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UNVEILING SEASONAL (KHARIF AND RABBI) AGRICULTURAL INSECT PEST VARIABILITY AND THEIR NATURAL ADVERSARIES IN DHULE TEHSIL (M.S.)

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ABSTRACT:
The present work carried out during the period of July 2021 to June 2022 at different localities of Dhule Tehsil of Maharashtra state revealed that there are total 39 agricultural insect pest from 20 different families of 10 different orders were recorded during both the seasons out of which 24 agricultural insect pest from 17 different families of 09 different order, while 15 insect species from 08 different families of 06 different orders were observed during rabbi season while 08 natural enemies and predatory insect species from 07 families of 06 different order of insect were observed during study period from study area. Among these Hemipteran, Lepidopteran, Thysonopteran and Isopteran insect species found abundant which are causing heavy damage to cultivated crops in both the seasons whereas pests comprises from rest of order viz, Diptera, Coleoptera, Orthoptera, Dermaptera, Arechnida, Trombidiformesand were recorded as minor pests and causing least damage to crops. The present work provide the information about seasonal variability of agricultural insect pests and there natural enemies from different localities of Dhule Tehsil.

Keywords:- Seasonal Variability, Kharif, Rabbi, Insect pests, predatory insects.

INTRODUCTION :

There are about 70 % of Indian peoples lives in rural areas and these are depend upon the farming and agro based industry. But majority of the farmers facing the severe problem caused by various insect which harmful to the agricultural crops. These insect pests not only damage the quality of crop but also decreases the average production of farmers. Most of insect species transmit various bacterial and viral diseases amongst the agricultural crops and vegetables. The most diverse and plenteous invertebrate on the planet is insects. Insects have been used as landmark studies in many areas like biomechanics, climate change, developmental biology, ecology, evolution, genetics and physiology (Thakkar, B., & Parikh, P. H. (2018), (Patel and Ghetiya, 2018). The assortment of insect species is entirely reliant on the agricultural environment, with their sustenance derived from roots, stems, leaves, flowers, and seeds. (Salunke R.N, and More S. V. 2017). Presently, the agricultural sector in India is grappling with an annual financial setback of approximately Rs. 8,63,884 million owing to insect pests. (Daliwal *et al* 2010). Insect-induced damages disrupt the physiological balance of plants, leading to a reduction in crop yield. (Nasiruddin M., 2012). The present work were conducted to assess the diversity and seasonal abundance (kharif and rabi) of agricultural insect pests including their natural enemies in different localities of Dhule district of Maharashtra state and collect pertinent data to formulate holistic strategies for managing agricultural insect pests. These tactics can be adopted by local farmers within their cropping systems.

MATERIALS AND METHODS

The present study was conducted in Dhule Tehsil, a prominent agricultural region within Dhule district, Maharashtra, India. Dhule Tehsil

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is situated in the northwestern part of the state and spans a diverse topography including Plains, Plateaus, Hills and Valleys it is moreover it located at Mapped location of Dhule, India (N 21° 4' 6.672", E 74° 35' 18.132"). The study area was selected on the basis of accessibility and location of eco region. The survey was conducted bi-monthly, commencing a month after sowing, to explore the seasonal variation in predominant agricultural insect pests and their associated natural predators. The population assessment of agricultural insect pests and their natural adversaries was conducted using a random sampling technique, with observations recorded along zigzag rows (Raja, *et al,*2014). The investigation involved the examination of agricultural crops that had suffered significant damage from a range of insect pests. The primary objectives were to assess the seasonal variability of these pests and to gather insect stages from the afflicted crops. Subsequently, the identified insect pests underwent laboratory identification. Furthermore, throughout the study duration within the designated area, observations were made to record the percentage of infestation and the extent of damage caused by these agricultural insect pests. Ten infested spots were observed from surrounding and middle part of selected agricultural crop field to record no. of insect pests from infested plants. Collected specimens were identified in the laboratory side by side with the help of available material. For identification, microscope with high magnification and different taxonomic keys were used. The individual species was recorded in accordance with family. Data Analysis was done based on their abundance and habit through Shannon Wiener diversity indices, Evenness indices by using PAST 3.X software.

