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Insect Pest Diversity and Their Pest Management in Paddy Crop of Tarai Region Kashipur, Udham Singh Nagar, Uttarakhand, India

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ABSTRACT
Insects are harmless creatures, but whenever their population reaches a critical level, they become serious pests, causing heavy damage. The present study focuses on the insect pests that adversely affect the paddy crop and pest management in the Tarai Region, Kashipur, District Udham Singh Nagar, Uttarakhand, India. There are two major rice varieties grown in this region: Oryza sativum and Oryza sativum japonica, PR 126 and PR 121. Mainly, the farmers of this region are focused on using chemical insecticides and are far away from organic farming. This study reveals the insect pest diversity and insecticides used in the paddy crop at the study site. The most dominant insect order and the most dominant family were Hemiptera and Delphacidae, respectively. The farmers in the study area use insecticides such as Chlorpyrifos, Imidacloprid, Phosalone, fipronil, and triazophos for pest control. This study also aims to contribute to raising awareness about organic farming at the farmer's level.
Keywords: *Paddy crop, Insect pests, Insecticides, Uttarakhand, Organic farming.*

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INTRODUCTION

Rice is the world's second-largest staple food crop after wheat, and demand for organic rice is increasing owing to its export potential. With a focus on traditional integrated agriculture, Uttarakhand is one of India's top states for organic farming [7]. Udham Singh Nagar is known as "Chawal Ki Nagari." The king of rice, basmati rice, is appreciated for its flavor, sizeable grains, and delicate aroma. It is priced high because of its organoleptic quality.

Insects cause enormous damage to agricultural crops. Insect pests attack all parts of the rice plant and all stages of plant growth. Feeding guilds consist of root feeders, stem borers, leaf hoppers or plant hoppers, defoliators, and grain-sucking insects. Rice is one of the most important food crops in the world. It provides the staple diet of 2.7 billion people in different parts of the world. It is grown in the entire world, except Antarctica. It occupies 150 million hectares of area and produces 573 million tonnes of rice with an average productivity of 3.83 tonnes per hectare [1].

About 90 percent of global rice production and consumption is in Asia [1]. More than 100 insect species are associated with the rice crop at one stage or another, and 20 of these insect pests have major economic significance. Among the sucking pests, BPH (brown plant hopper), WBPH (white-backed plant hopper), and rice bug pose severe threats to rice production [3]. The minor pests are the ear-head sting bug, rice striped bug, and rice leaf hopper. The insect pests found in paddy crops belong to the orders Lepidoptera, Orthoptera, Hemiptera, Coleoptera, Thysanoptera, etc. Most of the pests are serious defoliators; they damage the young foliage. Some are root borer, stem borer, and sap suckers while others are leaf miners.

Mainly, the crops have three stages: nursery, vegetative phase, and reproductive phase, and in all three stages, the pest insects are different. In the nursery stage, mainly stem borer and mosquitoes were seen, and in the vegetative stage, leaf hoppers, mealy bugs, stem borer, and hispa were seen. In the reproductive stage, the insect pests were: stem borer, BPH (brown plant hopper), WBPH (white-backed plant hopper), caterpillar, green leafhopper, leaf fodder, and Gundhi bug [8]. Pesticides are mainly substances or mixtures of substances that are used for pest destruction and control [5]. In many cases, the use of pesticides intended to reduce the impact of loss of production will result in undesirable environmental changes. The use of pesticides in the field causes a heavy damage when they are applied at levels higher than an ecologically acceptable level [6].

This study aims to inform farmers to use pest-resistant varieties of paddy. Recent years have seen an increase in organic farming due to people's increased awareness of the environment and food safety. The study describes the current status of insect pests and insecticide use in paddy crops.

MATERIAL AND METHODS

The study was carried out in the area of Jaitpur Ghosi village in Kashipur tehsil, Udham Singh Nagar. 29"10'31" N 79"01'03" E, 252m above sea level, that comes in the Tarai region of Kumaun division (Figure 1). The sampling was conducted from June 2022 to November 2022. The insects were collected from the study area; the insect population is primarily observed in the evening and less in the afternoon. Insects are collected by hand in an insect net, and in a killing jar. Species were documented by photography. The collected insect pests were identified on the basis of several keys and available literature. Insect identification was conducted by the identification books "Pests of Field Crops"(second edition) by F.G.W. Jones and Margaret G. Jones, London [2] and "A Field Guide in Color to Insects" by Dr. Jiri Zahradnik, illustrated by Frantisek Severa [9].

