15	-0.54**	$Y = 88.79 - 0.60x$
Pb.	58.72 $\pm$ 4.88	-0.16	$Y = 130.47 - 1.80x$
pH	7.22 $\pm$ 0.13	-0.19	$Y = 200.91 - 24.40x$
Fungi	24.48 $\pm$ 9.06	0.88**	$Y = -15.97 + 1.67x$
Y : <i>Isotomiella minor</i>	35.26 $\pm$ 29.28		
Organic carbon	2.84 $\pm$ 0.6	0.66**	$Y = -61.35 + 32.83x$
Nitrate	2.41 $\pm$ 0.034	0.88**	$Y = -86.25 + 47.24x$
Soil temperature	30.62 $\pm$ 4.94	0.20	$Y = -5.08 + 1.21x$
Moisture	17.08 $\pm$ 4.52	0.72**	$Y = -49.69 + 4.77x$
Cr.	64.02 $\pm$ 6.87	-0.56**	$Y = 188.95 - 2.46x$
Cu.	105.2 $\pm$ 15.15	-0.52**	$Y = 144.00 - 1.06x$
Pb.	58.72 $\pm$ 4.88	-0.45*	$Y = 194.81 - 2.77x$
pH	7.22 $\pm$ 0.13	0.34	$Y = 596.01 - 78.15x$
Fungi	24.48 $\pm$ 9.06	0.66**	$Y = -20.90 + 2.16x$
Y : <i>Lepidocyrtus (L) medius</i>	22.47 $\pm$ 14.95		
Organic carbon	2.48 $\pm$ 0.6	0.10	$Y = -21.93 + 0.48x$
Nitrate	2.41 $\pm$ 0.34	0.63**	$Y = -49.99 + 29.28x$

Table 77 (Contd.)

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Soil temperature	30.62 $\pm$ 4.94	-0.03	$Y = 23.42 - 0.10x$
Moisture	17.08 $\pm$ 4.52	0.53*	$Y = -11.22 + 1.84x$
Cr.	64.02 $\pm$ 6.87	-0.49*	$Y = 91.83 - 1.12x$
Cu.	105.2 $\pm$ 15.15	-0.23	$Y = 44.48 - 0.23x$
Pb.	58.72 $\pm$ 4.88	-0.23	$Y = 64.24 - 0.75x$
pH	7.22 $\pm$ 0.13	0.06	$Y = -31.13 + 7.13x$
Fungi	24.48 $\pm$ 9.06	0.71**	$Y = -8.31 + 1.19x$
Y : <i>Megalothorax minimus</i>	31.44 $\pm$ 28.15		
Organic carbon	2.48 $\pm$ 0.6	0.61**	$Y = -50.69 + 27.80x$
Nitrate	2.41 $\pm$ 0.34	0.67**	$Y = -108.36 + 56.35x$
Soil temperature	30.62 $\pm$ 4.94	-0.16	$Y = 55.23 - 0.92x$
Moisture	17.08 $\pm$ 4.52	0.57**	$Y = -32.30 + 3.49x$
Cr.	64.02 $\pm$ 6.87	-0.52*	$Y = 165.32 - 2.16x$
Cu.	105.2 $\pm$ 15.15	-0.40	$Y = 105.44 - 0.74x$
Pb.	58.72 $\pm$ 4.88	-0.43*	$Y = 173.95 - 2.50x$
pH	7.22 $\pm$ 0.13	-0.13	$Y = 224.41 - 27.42x$
Fungi	24.48 $\pm$ 9.06	0.71**	$Y = -27.66 + 2.24x$

** Significant at 1% level

* Significant at 5% level

§ Regression line not drawn

Table 78

Showing relationship total arthropod (micro $\pm$ macro) population including their two dominant sub-order population and soil factors/heavy metal content/fungi population at soil dune site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod			
(micro + macro)	10.47 $\pm$ 5.87		
Organic carbon	1.79 $\pm$ 0.09	0.73**	$Y = -75.65 + 48.06x$
Nitrate	1.25 $\pm$ 0.12	0.57**	$Y = -24.44 + 27.92x$
Soil temperature	32.35 $\pm$ 5.28	-0.02	$Y = 11.18 - 0.02x$
Moisture	10.53 $\pm$ 3.19	0.84**	$Y = -5.74 + 1.52x$
Cr.	13.23 $\pm$ 1.27	-0.40	$Y = 36.34 - 1.96x$
Cu.	15.45 $\pm$ 3.23	-0.25	$Y = 17.57 - 0.46x$
Pb.	23.22 $\pm$ 2.33	-0.60**	$Y = 45.36 - 1.50x$
pH	7.14 $\pm$ 0.08	-0.05*	$Y = 35.95 - 3.57x$
Fungi	7.76 $\pm$ 6.23	0.60**	$Y = 6.11 + 0.56x$
Y : Mesostigmata population			
Organic carbon	1.79 $\pm$ 0.09	0.67**	$Y = -87.69 + 55.92x$
Nitrate	1.25 $\pm$ 0.12	0.58**	$Y = -31.94 + 35.73x$
Soil temperature	32.35 $\pm$ 5.28	0.03	$Y = 11.02 + 0.05x$
Moisture	10.53 $\pm$ 3.19	0.82**	$Y = -7.54 + 1.87x$
Cr.	13.23 $\pm$ 1.27	-0.23	$Y = 30.10 - 1.33x$
Cu.	15.45 $\pm$ 3.23	-0.22	$Y = 20.27 - 0.50x$
§ Pb.	23.22 $\pm$ 2.33	-0.46*	$Y = 46.67 - 1.47x$
pH	7.14 $\pm$ 0.08	-0.04	$Y = 41.60 - 4.08x$
Fungi	7.76 $\pm$ 6.23	0.46*	$Y = 3.26 + 0.54x$
Y : Prostigmata population			
Organic carbon	1.79 $\pm$ 0.09	0.74**	$Y = -89.11 + 58.21x$
Nitrate	1.25 $\pm$ 0.12	0.61**	$Y = -31.14 + 37.15x$
Soil temperature	32.35 $\pm$ 5.28	-0.23	$Y = 25.49 - 0.32x$
Moisture	10.53 $\pm$ 3.19	0.78**	$Y = -2.75 + 1.70x$
Cr.	13.23 $\pm$ 1.27	-0.66**	$Y = 63.64 - 3.66x$
Cu.	15.45 $\pm$ 3.23	-0.27	$Y = 24.20 - 0.58x$
Pb.	23.22 $\pm$ 2.33	-0.42	$Y = 44.80 - 1.27x$
pH	7.14 $\pm$ 0.08	-0.14	$Y = 105.56 - 12.66x$
Fungi	7.76 $\pm$ 6.23	0.39	$Y = 11.73 + 0.45x$

** Significant at 1% level

* Significant at 5% level

§ Regression line not drawn

Table 79

Showing relationship between total collembola population including their three dominant species population and soil factors/heavy metal content/fungi population at soil dune site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	13.55 $\pm$ 10.66		
Organic carbon	1.79 $\pm$ 0.09	0.11	$Y = -68.42 + 42.69x$
Nitrate	1.25 $\pm$ 0.12	0.59**	$Y = -23.47 + 25.29x$
Soil temperature	32.35 $\pm$ 5.28	0.01	$Y = 7.61 + 0.01x$
Moisture	10.35 $\pm$ 3.19	0.90**	$Y = -6.54 + 1.37x$
Cr.	13.23 $\pm$ 1.27	-0.38	$Y = 27.93 - 1.50x$
Cu.	15.45 $\pm$ 3.23	-0.29	$Y = 14.87 - 0.44x$
Pb.	23.22 $\pm$ 2.33	-0.44*	$Y = 30.98 - 0.98x$
pH	7.14 $\pm$ 0.08	-0.07	$Y = 37.25 - 4.09x$
Fungi	7.76 $\pm$ 6.23	0.30	$Y = 6.25 + 0.24x$
Y : <i>Subisotoma fitchioides</i>	9.50 $\pm$ 6.60		
Organic carbon	1.79 $\pm$ 0.09	0.46*	$Y = -61.19 + 38.16x$
Nitrate	1.25 $\pm$ 0.12	0.42	$Y = -23.95 + 25.27x$
Soil temperature	32.35 $\pm$ 5.28	-0.03	$Y = 8.65 - 0.03x$
Moisture	10.53 $\pm$ 3.19	0.63**	$Y = -6.59 + 1.31x$
Cr.	13.23 $\pm$ 1.27	-0.22	$Y = 23.36 - 1.19x$
Cu.	15.45 $\pm$ 3.23	-0.15	$Y = 12.61 - 0.33x$
Pb.	23.22 $\pm$ 2.33	-0.27	$Y = 26.62 - 0.82x$
pH	7.14 $\pm$ 0.08	0.08	$Y = -45.80 + 7.47x$
Fungi	7.95 $\pm$ 6.24	0.12	$Y = 6.51 + 0.14x$
Y : <i>Isotomina thermophila</i>	9.26 $\pm$ 5.95		
Organic carbon	1.79 $\pm$ 0.09	0.51*	$Y = -53.79 + 34.82x$
Nitrate	1.25 $\pm$ 0.12	0.36	$Y = -14.94 + 18.89x$

Table 79 (Contd.)

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Soil temperature	32.35 $\pm$ 5.28	0.03	$Y = 6.77 + 0.05x$
§ Moisture	10.53 $\pm$ 3.19	0.56**	$Y = -2.76 + 1.66x$
Cr.	13.23 $\pm$ 1.27	-0.04	$Y = 11.19 - 0.20x$
Cu.	15.45 $\pm$ 3.23	-0.14	$Y = 12.76 - 0.28x$
Pb.	23.22 $\pm$ 2.33	-0.36	$Y = 30.28 - 0.94x$
pH	7.14 $\pm$ 0.08	0.09	$Y = -41.31 + 6.98x$
Fungi	7.95 $\pm$ 6.01	0.29	$Y = 6.15 + 0.28x$
Y : <i>Isotomurus ciliatus</i>	7.38 $\pm$ 6.01		
Organic carbon	1.79 $\pm$ 0.09	0.63**	$Y = -68.46 + 42.32x$
Nitrate	1.25 $\pm$ 0.12	0.50*	$Y = -24.91 + 25.89x$
Soil temperature	32.35 $\pm$ 5.28	-0.03	$Y = 8.41 - 0.03x$
Moisture	10.53 $\pm$ 3.19	0.67**	$Y = -6.08 + 1.25x$
Cr.	13.23 $\pm$ 1.27	-0.23	$Y = 21.90 - 1.10x$
Cu.	15.45 $\pm$ 3.23	-0.07	$Y = 9.32 - 0.13x$
Pb.	23.22 $\pm$ 2.33	-0.41	$Y = 32.56 - 1.09x$
pH	7.14 $\pm$ 0.08	0.02	$Y = -2.83 + 1.43x$
Fungi	7.95 $\pm$ 6.24	0.28	$Y = 5.29 + 0.27x$

** Significant at 1% level

* Significant at 5% level

§ Regression line not drawn

Table 80

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-order population and soil factors/heavy metal content/fungi population at Durgapur control Pasture site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)			
Organic carbon	13.90 $\pm$ 5.58	0.80**	$Y = -12.87 + 11.66x$
Nitrate	2.25 $\pm$ 0.40	0.82**	$Y = -5.79 + 11.46x$
Soil temperature	1.69 $\pm$ 0.42	-0.17	$Y = 18.22 - 0.13x$
Moisture	32.09 $\pm$ 6.91	0.80**	$Y = 0.19 + 0.82x$
Cr.	16.77 $\pm$ 5.43	-0.78**	$Y = 51.81 - 4.00x$
Cu	9.49 $\pm$ 1.09	-0.45**	$Y = 34.46 - 2.55x$
Pb.	8.04 $\pm$ 1.00	-0.74**	$Y = 32.49 - 1.37x$
pH	13.57 $\pm$ 3.01	-0.25	$Y = 168.85 - 21.87x$
Fungi	7.09 $\pm$ 0.06	0.32	$Y = 5.20 + 0.41x$
Y : Prostigmata population			
Organic carbon	22.76 $\pm$ 10.86	0.68**	$Y = -17.61 + 16.60x$
Nitrate	2.25 $\pm$ 0.40	0.78**	$Y = -11.20 + 18.47x$
Soil temperature	1.69 $\pm$ 0.42	-0.15	$Y = 27.11 - 0.21x$
Moisture	32.09 $\pm$ 6.91	0.75**	$Y = -2.21 + 1.34x$
Cr.	16.77 $\pm$ 5.43	-0.74**	$Y = 81.62 - 6.44x$
Cu.	9.49 $\pm$ 1.09	-0.65**	$Y = 71.62 - 6.25x$
Pb	8.04 $\pm$ 1.00	-0.65**	$Y = 48.41 - 2.06x$
pH	13.57 $\pm$ 3.01	-0.04	$Y = 62.59 - 5.94x$
Fungi	7.09 $\pm$ 0.06	0.86	$Y = 3.72 + 0.74x$
Y : Mesostigmata population			
Organic carbon	11.21 $\pm$ 6.39	0.74**	$Y = -12.81 + 12.19x$
Nitrate	2.25 $\pm$ 0.40	0.73**	$Y = -4.61 + 11.49x$
Soil temperature	1.69 $\pm$ 0.42	-0.15	$Y = 19.72 - 0.14x$
Moisture	32.09 $\pm$ 6.91	0.71**	$Y = 1.56 + 0.82x$
Cr.	16.77 $\pm$ 5.43	-0.69**	$Y = 53.02 - 3.98x$
Cu.	9.49 $\pm$ 1.09	-0.52**	$Y = 42.50 - 3.36x$
Pb.	8.04 $\pm$ 1.00	-0.64**	$Y = 33.44 - 1.35x$
pH	13.57 $\pm$ 3.01	-0.25	$Y = 194.88 - 25.36x$
Fungi	7.09 $\pm$ 0.06	0.77**	$Y = 5.07 + 0.45x$

** Significant at 1% level

* Significant at 5% level

Table 81

Showing relationship between total collembola population including their three dominant species population and soil factors/heavy metal content/fungi population at Durgapur control Pasture site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	8.63 $\pm$ 4.66		
Organic carbon	2.25 $\pm$ 0.40	0.56**	$Y = -5.75 + 6.32x$
Nitrate	1.69 $\pm$ 0.4	0.66**	$Y = -4.68 + 7.72x$
Soil temperature	32.09 $\pm$ 6.91	-0.44*	$Y = 18.05 - 0.29x$
Moisture	16.77 $\pm$ 5.43	0.58**	$Y = 0.27 + 0.50x$
Cr.	9.49 $\pm$ 1.09	-0.81**	$Y = 41.86 - 3.50x$
Cu.	8.04 $\pm$ 1	-0.35**	$Y = 21.97 - 1.65x$
Pb.	13.57 $\pm$ 3.01	-0.74**	$Y = 24.34 - 1.16x$
pH	7.09 $\pm$ 0.06	-0.25	$Y = 142.32 - 18.94x$
Fungi	22.76 $\pm$ 10.86	0.83**	$Y = 0.54 + 0.36x$
Y : <i>Isotomina telimophila</i>	9.42 $\pm$ 4.99		
Organic carbon	2.25 $\pm$ 0.40	0.30	$Y = -1.35 + 4.30x$
Nitrate	1.69 $\pm$ 0.42	0.39	$Y = -0.83 + 5.42x$
Soil temperature	32.09 $\pm$ 6.91	-0.21	$Y = 13.92 - 0.17x$
Moisture	16.77 $\pm$ 5.43	0.31	$Y = 3.02 + 0.32x$
Cr.	9.49 $\pm$ 1.09	-0.44*	$Y = 30.11 - 2.29x$
Cu.	8.04 $\pm$ 1.00	-0.23*	$Y = 19.15 - 1.34x$
Pb.	13.57 $\pm$ 3.01	-0.54**	$Y = 21.91 - 0.99x$
pH	7.09 $\pm$ 0.06	-0.47*	$Y = 301.13 - 41.30x$
Fungi	22.76 $\pm$ 10.86	0.47*	$Y = 3.10 + 0.24x$
Y : <i>Isotomina interrupta</i>	9.55 $\pm$ 6.64		
Organic carbon	2.25 $\pm$ 0.40	0.46*	$Y = -6.82 + 6.93x$
Nitrate	1.60 $\pm$ 0.42	0.55**	$Y = -4.84 + 8.07x$

Table 81 (Contd.)

