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Record of insect pollinators of *Moringa oleifera* lam.

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Abstract
Present study was carried out to record the insect pollinators on the blossom of *Moringa oleifera* during its flowering season. All the insects that visited the *M. oleifera* flowers between 6.00am and 6:00pm were observed and collected. The diversity and abundance of the insect visitors on the blossom were determined. Six species of Apidae family, two species of Vespidae, two species of Papilionidae family and one species of Nymphalidae family were found visiting the flowers of *M. oleifera*. *A. florea* was recorded as top workers on inflorescence of *M. oleifera* as pollen and nectar gatherers followed by *Apis dorsata*, *Amegilla* sp., *Megachile* sp. and *Xylocopa* sp.

Keywords: *Moringa oleifera*, insect pollinators

Introduction
Moringa oleifera Lam., native of India belongs to the family Moringaceae and occurrs as wild in the sub-Himalayan regions of Northern India. In India it is grown all over the subcontinent for its tender pods and also for its leaves and flowers. The tree is particularly renowned for its great versatility. Its uses include: a good food source for humans and animals alike, coagulant for water purification, remedy for numerous ailments as well as a source for biofuel production (Anwar *et al*., 2007) [1]. The pod of moringa is a very popular vegetable in South Indian cuisine and valued for their distinctly inviting flavour.
Moringa flowers are white or creamy-white, scented and arise in terminal or axillary panicles. *M. oleifera* is adapted to selfing (geitonogamy) and outcrossing (xenogamy) with larger fruit set, seed set and fecundity in the latter mode (Jyoth *et al.*, 1990) [4]. According to Bhattacharya and Mandal (2004) [2] each *M. oleifera* flower produces on average 23525 pollen grains with delayed stigma receptivity to promote cross pollination. The insect visitors/pollinators of *Moringa oleifera* need to be documented as not much data and literature is available on this aspect. Therefore present study was undertaken to record the diversity and abundance of insects that visits/pollinate *Moringa oleifera* flowers.

Botanical classification of Moringa

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Brassicales
Family	Moringaceae
Genus	*Moringa*
Species	*oleifera*

Material and methods
The flower visitors visiting the flowers of *Moringa oleifera* were collected, preserved and identified. Observation on the insect pollinators visiting the inflorescence of *M. koenigii* was recorded during the peak flowering season. These observations were recorded from 6:00 am to 6:00 pm at an interval of 3:00 hours. Observations were recorded after the initiation of 10% flowering. Abundance (number of visitors/ cymes /5 minutes) of major pollinators was recorded. Insect visitors either visited the flowers for the nectar or pollen rewards.

Results and discussion

Insect visitors visiting the blossom of *Moringa oleifera* were collected and identified. Six species of Apidae family, two species of Vespidae and two species of Papilionidae family and one species of Nymphalidae family were observed visiting the flowers of *M. oleifera* (Table-1). Bees are the dominant foragers. *A. florea* were recorded as top workers on inflorescence of *M. oleifera* as pollen and nectar gatherers followed by *Apis dorsata*, *Amegilla* sp., *Megachile* sp. and *Xylocopa* sp. Wasps were found to be the least abundant among order Hymenoptera. *Apis florea*, *Apis dorsata* and *Xylocopa* bees are more active during the morning hours. This may be because the flowers are filled with nectar in morning hours and the bees would hence have the highest yield per effort. *Papilio polytes* and *Danaus chrysippus* were most abundant among lepidopteran insects recorded (Fig-1). Mean no. of insect pollinators visiting the blosoom was highest (2.44) between 9.00-12.00 a.m.

In the present study it was found that insects forage on the pollen and nectar of the flowers of *Moringa oleifera* and through that means pollinate the flowers. Out off eight species of Hymenoptera and three species of Lepidoptera observed on the blossom of *M. oleifera*, the most dominant and abundant species were *A.florea* (4.42/cymes/5 minutes) and *A.dorsata* (2.75 cymes/5 minutes) (Table-2). The diversity and abundance of insect pollinators on the blossom of *M. oleifera* were earlier not reported. Puri (1941) [6] and Jyoth *et al.*, (1990) [4] reported that the flowers of *M. oleifera* produce both pollen and nectar with bees as the main pollinators. Hymenoptera including honeybees (*Apis* spp.), wild bees and wasps has long been associated with pollination, visiting more flowers because they actively collect pollen and nectar for provision to their young ones. Among the pollinators, bees are one of the most important and specialized groups (Danforth *et al*. 2006) [3]. Morphologically bees are adapted to collect, manipulate, transport and store pollen very effectively and efficiently (Thorp, 2000; Danforth *et al*., 2006) [7, 3]. Lane (1996) [5] considered Xylocopa as efficient pollinators and reported that Xylocopa have a tendency to collect pollen and nectar simultaneously.

