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Diversity And Abundance Of Insect Visitors/Pollinators On Onion (*Allium cepa* L.)

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ABSTRACT
Onion (Allium cepa L.) is one of the most important vegetable crop worldwide and has been used in various forms of food as salads, as a raw or cooked vegetable and as a condiment. A global review of major vegetables shows that onion ranks second after tomato in an area. A field experiment was conducted to investigate diversity and abundance of insect visitors/pollinators on onion (Allium cepa L.). Hymenopterans were most abundant (50%) followed by Lepidoptera. Three Apis species viz. A.dorsata, A. cerana and A. mellifera were top workers on onion umbels as pollen and nectar gatherers among these A. mellifera and A. cerena were the most frequent visitors.Pollinators activity were obscured in the weeks of 16th and 17thstandard weeks, among all the visitors Apis melifera found highest from onion umbels (3.75 bees/m²/5min) and over all maximum number of pollinators visit during morning hours between 10am to 12pm. The visits were low at the time of initiation and cessation of flowering but these remained high during mid-flowering period.
Keywords: *Allium cepa L., Hymenopterans, insect pollinators, diversity, abundance.*

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INTRODUCTION

Onion (*Allium cepa* L.) is an important vegetable crop worldwide and has been used in various forms of food as salads, as a raw or cooked vegetable and as a condiment. A global review of major vegetables shows that onion ranks second after tomato in an area. Approximately, 36 million tonnes onion is produced on 2-5 million ha globally. India, second in world onion production, grows onion in approximately 1181,000 ha with an average productivity of 16 tones/ha (Ministry of Agriculture & Farmers Welfare Government of India 2014-15). Vegetable and fruit crops depend upon insect pollination for yield and fruit quality. Colour, shape and odour of flowers are well-known attractants to pollinators. Besides these physical features, the other source of variation for differential attraction between genotypes is the caloric reward *viz,,* nectar and pollen provided by the flowers. The nectar provided by the flowers has been found to be a significant parameter that shapes the behavior of pollinators in relation to their energetic needs(Abrol, 1990). The absence of natural pollinators on onion seed plantations poses a serious problem for breeders all over the world. In case of onion, wind pollination has a little effect because of the presence of sticky pollen. According to Banik (1990), the pollination activity of wind was 10 %, other pollinators were 3% and honey bees were 87% in onion pollination. Hand pollination is a cumbersome job but an important method of pollen transfer in plant breeding. The onion umbel is a roughly spherical inflorescence composed of numerous open, dish shaped flowers with easily accessible nectar, which attracts many short tongued insects. Besides physical features of flowers such as colour, shape and odour, environmental factors such as temperature, humidity, light, solar radiation, time of the day and nectar flow affect the behavior of pollinating insects thereby influencing the cross-pollination and the production of the crop (Corbet *et al*., 1991). Thus, it was decided to investigate the diversity and abundance of insect pollinators on *Allium cepa* L. and correlate their incidence in relation to the abiotic environmental factors.

METHODOLOGY

The crop was raised under field conditions following standard agronomical practices. The bulbs of onion variety Nasik were planted on December 2016. The observations were recorded from April to May. The

crop was harvested in mid-May 2017. To determine the spectrum of different insects visiting the blossoms of onion, these were collected by a cone type hand net with 40 cm ring diameter.
Sweepings were made by insect net throughout the blooming period at weekly intervals during March to May at hourly intervals from morning to evening i.e. 10am, 12pm, 2pm and 4pm. Collected insects included both insect visitors and pollinators on onion umbels. These were identified as per available literature.
The abundance of different insect visitors/pollinators of onion crop mentioned above was recorded from the commencement (second week of April) till the end of the blooming season (third week of May). For this purpose, ten umbels of uniform size ofNasik-53 were randomly selected per meter row length and the total number of insect pollinators of each species was recorded by visual counting at the beginning of each hour for five minutes during 10am 12pm, 2pm and 4pm on all the days of observation. These observations were continued during the whole blooming period. To record the relative abundance of various pollinators, abundance as per the method described above was recorded per square meter per minute for the whole day on all days of observations. Behaviour of pollinating insects in relation to some meteorological variables was studied.

