





Macior (1975) also reported butterfly as important pollinator of *Delphinium*. *Danaus* as pollinator of *Satyrrium* was observed by Johnson (1997), as pollinator of Asteraceae and representing nearly 75% of all visitors by Mani & Sarvanan (1999), of milkweed by Ivey et al. (2003), of *Wedelia calendulacea* by Mitra et al. (2004), of *Justicia* by Seikh (2005), of *Woodfordia floribonda* by Soloman Raju (2005), of Teak flowers by Tangmitcharoen et al. (2006). *D. plexippus* as a floral visitor of brinjal has also been reported by Thapa (2006). *Danaus* as pollinator of *Strobilanthes consangoinea* was suggested by Anitha & Prasad (2007). *D. chrysippus* was recorded to transport some pollen of *Acacia*, by Martin (1993). Thapa (2006) reported *Lampides boeticus* to visit flowers of *L. siceraria*, *B. campestris* and *S. melongena*.

Maner et al. (1999) observed milkweed flowers to attract *C. pipiens* and Anderson & Joenson (1986) who found *C. pipiens* to feed on nectar of *Tanacetum vulgare*. According to Jhumur et al. (2006) *C. pipiens* are effectively attracted by appropriate floral scent of flowers. The male members of Culicidae are floral visitors which feed on nectar and other plants. Dipterans as visitors to the flowers of chervil were reported by Knuth (1908) and Sievers (1948). Robertson (1928) also recorded dipterans on the flowers of Asteraceae, Apiaceae, Fabaceae, Lamiaceae, Asclepiadaceae. Dipterans as pollinators of plants belonging to Asteraceae were noted by Noronha & Gottsberger (1980); Arroyo et al. (1982); Sazima & Machado (1983); Abbot & Irwin (1988), Herrera (1990) and Iwata (1990). Khemba & Mutinga (1982) suggested dipteran species as pollinator of sunflower especially when the number of bee visitors is too low to provide sufficient pollination. Dipteran as pollinator of an umbelliferous plant, carrot was reported by Ahmed & Aslam (2002), as pollinators of *T. erecta* have been noticed by Gange & Smith (2005), as floral visitors of mango were reported by Sung et al. (2006) and on the heads of *Mikania* were noted by Cerena (2004).

Thapa (2006) reported lady beetle *Coccinella* as pollinators of cucumber, pumpkin and brinjal which were true for the present study also. Goodman et al. (2001) observed *Coccinella* on flowers of buck wheat, Dunne (2001) on *Foeniculum vulgare*, Ahmed (1976) on Alfalfa flowers and Singh (1983) on mango flowers. *M. sexmaculatus* as flower visitors of mango has been reported by Sung et al. (2006), while, Patt (2000) and Ambrisomo et al. (2006) reported coccinellids as pests of *C. sativum*. Tybirk (1989) recorded beetles as floral visitors of *Acacia*. Gottsberger (1990) studied the relationship between flowers and beetles in the South American tropics. Sakai & Inone (1999) recorded beetles as pollinator of *Orchidantha inouei* and according to them beetles are effective pollinators to provide long distance pollen transfer. Kearns (2001) also noted beetles to be minor pollinators. Coleopterans as visitors to the flowers of chervil were reported by Knuth (1908) and Sievers (1948). Coleopterans as pollinators of plants belonging to Asteraceae were noticed by Noronha & Gottsberger (1980); Sazima & Machado (1983); Abbot & Irwin (1988) and Herrera & Iwata (1990). Coleopterans were noted as pollinators of an umbelliferous plant carrot by Ahmed & Aslam (2002). Samantha (2003) found pollen feeding beetle to be attracted towards the flowers of oil seed rape. Njorage

et al. (2004) observed beetles as pollinators of *Citrullus lanatus*. Coleopterans were noted on the heads of *Mikania* by Cerena (2004). According to Beach (1981) beetle pollinated flowers, often provide the pollinators with a space to protect them from predators and/or produce relatively large amounts of pollen and sometimes special nutritive tissue to provide nutrition for the pollinators.

Pollen is primary attractant and is an important food and protein source for beetles as suggested by Faegri & Pijl (1979). They also reported that beetles directly eat it, while according to Gottsberger (1990) in most beetles, scent acts as the primary attractant. This statement was also supported by Harborne (1993). Picker & Midgley (1996) studied flower and colour preferences of beetles and observed beetles pollinated blue violet and white flowers.