RESULTS AND DISCUSSION :

During the course of study period total 39 agricultural insect pest from 20 different families of 10 different orders were recorded during both the seasons out of which 24 agricultural insect pest from 17 different families of 09 different order, while 15 insect species from 08 different families of 06 different orders were observed during rabbi season while 08 natural enemies and predatory insect species from 07 families of 06 different order of insect were observed during study period from study area. The vast no of insect pests population naturally controlled by other insect which acts as parasitoid and predator. In agricultural area of Dhule region 08 species (Table:4*) (Chrysoperla zastrowi, Sympherobius fallax, Cotesia glomerata, Cheilomenes-sexmaculata, Mantis indica, Syritta pipiens*, Hunting Spider, Various spp. of ants) from seven different families of natural bio control agents were recorded belonging in six different orders (Neuroptera, Hymenoptera, Coleoptera, Dictyoptera, Diptera, Arachnida) during both the seasons.`

Present study demonstrates the major agricultural insect pests and their natural enemies of major crops cultivated during the Kharif and Rabbi season of the year 2021-2022 at Dhule Tehsil (M.S.). The major crops in Kharif were groundnut, bajara, cotton and onion whereas the major crops cultivated during rabbi were wheat, gram and maize. An examination of the total number of collected individuals revealed significant variations. We also conducted an analysis of the relative density of individuals belonging to different orders. The distribution of insect species as a percentage is illustrated in graphs 1 to 4. Throughout this study, we computed the Shannon Weiner indices (measuring species diversity), and Buzas and Gibson's indices (assessing species evenness) using the statistical PAST Software, collected data to enable a comparison between the two seasons. When considering overall diversity and richness between the two seasons, it became evident that Rabbi exhibited the highest values, as indicated in Table 3, in contrast to the Kharif

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season. Regarding species evenness, the Rabbi season demonstrated a more evenly distributed species composition compared to the Kharif season. Total 39 species of agricultural pests were recorded from Kharif and Rabbi crops which are belong to ten different orders. During Kharif Season in groundnut farms total eight insect species recorded from five different orders, in the field each of bajara and cotton six insect species were observed while in the field of onion four different insect species from four different orders was recorded. All the nine orders observed during kharif was comprises from 17 different families. Among all the insect pest the order Hemiptera (40.09%), Lepidoptera (22.20%), Thysanoptera (18.00%), was dominant order causing heavy loss of yield, while Diptera (08%), Isoptera (6.9%) Orthoptera (2.02%), Coleoptera (1.10%), Thrombidiformis and Dermaptera (0.03%) each was observed as minor pests. Among the total 39 species 15 species belongs to 06 orders and 08 families recorded during the Rabbi season in major crop wheat, gram and maize cultivated at Dhule District. From the field of wheat total seven insect species recorded from five different orders, in the field each of gram total four insect species recorded from order Lepidoptera and Isoptera and from the field of maize four insect species were observed belonging from four different orders. All the six orders observed during Rabbi was comprises from 08 different families. Among all the insect pest, the order Lepidoptera (42.08%), Hemiptera (25.20%), Isoptera (19.80%), was dominant order causing heavy loss of yield, while Coleoptera (7.60%), Orthoptera (3.05%), and Arechnida (1.2) was observed as minor pests. The similar finding were reported by (Anita Singh and Amarjit Lal Sharma, 2014) those stated that Insect pests belonging to order hemiptera *Aphis gossypi*, and *Myzus persicae* (Family: Aphididae); *Bemisia tabaci* (Family: Aleyrodidae); *Phenacoccus solenopsis* (Family: Pseudococcidae); *Dysdercus cingulatus* (Family: Pyrrhocoridae) and *Pyrilla perpusilla* (Family: Lophopidae) were considered as serious concern to kharif crops such as paddy, cotton, maize and sugarcane. In India, wheat is ravaged by a number of insect pests viz., termites, *Odontotermes obesus* (Ramb); shoot fly, *Atherigona naqvii* (Steyskal); brown wheat mite, *Petrobia latens* (Muller); armyworm, *Mythimna separata* (Walker); cutworms, *Agrotis ipsilon* (Hufnagel) and aphid, *Sitobion avenae* (Fabricius). (Rajni Dhadwal and *et al., 2014*).

There is vast diversity in groundnut fields of the study area greatest diversity of groundnut pests was seen. Aphids, Thrips, Leaf minor and leafhoppers were found to be widely distributed in groundnut fields as well as cotton and bajara fields during kharif season. On the other hand in the Rabbi season maximum infestation was also seen due the Aphids, Leaf hopper, Armyworm, pod borers, and other Lepidopteran larvae. From the present study the authors observed that cotton mealy bugs and Aphids is highly destructive pests and its damage was a serious problem for small scale farmers. These pests are responsible for huge economic losses to yield of Kharif and Rabi crops and different strategies are being developed against to keep them at below the normal level.

