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Study on Diversity, Distribution and Relative Abundance of Insect Pollinators of *Prunus persica (L.)* Stokes from Different Areas of Himachal Pradesh

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Abstract: ***Prunus persica (Peach) has several medicinal, nuritive properties and holds a strong economic value. For fruit production peach is mainly dependent on insect pollinators. So, study on diversity, distribution and relative abundance of insect pollinators is important for conservation of pollinators and pollination and the present study was conducted on insect pollinators of Prunus persica from different localities of Himachal Pradesh viz. Jatoli (1464m), Kandaghat (1425m), Mashobra (2146m), Summer Hill (2100m), Jaladi (508m), Hamirpur (786m), Gheori (559m), Bathra (503m), Bilaspur (673m) and Rajgarh (1555m). A total of 29 species of insect pollinators belonging to 4 orders and 11 families of class insecta were collected, of these, 8 belongs to Hymenoptera, 14 to Diptera, 6 to Lepidoptera and 1 to Coleoptera. It was observed that Kandaghat (51.32%), Jaladi (51.42%), Hamirpur (64.70%), Gheori (61.92%), Bathra (69.68%), Rajgarh (52.96%) were dominated by Hymenoptera, where as Jatoli (49.54%), Mashobra (54.19%), Summer Hill (51.17%), Bilaspur (53.30%) were dominated by Diptera.***

Keywords: Insect pollinators, *Prunus persica*

1. Introduction

Himachal Pradesh is a horticultural state of India, with diverse agro - climatic zones, ranging from subtropical to high altitude cold deserts and has a vast potential for successful cultivation of a wide range of horticultural crops. In India, Peach is grown mainly in Jammu and Kashmir, Himachal Pradesh, Punjab, Uttatrakhand, Nilgiri hills and North Eastern States (Josan *et al*., 2009). In Himachal Pradesh peaches grown in the entire hill zone and Rajgarh valley of district Sirmour is the main centre of peach production. The tree is rather small and mature tree grown upto fifteen feet tall (Chaurasiya and Mishra, 2017). In peach the flowering season is very short and last for few days (Chaudhary and Mehta, 2005). Peach has antidiabetic, antioxidant, antimicrobial, anticancer, anti - allergic inflammatory activities (Mokrani and Madani, 2016).

Many fruit crops (apples, blueberries, blackberries, cherries, strawberries, plum, pear, peach, litchi) are pollinated by insects. Majority of insect pollinators belong to three orders viz., Hymenoptera, Lepidoptera and Diptera. Animal pollination contributes to 35% of global food production (Klein *et al.*2007). Peach being a entomophilous crop is visited primarily by *Apis* species, constituting 80% of the total visitors (Chaudhary and Mehta, 2004). The availability of sufficient number of suitable pollinators during flowering time has direct impact on the yield and quality of fruit and seed. Many crops and populations of natural plants rely on pollination and often on the facilities provided by wild, unmanaged, pollinating communities (Free, 1993; Kluser and Peduzzi, 2007).

The decline in pollinators diversity affects the yield and quality of fruit crops. The number of insect pollinators decreases due to loss of habitat; introduced species; habitat disruption from grazing, mowing and fire; the use of pesticides; diseases and parasites, climate change and mono - cropping (Raj and Mattu, 2016). Singh *et al.* (2014) has been found that production of peach is decreasing due to diseases, overdependence on a selective cultivars and global warming. The decline of pollinating species can lead to a parallel decline of plant species (Biesmeijer *et al*.2006).

2. Material and Methods

The present investigation was carried out on diversity, distribution and relative abundance of various insect pollinators of *Prunus persica* from different sites viz., Gheori (Kangra), Bathra (Kangra), Jaladi (Hamirpur), Hamirpur, Bilaspur, Rajgarh (Sirmaur), Jatoli (Solan), Kandaghat (Solan), Mashobra (Shimla), Summer Hill (Shimla) of Himachal Pradesh during February - March from 2019 to 2021. Studies on relative abundance of various insect visitors were made by selecting plant at random on the basis of their size, age, flowering stage and number of branches, it was determined in terms of their visit per 500 flowers/10 minutes (Verma and Chauhan, 1985). The observation was recorded during 0900 - 1000, 1100 - 1200 and 1400 - 1500, 1500 - 1600 hours of a day and average count at these hours give abundance of insect pollinators for that particular day (Southwood, 1978). The relative abundance was analyzed statistically from the collected data.

