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### Pollinator fauna associated with pigeonpea, Cajanus cajan (L.) Millspaugh in Bijapur and Bagalkot district of Karnataka

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#### Abstract

An investigation was carried out at farmer's field of Bijapur and Bagalkot district of Karnataka to study the pollinator fauna of pigeonpea. The pollinator diversity in Bijapur and Bagalkot district on pigeonpea constituted a total of 8 insect species. Among these Bijapur district recorded 86.92, 9.35 and 3.97 percent proportion of hymenoptera, Lepidoptera and diptera, pollinator orders, respectively. Whereas, Bagalkot district recorded, hymenoptera (85.71), Lepidoptera (11.43) and diptera (2.86) per cent proportion of pollinator orders. The insect belongs to order Hymenoptera were most abundant in both the districts. Of all the bees, *Apis florea* Fabricius and *Megachilae* sp. were most abundant with 26.17 and 22.48 per cent proportion of pollination in Bijapur and 25.71 and 22.86 per cent in Bagalkot district, respectively. The insect belonging to order Lepidoptera and Diptera were most superior followed by lepidopterans and dipterans.

Keywords: Pollinator diversity, pigeonpea, Bijapur, Bagalkot and hymenoptera

#### Introduction

Pigeonpea, *Cajanus cajan* (L.) Millspaugh an important pulse crop widely cultivated in the sub-continent is an important source of protein. The name pigeonpea was first used for certain plants in Barbados, where the seeds of this plant were considered important as pigeon feed (Singh and Oswalt, 1992)<sup>[7]</sup>. Natural out-crossing in pigeonpea takes place as a result of frequent insect visitation from one flower to another within and across the fields and, according to Onim (1981)<sup>[4]</sup>, each visit to the flower lasts between 15-55 seconds. He also observed that insect pollinators tripped almost all newly opened pigeonpea flowers by the end of the day, thereby introducing foreign pollen on the stigmatic surface. The activity and availability of pollinating insects is a major factor in determining the extent of out crossing. Pigeonpeas shed pollen while their flowers are still in the bud stage, and they do not start germinating until the flowers start to wither 24-48 h after their anthers dehiscence.

According to Pathak (1970)<sup>[5]</sup>, the bees *Megachile lanita* and *Apis florea*, visit open flowers and bring about cross-fertilization in pigeonpea. Williams (1977)<sup>[9]</sup> reported that the main pollinating species at ICRISAT Center are Apis dorsata and Megachile spp., and that several insect species of Vespidae, Diptera, Lepidoptera, Coleoptera, Neuroptera, Hemiptera, and Orthoptera also frequently visited pigeonpea flowers but did not touch their anthers or stigma. In pigeonpea, natural out-crossing at a particular location is determined by a combination of factors. These include the number of insect pollinators present in relation to the number of

factors. These include the number of insect pollinators present in relation to the number of available flowers, the flowering habit of the varieties, the location of the field in relation to the insect habitat, cropping system, frequency of pesticide application, and environmental factors such as temperature, humidity, and wind velocity and direction (Bhatia *et al*., 1981) <sup>[1]</sup>. Redgram is cross pollinated up to 70 per cent by honey bees. Only 1 per cent of the flowers set become the pods and remaining 99 per cent drops down. Honey bees are the major pollination contributors. Keeping all these facts in view the present study was undertaken to know the pollinator fauna associated with pigeonpea in two major pigeonpea growing districts of Karnataka.

#### 2. Materials and Methods

The studies on pollinators of pigeonpea, C. cajan were carried out at two locations viz., Bijapur and Bagalkot districts of Karnataka during kharif 2018. Karnataka is the eighth largest state in India with an area of 190 lakh ha. It is situated between  $11.5^{\circ}$  &  $19.0^{\circ}$  N latitude and between  $74^{\circ}$  and  $78^{\circ}$  E longitude in the southern plateau. The State receives the average annual rainfall of about 1139 mm both from southwest and north-east monsoons. Bijapur district is situated well in the interior of the Deccan peninsula and lies between north latitude 15° 20' and 17° 28'. The average annual rainfall of the district is 668.2mm, the temperature ranges from 14.8° to 43 °C. The climate of the district is generally dry. Bagalkot is located in Northern Dry Zone (Zone-3) of Karnataka. The centre is located at 75° 42 ° East longitude and 16° 10° North latitude with an altitude of 542.00 m above Mean Sea Level (MSL). The average annual temperature is 25.8 °C in Bagalkot. The rainfall here averages 683 mm.

The observations on pollinator fauna was initiated at peak flowering stage of the crop and continued at regular intervals till its complete cessation. Observations were recorded at 1000 hr for different groups of pollinators visiting five randomly selected pigeonpea flowers for 5 minutes in each square meter area. 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. Based on the number of each insect pollinator collected, their percentage proportions were worked out in order to find out the order of their abundances.

