Environment & Ecology 35 (1B) : 585—588, January—March 2017
Website: environmentandecology.com ISSN 0970-0420

Abundance of Insect Pollinators on Almond (*Prunus amygdalus* L.) in Central Kashmir

Shahida Altaf, Ishtiyaq Ahad, Amit Kumar, Z. A. Baba

Received 2 May 2016; Accepted 6 June 2016; Published online 30 June 2017

Abstract Studies on diversity and relative abundance of various insect pollinators on almond were carried out at various orchards located at Srinagar, Budgam and Pulwama of Kashmir valley. Insect diversity studies showed that 12 insect species visited almond flowers belonging to 6 families and three orders Hymenoptera, Diptera and Lepidoptera. Order Hymenoptera comprised of: Helictidae, Apidae and Andrenidae families; Diptera comprised of Syrphidae and Scathophagidae families while, Lepidoptera comprised of Papilionidae family, respectively. Diversity of *Lasioglossum nursei* was found maximum at all the locations followed by *Apis cerana*. Moreover *L. nursei* were abundant in all the selected districts in which most abundant family Halictidae was registered, whereas least abundance was documented by the family Papilionidae and Scathophagidae. Foraging populations of honeybees responded differently to abiotic factors. Peak activity Hymenopteran and Lepidopteran was observed between 1200–1400 pm, however peak activity of Dipterans was observed between 08:00–09:00 am. Hymenopterans, Lepidopteran and Dipterans were positively correlated with temperature and sunshine but negatively correlated with relative humidity except dipterans. Sunshine showed significant positive correlation but rainfall showed negative impact. The findings suggest in maintaining a natural habitat that is suitable for *L. nursei* and other native insect pollinators to ensure successful survival of these important insects in almond orchards which contribute significantly to fruit set. Moreover, pesticide application should be avoided at time of full bloom.

Keywords Pollinator, Almond, Hymenopterans, Insect, Abundance.

S. Altaf, I. Ahad, A. Kumar*, Z. A. Baba
Faculty of Agriculture,
Wadura, SKUAST-Kashmir,
Baramulla (J & K) 193201, India
*Division of Fruit Science,
SKUAST-Kashmir, Shalimar,
Srinagar (J & K) 190025, India
e-mail : *khokherak@rediffmail.com
*Correspondence

Introduction

Almond (*Prunus amygdalus*, Batsch) is an important fruit crop of Kashmir valley, belongs to family Rosaceae and order Roseales. Jammu and Kashmir state ranks first with production of 3.3 thousand MT on an area of 16.8 thousand Ha, in which Pulwama and Budgam districts are the leading producers [1]. The productivity of is almond is directly dependant on

Table 1. Insect pollinators visited almond flowers under different locations.

Order	Family	Genera	Species
Hymenoptera	Apidae	*Apis*	*cerana mellifera*
		Bombus	*tunicatus*
		Xylocopa	*valga violacea*
	Halictidae	*Lasioglossum*	*nursei floridula*
	Andrenidae	*Andrena*	*patella cineraria*
Lepidpotera	Papilionidae	*Papilio*	*machaon*
	Syrphidae	*Eoseristalis*	*cerealis*
Diptera	Scathophagidae	*Scathophaga*	*scathophaga* spp. L.

Table 2. Species diversity of insect pollinators visiting almond blossom under different locations.

Species	Species diversity index (H)		
	Srinagar	Budgam	Pulwama
Apis cerana	0.1414	0.13639	0.13857
Apis mellifera	0.09624	0.06051	0.05936
Bombus tunicatus	0.08876	–	–
Xylocopa valga	0.10927	0.11816	0.0693
Xylocopa violacea	–	–	0.10646
Lasioglossum nursei	0.15975	0.15932	0.15922
Andrena floridula	0.11916	0.1136	–
Andrena patella	–	–	0.11028
Andrena cineraria	–	–	0.11811
Papilio machaon	0.07136	–	–
Eoseristalis cerealis	–	0.09645	–
Scathophaga spp.	–	0.0804	–

pollination carried mostly by insects. Seventy-five per cent of all crop species depend on insect pollinators to produce fruits or seeds [2]. Pollination is fundamental ecological process for the maintenance of the viability and diversity of flowering plants and provides important ecosystem services to wide variety of crops and finally to humans. Pollination benefits society by increasing food security and also improving livelihood [3]. Pollinators are extremely diverse, with more than 16,000 pollinator bee species (Apidae) described worldwide [4, 5]. Keeping above facts in view it was imperative to study various pollinators present on almond in Kashmir agro-ecosystem.