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Soil temperature	32.09 $\pm$ 6.91	-0.39	$Y = 19.51 - 0.33x$
Moisture	16.77 $\pm$ 5.43	0.58**	$Y = -1.42 + 0.62x$
Cr.	9.49 $\pm$ 1.09	-0.59**	$Y = 39.10 - 3.16x$
Cu.	8.04 $\pm$ 1.00	-0.15	$Y = 16.32 - 0.89x$
Pb.	13.57 $\pm$ 3.01	-0.58**	$Y = 24.51 - 1.14x$
pH	7.09 $\pm$ 0.06	-0.08	$Y = 60.18 - 7.21x$
Fungi	22.76 $\pm$ 10.86	0.74**	$Y = 4.44 + 0.40x$
<i>Y : Lepidocyrtus (Acro) scaber</i>			
	12.21 $\pm$ 8.08		
Organic carbon	2.25 $\pm$ 0.40	0.59**	$Y = -18.45 + 12.84x$
Nitrate	1.69 $\pm$ 0.42	0.55**	$Y = -8.32 + 11.22x$
Soil temperature	32.09 $\pm$ 6.91	-0.35	$Y = 24.74 - 0.43x$
Moisture	16.77 $\pm$ 5.43	0.47*	$Y = -1.41 + 0.74x$
Cr.	9.49 $\pm$ 1.09	-0.64**	$Y = 58.12 - 4.96x$
Cu.	8.04 $\pm$ 1.00	-0.60**	$Y = 54.16 - 5.42x$
Pb.	13.57 $\pm$ 3.01	-0.55*	$Y = 32.16 - 1.55x$
pH	7.09 $\pm$ 0.06	0.10	$Y = -86.98 + 13.84x$
Fungi	22.76 $\pm$ 10.86	0.62**	$Y = -0.08 + 0.49x$

** Significant at 1% level

* Significant at 5% level

Table 82

Showing relationship between total arthropod (micro + macro) population including their one dominant sub-order population and soil factors/heavy metal content/fungi population at Durgapur industrial effluent site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)	4.13 $\pm$ 1.55		
Organic carbon	2.02 $\pm$ 0.18	0.56**	$Y = -5.39 + 4.77x$
Nitrate	0.75 $\pm$ 0.08	0.67**	$Y = -5.61 + 13.01x$
Soil temperature	26.03 $\pm$ 8.40	0.19	$Y = 2.58 + 0.05x$
Moisture	17.25 $\pm$ 5.39	-0.43*	$Y = 6.22 - 0.12x$
Cr.	168.11 $\pm$ 87.41	-0.67**	$Y = 6.37 - 0.01x$
Cu.	236.63 $\pm$ 49.54	-0.61**	$Y = 8.67 - 0.02x$
Pb.	196.19 $\pm$ 41.35	-0.59	$Y = 7.93 - 0.02x$
pH	6.78 $\pm$ 0.10	0.43*	$Y = -40.81 + 6.62x$
Fungi	9.33 $\pm$ 5.14	-0.12	$Y = 4.49 - 0.04x$
Y : Mesostigmata population	7.19 $\pm$ 3.19		
Organic carbon	2.02 $\pm$ 0.18	0.46*	$Y = -8.78 + 7.99x$
Nitrate	0.75 $\pm$ 0.08	0.52*	$Y = -8.23 + 20.60x$
Soil temperature	26.03 $\pm$ 8.40	0.34	$Y = 3.38 + 0.13x$
Moisture	17.25 $\pm$ 5.39	-0.34	$Y = 10.56 - 0.19x$
§ Cr.	168.11 $\pm$ 87.11	-0.63**	$Y = 11.20 - 0.02x$
Cu.	236.63 $\pm$ 49.59	-0.42	$Y = 13.72 - 0.03x$
Pb.	196.19 $\pm$ 41.35	-0.43*	$Y = 13.68 - 0.03x$
pH	6.78 $\pm$ 0.10	0.24	$Y = -42.26 + 7.30x$
Fungi	9.33 $\pm$ 5.14	-0.06	$Y = 7.51 - 0.03x$

** Significant at 1% level

* Significant at 5% level

§ Regression line not drawn

Table 83

Showing relationship between total collembola population including their three dominant species population and soil factors/heavy metal content/fungi population at Durgapur industrial effluent site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola Population	3.67 $\pm$ 2.38		
Organic carbon	2.02 $\pm$ 0.18	0.35	$Y = -0.22 + 1.25x$
Nitrate	0.75 $\pm$ 0.08	0.47*	$Y = -1.52 + 5.06x$
Soil temperature	26.03 $\pm$ 8.4	-0.12	$Y = 2.82 - 0.02x$
Moisture	17.25 $\pm$ 5.39	-0.20	$Y = 2.83 - 0.03x$
Cr.	168.11 $\pm$ 87.41	-0.56**	$Y = 3.26 - 0.01x$
Cu.	236.63 $\pm$ 49.59	-0.26	$Y = 3.34 - 7.48x$
Pb.	196.19 $\pm$ 41.35	-0.52*	$Y = 4.40 - 0.01x$
pH	6.78 $\pm$ 0.10	0.04	$Y = -0.23 + 0.37x$
Fungi	9.33 $\pm$ 5.14	0.22	$Y = 1.91 + 0.04x$
Y : Cyphoderus assimilis	2.47 $\pm$ 1.36		
Organic carbon	2.02 $\pm$ 0.18	0.13	$Y = -0.53 + 1.15x$
Nitrate	0.75 $\pm$ 0.08	0.24	$Y = -1.87 + 4.83x$
Soil temperature	26.03 $\pm$ 8.4	0.15	$Y = 0.51 + 0.04x$
Moisture	17.02 $\pm$ 5.39	-0.38	$Y = 3.74 - 0.11x$
Cr.	168.11 $\pm$ 87.41	-0.69**	$Y = 4.00 - 0.01x$
Cu.	236.63 $\pm$ 49.59	-0.41	$Y = 4.94 - 0.01x$
Pb.	196.19 $\pm$ 41.35	-0.55**	$Y = 6.00 - 0.02x$
pH	6.78 $\pm$ 0.10	0.30	$Y = -31.06 + 4.84x$
Fungi	9.33 $\pm$ 5.14	-0.11	$Y = 2.09 - 0.03x$
Y : Entomobrya sp.	2.88 $\pm$ 1.27		
Organic carbon	2.02 $\pm$ 0.18	0.17	$Y = -0.72 + 1.53x$
Nitrate	0.75 $\pm$ 0.08	0.43*	$Y = -4.14 + 8.63x$
Soil temperature	26.03 $\pm$ 8.4	-0.04	$Y = 2.70 - 0.01x$

Table 83 (Contd.)

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Moisture	17.02 $\pm$ 5.39	-0.27	$Y = 3.76 - 0.08x$
Cr.	168.11 $\pm$ 87.41	-0.42	$Y = 3.72 - 0.01x$
Cu.	236.63 $\pm$ 49.59	-0.25	$Y = 4.22 - 0.01x$
Pb.	196.19 $\pm$ 41.35	-0.39	$Y = 5.35 - 0.02x$
pH	6.78 $\pm$ 0.10	0.03	$Y = 2.22 + 0.02x$
Fungi	9.33 $\pm$ 5.14	0.13	$Y = 1.95 + 0.04x$
Y : <i>Isotomina thermophila</i>	2.89 $\pm$ 2.27		
Organic carbon	2.02 $\pm$ 0.18	0.15	$Y = -1.17 + 1.76x$
Nitrate	0.75 $\pm$ 0.08	0.05	$Y = 3.40 - 1.35x$
Soil temperature	26.03 $\pm$ 8.4	0.02	$Y = 2.11 + 0.01x$
Moisture	17.25 $\pm$ 5.39	0.20	$Y = 0.92 + 0.09x$
Cr.	168.11 $\pm$ 87.41	-0.3	
Cu.	236.63 $\pm$ 49.59	-0.23	$Y = 0.25 - 0.01x$
Pb.	196.19 $\pm$ 41.35	-0.03	
pH	6.78 $\pm$ 0.10	-0.26	$Y = 43.69 - 6.10x$
Fungi	9.33 $\pm$ 5.14	0.07	$Y = 2.06 + 0.03x$

** Significant at 1% level

* Significant at 5% level

Table 84

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-order population and soil factor/fungi population at unmetalled road way site

Parametres	Mean $\pm$ S.D.	r' value	regression equation $Y = a + bx$
Y : Total arthropod (micro + macro)			
	7.47 $\pm$ 4.03		
Organic carbon	1.24 $\pm$ 0.12	0.90**	$Y = -30.50 + 30.61x$
Nitrate	0.60 $\pm$ 0.09	0.90**	$Y = -15.17 + 37.19x$
Soil temperature	31.87 $\pm$ 5.68	0.15	$Y = 3.96 + 0.11x$
Moisture	10.75 $\pm$ 3.74	0.87**	$Y = 0.15 + 0.74x$
pH	7.31 $\pm$ 0.10	-0.30	$Y = 93.09 - 11.71x$
Fungi	7.67 $\pm$ 4.00	0.79**	$Y = 1.46 + 0.78x$
Y : Prostigmata population			
	18.04 $\pm$ 17.19		
Organic carbon	1.24 $\pm$ 0.12	0.91**	$Y = -72.17 + 70.08x$
Nitrate	0.60 $\pm$ 0.09	0.91**	$Y = -41.06 + 91.37x$
Soil temperature	31.87 $\pm$ 5.68	0.22	$Y = 3.36 + 0.36x$
Moisture	10.75 $\pm$ 3.74	0.86**	$Y = -7.89 + 2.11x$
pH	7.31 $\pm$.10	-0.28	$Y = 195.10 - 24.68x$
Fungi	7.76 $\pm$ 4.08	0.79**	$Y = 1.41 + 1.75x$
Y : Mesostigmata population			
	18.39 $\pm$ 17.81		
Organic carbon	1.24 $\pm$ 0.12	0.88**	$Y = -32.29 + 32.45x$
Nitrate	0.60 $\pm$ 0.09	0.62**	$Y = -14.80 + 37.50x$
Soil temperature	31.87 $\pm$ 5.68	0.30	$Y = -1.83 + 0.30x$
Moisture	10.75 $\pm$ 3.74	0.53*	$Y = -1.00 + 0.84x$
pH	7.31 $\pm$ 0.10	0.06	$Y = -13.53 + 2.91x$
Fungi	7.76 $\pm$ 4.08	0.41	$Y = 3.51 + 0.59x$

** Significant at 1% level

* Significant at 5% level

Table 85

Showing relation between total collembola population including their three dominant species population and soil factors/fungi population at unmetalled road way site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Collembola population	5.33 $\pm$ 3.46		
Organic carbon	1.24 $\pm$ 0.12	0.85**	$Y = -26.98 + 26.87x$
Nitrate	0.60 $\pm$ 0.09	0.85**	$Y = -13.95 + 33.49x$
Soil temperature	31.87 $\pm$ 5.68	0.02	$Y = 6.03 + 0.01x$
Moisture	10.75 $\pm$ 3.74	0.91**	$Y = -3.43 + 0.92x$
pH	7.31 $\pm$ 0.10	-0.36	$Y = 101.76 - 13.05x$
Fungi	7.67 $\pm$ 4.08	0.75**	$Y = 1.14 + 0.68x$
Y : <i>Cyphoderus assimilis</i>	8.60 $\pm$ 5.03		
Organic carbon	1.24 $\pm$ 0.12	0.62**	$Y = -30.16 + 29.49x$
Nitrate	0.68 $\pm$ 0.09	0.62**	$Y = -16.44 + 37.97x$
Soil temperature	31.87 $\pm$ 5.68 c	0.11	$Y = 2.92 + 0.11x$
Moisture	10.75 $\pm$ 3.74	0.68**	$Y = -4.50 + 1.02x$
pH	7.31 $\pm$ 0.10	-0.38	$Y = 156.47 - 20.53x$
Fungi	7.76 $\pm$ 4.08	0.51*	$Y = 1.54 + 0.60x$
Y : <i>Isotomina thermophila</i>	7.70 $\pm$ 5.11		
Organic carbon	1.24 $\pm$ 0.12	0.57**	$Y = -24.46 + 25.66x$
Nitrate	0.68 $\pm$ 0.09	0.47*	$Y = -8.41 + 25.96x$
Soil temperature	31.87 $\pm$ 5.68	0.08	$Y = 4.98 + 0.07x$
Moisture	10.75 $\pm$ 3.74	0.67**	$Y = -2.80 + 0.94x$
pH	7.31 $\pm$ 0.10	-0.13	$Y = 55.25 - 6.56x$
Fungi	7.76 $\pm$ 4.08	0.24	$Y = 5.03 + 0.30x$
Y : <i>Proisotoma</i> sp.	7.82 $\pm$ 3.91		
Organic carbon	1.24 $\pm$ 0.12	0.63**	$Y = -26.96 + 27.22x$
Nitrate	0.68 $\pm$ 0.09	0.71**	$Y = -16.40 + 38.28x$
Soil temperature	31.87 $\pm$ 5.68	-0.10	$Y = 9.80 - 0.09x$
Moisture	10.75 $\pm$ 3.74	0.59**	$Y = -1.95 + 0.81x$
pH	7.31 $\pm$ 0.10	-0.45*	$Y = 169.24 - 22.22x$
Fungi	7.76 $\pm$ 4.08	0.87**	$Y = -1.47 + 1.09x$

** Significant at 1% level

* Significant at 5% level

Table 86

Showing relationship between total arthropod (micro + macro) population including their two dominant sub-orders population and soil factors/heavy metal content/fungi population at Metalled highway site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Total arthropod			
(micro + macro)	10.84 $\pm$ 5.50		
Organic carbon	1.59 $\pm$ 0.15	0.79**	$Y = -13.34 + 15.96x$
Nitrate	1.02 $\pm$ 0.14	0.67**	$Y = -20.13 + 30.08x$
Soil temperature	32.00 $\pm$ 4.94	0.17	$Y = 4.58 + 0.20x$
Moisture	11.65 $\pm$ 3.78	0.87**	$Y = -3.83 + 1.25x$
§ Cr.	69.20 $\pm$ 4.28	-0.42**	$Y = 49.98 - 0.5x$
§ Cu.	59.87 $\pm$ 7.34	-0.60*	$Y = 46.92 - 9.60x$
§ Pb.	244.73 $\pm$ 70.68	-0.65*	$Y = 58.14 - 0.19x$
pH	7.27 $\pm$ 0.09	-0.49*	$Y = 230.54 - 30.19x$
Fungi	15.52 $\pm$ 6.28	0.86**	$Y = 0.81 + 0.75x$
Y : Prostigmata population			
Organic carbon	1.59 $\pm$ 0.15	0.78**	$Y = -60.85 + 51.30x$
Nitrate	1.02 $\pm$ 0.14	0.63**	$Y = -30.08 + 49.11x$
Soil temperature	32.00 $\pm$ 4.94	0.04	$Y = 18.17 + 0.07x$
Moisture	11.65 $\pm$ 3.78	0.73**	$Y = -1.00 + 1.84x$
Cr.	69.20 $\pm$ 4.28	-0.32	$Y = 71.29 - 0.75x$
§ Cu	59.87 $\pm$ 7.34	-0.62*	$Y = 86.73 - 1.19x$
§ Pb.	244.73 $\pm$ 70.68	-0.75*	$Y = 114.69 - 0.38x$
pH	7.27 $\pm$ 0.09	-0.47*	$Y = 387.31 - 50.43x$
Fungi	15.52 $\pm$ 6.28	0.81**	$Y = 1.98 + 1.15x$
Y : Mesostigmata population			
Organic carbon	1.59 $\pm$ 0.15	0.75**	$Y = -69.35 + 53.90x$
Nitrate	1.02 $\pm$ 0.14	0.60**	$Y = -36.45 + 50.52x$
Soil temperature	32.00 $\pm$ 4.94	0.01	$Y = -0.90 + 0.53x$
Moisture	11.65 $\pm$ 3.78	0.83**	$Y = -10.59 + 2.28x$
Cr.	69.20 $\pm$ 4.28	-0.34	$Y = 75.74 - 0.86x$
§ Cu.	59.87 $\pm$ 7.34	-0.54*	$Y = 77.56 - 1.05x$
§ Pb.	244.73 $\pm$ 70.68	-0.56*	$Y = 93.38 - 0.32x$
pH	7.27 $\pm$ 0.09	-0.55**	$Y = 493.35 - 65.61x$
Fungi	15.52 $\pm$ 6.28	0.80**	$Y = -4.67 + 1.34x$

** Significant at 1% level * Significant at 5% level
§ Regression line not drawn

Table 87

Showing relationship between total collembola population including their three dominant species population and soil factors/heavy metal content/fungi population at Metalled highway site.

Parameters	Mean $\pm$ S.D.	'r' value	regression equation
Y : Collembola population	5.08 $\pm$ 3.36		
Organic carbon	1.59 $\pm$ 0.15	0.68**	$Y = -24.57 + 20.62x$
Nitrate	1.02 $\pm$ 0.14	0.65*	$Y = -16.06 + 23.48x$
Soil temperature	32.00 $\pm$ 4.94	0.05	$Y = 6.77 + 0.04x$
Moisture	11.65 $\pm$ 3.78	0.93**	$Y = 4.46 + 1.08x$
§ Cr.	69.20	-0.53**	$Y = 71.34 - 0.80x$
§ Cu.	59.87	0.88**	$Y = 75.67 - 1.00x$
§ Pb.	244.73	-0.58**	$Y = 71.81 - 0.23x$
pH	7.27 $\pm$ 0.09	-0.44*	$Y = 168.66 - 22.07x$
Fungi	15.52 $\pm$ 6.28	0.91**	$Y = -1.78 - 0.68x$
Y : <i>Isotomina thermophila</i>	8.32 $\pm$ 5.26		
Organic carbon	1.59 $\pm$ 0.15	0.40	$Y = -17.03 + 15.49x$
Nitrate	1.02 $\pm$ 0.14	0.52*	$Y = -13.74 + 20.84x$
Soil temperature	32.00 $\pm$ 4.94	0.04	$Y = 6.03 + 0.05x$
Moisture	11.65 $\pm$ 3.78	0.67**	$Y = -3.96 + 0.98x$
§ Cr.	69.20	-0.72**	$Y = 74.53 - 0.96x$
§ Cu.	59.87	-0.68**	$Y = 48.96 - 0.69x$
Pb.	244.73	-0.18	$Y = 20.78 - 0.05x$
pH	7.27 $\pm$ 0.09	-0.27	$Y = 130.09 - 16.85x$
Fungi	15.52 $\pm$ 6.28	0.72**	$Y = -2.08 + 0.64x$
Y : <i>Isotomiella minor</i>	10.94 $\pm$ 6.92		
Organic carbon	1.59 $\pm$ 0.15	0.47*	$Y = -22.51 + 20.02x$
Nitrate	1.02 $\pm$ 0.14	0.50*	$Y = -22.62 + 30.62x$
Soil temperature	32.00 $\pm$ 4.94	0.02	$Y = 8.09 + 0.02x$

Table 87 (Contd.)

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a+bx$
Moisture	11.65 $\pm$ 3.98	0.82*	$Y = -10.33 + 1.64x$
Cr.	69.20	-0.40	$Y = 56.65 - 0.69x$
§ Cu.	59.87	-0.65**	$Y = 62.88 - 0.90x$
Pb.	244.73	-0.37	$Y = 45.77 - 0.15x$
pH	7.27 $\pm$ 0.09	-0.47*	$Y = 316.95 - 42.38x$
Fungi	15.52 $\pm$ 6.28	0.75**	$Y = -5.32 + 0.91x$
Y : <i>Megalothorax minimus</i>	8.50 $\pm$ 5.83		
Organic carbon	1.59 $\pm$ 0.15	0.60**	$Y = -34.44 + 25.81x$
Nitrate	1.02 $\pm$ 0.14	0.55**	$Y = -17.03 + 23.26x$
Soil temperature	32.00 $\pm$ 4.94	0.20	$Y = -3.34 + 0.30x$
Moisture	11.65 $\pm$ 3.78	0.81**	$Y = -9.01 + 1.32x$
§ Cr.	69.20	-0.54**	$Y = 63.02 - 0.81x$
§ Cu.	59.87	-0.54**	$Y = 42.95 - 0.61x$
Pb.	244.73	-0.37	$Y = 37.04 - 0.12x$
pH	7.27 $\pm$ 0.09	-0.61**	$Y = 323.12 - 43.53x$
Fungi	15.52 $\pm$ 6.28	0.64**	$Y = -3.45 + 0.64x$

** Significant at 1% level
* Significant at 5% level
§ Regression line not drawn

Table 88

Showing relationship between total collembola population and total arthropod population in fourteen different sites.

DCS	Mean $\pm$ S.D.	'r' value	Regression equation
Y : Collembola population	8.66 $\pm$ 4.81		
Arthropod	69.48 $\pm$ 27.89	0.87**	$Y = -1.45 + 13.15x$
FL			
Y : Collembola population	15.62 $\pm$ 15.27		
Arthropod	90.38 $\pm$ 64.11	0.86**	$Y = -4.83 + 0.23x$
ACP			
Y : Collembola population	6.70 $\pm$ 2.98		
Arthropod	45.62 $\pm$ 19.90	0.91**	$Y = 0.51 + 0.14x$
RFF			
Y : Collembola population	16.22 $\pm$ 10.01		
Arthropod	133.24 $\pm$ 91.04	0.98**	$Y = 2.26 + 0.10x$
UCP			
Y : Collembola population	16.48 $\pm$ 13.72		
Arthropod	138 $\pm$ 114.4	0.95**	$Y = 0.63 + 0.11x$
SDS			
Y : Collembola population	8.08 $\pm$ 4.97		
Arthropod	52.00 $\pm$ 29.79	0.81**	$Y = 0.97 + 0.14x$
GDS			
Y : Collembola population	25.55 $\pm$ 17.11		
Arthropod	159.38 $\pm$ 94.32	0.91**	$Y = -1.44 + 0.15x$
APL			
Y : Collembola population	5.11 $\pm$ 2.61		
Arthropod	30.76 $\pm$ 14.68	0.97**	$Y = -0.18 + 0.17x$
DIE			
Y : Collembola population	2.28 $\pm$ 0.87		
Arthropod	20.67 $\pm$ 7.77	0.76**	$Y = 0.52 + 0.08x$
DS			
Y : Collembola population	4.95 $\pm$ 1.41		
Arthropod	44.14 $\pm$ 17.45	0.81**	$Y = 2.08 + 0.07x$
MHS			
Y : Collembola population	8.03 $\pm$ 4.49		
Arthropod	54.19 $\pm$ 27.52	0.83**	$Y = 0.88 + 0.13x$

Table 88 (Contd.)

