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ROLE OF MICROBIAL FLORA ON DISTRIBUTION OF COLLEMBOLA AT WASTE DISPOSAL SITE, DHAPA, KOLKATA

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INTRODUCTION

The ecology of collembolan fauna as well as microbial communities in soil was studied earlier in India by several workers like Mitra *et al.*, (1977), Alfred *et al.*, (1991), Hazra and Choudhuri (1981, '83) and Hazra *et al.*, (1976, '99, 2003). But studies on the distribution of soil fauna in general and Collembola with association of microbial flora in particular in tropical countries have not been undertaken seriously, especially in India. The present study deals with the association of the predominant species of microbial flora and their role on distribution of Collembola at waste disposal site, Dhapa, Kolkata.

Location and Characteristic of sampling site

The site is a dumping ground of city wastes, located by the side of Eastern Metropolitan by pass, Kolkata. The area is demarcated by 'Organic Fertilizer Pvt. Ltd.' The main constituents of the dumped materials were household wastes, industrial effluents and the residues of vegetables. In this sampling site cultivation of different vegetables (Seasonal salad leaves, cauliflower maize *etc.*) is practiced mixing the decomposing materials in the soil.

MATERIALS AND METHODS

Methods of sampling : Soil samples were collected at random, at the rate of 3 samples every month during June, 2002 to November, 2003. Therefore, 54 soil samples were drawn by using a stainless steel corer (inner cross sectional diameter 8.5 sq. cm) from a depth of 5 cm. Separate sample units were taken for the soil microbes. The soil samples thus collected were kept immediately in sterile polythene packet and stored in 4°C in the laboratory.

Extraction of Collembola : Collembola were extracted from the soil using Tullgren funnels as modified by McFadden (1953). A 40 watt bulb was used for heat and light source. Soil samples

were placed on wire screen (2 mm mesh) in the funnels approximately 15 cm below the bulbs. Collection jars (200 ml) with approximately 50 ml 70% ethanol plus 5% glycerin were attached below the funnels and the extraction period was 3 days. Specimens collected were identified as far as possible to species level and quantified to estimate the collembolan densities of the sites.

Isolation of soil microbes : (Bacteria, Actinomycetes and Fungi) : Considering the variety of microorganisms harbored in soil, it is apparent that no single method can reveal the total microbial population. The techniques available to study the soil microorganisms the dilution plate method is most widely used. With wide acceptance and popularity there are many variations of this technique Johnson *et al.*, (1959) gave a good description of the detail procedure. Through the viable colony count from a plating of diluted soil suspension however, it must be recognized that a single medium and a prescribed condition of incubation will not support the growth of all species in any group of these microorganisms. In this present investigation, sterile de-ionized double distilled water was used to prepare the soil suspension for dilution series.

Nature of culture :

Isolation	Medium	Dilution grade	Temperature	Incubation
Bacteria	Luria agar	10-4	37°C	24 hrs.
Actinomycetes	Starch-casein	10-4	28°C	7 days
Fungi	Czapek-Dox	10-4	30°C	72 hrs.

OBSERVATION

A total number of 1,078 microbes and collembolan were obtained from this site. The specimens which were found to occur in all the sampling months were identified up to generic/specific level and those showing irregular distribution were kept as unidentified and mentioned here as others. Microbes were the dominant group obtained from all the samples and comprised of 53.70% of the total population. Among the microbes, the *Penicillium* was most dominant and comprised of 10.66% of the total population and occupied second position among the total fauna. *Rhizopus* and *Bacillus* (both 6.02%) *Mucor* (5.47%) and *E. coli* (4.35) occupied second third and fourth position respectively in order of dominance. Other unidentified microbes comprised of 21.15% of the total population. Among the collembolan population, *Lepidocyrtus cyaneus* was most dominant species among all the fauna obtained and comprised of 12.33% of the total population. *Xenylla obscura* (6.70%) *Cyphoderus javanus* (6.50%), *Seira indica* (5.10%), and *Cryptopygus thermophilus* (4.90%) occupied second, third, fourth and fifth position respectively in order of dominance and other collembolan comprised of 10.90% of the total population.