Materials and Methods

Two sites from each district namely Dalgate and Badamvari from Srinagar, Central Institute of Temperate Horticulture (CITH) and KD farm from Budgam and Barsu and Lethpora from Pulwama, respectively, were surveyed for collection and identification of pollinators foraging on almond during flowering season in 2013. Insect specimens were collected at the experimental sites mentioning the collection date and name of locality/site. Taxonomic classification of specimens was done into groups with the help of the key given [5] up to species level except one species (genera level). The genera *Scathophaga* could not be identified, whereas other specimens were identified upto the species level with the help of the relevant literature in the laboratory of Research Training Center for Pollinator, Pollinizer and Pollination Management (RTCPPPM) SKUAST-Kashmir, Shalimar. Those species that were not identified upto the species level were sent Punjab Agriculture University (PAU), Ludhiana and University of Agricultural Sciencies, Dharward, Karnataka to the workers in India for their proper identification.

For recording insect pollinator abundance visiting almond, one meter length on each of the five trees selected per location was marked and number of such insects foraging on these branches was counted in the beginning of each hour for 15 min as per the methodology [6, 7, 8]. For recording insect pollinator diversity of hourly count of each insect foraging on almond blossoms was made for entire flowering period. The Shannon Index (H) was used for calculating indicator for pollinator diversity.

$$H = \sum Pi \, (\ln Pi)$$

where, $Pi = Ni/N$, Ni = total number of individuals in a species, N = total number of individuals in all species.

Table 3. Species diversity index of insect pollinators under different locations.

Sl. No.	District	No. of species	No. of individuals	Species diversity index (H)
1.	Srinagar	7	417	0.0162
2.	Budgam	7	490	0.0263
3.	Pulwama	7	527	0.0268

Table 4. Number of insect pollinators collected under different locations from almond blossoms.

Species	Srinagar			Budgam			Pulwama		
	Badam-vari	Dalgate	Total	KD farm	CITH	Total	Barsu	Leth-pora	Total
Apis cerana	40	46	86	48	44	92	49	54	103
Apis mellifera	18	21	39	10	12	22	11	12	23
Bombus tunicatus	6	7	13	–	–	–	–	–	–
Xylocopa valga	29	20	49	36	31	67	17	12	29
Xylocopa violacea	–	–	–	–	–	–	29	30	59
Lasioglossum nursei	75	81	156	84	83	167	88	90	178
Andrena floridula	28	30	58	30	32	62			–
Andrena patella	–	–	–	–	–	–	30	33	63
Andrena cineraria	–	–	–	–	–	–	32	40	72
Papilio machaon	7	9	16	–	–	–	–	–	–
Eoseristalis cerealis	–	–	–	20	26	46	–	–	–
Scathophaga spp.	–	–	–	15	19	34	–	–	–
Total	203	214	417	243	247	490	256	271	527

Results and Discussion

Insect diversity studies showed that almond flowers were visited by twelve species of insecta belonging to three orders and six families of class insects out of these twelve species, nine belonged to Hymenoptera, two to Diptera and one to Lepidoptera. It has been observed that Hymenoptera was represented by three families viz. Apidae, Halictidae and Andrenidae, Diptera (Syrphidae and Scathophagadiae) and Lepidoptera (Papilionidae) (Table 1). The results indicated that diversity was highest in the Pulwama district, among all the three districts *Lasioglossum nursei* was found to be more diverse (Tables 2 and 3). Species diversity was highest in Pulwama because least spray of pesticides was done compared to that of other two districts, Moreover Pulwama has karewas type of topography. The higher population of *L. nursei* in almond orchards may be due to it being native species and in bloom is more and thus having better adaptability to local environmental conditions.

In the most of studies carried out by earlier investigators identified a total of 53 insect species visiting flowers of stone fruit trees. They belonged to five families (Apidae, Megachilidae, Halictidae, Andrenidae and Colletidae) of the order Hymenoptera [9]. The same bee families have been recorded previously as visitors and pollinators of blossoms of stone fruit trees in other countries of the world, as well as on blossoms of vegetable crops and wild plants in the natural landscape [10]. The present findings are in tune with the earlier reports in which also the order Hymenoptera was found as a dominant group among other groups of insect pollinators on almond bloom [11, 12].

Earlier findings also confirmed that the pollinator community composed of 15 insect species belonging to three orders and 10 families, and that bees were the most abundant (435 individuals) flower visitors followed by butterflies (345 individuals) and other flies (248 individuals) while moths and wasps were observed occasionally [13]. Bees accomplish more than 80% of the insect pollination, yields of fruit, legumes and vegetable seeds often have been doubled or tripled by providing adequate number of bees for pollination [10].

