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Insect fauna associated with pigeon pea (*Cajanus cajan* L.) in Odisha

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Abstract
Field experiments were conducted during *Kharif*, 2017-2018 undertaken at Entomology Research Station of Orissa University of Agriculture and Technology, Bhubaneswar to study the occurrence of different insect pollinators on Pigeon pea (*Cajanus cajan* L.). Though Pigeon pea is a self pollinated crop with cleistogamous type of flower, it is visited by an array of insects. Under agroclimatic conditions of Odisha, It attracted eleven species of important pollinators represented by family Apidae (45.5%), Megachilidae (36.4%) and Vespidae (18.2%) all belonging to a single order hymenoptera barring stay population of Dipterans and Lepidopterans. Species wise diversity indicated that *Megachile lanata* Fab. was the most dominant one (29.1%) followed by *Megachile disjuncta* Fab. (20.5%), *Tetragonula iridipennis* Smith (14.2%), *Apis cerana indica* Fab. (10.95%) *Megachile bicolor* Fab. (10.7%), *Xylocopa latipes* Drury (8.5%), *Megachile hera* Bingham (2.1%), *Eumenes* spp. (1.7%), *Xylocopa aestuans* Lin. (1.2%), *Vespa tropica* Lin. (0.8%) and *Apis dorsata* Fab. (0.2%). It is inferred from the present investigation that Pigeon pea is an ideal crop supporting an array of pollinators, most important being the *M. lanata*.

Keywords: Pollinators diversity in pigeon pea, insect pollinators, bee pollinators

Introduction
Pigeon pea (*Cajanus cajan* L.), commonly known as red gram, tur or arhar is an important pulse crop of India belonging to the botanical family Fabaceae. India produces 2.46 million tons of arhar from an area of 3.75 million hectares with a mean yield of 656 kg per hectare. It is one of the most important pulse crops of Odisha too cultivated in an area of 0.14 million hectares with a production of 0.12 million tons registering yield of 886 kg per hectare (Agricultural Statistics at a glance, 2016) [1]. Pollination is one of the important factors in increasing crop productivity. Pigeon pea possesses cleistogamous flowers which favour self-pollination. However, 14-20 per cent natural out crossing has been reported to occur in Pigeon pea (Sharma and Green, 1980 and Howard *et al.* 1919) [5, 2]. Pigeon pea is an often cross pollinated crop, pollination being accomplished through entomophilies. Self-pollination occurs in the bud before the flowers open, while cross pollination is effected with the help of insects. Since, the published information on occurrence of pollinators on the pigeon pea under Odisha conditions is very scanty, the crop was chosen to study the occurrence of pollinators on it under Odisha conditions by the AICRP on honeybees and pollinators (ICAR), Bhubaneswar. In addition to detail studies on pollinators diversity and their impact on crop yield, an investigation was also made to record the association of insect fauna complex with the Pigeon pea crop those play positive or negative role in the crop yield. Shanower *et al.* (1999) [4] reported that Pigeon pea is an important crop in semi-arid tropical and sub-tropical farming systems and the insect pests feeding on flowers, pods and seeds are the most important biotic constraint affecting pigeon pea yields. Reed and Lateef (1990) [3] reported 200 species of insect attacked pigeon pea but most of them being sporadic in their distribution, they are not regarded as the pests. Singh (2016) [6] reported 7 species of pollinators belonging to three families of Hymenoptera order.

Materials and Methods
In order to record the insect fauna including pollinators associated with Pigeon pea crop, studies were conducted during *Kharif*, 2017-18 in the Experimental Station of Entomology located in the upland area of Central Research Station, Orissa University of Agriculture and Technology, Bhubaneswar. The seeds of HYV Pigeon pea cv. Asha were sown during 9th September of *Kharif*, 2017. The crop was raised in 40 plots of 4.0m^2 (2m×2m.) size with inter and intra row spacing of 50 cm and 30 cm respectively. The recommended dose of N_2: P_2O_5: K_2O at 20:40:20 kg/ha was applied and necessary agronomic practices were followed to

maintain proper plant population and normal growth of plants. In order to study the insect fauna associated with the arhar crop observation were recorded at weekly interval commencing from 30 DAG till harvesting of the crop. The insects including pollinators occurring at flowering stage of the crops were recorded, collected and preserved following standard method and were identified.

Results and Discussion

The results of the present investigation revealed that the Pigeon pea is a crop acting as a store house of insect fauna. It supported an array of insects, the commonly occurring insects belonging to 35 species, 21 families under 7 Orders (Table 1). Besides, many other butterflies, true flies, beetles and sucking insect made their stray visit to the crop at specific crop growth stages while pollinators occurred during flowering stages chiefly. The crop is not only important as a major pulse crop but also played a vital role in ecosystem sustenance in various ways.

Among the 35 species associated with the crop 21 species belonging to Lepidoptera (9), Hemiptera (7), Diptera (3), Coleoptera and Thysanoptera (one each) occurred as pests frequently on the crop. Pod borer complex and pod sucking bugs were occurred as major pests. Among other 14 species, 3 species belonging to one each from Coleopteran, Diptera and Neuroptera were the common predators of pest of the pigeon pea crops and 11 species belonging to three families viz., Apidae, Megachillidae and Vespidae under single order Hymenoptera were associated as the pollinators on the crop.

