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DIVERSITY OF INSECTS IN THE PADDY FIELDS OF *MUNDAKAM VAYAL*, KANNUR DISTRICT

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This study was conducted to determine the variation in the population of insects in the paddy plots of *Mundakam Vayal* area, Nedungome village, Kannur district. In this study a total of 71 insect species were observed. Out of these species, 52 species under eight orders were identified. Lepidoptera (12), Odonata (10), and Coleoptera (9) were recorded as the most dominant orders, followed by Araneae (7), Hemiptera (6), Orthoptera (5), Hymenoptera (2), and Diptera (1). The highest population density was in Lepidoptera, and the highest species diversity was seen in both Lepidoptera and Coleoptera. The most abundant species recorded were *Cnaphalocrocis medinalis*, belonging to the Order Lepidoptera, and *Leptocorisa oratoria* belonging to the order Hemiptera. The overall insect diversity and richness increased during the flowering and milky phase of the paddy plant. Results indicate that diversity of insects in paddy fields ensured a good balance between the populations of pests, and the beneficial insects (predators and parasitoids) of paddy. The diversity of insects can potentially be an effective way to conserve, use and enhance biodiversity to sustain food security in the agricultural ecosystem in the *Mundakam Vayal* area.

Keywords: Insect diversity; Paddy field; *Mundakam Vayal;* species richness; species abundance.

1. INTRODUCTION

Paddy cultivation plays a significant and vital role in rice production. Most of the global population depends on the 480 million tons of rice produced each year, as the basis for their lives. While about 90% of the world's 160 million hectares of paddy fields are in Asian countries, mainly in monsoon regions, paddy is

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also seen in North America and Africa, and even in dry regions where irrigation has reclaimed dry land for paddy fields [1]. Rice is one of the chief grains of India. Moreover, India has the largest area under rice cultivation, as it is one of the principal food crops.

Various insects, pests and disease infestations are the major constraints in rice (*Oryza sativa*) production systems. Those insects belong to class Insecta. The insect, (Class Insecta or Hexapoda), that is any member of the largest class of the phylum Arthropoda, is the largest of the animal phyla [2].

Insect pests are the main sources of biotic stress on crops [3,4]. There are hundreds of insects that cause serious damage to crops, and are controlled by synthetic insecticides, which are the main source of pollution and cause the development and progression of a number of health problems in humans and animals. Insect pests attack all portions of the rice plant and all stages of plant growth [5].

Several species, once considered minor pests, are now considered major, like the brown planthopper, white backed planthopper, green leafhopper, and leaf folders [6-10]. Until the 1960's, the stem borers were considered the most serious pests of rice throughout the tropics. In recent years, however, damage from them has declined. In Japan, the population densities of stem borers have steadily declined since the mid-1960s [11].

Rice is one of the major crops of *Mundakam Vayal* area, grown at different agro-climatic zones. Rice fields are considered as temporary wetland ecosystems that contain greater biodiversity, especially arthropods. This study aims to evaluate the diversity of different insect species in organic rice crops.

2. MATERIALS AND METHOD

2.1 Study Area

The area selected for the study was *Mundakam Vayal*, a small land area of Nedungome village, situated at Sreekandapuram municipality, Kannur district. This area is located between 12.051435^0 East-West Latitude and 75.559074^0 North-South Longitude.26136 square feet of cultivated area of the *Mundakam Vayal*, was taken for this study.

2.2 Study Period

The study was conducted for one month (November 2020). Observations were made from 4.30 p.m. to 6.30 p.m., and the frequency of occurrence of different insect species was noted.

2.3 Methods

Insects were collected by direct hand-picking. The species were collected in collecting jars. They were photographed from the paddy field directly. The observed population densities of insect species were counted daily [12-14]. The insects are morphologically recognized by using checklists available in literature. The insects were screened by the microscope and identified to the family level by using keys presented by Triplehorn and Johnson [15]. Identified to the species level from Insect Pests of Rice by Pathak and Khan [16] and subsequently the samples were sent to experts for identification to the species level when possible.