$$\text{Relative abundance of species} = \frac{\text{Total number of individual of species A}}{\text{Total number of individuals of all species}} \times 100$$

3. Results and Discussion

Study showed that *Prunus persica* flowers were visited by 29 species of insect pollinators belonging to 4 order and 11 families. Of these, 8 belongs to Hymenoptera, 14 to Diptera, 6 to Lepidoptera and 1 to Coleoptera (Table I). Hymenoptera was represented by 3 families i. e. Apidae, Vespidae, Halictidae with species like *Apis cerana*, *Apis dorsata*, *Bombus haemorrhoidalis*, *Bombus trifasciatus*, *Xylocopa tenuiscapa*, *Vespa velutina auraria*, *Polistes delhiensis* and *Halictus* sp. Among the 14 species of Diptera, eight species i. e. *Episyrphus balteatus*, *Eristalis tenax*, *Eristalis cerealis*, *Eristalinus paria*, *Eristalis himalayensis*, *Melanostoma orientale*, *Eristalinus arvorum*, *Scaeva selenitica* belongs to family Syrphidae, three species i. e. *Morellia* sp., *Mikia* sp., *Tachina sacontala* belongs to Tachinidae. Each of Calliphoridae, Asilidae, Bombylidae represented by one species each (*Calliphora vomitoria*, *Neoitamus graham* and *Usia marginata).* Six species of lepidopterans were reported which belongs to Pieridae (*Pieris canidia indica*, *Pieris brassicae* and *Gonepteryx rhamni neplensis)* and Nymphalidae (*Vanessa indica*, *Aglais caschmirensis* and *Neptis hylas).* Only one species of coleopteran was observed i. e. *Coccinella septempunctata* of family Coccinellidae.

Different investigators on different temperate fruit crops have reported different number of pollinators. Abrol *et al*. (2005) studied that peach and plum flowers were visited by 27 species of insect pollinators belonged to 4 orders, 14 families of class insecta in Udheywala of Jammu. A similar survey by (Mattu and Bhagat, 2015) revealed a total of 39 species of pollinators on apple flowers in Kullu hills of Western Himalaya. Dar *et al*. (2018) recorded 46 species of insect pollinators belonging to 5 orders, 31 families on peach in temperate India. Similarly, Chauhan *et al*. (2021) recorded 23 species of insect pollinators of mango from Kyarda Doon valley of district Sirmaur, Himachal Pradesh. Of these, 11 species belonged to Diptera, 6 to Coleoptera, 4 to Hymenoptera and 2 to Hemiptera. Chauhan and Thakur, (2021) reported 16 species under 4 orders and 9 families visiting litchi flower in Kyarda Doon valley of District Sirmaur, Himachal Pradesh. Kumari and Thakur, (2021) observed 25 species of insect pollinators on *Punica granatum* L., of which 13 species belonged to Order Hymenoptera, 6 to Diptera, 2 to Lepidoptera and 1 to Coleoptera.

Study of insect pollinators of *Prunus persica* showed that relative abundance of hymenopteran species were more abundant at Kandaghat (51.32%), Jaladi (51.42%), Hamirpur (64.70%), Gheori (61.92%), Bathra (69.68%) and Rajgarh (52.96%) where as for dipteran it was more at Jatoli (49.54%), Mashobra (54.19%), Summer Hill (51.17%) and Bilaspur (53.30%) followed by coleoptran and lepidopteran. Among the hymenopteran members of family Apidae were observed most common at Jatoli (28.98%), Kandaghat (41.19%), Mashobra (24.92%), Summer Hill (29.86%), Jaladi (46.47%), Hamirpur (58.30%), Gheori (52.01), Bathra (56.94%), Rajgarh (45.53%) and Bilaspur (29.75%) which is followed by Vespidae and Halictidae. In the hymenopteran *Apis cerana* was the most abundant insect visitor on Peach at Jatoli (16.25±**7.1**4, 13.21%), Kandaghat (29.56±6.37, 21.92%), Mashobra (17.75±7.24, 14.86%), Summer Hill (20.19±7.34, 15.94%), Hamirpur (25.16±8.99, 24.86%), Gheori (26.50±7.93, 17.34%), Bathra (24.58±5.63, 20.23%), Rajgarh (21.08±5.74, 19.43%) and Bilaspur (15.33±5.36, 16.39%) (Table II, III, IV, V, VI).

