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Abundance of insect pollinators associated with broad bean *Vicia faba* L. var. major (Fabales: Fabaceae) in North Karnataka

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Abstract

An investigation was carried out at Garag village of Dharwad district to study the diversity of pollinators visiting broad bean during *rabi* 2019. The pollinator fauna of broad bean comprised of a total of nine insect species belonging to three insect orders *viz.*, Hymenoptera, Lepidoptera and Diptera. Among these, Hymenoptera was the most dominant pollinator group with a maximum of 62.27 per cent proportion followed by Lepidoptera (25.16) and Diptera (12.57). The most abundant pollinator among the hymenopterans was the little bee, *Apis florea* Fabricius which recorded 31.14 per cent proportion followed by *Apis dorsata* Fabricius, *Apis cerana* Fabricius and *Megachilae* sp. with 15.23, 10.60 and 5.30 per cent proportion, respectively. Two species of lepidopterans *viz.*, *Phoebis sennae* Linnaeus and *Lampides boeticus* Linnaeus, among depterans, *Musca* sp., *Episyrphus* sp., and *Lucilia* sp were also found visiting broad bean flowers.

Keywords: Pollinators, broad bean, hymenoptera, *Apis florea* fabricius

1. Introduction

Vicia faba, also known in the culinary sense as the broad bean, fava bean, or faba bean is a species of flowering plant in the pea and bean family Fabaceae. It is of uncertain origin and widely cultivated as a crop for human consumption. It is said that 75 percent of the 115 most important food crops in the world benefit in various degrees on insect mediated pollination for yield increase, and this equals around one third of global crop production (Klein *et al.* 2007). Without insect pollination, yield results vary greatly both yearly and depending on geographic location and local environment (Garibaldi *et al.* 2011a and 2013) [3].

Broad bean is partly auto fertile, it has been extensively shown that yields benefit from insect pollination (Bishop *et al.* 2016) [4]. Broad bean pollen crude protein value form dry matter is 24 percent, which is close to the mean of 62 floral species foraged by the honeybee (Somerville and Nicol 2006) [6, 9]. The pollen contains some of the essential amino acids for honeybees, including histidine, threonine, arginine and small amounts of leucine and valine can be found, which are especially important for the bees (De Groot 1953, Cook *et al.* 2003) [7, 8, 11].

Honeybees forage flowers on single species of plant in one trip. This flower-constant behaviour makes the insect a good pollinator of commercial crops (Joshi and Joshi, 2010) [5]. Sufficient wild pollinator abundance can be important to field crops especially when honeybees are not available. Less numerous pollinators can also be beneficial to the pollination due to pollinator abundance effect. Mass-flowering plants like the faba bean, that offer both pollen and nectar sources can be very attractive to bumblebees as well as other beneficial insects, increasing the overall pollinator abundance in the immediate area of the field (Kopke and Nemecek 2010) [1].

The pollination by of honeybees benefits faba bean yield, they give a good understanding into the potential yield effects and provide pointers for future research on the topic. The study was aimed to prepare the background for introducing a better basis for cooperation between beekeepers and broad bean farmers. However, meagre studies have been carried out on pollination and related aspects of broad beans in Karnataka. Hence, the present investigations was undertaken targeting the same.

2. Materials and Methods

A systematic procedure was adopted for conducting the present investigation which was carried out at Garag village of Dharwad district, Karnataka during *rabi* 2019. Dharwad is a district head quarter in north Karnataka, situated at 15°26' North latitude, 75° 07' East

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longitude and at an altitude of 731.80 m above mean sea level (MSL). The place lies in the North transitional zone (zone-8) with temperature and relative humidity ranging from 11 to 37 °C and 40.00 to 85.00 per cent, respectively. An average annual rainfall of 860.00 mm is received here which is distributed all over the year.