	Mean $\pm$ S.D.	'r' value	Regression equation
URS			
Y : Collembola population	6.3 $\pm$ 3.70		
Arthropod	37.33 $\pm$ 20.15	0.94**	Y = -0.20 + 0.18x
IOC			
Y : Collembola population	5.34 $\pm$ 2.19		
Arthropod	44.86 $\pm$ 12.22	0.92*	Y = 1.10 + 0.09x
SCE			
Y : Collembola population	4.42 $\pm$ 2.38		
Arthropod	39.05 $\pm$ 21.53	0.98**	Y = 0.20 + 0.11x

** Significant at 1% level

* Significant at 5% level

Table 89

Showing relationship between total fungi population and soil factors
at Fallow land site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation Y = a+bx
Y : Fungi population	24.43 $\pm$ 9.15		
Organic carbon	2.61 $\pm$ 0.36	0.80**	Y = -28.89 + 20.45x
Nitrate	1.81 $\pm$ 0.30	0.75**	Y = -17.55 + 23.25x
Soil temperature	27.30 $\pm$ 2.76	-0.31	Y = 39.87 - 0.49x
Moisture	14.76 $\pm$ 6.27	0.78**	Y = 7.52 + 1.14x
pH	7.07 $\pm$ 0.06	-0.28	Y = 341.26 - 44.83x

** Significant at 1% level

Table 90

Showing relationship between total fungi population and soil factors
at Agriculture practice land site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	16.33 $\pm$ 7.07		
Organic carbon	1.76 $\pm$ 0.48	0.67**	$Y = -1.25 + 10.49x$
Nitrate	1.25 $\pm$ 0.22	0.78**	$Y = -15.72 + 25.65x$
Soil temperature	28.17 $\pm$ 7.18	-0.59**	$Y = 22.91 - 0.27x$
Moisture	16.83 $\pm$ 4.62	0.09	$Y = 14.01 + 0.14x$
pH	7.31 $\pm$ 0.08	-0.11	$Y = 89.03 - 9.94x$

** Significant at 1% level

* Significant at 5% level

Table 91

Showing relationship between total fungi population and soil factors
at Deforested site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	7.38 $\pm$ 3.28		
Organic carbon	1.51 $\pm$ 0.27	0.82**	$Y = -7.66 + 9.93x$
Soil temperature	22.53 $\pm$ 10.75	-0.27	$Y = 12.26 - 0.16x$
Nitrate	1.40 $\pm$ 0.26	0.66**	$Y = -4.49 + 8.51x$
Moisture	11.05 $\pm$ 4.51	0.76**	$Y = 1.27 + 0.55x$
pH	7.34 $\pm$ 0.10	-0.58*	$Y = 149.82 - 19.40x$

Significant at 5% level

** Significant at 1% level

Table 92

Showing relationship between total fungi population and soil factors
at Reserve forest floor site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	24.6 $\pm$ 12.06		
Organic carbon	3.18 $\pm$ 0.61	0.72**	$Y = -19.70 + 14.30x$
Soil temperature	27.64 $\pm$ 8.71	-0.23	$Y = 39.43 - 0.05x$
Nitrate	2.08 $\pm$ 0.27	0.74**	$Y = -43.31 + 32.86x$
Moisture	15.74 $\pm$ 4.11	0.77**	$Y = -10.17 + 2.23x$
pH	7.05 $\pm$ 0.05	0.08	$Y = -245.95 + 38.48x$

** Significant at 1% level

* Significant at 5% level

Table 93

Showing relationship between total fungi population and soil factors
at undisturbed city park site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	23.55 $\pm$ 12.37		
Organic carbon	2.31 $\pm$ 0.39	0.84**	$Y = -38.54 + 26.91x$
Soil temperature	30.46 $\pm$ 5.39	0.30	$Y = 23.22 + 0.01x$
Nitrate	2.22 $\pm$ 0.56	0.90**	$Y = -19.68 + 14.49x$
Moisture	16.03 $\pm$ 5.70	0.91**	$Y = -7.91 + 1.96x$
pH	7.13 $\pm$ 0.08	0.32	$Y = -344.36 + 51.61x$

** Significant at 1% level

* Significant at 5% level

Table 94

Showing relationship between total fungi population and soil factors
at Anthropogenic pressurised city park.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	9.48 $\pm$ 4.88		
Organic carbon	0.83 $\pm$ 0.19	0.69**	$Y = -14.79 + 26.89x$
Nitrate	0.90 $\pm$ 0.12	0.67**	$Y = -14.79 + 26.89x$
Soil temperature	27.44 $\pm$ 8.87	-0.26	$Y = 16.89 - 0.24x$
Moisture	11.10 $\pm$ 3.41	0.83**	$Y = -3.58 + 1.18x$
pH	7.09 $\pm$ 0.02	-0.05	$Y = 33.78 - 3.43x$

** Significant at 1% level

Table 95

Showing relationship between total fungi population and soil factor/heavy metal
content at Irrigation canal embankment site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	9.83 $\pm$ 4.31		
Organic carbon	2.69 $\pm$ 0.49	0.57*	$Y = -36.21 + 16.17x$
Nitrate	1.59 $\pm$ 0.30	0.71**	$Y = -6.99 + 10.31x$
Soil temperature	31.32 $\pm$ 5.59	-0.26	$Y = 15.60 - 0.20x$
Moisture	16.30 $\pm$ 6.74	0.63**	$Y = 2.49 + 0.39x$
Cr.	8.93 $\pm$ 1.41	-0.01	$Y = 7.97 - 0.16x$
Cu.	11.81 $\pm$ 1.94	-0.18	
Pb.	10.47 $\pm$ 1.72	-0.11	
pH	7.25 $\pm$ 0.11	-0.12	$Y = 47.14 - 5.21x$

** Significant at 1% level

* Significant at 5% level

Table 96

Showing relationship between total fungi population and soil factors/heavy metal content at sewage canal embankment site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	28.50 $\pm$ 6.64		
Organic carbon	2.82 $\pm$ 0.32	0.61**	$Y = -6.95 + 12.69x$
Nitrate	1.98 $\pm$ 0.27	0.59*	$Y = 1.20 + 14.49x$
Soil temperature	29.77 $\pm$ 5.22	-0.56*	$Y = 49.95 - 0.7x$
Moisture	21.86 $\pm$ 6.00	0.46*	$Y = 17.72 + 0.5x$
Cr.	178.22 $\pm$ 27.83	-0.34	$Y = 14.34 - 0.08x$
Cu.	11.81 $\pm$ 1.94	-0.18	
Pb.	140.13 $\pm$ 59.69	-0.24	
pH	7.12 $\pm$ 0.07	-0.13	$Y = 112.03 - 11.63x$

** Significant at 1% level

* Significant at 5% level

Table 97

Showing relationship between total fungi population and soil factors/heavy metal content at Garbage dumping dune.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	24.48 $\pm$ 9.06		
Organic carbon	2.84 $\pm$ 0.60	0.94**	$Y = -15.87 + 14.20x$
Soil temperature	30.62 $\pm$ 4.94	-0.06	$Y = 28.05 - 0.12x$
Nitrate	2.41 $\pm$ 0.34	0.84**	$Y = -31.23 + 23.19x$
Moisture	17.08 $\pm$ 4.52	0.83**	$Y = -3.86 + 1.66x$
Cr.	64.02 $\pm$ 6.87	-0.85**	$Y = -96.06 - 1.12x$
Cu.	105.20 $\pm$ 15.15	-0.56*	$Y = 59.27 - 0.33x$
Pb.	58.72 $\pm$ 4.88	-0.45*	$Y = 73.94 - 0.84x$
pH	7.22 $\pm$ 0.13	-0.24	$Y = 134.88 - 0.24x$

** Significant at 1% level

* Significant at 5% level

Table 98

Showing relationship between total fungi population and soil factors/heavy metal content at soil dune site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	7.76 $\pm$ 6.23		
Organic carbon	1.79 $\pm$ 0.09	0.30	$Y = -31.21 + 21.76x$
Soil temperature	32.35 $\pm$ 5.28	-0.29	$Y = 18.65 - 0.34x$
Nitrate	1.25 $\pm$ 0.12	0.29	$Y = -18.05 + 21.46x$
Moisture	10.53 $\pm$ 3.19	0.43*	$Y = -1.00 + 0.83x$
Cr.	13.23 $\pm$ 1.27	-0.31	$Y = 28.21 - 1.55x$
Cu.	15.45 $\pm$ 3.23	-0.29	$Y = 16.84 - 0.59x$
Pb.	23.22 $\pm$ 2.33	-0.70**	$Y = 51.27 - 1.89x$
pH	7.14 $\pm$ 0.08	-0.26	$Y = 170.86 - 22.83x$

** Significant at 1% level

* Significant at 5% level

Table 99

Showing relationship between total fungi population and soil factors/heavy metal content at Durgapur control Pasture site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	22.76 $\pm$ 10.86		
Organic carbon	2.25 $\pm$ 0.40	0.81**	$Y = -28.54 + 22.35x$
Nitrate	1.69 $\pm$ 0.42	0.90**	$Y = -19.51 + 24.61x$
Soil temperature	32.09 $\pm$ 6.91	-0.22	$Y = 33.53 - 0.34x$
Moisture	16.77 $\pm$ 5.43	0.88**	$Y = 6.65 + 1.75x$
Cr.	9.49 $\pm$ 1.09	-0.82**	$Y = 100.11 - 8.16x$
Cu.	8.04 $\pm$ 1.00	-0.58*	$Y = 74.84 - 6.41x$
Pb.	13.51 $\pm$ 3.01	-0.79**	$Y = 61.35 - 2.84x$
pH	7.09 $\pm$ 0.06	-0.15	$Y = 35.74 - 1.93x$

** Significant at 1% level

* Significant at 5% level

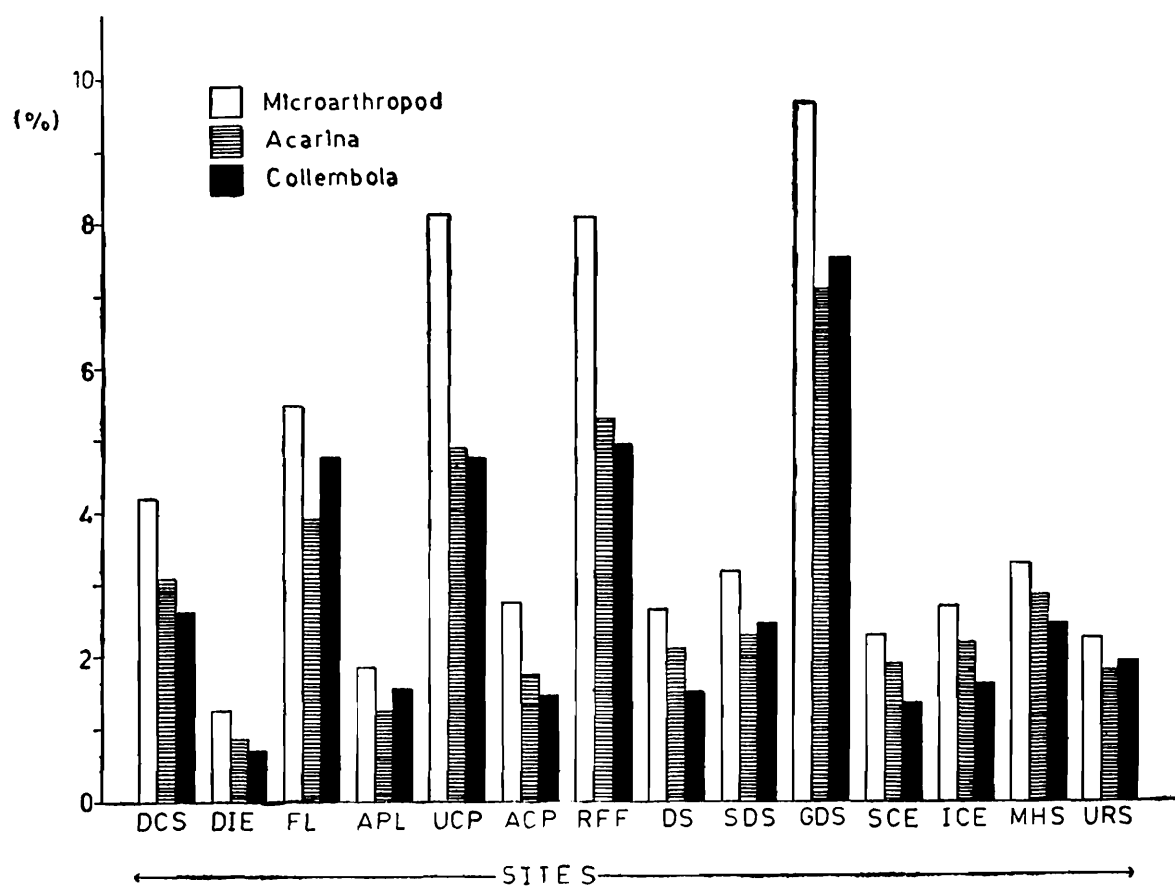


Fig. 100. Showing total number of microarthropod, acarina and collembola in different sites (%).

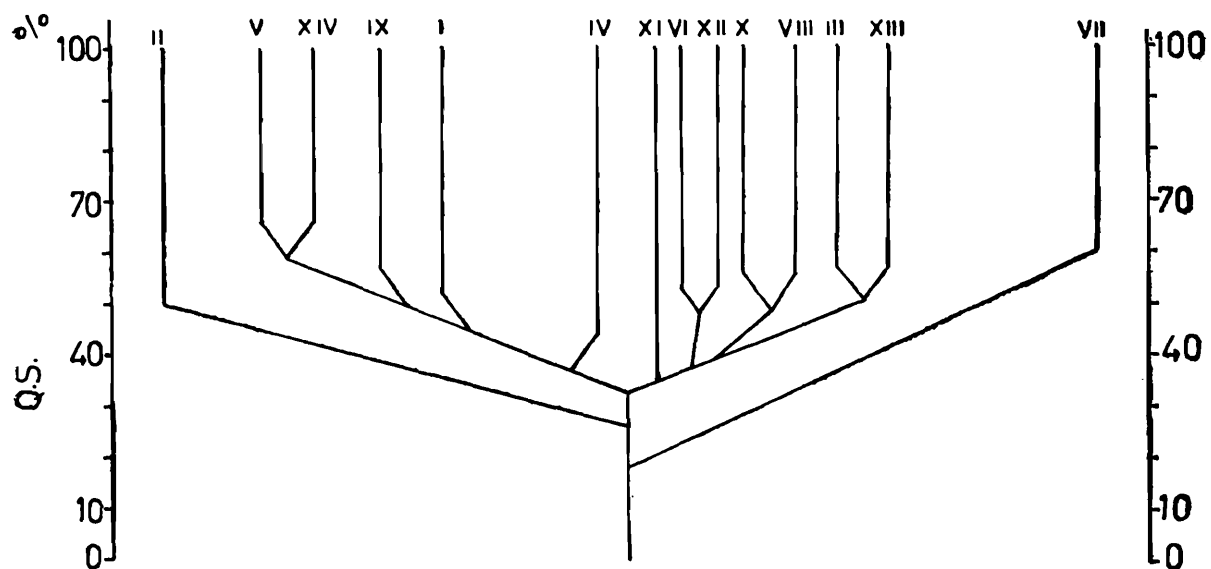


Fig. 101. Dendrogram showing the relationship between the studied sites of West Bengal.

Table 100

Showing relationship between total fungi population and soil factors/heavy metal content at Durgapur industrial effluent site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	9.70 $\pm$ 4.99		
Organic carbon	2.02 $\pm$ 0.18	0.15	$Y = 0.67 + 4.28x$
Nitrate	0.75 $\pm$ 0.08	0.17	$Y = 1.37 + 10.61x$
Soil temperature	26.03 $\pm$ 8.40	-0.74**	$Y = 28.61 - 0.66x$
Moisture	17.25 $\pm$ 5.39	-0.01	$Y = 9.51 - 0.01x$
Cr.	168.11 $\pm$ 87.41	-0.10	$Y = 8.31 - 0.01x$
Cu.	236.63 $\pm$ 49.59	-0.36	$Y = 0.40 - 0.04x$
Pb.	196.19 $\pm$ 41.35	-0.02	
pH	6.78 $\pm$ 0.10	-0.51*	$Y = 79.60 - 10.40x$

** Significant at 1% level

* Significant at 5% level

Table 101

Showing relationship between total fungi population and soil factors at unmetalled road way site

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	7.67 $\pm$ 4.08		
Organic carbon	1.24 $\pm$ 0.12	0.65**	$Y = -20.50 + 22.71x$
Nitrate	0.60 $\pm$ 0.09	0.81**	$Y = -14.51 + 36.79x$
Soil temperature	31.87 $\pm$ 5.68	-0.16	$Y = 11.40 - 0.12x$
Moisture	10.75 $\pm$ 3.74	0.67**	$Y = -0.17 + 0.73x$
pH	7.27 $\pm$ 0.09	-0.40	$Y = 81.43 - 9.03x$

** Significant at 1% level

Table 102

Showing relationship between total fungi population and soil factors/heavy metal content at Metalled highway site.

Parametres	Mean $\pm$ S.D.	'r' value	regression equation $Y = a + bx$
Y : Fungi population	15.52 $\pm$ 6.29		
Organic carbon	1.59 $\pm$ 0.15	0.76**	$Y = -36.34 + 32.72x$
Nitrate	1.02 $\pm$ 0.14	0.60**	$Y = -12.53 + 27.50x$
Soil temperature	32.00 $\pm$ 4.94	-0.17	$Y = 22.33 - 0.21x$
Moisture	11.65 $\pm$ 3.78	0.89**	$Y = -1.60 + 1.47x$
pH	7.27 $\pm$ 6.09	-0.40	$Y = 81.43 - 9.03x$
§ Cr.	60.20 $\pm$ 17.25	-0.53*	$Y = 71.34 - 0.80x$
§ Cu.	59.87 $\pm$ 15.21	-0.88*	$Y = 75.67 - 1.00x$
§ Pb.	244.73 $\pm$ 68.15	-0.58*	$Y = 71.81 - 0.23x$

** Significant at 1% level

* Significant at 5% level

§ Regression line not drawn

GENERAL DISCUSSION

The results presented here were based on a sample survey of 42 plots from fourteen different habitats of West Bengal over a period of twenty one months (April, 1979 to December, 1980). Of the plots sampled, 12 had polluted soil environment and 9 were poor and the remaining 21 were reserve forest floor, undisturbed city park, uncultivated fallow land, unmetalled road way site, irrigation canal embankment, soil dune and a pasture land. These habitats also served as comparative sites for the above mentioned plots. All the plots under study were in the Gangetic plain exposed to tropical climate with high humidity and high temperature, both of which were comparatively low during winter months. The principal nature of soil in all the plots were more or less identical except the plots at Durgapur, where it was laterite in nature.