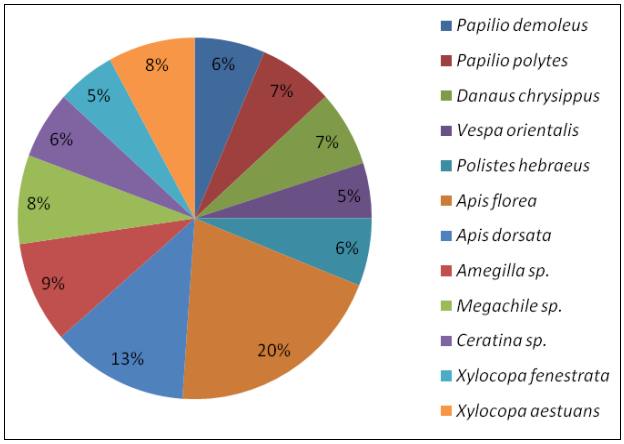

Fig 1: Abundance of different insect pollinators on blossom of *Moringa oleifera*

Table 1: List of insect visitors/ pollinators of *Moringa oleifera*

S. No	Common Name	Scientific Name	Order	Family
1.	Lime butterfly	*Papilio demoleus*	Lepidoptera	Papilionidae
2.	Common Mormon	*Papilio polytes*	Lepidoptera	Papilionidae
3.	Plain Tiger	*Danaus chrysippus*	Lepidoptera	Nymphalidae
4.	Oriental hornet	*Vespa orientalis*	Hymenoptera	Vespidae
5.	Paper wasp	*Polistes hebraeus*	Hymenoptera	Vespidae
6.	Little bee	*Apis florea*	Hymenoptera	Apidae
7.	Giant bee	*Apis dorsata*	Hymenoptera	Apidae
8.	Carpenter bee	*Xylocopa fenestrata*	Hymenoptera	Apidae
9.	Carpenter bee	*Xylocopa aestuans*	Hymenoptera	Apidae
10.	Blue-banded bee	*Amegilla* sp.	Hymenoptera	Apidae
11.	Leafcutter bees	*Megachile* sp.	Hymenoptera	Megachilidae
12.	Small carpenter bees	*Ceratina* sp.	Hymenoptera	Apidae

Table 2: Abundance of insect pollintaors visiting the blossom of *Moringa oleifera*

S. No	Insect species	Number of pollinators/ cymes / 5 minutes during different day hours				
		6.00-9.00	9.00-12.00	12.00-3.00	3.00-6.00	Mean
1.	*Papilio demoleus*	1.00	1.33	2.00	1.33	1.42
2.	*Papilio polytes*	1.33	2.00	1.33	1.33	1.49
3.	*Danaus chrysippus*	1.33	2.33	1.33	1.00	1.49
4.	*Vespa orientalis*	0.00	1.67	1.00	1.67	1.09
5.	*Polistes hebraeus*	0.00	2.00	1.67	1.67	1.34
6.	*Apis florea*	2.66	5.67	5.00	4.33	4.42
7.	*Apis dorsata*	2.00	3.33	2.67	3.00	2.75
8.	*Amegilla* sp.	2.00	2.67	1.67	1.67	2.00
9.	*Megachile* sp.	1.00	2.33	1.67	2.00	1.75
10.	*Ceratina* sp.	1.00	1.67	1.33	1.33	1.33
11.	*Xylocopa fenestrata*	0.00	1.67	1.67	1.33	1.17
12.	*Xylocopa aestuans*	1.67	2.66	1.67	1.00	1.75
	Mean	1.17	2.44	1.92	1.81	-

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