The neuropteran *Chrysopa* sp. is commonly known as lace wing fly. It is a predacious insect which preys upon aphids, jaccids, psyllids, coccids, thrips etc. (Nayar, 1998). Bruce et al. (2002) also recorded lace wings on the flowers of *T. erecta* which support the present findings. Lace wings were observed to be attracted towards dill by Dunne (2001), while, according to Ivey et al. (2003) although *Chrysopa* sp. visited the flowers of milkweed they were not found to carry pollen.

The observations made during the present study therefore suggest that the frequent visitors would definitely act as pollinators, but, others cited as rare, could also by chance help in pollination.

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**Table 1:** Insect visitors on flowers on different crops at the agro – ecosystem during the period of study

Order: Coleoptera	Mustard	Rye	Wheat	Barley	Gram	Fenugreek	Pearl millet	Cotton	Sorghum	Cluster beans	Mung bean
<b>Family: Scarabaeidae</b>											
<i>Onthophagus catta</i>	-	-	-	-	-	-	-	-	-	-	2
<i>Onthophagus bonasus</i>	-	-	-	-	-	-	-	-	-	-	3
<i>Adoretus sp.</i>	-	-	-	-	-	-	-	-	-	-	3
<i>Ochodius sp.</i>	-	-	-	-	-	-	-	-	-	-	-
<i>Peltonotus nasutus</i> Arrow	-	-	-	-	-	4	10	-	-	-	1
<i>Apogonia ferruginea</i>	-	-	-	-	-	-	15	-	-	-	-
<b>Family: Coccinellidae</b>											
<i>Coccinella septempunctata</i>	35*	20*	20*	10	-	15	-	-	-	-	-
<i>Menochilus sexmaculatus</i>	10	12	10	8	-	-	-	-	-	-	-
<b>Family: Curculionidae</b>											
<i>Myllocerus sp.</i>	10	5	1	-	-	-	-	-	-	-	5
<i>Hypolixus truncatulus</i> Fab.	-	-	-	-	-	1	-	-	-	-	-
<b>Family: Meloidae</b>											
<i>Cylindrorhax pictus</i> Fast	-	-	-	-	-	-	25*	-	-	-	-
<b>Order: Lepidoptera</b>											
<b>Family: Pieridae</b>											
<i>Catopsila pomona</i> Cramer	1	-	-	-	-	-	-	-	-	-	-
<i>Colotis vestalis</i> Butler	11	9	1	2	-	-	10	-	-	1	8
<i>Colias fieldii</i> Menetries	6	6	3	1	1	3	2	1	1	12	2
<i>Eurema hecabe</i>	7	10	4	-	-	3	6	1	1	-	10
<i>Anaphaes aurota</i>	1	-	-	-	-	-	-	-	-	-	-
<b>Family: Lycaenidae</b>											
<i>Lampides boeticus</i> Linn.	6	2	1	-	1	4	-	-	-	-	12