The surface soil of the plots in general contained good vegetational cover particularly the undisturbed and non-polluted plots. According to Choudhuri and Roy (1972), Hazra *et al* (1976) and Mitra *et al* (1977) the surface soil vegetation exerted an indirect influence on the collembolan population through its effect on the porosity of soil, humus formation and soil moisture. The

nature of vegetation in many of the sampling sites considered here were more or less similar. In general there might be a moderate amount of interaction between plant and microarthropods or collembolan association, but there remained little evidence on the restriction of individual microarthropod/collembola species to one species of plant. Christiansen (1964) had earlier arrived at similar conclusion. A similar situation was found to exist for oribatei by Wauthy and Lebrun (1980) who studied the oribatei communities of deciduous forest in Belgium and found low level correlation with the vegetation pattern. They concluded that the deciduous Phytocenoses were mainly influenced by climatic factors, while the taxocenoses of oribatei which they sheltered were primarily regulated by the edaphic factors and secondarily by climatic factors. In a study of collembola in various forest types in Poland, including both deciduous and coniferous trees, Szeptycki (1967) noticed that their fauna was astonishingly alike, though the sites in question differed in soil, inclination, exposition, microclimate, etc. In his opinion the main factor regulating the collembolan fauna in those forests was the presence of coniferous trees which provided litter with special chemical features.

According to Waliwork (1970) the collembolan fauna of a certain locality was determined by a complex of factors, both ecological and historical. Therefore, in his view the degree of similarity in species composition, between two sites could be used as an index of an overall ecological similarity. According to him the influence of vegetation types is indirect, being exerted, perhaps, through its effect on soil type, microfloral composition, or soil moisture.

Recently Hågvar (1982) found that in coniferous forest floor in Norway, the species number of collembola increased with increasing soil fertility, but the diversity of species was highest in medium rich soils. He measured the fertility-scale in accordance to vegetation types, and noticed that in case of more extreme environmental condition e.g. soil moisture, the vegetation would better indicate the collembolan fauna. The collembolan fauna obtained here belonged to 39 genera of the families Entomobryidae, Isotomitidae, Hypogastruridae and Sminthuridae (Table 103). As already stated, some forms differed in their abundance from one site to other and from season to season. Moreover, the number of genera occurring in the different sampling sites also varied, maximum being extracted from the Reserve forest floor (19 in number) and minimum from the Durgapur industrial effluent site (8 in number). Of the 39 genera the predominant ones were *Lepidocyrtus* (7 species), *Isotomina* (3 species), *Isotomella* (2 species) *Megalothorax* (1 species) and *Cyphoderus* (4 species) mentioned in order to dominance

Table 103

Showing total number of each genera of collembola encountered from the sampling sites of different habitats (Percentages are shown in the parenthesis)

Genera / Sites	ACP	UCP	RFF	DS	APL	FL	DCS	DIE	SCE	ICE	SDS	GDS	MHS	URS	Total
<i>Lepidocyrtus</i> sp.	138 (0.99)	246 (1.77)	352 (2.53)	94 (0.68)	135 (0.98)	337 (2.42)	278 (2.00)	16 (0.12)	25 (0.18)	109 (0.78)	39 (0.28)	427 (3.07)	81 (0.58)	45 (0.35)	2302 (16.56)
<i>Cyphoderus</i> sp.	39 (0.28)	76 (0.55)	179 (1.29)	36 (0.26)	122 (0.88)	260 (1.87)	28 (0.20)	47 (0.34)	17 (0.13)	24 (0.18)	33 (0.24)	390 (2.81)	39 (0.28)	134 (0.95)	1424 (10.24)
<i>Isotomiella</i> sp.	149 (1.07)	218 (1.57)	168 (1.21)	31 (0.22)	— (—)	53 (0.38)	34 (0.24)	— (—)	77 (0.55)	— (—)	— (—)	759 (5.46)	186 (1.34)	34 (0.24)	1709 (12.29)
<i>Sinella</i> sp.	— (—)	28 (0.20)	42 (0.30)	— (—)	— (—)	35 (0.25)	— (—)	— (—)	— (—)	43 (0.31)	— (—)	— (—)	— (—)	43 (0.31)	191 (1.37)
<i>Calx</i> sp.	31 (0.22)	32 (0.23)	— (—)	— (—)	— (—)	35 (0.25)	— (—)	— (—)	— (—)	— (—)	29 (0.21)	— (—)	— (—)	27 (0.17)	154 (1.11)
<i>Megalothorax</i> sp.	— (—)	336 (2.42)	218 (1.57)	— (—)	— (—)	311 (2.24)	— (—)	— (—)	— (—)	— (—)	— (—)	566 (4.07)	141 (1.01)	— (—)	1572 (11.31)
<i>Isotomurus</i> sp.	— (—)	— (—)	— (—)	— (—)	25 (0.18)	34 (0.24)	— (—)	— (—)	30 (0.21)	— (—)	155 (1.11)	78 (0.56)	— (—)	— (—)	322 (2.32)
<i>Folsomides</i> sp.	33 (0.24)	37 (0.27)	41 (0.29)	— (—)	23 (0.17)	42 (0.30)	29 (0.21)	14 (0.10)	81 (0.58)	— (—)	— (—)	— (—)	33 (0.24)	— (—)	333 (2.40)
<i>Proisotoma</i> sp.	33 (0.24)	— (—)	— (—)	79 (0.57)	— (—)	33 (0.24)	— (—)	— (—)	— (—)	— (—)	42 (0.30)	— (—)	— (—)	143 (1.03)	330 (2.37)
<i>Subisotoma</i> sp.	— (—)	— (—)	177 (1.27)	— (—)	89 (0.64)	318 (2.29)	37 (0.27)	— (—)	85 (0.61)	24 (0.18)	159 (1.14)	— (—)	43 (0.31)	— (—)	932 (6.70)
<i>Entomobrya</i> sp.	37 (0.27)	218 (1.57)	21 (0.15)	28 (0.20)	17 (0.12)	40 (0.29)	31 (0.22)	49 (0.36)	— (—)	71 (0.51)	29 (0.21)	— (—)	33 (0.24)	53 (0.38)	627 (4.51)
<i>Xenylla</i> sp.	— (—)	— (—)	44 (0.32)	— (—)	25 (0.18)	39 (0.29)	29 (0.21)	— (—)	— (—)	— (—)	27 (0.19)	— (—)	42 (0.30)	— (—)	206 (1.48)

Table 103 (Contd.)

Genera / Sites	ACP	UCP	RFF	DS	APL	FL	DCS	DIE	SCE	ICE	SDS	GDS	MHS	URS	Total
<i>Stenacidia</i> sp.	-	-	-	-	-	36 (0.26)	-	-	-	-	-	-	-	-	36 (0.26)
<i>Sphaeridia</i> sp.	37 (0.27)	35 (0.25)	-	-	27 (0.19)	41 (0.30)	24 (0.17)	14 (0.10)	-	23 (0.17)	17 (0.12)	71 (0.51)	-	-	289 (2.08)
<i>Katianna</i> sp.	-	-	-	-	-	28 (0.20)	-	16 (0.12)	-	-	-	-	-	-	44 (0.32)
<i>Sminthurides</i> sp.	-	-	25 (0.18)	22 (0.16)	45 (0.32)	-	26 (0.18)	-	-	18 (0.13)	-	-	-	-	136 (0.98)
<i>Seria</i> sp.	-	-	39 (0.28)	-	28 (0.20)	-	-	-	-	-	-	-	-	-	67 (0.48)
<i>Isotomina</i> sp.	148 (1.06)	259 (1.86)	144 (1.04)	132 (0.95)	-	-	370 (2.66)	50 (0.36)	89 (0.64)	91 (0.65)	179 (1.29)	91 (0.65)	181 (1.30)	154 (1.11)	1888 (13.58)
<i>Salina</i> sp.	-	-	35 (0.25)	24 (0.17)	-	-	-	-	-	-	-	-	-	-	59 (0.42)
<i>Isotomodes</i> sp.	-	-	-	29 (0.21)	-	-	-	-	-	-	-	-	-	34 (0.25)	63 (0.45)
<i>Willemia</i> sp.	-	-	-	24 (0.17)	-	-	-	-	-	19 (0.14)	-	-	-	-	43 (0.31)
<i>Arrhopalites</i> sp.	-	35 (0.25)	-	21 (0.15)	-	-	-	-	-	-	-	-	-	-	56 (0.40)
<i>Pseudachorutes</i> sp.	-	-	31 (0.22)	-	-	-	-	-	-	-	-	-	-	-	31 (0.22)
<i>Hypogastrura</i> sp.	-	-	40 (0.28)	-	-	-	-	-	-	98 (0.70)	34 (0.24)	-	-	-	172 (1.24)
<i>Dicyrtomina</i> sp.	-	-	39 (0.23)	-	-	-	-	-	-	-	-	-	-	-	39 (0.23)

Table 103 (Contd.)

Genera / Sites	ACP	UCP	RFF	DS	APL	FL	DCS	DIE	SCE	ICE	SDS	GDS	MHS	URS	Total
<i>Alloscopus</i> sp.	-	-	32 (0.23)	-	-	-	-	-	-	-	-	-	-	-	32 (0.23)
<i>Lobella</i> sp.	-	30 (0.22)	58 (0.42)	-	-	-	-	-	-	18 (0.13)	-	-	-	-	106 (0.76)
<i>Tullbergia</i> sp.	-	32 (0.23)	24 (0.17)	-	-	-	-	-	-	-	19 (0.14)	-	-	-	75 (0.54)
<i>Sminthurus</i> sp.	36 (0.26)	31 (0.22)	-	-	-	-	-	-	-	-	-	-	-	-	67 (0.48)
<i>Dicyrtoma</i> sp.	22 (0.16)	-	-	-	-	-	-	-	-	-	-	-	-	-	22 (0.16)
<i>Pseudosinella</i> sp.	-	35 (0.25)	-	-	-	-	-	-	-	24 (0.18)	-	-	33 (0.24)	-	92 (0.66)
<i>Stenognathellus</i> sp.	-	-	-	-	-	-	23 (0.17)	-	-	-	-	70 (0.50)	-	-	93 (0.67)
<i>Bourletilla</i> sp.	-	-	-	-	-	-	-	18 (0.13)	-	-	-	-	-	-	18 (0.13)
<i>Sminthurinus</i> sp.	-	-	-	-	-	-	-	31 (0.22)	-	-	-	-	-	-	31 (0.22)
<i>Drepanura</i> sp.	-	-	-	-	-	-	-	-	-	-	-	76 (0.55)	-	-	76 (0.55)
<i>Bhrachystomella</i> sp.	-	-	-	-	-	-	-	-	28 (0.20)	-	37 (0.27)	75 (0.54)	-	-	140 (1.02)
<i>Isotoma</i> sp.	-	-	-	-	-	-	-	-	-	-	49 (0.35)	-	-	-	49 (0.35)
<i>Folsomina</i> sp.	-	-	-	-	-	-	-	-	32 (0.32)	-	-	-	-	-	32 (0.23)
<i>Cryptopygus</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	40 (0.29)	-	40 (0.29)

The genus *Lepidocyrtus* was represented by seven species viz., *Lepidocyrtus* (*Acrocyrtus*) *scaber*, *L. (Lepidocyrtus) medius*, *L. suborientalis*, *L. (Discocyrtus) magnificus*, *L. (Acrocyrtus) hererolepis*, *L. (Acrocyrtus) sp.* and *Lepidocyrtus sp.* They were widely distributed being found in all the sampling sites and comprising about 16.56% of the total population of collembola and being numerically dominant over other forms. The wide distributional range and numerical dominance suggested the capability of this genus to exist in varying ecological conditions. The species, *Lepidocyrtus* (*L.*) *medius* was the most dominant taxon under this genus, and occupied the fourth position in order of dominance in respect of the total number of collembola (comprising 7%), but it was extracted only from four sites with the maximum number from the Garbage dumping site (3.07% of total collembola). The population maxima of this species in all the sites under study were in the month of July and minima in May (except in the MHS where the maximum and minimum populations were in October and April-May respectively). The total population of this genus (irrespective of plots) was maximum in July (3.63%).

The second predominant genus *Isotomina* was represented by three species viz., *Isotomina thermophila*, *I. interrupta* and *Isotomina sp.*; and they together comprised 13.58% of the soil collembolan population being found in all the sites (except in APL and FL sites). This genus also exhibited similar peak like *Lepidocyrtus* being maximum in July. The species, *Isotomina thermophila* showed quite high tolerance for various habitats as it was extracted from the maximum number of sites (in ten out of fourteen sites) and occupied the third position in order of dominance comprising 10.3% of the total collembola obtained here. The population maxima and minima of this species also varied from site to site in most cases, maxima ranged from July to September except in SCE where the peak was shifted to April, but the population minima changed from month to month depending upon the characters of sampling sites. The species was obtained in maximum number from the undisturbed city park site (1.86%).

The third numerical dominant genus *Isotomiella* was represented by two species, *Isotomiella minor* and *Isotomiella sp.* These were extracted from ten sampling sites and comprised 12.29% of the total collembola population being maximum in July. Although *Isotomiella minor* was numerically second dominant collembolan species, it was totally absent in five sites with the maximum number obtained from the Garbage dumping dune site (4.82% of the total collembolan population). Thus the species showed a low tolerance for various contrasting habitats. In rest of the nine habitats it showed its maxima during July-August (except in Sewage canal embankment site, where the peak was in April and minima in October, (except in DS,

SCE and GDS sites where the populations were minimum respectively in September, July and December).

The fourth dominant genus *Megalothorax* was represented by a single species, *Megalothorax minimus*, which was extracted from five sites only. It comprised 11.31% of the total collembolan population and occupied the fourth position in order of dominance. The Garbage dumping dune site contained maximum number (4.07%) of this species. This species was not able to tolerate the habitat variations. The population maxima of this species in all the sites were in the month of July, but the population minima were recorded in June, April, May, October and May respectively in the sites of UCP, RFF, ICE, GDS and MHS.

The fifth important genus *Cyphoderus* was represented by four species viz., *Cyphoderus javanus*, *Cyphoderus albinus*, *Cyphoderus assimilis* and *Cyphoderus* sp. They were also widely distributed (ubiquists) like the genus *Lepidocyrtus* being extracted from all the sampling sites and comprised 10.24% of the total collembolan population. Its population was maximum in July (1.84%). The predominant species under this genus was *Cyphoderus javanus*, the highest number of which was found from the Fallow land site (1.87%). The population was maximum during July-August (except in APL, where it was shifted to April) and minimum in the months of May, April, July, May and May respectively in the sites of UCP, RPF, FL and MHS. The distribution pattern of this genus revealed a high tolerance for various habitats not necessarily coupled with a general high abundance. Similar observations were earlier made by Rusek (1971) and Hågver (1982).

The other important collembolan genera obtained were *Subisotoma*, *Entomobrya*, *Folsomides*, *Proisotoma*, *Isotomurus* and *Sphaeridia*, constituting 6.70%, 4.51%, 2.40%, 2.37%, 2.32% and 2.08% of the total population of collembola respectively.

The genus *Subisotoma* was found in the eight sampling sites (Reserve forest floor, Agriculture practice land, Fallow land, Durgapur control Pasture site, Sewage canal embankment, Irrigation canal embankment, Soil dune site and Metalled highway site) and was represented by a single species, *S. fitchioides*. It was numerically dominant in the Fallow land site (2.29%). Its population was maximum in the month of August (1.34%). It comprised 6.70% of the total collembola population. *Folsomides* occurred in the sampling sites of Anthropogenic pressurised city park, undisturbed city park, Reserve forest floor, Agriculture practice land, Fallow land, Durgapur control pasture site, Durgapur industrial effluent site, Sewage canal embankment and Metalled highway site. It was represented

by two species, of which *Folsomides parvulus* was dominant comprising 2.10% of the total collembolan population. The maximum number was encountered from the Sewage canal embankment site (0.58%). Its population reached the peak in July while the population minima varied from site to site.

The genus *Entomobrya* occurred in the sampling sites under consideration except two, namely the Sewage canal embankment and the Garbage dumping dune. Numerically the genus was dominant in the undisturbed city park (1.57%). It showed maximum population in the month of July (0.90%) while the population minima varied from site to site.

The individuals belonging to the genus *Proisotoma* were extracted from the sampling sites of Anthropogenic pressurised city park, Deforested site, Fallow land, Soil dune site and Unmetalled road way site. The Unmetalled road way site bound maximum number of individuals of this genus (1.03%). The population was maximum in the month of July, while the population minima varied in different months depending on the nature of the habitat.

The members of the genus *Isotomurus* were found in five sampling sites viz., Agriculture practice land, Fallow land, Sewage canal embankment, Soil dune site and Garbage dumping dune site. It was maximum in the Soil dune site (1.17%). It was represented by two species, of which *Isotomurus ciliatus* was most abundant comprising 2.14% of the total collembola. It showed the peak population in July (0.40%).

The individuals of the genus *Sphaeridia* were extracted from nine sampling sites namely Anthropogenic pressurised city park, Undisturbed city park, Deforested site, Fallow land site, Durgapur control pasture site, Durgapur industrial effluent site, Irrigation canal embankment site, Soil dune site and Garbage dumping dune site. Numerically the genus was most abundant in the latter site comprising 0.51% of total population of collembola. It was represented by two species viz., *Sphaeridia cornuta* and *Sphaeridia* sp., of which *Sphaeridia* sp. was more dominant comprising 1.68% of the total collembola. Its population was maximum in July.

The forms belonging to the genera *Xenylla* (1.48%), *Sinella* (1.27%), *Hypogastrura* (1.24%), *Calx* (1.11%), *Brachystomella* (1.02%), *Sminthurides* (0.98%), *Lobella* (0.76%), *Stenognathellus* (0.67%), *Pseudosinella* (0.66%), *Drepanura* (0.55%), *Tullbergia* (0.54%), *Seira* (0.48%), *Sminthurus* (0.48%), *Isotomodes* (0.45%), *Salina* (0.42%), *Arrhopalites* (0.40%), *Isoptoma*

(0.35%), *Katianna* (0.32%), *Willemia* (0.31%), *Cryptopygus* (0.29%), *Dicyrtomina* (0.16%), *Stenacidia* (0.26), *Folsomina* (0.23%), *Alloscopus* (0.23%), *Sminthurinus* (0.22%), *Pseudachorutes* (0.22%), *Dicyrtoma* (0.16%) and *Bourletiella* (0.13%) occupied individually very minor position in relation to total collembolan community and were more or less localised forms being restricted to only two or three sampling sites. The other arthropod fauna obtained in this study belonged to Acarina, Coleoptera, Diptera, Diplura, Protura and some other unidentified groups (Table 104). Like collembola these forms also differed in their abundance from one sampling site to other. It was also noted that all the enlisted arthropod groups were obtained from the sampling sites of Fallow land, Reserve forest floor, Undisturbed city park, Irrigation canal embankment, Garbage dumping dune and Soil dune sites.

