



INSECT FAUNAL DIVERSITY IN DIFFERENT CROP ECOSYSTEMS IN SUB HUMID ZONE OF SOUTHERN RAJASTHAN

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ABSTRACT

Investigations were undertaken to study and record the insect fauna and species spectrum attracted towards the light trap in three ecosystems at Rajasthan College of Agriculture, MPUAT, Udaipur during *rabi* 2014-15. Lepidoptera dominated the catches by light traps contributing 23.27, 29.64 and 32.62 percent which was followed by Hemipterans (30.80, 29.62 and 25.53%), Dipterans (18.80, 19.11 and 22.05%) and Coleopterans (15.50, 12.98, and 13.14%) in pulse, oilseed and vegetable ecosystem respectively, during *rabi* 2014-15. The Shannon diversity index as calculated for cumulative collection of all insect orders during *rabi* 2014-15 was 1.175, 1.629 and 1.578 in pulse, oilseed, and vegetable ecosystem, respectively.

Key Words: diversity, light traps, ecosystems

INTRODUCTION

Light traps are being used since long for collecting the phototropic insects both for estimating the populations in an area and to provide precise estimate about the diversity of insects in any ecosystem (Southwood and Henderson, 2000). Collection of insects by light traps is cheap and convenient method; however, the work in this area has been under negligence by scientists. Different kinds of light traps are available in the market manufactured by various companies fitted with light sources varying in their intensity and wavelengths, but no scientific relevant data on the trap collection, diversity, number and its efficacy is available for ready use by the researchers. Ramamurthy *et al* (2010) used Mercury, Black and Ultra-violet light traps for insect capture and found that Coleopterans dominated the catches followed by Hemipterans, Hymenopterans and Lepidopterans. When light traps were used as attractants; the common orders frequented were Diptera, Coleoptera and Lepidoptera. Such information, if properly documented, could be put to multi-dimensional use by field- researchers. In this regard, a comparative analysis of collections in various ecosystem by light traps becomes mandatory in order to study the diversity of insects of specific orders viz., Coleoptera (Sushil *et al.*, 2004), Hemiptera (Rai and Khan, 2002; Manimaran and Manickavasagam, 2000), Lepidoptera (Rose *et al.*, 2004), Hymenoptera and Diptera (Nair *et al.*, 2004). Further analyzing this data could help to predict the insect diversity and their activity in various ecosystems. In order to make such information available, a complete segregation of the

individual trap collection over a period of time on the basis of order and total catch, and simultaneously correlating it becomes necessary. A comparative analysis of the light-trap collections operating in three agro ecosystems would provide the estimate of relative density of different categories of insects, population composition and diversity of insect fauna. Hence, the present study has been carried out focusing the orders of agriculture importance in various agro ecosystems in the sub humid ecological zone of southern Rajasthan in India.

MATERIALS AND METHODS

The experiment to study the insect faunal diversity was carried out at Agronomy Farm and Horticulture Farm of RCA, Udaipur during *rabi*, 2014-15 in different agro-ecosystems. The experiment was conducted in three different agro ecosystems *i.e.*; pulses, oilseeds and vegetables where Universal eco friendly light traps fabricated and manufactured by Universal Biotech, Jaipur, were installed to get catches of flying pest faunal complex. Bulb 125 watt Mercury vapor Lamp & Halogen 500 watt light was used as attraction source. The light traps were installed on the iron stands earthen properly at the distance of 50 meters and about 2 ft. above the crop canopy and were connected to the source of electric supply which get on in the evening and automatically get off after 3 hours. The insect collection chamber of the light traps was removed daily in the morning hours from the stands to record the insects trapped in them and were reinstalled in the evening hours. The light tarps were monitored for the insect

catches in three ecosystems *i.e.*; pulses, oilseeds and vegetables. The observation on the population of insects trapped in each trap was recorded daily from all the locations. The insects collected in the collecting chamber were removed in the bucket and counted after putting some quantity of kerosene or pesticide in the bucket. The insects trapped in three types of traps installed in different agro eco system were counted and recorded separately. The collected insects were sorted out order wise and were counted daily in morning hours separately. The record was maintained for the complex of insects trapped in each type of trap installed at three locations in three ecosystems *i.e.*; pulses, oilseeds and vegetables respectively. The relative density, population composition and diversity, and evenness of fauna of three ecosystems at RCA, MPUAT, Udaipur, was calculated from the recorded data.