It was also observed that relative abundance of other insect pollinators of hymenopterans at Jatoli, Kandaghat, Mashobra, Summer Hill, Jaladi, Hamirpur, Gheori, Bathra, Rajgarh and Bilaspur were *Apis dorsata (*6.30%, 11.05%, 4.25%, 7.24%, 16.27%, 18.15%, 14.69%, 17.00%, 16.36%, 6.15%), *Bombus haemorrhoidalis* (3.92%, 3.39%, 2.63%, 3.16%, 5.89%, 6.39%, 6.41%, 7.90%, 5.37%, 2.67%), *Bombus trifasciatus* (3.11%, 2.65%, 2.09%, 1.45%, 3.35%, 4.62%, 5.69%, 6.99%, 2.30%, 1.24%), *Xylocopa tenuiscapa* (2.30%, 1.91%, 1.75%, 2.02%, 3.35%, 4.62%, 6.35%, 4.77%, 2.07%, 3.11%), *Polistes delhiensis* (2.09%, 2.71%, 1.48%, 1, 45%, 3.35%, 4.62%, 3.50%, 5.68%, 1.91%, 1.69%) and *Halictus* sp. *(*3.99%, 3.95%, 3.68%, 3.43%, 3.18%, 4.70%, 4.74%, 7.06%, 4.22%, 4.81%) respectively. Where as for *Vespa velutina auraria* it was observed 1.75%, 3.08%, 1.14%, 1.30%, 1.19% in Jatoli, Kandaghat, Mashobra, Rajgarh and Bilaspur respectively.

While studying the relative abundance of insect pollinators it has been observed that *Episyrphus balteatus*, *Eristalis tenax*, *Eristalis cerealis*, *Eritalinus paria* and *Melanostoma orientale* were the most abundant dipteran pollinators of *Prunus persica* L. Stokes at ten localities i. e. Mashobra (13.66 ±3.92, 11.06%, 10.91±2.01, 8.84%, 5.50±1.18, 4.15%, 3.50±1.23, 2.83%, 9.91±1.35, 8.03%,), Summer hill (16.58±5.27, 12.64%, 6.91±2.60, 5.26%, 4.41±1.34, 3.35%, 6.41±0.73, 4.88%, 6.75±3.05, 5.14%), Jatoli (10.25±4.65, 8.33%, 9.16±3.20, 7.44%, 4.50±1.73, 3.65%, 3.08±1.56, 2.50%, 8.16±2.98, 6.63%), Kandaghat (12.33±4.11, 9.14%, 4.91±3.92, 3.10%, 5.33±1.65, 3.95%, 2.87±2.03, 2.12%, 6.08±3.79, 4.59%), Jaladi (15.91±2.01, 10.33%, 5.58±1.24, 3.62%, 3.91±0.93, 2.54%, 6.83±1.30, 4.43%, 10.75±1.92, 6.98%), Hamirpur (10.91±4.45, 11.21%, 3.25±1.02, 3.34%, 2.05±1.00, 2.10%, 2.41±1.47, 2.47%, 3.91±1.83, 4.02), Gheori (13.75±3.65, 8.99%, 8.25±2.33, 5.39%, 6.41±0.92, 4.19%, 2.50±1.23, 1.63%, 10.66±2.90, 6.97%), Bathra (9.33±4.59, 7.68%, 4.02±2.84, 3.30%, 2.08±1.68, 1.71%, 2.75±0.97, 2.26%, 5.16±2.78, 4.24%), Bilaspur (13.83±5.02, 14.79%, 5.41±1.72, 5.78%, 4.08±1.52, 4.36%, 2.58±0.98, 2.75%, 9.33±3.50, 9.98%) and Rajgarh (9.58±3.35, 8.83%, 3.91±0.74, 3.60%, 2.66±1.47, 2.45%, 3.78±1.03, 3.48%, 5.41±1.13, 4.98%) followed by *Eristalis himalayensis* i. e.4.16±1.33, 3.37% (Mashobra), 2.75±0.97, 2.09% (Summer hill), 2.66±1.18, 2.16% (Jatoli), 3.75±1.16, 2.78% (Kandaghat), 7.08±1.90, 4.59% (Jaladi), 3.41±1.69, 3.64% (Bilaspur), 2.33±0.97, 2.14% (Rajgarh) respectively. *Eristalinus arvorum* was recorded at five localities i. e. Mashobra (5.91±0.51, 4.78%), Summer hill (4.41±2.68, 3.35%), Jatoli (4.66±1.44, 3.78%), Kandaghat (3.08±2.42, 2.28%) and Rajgarh (2.75±0.69, 2.53%). Where as relative abundance of *Scaeva selenitica* was 5.08±0.98, 4.11%, 5.75±2.81, 4.38%, 3.25±1.32, 2.32%, 3.08±1.25, 2.50%, 7.08±2.88, 7.57%, 3.08±0.86, 2.84% in Mashobra, Summer hill, Naldera, Jatoli, Bilaspur and Rajgarh respectively (Table II, III, IV, V, VI).

