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Diversity and Distribution of Agricultural Insect Pest in Some Selected Areas of Indapur (Pune) and Phaltan (Satara) Tehsil, Maharashtra, India

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Abstract: *A survey was conducted to investigate the agricultural insect pest diversity in Indapur and Phaltan Tehsil. The actual survey was carried out during 15 Sep. 2020 to 15March 2021. Throughout study period, total 25 species of agricultural insect pests were collected & identified from 29 different sampling sites of 7 villages. They are belonging to 4 orders that is Orthoptera, Hemiptera, Coleoptera and Lepidoptera, while included in 12 families that is Gryllidae, Gryllotalpidae, Acrididae, Tettigoniidae, Pyrgomorphidae, Pentatomidae, Pseudococcidae, Coreidae, Chrysomelidae, Scarabaeidae, Cupedidae, and Sphingidae. The reported species were recorded from different habitat like Agricultural field, Residential area, Water Reservoirs, Woodland & Forest, Thorny Scrub and Grassland area. According to IUCN Red list, 1 species is critically Endangered, 2 species are Endangered, 1 species is Vulnerable, 5 species are Near Threatened, 14 species are Data deficient, and 2 species are Least Concern. The insect pest cause on an average 15 –20% yield losses in food and cash crops. Due to heavy of Insecticides use in agricultural field, then a tural bio control agent's numbers are drastically declined in study area. Suggestions for future improvement include, Integrated Pest Management (IPM) program through the ecological pest management practices.*

Keywords:Diversity, Distribution, Agricultural Insect Pest, Indapur, Phaltan, etc.

I. INTRODUCTION

India is the world's largest popular agriculture countries in the glob and the largest producer of crop wheat, rice, sugarcane, vegetables, groundnut, fruits and cotton. Food plants of the world are damaged by more than 10,000 species of insects, 100,000 diseases, 30,000 species of weeds and 1000 species of nematodes (Hall, 1995; Dhaliwal et al., 2007). Insect cause damage to plants either directly or indirectly in their attemptsto source food, and almost all the portions, viz. Roots, bark, shoots, stem, leaves, buds, flowers and fruits of plant are attacked and injured by insects (Atwal and Dhaliwal, 2015). Many of the insect pests such as aphids, caterpillar, grasshopper, locusts, whiteflies, leafhopper, mole cricket, thrips and some bugs etc. are damage the crop. There are many different types of insect pest included in different orders.

Losses because of the insect pest in Indian agriculture have been assessed from time to time (Singh et al., 2014; Dhaliwal & Arora, 2015). Extensive surveys carried out during early 1960s revealed that fruit, cotton, rice, and sugarcane suffered 25, 18, 10 and 10% yield losses, respectively (Pradhan, 1964). The number of insect pest damage the crop and loss of the yield. The agriculture field of India is presently suffering an annual loss of about Rs. 8, 63,884 million due to insect pest (Dhaliwal et al., 2010). The heavy crops are loss from insect pests, the farmers practice large amounts of pesticides (Aktar et al., 2009). But, both the quantity of food loss due to pests and the cost of pest controlin terms of money and human health are significant (Pimentel and Greiner, 1997).Sucking insect pests and defoliators like mirid bug, whitefly, aphids, mealy bug, plant hoppers, shoot fly, and the defoliating tobacco caterpillar, leaf miner and leaf folder *Cnaphalocnocis medinalis* (Guenee) have emerged as major pests (Chakra- barty, 2015).

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Insects have a directly influence on agricultural food production by sucking out plant juices, chewing the leaves of crop plants, stems or leaves and spreading plant pathogens, boring within the roots. They feed on natural fibers, destroy wooden building materials, ruin stored grain and accelerate the process of decay. (Yang et al. 2014) Pest control is the best achieved with an integrated pest management plan using a range of biological, chemical, physical, mechanical or cultural control methods. Selective insecticides can be employed with fewer effects on natural enemies. Common predators of insect pest include praying mantis, ladybird beetles, spiders, true bugs, earwigs, ground beetles, hoverfly larvae and lacewings (Cork, A., Dobson, et al., 2009).

Considering the above importance of the study, the present investigation was undertaken to know the diversity and distribution of agricultural insect pest in some selected areas of Indapur (Pune) and Phaltan (Satara) Tehsil.

