4.1 Collection of Macroinvertebrates and Soil Samples

Macroinvertebrates were sampled from an area of 25 m² at about the centre of each forest stand. Sampling was carried out at monthly intervals from February to July, 2014. Nine randomly distributed soil monoliths (25×25×30 cm) were obtained at each site by digging a trench around a monolith as described by Anderson and Ingram (1993). A soil monolith was cut down in to three layers of 10 cm each, i.e. 0-10 cm, 10-20 cm and 20-30 cm. Macroinvertebrates were hand sorted out from each layer of soil and preserved in 70% alcohol. Earthworms were, however, washed with water in order to remove adhered soil and dirt, subsequently killed in 90% alcohol and preserved in 5 % formalin. Rocky areas were avoided for sampling.

Soil samples were collected and air-died in shade for various analyses of physico-chemical parameters. Each soil sample was prepared for analysis by removing pebbles and sieving in a 0.5 mm sieve.

4.2 Rainfall and Atmospheric Temperature Data

Rainfall and atmospheric temperature data were obtained from the Meteorological Observatory of the Department of Soil Sciences, Dr YS Parmar University of Horticulture and Forestry, which is located at a straight distance of 2-3 km from the collection site.

4.3 Analysis of Physico-chemical Parameters

4.3.1 Soil Texture

Soil texture was detected by pipette method as described by Piper (1966).

4.3.2 Soil Moisture

For moisture content, 10 g of soil sample was dried overnight at 105°C in an oven, cooled in desiccators and weighed. Loss in weight reflected the moisture content which was converted into percentage by following formula by Santhanam et al. (1989):
Photo 4.1: Soil Monolith
Material and Methodology

4.3.3 Soil Temperature
The soil temperature at 10 cm depth was recorded at the same time by using standard soil thermometer.

4.3.4 Soil pH
The pH determination involved dilute suspension of soil: water ratio of 1:5, following Misra (1968). To a 25 g of air dried and powdered soil in a beaker, 50 ml of distilled water was added. The mixture was thoroughly stirred for 60 minutes with an electromagnetic stirrer. The pH of freshly stirred suspension was recorded by immersing electrode of digital ‘AMKAY’ pH meter.

4.3.5 Soil Organic Matter, Available Nitrogen, Available Phosphorous and Available Potassium
Soil chemical parameters like Organic Carbon (OC), Nitrogen (N), Phosphorous (P) and Potassium (K) was also studied by using different methods given below
i) Total organic matter was estimated by Walkey and Black’s (1934) method.
ii) Nitrogen by Jackson (1962) method.
iii) Phosphorus by Bray and Kurtz (1945) method.
iv) Potassium by Stanford and English (1949) method.

4.4 Identification of Macroinvertebrate Samples
Different groups of macroinvertebrates were identified through the works of different workers (given in parenthesis): Earthworms (Gates, 1972; Julka, 1988) to species level; Arthropods (Mani, 1962; Imms, 1957; Dindal, 1990) to morpho-species level. Earthworms

$$\text{Moisture content (\%) } = \frac{I - F}{I} \times 100$$

Where, 
- $I = \text{initial weight of sample (g)}$
- $F = \text{final weight of dried sample (g)}$
were classified on the basis of sexual maturity i.e. juveniles, aclitellate and clitellate worms following Julka (1988).

4.5. Statistical Data Analysis

The data of all counting of a month was pooled and the following community characteristics were calculated to quantify the soil macroinvertebrates community in the broad leaf stand and pine stand:

4.5.1 Species Relative Abundance

(i) Relative abundance was calculated as follows:

\[ \frac{n_i}{N} \times 100 \]

Where \( n_i \) is the number of soil macroinvertebrates of ith species and \( N \) is the total number of soil macroinvertebrates recorded.

(ii) The degree of correlation between species occurrence and abundance in broad leaf stand and pine stand was determined by non-parametric statistic Spearman’s coefficient,

\[ \rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)} \]

Where \( d_i \) is the difference between abundance and site ranks of the ith species, ‘\( n \)’ is the number of species.

4.5.2 Relative Frequency

The relative frequency of species was estimated by the following formula:

\[ \text{RF} \% = \frac{\text{frequency of species A}}{\text{sum of frequency values for all}} \]
4.5.3 Species Diversity Index

Species diversity was calculated by Shannon-Wiener Index:

\[ H' = -\sum_{i=1}^{S} P_i \log_2 P_i, \quad (P_i = n_i/N) \]

Where,
- \( H' \) = Diversity index of species
- \( n_i \) = Total number of individuals of ‘i’ species in the sample
- \( N \) = Total number of individuals of all species in the sample
- \( S \) = Total number of species

4.5.4 Species Dominance Index

Index of dominance has been calculated as per Simpson (1949) using formula

\[ C = \sum_{i=1}^{S} \left( \frac{n_i}{N} \right)^2 \]

Where,
- \( C \) = Index of dominance
- \( n_i \) = Total number of individuals of ‘i’ species in the sample
- \( N \) = Total number of individuals of all species in the sample
- \( S \) = Total number of species

4.5.5 Species Richness Index

Index of species richness has been estimated by adopting the formula given by Margalef (1968) as follows:

\[ D = \frac{S-1}{\log N} \]

Where,
- \( D \) = index of variety of species
- \( S \) = total no of species
- \( N \) = total no of individuals
4.5.6 Species Evenness Index

Index of evenness has been quantified by following formula developed by Pielou (1966) as follows

\[ E = \frac{H^\prime}{\log_2 S} \]

Where,

- \( E \) = index of evenness
- \( H^\prime \) = Shannon- Wiener index
- \( S \) = total number of species