In lepidopteran, *Pieris canidia indica* was recorded at ten localities i. e. Mashobra (1.58±0.85, 1.28%), Summer hill (2.66±0.60, 2.02%), Jatoli (2.91±0.80, 2.36%), Kandaghat (2.66±1.14, 1.97%), Jaladi (5.08±0.44, 3.30%), Hamirpur (3.08±1.59, 3.16%), Gheori (5.33±1.31, 3.48%), Bathra (2.25±0.30, 1.85%), Bilaspur (2.91±1.59, 311%) and Rajgarh (2.66±0.60, 2.45%). *Coccinella septumpunctata* was only coleopteran observed at Mashobra (4.58±1.52, 3.71%), Summer hill (5.08±2.58, 3.87%), Jatoli (4.83±1.05, 3.92%), Kandaghat (6.08±3.08, 4.50%), Jaladi (5.41±0.62, 3.51%), Hamirpur (4.83±1.79, 4.96%), Gheori (6.33±2.96, 4.14), Bathra (3.90±1.61, 3.21), Bilaspur (3.75±2.18, 4.01) and Rajgarh (3.83±1.44, 3.53%) respectively (Table II, III, IV, V, VI).

It was concluded from the present study that hymenopterans were the most abundant insect pollinators of peach at Kandaghat (51.32%), Jaladi (51.42%), Hamirpur (64.70%), Gheori (61.92%), Bathra (69.68%) and Rajgarh (52.96%) where as for dipteran it was more at Jatoli (49.54%), Mashobra (54.19%), Summer Hill (51.17%) and Bilaspur (53.30%).

Table 1: Systematic list of insect pollinators of *Prunus persica* (L.) Stokes from different areas of Himachal Pradesh

Order	Family	Fauna
HYMENOPTERA	APIDAE	*Apis cerana* (Fabricius) *Apis dorsata* (Fabricius) *Bombus haemorrhoidalis* (Smith) *Bombus trifasciatus* (Smith) *Xylocopa tenuiscapa* (Westwood)
	VESPIDAE	*Vespa velutina auraria* (Smith) *Polistes delhiensis* (Das and Gupta)
	HALICTIDAE	*Halictus* sp.
DIPTERA	SYRPHIDAE	*Episyrphus balteatus* (De Geer) *Eristalis tenax* (Linnaeus) *Eristalis cerealis* (Fabricius) *Eristalinus paria* (Bigot) *Eristalis himalayensis* (Brunetti) *Melanostoma orientale* (Wiedemann) *Eristalinus arvorum* (Fabricius) *Scaeva selenitica* (Meigen)
	TACHINIDAE	*Morellia* sp. *Mikia* sp. *Tachina sacontala* (Walker)
	CALLIPHORIDAE	*Calliphora vomitoria* (Linnaeus)
	ASILIDAE	*Neoitamus graham* (Joseph and Parui)
	BOMBYLIDAE	*Usia marginata* (Brunetti)
LEPIDOPTERA	NYMPHALIDAE	*Vanessa indica* (Herbst) *Aglais caschmirensis* (Kollar) *Neptis hylas* (Linnaeus)
	PIERIDAE	*Pieris canidia indica* (Sparrman) *Pieris brassicae* (Linnaeus) *Gonepteryx rhamni neplensis* (Doubleday)
COLEOPTERA	COCCINELLIDAE	*Coccinella septempunctata* (Linnaeus)

