GSC Biological and Pharmaceutical Sciences
eISSN: 2581-3250 CODEN (USA): GBPSC2
Cross Ref DOI: 10.30574/gscbps
Journal homepage: https://gsconlinepress.com/journals/gscbps/

(RESEARCH ARTICLE)

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Diversity and abundance of insects on Potato, Mustard and Tomato in winter at Mitchells farm, Okara, Pakistan

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GSC Biological and Pharmaceutical Sciences, 2022, 18(01), 036–040

Publication history: Received on 28 November 2021; revised on 05 January 2022; accepted on 07 January 2022

Article DOI: https://doi.org/10.30574/gscbps.2022.18.1.0373

Abstract

Abundance is defined as the relative representation of species in a particular area. It is usually measured as the number of individuals found per sample. The abundance of insects was recorded from the selected fields of mustard, potato and tomato fields. Samples were collected by applying quadrant method, simple tools were used i.e. sweep nets and direct handpicking. Hemiptera, Lepidoptera and Hymenoptera were the main orders of the insects that were most abundant and effecting the selected fields. Total collected specimens were numbered as 117, out of which 65 specimens were recorded from mustard 36 from tomato and 16 from potato field. The results indicate that insects have subsequent association with their host vegetables at leafy stage. A maximum abundance of insects was found in mustard fields and least in Potato field. A common insect found among all fields was the budworm. Abundance was recorded less because of some factors i.e. low temperature and pesticides.

Keywords: Abundance; Diversity; Mustard; Tomato; Potato

1. Introduction

In ecology abundance is defined as the depiction of a species in a particular area or ecosystem. It can be measured by counting the number of individuals that are present in a sample. The ratio of abundance of one species to one or other multiple species that are living in an ecosystem is known as the relative abundance of species [1].

Insects are the most abundantly and diversified group of organisms on the lithosphere. The species which are present on the earth are estimated between 2.5 to 3.7 million. Insects are well adapted, have well adapted structures and material over geological time. For example in insects, camouflage and mimicry is seen which cannot be seen in other organisms. Insect survived four major cataclysms that resulted in planet wide extinctions [2].

Loss of insects is certain to have adverse effects on ecosystem functioning, as insects play a central role in a variety of processes, including pollination herbivory and detrivory nutrient cycling and providing a food source for higher trophic levels such as birds, mammals and amphibians (Smith *et al*., *2007)*. For example, 80% of wild plants are estimated to depend on insects for pollination, while 60% of birds rely on insects as a food source [3].

Average vegetable production contributes in Asia is almost 218 million tons. In Pakistan, India and China production rate of vegetables is highest. These are considered as fruit vegetables which possess leaves and stem. During present period, almost 3,460,000 ha area is under cultivation for vegetables and almost 13.7 million tonnes of edible vegetables are produced in Pakistan per annum [4].

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Skeletonized leaves are one of the biggest damage caused by the feeding habit of insects. All the parts of plants including stem, leaves, roots, and fruits are attacked by many species Aleyrodidae, Aphididae, and Pseudococcidae family. Larvae of the diamondback moth (Lepidoptera), mustard beetle, and herbivory leaf beetle attacked the leaves of Chinese cabbage [5].

The major control methods used since the 1970s were the use of resistant rice varieties (early protection to pest and disease), cultural control (e.g. intercropping), biological control and chemical control.Rice production is limited by pests, diseases and weeds. The major rice pests and diseases in Indonesia include rice stem borers (*Scirphopaga/Tryphoryza*spp), brown plant hoppers (*Nilaparvatalugens),* rice field rats (*Rattus-rattusargentiventer*), blast disease (*Pyriculariagrisea*), and rice tungro (*tungro virus*). The estimated loss due to these five main pests and diseases in Indonesia was 191,729 tonnes or 5,59 % from total rice planting area in 2011 (Directorate Food Crop Protection, Ministry of Agriculture Republic Indonesia, 2012). The economic cost of using insecticides to control *D. Suzuki* is less than the revenue lost from reduced fruit yields [6]. The negative effects of insecticides have directed the need to reduce applications and to improve integrated pest management strategies, which includes trapping, biological and cultural control [7].

2. Material and methods

2.1. Research area

This study was conducted in winter; November 2021 at Mitchell Farm located at Renala khurd near the University of Okara, Pakistan, to observe and relate the diversity and sequential relationship of insects among different food crops i.e. Mustard, Tomato and Potato in winter season.

Figure 1 Location of Mitchel farm at Google map

Figure 2 a) Potato field b) Tomato field c) Mustard field

Samples were collected from the fields i.e. Mustard, Potato and Tomato. That can be seen in Fig 2.

2.2. Collection of samples

To collect the specimens of Foliage, Aerial and Ground insects on Mustard, Tomato and Potato quadrant method was used; samples were collected once from an area of an Acre from each field. It is suggested that samples should be collected between early morning or late evening to record more abundance. Common tools were used to collect the specimens i.e. hand picking, aerial nets, sweep nets and forceps, After collection the samples were brought to the Laboratory of general zoology to preserve them.

