ECOLOGICAL INDICES OF FRESHWATER COPEPODS AND CLADOCERANS FROM DHARMAPURI DISTRICT, TAMIL NADU

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ABSTRACT
Four copepods and seven cladoceran species were identified in the zooplankton samples collected from fifty freshwater bodies, in and around Dharmapuri District, Tamil Nadu including during September 1999 and April, 2000. Ecological indices for similarity and dissimilarity, index of dominance, index of diversity, index of evenness and species richness indicate variations pertaining to winter and summer zooplankton density. Zooplankton populations of winter and summer are discussed.

KEYWORDS
Copepods, cladocerans, dominance, diversity, evenness, species richness

Zooplankton populations of tropical freshwater bodies depend on the primary productivity and physico-chemical parameters. Copepods and cladocerans constitute the dominant groups of freshwater habitat. They inhabit the ponds, lake, rivers and reservoirs and reported to occur more abundantly in ponds and lakes than in rivers (Reid, 1986; Raghunathan, 1983; Sharma, 1991). Some genera of copepods and cladocerans are cosmopolitan in distribution, while others are restricted to some continents (Brooks, 1959; Williamson, 1991). Depth of the pond, water transparency, pH and predators determine the distribution and abundance of copepods (Confer et al., 1983; Patalas, 1971). Dussart (1984) reviewed the systematic and distribution of tropical freshwater zooplankton from all over the world.

The successions of zooplankton populations depend upon the interspecific and intraspecific interaction and predation potential (Fernando, 1980). There has been some report on the species composition and species diversity of harpacticoid copepod in tropical reef lagoon (Villers & Bodiou, 1996). The freshwater bodies such as ponds, lakes, rivers and reservoirs of Dharmapuri district, Tamil Nadu characterize tropical freshwater ecosystem. The present paper deals with the copepod and cladoceran populations of fifty freshwater bodies with regard to ecological indices of winter and summer populations.

MATERIALS AND METHODS
Zooplankton samples were collected during September, 1999 (winter) and April, 2000 (summer) from fifty freshwater bodies of Dharmapuri District, Tamil Nadu. Samples were collected during early hours of the day (6.00am), using a plankton net made up of bolten silk (mesh size 100µm)

During the study period temperature and pH of the water sample were recorded. The samples were preserved in 5% neutral buffer formalin for qualitative analysis and identified following the taxonomic keys provided by Rajendran (1973), Pennák (1978), Tonapi (1980), Barnes (1982), Battish (1992), Maas (1994), Reddy (1994) and, Dussart and Defaye (1995) for copepods and Michael (1973), Venkataraman (1983), Sharma and Michael (1987), Raghunathan (1989) and Murugan et al. (1998) for cladocerans. For quantitative analysis, 100L of water sample was filtered through the plankton net and the plankton sample was carefully transferred with out any loss to a plastic container and preserved in 5% neutral buffer formalin.

Copepods and cladocerans were enumerated using Sedgewick-Rafter chamber following Santhanam et al. (1989). The data was analyzed for ecological indices such as similarity and dissimilarity, index of dominance, index of diversity, index of evenness and species richness following the methods described by Odum (1983).

RESULTS
Copepods and cladocerans recorded from fifty freshwater bodies of Dharmapuri District, Tamil Nadu were:

In dissimilarity analysis values were divided into four ranges i) 0.1-0.25, ii) 0.26-0.50, iii) 0.51-0.75 and iv) 0.76-1.00 and were framed as matrices. In winter season, dissimilarity values of H. viduis and S. (R.) indicus and, S. (R.) indicus and T. hyalinus were in the range of 0.51-0.75 and other animal dissimilarity values were in the same range (0.76-1.00). Different species of copepods showed similar range of dissimilarity (0.51-0.75) in summer season (Fig. 1).

In cladocerans, during winter season D. sarsi and M. micrura showed lesser dissimilarity values (0.1-0.25). Range of dissimilarities values for D. sarsi and C. cornuta and, C. cornuta and M. micrura were 0.26-0.50, D. carintna and M. micrura showed 0.51-0.76, while in other cladocerans it ranged between 0.76-1.00. During summer season, D. sarsi and M. micrura and, D. sarsi and C. cornuta showed dissimilarity range of 0.51 – 0.75, however, M. micrura and C. cornuta showed a range of 0.26 – 0.50, while other cladocerans showed similar range (0.76-1.00) (Fig. 1-4).

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Higher index of dominance was recorded in nauplii (0.1090) and copepodid (0.0910) of copepods and T. hyalinus (0.0676). Among cladocerans, C. cornuta (0.1107) D. sarsi (0.1013) and M. micrura (0.0853) showed highest dominance value. In summer season, T. hyalinus and C. cornuta showed highest dominance of 0.2959 and 0.2836 respectively, while A. quadrangularis was least dominant (0.000002) (Table 1).

