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RESEARCH ARTICLE

DIVERSITY OF INSECTS IN KALLAR HORTICULTURE FARM, WESTERN GHAT, SOUTH INDIA

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ABSTRACT

Biodiversity is often used as a measure of the health of biological system. The biodiversity found on Earth today consists of many millions of distinct biological species. Insects create the biological function for all terrestrial ecosystems. They cycle nutrients, pollination and seed formation, maintain the soil structure and fertility, control populations of other organisms, and provide a major food source for other taxa. Virtually food web in a terrestrial ecosystem will show insects as a key component although food web architecture in the ecosystems. Bees, moths, ants and other insects, for example, perform a critical role in the life of seed plants by transferring pollen. Insect pollination is particularly important for production of certain fruits, nuts and vegetables. In the present study was depicts the Insects diversity of Kallar horticulture farm, Mettupalayam. An insect collection method was done by method, pitfall trap, Sweep net, Malaise traps, and Sticky trap. The main focusing of this study is the agricultural development depending upon the insect biodiversity, as well as provides opportunities for enhancing the resilience of soil ecosystem services by conserving soil biodiversity. These findings considers the aspects of sustainability of agriculture production involving insects populations, the effects of crop intensification on these populations, the agricultural practices that utilize insects, and the current status of improving the sustainability of agriculture producing environments.

INTRODUCTION

Measuring and monitoring of biodiversity is an essential tool for the selection of nature reserves and the evaluation of management regimes aiming at the conservation or restoration of biodiversity. The debate on whether there is a basic causal relation between biodiversity and ecosystem stability has never ended since. Insects are now recognized as an important component of biodiversity (Kim, 1993; Kremen *et al.,* 1993; Oliver and Beattie, 1996; Yen and Butcher, 1997). They are important in all ecosystems in terms of species numbers and biomass, and play vital roles in processes such as pollination, soil formation and fertility, plant productivity, organic decomposition, and the regulation of populations of other organisms through predation and parasitism (Daily *et al.,* 1997; Yen and Butcher, 1997). Insects are the major bio indicators. The study on insect's diversity is conducted in Kallar horticulture farm, which is one of the most plantation crops in it. The present study was focus on the effects of different plantation crops in the study area. Human beings are an integral part of the ecosystem and have sizeable impact on their function as well (Von Bodungan and Turner, 2001). Disturbance is one of the dominant forces affecting community structure in many ecological systems (Souca, 1984; Pickett and White, 1985; Wootton 1998; Lake, 2000). Robinson and Minshall (1986), Death (1996a) and Death and Winterbourn (1995) observed that the increased levels of disturbance reduce both insect's diversity and abundance. Number of hypotheses has been proposed to explain how disturbance will affect the diversity (Connell, 1978; Petraitis *et al*.,1989; Huston, 1994; Mackey and Currie, 2000). Hence the present study concentrated on the disturbances in the insect populations. Land transformation is the inevitable result of high human population density and can greatly influence local insect's assemblages (Cincotta *et al*., 2000; Samways, 2005). Rarely have these evaluations focused on microscale urban landscapes and systems such as roof gardens or bioretention basins (Kadas, 2006). However, during a time when biodiversity loss is increasingly important and in urban areas where urbanization leaves little open space for biodiversity enhancement, action should be taken for biodiversity conservation at all levels regional and local, macro and micro scales (Rookwood, 1995). Application of certain fertilizers and improper planning also leads to loss of biodiversity and it's quite that the fertilizer applications will be more in the case of plantations compared to that of natural forests. Mismanagement of organic wastes, have impacted public health and environment. These organic wastes are rich plant nutrients and through proper management such as composting can be used as a soil conditioner, as well as a nutrient source for plants (Smith, 1992). Compost addition was found to not only increase crop yield, but also to improve soil fertility in terms of organic C and N content permeability, plant available water capacity and air-filled porosity (Mamo *et al.,*1998;Keener *et al.,* 2000). Hence, the main objective of the

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current study was to identify in different types of vegetation supported the most abundant and diverse of insect's population.