Figure 3 a) Collected specimens b) *Aglais Urticae*

2.3. Preservation

To preserve the diversity of Foliage, aerial and ground insects were kept in a container that is half filled with the solution of 10% formalin with 90% of distilled water to make them reliable. Each sample was labeled with the date, time and name of the sample crop.

2.4. Identification

To identify the specimens these methods and tools were used i.e. digital images, magnifying glass, light microscope, stereo microscopes, and open internet sources.

3. Results and discussion

The research was completed according to plan .Total collected specimens were numbered as 117, out of which 65 specimens were recorded from mustard 36 from tomato and 16 from potato field. The abundance was recorded less just because of some factors i.e. low temperature (minimum 17 °C and maximum25°C) and some pesticides used by the farm caretaker to enhance the production of crops in Renala khurd, Pakistan. Out of total specimens 117 which were divided into 6 orders 9 families and 12 species shown in (Table 1), *Hellulaphidilealis* commonly known as bud worms recorded for most abundant specie among all the fields i.e. Potato, Tomato and Mustard.

Table 1 Recorded comparative abundance among Mustard, Potato, and Tomato in winter

Order	Sub order	Family	Specie	Mustard	Potato	Tomato
Hemiptera		Aphidoidea	*Aphidoidea*	(15.38)10	(25.00)4	(0.00)0
		Nabidae	*Nabidae*	(26.15)17	(0.00)0	(0.00)0
Coleoptera	Polyphaga	Chrysomelidae	*Alticini*	(00)0	(18.75)3	(16.66)6
		Coccinellidae	*Coccinella magnifica*	(16.92)11	(0.00)0	(0.00)0
Lepidoptera		Nymphilidae	*Aglais urticae*	(4.61)3	(12.50)2	(0.00)0
		Noctuidae	*Trichoplusia ni*	(0.00)0	(0.00)0	(19.44)7
	Zeugloptera		(Bud worms) *Hellula phidilealis*	(15.38)10	(43.75)7	(11.11)4
	Aglossata					

	Heterobathmiina Glossata					
			Heliothis virescens	(3.07)2	(0.00)0	(22.22)8
Thysonoptera		Thripidae	*Thysanoptera*	(0.00)0	(0.00)0	(30.55)11
Odonata		Libelluidae	*Pachydiplax longipennis*	(0.00)0	(0.00)0	(0.00)0
Hymenoptera		Apidae	*Apis mellifera*	(18.46)12	(0.00)0	(0.00)0
Total				65	16	36

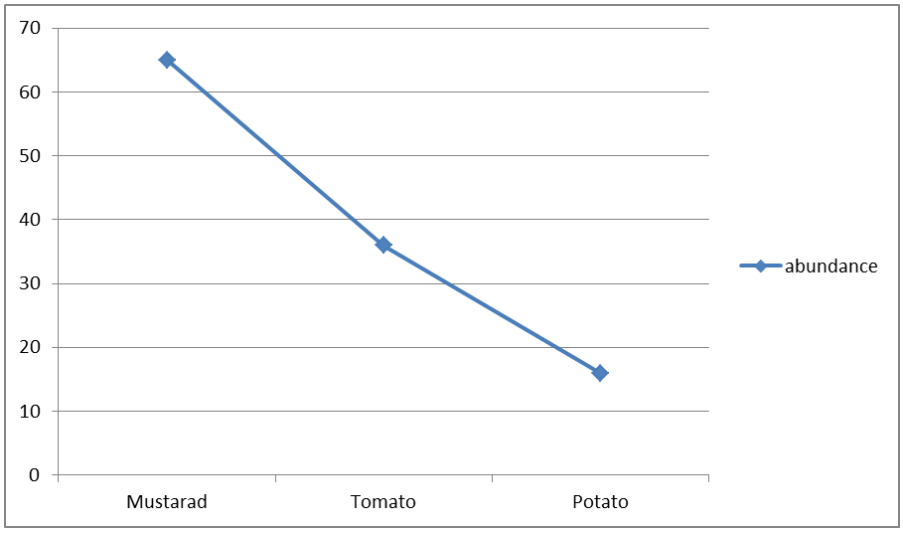

Figure 4 Recorded abundance of insects among Mustard, Potato and Tomato

This graph represents that most of the diversity and abundance of insects were recorded from the Mustard crop (=65 specimens) out of which most of them were aerial insects and least abundance was recorded in Potato field i.e. (=16).

4. Conclusion

Since the dawn of time, vegetables have been an excellent source of human sustenance and nutrition. Potato, tomato and mustard were chosen as three vegetables crops with the most insect's diversity was low due to low temperature and pesticide used to protect the crops. It describes the sequential interaction with insects that are beneficial and harmful across fields. According to findings of this investigation, insects alternately inhabit these three vegetables fields. Maximum abundance was recorded from the mustard field. This research will help for any crop field management strategies. It is suggested that more research is needed to better understand the insect's abundance and behavior in winter season.

Compliance with ethical standards

Acknowledgments

We are thankful to the General Zoology Laboratory, Department of Zoology, University of Okara for providing us with all the facilities for conduction of research. All the authors contributed equally to this work.

Disclosure of conflict of interest

Authors have no conflict of interest to declare.

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