#### 3. Results and Discussion

The studies were conducted on pollinator complex visiting pigeonpea at two different districts of Karnataka which included Bijapur and Bagalkot. The study revealed that Apis florea Fabricius, Apis dorsata (Fab), Apis cerana (Fab), Xylocopa sp., Megachilae sp., Danaus chrysippus Linnaeus, Lampides boeticus Linnaeus and Musca spp. were recorded at both the locations during 2018-19. The pollinator diversity in pigeonpea in Bijapur and Bagalkot constituted a total of 8 insect species which belonged to the orders viz., Hymenoptera, Lepidoptera and Diptera. Among these, the hymenopteran pollinators were most abundant namely Apis florea Fabricius (26.17 and 25.71), Megachilae sp., (22.48 and 22.86), Apis dorsata Fabricius (18.69 and 17.14), Apis cerana Fabricius (10.28 and 11.43) and Xylocopa sp. (9.35 and 8.57) per cent proportion in Bijapur and Bagalkot district, respectively (Table 1 and Table 2).

butterflies *viz.*, *Danaus chrysippus* Linnaeus (6.54%) and *Lampides boeticus* Linnaeus (2.80%) which were comparatively less in Bijapur district. In case of Bagalkot district, lepidopteran pollinators constituted two butterflies *viz.*, the nymphalid, *D. chrysippus* and the lycaenid, *L. boeticus* which were only rare visitors, both recording a per cent proportion of 5.71 each (Fig 2). Only one species of Diptera was noticed i.e., *Musca* spp. with mere per cent proportion of 3.74 and 2.86 in Bijapur and Bagalkot district, respectively (Table 1, 2 and Fig 1, 2).

The present findings on pollinator fauna of Pigeonpea are in conformity with the findings of Singh *et al.*, 2017<sup>[8]</sup> wherein they conducted a study to determine the impact of pollinators on the production of Pigeonpea and revealed that *C. cajan* flowers attracted 15 species of insects belonging to five families, 7 genera and three orders. The insect belongs to order Hymenoptera were most abundant. Of all the bees, megachilid bees were most abundant and compared more than 50 per cent of the total flower visiting insects followed by honeybees 39.4 per cent and anthophorid bees 6.6 per cent. The insects belonging to order Lepidoptera and Diptera which were reported in very small numbers at interrupted hours. Chaudhary and Jain (1978)<sup>[2]</sup> reported that *Megachile lamata* was the important pollinator of Pigeonpea throughout India.

Pigeonpea in the present study are in agreement with the findings of Ichpal *et al.*, (2017) <sup>[3]</sup> reported 15 species of insects belonging to five families, 7 genera and three orders, among them *Apis dorsata*, *A. mellifera*, *A. cerana*, *A. florea*, *solitary bees*, *Xylocopa latipes*, *X. pubescence*, *Amegill azonata*, *Megachile bicolor*, *M. lanata*, *M. hera*, *M. cephalotes* and *M. disjuncta* were commonly recorded in pigeon pea. Similarly, Singh (2016) <sup>[6]</sup> reported that 7 insect species were true pollinators where *Megachile* spp., *X. tenuiscapa*, *A. zonata* and *Nomia* sp. are the major pollinators of pigeon pea. On contrary, Williams (1977) <sup>[9]</sup> identified 48 insect species visiting pigeonpea flowers at ICRISAT Center, while in Kenya Onim (1981) <sup>[4]</sup> listed 24 insect species which may affect cross-fertilization in this crop.

In general the number of pollinator species may vary because of the soil, climatic factors, crop variety, frequency of pesticide application and cropping system adopted. Which were conformity with the findings of Bhatia *et al* ., (1981)<sup>[1]</sup> he reported natural out-crossing at a particular location is determined by a combination of factors. The factors include number of available flowers, the flowering habit of the varieties, the location of the field in relation to the insect habitat, cropping system, frequency of pesticide application, and environmental factors such as temperature, humidity, and wind velocity and direction.

The insects belonging to the order Lepidoptera constituted

Table 1: Pollinator fauna recorded on pigeonpea,	<i>Cajanus cajan</i> bloom o	during 2018-19 in Bijapur District
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Order	Family	Scientific name/ Common name	No./m <sup>2</sup> /5 min	Percentage proportion	Total	
Hymenoptera	Apidae	Apis florea Fabricius	28	26.17		
		Apis dorsata Fabricius	20	18.69		
		Apis cerana Fabricius	11	10.28	86.92	
		<i>Xylocopa</i> sp.	10	9.35		
	Megachilidae	Megachilae sp.	24	22.48		
Lepidoptera	NymphalidaeDanaus chrysippus LinnaeusLycaenidaeLampides boeticus Linnaeus		7	6.54	9.35	
			3	2.80		
Diptera	Muscidae	Musca spp.	4	3.74	3.74	



Fig 1: Abundance different honey bee species in the pollination of Pigeonpea in Bijapur

Order	Family	Scientific name/ Common name	No./m²/5 min	Percentage proportion	Total	
Hymenoptera	Apidae	Apis florea Fabricius	9	25.71		
		Apis dorsata Fabricius	6	17.14		
		Apis cerana Fabricius	4	11.43	85.71	
		<i>Xylocopa</i> sp.	3	8.57		
	Megachilidae	Megachilae sp.	8	22.86		
Lepidoptera	Nymphalidae	Danaus chrysippus Linnaeus	2	5.71	11.43	
	Lycaenidae	Lampides boeticus Linnaeus	2	5.71		
Diptera	Muscidae	Musca spp.	1	2.86	2.86	

Table 2: Pollinator fauna recorded on	pigeonpea,	Cajanus caja	n bloom di	uring 2018-19 in	Bagalkot District
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Fig 2: Abundance different honey bee species in the pollination of Pigeonpea in Bagalkot



#### 4. Conclusion

The pollinator fauna of pigeonpea, in bijapur and bagalkot district of Karnataka comprised of four 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 buckwheat were of the order Lepidoptera among which, Nymphalids were higher in abundance and the *Musca* spp were the major visitors among the Dipterans.

#### 5. Acknowledgment

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