METHODOLOGY

Study Area

The State Horticultural farm (Kallar) was established in 1900. The total area is about 8.92 hectares. Its elevation is 360 mts above MSL with annual rainfall 1250- 1400 mm and Humidity ranges from 70- 80%. The total area is mainly divided into cropped, uncultivated area. The major plantation crops include Jack graft, Lime layers, Pepper, Clove seedlings, Nutmeg Crops, silver Oak, Mangoosten, Arecanut seed, Coffee and some minor fruits and ornamental plants. Perennial source of gravitational water from Kallar stream flowing from coonoor along the hill slopes. The farm produces high quality of tree species fruit trees other economic crops and also serve as educational center for many students.

Selection Sites

The study area was divided into six different sites based on the vegetation's (Plot A- Grassland, Plot B- Mixed plantation, Plot C- Mangoosten plantation, Plot D- Gooseberry plantation, Plot E- Nursery Bed, and Plot F- Natural forest area). The study was conducted by (November 2009- April 2010). Insects were collected from the each plot by using various methods.

COLLECTION METHODS

The methods was used to collect insects are dictated by the ultimate goal of samples collected. We adopted Pitfall traps, Sweep net, Malaise traps, and Sticky traps for insect collections. If specimens are destined for display cases that portray them in their natural habitats. It may be important to collect a sample of the host plant for the display.

Statistical Analysis

Insect diversity was calculated by the Shannon wiener diversity index. The Shannon wiener diversity index (H) which is one of the most widely used and popular diversity indices, was used for the comparison of the sites and independent samples (Mensing *et al*., 1998; Hermy and Cornelis, 2000; Turner *et al*., 2005). The difference between the plots one way ANOVA was performed by using SPSS.17).

RESULTS

The abundance, diversity and richness of the insects recorded were shown (Figure 1- Figure 6). The insects recorded during the study period shows more abundance in plot F (Natural Forest) and Plot B (Mixed plantation) Order Lepidoptera shows more abundance in majority of the plots and coleopteran occupies the next, abundances is very low in the order isopteran.

Species richness was observing more in Plot F (Natural forest) and Plot B (Mixed Plantation). Araneae and Lepidoptera shows high species richness compared to other orders and isopteran shows least richness. The overall insect's diversity was more in Plot F (Natural Forest) and Plot B (Mixed Plantation) and significant results ($P<0.005$) were observed with the richness and abundance between the 6 different plots (Table 1& 2)

DISCUSSION

In the present study observed that the vegetation types plays a major role in the diversity of insects and in other plantation namely goose berry, mangosteen were with less diversity. Agro ecology and farming systems approaches have greatly contributed to the design of more sustainable and productive agroecosystems (Pimbert, 1999). Spatial statistics have been used to predict soils and regions within landscapes or fields that are more or less productive, helping farmers to decide where they should plant their crops, in what densities, at what times of the year, and where fertilizer side-dressing should be performed (Mausbach and Wilding, 1991). Despite sampling in a highly modified terrestrial habitat, we found that the insect's community was made up predominantly of native taxa. And some species are dependent on some peculiar vegetation and those where seen abundant in all the plantations. Our results shows much number of Lepidoptera groups distributed normally in all the plantations and this may be due to availability of food sources. Lepidopeteran are agricultural sites had significantly more butterflies than non agricultural sites (Erica Fleishman, 1999). Araneae and Lepidoptera shows high species richness compared to other orders and isopteran shows least richness. Most species cannot survive in anthropogenic habitat, but tree plantation can provide buffer zones around forests, providing food in some seasons, typically for smaller, more omnivorous lemurs (Ganzhorn, 1987; Ganzhorn *et al*., 1999). Moderate disturbance can increase insect diversity, especially when it causes greater habitat heterogeneity; with smaller fragments or heavier disturbance, species loss becomes increasingly likely, and ant communities become vulnerable to invasion (Holway *et al*., 2002).