Broad bean was grown during *rabi* season of 2019 in order to study the pollinator fauna of the crop under Dharwad conditions. No plant protection measures were undertaken during the entire flowering period of the crop. The observations on pollinator fauna was initiated during 10.00 per cent flowering of the crop and continued at regular intervals till its complete cessation. Observations were recorded at 10.00 hr for different groups of pollinators visiting broad bean flowers for 5 minutes in each square meter area from five such randomly selected spots. The representative samples of each of the pollinator observed during the course of the study was collected and was identified to the level of species, when possible; using published systematic keys.

3. Results and Discussions

The pollinator diversity of broad beans in Dharwad constituted a total of 9 insect species which belonged to three insect orders *viz.*, Hymenoptera, Lepidoptera and diptera. Among these hymenopteran were most abundant pollinators which constituted a maximum of (62.27%) proportion followed by, Lepidoptera (25.16%) and diptera (12.57%) (Table.1 and Fig.1). In hymenoptera the little bee *Apis florea* was the most prominent pollinator which recorded highest per cent proportion of (31.14%) followed by rock bee *Apis dorsata*, *Apis cerana* and *Megachilae* sp. with 15.23, 10.60 and 5.30 percent proportion, respectively (Fig.2). The pollinators belonging to Lepidoptera constituted two butterflies *viz.*, *Lampides boeticus* Linnaeus (20.53%) and *Phoebis sennae* (4.63%). Three species of depterans were recorded *viz.*, *Episyrphus* sp. (5.96%) followed by *Musca* spp. (3.97%) and *Lucilia* sp (2.64%) (Fig. 3).

The present findings were in line with the findings of Philippe, 1991; Pierre *et al.* 1997, wherein they reported

vegetable attracts pollinator insects composed almost exclusively of Hymenoptera apoidea of the Apidae family. This is in concurrence with the present findings that the family apidae of hymenoptera comprising of honeybees dominated pollinator fauna of broad bean. The abundance of little bees may be due to presence of essential amino acids for honeybees, including histidine, threonine, arginine and small amounts of leucine and valine, which are especially important for the bees (De Groot 1953, Cook *et al.* 2003) [7, 8, 11].

In another study carried out at East far of Algiers, Africa (Aouar-sadli *et al.* 2008) [13] ten species of bees belonging to 3 families *viz.*, Apidae, Anthophoridae and Halictidae foraging on flowers. The most abundant species on the broad bean flowers was *Eucera pulveracea* (Anthophoridae), which alone accounted for 49.9 percent of the total population, where as honey bees accounted for 42 percent of total Apoidea visitors to broad bean. However, in contrast to this report no Anthophoridae and Halictidae were observed pollinating on broad beans under Dharwad condition. Whereas, the pollination of apidae family was found dominant and Lycaenidae was second dominant pollinator that might be due to *Lampides boeticus* Linnaeus is also the pest of broad bean in larval stage. The activity of depteran species, *Megachilae* sp. of Hymenoptera and *Phoebis sennae* of Lepidoptera were also noted in the present findings.

4. Conclusion

The pollinator fauna of broad bean in Dharwad, Karnataka comprised of three major insect orders *viz.*, Hymenoptera, Lepidoptera and Diptera among which, the maximum occurrence of hymenopterans was noticed. In the order Hymenoptera, *A. florea* was the most active and abundant pollinator followed by *A. dorsata* and *A. cerana*. The next prominent floral visitors of broad bean were of the order lepidoptera among which, lycaenid butterflies were higher in abundance and syrphids were the major visitors among the depterans.

