Internat. J. agric. Sci. Vol.2 No.2 July 2006 : (474-477)

Species composition and taxonomic similarity of Hymenoptera in an irrigated rice ecosystem of Tamil Nadu, India

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ABSTRACT

A total of 22 taxa of hymenopteran arthropods were recorded in 7 families on rice ecosystem. All the 22 taxa were present in partially weeded plot, where as in weeded plot, 16 taxa were recorded. Among the hymenopteran arthropods, *Xanthopimpla punctata* (Fab.), *X. flavolineata* Cameron and *Temelucha biguttata* (Munakata) were the dominant species of parasitoids in weeded and partially weeded rice ecosystems. Two taxa of ants were recorded in both the ecosystems. Four taxa of parasitoids *viz., Cotesia boaris* Wilkinson, *Goniozus* nr. *triangulifer*, *Brachymeria lasus* (Walker) and *Telenomus rowani* (Gahan) showed greater abundance in partially weeded rice ecosystem. However, the abundance of all the taxa of parasitoids was comparatively more in partially weeded rice ecosystem than in weeded rice ecosystem. The diversity of Hymenoptera exhibited 0.80 – 1.00 similarity in the first and last week and some families of parasitoids were absent in the last week. The similarity of parasitoids was found to be less during tillering and flowering stages of the crop (third, fourth, fifth, and sixth week). Formicids registered perfect similarity (1.00) through out the season. There were 18 species of weed plants recorded in partially weeded rice ecosystem. Among them, *Echinochloa colonum*, *Cyperus rotundus*, *C. iria*, *C. diformis*, *Panicum repens* and *Bracharia mutica* were dominant. The weed plants present in partially weeded rice plot provided pollen and nectar, which was more useful to conserve parasitoids when the population of herbivores was low.

Key words: Taxonomic similarity, Abundance, Diversity, Hymenoptera, Rice crop, Weed plants.

INTRODUCTION

An inventory of the biodiversity of hymenopterous parasitoids associated with rice agroecosystems of the world has shown that there are 524 species, which are intensively and extensively exercising natural control. The observation on the biosystematics of these species have shown that these fall under 181 genera belonging to six super families and 19 families. An analysis of their parasitism on the different stages of the life cycle of the various rice pests indicates that a greater majority of them are egg and larval parasitoids (148 and 289 species respectively); while seven are egg – larval, 17 larval – pupal and 63 pupal indicating their immense potential for both biodiversity exploration and biological control for IPM and sustainable agriculture. The inventory has been reinforced with all associated details namely zoogeographical distribution, parasitism potential attributes and other such relevant details from primary sources so that it will serve as a startup for planning an IPM strategy involving biocontrol in rice agroecosystem. The inventory has indicated that Ichneumonoidea and Chalcidoidea are the potential groups, which have to be exploited, monitored and watched for a better IPM approach in rice agro ecosystem (Dey *et al*., 1999). In Tamil Nadu, the abundance, inventory and diversity of Hymenoptera between weeded and partially weeded rice ecosystem had not been studied earlier. Hence, the present investigation was taken up in an irrigated rice ecosystem to study the diversity of various families of Hymenoptera.

MATERIALS AND METHODS

The field trial to study the diversity and relative abundance of Hymenotpera in irrigated rice ecosystem was conducted at the wetlands of Agricultural College and Research Institute, Madurai, Tamil Nadu during *Kharif* 2000. Four ruling rice varieties viz., MDU 5, ADT 36, ADT 39 and ADT 43 were used and each variety replicated into two treatments namely weeded plot (all the weeds removed) and partially weeded plot (10 weeds allowed /m^2). The study area receives water from the vaigai dam. Monthly minimum and maximum temperatures varied between 28° and 38°, May being the warmest (40° C maximum temperature) and January the coolest (28° C minimum temperature) months during 2000. The average rainfall of Madurai was 893 mm during 2000. The collection of arthropods was done with sweep net and the collected insects sorted out into respective taxa based on taxonomic characters. The collection of arthropods was done at weekly intervals from 30 days after transplanting and a total of seven samples taken during the season. Twenty sweeps were made diagonally across each plot. The numbers of taxa in weeded and partially weeded rice ecosystems were recorded in each week. The weed plants allowed in partially weeded plot were collected and identified. In the present investigation, Morisita coefficient index of similarity (Magurran, 1988; Wolda, 1981) was used to study the similarity of insects (= diversity) between weeded and partially weeded rice ecosystems in a location; data will be expressed as percentage of similarity (100 times Cmhw).

$$\text{Morisita index } (C_{mhw}) = \frac{2\,\Sigma(\text{ani} \times \text{bni})}{(\text{da} + \text{db})\,\text{aN} \times \text{bN}}$$

Where,

aN = Number of individuals in sample A.
bN = Number of individuals in sample B
ani = Number of individuals in the i th taxon in sample A and
bni = Number of individuals in the i th taxon in sample B.

$$\text{Da} = \frac{\Sigma \text{ani}^2}{\text{aN}^2} \text{ and } \text{db} = \frac{\Sigma\, \text{bni}^2}{\text{bN}^2}$$

RESULTS AND DISCUSSION

The inventory of Hymenoptera diversity revealed the record of 22 species in 7 families (Fig. 1). Among the hymenopteran parasitoid groups, Ichneumonids recorded 9 species followed by braconds, chalcids, bethylids, scelionids and encyrtids containing 4, 3, 2, 1 and 1 species, respectively. Two species of ants were only the hymenopteran predators recorded in rice ecosystem. Among the inchneumone parasitoids, *Xanthopimpla punctata* (Fab.) was the dominant species followed by *X. falvolineata* Cameron and *Temelucha biguttata* (Munakata) in weeded and partially weeded rice ecosystems. The common species with more individuals had behaviour of surviving in existing maximum and minimum environmental conditions. This finding is in accordance with the statement of Risch (1981), who stated that abundance of a common species (dominant taxa) was relatively more

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