And the difference in composition of insects in the study area is may be due to climatic changes, altitudinal differences and availability of food sources. The diversity of bees at different altitudes in the tropics may provide clues to the likely responses of bee species and communities to climate change at any one point over time (Karunaratne *et al*., 2008). Similar Insects seasonality was found in the upload tropical rain forest of northern Queensland (90 S), Australis, which has a similar climate, except for the smaller annual temperature, range (Frith and Frith, 1990). Population numbers of Insects vary in accordance with natural changes in season, temperature, amount of rainfall, altitude and other environmental gradients (Wiwatwitaya, 2000). Supplemented summer rainfall led to a large increased (nymphs and adults), which was directly related to the increase in vegetation cover, particularly that of grasses (Masters and Brown, 1998). There is also other evidence on the ecosystem role of leaf litter as suitable shelter habitats for Insects. This role might be a protection effect against predators or against unfavorable climatic conditions of the surroundings (Kappes *et al*., 2006; Maguraa *et al*., 2008). Although community characterization is not the main focus of the present study it is worthwhile to mention than less mobile or that the interplay between biological and non-biological sampling factors may ultimately account for differences in the effects of heterogeneity and disturbance on the sampling efficiency. Pitfall trap catches depend on species abundance

Table 1 Showing the analysis of variance between different plots for the abundance of Insects

Abundance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2266186.944	5	453237.389	1.569E5	.000
Within Groups	34.667	12	2.889		
Total	2266221.611	17			

Table 2 Showing the analysis of variance between different plots for the richness of insects

Richness	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1360.444	5	272.089	19.057	.000
Within Groups	171.333	12	14.278		
Total	1531.778	17			

and activity and more insects were captured by this technique. It is well documented that this sampling method is more efficient to capture mobile epigamic insect smaller species (Luff, 1975; Melbourne, 1999). On the other hand, the efficiency of pitfall traps depends on vegetation density (Melbourne, 1999), but also does the structure of epigamic insect communities. Comparative and experimental evidence suggests patterns in the abundance and diversity of omnivorous, detritus and carnivorous coleopteran species may indeed change substantially along the west to east gradient in response to micro-scaled environmental changes in vegetation cover (Mazia, 2004). It is also likely that the effect of fire affected distinct taxonomic group differently. Hence in the present study vegetation plays a major role and we observed significant difference between different plots and in natural and mixed vegetation more abundance and richens of species is observed compared to other plantation groups.

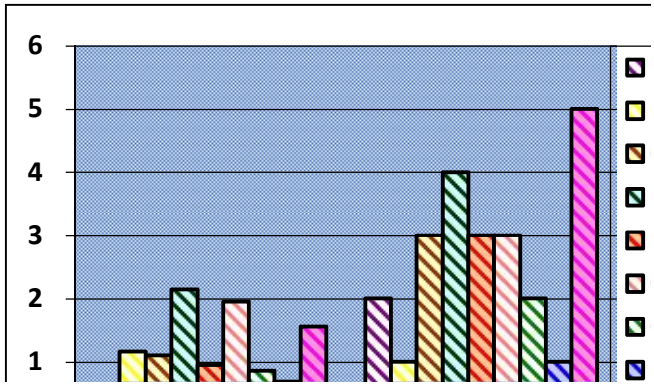

Figure1. Bar diagram showing Diversity and Richness of Insects observed in PLOT A.

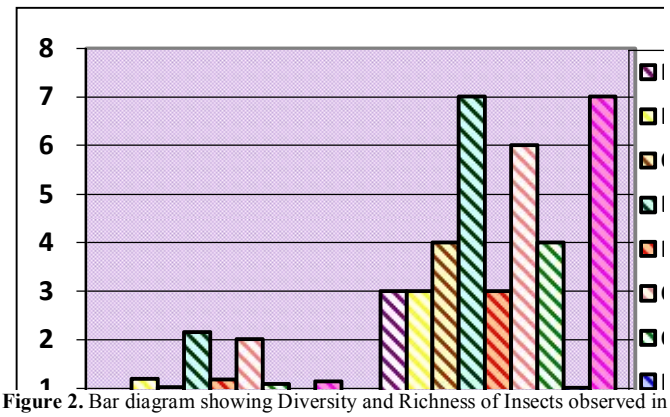

Figure 2. Bar diagram showing Diversity and Richness of Insects observed in PLOT B.