3. RESULTS AND DISCUSSION

During this observation, rainfall patterns and other meteorological factors played an important role in affecting the population of the pest and non-pest insects. Because, very light rain, about 0.1-15.5 mm only, was reported in November [17]. According to the Ground water year book of Kerala [18] the total rainfall in November was 39 mm (Central Ground Water Board). So, the absence of heavy rain increases the density of insects, and helps in proper growth of paddy cultivation. Furthermore, most orders of insects have close correlation with climate and food, that influence their daily activities and life cycle. During the study it was clearly understood that, most of the Lepidopterans, Coleopterans, and Hemipterans, feed on parts of paddy as their food. The insect species in Araneae, usually traps the small bugs, moth larvae, Coleopterans and other insects for their food. Warm climate and active vegetative growth phase of the host plants, would stimulate insect development and abundance, because of the availability of abundant food and optimum temperature for their proliferation. The average temperature of the area varied between 29^0C - 32^0C during the study period. This range was optimum for the rice plant, as it helps the insect to live in paddy fields. Also, the humid condition in the field varies from 60% to 93%. Extreme humid conditions in paddy fields and the marshy areas are an important factor for this high species level.

The proximity of other vegetation like coconut tree, banana tree, tapioca, areca palm, and green fodder grass in the paddy area, could also influence the distribution pattern of insects, where their diversity would increase due to the abundance of a reservoir of host plants. However, the total number of competitors and enemies for the various types of insects is in natural equilibrium, where reduced usage of pesticides and agrochemicals under the paddy

cultivation facilitated the adaptive balance between the herbivorous, carnivorous and omnivorous insect groups. This is crucial in controlling pestilence and pest outbreaks in the agricultural area.

Table 1. List of insects during the study period

SI. No	Order	Family	Species
1.	Lepidoptera	Crabidae	*Cnaphalocrocis medinalis*
2.	Lepidoptera	Crabidae	*Scirpophaga incertulas*
3.	Lepidoptera	Crabidae	*Spoladea recurvalis*
4.	Lepidoptera	Crabidae	*Herpetogramma bipunctalis*
5.	Lepidoptera	Crabidae	*Parapoynx fluctuosalis*
6.	Lepidoptera	Crabidae	*Omiodes diemenalis*
7.	Lepidoptera	Crabidae	*Scirpophaga innotata*
8.	Lepidoptera	Noctuidae	*Sesamia inferens*
9.	Lepidoptera	Erebidae	*Lyclene alikangiae*
10.	Lepidoptera	Nymphalidae	*Melantis leda*
11.	Lepidoptera	Hesperiidae	*Pelopidas mathias*
12.	Lepidoptera	Lycaenidae	*Jamides celeno*
13.	Odonata	Coenagrionidae	*Agriocnemis pygmaea*
14.	Odonata	Coenagrionidae	*Ischnura aurora*
15.	Odonata	Coenagrionidae	*Ceriagrion coromandelianum*
16.	Odonata	Coenagrionidae	*Pseudagrion microcephalum*
17.	Odonata	Coenagrionidae	*Agriocnemis femina*
18.	Odonata	Libellulidae	*Diplacodes trivialis*
19.	Odonata	Libellulidae	*Orthetrum pruinosum*
20.	Odonata	Libellulidae	*Pantala flavescens*
21.	Odonata	Libellulidae	*Neurothemis tullia*
22.	Odonata	Libellulidae	*Orthetrum sabana*
23.	Hemiptera	Alydidae	*Leptocorisa oratoria*
24.	Hemiptera	Pentatomidae	*Nezara viridula*
25.	Hemiptera	Pentatomidae	*Scotinophara coarctata*
26.	Hemiptera	Pentatomidae	*Amaurochrous dubius*
27.	Hemiptera	Cicadellidae	*Nephotettix virescens*
28.	Hemiptera	Cicadellidae	*Cofana sp.*
29.	Orthoptera	Trigonidiidae	*Metioche vittaticolis*
30.	Orthoptera	Acrididae	*Hieroglyphus banian*
31.	Orthoptera	Acrididae	*Oxya hyla*
32.	Orthoptera	Acrididae	*Spathosternum prasiniferum*
33.	Orthoptera	Pyrgomorphidae	*Atractomorpha crenulata*
34.	Hymenoptera	Formicidae	*Lasius niger*
35.	Hymenoptera	Sphecidae	*Sceliphron madraspatanum*
36.	Coleoptera	Coccinellidae	*Coccinella repanda*
37.	Coleoptera	Coccinellidae	*Coccinella transversalis*
38.	Coleoptera	Coccinellidae	*Micraspis discolor*
39.	Coleoptera	Coccinellidae	*Micraspis lineata*
40.	Coleoptera	Coccinellidae	*Micraspis hirashimai*
41.	Coleoptera	Coccinellidae	*Harmonia octomaculata*
42.	Coleoptera	Chrysomelidae	*Asphaera lustrans*
43.	Coleoptera	Chrysomelidae	*Haltica cyanea*
44.	Coleoptera	Scarabaeidae	*Dyscinetus morator*
45.	Diptera	Ephydridae	*Hydrellia sp.*
46.	Araneae	Lycosidae	*Pardosa pseudoannulata*
47.	Araneae	Linyphiidae	*Atypena formosana*
48.	Araneae	Araneidae	*Neoscona theisi*
49.	Araneae	Araneidae	*Argiope catenulata*
50.	Araneae	Tetragnathidae	*Tetragnatha mandibulata*
51.	Araneae	Tetragnathidae	*Tetragnatha maxillosa*
52.	Araneae	Oxyopidae	*Oxyopes javanus*