Table 1: Pollinator fauna recorded on broad bean (*Vicia faba* L.var. major) during 2018-19

Order	Family	Scientific name/ Common name	No./m ² /5 min	Percentage proportion	Total
Hymenoptera	Apidae	<i>Apis florea</i> Fabricius	47	31.14	62.27
		<i>Apis dorsata</i> Fabricius	23	15.23	
		<i>Apis cerana</i> Fabricius	16	10.60	
	Megachilidae	<i>Megachilae</i> sp.	8	5.30	
Lepidoptera	Pieridae	<i>Phoebis sennae</i>	7	4.63	25.16
	Lycaenidae	<i>Lampides boeticus</i> Linnaeus	31	20.53	
Diptera	Muscidae	<i>Musca</i> spp.	6	3.97	12.57
	Syrphidae	<i>Episyrphus</i> sp.	9	5.96	
	Calliphoridae	<i>Lucilia</i> sp.	4	2.64	

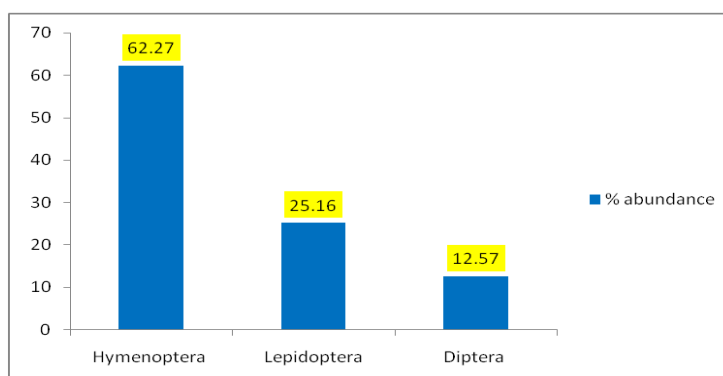


Fig 1: Abundance of different honey bees species in the pollination of broad bean