Order: Coleoptera	Mustard	Rye	Wheat	Barley	Gram	Fenugreek	Pearl millet	Cotton	Sorghum	Cluster beans	Mung bean
<b>Family: Danaidae</b>											
<i>Danaus chryssipus</i>	10	6	1	1	2	4	2	-	1	-	10
<b>Family: Nymphalidae</b>											
<i>Junonia orithya</i> Linn.	4	-	2	-	-	1	-	-	-	-	-
<b>Family: Noctuidae</b>											
<i>Earias insulana</i> Boisduval	-	5	-	-	-	1	-	-	-	-	-
<i>ThysanoMythimna seprata</i> Walker	2	1	-	-	-	-	10	-	20*	-	-
<i>Agrotis Ipsilon</i> Hufnagel	15	10	-	-	-	-	-	-	-	-	-
<i>Mythimna seprata</i> Walker	-	-	-	-	-	10	-	-	-	-	-
<i>Spodoptera exigua</i> Hubner	1	-	-	-	-	-	1	-	-	-	-
<b>Family: Crambidae</b>											
<i>Hymenia fasciles</i> Cramer	4	-	-	-	-	-	20*	-	10	1	-
<i>Cryptographis indica</i> Saunders	1	-	-	-	-	-	-	-	-	-	-
<b>Family: Pyralidae</b>											
<i>Etiella zinckenella</i> Treitschke	-	-	-	-	-	-	4	-	-	-	-
<b>Family: Arctidae</b>											
<i>Utethesia pulchella</i> Linn.	2	-	-	-	-	-	-	-	-	-	-
<b>Family: Geometridae</b>											
<i>Tephрина disputara</i> Guenee	10	5	21*	10	-	-	35*	-	5	-	-
<b>Order: Hemiptera</b>											
<b>Family: Pentatomidae</b>											
<i>Nezara viridula</i>	-	-	-	-	-	-	-	-	-	1	-
<i>Oncocephalus</i> Sp.	-	-	-	-	-	-	1	-	-	-	-
<b>Family: Pyrrhocoridae</b>											
<i>Dysdercus cingulatus</i> Fab.	-	-	-	-	-	-	-	-	-	2	-
<b>Family: Aphididae</b>											
<i>Lipaphis erysimi</i>	15	-	-	-	-	-	-	-	-	-	-
<b>Order: Hymenoptera</b>											
<b>Family: Apidae</b>											
<i>Xylocopa fenestrata</i> Fab.	3	-	-	-	-	-	-	-	-	-	-
<i>Apis cerana</i> Fab.	25*	18*	36*	10	-	10	15	4	-	7	2
<i>Apis mellifera</i> Linn.	47*	45*	10	15	15	8	25*	1	-	5	4
<i>Apis dorsata</i> Fab.	13	-	1	2	-	-	15	4	-	6	1
<i>Apis florae</i> Fab.	40*	28*	25*	-	9	-	20*	3	10	4	-
<i>Amegila cingulata</i>	2	1	1	-	1	-	1	-	-	-	-
<b>Family: Vespidae</b>											
<i>Polistes</i> sp.	1	-	-	-	-	-	-	1	1	-	-
<i>Delta</i> sp.	-	-	-	-	-	-	1	-	-	-	-
<i>Eumenus fenestrata</i>	-	-	-	-	-	-	-	-	-	1	-
<b>Family: Sphecidae</b>											
<i>Sceliphron brunneum</i>	-	-	-	-	1	-	-	-	-	-	-
<b>Family: Ichneumonidae</b>											
<i>Enicospilus</i> sp.	-	-	2	-	-	1	-	-	-	-	-
<b>Order: Diptera</b>											
<b>Family: Calliphoridae</b>											
<i>Chrysoma megacephala</i> Fab.	2	-	-	-	-	-	-	-	-	-	-
<i>Chrysoma saffrocnea</i>	1	-	-	-	-	-	-	-	-	-	-
<b>Family: Asilidae</b>											
<i>Stichopogon</i> sp.	-	-	-	-	-	-	4	-	-	-	-
<b>Family: Culicidae</b>											
<i>Culex quinquefasciatus</i>	28*	25*	15	10	-	15	20*	-	15	25*	31*
<b>Order: Orthoptera</b>											
<b>Family: Tettigoniidae</b>											
<i>Eucenocephalus</i> sp.	-	-	-	-	-	-	-	-	-	10	-
<b>Order: Neuroptera</b>											
<b>Family: Chrysopidae</b>											
<i>Chrysopa carnea</i>	15	-	15	5	-	5	-	-	-	-	-

\* Frequent visitors (number of visits/man hour  $\geq 16$ )

**Table 2:** Botanical names and floral attributes of different crops cultivated in the agro-ecosystem during the period of study

<i>Crop</i>	<i>Botanical name</i>	<i>Family</i>	<i>Inflorescence</i>	<i>Scent</i>	<i>Colour</i>	<i>Self/Cross</i>	<i>Flowering period</i>
Pearl-millet	<i>Pennisetum typhoidea</i>	Poaceae	Cymose	Scented	Pale and brownish purple	Cross	Sept. to Oct.
Cotton	<i>Gossypium herbaceum</i>	Malvaceae	Solitary axillary	Scented	Yellow and blues	Cross	Sept. to Oct.
Sorghum	<i>Sorghum cernuum</i>	Poaceae	Solitary	Scented	Red	Self	Sept. to Oct.
Clusterbeans	<i>Cyamopsis tetragonoloba</i>	Fabaceae	Spiked	Scented	Purple/blues	Self/cross	Sept. to Oct.
Mung beans	<i>Vigna radiata</i>	Fabaceae	Raceme	Scented	Light Yellow	Self/cross	Sept. to Oct.
Mustard	<i>Brassica campestris</i>	Brassicaceae	Corymbose/raceme	Aromatic	Yellow	Self/cross	Jan to Feb.
Rapeseed	<i>Brassica juncea</i>	Brassicaceae	Corymbose/raceme	Aromatic	Yellow	Self/cross	Jan to Feb.
Wheat	<i>Triticum aestivum</i>	Graminae	Spike	Scented	Green	Wind pollinated	Jan to Feb.
Barley	<i>Hordeum vulgare</i>	Graminae	Raceme	Scented	Green	Wind pollinated	Jan to Feb.
Gram	<i>Cicer arietinum</i>	Leguminosae	Solitary	Scented	Dark purple	Self/cross	Jan to Feb.
Fenugreek	<i>Trigonella foenum-graecum</i>	Leguminosae	Axillary	Scented	Purple	Self	Jan to Feb.