II. Materials And Methods

A. StudyArea-

Indapur is located at 18.1187° N, 75.0234° E. It has an average elevation of 527 meters. and Phaltan is located at 17.9935° N, 74.4304° E. It has an average elevation of 558 meters. The climate of Indapur is quiet hot place as it receives scanty rainfall an inland climate of Maharashtra. The Phaltan climate is an inland of Maharashtra. The temperature is relatively high range between 12ºC to 45ºC. The observation of agricultural insect pest was carried out in twice a day (morning and evening) from two places of sampling site of Indapur and Phaltan Tehsil. The total study period 15 Sep. 2020 to 15 March 2021. The places include Dalaj no. 1, Dalaj no.2, Dalaj no. 3, Kalewadi, Bhadalwadi, Pilewadi, Bhigwan, Takalwade, Pimprad, Nimblak, area of Indapur and Phaltan city.

B. SamplingSite-

Throughout the Indapur and Phaltan Tehsil, extensive survey was carried out to cover maximum study area, actual collection sites shown in table No. 1- collection site along with their GPS location and elevation of Indapur and Phaltan city.

C. CollectionoftheInsect-

The regular collection of agricultural insects made during period of 15 Nov 2020 to 15 March 2021 using hand picking and insect net. The photography of the specimen was carried out by using DSLR camera Canon 760 D with 18-55 lance. The insects were anesthetized using jar containing cotton wad dipped chloroform. The insects then sun- dry& preserved and entomological pins were used for spread of the insect on entomological board.

D. TaxonomicIdentification-

Agricultural insect pest identification was done by using the available literature, Research article and identification keys.

III. Result And Discussion

During present study, a total 25 species of agricultural insect pest belonging to 4 order and 12 family were collected and identified (Table No. 2). Out of 25 species specimen, 1 species belonging to family Gryllidae. In order Orthoptera, 15 species from family Gryllotalpidae, 3 species from family Acrididae, 7 species from family Tettigoniidae, and 2 species from family Pyrgomorphidae, 3 species from family Pentatomidae.

Table No.1- Agricultural insect pestssamplingsitesalongwithGPSlocationandelevation.

Sr. No.	NameofVillage	Habitat	Latitude	Longitude	Elevation (InMeters)
1	DalajNo.3	Residentialarea	18°13'33.9"N	74°49'29.1"E	510
2	DalajNo.3	Grasslandarea	18°13'43.6"N	74°49'34.1"E	505
3	DalajNo.3	Residentialarea	18°13'45.6"N	74°49'39.2"E	503
4	DalajNo.3	Agriculturalarea	18°13'53.3"N	74°49'40.0"E	500
5	DalajNo.3	Agriculturalarea	18°13'37.6"N	74°49'42.7"E	503
6	DalajNo.3	Agriculturalarea	18°13'28.3"N	74°49'31.1"E	509

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7	DalajNo.1	Grasslandarea	18°14'00.9"N	74°48'54.4"E	507
8	DalajNo.1	Grasslandarea	18°14'24.0"N	74°48'48.1"E	502
9	DalajNo.1	Residentialarea	18°14'03.1"N	74°49'12.4"E	502
10	DalajNo.2	Agriculturalarea	18°14'04.0"N	74°48'11.6"E	505
11	DalajNo.2	Agriculturalarea	18°13'27.8"N	74°47'59.7"E	529
12	DalajNo.2	Grasslandarea	18°13'59.4"N	74°48'15.8"E	508
13	Kalewadi	Residentialarea	18°24'27.8"N	74°41'00.3"E	515
14	Pilewadi	Agriculturalarea	18°12'20.2"N	74°47'20.5"E	558
15	Bhadalwadi	Agriculturalarea	18°13'39.0"N	74°46'13.5"E	526
16	Bhadalwadi	Grasslandarea	18°13'45.8"N	74°46'27.3"E	522
17	Bhadalwadi	Agriculturalarea	18°13'45.8"N	74°46'21.3"E	521
18	Bhadalwadi	Residentialarea	18°13'40.1"N	74°46'28.0"E	521
19	Bhigwan	Residentialarea	18°18'06.9"N	74°45'18.0"E	507
20	Takalwade	Residentialarea	17°59'35.3"N	74°33'10.2"E	547
21	Takalwade	Agriculturalarea	17°59'29.1"N	74°33'06.6"E	547
22	Takalwade	Residentialarea	17°59'41.9"N	74°33'12.2"E	545
23	Takalwade	Grasslandarea	17°59'39.2"N	74°33'21.2"E	546
24	Nimblak	Agriculturalarea	19°09'15.0"N	74°40'16.7"E	654
25	Nimblak	Grasslandarea	19°09'16.0"N	74°40'34.1"E	646
26	Nimblak	Agriculturalarea	19°09'17.1"N	74°40'42.8"E	644
27	Pimprad	Agriculturalarea	17°58'59.8"N	74°31'47.0"E	558
28	Pimprad	Agriculturalarea	17°58'40.5"N	74°32'00.1"E	559
29	Pimprad	Residentialarea	17°58'43.0"N	74°31'53.3"E	559

In order Hemiptera, 2 species from family Pseudococcidae, 1 species from familyCoreidae. 1 species from family Chrysomelidae. In order Coleoptera, 2 species fromfamily Scarabaidae, 1 species from family Cupedidae. 1 species from family Sphingidae.In order Lepidoptera were collected. The photographs of the observed agricultural insectpest aregiven in plate.