A questionnaire was designed to conduct a survey in the study area (Table 1). This survey constitutes the information on insect pests that harm the paddy crop and the insecticides used for prevention provided by farmers and agricultural labourers. Specifically, the questions ranged from basic information like the growing and harvesting period of paddy to awareness about organic farming. Other questions were related to crop losses due to insect pests, insect pest types, pest management in the surrounding area, and methods of insecticide application.

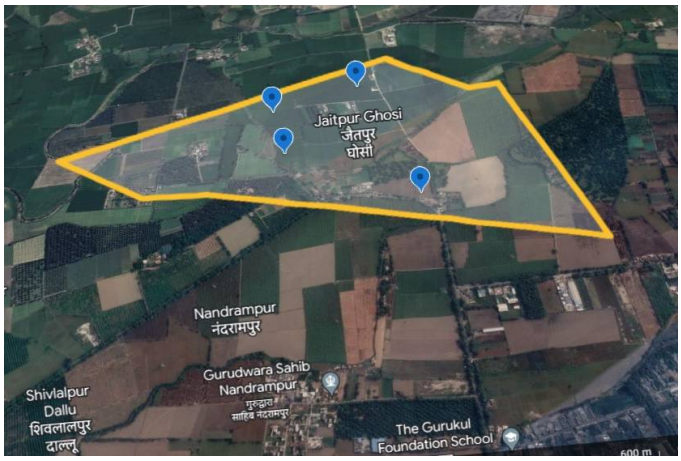

Figure1: Study area

RESULT AND DISCUSSION

During the investigation, a questionnaire was prepared and a total of 20 respondents were interviewed. The average response was tabulated as table 1 from the study site.

A total of 159 insect's pest individuals from five different orders with a total of 8 families were documented from the study area. Order Hemiptera (80), were found to be the highest number of individuals, followed by Lepidoptera(50), Thysanoptera(22), Coleoptera (2), Orthoptera (5), and among the families Delphacidae (50), dominated the study area followed by Pyralidae(26), Noctuidae(24) Cicadellidae(13), Alydidae(17), Acrididae(5), Chrysomelidae(2), Thripidae (22), and in total they are responsible for 40% loss of the paddy crop. Larvae of the order Lepidoptera, Coleoptera, are voracious feeders and were considered as phytophagous pests.

Beetles are primarily crop pests of paddy crop [4]. The insect pests at study site are mainly, stem borer, grasshopper, BPH (brown plant hopper), WBPH (white backed plant hopper), caterpillar, gundhi bug, hispa, armyworm, leaf roller, thrips. A detailed account of these orders, along with the number of species and number of individuals are shown in Table 1.

As per survey, 90% of the farmers in the study area mainly use chemical pesticides for pest control. The maximum used pesticides were Chlorpyrifos and Phosalone. A pesticide has both direct as well as indirect effect on ecology of not only the insect pest but also the other insects in the ecosystem [9].

Figure 3: Some insect pests collected from the study area.

Table 1: Questionnaires content

S.no.	Particulars	Average Response
1.	Growing period of paddy	May- June
2.	Harvesting period of paddy	October –November
3.	Loss of crop due to insect's pest	30-40% loss
4.	Insect pests types	10-12 types of insect pests were found in the study area.
5.	Pest management in the surroundings	Use of chemical insecticides such as Phorate, Fipronil, Chlorpyrifos, Quinalphos etc.
6.	Method of insecticides application	Spray method
7.	Awareness about organic farming	12-15%

Table 2: Checklist of major insect's pest of paddy crop in Kashipur

Order	Family	Insects as pest (Scientific name)	Parts damaged	Infective stage of insects pest	No. of Individuals
Lepidoptera	Pyralidae	Stem borer (*Scirpophaga incertulas)*	Stem	Caterpillars	11
		Leaf roller, (*Cnaphalocrocis medinalis)*	Leaves and stem	Both Caterpillars and adults	15
	Noctuidae	Swarming caterpillar (*Spodoptera mauritia)*	Caterpillars feed on the foliage of young seedlings in the nursery and transplanted plants	Caterpillars	8
		Army worm, (*Mythimna separate)*	cut off half ripe ears	Caterpillars	16
Hemiptera	Delphacidae	BPH *(Nilaparvata lugens)*	Circular patches of drying on mature plant	Both nymphs and adults	30
		WBPH (*Sogatella furcifera)*	Suck the sap	Both nymphs and adults	20