In winter, Diversity, abundance and density values for H. viduus were 4.2147, 2.3522 and 1.0965, for M. aspericornis 3.7537, 2.0949 and 0.9921, for S. (R.) indicus 2.7293, 1.5232 and 0.8206, for D. excisum 5.0735, 3.1524 and 1.2461 and for D. carinata 3.0267, 1.8808 and 0.7561 respectively. In summer season, S. (R.) indicus, S. (R.) indicus and M. micrura showed high dominance and density, while T. hyalinus (1.1528, 0.7163 and 0.5202) and C. cornuta (1.1649, 0.7258 and 0.5698) showed lowest diversity, abundance and density. M. brachiata and A. quadrangularis were absent in winter, while M. aspericornis, D. carinata and D. excisum were absent in summer (Table 1).

**DISCUSSION**

In this study H. viduus and S. (R.) indicus, S. (R.) indicus and T. hyalinus showed similar dissimilarity range in both the seasons, but H. viduus and T. hyalinus showed similar range during summer season, whereas in winter season other copepods showed similar range (0.76-1.00).

In cladocerans, species dissimilarity ranged between 0.76-1.00 during winter and summer season and showed 6 and 7 combinations respectively. Nishida (1985) stated matrix of dissimilarity of coefficient of Oithoninae family of genera Oithona sp. and Paroiithona sp., which is a dense assemblage of closely allied species.

High dominance of species was recorded during winter season than in summer but T. hyalinus and C. cornuta showed high dominance during summer season in fifty samples. In the samples, one or two species dominated during study period such type of results have been reported by Villers and Bodiu (1996).

Index of diversity of the present study showed H. viduus and D. excisum with high value in winter and, S. (R.) indicus and A. quadrangularis with high value in summer. Lyons (1981) had shown that biomass or productivity, which are often more ecologically appropriate, can be used in such statistical tests if number of individuals are also known.

Odum (1983) suggested that two broad approaches are used to analyse species diversity in different situations of dominance – diversity, relative abundance curves and diversity indices, which are ratios or other mathematical expression of species importance relationships.

In the present study, abundance and density increased with diversity value. Diversity is directly related to abundance or equitability (Odum, 1983). Villers and Bodiu (1996) reported that, harpactocoid copepods showed lowest values of diversity and equitability, but the greatest degree of dominance in single species. Similar type of results were obtained with regard to ecological indices, which also coincide with Odum (1983) that the dominance value is inversely proportional to values of diversity, evenness and species richness.

Species diversity is reported to be influenced by the functional relationships between the trophic levels. The amount of predation greatly affects the diversity of prey population (Odum, 1983). The reason for low diversity values of nauplii and copepodid of copepods and C. cornuta recorded in the present study might be that, they are preferred by predators (fish).

**REFERENCES**


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**Table 1. Ecological indices of planktonic copepods and cladocerans in winter (Sep., 1999) and summer (Apr., 2000) seasons in Dharmapuri District**

<table>
<thead>
<tr>
<th>Zooplankton</th>
<th>C</th>
<th>H</th>
<th>e</th>
<th>d</th>
<th>C</th>
<th>H</th>
<th>e</th>
<th>d</th>
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<tr>
<td>Heliodiapomus viduus</td>
<td>0.0023</td>
<td>4.2147</td>
<td>2.3522</td>
<td>1.0965</td>
<td>0.0057</td>
<td>2.7293</td>
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<td>Sinodiapomus</td>
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<td>2.7293</td>
<td>1.5232</td>
<td>0.8206</td>
<td>0.0041</td>
<td>2.8734</td>
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<td>0.7207</td>
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<tr>
<td>(Rhinediapomus) indicus</td>
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<tr>
<td>Thermocylops hyalinus</td>
<td>0.0676</td>
<td>1.6071</td>
<td>0.8969</td>
<td>0.6748</td>
<td>0.2959</td>
<td>1.1528</td>
<td>0.7163</td>
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<td>Mesocyclops aspericornis</td>
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<td>3.7537</td>
<td>2.0949</td>
<td>0.9921</td>
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<td>Copepodid</td>
<td>0.0910</td>
<td>1.5040</td>
<td>0.8394</td>
<td>0.6614</td>
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<td>nauplii</td>
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<td>1.4387</td>
<td>0.8209</td>
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<tr>
<td>Daphnia carinata</td>
<td>0.0026</td>
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<td>0.9494</td>
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<td>3.5695</td>
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<td>5.0735</td>
<td>3.1524</td>
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<td>1.4387</td>
<td>0.8039</td>
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<td>0.000002</td>
<td>6.5727</td>
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*C* - index of dominance, *H* – index of diversity, *e* – index of evenness, *d* – species richness
Ecological indices of freshwater copepods and cladocerans from Dharmapuri District, Tamil Nadu

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**Figures 1-4. Matrices of dissimilarity values of copepods and cladocerans during winter and summer seasons**

**References**


**Acknowledgements**

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