Table 2. Data on climatic condition in November

November Days	Temperature (^{0}C)	Humidity (%)
1.	29	65
2.	29	60
3.	31	77
4.	32	91
5.	29	83
6.	31	87
7.	32	93
8.	32	92
9.	32	90
10.	31	89
11.	29	72
12.	32	79
13.	32	89
14.	31	83
15.	29	85
16.	29	88
17.	32	93
18.	31	90
19.	31	90
20.	31	89
21.	29	85
22.	29	74
23.	29	83
24.	31	89
25.	32	90
26.	31	90
27.	29	82
28.	29	77
29.	29	69
30.	29	75

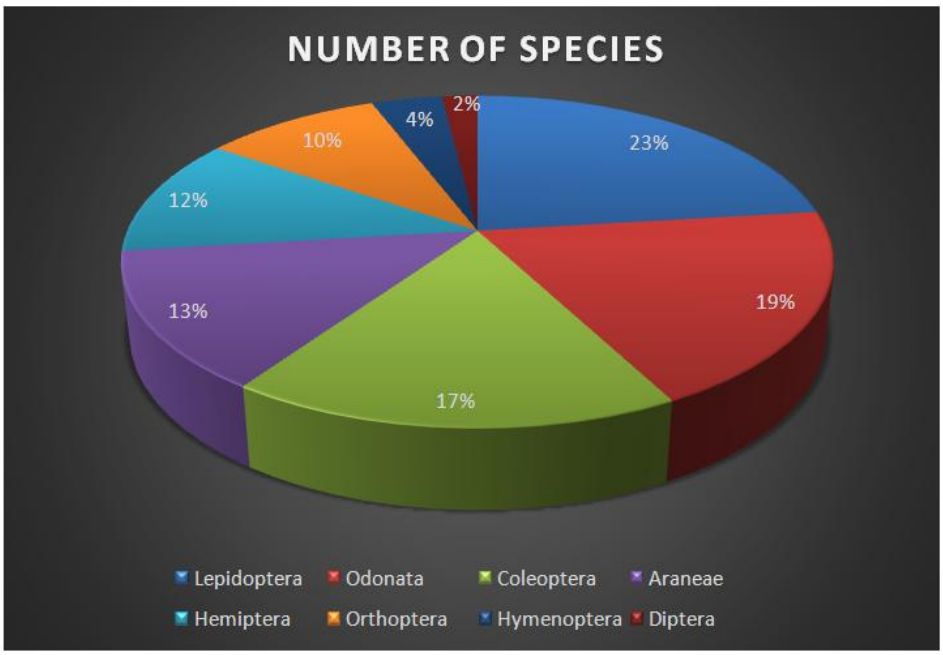

Fig. 1. Order wise abundance of species in percentage

Table 3. Monthly Rainfall Distribution during 2020-2021 (Figures in mm)- Ground Water Year Book of Kerala (2020-21)