In Order Orthoptera, *Telegryllus emma* commonly known as a field cricket isblack to dark brown insect, about 25mm long. They have large heads and wings that arefolded flat against the black. They have long antennae and two hairy prongs sticking outof the end of the abdomen. In family Gryllotalpidae, *Neocurtilla hexadactyla* are callednorthernmolecricket.Thenorthernmolecrickethasyellowishbrownwithadarkprothorax. 3 or 4 claws, short wings, long tail like extension and brawny legs. In familyAcrididae, *Phaulacridium marginale* are called New Zealand grasshopper. Wings aresmall,sizewereoftenunfortunatelysmall.Theyarecoloredtomatchbackgroundvegetationand three pairs ofleg.

Schistocerca americana is also called as American grasshopper. The body of thispest generally yellow brown in color. The wings are pale with large brown spot. They areslender grasshopper with longs wings. White strips on the tegmina, pronotum and headare distinct. Another grasshopper *Oedaleus infernalis* shows cylinder body shape. Thispest usually has a light brown body with dark brown stripes and small size. In familyTettiggoniidae, *Microcentrum rhombifolium* shows pale green color. Veins on the wingslook like the veins on a leaf. The wings are longer than the body and overlap each otherwhen closed. The tip of the wings comes to a point much like a willow leaf. *Pterophyllacamellifolia* are leaf green in color, length from 1.5 to 2.5 inches, long antennae and theirveins on their oval shaped.

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Plate No. 1 - Photographs of Agricultural Insect Pest from Study Area

A- *Teleogryllus emma* **B-** *Neocurtilla hexadactyla* **C-** *Phaulacridium marginale* **D-** *Schistocerca americana* **E-** *Oedaleus infernalis*
F- *Microcentrum rhombifolium* **G-** *Tettigonia viridissima* **H-** *Letana intermedia* **I-** *Conocephalus maculatus* **J-** *Pterophylla camellifolia*
K- *Chrotogonus oxypterus* **L-** *Tagasta apludi* **M-** *Halyomorpha halys* **N-** *Chinavia hilaris* **O-** *Podisus maculiventris*
P- *Phenacoccus solenopsis* **Q-** *Dysdercus cingulatus* **R-** *Leptoglossus occidentalis* **S-** *Anasa tristis* **T-** *Monolepta signata*
U- *Cyclocephala lurida* **V-** *Oryctes rhinoceros* **W-** *Heteronychus arator* **X-** *Tenomerga cinerea* **Y-** *Daphnis nerii*

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The *Tettigonia viridissima* commonly known as Great green bush cricket are green with orangey brown stripes running the length of the body, long wings. It can be up to 3-4 cm long. Antennae are very long and thin. The *Letana intermedia* shows green color with or without dark, medium sized, slender, antennae and 3 pairs of leg are present. *Conocephalus maculates are* smaller size, slanting shaped head, antennae are long, tegmina and wings are white in color and without any spots.

In family Pyrgomorphidae, *Chrotogonus oxypterus*are are brown pale, ventrally with black spots on thorax and metasoma. Antennae darker towards tip, hind femur with black spots. Head is sub conical, straight, cerci short, conical, stumpy. *Tagasta apludi* shows yellowish brown in color and brown spots in body. Antennae are short, 3 pairs of leg and head is pointed.

The survey was conducted to check the abundance of agricultural insect pest in Indapur and Phaltan Tehsil. The present study indicates the agricultural insect pests are increase in number as compared to biological agents. In order Orthoptera species was highly observed as compared to order Hemiptera, Coleoptera, Lepidoptera. The most of the order Hemiptera in green stink bug are found in maize plant. The order Coleoptera in different species found in different areas. Some caterpillars are found in plants and vegetables.