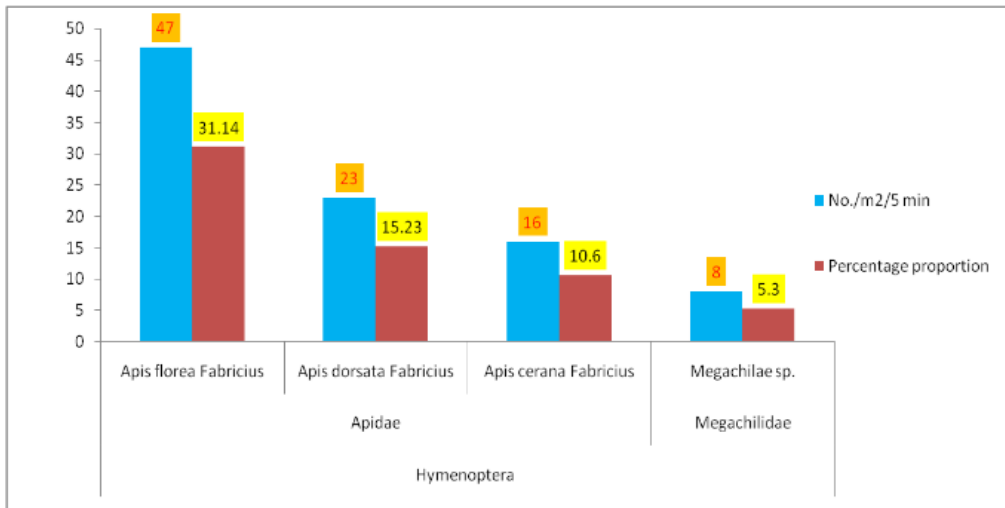


Fig 2: Abundance of hymenopteran families in the pollination of broad bean

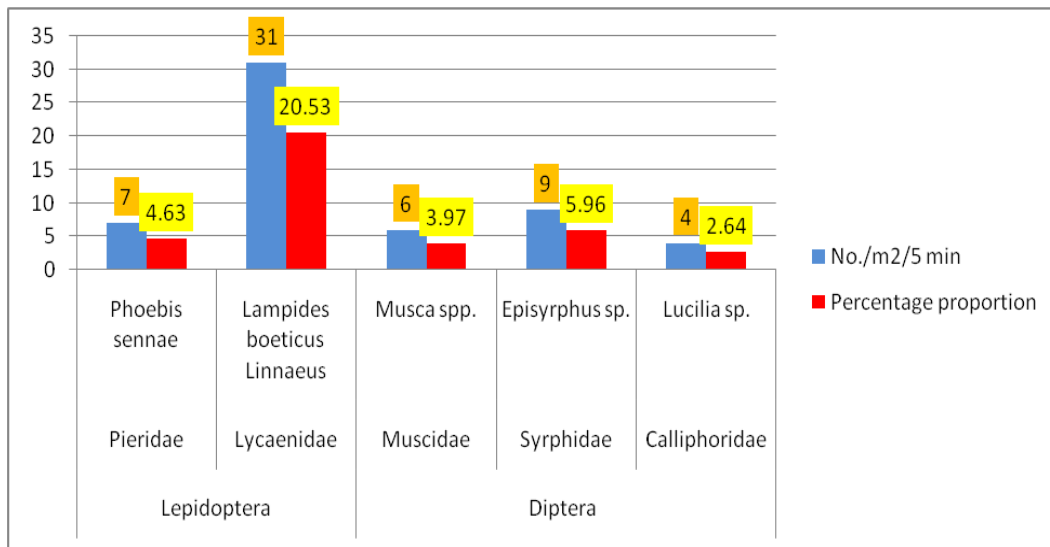
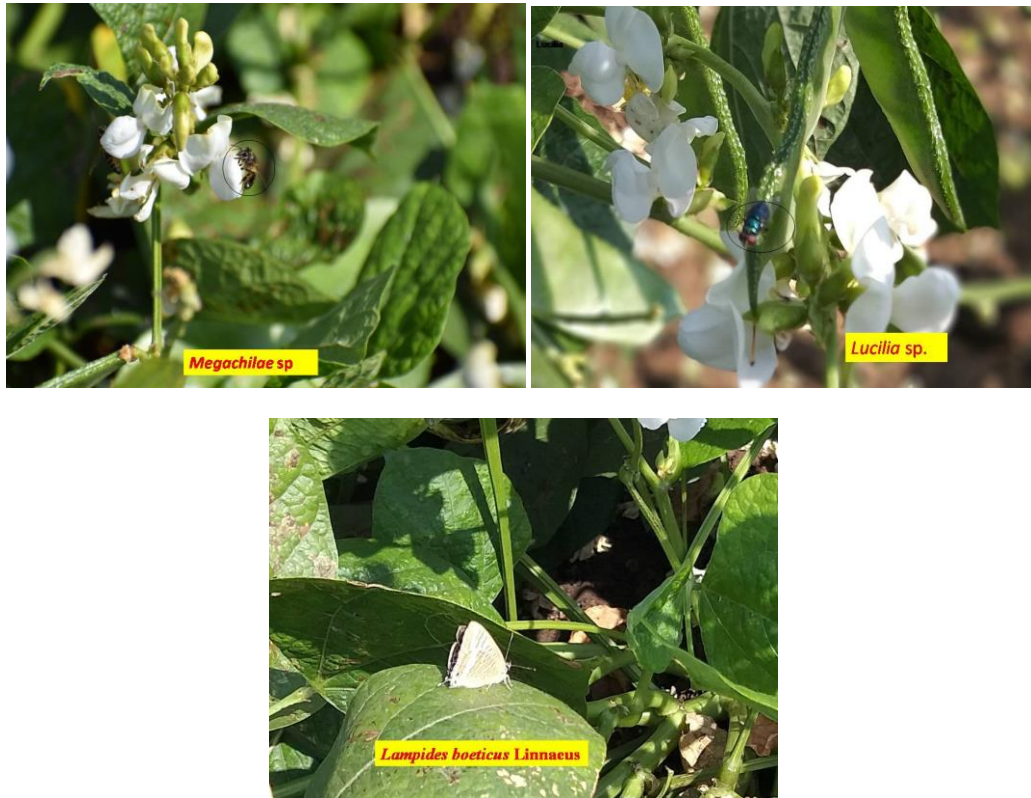


Fig 3: Abundance of lepidopteran and depteran families in the pollination of broad bean





Different pollinators of broad bean in Dharwad region

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