Percentage of total number of microbes and collembolan collected in each month showed maximum in the month of October and minimum in the month of June (Table 1 and Figs. 1-3).

Table 1. Abundance (%) of Collembola and Microbial flora extracted during June, 2002 to November, 2003.

SPECIES	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	Total
<i>L. cyaneus</i>	0.37	0.83	0.93	1.02	0.37	1.21	1.11	0.46	0.65	0.56	0.46	0.65	0.28	0.46	0.37	0.83	1.02	0.65	12.23
<i>X. obscura</i>	0.09	0.19	0.28	0.28	1.11	0.46	0.65	0.28	0.19	0.28	0.28	0.19	0.19	0.37	0.28	0.46	0.37	0.74	6.7
<i>C. javanus</i>	0.37	0.09	0.19	0.56	0.56	0.28	0.37	0.46	0.19	0.37	0.09	0.46	0.28	0.19	0.37	0.74	0.65	0.28	6.5
<i>Seira indica</i>	0.09	0.28	0.19	0.37	0.56	0.65	0.19	0.37	0.19	0.28	0.19	0.28	0.19	0.09	0.19	0.37	0.46	0.19	5.1
<i>C. thermophilus</i>	0.19	0.28	0.46	0.65	1.4	1.02	0.83	1.11	0.19	0.37	0.28	0.19	0.46	0.19	0.28	0.28	0.19	0.46	4.9
<i>Others</i>	0.19	0.28	0.46	0.65	1.4	1.02	0.83	1.11	0.19	0.37	0.28	0.19	0.46	0.37	0.56	0.65	0.83	1.02	10.9
	1.28	1.85	2.13	3.15	4.75	3.1	3.43	2.96	2.14	2.32	1.58	2.14	1.58	1.67	2.14	3.43	3.63	3.43	46.3
SPECIES	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	Total
<i>Penicillium</i>	0.37	0.65	0.74	0.65	0.93	0.74	0.65	0.46	0.46	0.56	0.28	0.37	0.09	0.46	0.56	0.65	1.11	0.74	10.66
<i>Mucor</i>	0.19	0.28	0.19	0.19	0.37	0.46	0.65	0.37	0.28	0.19	0.09	0.28	0.09	0.19	0.28	0.46	0.56	0.37	5.47
<i>Rhizopus</i>	0.19	0.28	0.56	0.46	0.74	0.65	0.56	0.28	0.19	0.28	0.19	0.37	0.19	0.09	0.19	0.37	0.37	0.19	6.02
<i>Bacillus</i>	0.09	0.19	0.46	0.37	0.46	0.56	0.37	0.37	0.46	0.28	0.46	0.09	0.19	0.28	0.09	0.28	0.46	0.56	6.02
<i>E. coli</i>	0.19	0.09	0.28	0.37	0.46	0.28	0.37	0.19	0.19	0.09	0.28	0.09	0.19	0.19	0.28	0.19	0.28	0.37	4.35
<i>Others</i>	0.83	1.02	0.65	1.3	1.95	1.76	1.21	1.58	1.02	0.74	0.56	0.74	0.83	1.02	1.3	1.58	1.48	1.58	21.15
	1.85	2.5	2.88	3.33	4.91	4.45	3.8	3.25	2.6	2.13	1.85	1.94	1.67	2.23	2.69	3.53	4.23	3.8	53.7