	Cicadellidae	Leafhopper *(Nephotettix bipunctatus*)	Suck sap from green leaves	Both nymphs and adults	13
	Alydidae	Gundhi bug, *(Leptocorsia acuta)*	Suck the juice from developing grains.	Both nymphs and adults	17
Orthoptera	Acrididae	Grasshopper, (*Hieroglyphus banian)*	Damage paddy crop by feeding on leaves and shoots.	Both nymphs and adults	5
Coleoptera	Chrysomelidae	Rice Hispa (*Didadispa armigera)*	Feed on green part of leaf(mesophyll)	Adults	2
Thysanoptera	Thripidae	Paddy thrips *(Thrips oryzae*)	Grubs- internal feeders of leaf Adults- feed on green parts of leaf	Both nymphs and Adults	22

Table3: Various crop stages damaged by common insect pest and their control measures

S. No.	STAGES	PEST	CONTROL MEASURES
1.	Nursery	Stem borer	Apply phorate @ 12 kg/ha Fipronil@33kg /ha 5 to 7 days before pulling seedings for transplanting spray with Chlorpyrifos, Quinalphos
2.	Vegetative phase	Stem borer, green leaf hopper, leaf folder.	Phorate 10G @10 kg/ha Or Chlorpyrifos 10G @ 10 kg/ha Imidacloprid @125ml/ha Phosalone, Fipronil Triazophos
3.	Reproductive stage	Stem borer, BPH (black plant hopper), WBPH (white backed plant hopper) leaf folder, caterpillar, gundhi bug, green leafhopper.	Spray Quinalphos @1600 ml/ha Phosalone @1100 ml/ha Spray carbonyl 50WP @ 1500 g/ha During afternoon hours.

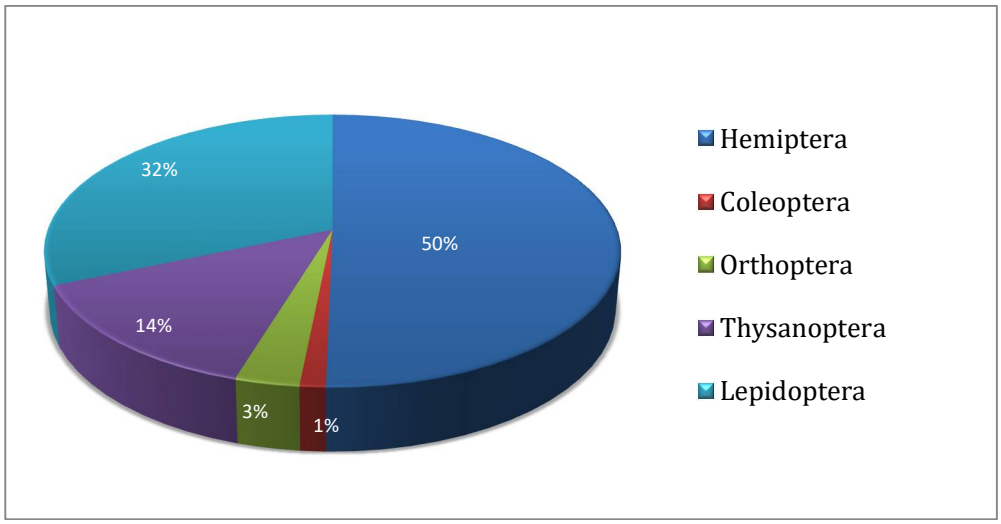

Figure 2: Percent of individuals Insect orders from the study site

CONCLUSION

The result exhibited major farm insects as pests, comprising a total of 11 species belonging to 5 different orders, i.e., Lepidoptera, Hemiptera, Orthoptera, Coleoptera, and Thysanoptera, and 9 families, i.e., Pyralidae, Noctuidae, Delphacidae, Cicadellidae, Alydidae, Acrididae, Chrysomelidae, and Thripidae, from the study area. Among all the insects' pests, *Scirpophaga incertulas* dominated the study area.

Moths and butterflies are known as good pollinators, but it was observed that their larvae are very harmful for paddy crops. Also, the continuous heavy usage of chemical pesticides in the study area can result in

more severe soil pollution, non-target killing, and environmental hazards that can lead to a great disturbance in the whole food chain of non- target animals.
As the present investigation revealed, paddy crop borer causes 30-40% loss of paddy crop during severe infestations; therefore, to avoid such losses, the farmers of the study area should use pest-resistant varieties and natural pest control methods in place of harmful chemical insecticides.
Improved soil quality and increased crop yields are two direct effects of organic farming's potential benefits. Moreover, organic agricultural practises enhance health and reduce the risk of diseases brought on by hazardous insecticides.

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