Table 2: Relative abundance of insect pollinators of *Prunus persica* (L.) Stokes from Jatoli and Kandaghat Localities of district Solan, Himachal Pradesh

Order	Family		Locality: Jatoli				Locality: Kandaghat			
		Genus/Species	Mean±S. E.	Percent Population	Family Percent	Order Percent	Mean±S. E.	Percent Population	Family Percent	Order Percent
Hymenoptera	Apidae	*Apis cerana*	16.25*±7.14	13.21	28.98	37.02	29.56*±6.37	21.92	41.19	51.32
		Apis dorsata	7.75±3.50	*6.30*			*14.91*±3.20	*11.05*		
		Bombus haemorrhoidalis	4.83± 2.28	3.92			4.58±1.91	3.39		
		Bombus trifasciatus	3.83± 0.90	3.11			3.52±1.16	2.65		
		Xylocopa tenuiscapa	2.83±1.31	2.30			2.58±1.22	1.91		
	Vespidae	*Vespa velutina auraria*	2.16±1.23	1.75	3.85		4.16±2.14	3.08	5.82	
		Polistes delhiensis	2.58±1.01	2.09			3.66±1.67	2.71		
	Halictidae	*Halictus sp.*	4.91±1.61	3.99	4.01		5.33±3.20	3.95	3.97	
Diptera	Syrphidae	*Episyrphus balteatus*	10.25±4.60	8.33	37.17	49.54	12.33±4.11	9.14	28.05	34.35
		Eristalis tenax	9.16±3.20	7.44			4.91±3.92	3.10		
		Eristalis cerealis	4.50±1.73	3.65			5.33±1.65	3.95		
		Eristalinus paria	3.08±1.56	2.50			2.87±2.03	2.12		
		Eristalis himalayensis	2.66±1.18	2.16			3.75±1.16	2.78		
		Melanostoma orientale	8.16±2.98	6.63			6.08±3.79	4.50		
		Eristalinus arvorum	4.66±1.44	3.78			3.08±2.42	2.28		
		Scaeva selenitica	3.08±1.25	2.50			-	-		
	Tachinidae	*Morellia sp.*	3.16±1.45	2.56	4.81		2.50±1.15	1.85	1.86	
		Mikia sp.	2.75±1.16	2.23			-	-		

	Calliphoridae	*Calliphora vomitoria*	2.07±1.02	1.68	1.69		2.58±1.31	1.91	1.92	
	Asilidae	*Neoitamus graham*	3.58±1.61	2.91	2.92		3.08±0.87	2.28	2.29	
	Bombylidae	*Usia marginata*	3.33±1.36	2.70	2.71		-	-	-	
Lepidoptera	Nymphalidae	*Vanessa indica*	2.91±1.38	2.36	4.41	9.92	3.75±1.15	2.78	6.57	10.38
		Aglais caschmirensis	2.50±0.87	2.03			2.33±1.16	1.72		
		Neptis hylas	-	-			2.75±1. .02	2.03		
	Pieridae	*Pieris brassicae*	1.66±0.54	1.34	5.47		1.30±0.96	0.96	3.75	
		Pieris canidia indica	2.91±0.80	2.36			2.66±1.14	1.97		
		Gonepteryx rhamni neplensis	2.16±0.79	1.75			1.08±0.92	0.80		
Coleoptera	Coccinellidae	*Coccinella septempunctata*	4.83±1.05	3.92	3.93	3.94	6.08±3.08	4.50	4.53	4.56