Activity of different pollinators started at 10 per cent flowering stage coinciding with 69 DAS and the activity continued till the late flowering stage i.e. 159 DAS. The pollinators visit though was very negligible but it continued till the harvest of the crop. A great majority of Pigeon pea plants flowered between 89 DAS to 129 DAS. Among the pollinators, family Apidae with 45.5 per cent share was the most dominant followed by Megachilidae (36.36 %) and Vespidae having 18.18 per cent share.

Pigeon pea crop is visited by three species of honeybees i.e. *Apis dorsata* Fab., *Apis cerana indica* Fab. and *Tetragonula iridipennis* Smith. Along with the bee species viz., *Megachile lanata* Fab., *Megachile disjuncta* Fab., *Xylocopa latipes* Drury, *Xylocopa aestuans* Lin. and *Megachile bicolor* Fab. which were most frequent visitors.

Stray population of butterflies and true flies were also observed visiting the Pigeon pea flower for their dietary requirement.

Reed and Lateef (1990) [3] reported 200 species of insect attacked pigeon pea but most of them being sporadic in their distribution; they are not regarded as the pests. The present investigation was for short duration and in a limited agro ecosystem and the insects recorded are closely associated with the crops. The stray visitors have not been included in the list. Further, Singh (2016) [6] reported 7 species of pollinators belonging to three families viz., Megachillidae, Apidae and Halictidae of Hymenoptera order. As observed in the present study, he also observed the megachillidae as major pollinators, but under Nagaland conditions the rock bees and Indian hive bees didn't occurred as pollinator.

Table 1: Diverse species of pests and pollinators occurring on Pigeon

Sl. No	Name of Pest	Scientific Name	Family	Order	Status
1.	Jassids	*Empoasca kerri*	Cicadellidae	Hemiptera	Pest
2.	White fly	*Bemisia tabaci*	Aleyrodidae	Hemiptera	Pest
3.	Thrips	*Taeniothrips spp.*	Thripidae	Thysanoptera	Pest
4.	Aphids	*Aphis craccivora*	Aphididae	Hemiptera	Pest
5.	Leaf weber	*Grapholita critica*	Tortricidae	Lepidoptera	Pest
6.	Leaf miner	*Phytomyza atricornis*	Agromyzidae	Diptera	Pest
7.	Cow bug	*Oxyrachis tarandus*	Membracidae	Homoptera	Pest
8.	Spotted pod borer	*Maruca testulalis*	Crambidae	Lepidoptera	Pest
9.	Blue butterfly	*Catochrysops cnejus/Lampoides boeticus*	Lycaenidae	Lepidoptera	Pest
10.	Gram pod borer	*Helicoverpa armigera*	Noctuidae	Lepidoptera	Pest
11.	Spiny pod borer	*Etiella zinckenella*	Phycitidae	Lepidoptera	Pest
12	Plume moth	*Exelastis atomosa*	Pterophoridae	Lepidoptera	Pest
13	Blister beetle	*Mylabris pustula*	Meloidae	Coleoptera	Pest
14	Pod borer	*Adisura atkinsoni*	Noctuidae	Lepidoptera	Pest
15	Pod bug	*Clavigralla gibbosa*	Coreidae	Hemiptera	Pest
16	Pod bug	*Riptortus pedestris*	Coreidae	Hemiptera	Pest
17	Pod bug	*Anoplocnemis phasiana*	Coreidae	Hemiptera	Pest
18	Gram Pod fly	*Melanagromyza obtuse*	Agromyzidae	Diptera	Pest
19	Stem fly	*Ophiomyia phaseoli*	Agromyzidae	Diptera	Pest
20	Cut worm	*Agrotis ipsilon*	Noctuidae	Lepidoptera	Pest
21	Hairy caterpillar	*Euproctis scintillans*	Lymantriidae	Lepidoptera	Pest
22	Lady bird beetle	*Chilomenes sexmaculata*	Coccinelidae	Coleoptera	Predator
23	Syrphid fly	*Ischiodon scutellaris*	Syrphidae	Diptera	Predator
24	G.L.wing bug	*Chrysoperla carnea*	Chrysopidae	Neuroptera	Predator
25	Indian hive bee	*Apis cerana indica* Fab.	Apidae	Hymenoptera	Pollinator
26	Rock bee	*Apis dorsata* Fab.	Apidae	Hymenoptera	Pollinator
27	Leaf cutting bee	*Megachilel anata* Fab.	Megachilidae	Hymenoptera	Pollinator
28	Leaf cutting bee	*Megachile disjuncta* Fab.	Megachilidae	Hymenoptera	Pollinator
29	Leaf cutting bee	*Megachile bicolor* Fab.	Megachilidae	Hymenoptera	Pollinator
30	Leaf cutting bee	*Megachile hera* Bingham	Megachilidae	Hymenoptera	Pollinator
31	Stingless bee	*Tetragonula iridipennis* Smith	Apidae	Hymenoptera	Pollinator
32	Carpenter bee	*Xylocopa latipes* Drury	Apidae	Hymenoptera	Pollinator
33	Carpenter bee	*Xylocopa aestuans* L.	Apidae	Hymenoptera	Pollinator
34	Wasp	*Eumenes* spp.	Vespidae	Hymenoptera	Pollinator
35	Wasp	*Vespa tropica* Linnaeus	Vespidae	Hymenoptera	Pollinator

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