The Acarina was represented by three sub-orders Prostigmata, Mesostigmata and Cryptostigmata (Table 104). The individuals of this order were seen to tolerate widely varying habitat as they occurred in all the sampling sites of the present study (except Prostigmata which did not occur in Industrial effluent site). The sub-order Prostigmata was numerically most abundant, and comprising 27.01% of the total other arthropod population it occupied first position in order of dominance; maximum number of it was encountered from the Garbage dumping dune site (5.12%). The population of Prostigmata in this site was maximum in July and minimum in May. In all other sites the population maxima were encountered in monsoon and in summer.

The second predominant acarine was sub-order Mesostigmata, which comprised 23.01%, they were abundant in Reserve forest floor comprising 3.16% of the total other arthropod population. The population was maximum in July-August in all the sites (except in Agriculture practice land and Industrial effluent sites where the same was observed in November and in Sewage canal embankment site where it was in April, while the population minima varied from site to site.

The sub-order cryptostigmata was third predominant acarine fauna and comprised 21.50% of the total other arthropod population. The Garbage dumping dune site contained the highest population (4.34%) of this sub-order. The populations in most of sites were maximum in July-August and minimum in May-June.

The order coleoptera was represented by two families ptiliidae and staphylinidae and some larvae. The family ptiliidae comprised 8.07% of the total other arthropod population and occupied fourth position in order of

Table 104

Showing other arthropod groups and total numbers recovered from various sites of West Bengal
(Expressed in percentage of total arthropods)

SITES	FL	APL	DS	RFF	UCP	ACP	ICE	SCE	GDS	SDS	DCS	DIE	URS	MHS	Total
ACARINA															
Prostigmata	2.50	0.87	1.45	3.29	3.05	1.13	1.74	0.43	5.12	1.59	2.15	—	1.55	2.14	27.01
Mesostigmata	2.35	0.71	1.30	3.16	3.02	1.04	1.12	1.37	2.80	1.81	1.60	0.75	0.81	1.69	23.01
Cryptostigmata	1.89	0.59	0.89	2.68	2.75	0.90	0.93	1.33	4.34	1.05	1.58	0.70	0.74	1.12	21.50
COLEOPTERA															
Ptiliidae	1.03	0.34	0.34	1.31	1.36	0.49	0.28	0.26	0.90	0.48	0.77	0.24	0.25	—	8.07
Staphylinidae	0.62	0.24	0.23	1.50	1.43	0.46	0.22	0.18	1.23	0.38	0.30	0.17	0.18	0.45	7.61
Larvae	0.22	0.08	0.15	0.73	0.90	0.25	0.07	0.09	0.47	0.09	0.17	0.07	0.08	0.07	3.45
DIPTERA															
Larvae	0.29	0.15	—	0.70	0.88	0.17	0.04	0.10	0.41	0.14	0.22	0.11	0.07	0.05	3.36
DIPLURA	0.07	—	0.02	0.18	0.10	—	0.03	0.04	0.10	0.05	0.12	—	—	0.001	0.73
PROTURA	0.001	—	—	0.03	0.01	—	0.01	—	0.03	0.01	0.03	—	—	—	0.13
Other unidentified groups	0.50	0.22	0.24	0.39	0.57	0.34	0.23	0.15	1.28	0.38	0.34	0.11	0.22	0.14	5.13

dominance. The family was most abundant in undisturbed city park (1.36% of the total other arthropod population). Except in Agriculture practice land, Sewage canal embankment and Industrial effluent sites the population peaks of this group in other sites were in the month of July-August.

The fifth predominant other arthropod group was the family staphylinidae which comprised 7.16% of the total other arthropod population. They were abundant in Reserve forest floor comprising 1.5% of the total other arthropod population. The populations in all the sites were maximum in the months of July-August (except the sites APC, SCE and DCS where the peaks were in November, May and May respectively).

The rest of the other arthropod faunal groups viz., coleoptera larvae, diptera adult and larvae, diplura, protura and some other unidentified groups formed an insignificant part of the other arthropod community and were not available from all the sampling sites.

The above mentioned variations in the faunal make up might be due to the differences in the ecological conditions. Some genera were wide spread occurring regularly in different sampling sites, they could tolerate wide variety of habitats and were aptly called "ubiquists" or "ecological generalists groups"; on the other hand some forms were localised i.e. restricted to a particular habitat and they were accordingly termed as "stenoecious" or "ecological specialists" group.

The two genera of collembola (*Lepidocyrtus* and *Cyphoderus*), two sub-orders of acarina (Mesostigmata and Cryptostigmata) and one family of coleoptera (Staphylinidae) seemed to have wider tolerance for various habitats in the present study. Therefore, they were "ubiquists" while twentythree forms of collembola were restricted to single site and as such they were "stenoecious" but not a single "stenoecious" group was present among the other arthropods. Of these faunal groups, acarina showed largest "ubiquists" besides occurring in all the sampling sites, their abundance was rather high in all the sites except for one environmentally poorest site (Industrial effluent site). In a study of collembola from twenty different habitats in South Sweden, Bodvarson (1961) found that the "ubiquists" dominated the picture in most of the habitats.

Hägvar (1982) while working in a coniferous forest of Norway found that fourteen species of collembola namely, *Isotoma notabilis*, *Mesaphorura tenuisensillata*, *Isotomiella minor*, *Onychiurus armatus*, *Folsomia quadrioculata*, *Friesea mirabilis*, *Folsomia sensibilis*, *Anurophorus binoculatus*, *Lepidocyrtus lignorum*, *Willemia anoplhalma*, *Anurida pygmaea*, *Onychiurus absoloni*,

Anurida forsslundi, and *Karlstejnia norveijica* were present in seven vegetation types.

While in the present study twenty three species of collembola namely *Katianna* sp., *Xenylla welchi*, *Isotomurus* sp., *Salina indica*, *Isotomodes* sp., *Salina* sp., *Folsomides exigua*, *Xenylla obscura*, *Pseudachorutes* sp., *Dicyrtoma* sp., *Alloscopus tetracantha*, *Lobella silva*, *Dicrytomina* sp., *Lepidocyrtus magnificus*, *Bourletiella* sp., *Sminthurinus* sp., *Drepanura* sp., *Isotoma* sp., *Folsomina* sp., *Brachystomella* sp., *Isotomina* sp., *Sinella coecobrya* sp. and *Cryptopygus thermophilus* were restricted to twelve out of fourteen contrasting habitats, only the unmetalled road way site and undisturbed city park site were devoid of any "stenoeccious" species, and Reserve forest floor site contained maximum number of "stenoeccious" species (7). The distribution pattern of various species of collembola and other arthropods and their numerical importance in terms of total fauna could be expressed in terms of relative density. The results thus obtained were presented in the table 105.

The total population of collembola and other arthropod fauna obtained from all the sampling sites in the present study showed numerical variations with the change of season (Tables 106 and 107).

It was minimum mostly in May (of the 39 genera of collembola obtained in the present study 27 showed their minimum number in May, 4 showed in June, 7 showed in April and 2 showed in October; of the other arthropods Mesostigmata, Staphylinidae and other unidentified groups showed minimum population in June and maximum population in July (of the 39 collembolan genera, 26 genera showed their population maxima in July, 9 showed in August, 2 showed in September, 2 showed in October and 1 showed in December; of the other arthropods only protura showed peak, population in August, while other groups showed their peaks in July. In majority of cases fluctuation of population appeared to follow a seasonal pattern with maxima in monsoon and minima in summer. In Ireland Curry (1971) found that the maximum and minimum populations were not confined to any specific time of the year. In the present study the prevalence of maximum and minimum populations were confined to particular month or season of the year which agreed with the findings of most of the other workers in different parts of the world. This was perhaps due to the prevalence of extreme seasonal variations in environmental conditions at these sites. Tables 2, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42 and figures 8, 9, 17, 21, 25, 29, 33, 37, 41, 45, 49, 53, 57, 61 generally indicated a low summer population of collembola (in different sites with mean total of each site) with increase in monsoon, thus it did agree with the general experience for this group.

Table 105

Showing relative densities of Collembolan species recorded from the various sites of West Bengal

[illegible]

Table 105 (Contd.)

Species / Sites	FL	APL	DS	RFF	UCP	ACP	ICE	SCE	GDS	SDS	DCS	DIE	URS	MHS	Total
<i>Cyphoderus albinus</i>	—	0.16	—	—	0.28	0.25	0.17	—	2.81	—	0.20	—	—	—	3.92
<i>Lepidocyrtus suborientalis</i>	—	0.78	0.68	—	—	—	—	—	—	—	—	—	—	—	1.46
<i>Isotomurus</i> sp.	—	0.18	—	—	—	—	—	—	—	—	—	—	—	—	0.18
<i>Isotomina thermophila</i>	—	—	0.74	—	1.86	1.06	—	0.64	0.65	1.29	1.29	0.36	1.11	1.30	10.31
<i>Cyphoderus</i> sp.	—	—	0.26	—	0.27	—	—	—	—	0.24	—	—	—	—	0.76
<i>Salina indica</i>	—	—	0.17	—	—	—	—	—	—	—	—	—	—	—	0.17
<i>Isotomodes</i> sp.	—	—	0.21	—	—	—	—	—	—	—	—	0	0.24	—	0.45
<i>Willemia</i> sp.	—	—	0.17	—	—	—	0.14	—	—	—	—	—	—	—	0.31
<i>Arrhopalites</i> sp.	—	—	0.15	—	0.25	—	—	—	—	—	—	—	—	—	0.40
<i>Salina</i> sp.	—	—	—	0.25	—	—	—	—	—	—	—	—	—	—	0.25
<i>Folsomides exiguus</i>	—	—	—	0.30	—	—	—	—	—	—	—	—	—	—	0.30
<i>Xenylla obscura</i>	—	—	—	0.32	—	—	—	—	—	—	—	—	—	—	0.32
<i>Pseudachorutes</i> sp.	—	—	—	0.22	—	—	—	—	—	—	—	—	—	—	0.22
<i>Hypogastrura</i> sp.	—	—	—	0.29	—	—	0.70	—	—	0.24	—	—	—	—	1.24
<i>Isotomina interrupta</i>	—	—	—	1.04	—	—	0.65	—	—	—	1.37	—	—	—	3.06
<i>Dicyrtomina</i> sp.	—	—	—	0.28	—	—	—	—	—	—	—	—	—	—	0.28
<i>Alloscopus tetracantha</i>	—	—	—	0.23	—	—	—	—	—	—	—	—	—	—	0.23
<i>Lobella siva</i>	—	—	—	0.14	—	—	—	—	—	—	—	—	—	—	0.14
<i>Lobella (L) maxillaris</i>	—	—	—	0.28	0.22	—	0.13	—	—	—	—	—	—	—	0.63
<i>Sminthurides appendiculatus</i>	—	—	—	0.18	—	—	—	—	—	—	0.19	—	—	—	0.37
<i>Tullbergia</i> sp.	—	—	—	0.18	0.23	—	—	—	—	0.14	—	—	—	—	0.55
<i>Sminthurus</i> sp.	—	—	—	—	0.22	0.26	—	—	—	—	—	—	—	—	0.48

Table 106

Showing monthly variations of total population of different collembola genera obtained from the various sampling sites of West Bengal (percentage of total population of collembola are given in each parenthesis)

Collembola genera / Months	April	May	June	July	August	September	October	November	December
<i>Lepidocyrtus</i> sp.	151 (1.09)	100 (0.72)	118 (0.85)	504 (3.63)	368 (2.65)	224 (1.61)	197 (1.47)	161 (1.16)	239 (1.720)
<i>Cyphoderus</i> sp.	89 (0.64)	34 (0.24)	71 (0.51)	256 (1.84)	222 (1.60)	180 (1.29)	111 (0.80)	107 (0.77)	142 (1.02)
<i>Sinella</i> sp.	76 (0.55)	76 (0.55)	73 (0.53)	338 (2.13)	297 (2.14)	175 (1.26)	90 (0.65)	156 (1.12)	75 (0.54)
<i>Calx</i> sp.	9 (0.06)	4 (0.03)	13 (0.09)	41 (0.29)	28 (0.20)	26 (0.19)	16 (0.12)	11 (0.08)	15 (0.11)
<i>Megalothorax</i> sp.	2 (0.01)	— —	7 (0.05)	40 (0.29)	26 (0.19)	23 (0.17)	17 (0.12)	10 (0.07)	14 (0.10)
<i>Isotomurus</i> sp.	59 (0.42)	61 (0.44)	52 (0.37)	447 (3.22)	291 (2.09)	156 (1.12)	100 (0.72)	73 (0.53)	183 (1.32)
<i>Folsomides</i> sp.	20 (0.14)	18 (0.13)	19 (0.14)	52 (0.37)	55 (0.40)	39 (0.28)	15 (0.11)	25 (0.18)	24 (0.17)
<i>Proisotoma</i> sp.	25 (0.18)	17 (0.12)	27 (0.19)	53 (0.38)	38 (0.27)	29 (0.21)	23 (0.17)	31 (0.22)	34 (0.24)
<i>Subisotoma</i> sp.	15 (0.11)	15 (0.11)	16 (0.12)	65 (0.47)	36 (0.26)	43 (0.31)	39 (0.28)	36 (0.26)	34 (0.24)
<i>Entomobrya</i> sp.	55 (0.40)	64 (0.46)	50 (0.36)	179 (1.29)	186 (1.34)	74 (0.53)	73 (0.53)	73 (0.53)	78 (0.56)
<i>Xenylla</i> sp.	35 (0.25)	15 (0.11)	35 (0.25)	125 (0.90)	101 (0.73)	75 (0.54)	61 (0.44)	44 (0.32)	53 (0.38)

Table 106 (Contd.)

Collembola genera / Months	April	May	June	July	August	September	October	November	December
<i>Stenacidia</i> sp.	12 (0.09)	8 (0.06)	13 (0.09)	33 (0.24)	24 (0.17)	19 (0.14)	27 (0.19)	21 (0.15)	22 (0.16)
<i>Sphaeridia</i> sp.	— —	8 (0.06)	2 (0.01)	5 (0.04)	— —	3 (0.02)	5 (0.04)	— —	5 (0.04)
<i>Katianna</i> sp.	8 (0.06)	6 (0.04)	10 (0.07)	68 (0.49)	47 (0.34)	33 (0.24)	40 (0.29)	32 (0.23)	26 (0.19)
<i>Sminthurides</i> sp.	— —	— —	3 (0.02)	8 (0.06)	5 (0.03)	1 (0.001)	6 (0.04)	1 (0.001)	3 (0.02)
<i>Seira</i> sp.	4 (0.03)	2 (0.01)	2 (0.01)	17 (0.12)	9 (0.07)	23 (0.17)	13 (0.09)	10 (0.07)	18 (0.14)
<i>Isotomina</i> sp.	5 (0.03)	3 (0.02)	3 (0.02)	8 (0.06)	13 (0.09)	9 (0.07)	10 (0.07)	5 (0.03)	6 (0.04)
<i>Salina</i> sp.	119 (0.86)	119 (0.86)	109 (0.78)	381 (2.74)	312 (2.24)	257 (1.85)	178 (1.28)	184 (1.32)	180 (1.29)
<i>Isotomodes</i> sp.	6 (0.04)	3 (0.02)	4 (0.03)	10 (0.07)	13 (0.09)	5 (0.03)	— —	12 (0.08)	6 (0.04)
<i>Willemia</i> sp.	— —	— —	— —	7 (0.05)	5 (0.03)	5 (0.03)	8 (0.06)	2 (0.01)	7 (0.05)
<i>Arrhopalites</i> sp.	2 (0.01)	— —	1 (0.001)	13 (0.09)	10 (0.07)	8 (0.06)	6 (0.04)	9 (0.07)	1 (0.001)
<i>Pseudachorutes</i> sp.	— —	3 (0.02)	2 (0.02)	10 (0.07)	4 (0.03)	2 (0.01)	— —	5 (0.03)	4 (0.03)
<i>Hypogastrura</i> sp.	14 (0.10)	13 (0.09)	11 (0.08)	28 (0.20)	19 (0.14)	24 (0.17)	25 (0.18)	11 (0.08)	13 (0.09)
<i>Dicyrtomina</i> sp.	— —	— —	2 (0.01)	4 (0.03)	14 (0.10)	6 (0.04)	6 (0.04)	2 (0.01)	2 (0.01)

Table 106 (Contd.)