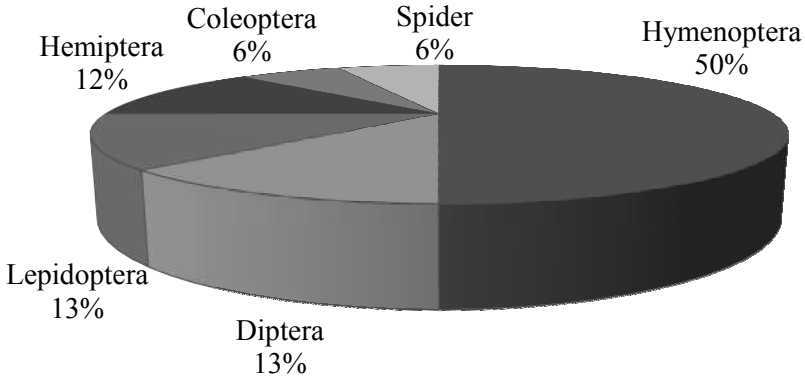

Fig 1. Abundance of different insect pollinators on onion (*A. cepa*) umbels

Table 1. List of insect visitors/ pollinators of onion (*Allium cepa* L.) umbels

Sl.No	Insect (Scientific name)	Family	Order
1	*Apis mellifera* L	Apidae	Hymenoptera
2	*Apis cerana* Fab.	Apidae	Hymenoptera
3	*Apis dorsata* Fab.	Apidae	Hymenoptera
4	Hover fly	Syrphidae	Diptera
5	*Coccinella* sp.	Coccinellidae	Coleoptera
6	*Pieris spp*	Pieridae	Lepidoptera
7	Thin waisted wasp (a)	-	Hymenoptera
8	Thin waisted wasp (b)		Hymenoptera
9	Monarch butterfly	Danaidae	Lepidoptera
10	*Nezara spp*	Miridae	Hemiptera
11	Yellow banded wasp	Vespidae	Hymenoptera
12	Big black wasp		Hymenoptera
13	Black ants	Formicidae	Hymenoptera
14	*Musca domestica*	Muscidae	Diptera
15	Spider	-	Aranae

Table. 2 Seasonal abundance of pollinators on onion umbels during April- May 2017

SW	Time	No. of pollinators/m^2/5 min				Total	Temp. (^{0}C)	RH (%)
		A. mellifera	*A. cerena*	*A. dorsata*	Syrphids			
16	10am	4	2	2	1	9	35	26
	12pm	3	3	1	2	9	39	23
	2pm	2	4	-	2	8	41	14
	4pm	3	2	1	1	7	40	16

Mean		3	2.75	1	1.5			
17	10am	3	3	3	-	9	32	15
	12pm	5	2	1	1	9	36	11
	2pm	3	4	1	1	9	38	10
	4pm	4	3	-	-	7	39	9
Mean		3.75	3	1.25	1.5			
18	10am	3	1	2	1	7	35	15
	12pm	4	2	-	2	8	39	11
	2pm	2	2	1	-	5	42	8
	4pm	2	1	-	-	3	42	7
Mean		2.75	1.5	0.75	0.75			
19	10am	2	1	3	-	6	35	30
	12pm	1	2	-	-	3	37	27
	2pm	1	3	-	1	4	38	25
	4pm	2	1	1	-	4	38	27
Mean		1.5	1.75	1	.25			
20	10am	1	-	2	-	3	40	18
	12pm	-	-	-	-		43	14
	2pm	-	1	1	-	2	43	14
	4pm	1	1	-	-	2	42	15
Mean		0.5	0.5	0.75	0	-		

Note: SW= Standard week; RH= Relative Humidity; Temp. = Temperature

RESULTS

The pollinators recorded in the present investigation have been listed in Table 1. As far as per cent frequency of occurrence in terms of pollination activity is concerned, Hymenopterans were most abundant (50%) followed by Lepidoptera, Diptera, Coleoptera and Hemiptera (fig 1). Three *Apis* species *viz*. *A.dorsata*, *A. cerana* and*A. mellifera* were recorded astop workers on onion umbels as pollen and nectar gatherers. Of all the insect visitors,*A. mellifera* and*A. cerena* were the most frequent visitors. In earlier studies also, insect fauna belonging to Diptera, Hymenoptera and butterflies has been reported to visit and pollinate the onion field(Shafqat and Masood 2008). Ingeneral, diversity of pollinating insects varies from region to region and locality to locality. According to Saeed *et al.* (2008), the community of pollinators on onion wascomposed of four bee species and twelve true fly species, whereas Shafqat and Masood (2008) reported two Hymenopteran bees and eight true flies of Diptera as pollinators of onion crop. In consonance with our findings, the predominance of honey bees constituting 68.4% (Kumar *et al.,*1985) and 82.3% pollinators was recorded in onion crop.

Data on the abundance of bee pollinators on *A. cepa* umbels at different hours of the day is presented in Table 2. Variation inabundance was recorded over time and space. The maximum numbers of pollinators were recorded in the 16thand 17thSW in the morning time (32^0- 36^{0}C; RH 15-26%) with 9 pollinators/ m^2/ week. Among these pollinators maximum number of *Apis mellifera* was recorded from onion umbels (3.75 bees/m^2/5min.) followed by *A. cerena* (3bees/m^2/5 min.), Syrphids(1.5 bees/m^2/5 min.) and minimum population of *A. dorsata* (1.25 bees/m^2/5min.) was observed on onion umbels during 17th SW. Over all maximum number of pollinators visit during morning hours 10am – 12pm (table 2).Pollination process is more efficient when there are more flowers on a plant. At peak flowering, the availability of flowers is more than commencement and cessation and large numbers of insects visit the crops during this period to help maximize the pollination process. In the present investigation, fluctuation in visits of insect pollinators on different days on onion crop was observed. The visits were low at the time of commencement and cessation of flowering but these remained high during mid flowering period. This difference may be due to variation in the floral density during the span of blooming on the crops. Kendell and Smith (1975) also stated that at the peak flowering, the number of flowers was more/maximum and these were visited by a large number of pollinators and helped maximization of pollination in different crops.

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