Abundance of insect pollinators on almond

Almond flowers attracted insect pollinators belonging to the orders Hymenoptera, Lepidoptera and Diptera (Table 4). The hymenopterous insects viz., *Lasioglossum* spp. were more abundant followed by, *A. cerana* almond blossoms, as soil dwelling bees remain high during spring because of their adaptation to temperature and soil acts as a shield to the soil dwelling bees against habitat destruction and pesti-

cide sprays so population of bees remain high during the spring.

Most of the studies carried out by earlier investigators revealed that bees from the families Halictidae and Apidae were the most frequent native insect visitors to the flowers with 803 and 267 individuals, respectively. However, Megachilidae (192 individuals) and Andrenidae (170 individuals) families were intermediately abundant, whereas least abundant bees represented the family Colletidae (29 individuals only) [11]. Earlier reports also indicated that honey bees were the most abundant pollinators on apple blossoms [14]. The butterflies belonging to order Lepidoptera, *Scathophaga* sp. and Syrphid flies from order Diptera were observed in low numbers and are not regarded as effective pollinators.

On almond bloom, Hymenopterans (78.89%) were the most important insect pollinators, whereas, on peach bloom the percentage of Hymenopterans (44.50%) and Dipterans (49.37%) were almost equal in Shimla and Solan hills, respectively [10]. Abundance, richness and evenness of the hymenopterous pollinator were found at peak during the successional flowering time in the orchards of both pome and stone fruits in various localities [15, 16].

In the present study, maximum abundance was shown by *L. nursie* (Halictidae, Hymenoptera). The higher values on rank abundance of these species can be attributed to the fact that these species are supposed to have a greater adaptability to local environmental conditions. The results revelations of which confirmed that 9 species of insects in five genera belonged to order Hymenoptera as per rank abundances [17].

References

1. Anonymous (2012) Area and production statement. Dep Hort, Jammu and Kashmir, pp 1—2.
2. Klein AM, Vaissiere BE, Cane JH, Steffan-Dewenter I, Cunningham SA, Kremen C, Tscharntke T (2007) Importance of pollinators in changing landscapes for world crops. Proc Royal Soc London, Series B 274 : 303—313.
3. Khan MR, Khan MR (2004) The role of honey bees *Apis mellifera* L. (Hymenoptera: Apidae) in pollination of apple. Pak J Biol Sci 7 : 359—362.
4. Kevan PG (2003) Pollination for the 21st century: Integrating pollinator and plant inter pollinators of the future. Thomas Say Publ, Entomol Soc Am, Lanham, Maryland, USA, pp 181—204.
5. Michener CD (2007) The bees of the world. 2nd ed. Johns Hopkins Univ Press, Baltimore.
6. Jonathan JK (1990) Collection and preservation of animals (Hymenoptera). Zool Surv India, Calcutta, pp 147—150.
7. Joseph ANT (1990) Collection and preservation of animals (Diptera). Zool Surv India, Calcutta, pp 141—144.
8. Arora GS (1990) Collection and preservation of animals (Lepidoptera). Zool Surv India, Calcutta, pp 131—138.
9. Al-Ghzawi A, Zaitoun S, Mazary S, Schindler M, Wittmann D (2006) Diversity of bees (Hymenoptera, Apiformes) in extensive orchards in the highlands of Jordon, Arxius de Miscel. Lania Zoologica 4 : 42—48.
10. McGregor SE (2009) Insect pollination of cultivated crop plants. www.Jason/book/index.html.
11. Thakur B, Mattu VK (2014) Diversity and distribution of pollinators of temperate fruit crops of Shimla hills in Himachal Pradesh. Asian J Adv Basic Sci 3 : 151—163.
12. Abrol DP, Sharma D, Monobrullah M (2005) Abundanc and diversity of different insect pollinators visiting peach and plum flowers and their impact on fruit production. J Apicult Res 4 : 38—45.
13. Saeed S, Malik SA, Dad K, Sajjad A, Ali M (2012) In search of the best native pollinators for bitter gourd (*Momordica charantia* L.) pollination in Multan, Pakistan. Pak J Zool 44 : 1633—1641.
14. Mattu VK, Thakur B (2016) Foraging strategies of honeybees in pollinating apple flowers and its variation with altitude in Kullu hills of western Himalaya, India. J Entomol and Zool Studies 4 : 164—169.
15. Jasara AW, Rafi MA (2008) Pollination management of apricot as alivelihood source in northern areas. Pak J Agric Agric Engg & Vet Sci 24 : 34—40.
16. Raj H, Mattu VK, Thakur M (2012) Pollinator diversity and relative abundance of insect visitors on apple crop in Shimla Hills of western Himalaya, India. Int J Sci and Nature 3 : 507—513.
17. Hussain AK, Rahim M, Ghffar A, Alia H, Jamil A (2012) The hymenopterous pollinators of Himalayan foot hills of Pakistan (distributional diversity). Afr J Biotechnol 11 : 7263—7269.