Collembola genera / Months	April	May	June	July	August	September	October	November	December
<i>Alloscopus</i> sp.	—	—	2 (0.01)	9 (0.07)	8 (0.06)	5 (0.03)	—	2 (0.01)	2 (0.01)
<i>Lobella</i> sp.	—	—	1 (0.001)	25 (0.18)	31 (0.22)	18 (0.13)	12 (0.09)	8 (0.06)	8 (0.06)
<i>Tullbergia</i> sp.	—	—	1 (0.001)	20 (0.14)	15 (0.11)	11 (0.08)	13 (0.09)	8 (0.06)	3 (0.02)
<i>Sminthurus</i> sp.	—	—	—	15 (0.11)	9 (0.07)	7 (0.05)	13 (0.09)	13 (0.09)	3 (0.020)
<i>Dicyrtoma</i> sp.	—	—	1 (0.001)	3 (0.02)	3 (0.02)	5 (0.03)	1 (0.001)	2 (0.01)	5 (0.03)
<i>Pseudosinella</i> sp.	7 (0.05)	4 (0.03)	7 (0.05)	16 (0.12)	16 (0.12)	9 (0.07)	7 (0.05)	13 (0.09)	5 (0.03)
<i>Stenognathellus</i> sp.	3 (0.02)	4 (0.03)	6 (0.04)	18 (0.13)	18 (0.13)	10 (0.07)	8 (0.06)	7 (0.05)	7 (0.05)
<i>Bourletiella</i> sp.	2 (0.01)	2 (0.01)	2 (0.01)	—	—	2 (0.01)	3 (0.02)	2 (0.01)	2 (0.01)
<i>Sminthurinus</i> sp.	2 (0.01)	—	2 (0.01)	15 (0.11)	—	3 (0.02)	2 (0.01)	1 (0.001)	3 (0.02)
<i>Drepanura</i> sp.	—	—	5 (0.03)	16 (0.12)	13 (0.09)	9 (0.07)	16 (0.12)	9 (0.07)	8 (0.06)
<i>Brachystomella</i> sp.	9 (0.07)	3 (0.02)	8 (0.06)	21 (0.15)	17 (0.12)	19 (0.14)	19 (0.14)	11 (0.08)	18 (0.13)
<i>Isotoma</i> sp.	7 (0.05)	—	—	5 (0.03)	5 (0.03)	5 (0.03)	15 (0.11)	5 (0.03)	3 (0.02)
<i>Folsomina</i> sp.	5 (0.03)	4 (0.03)	4 (0.03)	5 —	2 —	— (0.01)	2 (0.01)	2 (0.01)	2 (0.01)
<i>Cryptopygus</i> sp.	2 (0.01)	6 (0.04)	3 (0.02)	8 (0.06)	5 (0.03)	7 (0.05)	—	1 (0.001)	3 (0.02)

Table 107

Showing monthly variations of total population of different other arthropod groups encountered from the various sampling sites of West Bengal (percentage of total arthropod population are given in each parenthesis)

Groups /	Months	April	May	June	July	August	September	October	November	December
ACARINA										
Prostigmata		277 (1.54)	244 (1.34)	327 (1.82)	977 (5.43)	842 (4.68)	683 (3.79)	530 (2.94)	466 (2.59)	531 (2.95)
Mesostigmata		304 (1.69)	254 (1.41)	244 (1.36)	866 (4.81)	766 (4.26)	528 (2.93)	375 (2.08)	415 (2.31)	398 (2.21)
Cryptostigmata		296 (1.64)	226 (1.26)	254 (1.41)	848 (4.91)	672 (3.73)	510 (2.83)	348 (1.93)	353 (1.96)	361 (2.01)
COLEOPTERA										
<i>Ptiliidae</i>		107 (0.59)	80 (0.44)	95 (0.53)	288 (1.60)	254 (1.41)	183 (1.02)	145 (0.81)	120 (0.67)	153 (0.85)
Staphylinidae		112 (0.62)	97 (0.54)	89 (0.49)	326 (1.81)	241 (1.34)	153 (0.85)	111 (0.62)	110 (0.61)	114 (0.63)
Larvae		9 (0.05)	11 (0.06)	44 (0.24)	176 (0.99)	162 (0.90)	116 (0.64)	53 (0.29)	27 (0.15)	12 (0.07)
DIPTERA										
Larvae		17 (0.09)	12 (0.07)	21 (0.12)	206 (1.14)	141 (0.78)	123 (0.68)	43 (0.24)	33 (0.18)	32 (0.18)
DIPLURA										
		2 (0.01)	—	17 (0.09)	42 (0.23)	34 (0.19)	24 (0.13)	11 (0.06)	11 (0.06)	1 (0.001)
PROTURA										
		—	—	3 (0.02)	5 (0.03)	7 (0.04)	9 (0.05)	3 (0.02)	—	—
Other unidentified Groups		97 (0.54)	56 (0.31)	35 (0.19)	225 (1.25)	103 (0.57)	94 (0.52)	86 (0.48)	113 (0.63)	127 (0.71)

As already mentioned the populations of *Lepidocyrtus* were significantly higher in July, but the population of the species *Lepidocyrtus* (*Acrocyrtus*) *scaber* showed its peak in July-August in both Reserve forest floor and in Durgapur control pasture sites, but the picture was different in polluted sewage canal embankment and in soil dune sites. In case of former the higher peak was observed in February, March and April, which might be due to inundated conditions of the embankment during monsoon; in case of latter the higher peak was recorded in October which might be due to the heavy rainfall during July-August, which was not favourable for the fauna on the slope of the dunes, thus resulting to post-monsoon peak. Choudhuri and Roy (1972), Hazra (1978a,b), Hazra and Choudhuri (1981) and Hazra (1984) recorded the July peak for *Lepidocyrtus* sp., *Lepidocyrtus* (*Acrocyrtus*) *heterolepis*, *Lepidocyrtus* (*Lepidocyrtus*) *medius*; but Mitra *et al* (1977) in a grassland of West Bengal recorded maximum population in November for *Lepidocyrtus* sp., *Xenylla*, *Sinella*, *Hypogastrura*, *Calx*, *Brachystomella*, *Sminthurides*, *Lobella*, *Stenognathelus* and *Pseudosinella*. These also attained similar maxima in July like other predominant forms in this study. Most of the collembolan forms obtained in this study exhibited low population in May (Figures 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 54, 55, 58 and 62).

Individuals of the genus *Katianna*, *Arrhopalites*, *Pseudachorutes*, *Dicyrtomina*, *Tullbergia*, *Sminthurus*, etc. were though numerically high in July showed a very irregular trend of fluctuation, being altogether absent in many of the sampling months. Besides the strong monsoon peak, when the collembolan population was considered as a whole it also showed a minor peak in December which seemed to be due to population spurt of some forms belonging to genera *Lepidocyrtus*, *Megalothorax*, *Folsomides*, *Isotomina*, *Dicyrtoma* and *Brachystomella* in winter. The prevalence of similar two population peaks was also observed by Strenzke (1949) and Hale (1966) for *Onychirus* sp. Poole (1961) reported summer maxima with smaller winter peaks for *Tullbergia krausbaeri*. Takeda (1973) observed similar two peaks for some species of collembola in a Pine forest of Japan. According to Hale (1966) the occurrence of peak populations in various of collembola was related to their life cycles; peak populations of different species were caused by the prevalence of large number of juveniles in the samples, and peaks could be correlated with the period of egg-laying in the field in species where data on times of egg-laying were available. In his opinion, the species which showed two annual peaks had two generations a year, and the species which showed a single peak had only one generation a year. In general the monsoon maxima in July and summer minima in May as met

with in this study agreed with the findings of Choudhuri and Roy (1972), Hazra (1978a,b), Hazra and Choudhuri (1981, '83).

Total acarine and other arthropod populations were also significantly higher in July with the exception of Protura which showed its peak in August (Table 118). The population peaks in July as observed in this study in case of acarines conformed the observations made by Choudhuri and Banerjee (1975, '77), Hazra (1984) in India, and Curry (1971) in temperate soils of Dublin. Thus the pattern of fluctuation of acarines as found here appeared to be a bit different from that of Riha (1951), Macfadyen (1952), Sheals (1957), Chibba *et al* (1975), Sanyal (1981a,b, 1982) in which were observed the population peaks in pre-monsoon and autumn. Prabhoo (1976) and Bhattacharya and Raychoudhuri (1979) observed post-monsoon peaks, whereas Wallwork (1959, 1972), Madge (1965) and Usher (1975) recorded the population maxima during winter.

Total Prostigmatid, Mesostigmatid and Cryptostigmatid populations were significantly higher in July when their nymphs were also significantly more abundant during this period. These results agreed with those of Evans *et al* (1961), Wallwork (1967), Curry (1971), Choudhuri and Banerjee (1977). The various species of these acarines were not identified, and thus it was not possible to draw any inference on their life cycles from the population curves involving the members of this group. However, Curry (1971) noted one generation a year for the Mesostigmatid species, *Rhodacarus roseus* and two generations a year for the Prostigmatid species, *Minunthozetes semirufus*. The numbers of coleoptera were significantly higher in July and August, Hazra *et al* (1982), also recorded maximum population of this group in August. Edwards *et al* (1967), Curry (1971) and Chattopadhyay and Hazra (1983) recorded higher population of this group of insects respectively in November, March and April. The significant abundance of Dipteran larvae in July as found here agreed with the observation of Chattopadhyay and Hazra (1983). Curry (1971) however, noted higher population of this group in November. No significant difference as to the number of Diplura and Protura was noted in this study. This corroborated the finding of Curry (1971).

The dependence of soil meso- and micro-fauna on the microorganisms like fungi, for food had been studied by earlier workers. According to Balogh *et al* (1952) the majority of the soil inhabiting oribatid mites were fungus feeders. While evaluating the feeding habits of the soil mites, Wallwork (1958) observed the mites as nymphs or adults showed strong affinity for fungal hyphae as food. According to Tonnevon (1961, '67) certain microflora present as gut symbionts in collembola might have an

important role in the digestion of plant material consumed by the host. The soil microflora especially fungi were known as food for collembola, and because collembola showed strong feeding preferences for fungal hyphae and spores it might be suggested that the distribution of these animals would partly be conditioned by the distribution of fungi (Knight, 1961). Loots and Ryke (1966) had also supported the view that the oribatid mites fed on decaying organic matter and fungi. Anderson and Healy (1972) reported the presence of fungal hyphae and humus particles in the gut contents of collembola. Choudhuri and Banerjee (1975) and Hazra (1984) also observed a direct proportional interdependence between the collembola/acari and fungi population in forest litter and on a grassland ecosystem respectively. Satchell (1974) and recently Parkinson (1983) reviewed the interactive roles of the litter microflora and fauna in decomposition processes and they reiterated the view that soil invertebrate biomass acted "as a reservoir of plant nutrients" and served as a brake to nutrient leaching from decomposing litter. This implied considerable consumption of microbial tissue (the primary decomposer organisms) by invertebrates.

The underground fungi flora encountered in this study belonged to 69 species under 45 genera (Table 1). As already mentioned, some forms differed in their abundance from one site to other. Moreover, number of species occurring in the plots of the different sampling site also varied maximum being obtained from Garbage dumping dune sites (57) and minimum from Durgapur industrial effluent site. The genus *Aspergillus* and *Penicillium* were represented by maximum number of seven species each viz., *Aspergillus niger*, *A. terreus*, *A. flavus*, *A. candidus*, *A. fumigatus*, *A. nidulans*, *A. monteridensis* and *Penicillium variables*, *P. purpurogenum*, *P. funiculonum*, *P. notatum*, *P. humicola*, *P. brefeldianum* and *Penicillium* sp. The members of these two genera were found to occur from eleven sampling sites. The two species namely *Phoma hibernica* and *Penicillium* sp. were obtained from 12 sampling sites, such a wide distribution of these species suggested their capability to withstand the varying ecological conditions. On the other hand, the species like *Oedocephalum coprophilum*, *Gliocladium fimbriatum*, *Rhizopus nigricans*, *R. oryzae* and *Pythium debaryanum* were restricted to only four sites, indicating thus that they were "stenoecious" species.

The total population of fungi flora obtained from all the sampling sites when considered together showed numerical variations with change of season. It was minimum in May and maximum in July i.e. in monsoon when soil moisture content was high except Agriculture practice land, Durgapur industrial effluent site and Sewage canal embankment site where

the populations were maximum in November-December i.e. in winter season. This agreed with the works of Waksman (1932, '52), Gujarati (1968) and Choudhuri and Banerjee (1975). According to Behara and Dash (1981) the fungal population was maximum in winter and minimum in May from Orissa in India. Besides the well marked monsoon peak, the fungal population when considered as a whole also exhibited a minor winter peak, which might be due to population spurt of some forms in winter.

Majority of the sampling sites experienced heavy rainfall in July-August which highest have resulted to a significant increase in the moisture content of soil leading to an luxuriant growth of macro- and microflora in most of the sites. Thus an optimum condition was set for supporting a larger population of both flora and fauna. Contrary to this, during summer months (particularly in May), just reverse condition was found to prevail due to low rainfall combined with minimum quantity of soil moisture which brought about a considerable reduction in number, perhaps partly due to increased mortality of the delicate and susceptible forms. Besides, the decline in population of micro-arthropod fauna might also have been due to the corresponding decline of fungal population. As mentioned earlier the fungal hyphae and spores were the major food for these groups. This finding supported the observations of Mitchell and Parkinson (1976); Dash and Cragg (1972); Visser and Whittaker (1977). These workers examined the gut contents and faeces of various soil fauna and made conventional food preference studies for these organisms. According to them collembola, acarina and insect larvae preferred *Penicillium* spp. and *Paecilomyces* spp. Moreover, the population decline of collembola might also have been contributed by the mesostigmatid mites through predation (Wallwork, 1970). In this study the total population of fauna extracted in the disturbed and polluted sites were significantly low in comparison to those extracted from the undisturbed and non-polluted sites except the Garbage dumping dune site (Figure 100, table 108).

In this study the total population extracted in the Agriculture practice land was low in comparison to the adjacent Fallow land (Figure 100). Similar results were reported by Ghilarov (1973), Edwards and Lofty (1973) and Hazra and Choudhuri (1983). Hammer (1949); Sheals (1956) and Raw (1967) found that the cultivation, particularly ploughing, considerably reduced the population and diversity of the fauna as a whole and according to them the effects of cultivation though varied with the different animal groups in majority of cases they produced adverse results. Blackith (1975) put forward a hypothesis that the soil animals were forced to live in closer association with the plants and were more subjected to the

Table 108
 Number of arthropod, collembola and acarina in fourteen different sites.
 Percentages of total population are shown in each parenthesis.

Groups / Sites	FL	APL	DS	RFF	UCP	ACP	ICE	SCE	GDS	SDS	DCS	DIE	URS	MHS
Other Arthropods	1460 (5.50)	646 (1.87)	927 (2.68)	2804 (8.11)	2824 (8.17)	958 (2.77)	940 (2.72)	794 (2.30)	3347 (9.68)	1098 (3.18)	1460 (4.22)	437 (1.26)	784 (2.27)	1138 (3.29)
Collembola	1642 (4.75)	537 (1.55)	520 (1.50)	1709 (4.49)	1648 (4.77)	506 (1.46)	562 (1.63)	464 (1.34)	2603 (7.53)	484 (2.45)	909 (2.63)	239 (0.69)	667 (1.93)	852 (2.47)
Acarina	1346 (3.89)	437 (1.26)	729 (2.11)	1831 (5.30)	1700 (4.90)	615 (1.78)	761 (2.20)	654 (1.89)	2459 (7.11)	792 (2.29)	1067 (3.09)	292 (0.84)	620 (1.79)	993 (2.87)
Total	14.14	4.68	6.29	18.35	17.86	6.01	6.55	5.53	24.32	7.92	9.94	2.79	5.99	9.83

relative influence of their rhizosphere in such situations than they would be in agricultural soils, where biological activity was less restricted to the vicinity of root system. According to Ghilarov (1973) when the uncultivated virgin soil was tilled the upper layers were destroyed and the litters and other plant debris disappeared from the surface horizon. As a result, all animals living in the litter layer found no suitable place after cultivation and obviously disappeared. Further, in his opinion the decrease in the density of the soil forms after cultivation indicated a decline in the biological activity in the soil resulting to a marked decrease in the humus content. In this study also the agriculture fields showed significantly low content of organic carbon and supported lower fauna. The number of genera of flora and fauna extracted in the cultivated sites were 22 and 10 while those were 29 and 15 respectively in the Fallow land.

The number of genera of both flora and fauna obtained from the undisturbed city park and anthropogenic pressurised city park respectively were (34, 16) and (15, 11). This might be due to the effect of trampling, which agreed with the observation of Molfetas and Blandin (1980), in which they found that the macro- and micro-arthropod fauna were in much lower densities in trampled forest floor.

The Reserve forest floor harboured 35 and 19 genera of flora and fauna respectively and corresponding number in the Deforested site were 26 and 11 respectively. This might be due to the accumulation of higher amount of litter in the forest site than that of deforested one. According to Garay *et al* (1980) the number of macro- micro-arthropods showed direct correlation with the amount of litter, similar results were also obtained by Liddle (1975) and Hazra (1978).

In Durgapur control pasture site the flora and fauna belonged to 33 genera and 11 genera respectively and in Industrial effluent site the respective number were 20 genera and 2 genera. This might be due to the effect of toxic substances released by the industries. Similar reduction in soil invertebrate fauna due to the effects of industrial effluents were also reported by Vanek (1967); Gorny (1975); Petal *et al* (1975); Petal (1978) and in India by Bhattacharya and Bhattacharya (1981) and Hazra *et al* (1982).

In the Irrigation canal embankment site the number of genera of flora and fauna respectively were 29 and 12, on the other hand the Sewage canal embankment site the corresponding figures were 33 and 9 respectively. The increased number of genera of microflora in the latter in comparison to the former might be due to the presence of high concentration of inorganic and organic nutrients in Sewage canal embankment. It agreed with the

findings of Tadros (1980) and Mitchell and Horner (1980). But the reduced number of collembola genera in this site was perhaps due to the potential toxic effects of some of the pollutants on some collembola and other soil arthropods, similar results were also obtained by Mitchell and Horner (1980) and Chattopadhyay and Hazra (1983). The number of fungal genera in Soil dune and Garbage dumping dune respectively were 27 and 37; the number of collembola genera in both the sites respectively were 14 and 10, here again it proved that toxicity of the pollutants did not exert much adverse effects on fungi but it largely affected the collembola and other arthropod fauna as was evidenced in the presence of maximum number of fungal genera and reduced number of collembola genera in the Garbage dumping dune site in comparison to that of the Soil dune site. Similar observations were also made by Mitchell *et al* (1978, '80), Hutha *et al* (1980) and Tadros (1980).

In Unmetalled road way site the genera/species of flora and fauna respectively were 18 and 9 and in Metalled highway site the respective numbers were 26 and 11. The occurrence of comparatively higher number of genera of both flora and fauna in Metalled highway site might be due to the existence of stable soil environment which provided good nutrients in comparison to the unstable muddy soil environment which reduced the pore space and provided less nutrients to soil in unmetalled road way site. According to Tadros (1980) the anaerobic conditions prevailing in muddy soil, resulted to a reduced fauna. Aoki and Kuriki (1980) also found similar results in the road side of Japan.

The vertical distribution study (Tables 35 to 59, figures 72 to 99) revealed that in almost all the cases, the cottesbota, acarina and fungi were significantly high in the upper most layers (0-5 cm) and composed 52.53% of total micro-arthropod fauna and comprised 44.26% of total fungi flora. Similar results were obtained from all over the world; case of collembola by Murphy (1953), Poole (1959, '61), Dhillon and Gibson (1962), Davis (1964), Christiansen (1964), Hale (1966), Curry (1971), Chiba *et al.* (1975), Takeda (1976) and also from the Indian sub-continent by Choudhuri and Roy (1967, '71b, '72), Hazra (1978), Hazra and Choudhuri (1983). It was evident from the figures 72 to 75 that the surface concentration of collembola was quite marked in this study, with 21.82% of total micro-arthropod population. The individual family when considered separately showed variations in their vertical distribution patterns. In the Fallow land site forms belonging to the family Entomobryidae, Isotomidae and Hypogastruridae were maximum in upper layer and less frequent in other two lower layers and Hypogastruridae were absent from 10-15 cm.

depth. The peak populations were obtained in the month of July. In Agriculture practice land site the above three dominant families were found to concentrate maximum in 5-10 cm layer but the families Entomobryidae and Hypogastruridae were not obtained from the lower layer. The population peak was observed in November. The probable cause of shifting of maximum population from surface layer to the middle layer in this site might be due to the mechanical disturbance of the upper most layer carried by tillage. Similar results were also obtained by Ghilarov (1973) and others. The shifting of peak population from monsoon to pre-winter season might be due to the waterlogging conditions during July-August in this field. In other sites the collembolan family, Entomobryidae was maximum in 0-5 cm layer (in Irrigation canal embankment, Sewage canal embankment, Garbage dumping dune, Soil dune site, Deforested site, Reserve forest floor, Durgapur control pasture site, Durgapur industrial effluent site, Undisturbed city park site) but in Metalled high way site this family was maximum in 5-10 cm. layer. The members belonging to family Isotomidae were maximum in 5-10 cm. i.e. in middle layer in Irrigation canal embankment, Undisturbed city park, Anthropogenic pressurised city park, Sewage canal embankment, Reserve forest floor, Soil dune site, Durgapur control pasture site, Durgapur industrial effluent site, whereas in Garbage dumping dune and Unmetalled road way site the isotomids were maximum in upper most (0-5 cm.) layers, the family Hypogastruridae was maximum in 0-5 cm layer in Irrigation canal embankment, Garbage dumping dune, Soil dune site, Durgapur control pasture site, Durgapur industrial effluent site, Unmetalled road way site, Undisturbed city park site ; but in Sewage canal embankment, Anthropogenic pressurised city park and Metalled highway site this family was maximum in middle (5-10 cm.) layer. The family Hypogastruridae was absent from the lower most layer in 10-15 cm. from all the sites. The family Entomobryidae was absent in this lower layer from Agriculture practice land, Reserve forest floor, Anthropogenic pressurised city park, Irrigation canal embankment, Durgapur control pasture site, Durgapur industrial effluent site and unmetalled road way site. The family Isotomidae was not present in this layer only in Durgapur industrial effluent site.