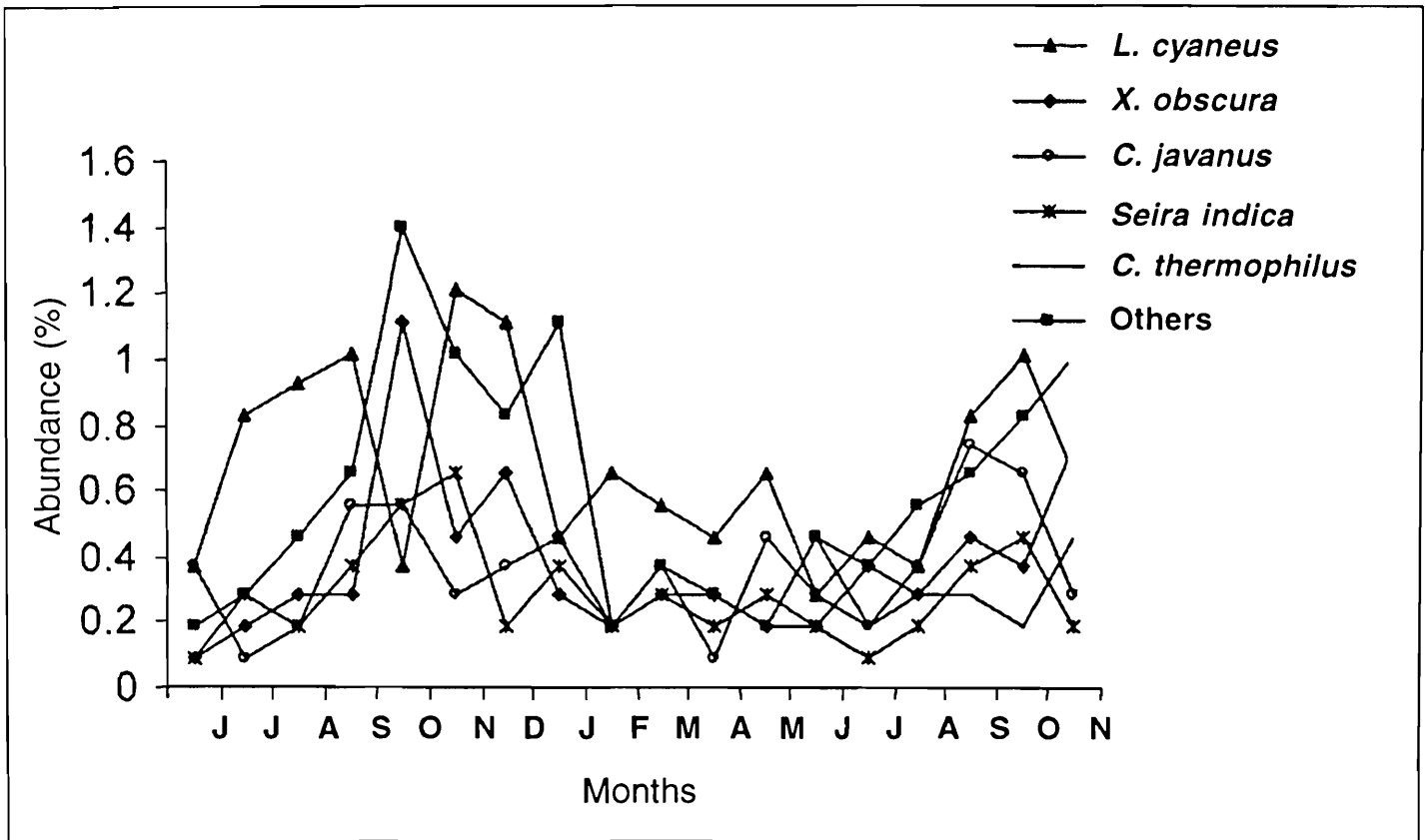


Fig. 1. : Monthly variation of collembola species.