Table 3: Relative abundance of insect pollinators of *Prunus persica (*L). Stokes from Mashobra and Summer Hill Localities of district Shimla, Himachal Pradesh

Order	Family		Locality: Mashobra				Locality: Summer Hill			
Hymenoptera		Genus/Species	Mean±S. E.	Percent Population	Family Percent	Order Percent	Mean±S. E.	Percent Population	Family Percent	Order Percent
	Apidae	*Apis cerana*	17.75*±7.24	14.86	24.92	31.12	20.91*±7.34	15.94	29.86	34.74
		Apis dorsata	5.25±1.94	4.25			9.50±2.86	7.24		
		Bombus haemorrhoidalis	3.25±0.98	2.63			4.15±1.55	3.16		
		Bombus trifasciatus	2.58±1.14	2.09			1.91±1.15	1.45		
		Xylocopa tenuiscapa	2.16±1.22	1.75			2.66±1.06	2.02		
	Vespidae	*Vespa velutina auraria*	1.41±0.23	1.14	2.60		-	-	1.45	
		Polistes delhiensis	1.83±1.50	1.48			1.91±0.60	1.45		
	Halictidae	*Halictus sp.*	4.58±2.68	3.71	3.68		4.50±4.45	3.43	3.43	
Diptera	Syrphidae	*Episyrphus balteatus*	13.66±3.92	11.06	47.13	54.19	16.58±5.27	12.64	41.15	51.17
		Eristalis tenax	10.91±2.01	8.84			6.91±2.60	5.26		
		Eristalis cerealis	5.50±1.18	4.45			4.41±1.34	3.35		
		Eristalinus paria	3.50±1.23	2.83			6.41±0.73	4.88		
		Eristalis himalayensis	4.16±1.33	3.37			2.75±0.97	2.09		
		Melanostoma orientale	9.91±1.35	8.03			6.75±3.05	5.14		
		Eristalinus arvorum	5.91±0.51	4.78			4.41±2.68	3.35		
		Scaeva selenitica	5.08±0.98	4.11			5.75±2.81	4.38		
	Tachinidae	*Morellia sp.*	2.25±0.60	1.82	2.51		2.58±1.20	1.96	2.91	
		Mikia sp.	0.91±0.70	0.73			1.25±0.28	0.95		
	Calliphoridae	*Calliphora vomitoria*	2.83±0.72	2.29	2.27		0.91±0.30	0.69	0.69	
	Asilidae	*Neoitamus graham*	3.33±1.27	2.69	2.67		5.75±1.77	4.38	4.38	
	Bombylidae	*Usia marginata*	-		-		2.58±1.19	1.96	1.96	
Lepidoptera	Nymphalidae	*Vanessa indica*	1.83±1.10	1.48	5.41	10.41	2.66±1.34	2.02	3.65	10.04
		Aglais caschmirensis	2.83±0.97	2.29			2.25±0.98	1.71		
		Neptis hylas	2.08±0.92	1.68			-	-		
	Pieridae	*Pieris brassicae*	2.25±1.04	1.82	5.08		2.08±1.40	1.58	6.38	
		Pieris canidia indica	1.58±0.85	1.28			2.66±0.60	2.02		
		Gonepteryx rhamni neplensis	2.50±0.50	2.02			3.83±1.75	2.91		
Coleoptera	Coccinellidae	*Coccinella septempunctata*	4.58±1.52	3.71	3.68	3.68	5.08±2.58	3.87	3.87	3.87

Table 4: Relative abundance of insect pollinators of *Prunus persica (*L.) Stokes from Jaladi and Hamirpur Localities of district Hamirpur, Himachal Pradesh