From the figures 86 to 99, it would be evident that the aggregation of acarina was also maximum on the upper most layer being 28.64% of the total microarthropod population. The sub-order prostigmata was maximum in 0-5 cm. layer in following sites : Fallow land, Agriculture practice land, Deforested site, Reserve floor, Undisturbed city park, Sewage canal embankment, Garbage dumping dune, Soil dune site, Durgapur control pasture site and Unmetalled road way site, but this sub-order was maximum in 5—10 cm.

layer in Anthropogenic pressurised city park, Irrigation canal embankment and Metalled highway site.

The suborder Mesostigmata was concentrated maximum in 0—5 cm. layers in all sites except Agriculture practice land where it was concentrated maximum in 5—10 cm. layer. The sub-order Cryptostigmata was also in higher density in 0—5 cm. layer in all the sites except in Agriculture practice land where it was maximum in 5—10 cm. layer. The Cryptostigmata was evenly distributed in all the three layers in Anthropogenic pressurised city park.

From the present study it was clear that the collembolans were maximum in two upper layers (0—5 cm and 5—10 cm) and less frequent or totally absent from the lower most layer. On the other hand acarina had shown relatively vertical distribution, the families being present in all the three soil layers.

On the whole these soil inhabiting microarthropods were most abundant on the upper layer in the present study which might be characterised by living space, favourable moisture condition and rich accumulation of organic matter. This agreed with the findings of Murphy (1953), Haarlov (1960), Hale (1967), Wallwork (1970), Curry (1971), Price and Benham (1977), Choudhuri and Banerjee (1977), Hazra (1978) and Hazra and Choudhuri (1983).

According to Haarlov (1960) and Dhillon and Gibson (1962) the distribution of a given species might be related to some of its morphological characteristics i.e. life forms, and attempted to apply this concept not only to collembola but also to soil inhabiting mites and Diptera larvae. Changes in the numbers of main groups of Acari and Collembola in the different soil layers drawn in figures 72 to 99 and the tables 45 to 59, revealed quite marked changes with months in the vertical distribution patterns of most groups. Such changes in the number of occurrence of groups in different soil layers could be cited as evidence of vertical migration.

As it was evident from the figures 72 to 99 in almost all the sampling sites the populations of collembola and acarina were less in number in the upper most layers during April-May (summer) in comparison to middle layers, but during July-August and slightly during December-January it was reversed (except in the Agriculture practice land, Industrial effluent site, Sewage canal embankment site, where the results were different, might be due to the water logging conditions of these sites during monsoon). This kind of seasonal changes in vertical distribution was recorded by workers like Glassgow (1939), Strickland (1945), Stockli (1957), Belfield (1956),

Ogino *et al* (1965) and Chiba *et al* (1975) observed that the mesofauna responded to desiccation by moving downward into the lower horizon of the soil, where as according to Curry (1971) due to absence of marked seasonal and climatic differences at Lyons Hill in Ireland not much difference in vertical migration of total acarina population was noticed. Wallwork (1970) observed existence of moisture and/or temperature relationship of collembola and acarina which affected their choice of microhabitat in the soil profile. Moreover, the abundance of the juvenile forms of both groups in upper layers as observed in this study conformed the findings of Choudhuri and Banerjee (1975), Takeda (1976) and Hazra (1976, '78b).

As to the role of edaphic factors it might be assumed that the factors analysed in this study exerted both significant and insignificant effects either singly or in a cumulative way, depending on the nature of the sites. This could be substantiated if an analysis was made as to the extent of important different factors by taking into consideration the mean value of the soil factors during maximum population peaks in different sampling sites (Table 109). The data in the table 109 showed that in most of sampling sites the population was maximum in July when the factors like moisture, organic carbon, nitrate and fungal population also were significantly high and other conditions were optimum.

In the summer months soil-temperature was significantly high while moisture, organic carbon and nitrate were low, as a result the populations of flora and fauna were lean during that period. Of the edaphic factors studied, temperature showed a wide variation with the change of season ranging between 15.5°C and 39.5°C. Temperature and moisture being interlinked might exert their effects on the population conjointly (Schebert, 1930). In the summer months the samples yielded low population when the temperature was significantly high and moisture were appreciably minimum. Similar result was recorded by Webb (1970). It might be noted in this connection that the direct influence of temperature on the distribution pattern of soil arthropods was difficult to evaluate (except in Antarctic where according to Block (1980), temperature was a major determinant of arthropod activity); because the collembolans and acarines were known to withstand wide range of temperature, some forms of collembola and acarina could withstand temperature as low as—50°C (Paclt, 1956, Pryor, 1962; Block *et al* 1978; Somme, 1978 and others as high as 55°C (Willson, 1960; Dunger, 1964; Wallwork, 1980). Agrell (1941), Bellinger (1954), Davis (1963) and Takeda (1976) reported high rate of mortality of some forms of arthropods in a temperature range between 34°C and 40°C. Ashraf (1971) in his laboratory experiment reported that 30°C was the

optimum temperature for some species of collembola. In this study as the sampling sites belonged to typical tropical monsoon climate, the variation in soil temperature ranged from 30°C-39°C in contrast to the moisture content which varied widely ranging from 4.5% to 32.5%, resulting in minimum (summer) and maximum (monsoon), populations of microflora and fauna. In the monsoon months when the maximum population occurred; the soil temperature was higher being more or less near to summer temperature in the climate of Gangetic West Bengal (India), having high precipitation rate and temperature. According to Christiansen (1964) the relationship between population and temperature optima was not clear. The statistical analysis for finding out regression and correlation between the microfaunal and floral population and the edaphic factors did not indicate any significant correlation between temperature and the collembola-acarina-fungi population even upto the species level of collembola and sub-order level of acarina, except in three sites viz., Durgapur control site, Agriculture practice land and Irrigation canal embankment where temperature showed significant correlations with the collembolan population (in DCS-total collembola population was negatively correlated; in APL—the species *Subisotoma fitchioides* was negatively correlated; in ICE—the species *Isotomina interrupta* was negatively correlated), the acarina showed significant correlation in only one site viz., Agriculture practice land; but the fungi population showed significant correlations with the temperature in three sites viz., Durgapur industrial effluent site, Agriculture practice land and Sewage canal embankment. The negative correlations shown by temperature in this study might be explained in terms of the fact that the rise of temperature was expected to cause greater evaporation from the soil making it dry and the minimum population in summer was generally attributed to both the lesser water content and to the physical instability of the humus layers in this type of climate in West Bengal. But the actual influence of temperature on soil organisms could not be evaluated unless it was considered in conjunction with the effect of moisture.

The moisture content of soil showed wide range of variation from 4.5% in a sample collected from the Deforested site to 32.5% in a sample collected from Sewage canal embankment, and it was found to be positively and significantly correlated with the collembolans, other arthropod fauna and fungi population in almost all the sampling sites with the exception of the two polluted and one cultivated sites viz., Sewage canal embankment, Durgapur industrial effluent site and Agriculture practice land, where moisture showed negative and non significant correlation with the population of flora and fauna even upto the species level of collembola. But it was marked interestingly that the fungi population showed negative correlation only in the Durgapur industrial effluent site and showed positive correlation with the two other

sampling sites. The negative correlations showed by moisture in these three sampling sites might be due to the fact that the sampling plots in Sewage canal embankment and Durgapur industrial effluent site were situated on the embankment of the respective canals, as a result during monsoon due to heavy rain-fall most of the sampling sites remained frequently submerged and the Agriculture practice land also remained waterlogged during this period, thus affecting adversely the population of collembola, acarina and fungi at DIE, and also shifted their population peaks from monsoon to some other months. Similar results were also obtained by Oatman and Voth (1972) while studying the effects of flooding on the soil fauna. Mitra *et al* (1977, '83) studied the impact of a rain water drainage of Calcutta and Pai and Prabhu (1981) worked in a paddy field of Kerala. Except on the above three sampling sites (DIE, SCE and APL) in all other sites the populations of fauna and microflora were found maximum in monsoon months (July—September) when the moisture level in soil reached its peak, and minimum in the summer months (except in APL, DIE, SCE sites) when the moisture content was significantly low. Shackles and Murphy (1969) came across abundance of collembola and acarina from the plots richer in water content. The results obtained in this study agreed with those of (in case of collembola) Agrell (1941), Backlund (1945), Sachsse (1960), Poole (1961), Knight (1961), Christiansen *et al* (1961), Pryor (1962), Janetsehek (1963), Davis (1963), Choudhuri and Roy (1972), Gupta and Mukherjee (1976), Mitra *et al* (1977, '84), Hazra & Choudhuri (1981) and Hazra and Choudhuri (1983); and with those of (in case of acarina) Macfadyen (1965), Loots and Ryke (1966), Fujikawa (1970), Choudhuri and Banerjee (1977), Sanyal (1981) and Mitra *et al* (1983), in case of soil fungi Waksman (1932, '52), Dixon (1928), Cobbs (1932), Ghosh and Dutta (1960), Mishra (1964), Gujarati (1968), Choudhuri and Banerjee (1975), Parkinson (1983) and Hazra (1984). Hammer (1953), Dhillon and Gibson (1962) and Davis (1963) reported negative correlation of some forms of soil mites with soil moisture. Macfadyen (1952), Huther (1961), and Murcuzzi (1962) found no association of moisture with population. In the opinion of Haarlov (1960) the favourite habitats of the micro-arthropods were characterised by stable, humid conditions with plant material available throughout the year. The marked increase in the populations of collembola, acarina and fungi in monsoon months, perhaps, suggested the probability of the existence of the hydrophilic forms in different faunal groups, having some preference to moisture condition. For instance, Agrell (1941) noted large similarity in the collembolan fauna of various moist Alpine habitats, and correspondingly a large similarity prevailed between various dry habitats. Sendstad (1977) found characteristic species of various moist habitats, and other characteristic species of various moist habitats, and other characteristic

species for different dry habitats. Hagvar (1982) found some characteristic hygrophilic and xerophilic collembolan species in some moist and dry habitat respectively. In the present study also the forms like *Lobella*, *Tullbergia*, *Dicrytoma*, *Drepanura*, *Salina*, *Katianna*, etc. were abundant during monsoon and the populations sharply declined with the onset of monsoon and became totally absent from the field during summer (Table 106), therefore, these forms might be termed as hygrophilic. Besides this, the variable capacity of the collembolan forms to withstand the condition of desiccation or drought occasionally prevailing in nature (Choudhuri, 1963) might also be considered as one of the factors contributing to the population fluctuation. From the information available to date it might be assumed that the moisture content of soil exerted direct or indirect influence on the microfloral and faunal population by (i) maintaining the soil reaction, (ii) controlling humification, (iii) stimulating the growth of macro- and microflora.

The content of organic carbon varied between 0.59% and 4.53% and exhibited a strong positive correlation with the populations of acarina, collembola and fungi (Tables 60 to 99, except in SCE site). It also seemed likely that some instances such as dryness as such influenced the soil fauna indirectly rather than directly since this factor largely determined the type and density of the vegetation which in turn contributed towards the augmentation of soil organic matter. The latter not only served as a source of food but influenced the amount of living space available for soil animals. The increased population of fungi and fauna with the increased content of organic matter in soil as met with in this study was reported already by Haarlov (1960), Christiansen *et al* (1961), Hollerland (1962), Davis (1963), Curry (1969), Choudhuri and Roy (1972), Hazra (1978) and Hazra and Choudhuri (1983) in collembola, and in acarina Ryke and Loots (1967), Banerjee (1974), Choudhuri and Banerjee (1977), Joy and Bhattacharya (1981), Sanyal (1981), and in case of soil fungi Mishra (1964), Gujarati (1968), Dickison and Pugh (1974), Cromack *et al* (1975), Satchell (1974), Parkinson (1983), Tadros and Varney (1983) and Hazra (1984). Moreover, the concentration of larger population of flora and fauna in the litter and humus layer suggested their affinity to organic matter. The high temperature and low moisture content of soil seemed to influence the amount of organic carbon as it was evident from the present study that during summer, soil contained less amount of organic carbon which might be due to low moisture level and ready oxidation occurring in organic matter.

It should be mentioned in this connection that the edaphic factors like, organic carbon, nitrate and moisture showed an adverse impact on the fauna in an atypical site of Sewage canal embankment, the reason might be

due to the fact that this was the only site where summer peak of the population was observed due to frequent inundation of the embankment during rainy season, as a result the soil flora and fauna were bound to remain very low; but the amount of above mentioned soil factors like nitrate and organic carbon were directly dependent on the moisture content of the soil, this finding agreed with the observations of Mitra *et al* (1977, '83) and Prabhoo (1981), where they also found negative correlations of fauna in a drainage system and in an inundated paddy fields respectively. The concentration of nitrate in the sampling sites under this study and in most cases increased with the onset of monsoon when the populations of both flora and fauna also became numerically high. The break down of arthropod exuviae by bacterial action started at the rainy season and for this reason the nitrate content of soil increased (Veld Kemp, 1955, and Belfield, 1970). The analysis of correlation coefficient values revealed that the contents of nitrate in most cases were significantly correlated with the populations of fungi, acarina and collembola. This was compatible with the findings of Kühnelt (1963), Choudhuri and Roy (1972), Choudhuri *et al* (1978), Hazra and Choudhuri (1983). According to Anderson *et al* (1983), the increased nitrate content was not simply due to excretion, the nitrate might be either derived heterotrophically from grazed fungi or from autotrophic nitrification stimulated by increased ammonium availability, this was experimented with ^{15}N labelled millipedes and showed that only approximately 7% of the mobilised nitrogen was attributable to the animals. However, the nitrate being most essential macronutrients for the plants, probably exerted its influence on the collembolan and other soil arthropod population through vegetation. As mentioned earlier in the monsoon months increased content of moisture stimulated decomposition, ammonification, and nitrification through activities of some bacteria and resulted to a higher nitrate level. Therefore, it might be assumed that the content of nitrate brought about appreciable changes in both macro- and micro-climates and thus led to population fluctuations.

The value of pH of the soil samples varied between 6.63 and 7.52 and these were perhaps well within the tolerance range of most of species as reported by Frenzel (1936), Butschek (1951), Strenzke (1952), Franz (1954), Choudhuri and Roy (1972), Hazra *et al* (1976), Choudhuri and Banerjee (1977), Hazra and Choudhuri (1981) and Sanyal (1981). In July when the population attained its peak the mean value of pH read at 7.23. Therefore, it would be reasonable to believe that more or less neutral pH was favourable to arthropod population. The statistical analysis showed that the pH in most cases showed significant correlation with the fungi, acarina and collembola (except for fungi which showed significant negative

correlation in sites DIE and DS, for collembola which showed negative significant correlations with total population, *Isotomiella minor*, *Megalothorax minimus* in MHS; *Proisotoma* sp. in URS, *Isotomina thermophila* in DS and positive significant correlation with *Isotomina thermophila* in SCE, for other arthropod which showed negative significant correlation in DIE, mesostigmata in DS, total arthropod, prostigmata and mesostigmata population in MBS). This agreed with the findings of Agrell (1941), Bellinger (1954), Dhillon and Gibson (1962), and Choudhuri *et al* (1978). Edwards and Lofty (1974) reported that the population of surface forms (Entomobryidae, Sminthuridae, Isotomidae) showed very little variation in the plots having pH values between 4.0 and 8.0, while the forms living below the surface (Poduridae and Onychiuridae) exhibited more affinity to neutral pH. Thus it would be clear from the present study and also from the data presented by the previous workers that the Hydrogen ion concentration had very little or no direct effect on the flora and faunal population but it might contribute to the population fluctuation by indirectly influencing vegetation and other physicochemical properties of the soil.

The number of fungi in the sampling sites under this study varied between 1 thousand and 44 thousands (per gm. soil), in most cases the populations increased during monsoon, when the populations of soil collembola and other arthropod also increased. The analysis and correlation co-efficient values revealed that the fungi populations in all cases (except SCE) were positively and significantly correlated with the populations of acarina and different species of collembola, this was compatible with the findings of Knight (1961). The soil fungi served as food for collembola and mites, and these animals showed strong feeding preferences for fungal hyphae and spores. It might be suggested, therefore, that the distribution of these soil arthropods would partly be conditioned by the distribution of fungi. Tadros and Varney (1983) found a positive correlation between arthropods and fungi inhabiting a particular soil type. According to them the soil arthropods, especially mites and collembola constituted 75%-80% of the arthropods found in soil and fed on bacteria and fungi. Similar results were also obtained by Choudhuri and Banerjee (1975) and Hazra (1984).