In farmer's point of view agricultural insect pest like grasshopper, leafhopper, army worm, locusts, beetles, bugs, some caterpillar damages the agricultural crops and forestry causing significant losses to farmers. Examples of agricultural insect pest like brown marmorated stink bug can cause widespread damage to fruit and vegetable crops. Aphids are damaging crops by the direct action of sucking sap, but also harming them. Insects are responsible for two major forms of damage to crops. First, there is the direct injury they cause to the plants as they feed on tissues. Second, there is the indirect damage in which the insect itself does little or no harm but transmits a bacterial viral, fungal infection into a crop. So, pesticides and herbicides are applied to agricultural land to control pests that disrupt crop production. Pesticide can be toxic to a host of otherorganisms like beneficial insects and non-target plants and also damage soil biomass. They are best for the agricultural use of vermicompost organic fertilizer production and also the conservation of biocontrol agents.

IV. Summary And Conclusion

A survey was conducted to investigate the diversity and distribution of Agricultural insect pest in Indapur and Phaltan Tehsil. The actual survey was carried out during 15 Sep. 2020 to 15 March 2021. Throughout study period, total 25 species of agricultural insect pests were collected & identified from 29 different sampling sites of 7 villages. They are belonging to 4 orders and 12 families. The reported species were assessed on IUCN Red list to know the status. The insect pest cause on an average 15–20% yield losses in food and cash crops. Due to heavy of Insecticides use in agriculturalfield, the natural biocontrol agent's numbers are drastically declined in study area.

Suggestions for future improvement include, Integrated Pest Management (IPM) program through the ecological pest management practices.

Table2: ChecklistofAgriculturalInsectPestsinIndapurandPhaltanTehsil.

Sr.No.	EnglishName	ScientificName	IUCNStatus	Habitat
	Order – 1 Orthoptera			
	Family – 1 Gryllidae			
1	Emma field cricket	*Teleogryllus emma*	EN	GA&RA
	Family - 2 Gryllotalpidae			
2	Northern mole cricket	*Neocurtilla hexadactyla*	DD	WR&RA
	Family – 3 Acrididae			
3	New Zealand grasshopper	*Phaulacridium marginale*	DD	GA
4	American grasshopper	*Schistocerca americana*	DD	GA&WF
5	Grasshopper	*Oedaleus infernalis*	EN	GA

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	Family – 3 Tettigoniidae			
6	Broadwinged katydid	*Microcentrumrhombifolium*	DD	TS&WF
7	Great green bush cricket	*Tettigonia viridissima*	LC	GA&AF
8	Bush cricket	*Letana intermedia*	DD	GA
9	Spotted meadow katydid	*Conocephalus maculatus*	LC	GA&RA
10	True katydid	*Pterophylla camellifolia*	CR	TS&WF
	Family – 4 Pyrgomorphidae			
11	Deccan grasshopper	*Chrotogonus oxypterus*	DD	WF
12	Grasshopper	*Tagasta apludi*	DD	GS & RA
	Order – 2 Hemiptera			
	Family – 5 Pentatomidae			
13	Brown marmorated stink bug	*Halyomorpha halys*	DD	AF & RA
14	Green stink bug	*Chinavia hilaris*	NT	AF,WF &RA
15	Spined soldier bug	*Podisus maculiventris*	NT	AF & RA
	Family – 6 Pseudococcidae			
16	Cotton mealy bug	*Phenacoccus solenopsis*	DD	AF
17	Red cotton stainer	*Dysdercus cingulatus*	DD	AF & RA
	Family – 7 Coreidae			
18	Western conifer seed bug	*Leptoglossus occidentalis*	NT	
19	Squash bug	*Anasa tristis*	DD	AF
	Order -3 Coleoptera			
	Family – 8 Chrysomelidae			
20	Leaf beetle	*Monolepta signata*	NT	AF
	Family – 9 Scarabaeidae			
21	Southern masked chafer	*Cyclocephala lurida*	DD	AF & WF
22	African black beetle	*Heteronychus arator*	DD	AF &GA
23	Coconut rhinoceros beetle	*Oryctes rhinoceros*	VL	AF,WF &RA
	Family – 10 Cupedidae			
24	Beetle	*Tenomerga cinerea*	DD	AF
	Order – 4 Lepidoptera			
	Family – 11 Sphingidae			
25	Oleander hawk moth	*Daphnis nerii*	NT	AF & WF

Abbreviations

LC–Least Concern **CR**–Critically Endangered **NT**–Near Threatened
VL–Vulnerable **EN**–Endangered **DD**–Data Deficient
RA–Residential area **WR**–Wate rReservoirs **WF**–Woodland and Forest
TS – Thorny Scrub **GA**–Grass land area **AF**–Agricultural field

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