Order	Family		Locality: Jaladi				Locality: Hamirpur			
		Genus/Species	Mean±S. E.	Percent Population	Family Percent	Order Percent	Mean±S. E.	Percent Population	Family Percent	Order Percent
Hymenoptera	Apidae	*Apis cerana*	28.41*±2.50	18.45	46.47	51.42	25.16*±8.99	24.86	58.30	64.7
		Apis dorsata	25.05±2.86	16.27			17.66±6.15	18.15		
		Bombus haemorrhoidalis	9.08±1.45	5.89			6.22±1.54	6.39		
		Bombus trifasciatus	8.16±1.57	5.30			3.16±1.07	3.24		
		Xylocopa tenuiscapa	5.16±1, 12	3.35			4.50±1.41	4.62		
	Vespidae	*Polistes delhiensis*	8.25±1.27	5.35	5.04		1.66±0.63	1.70	1.70	
	Halictidae	*Halictus sp.*	4.91±1.18	3.18	3.00		4.58±2.13	4.70	4.70	
Diptera	Syrphidae	*Episyrphus balteatus*	15.91±2.01	10.33	30.56	31.10	10.91±4.45	11.21	23.15	24.35
		Eristalis tenax	5.58±1.24	3.62			3.25±2.02	3.34		
		Eristalis cerealis	3.91±0.93	2.54			2.05±1.009	2.10		
		Eristalinus paria	6.83±1.30	4.43			2.41±1.47	2.47		

		Eristalis himalayensis	7.08±1.90	4.59			-	-		
		Melanostoma orientale	10.75±1.92	6.98			3.91±1.83	4.02		
	Tachinidae	*Morellia sp.*	1.91±1.51	1.24	2.41		1.16±1.30	1.19	1.19	
		Tachina sacontala	0.71±0.38	0.46			-	-		
		Mikia sp.	1.33±0.17	0.86			-	-		
Lepidoptera	Nymphalidae	*Aglais caschmirensis*	4.66±2.83	3.02	2.84	8.92	2.75±0.92	2.82	2.82	5.98
	Pieridae	*Pieris brassicae*	2.41±0.88	1.56	6.62		-	-	3.16	
		Pieris canidia indica	5.08±0.44	3.30			3.08±1.59	3.16		
		Gonepteryx rhamni neplensis	3.33±1.33	2.16			-	-		
Coleoptera	Coccinellidae	*Coccinella septempunctata*	5.41±0.62	3.51	3.30	3.11	4.83±1.79	4.96	4.96	4.96

Table 5: Relative abundance of insect pollinators of *Prunus persica (*L.) Stokes from Gheori and Bathra, Localities of district Kangra, Himachal Pradesh

Order	**Family**		**Locality: Gheori**				**Locality: Bathra**			
		Genus/Species	Mean±S. E.	Percent Population	Family Percent	Order Percent	Mean±S. E.	Percent Population	Family Percent	Order Percent
Hymenoptera	Apidae	*Apis cerana*	26.50*±7.93	17.34	52.01	61.92	24.58*±5.63	20.23	56.94	69.68
		Apis dorsata	22.33±4.34	14.69			20.66±4.53	17.00		
		Bombus haemorrhoidalis	9.75±3.06	6.41			9.60±3.94	7.90		
		Bombus trifasciatus	8.66±1.28	5.69			8.50±2.24	6.99		
		Xylocopa tenuiscapa	9.66±2.88	6.35			5.80±1.38	4.77		
	Vespidae	*Polistes delhiensis*	5.33±0.81	3.50	3.58		6.91±2.06	5.68	5.68	
	Halictidae	*Halictus sp.*	7.25±2.64	4.74	4.83		8.58±2.04	7.06	7.06	
Diptera	Syrphidae	*Episyrphus balteatus*	13.75±3.65	8.99	27.84	30.87	9.33±4.59	7.68	19.20	20.56
		Eristalis tenax	8.25±2.33	5.39			4.02±2.84	3.30		
		Eristalis cerealis	6.41±0.92	4.19			2.08±2.68	1.71		
		Eristalinus paria	2.50±1.23	1.63			2.75±0.97	2.26		
		Melanostoma orientale	10.66±2.90	6.97			5.16±2.78	4.24		
	Tachinidae	*Morellia sp.*	3.41±1.41	2.23	2.28		1.66±3.87	1.36	1.36	
Lepidoptera	Pieridae	*Pieris brassicae*	3.41±1.33	2.23	8.03	8.22	2.18±1.8	1.79	6.85	6.86
		Pieris canidia indica	5.33±1.31	3.48			2.25±0.30	1.85		
		Gonepteryx rhamni neplensis	3.25±0.67	2.13			3.50±1.60	2.88		
Coleoptera	Coccinellidae	*Coccinella septempunctata*	6.33±2.96	4.14	4.51	4.62	3.90±1.61	3.21	3.21	3.21