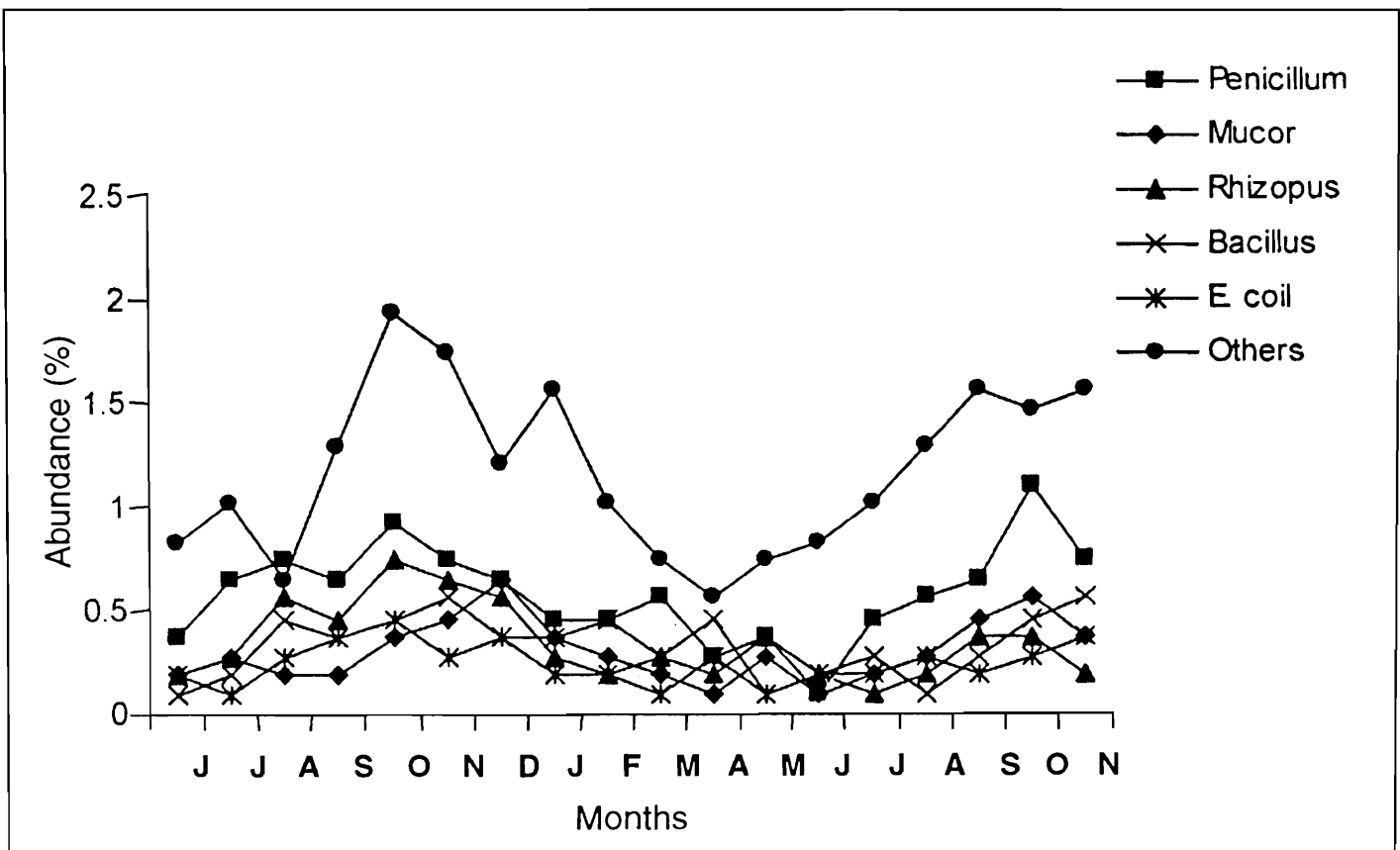


Fig. 2. : Monthly variation of microbial species.