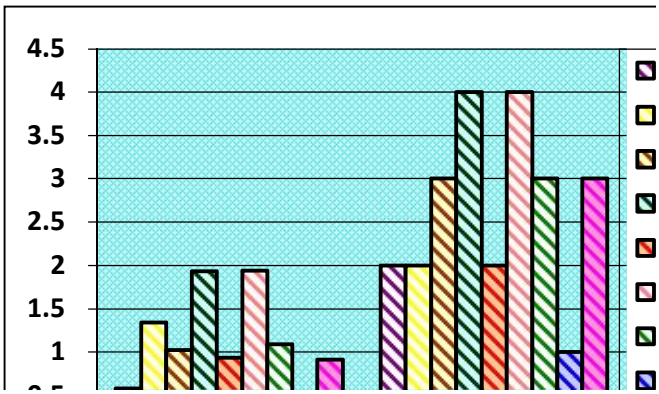

Figure3. Bar diagram showing Diversity and Richness of Insects observed in PLOT C.

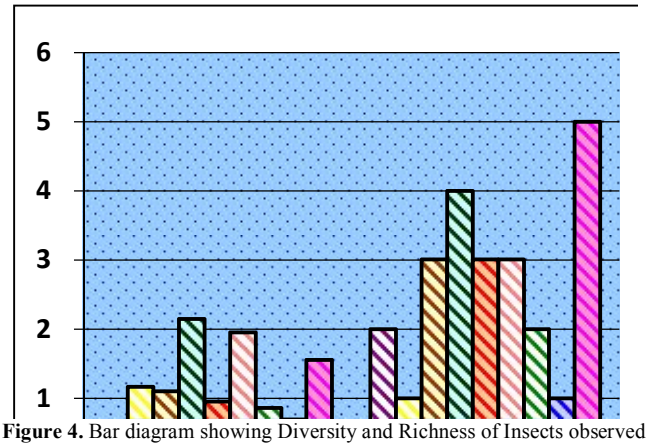

Figure 4. Bar diagram showing Diversity and Richness of Insects observed in PLOT D.

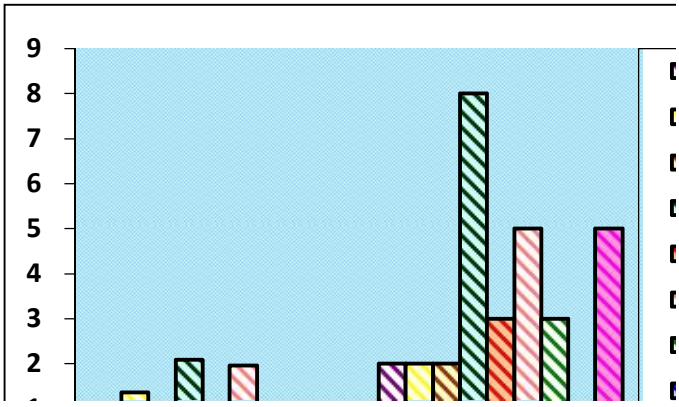

Figure 5. Bar diagram showing Diversity and Richness of Insects observed in PLOT E.

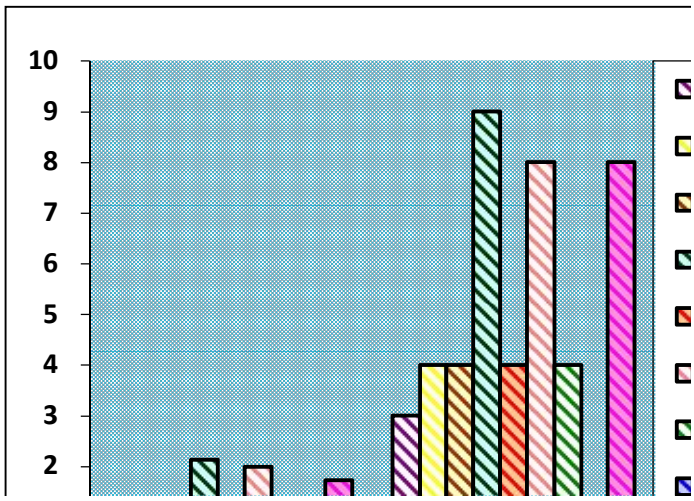

Figure 6. Bar diagram showing Diversity and Richness of Insects observed in PLOT F.

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