CONCLUSION:

This increasing pest population is naturally control by some other beneficial insects. During both the seasons 08 species of insect predators and parasitoids were observed. These predators like Green lacewing, brown lacewing and Lady Bird beetles are commonly seen to feed on mealy bugs and aphids. and *Cotesia glomerata, Syritta pipiens* parasitoid on Thrips, mealybugs, Aphids and some Lepidopteran larvae (Table:4). But due to the lack of knowledge in farmers, population of these natural enemies or beneficial insects is decreased by the uncontrolled use of synthetic pesticides that resulting pest resurgence and pesticide resistance. However, the population of

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bio agents was adversely affected by the extensive use of insecticides (Cork et al., 2003). This increased use of insecticides is aimed at preventing yield losses due to a rise in pest populations. Unfortunately, this excessive chemical use has led to issues such as resistance, resurgence, and environmental hazards (Mascarenhas et al., 1998). Therefore, it is imperative to adopt proper management strategies for insect pests by integrating this knowledge with various proven methods of pest control, as suggested by (Gupta et al. in 2004). Ultimately, this approach aims to replace the insecticides to which the pests have developed resistance, leading to increased yields (Ahuja et al., 2012), while also aiding in the conservation and proliferation of both exotic and native natural enemies. Thus, the present study provides essential insights into the occurrence and infestation status of insects (whether pests or bio control agents) in the fields. This information is invaluable for selecting effective and environmentally friendly methods to manage these polyphagous insect pests at the appropriate times."

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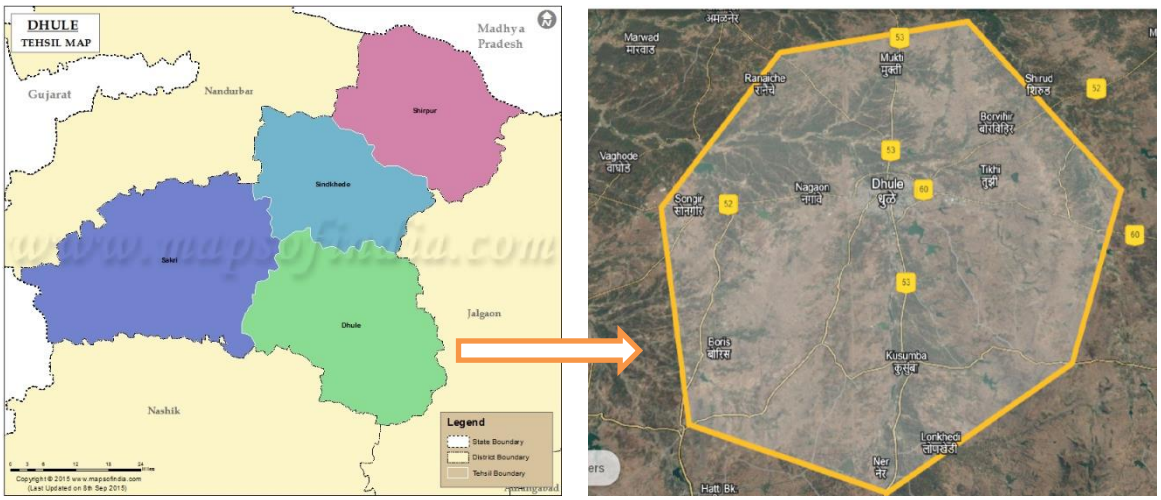

a) b)

Fig 1: a) Map of Dhule District b) Map of Study area

Table: 1: List of agricultural insect pests recorded during kharif season from Dhule Tehsil

Sr. No	Name of Major Crops	Name of Pest	Scientific name	Order	Pi	In pi	pi In pi
1	Groundnut	Termites	*Odontotermes sp.*	Isoptera	0.0688326	-2.6761	-0.184
		Thrips	*Scirtothrips dorsalis*	Thysanoptera	0.0971916	-2.3311	-0.227
		Ear wing	*Anisolabis stalli*	Dermaptera	0.003304	-5.7126	-0.019
		Leaf hopper	*Empoasca kerri*	Hemiptera	0.0390969	-3.2417	-0.127
		Aphids	*Aphis craccivora*	Hemiptera	0.0264317	-3.6332	-0.096
		Leaf miner	*Aproaerema modicella*	Lepidoptera	0.0129405	-4.3474	-0.056
		Red hairy caterpillar	*Amsacta albistriga*	Lepidoptera	0.0049559	-5.3072	-0.026
		Tobacco caterpillar	*Spodoptera litura*	Lepidoptera	0.0101872	-4.5866	-0.047
2	Bajara	Stem Borer	*Chilo partellas*	Lepidoptera	0.0115639	-4.4599	-0.052
		Pink Stem Borer	*Sesamia inferens*	Lepidoptera	0.0239537	-3.7316	-0.089
		Semilooper	*Eublema silicula*	Lepidoptera	0.0173458	-4.0544	-0.07
		Grasshopper	*Colemania sphenaroides*	Orthoptera	0.0217511	-3.8281	-0.083
		Stink bug	*Nezara viridula*	Hemiptera	0.0115639	-4.4599	-0.052
		Shoot fly	*Atherigona soccata*	Diptera	0.0803965	-2.5208	-0.203
3	Cotton	Red cotton bug	*Dysdercus cingulatus*	Hemiptera	0.0980176	-2.3226	-0.228
		Cotton aphids	*Aphis gossypii*	Hemiptera	0.0765419	-2.5699	-0.197