Table 6: Relative abundance of insect pollinators of *Prunus persica (*L.) Stokes from Rajgarh, Sirmaur and Bilaspur district of Himachal Pradesh

Order	Family		Locality: Rajgarh				Locality: Bilaspur			
		Genus/Species	Mean±S. E.	Percent Population	Family Percent	Order Percent	Mean± S. E.	Percent Population	Family Percent	Order Percent
Hymenoptera	Apidae	*Apis cerana*	21.08*±5.74	19.43	45.53	52.96	15.33*±5.36	16.39	29.75	38.03
		Apis dorsata	17.75±3.48	16.36			5.75±2.42	6.15		
		Bombus haemorrhoidalis	5.83±0.79	5.37			2.50±1.17	2.67		
		Bombus trifasciatus	2.50±0.50	2.30			1.16±1.27	1.24		
		Xylocopa tenuiscapa	2.25±1.04	2.07			2.91±1.43	3.11		
	Vespidae	*Vespa velutina auraria*	1.41±0.41	1.30	3.21		1.12±0.62	1.19	2.89	
		Polistes delhiensis	2.08±0.83	1.91			1.58±1.27	1.69		
	Halictidae	*Halictus sp.*	4.58±1.41	4.22	4.22		4.50±3.83	4.81	5.14	
Diptera	Syrphidae	*Episyrphus balteatus*	9.58±3.35	8.83	30.85	35.74	13.83±5.02	14.79	49.19	53.30
		Eristalis tenax	3.91±0.74	3.60			5.41±1.72	5.78		
		Eristalis cerealis	2.66±1.47	2.45			4.08±1.52	4.36		
		Eristalinus paria	3.78±1.03	3.48			2.58±0.98	2.75		
		Eristalis himalayensis	2.33±0.97	2.14			3.41±1.69	3.64		
		Melanostoma orientale	5.41±1.13	4.98			9.33±3.50	9.98		
		. Eristalinus arvorum	2.75±0.69	2.53			-	-		
		Scaeva selenitica	3.08±0.86	2.84			7.08±2.88	7.57		
	Tachinidae	*Mikia sp.*	-	-	-		3.50±1.63	3.74	3.76	

	Calliphoridae	*Calliphora vomitoria*	2.16±0.56	1.99	1.99		-	-	-	
	Asilidae	*Neoitamus graham*	1.75±0.52	1.61	1.60		-	-	-	
	Bombylidae	*Usia marginata*	1.41±0.69	1.30	1.30		-	-	-	
Lepidoptera	Nymphalidae	*Neptis hylas*	2.33±0.31	2.14	2.14		-	-	-	
	Pieridae	*Pieris brassicae*	2.25±0.34	2.07			-	-		
		Pieris canidia indica	2.66±0.60	2.45	5.51	7.65	2.91±1.59	3.11	6.09	6.13
		Gonepteryx rhamni neplensis	1.08±0.95	0.99			2.75±1.17	2.94		
Coleoptera	Coccinellidae	*Coccinella septempunctata*	3.83±1.44	3.53	3.53	3.53	3.75±2.18	4.01	4.03	4.05

* Each value is an overall average for an insect species
S. E. = Standard error about the mean

4. Conclusion

Pollinators are key to global sustainable terrestrial productivity, agriculture cannot perform efficiently without pollinators. Study on diversity, distribution and relative abundance of insect pollinators helps in their conservation. Present study showed that hymenopteran and dipteran were dominated pollinators of *Prunus persica* followed by coleopteran and lepidopteran. Among hymenopteran *Apis cerana* dominated in most of localities and in dipteran, *Episyrphus baltateus* was most important pollinator of *Prunus persica.* Besides dipterans and hymenopterans, coleopterans and lepidopterans also constituted an important group of insect pollinators of *Prunus persica.*

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