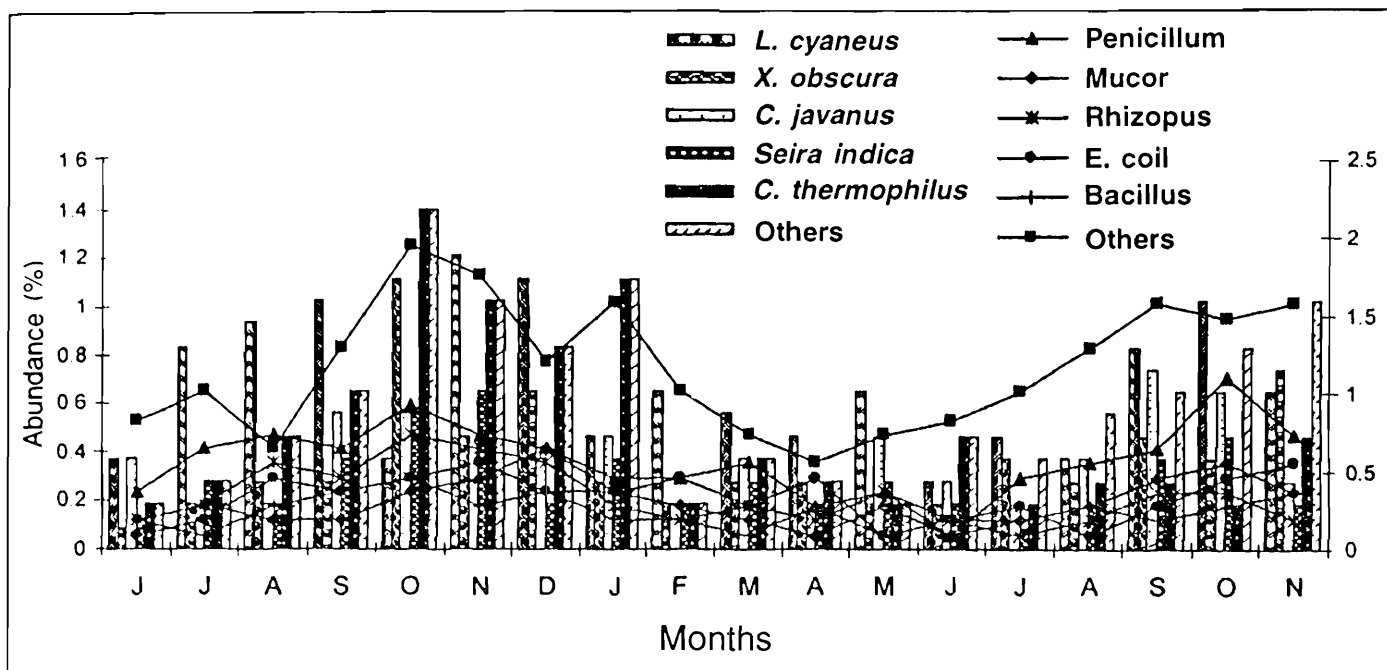


Fig. 3. : Monthly variation of Collembolan and Microbial species.

Predominant forms of microbes and collembolan showed an irregular trend of fluctuation during the sampling period. The population of different species of the groups showed peaks in different months but in general they showed maxima in post monsoon and minima in monsoon. The dumped wastes materials affect directly in shifting the population peaks of microbes and collembolan.

DISCUSSION

Altogether five genera of soil microbial flora (*Penicillium*, *Rhizopus*, *Bacillus*, *Mucor* and *E. coli*) and five genera of collembolan fauna (*Lepidocyrtus*, *Xenylla*, *Cyphoderus*, *Seira* and *Cryptopygus*) were obtained during the present study. In order to find out as to whether there was any significant correlation between soil microbes and collembolan population, correlation coefficient (*r*) were worked out (Table 2). The population of collembolan throughout the period of sampling exhibited positive correlation with soil microbes.

Table 2. : Correlation coefficient (*r*) for collembolan population and soil microbes.

PERIOD		VALUE OF 'r'
June, 2002 to November, 2003	Collembolan population : Soil microbes	0.929 (Significant at 5% level)

It is interesting to note that the microbial population showed an almost parallel pattern of fluctuation with that of Collembola. This coincided with the observations of Knight (1961), Mitchell and Parkinson (1976), Hazra and Choudhuri (1990), Pal *et al.*, (1992) and Hazra (1984).

This suggested a direct dependence of collembolan population of microbial flora. The maximum population peak of collembolans and microbes were found in the month of October (post-monsoon) in the site, it agreed with the observation of Hazra and Choudhuri (1990) and Pal *et al.*, (1992). According to them the significant increase in the moisture content of soil leading to a luxuriant growth of macro and micro flora during monsoon.

According to Knight (1961) as collembolan showed strong feeding preference for fungal hyphae and spores it might be suggested that distribution of these animals would partly be conditioned by the distribution of fungi species also indicated that the gut content of a single collembolan species taken from several habitats may show greater diversity than the gut content of several species taken from the same habitat, this suggests that collembolans are indiscriminate feeders.

The pattern of seasonal variation in population appeared to be different in different forms of microbes and collembolan which perhaps indicates the existence of different breeding periods. Again the existence of single population peak in some species of microbes and collembolan suggested the probability of only one generation per year.

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