The concentration levels of the three heavy metals (Chromium, Copper and Lead) in the soil considered in the present study showed wide range of variation from 6.25 ppm to 304.11 ppm (Chromium), 6.21 ppm to 307.46 ppm (Copper) and 8.24 ppm to 162.11 ppm (Lead); and these were found to be negatively correlated in all cases with the populations of soil biota (Tables 86 to 97, 100, 101 and 109 to 114, 116) but were not significant in few cases of fungi, acarina and collembola. The collembola were non-significant in DCS plots between Cu and total population of collembola,

Isotomina thermophila/*Isotomina interrupta*; in DIE plots between Cu/Cr/Pb and *Entomobrya* sp./*Isotomina thermophila*; in SCE plots between Pb and *Isotomina thermophila*/*Folsomides parvulus*; between Cu and *Folsomides parvulus* between Cu/Cr/Pb and *Isotomina interrupta*; between Cu and *Lepidocyrtus* (*Ascocyrtus*) *heterolepis*; between Cu/Pb and total population of collembola/*Hypogastrura* sp., in GDS plots between Cu and total population of collembola/*Megalothorax minimus*; between Cu/Pb and *Lepidocyrtus medius*; in SDS plots between Cr/Cu and total population of collembola; between Cu/Cr and *Subisotoma fitchioides*/*Isotomina thermophila*/*Isotomurus ciliatus*; in MHS plots between Pb and *Megalothorax minimus*/*Isotomiella minor*/*Isotomina thermophila*. The acarines were found to be non-significant between Cu and mesostigmata in DIE plots, in SDS plots between Cr/Cu and total acarina population/mesostigmata population; between Cu/Pb and prostigmata; in GDS plots between Pb and total acarina population/prostigmata population; between Cu and prostigmata population; in ICE plots between Cu/Cr/Pb and total acarina population; between Cu/Cr/Pb and prostigmata/mesostigmata; in SCE plots between Cu/Pb/Cr and all acarina populations between Pb and mesostigmata population; in MHS plots between Cr and prostigmata/mesostigmata. The fungi populations also showed insignificant results in DIE site between Cr/Cu/Pb and total population of fungi; in SDS site between Cr/Cu and total fungal population; in ICE site between Cr/Cu/Pb and total fungal population. Thus from the present study it appeared that the same floral and faunal groups, even same species in different sites in some cases did not show any significant correlation with these three heavy metals, which might be due to the development of increased susceptibility to the toxicity of the heavy metals by those flora and fauna. Similar results were also obtained by Bradshaw, *et al* (1965); Hilton (1967), Edwards (1969), Griffiths *et al* (1974), Williams *et al* (1977), Wong and Kwan (1980), Bhattacharya and Bhattacharya (1981) and Kandaswamy, Rajanan and Oblisami (1981) on different microflora and fauna. However, no definite conclusion could be drawn as to whether the fungal flora and microfauna collected from the sites which contained a rather high level of various heavy metals were tolerant populations. Further studies should be made on the toxicity of heavy metals on the microflora and fauna collected from these highly polluted areas. Except the Sewage canal embankment and Durgapur industrial effluent sites in all cases (where quantitative estimation of heavy metals was done), the populations were found to be maximum in monsoon months (July-September) when the levels of the three heavy metals (Chromium, Copper and Lead) were significantly low, and minimum in the summer months when the levels of the three heavy metals reached their respective peaks (Table 109 and figures 5-5f; 6d-6f; 7d-7f; 8d). It was observed

Table 109

Showing the values of soil factors and the levels of heavy metals in the months when maximum and minimum total soil arthropod fauna extracted in fourteen different sites.

Sampling sites	Temperature	Moisture	Organic	pH	Nitrate	Copper	Lead	Chromium	Month of maximum and minimum population of total fauna
FL	34.75	25.2	3.10	7.2	2.25	—	—	—	JULY
	37.90	5.70	2.15	7.3	1.33				MAY
APL	30.00	17.00	2.48	7.33	1.63	—	—	—	NOVEMBER
	32.80	22.35	1.83	7.30	1.23	—	—	—	AUGUST
DS	33.85	19.00	2.04	7.32	1.80	—	—	—	JULY
	36.85	5.00	1.10	7.39	1.05	—	—	—	MAY
RFF	31.75	19.75	3.85	7.45	2.35	—	—	—	AUGUST
	33.25	9.85	2.38	7.06	1.75	—	—	—	MAY
UCP	35.25	25.00	3.15	7.14	3.10	—	—	—	JULY
	35.85	9.10	1.80	7.17	1.33	—	—	—	MAY
ACP	32.80	14.45	1.04	7.10	1.10	—	—	—	JULY
	36.00	5.70	0.62	7.10	0.74	—	—	—	MAY
ICE	33.55	24.95	3.20	7.57	1.90	9.02	9.73	7.77	SEPTEMBER
	34.63	18.78	2.75	7.38	1.27	12.77	10.35	8.45	JUNE

Table 109 (Contd.)

Sampling sites	Temperature	Moisture	Organic	pH	Nitrate	Copper	Lead	Chromium	Month of maximum and minimum population of total fauna
SCE	33.85	15.98	2.49	7.16	1.60	137.26	119.93	142.74	APRIL
	32.63	29.00	3.23	7.75	2.18	170.70	157.80	206.30	SEPTEMBER
GDS	33.35	24.50	3.93	7.16	2.90	94.63	54.77	54.40	JULY
	35.73	11.90	2.50	7.32	1.88	134.60	64.76	73.09	MAY
SDS	34.50	14.63	1.94	7.14	1.34	15.10	20.63	11.88	JULY
	37.85	6.25	1.66	7.21	1.05	20.32	26.77	15.05	MAY
DCS	35.40	25.50	3.02	7.10	2.40	7.16	8.74	7.83	JULY
	39.00	10.35	1.91	7.15	1.15	9.27	18.14	11.50	MAY
DIE	30.00	20.10	2.25	6.76	0.85	228.90	177.98	99.23	NOVEMBER
	31.75	24.60	1.91	6.67	0.64	299.54	249.30	261.42	SEPTEMBER
URS	34.17	17.42	1.43	7.23	0.74	—	—	—	JULY
	36.75	5.90	1.15	7.39	0.49	—	—	—	MAY
MHS	35.20	18.50	1.82	7.16	1.18	54.65	219.70	66.24	JULY
	36.88	6.88	1.41	7.33	0.88	68.66	276.7	75.31	MAY

clearly from the present study that the qualitative and quantitative reduction of total microflora and fauna increased with the increase level of concentration of these pollutants in the soil. The results agreed with those of Vanek (1967), Edwards (1969); Tyler (1972); Gorny (1975); Petal *et al* (1975), Keeney and Walsh (1975); Takai (1977), Mc Grath, Fleming and Poole (1977), Petal (1978), Curry and Cotton (1980); Carter *et al* (1980); Bhattacharya *et al* (1980) Hazra *et al* (1982) and Chattopadhyay and Hazra (1983). However, Gorny (1976) found industrial pollutants rich in nitrogen, increased population of *Formica polycтена*. Dindal (1977) and Lebrun *et al* (1978) suggested that some Cryptostigmatid mites could be very useful as bioindicators of the pollution of soil and air. Bhattacharya and Bhattacharya (1981, '83) reported abundance of two Cryptostigmatids and an Astigmatid in a site where it was polluted by the effluent from a coal distillation plant. Mazina and Khletsikova (1975); Oblisami and Rajanan (1977) reported decrease in microbial populations in soil added with the effluents of Polyvinyl chloride and other chemical industries. According to Kandaswamy *et al* (1981) there was a decrease of fungal population in soil due to addition of effluents from chemical and PVC pipe industries, while an increase was observed with that of aluminium industry and they found no growth of actinomycetes in effluent added soil from chemical industry. According to Tyler (1974, '75, '76); Liang and Tabatabai (1977, '78) and Williams *et al* (1977) the high concentration of heavy metals in plant litters would inhibit the C and N mineralization, Cellulose and Starch decomposition and enzyme activity of decomposers resulted to smaller number of micro-organisms. The highest levels (mean) of all the heavy metals in different experimental sites in the present study are listed in table 110. It was interesting to note that the

Table 110

Showing total quantity of heavy metals in all the polluted sites
(Mean level of total data)

HEAVY / SITES METAL	ICE	SCE	GDS	SDS	DCS	DIE	MHS
CHROMIUM (ppm)	8.33	178.22	64.02	13.23	9.49	168.11	69.58
COPPER (ppm)	11.81	161.80	105.20	15.45	8.04	236.63	59.87
LEAD (ppm)	10.47	140.13	58.72	23.22	13.57	196.19	244.91

concentration levels of the three metals were highest in three different sites viz., Chromium was highest in Sewage canal embankment site (178.22 ppm), Copper was highest in Durgapur industrial effluent site (236.63 ppm) and Lead was highest in Metalled highway site (244.91 ppm). The toxicity of Copper on soil fauna was studied by Keeney and Walsh (1975), McGarth, Fleming and Poole (1977) and Curry and Cotton (1980). In this study it was found that the highest copper concentrated area (DIE) bound the lowest percentage of all the soil fauna, this might be due to the fact that all these soil fauna were highly sensitive to Copper.

The highest number of all the faunal groups and the higher number of fungi as obtained from the old abandoned Garbage dumping dune might be due to the slightly higher level of metals in this site as well as faunal growth, (Table 108). Similar phenomena were observed by McNeilly and Bradshaw (1968), Wong and Kwan (1980). The reduction in the level of heavy metal in this abandoned polluted site might be due to soil's unique ability for detoxification of wastes as suggested by Moore and Moore (1976). The DIE showed the lowest number of fauna and minimum diversity of collembola and acarina species in the present study and thus confirmed that the gross industrial effluent discharge on soil was extremely toxic to the composition of microarthropod fauna. This might be due to the impact/stress of high levels of heavy metal in soil coming from industrial discharge on acarina and collembola (Table 108 and figure 100), similar results were also obtained by Joose and Buker (1979), Curry and Cotton (1980).

Indices of similarity

An attempt was made to compare objectively the Collembola communities associated with the different habitats. Sorensen's (1948) quotient of similarity (QS) was calculated for comparisons of the fauna taken in two

samples from the expression
$$QS = \frac{2j}{(a+b)} \times 100$$
 where j was the number

of common species to both samples, 'a' was the number of species recorded from Sample A, and 'b' the number of species recorded from sample B. The result was based on total species. The quotients thus obtained were compared with the Renkonen number and presented in the form of coincidence table 111, which were then simplified by Mountford's procedure (1962) and presented as dendrogram in figure 101.

From figure 101, it would be evident that the pair of sites (V and XIV) namely Undisturbed city park and Metalled highway site showed the highest similarity index (58.49%). The indices of similarity between this group

Table 111

Coincidence table showing Renkonen numbers calculated for pairs of sites.

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	
FL	APL	DS	RFF	UCP	ACP	ICE	SCE	GDS	SDS	DCS	DIE	URS	MHS	
100	38.90	7.67	40.55	45.42	11.64	8.84	44.50	40.64	29.78	14.69	10.00	11.94	43.98	FL
	100	25.48	29.37	9.97	16.58	14.74	20.85	4.10	19.74	13.51	12.48	3.17	21.48	APL
		100	7.19	31.43	29.76	11.96	25.14	9.46	31.07	26.84	25.19	50.58	29.64	DS
			100	30.92	12.00	20.98	25.58	22.59	19.96	28.76	7.92	8.79	38.24	RFF
				100	33.72	22.76	31.20	54.35	26.94	27.49	33.38	32.41	58.49	UCP
					100	13.62	23.87	15.20	34.58	32.01	37.56	35.05	33.60	ACP
						100	4.21	8.36	13.70	29.39	12.63	22.53	12.01	ICE
							100	23.09	48.57	35.57	28.70	27.94	44.68	SCE
								100	11.38	15.49	3.50	8.60	45.57	GDS
									100	36.95	24.34	31.90	32.72	SDS
										100	26.29	20.84	37.21	DCS
											100	48.54	33.42	DIE
												100	30.21	URS
													100	MHS

(V and XIV) and each of the remaining sites were determined, which reflected that the sites I, IV and IX exhibited greater similarity to the group (V and XIV) than to the group (III and XIII). The sites (VI and XII) and (VIII and X) were more similar to each other having affinity to the group (II and XIII). The sites II and VII did not show similarity to any of the above groups. Similarity indices were not, however, clear for the site XI.

Besides the geographical position and composition of the habitats, the soil arthropod particularly the acarina and collembola communities were probably regulated by a number of factors. Soil fertility, soil profile, humus type, water content and microflora reportedly influenced their distribution and life conditions in environmentally poorest and richest soils. When the chemical pollutants were added to the aforesaid list of factors; it would be revealed that the heavy metals were negatively correlated with all the groups of soil flora and fauna. The results of this investigation mostly corroborated those of other workers, while in certain aspects they showed striking differences from those reported earlier. This might be due to the prevalence of local environmental factors which were likely to exert profound influences in the pattern of population structure (Wallwork, 1970). It might be inferred that the factorial components evaluated here in conjunction with the other components not considered in this study collectively contributed to the population fluctuation and the distribution pattern of soil arthropod fauna and microflora in the different habitats of tropical climate of Eastern India.

Garay *et al* (1980) rightly proposed the use of Microarthropods as indicators of trampling damage. The contention of Garay *et al* (1980) could perhaps, be justified on the basis of the results obtained here. These observations might afford to propose the use of acarina and collembola communities as indicators of damage of soil environment due to degradation and pollution. In particular, this could be used for all practical purposes in evaluating the threshold beyond which these damages were irreversible. Taking into account the overall quantitative and qualitative changes undergone by the communities of soil arthropods, precise information could be obtained. The qualitative variations of a single species or category did not permit to draw definitive conclusions, although these could be provided by the comparative study of species having different sensibilities. In this context the question of studying the whole community as an indicator of the above mentioned damage became indispensable.

Lastly, it would be worth mentioning that any attempt to unravel the interactions between edaphic factors and fungi/collembola/acarina population

would be abortive unless the behaviour of individual species in relation to each factor and pollutant were studied separately under controlled laboratory conditions (Choudhuri and Roy, 1972; Garay *et al.*, 1980, Wong and Kwan, 1980.)

SUMMARY

1. Thesis contained results of an ecological study involving impact of different soil factors and some heavy metal pollutants on subterranean collembola, acarina and other arthropod populations from fourteen different poor, polluted and undisturbed habitats of West Bengal, India.
2. Soil factors like organic carbon, temperature, moisture, pH, heavy metal contents such as chromium, copper and lead were taken into consideration. Fungi population and their interactions with these parameters and soil fauna were also studied. All these were found to vary seasonally and sampling site wise.
3. A total of 4, 410 soil samples were drawn from various plots at monthly interval over a period of twentyone months (April, 1979 to December, 1980). Of 42 plots sampled, 9 were from poor soil environment, 12 were from polluted, and remaining 21 were reserve forest floor, undisturbed city park, uncultivated fallow land, unmetalled road way, irrigation canal embankment, soil dune and undisturbed pasture land.
4. Population density of total arthropod, acarina and collembola in order of abundance were Garbage dumping dune site with 18.35%; Undisturbed city park site with 17.86%; Fallow land site with 14.14%; Durgapur control pasture site with 9.94%; Metalled highway site with 9.63%; Soil dune site with 7.92%; Irrigation canal embankment site with 6.55%; Deforested site with 6.29%; Anthropogenic pressurised city park site with 6.10%; Unmetalled road way site with 5.99%; Sewage canal embankment site with 5.53%; Agriculture practice land site with 4.68% and Durgapur industrial effluent site with 2.79%.
5. Maximum species diversity was observed in the Reserve forest floor site and minimum diversity was recorded in the Durgapur industrial effluent site.
6. The acarina fauna belonged to three sub-orders : Prostigmata, Mesostigmata and Cryptostigmata. They were seen to tolerate widely varying habitat as they occurred in maximum number in all the sampling sites, except prostigmata which did not occur in the industrial effluent site.

7. Species composition of collembola of fourteen habitats differed considerably, no species of collembola was found to occur in all the habitats while twentythree species of collembola were restricted to one site as follows :

Salina sp., *Folsomides exigua*, *Xenylla obscura*, *Pseudachorutes* sp., *Dicyrtomina* sp., *Alloscopus tetracantha*, and *Lobella siva* were confined to only Reserve forest floor site, *Xenylla welchi* and *Isotomurus* sp. were confined to only Agriculture practice land, *Salina indica*, *Isotomodes* sp. and *Isotomina* sp. were confined to Deforested site, *Bourletiella* sp. and *Sminthurinus* sp. were confined to Industrial effluent site, *Folsomina* sp. and *Brachystomella* sp. were confined to Sewage canal embankment site, *Katianna* sp. was confined to Fallow land site, *Dicyrtoma* sp. was confined to Anthropogenic pressurised city park site, *Lepidocyrtus magnificus* was confined to Durgapur control site, *Drepanura* sp. was confined to Soil dune site, *Sinella (Coecobrya)* sp. was confined to Irrigation canal embankment site and *Cryptopygus thermophilus* was confined to Metalled highway site.

8. Fungal population studied belonged to 69 species under 45 genera, no species of fungi was found in all the fourteen sites studied, and no species of fungi was found to be confined to a particular site.
9. In order of dominance sub-order prostigmata occupied topmost position among the other arthropod fauna.
10. Numerically the genus *Lepidocyrtus* occupied topmost position among the collembolans and was wide spread and the genera *Isotomina*, *Isotomiella* : *Megalothorax* respectively occupied second, third and fourth position. Population of most of the other collembola genera were numerically low and irregular in distribution.
11. Population density varied considerably from month to month, season to season; maximum population peak also varied in some poor and polluted sites, usually showing maxima in monsoon and minima in summer months.
12. As indicated in population-curves, population-fluctuation of both arthropods and collembolans were though regular in majority of sub-orders and species, in case of few species of collembola it was irregular.
13. The vertical distribution study showed that the population density of collembola, acarina and fungi in majority cases were maximum in the topmost layer (0-5 cm.).

14. The seasonal changes in vertical distribution were also studied and it was observed that the populations of collembola and acarina were less in number in upper most layer during April-May in comparison to that of middle layer (5-10 cm.) and during July-August it was just opposite.
15. Of the soil factors viz., organic carbon, nitrate and moisture were found to be positively and significantly correlated with the population of total arthropods, total collembola except in SCE where all these three parameters were negatively correlated and in APL site only moisture was negatively correlated. In respect to soil temperature and pH nature of correlation varied from one site to other and one faunal group to other. For instance soil temperature was negatively correlated with the total collembola population at Fallow land site but showed positive correlation with the arthropod population in the same site again pH showed negative correlation with both the faunal groups at the same site.
16. Relationship of these soil factors when studied at the sub-order level in acarina and at the species level in collembola showed more or less same correlation as that of total population; but in some cases the correlation varied from species to species in case of collembola.
17. When the correlations were studied in regard to the populations of arthropod, collembola and fungi they showed in all cases significant positive relationship even at the sub-order level of acarina and species level of collembola.
18. Organic carbon, nitrate and moisture were found to bear positive significant correlations with the fungi population, except the moisture in the industrial effluent site, where it showed a negative correlation with the fungi.
19. Heavy metal pollutants like chromium, copper and lead showed significant negative correlations with the total population of arthropod, collembola and fungi in all the studied polluted sites. Similar results were also obtained in case of different species of collembola and sub-orders of acarina (except prostigmata which showed positive correlation with copper in Fallow land site).
20. Similarity indices when studied for different sites it showed the highest affinity (58.84%) between Undisturbed city park and Metalled highway site. The sites like Fallow land, Reserve forest floor and Garbage dumping dune showed greater similarity with those of Metalled highway site and Undisturbed city park site. Anthropogenic pressurised city park and

Industrial effluent sites showed greater similarity with the Sewage canal embankment site and Soil dune site. Agriculture practice land and Irrigation canal embankment sites were similar to each other but Durgapur control pasture site did not show any affinity to any of the above groups.

21. From the present study it might be inferred that the effect of trampling in the Anthropogenic pressurised city park and Unmetalled roadway site, and mechanical disturbances due to agriculture practice, deforestation, irrigation canal and heaped soil which caused the poor soil environment and the effect of industrial discharge, sewage discharge and automobile smoke discharge which caused the polluted soil environment reduced the total microfauna and flora and also some species of collembola. Therefore, with the reduction of these active bio-agents the process of soil formation would be very slow associated with the drastic ultimate effects on the soil fertility in West Bengal areas.

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