District	2020								
	April	**May**	**June**	**July**	**August**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Alappuzha	84.2	383.8	495.3	346.8	378.3	635.6	243.2	112.8	60.1
Kannur	56.4	154.2	987.8	856.2	803.7	718.2	259.1	39	46.5
Ernakulam	140.7	237.2	501.5	549.9	628.6	576.3	233.9	155.8	43.6
Idukki	131.7	255.6	400.3	524.4	854.3	691.4	298	158.4	51.1
Kasaragod	2.6	122.5	878.6	1056	729.4	941.7	309.6	46.5	37.9
Kollam	90.2	346.7	355.2	263.3	331.1	402.8	248	130.3	56
Kottayam	201.5	366	617.9	588.1	546.6	577	251.8	132.5	69.4
Kozhikode	96	241.8	1166.7	735.9	676.1	861.7	236.4	91.8	50.4
Malappuram	111	120.5	463.4	463.9	485.7	574.3	131	49.8	20.2
Palakkad	85.3	67.7	309.4	417	524.2	455	162.3	38.7	19
Pathanamthitta	191.7	491.5	487.5	432.9	305.2	610.8	231.4	198.4	103.4
Thiruvananthapuram	129.3	432.1	366.4	149.5	217	420.8	203.2	107.1	36.3
Thrissur	80.8	149.6	477.4	447.3	498.8	576.2	218.3	65.8	11.3
Wayanad	145.4	124.3	293.1	426.7	867.7	494.9	125	84.6	30.4

In this study 12 different Lepidopteran species were identified. The most abundant species were *Cnaphalocrocis medinalis, Spoladea recurvalis*, and *Parapoynx fluctuosalis*. Stem borers *(Scirpophaga incertulas)* were less abundant than the leaf folders. The leaf folder *Cnaphalocrocis medinalis* was present in large numbers in rice, and it was the most dangerous pest on this paddy field. In order, Odonata, *Agriocnemis pygmeae, Ischnura aurora, and Pantala flavescens* were the most abundant species. Total 10 species were identified, 5 of them belonged to Damselflies and the other was Dragonflies.

The second most dangerous pest species in rice was *Leptocorisa oratoria*, which belongs to the order Hemiptera. The other abundant species in this order was *Cofana sp.* Total 6 different species were identified in the order Hemiptera. *Metioche vittaticolis*, belonging to the order Orthoptera, was the most abundant species, and a total of about 5 Orthopterans were identified in this order.

In order Hymenoptera, 2 species were identified and *Lasius niger* was the most abundant species in this order. A total of 9 species were identified in the order Coleoptera. *Haltica cyanea* was the most abundant species in this order. *Hydrellia sp.* was the only one species identified under order Diptera [15-18].

The species richness of the order Araneae was 7. *Tetragnatha maxillosa* and *Tetragnatha mandibulata* were the most abundant species in this. These species are normally present in all paddy fields [19]. From this study, we understand that, paddy fields of *Mundakam Vayal* village were heavily attacked by different species of insects. This may be due to the excellent weather, atmosphere and the presence of other plants cultivated near the paddy fields [19,20].

4. CONCLUSION

In this study a total of 71 species were observed. Out of these species, 52 species under eight orders were identified and recorded in *Mundakam Vayal* area. Lepidoptera (12), Odonata (10), and Coleoptera (9) was recorded as the most dominant orders in terms of number of species, followed by Araneae (7), Hemiptera (6), Orthoptera (5), Hymenoptera (2), and Diptera (1). The highest population abundance was recorded from Lepidoptera, and the highest species diversity was seen in both Lepidoptera as well as Coleoptera. The most abundant species was *Cnaphalocrocis medinalis*, belonging to the Order Lepidoptera, and *Leptocorisa oratoria*, belonging to the order Hemiptera. The overall insect diversity and infestation increased along with the growth phase of the paddy plant.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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