Environment & Ecology 27 (3A) : 1228—1230, 2009
 ISSN 0970-0420

Biodiversity of Soil Arthropods under Mango, *Mangifera indica* L. Orchard Ecosystem in Varanasi, Uttar Pradesh

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Abstract

The Taxonomic compositions of soil arthropods were studied in orchard ecosystem dominated by *Mangifera indica* L. About 4,071 individuals belonging to 19 orders were collected in 200 samples. Acarina alone showed highest in population constituting 26.67% and Collembola 25.35%, second highest of total individuals whereas, maximum numbers of 7 species were received from Collembola and 4 species from Acarina. The average population densities varied from 318.25 to 76889.2/m^2.
Key words : Taxonomic compositions, Soil arthropods, Orchard ecosystem, Population densities.

The most important groups of animals inhabiting in soil and litter are Protozoa, nematodes, annelids and arthropods, the last frequently dominating over others. There are evidence that soil organisms play an important role in maintaining soil structure and fertility (Edwards et al. 1970, Anderson 1973a, 1973b, Reddy 1981). They are also serving as indicator of soil quality (Karg 1968). The qualitative and quantitative composition of these arthropods have been investigated in tropical (Plowman 1979) and warm temperate forest ecosystem (Niijima 1971). In India several work has been done on managed ecosystem. The more work is required in the natural ecosystem from structural view. Present investigation included the taxonomic composition of Arthopoda and population density in sub-tropical orchard dominated by *Mangifera indica* L.

(The facilities for working provided from NPIB Varanasi are gratefully acknowledged).

Methods

Sites. The study site is located at the university campus,Varanasi ($25^0$18´N and $83^0$03´E), where the climate is sub-tropical monsoonic with an average rainfall 1,100 mm. Mostly the rain received during three wet months of rainy season (July to September). It is followed by cool and hot dry period from October to June.

Vegetation. The site is a sub-tropical orchard dominated by *M. indica.* There was sparse shrub by undergrowth domination by *Bauhonia variegata* and *B. alba*. The herbaceous stratum was *Tabernaemontana* sp. (Chandni), *Canabis sativa* and *Parthenium hysterophorus*.The herbaceous strata were medium dense during raining season. In all 35 species of plants were recorded in studies area. Of these, 12 species were throughout the year. There were 29 species in rainy season, 20 in winter and 8 and in summer.

Sampling. A sampler of the size of 10.0 ×7.5 ×22.5 cm (1,687.5 cc in volume) was used to take the samples. Sampling was conducted fortnightly for a period August 2007–2008 on each sampling day, samples were collected form five different spots. Sampling between two spots varied from 10—15 meter. The sampling was done between 0700 to 0800 hours in summer and rainy and 0800 to 0900 in winter season. Samples were transferred in polythene bag separately and brought to laboratory for extraction.

Extraction. All the samples were extracted through Tullgren's funnel techniques (Tullgren 1918).The organisms fall into collecting tube (containing absolute alcohol and one to two drops of glycerol) kept below the lower opening of the funnel. Initially less heat was given and gradually increased it.

Table 1. Major groups of arthropods found in survey.

	Classs	Order
1	Myriapoda	Chilopoda
		Diplopoda
		Symphyla
2	Arachnida	Acarina
		Araneae
		Pseudoscorpiones
		Uropygi
3	Insecta	Diplura
		Collembola
		Dermaptera
		Orthoptera
		Hemiptera
		Thysanoptera
		Neuroptera
		Isoptera
		Coleoptera
		Diptera
		Hymenoptera
		Lepidoptera

Complete extraction took 24 to 36 hr depending upon soil type and fauna present. The soil fauna sorted out under stereoscopic binocular microscope after extraction and specimens were preserved in absolute alcohol with few drops of glycerol.

Classification. Classification of Collembola was made according to Gisin (1960) and Hazra and Mandal (2007) and www.collembola.org. The rest were confirmed through the keys of Borror and De Long (1970).

Results and Discussion

About 4,071 individuals belonging to 19 orders were collected from 200 samples during study period (Table 1). Though, Acarina alone constitute 57.97% of total individuals whereas, the maximum numbers of species recorded in Collembola before Coleoptera (Table 2).

Forty six species of soil arthropod's were collected from orchard ecosystem . Acarina and Collembola both collectively constitute 55.02% and remaining were other soil arthropods.

Out of 43 species, Acarina were dominating taxa with 29.67% and average population density of it was 76,889.20 in our survey. Singh and Singh (1975) and Khan and Singh (2007) also reported the dominating taxon was Acarina in their survey. Singh and Singh (1975) recorded Acarina with 59.27% in survey.

Collembola was second dominating taxa with 25.35% which dominating overall after the Acarina. The average population density of it was 65,686.80. Singh and Singh (1975) found Collembola with

Table 2. Numbers of individual and species of different order were collected from study site.

Arthropods (order)	No. of individuals	Relative abundance	No. of species	Percent of total species	Average density (per m^2)
Chilopoda	5	0.12	1	2.17	318.25
Diplopoda	212	5.21	2	4.35	13493.8
Symphyla	52	1.28	1	2.17	3309.8
Acarina	1208	29.67	4	8.70	76889.2
Araneae	76	1.87	2	4.35	4837.4
Pseudoscorpiones	35	0.86	1	2.17	2227.75
Uropygi	24	0.59	1	2.17	1527.6
Diplura	129	3.17	3	6.52	8210.85
Collembola	1023	25.35	7	15.22	65686.8
Dermaptera	26	0.64	2	4.35	1654.9
Orthoptera	18	0.44	3	6.52	1145.7
Hemiptera	25	0.61	2	4.35	1591.25
Thysanoptera	65	1.60	3	6.52	4137.25
Neuroptera	8	0.20	1	2.17	509.2
Isoptera	102	2.51	1	2.17	6492.3
Coleoptera	250	6.14	5	10.87	1591.25
Diptera	185	4.54	2	4.35	11775.25
Hymenoptera	365	8.97	3	6.52	23232.25
Lepidoptera (larvae)	254	6.24	2	4.35	16167.1
Total	4071	100	46	100	161664.9

18.51% in their survey. Reddy (1984) and Schenker (1984) observed Collembola as dominant group in forest ecosystems, whereas Pillai and Singh (1980), Vats and Handa (1988) reported their dominance in crop land ecosystem. Singh and Singh (1975) and Vats and Narula (1990) reported 4,605.5/m^2 and 170 to 77,059/m^2, respectively.

All other arthropods (44.98%) were poor in population except Diplura, Orthoptera, Thysanoptera, Coleoptera and hymenoptera (Table 2). Narula (1987) reported that the taxonomic composition in forest stand as Isopoda 0.02%, Chilopoda 0.03%, Diplopoda 0.12% Symphyla 0.51%, Aracnida 0.13%, Blattoidea 0.01%, Psocoptera 2.22%, Hemiptera 0.07%, Homoptera 0.02%,Thysanoptera 0.43%,Isoptera 0.03%, Coleoptera 1.62%, Diptera 2.69%, Hymenoptera 0.74% and Lepidoptera 0.38%. Our finding is somewhat similar with finding of Singh and Pillai (1981) and Singh and Mukherji (1986).

The average population densities vary from 10.18 to 93,652.06/m^2. Narula (1987) reported that average density ranges from 509 to 139,436/m^2 whereas Mukharji and Singh (1970) recorded 50—280 specimens per sample.

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