The average temperature ranged from 21-29 °C maximum and 5-18 °C minimum. The common measures of diversity Shannon index and the total number of species were used to relate generalized entropy of ecosystems which not only provide estimates of the effective number of species present, but also provide estimate to include or to ignore the relatively rare species. The Shannon index is affected by both the number of species and their equitability, or evenness. A greater number of species and a more even distribution both increases diversity as measured by H' while species evenness measures the relative abundance of various populations present in an ecosystem.

Measurement of diversity. The type of diversity used here is alpha Diversity which is the diversity of species with in a community or habitat. The diversity index was

calculated by using the Shannon-Wiener diversity index (Shannon and Wiener, 1949).

$$H = - \sum P_i \ln P_i$$

Where $P_i = S/N$, S= Number of individual of one species

N = Total number of all individual in the sample; \ln = logarithm to base e

Measurement of evenness. For calculating the evenness of species, the Evenness Index (e) was used (Pielou, 1966).

$$E = H / \ln S$$

H = Shannon-wiener index

S = total number of species in the sample

RESULTS AND DISCUSSION

The total number of insects collected during the period of investigation in pulse, oilseed and vegetable ecosystem were 3026, 3883 and 4504 respectively. The various insects caught in different ecosystems by the light trap were found to fall under the order Lepidoptera, Diptera, Hemiptera, Coleoptera, Orthoptera, Hymenoptera, Neuroptera, Odonata and Dermaptera. In all three ecosystems order Lepidoptera dominated the catches by light traps contributing 23.27, 29.64 and 32.62 per cent, which was followed by Hemiptera (30.80, 29.62 and 25.53%), Diptera (18.80, 19.11 and 22.05%) and Coleoptera (15.50, 12.98, and 13.14%) in pulse, oilseed and vegetable ecosystem, respectively during *rabi* 2014-15. Besides these major orders, other contributors to the collection in three ecosystems include Hymenoptera (3.80, 2.50 and 2.20%), Orthoptera (1.78,

Table 1. Diversity indices for the insect orders in different crop ecosystems in *rabi* 2014-15

S.No.	Order	Pulses Ecosystem		Oilseed Ecosystem		Vegetable Ecosystem	
		Population (No)	RD (%)	Population (No)	RD (%)	Population (No)	RD (%)
1	Lepidoptera	704	23.27	1151	29.64	1469	32.62
2	Diptera	569	18.80	742	19.11	993	22.05
3	Hemiptera	932	30.80	1150	29.62	1150	25.53
4	Coleoptera	469	15.50	504	12.98	592	13.14
5	Orthoptera	54	1.78	74	1.91	46	1.02
6	Hymenoptera	115	3.80	97	2.50	99	2.20
7	Neuroptera	79	2.61	57	1.47	68	1.51
8	Odonata	24	0.79	30	0.77	21	0.47
9	Dermaptera	80	2.64	78	2.01	66	1.47
	Total	3026		3883		4504	
	H'	1.730		1.647		1.595	
	H'_{max}	2.195		2.195		2.195	
	Evenness Index	0.5337		0.75068		0.72665	

1.91 and 1.02%), Neuroptera (2.61, 1.47 and 1.51%), Odonata (0.79, 0.77 and 0.47%) and Dermaptera (2.64, 2.01 and 1.47%) during the period of investigation (Table 1). The maximum numbers of species were caught from vegetable ecosystem possibly due to rich vegetation in the area.

The Shannon diversity index as calculated for cumulative collection of all insect orders in various ecosystems during *rabi* 2014-15 was 1.175, 1.629 and 1.578, which indicates moderate to rich diversity (Table 1). The diversity of fauna in various ecosystems is mainly due to different vegetation, which plays an important role for existence of insect fauna in a community. The presence of the large number of species in different ecosystems warrants frequent monitoring of the ecological process beside adoption of appropriate conservation strategy in order to safe guard its rich genetic diversity (Mathew and Rahmatullah, 1993). The total number of individuals caught in a light trap is an indication of biomass although more care has to be taken in its interpretation than for diversity as the size of a light trap catch can be influenced significantly by the setting of the trap, interference from other lights and lunar cycles (Barlow and Woiwod, 1989). This work was an attempt to describe some aspect of diversity of fauna of sub humid region of Rajasthan, India. The collected insects fall under the group of economically important pests damaging various crop ecosystems. This preliminary information on the species spectrum may be utilized in future to access diversity of the region.

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