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		Cotton mealy bug	*Phenococcus gossypiphilous*	Hemiptera	0.0580947	-2.8457	-0.165
		American bollworm	*Helicoverpa armigera*	Lepidoptera	0.0503855	-2.9881	-0.151
		Pink bollworm	*Pectinophora gossypiella*	Lepidoptera	0.0407489	-3.2003	-0.13
		Cotton boll weevil	*Anthonomus grandis*	Coleoptera	0.0110132	-4.5087	-0.05
4	Onion	Onion Thrips	*Thrips tabaci*	Thysanoptera	0.0828744	-2.4904	-0.206
		Red Spider Mites	*Tetranychus spp.*	Trombidiformes	0.003304	-5.7126	-0.019
		Whiteflies	*Trialeurodes vaporariorum*	Hemiptera	0.0991189	-2.3114	-0.229
		Armyworms	*Spodoptera spp.*	Lepidoptera	0.0503855	-2.9881	-0.151

Table: 2: List of agricultural insect pests recorded during rabbi season from Dhule Tehsil

Sr. No	Name of Major Crops	Name of Pest	Scientific name	Order	Pi	In pi	pi In pi
1	Wheat	Termites	*Odontotermis obesus*	Isoptera	0.0832902	-2.4854	-0.207
		Grasshopper	Acrida exaltata	Orthoptera	0.0346611	-3.3621	-0.117
		Click beetle	*Melanotus pyncolineatus*	Coleoptera	0.003104	-5.7751	-0.018
		Leaf hopper	Pentastiridus hodgarti	Hemiptera	0.0315572	-3.456	-0.109
		Aphids	*Rhopalosiphum padi*	Hemiptera	0.1360579	-1.9947	-0.271
		Armyworm	*Mythimna seperate*	Lepidoptera	0.0460424	-3.0782	-0.142
		Legum pod borer	*Helicoverpa armigera*	Lepidoptera	0.0889809	-2.4193	-0.215
2	Gram	Pod borer	*Helicoverpa armigera*	Lepidoptera	0.0931195	-2.3739	-0.221
		Cutworm	*Agrotis ipsilon*	Lepidoptera	0.067253	-2.6993	-0.182
		Semilooper	*Autographa nigrisigna*	Lepidoptera	0.0734609	-2.611	-0.192
		Termites	*Odontotermis spp.*	Isoptera	0.1143301	-2.1687	-0.248
3	Maize	Fall armyworm	*Spodoptera frugiperda*	Lepidoptera	0.0589757	-2.8306	-0.167
		Corn leaf aphid	*Rhopalosiphum maidis*	Hemiptera	0.0848422	-2.467	-0.209
		Maize weevil	*Sitophilus zeamais*	Coleoptera	0.0724263	-2.6252	-0.19
		Spider mites	*Tetranychus spp.*	Arachnida	0.0118986	-4.4313	-0.053

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Table: 3: Diversity indices of pests recorded during Kharif & rabbi season from Dhule Tehsil

Taxa_S	Pest recorded during Kharif	Lower	Upper	Pest recorded during Rabbi	Lower	Upper
	24	24	24	15	15	15
Individuals	3632	3632	3632	1933	1933	1933
Dominance_D	0.0672	0.06562	0.06935	0.08542	0.08336	0.08867
Simpson_1-D	0.9328	0.9306	0.9344	0.9146	0.9113	0.9166
Shannon_H	2.856	2.831	2.874	2.54	2.516	2.557
Evenness_e^H/S	0.7244	0.7066	0.7378	0.8456	0.825	0.8595

Table: 4: List of agricultural insect pests recorded during Kharif & rabbi season from Dhule Tehsil

Sr.	Name of natural enemy	Scientific name	Order	Family
1	Green lacewing	*Chrysoper la zastrowi*	Neuroptera	Chrysopidae
2	Brown lacewing	*Sympherobius fallax*	Neuroptera	Chrysopidae
3	Wasp	*Cotesia glomerata*	Hymenoptera	Braconidae
4	Lady bird beetle	*Cheilomenes-sexmaculata*	Coleoptera	Coccinellidae
5	Praying mantis	*Mantis indica*	Dictyoptera	Mantidae
6	Hover fly	*Syritta pipiens*	Diptera	Syrphidae
7	Ground spider	Hunting Spider	Arachnida	Lycosidae
8	Ants	Various spp	Hymenoptera	Formicaedae

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