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## Record of natural enemies in pigeonpea at Raipur region of Chhattisgarh state

**Akkabathula Nithish and Navneet Rana**

**Abstract**

This paper reports the natural enemies of insects' pest in pigeonpea [*Cajanus cajan*] in Raipur, Chhattisgarh during Kharif season 2013-2014. The present study was conducted at the Research cum Instructional Farm, IGKV, Raipur, Chhattisgarh during Kharif season 2013-2014. Recent research investigating the complex interactions among pigeonpea, its key pests, and their natural enemies was reviewed. These relationships have implications for the pest status of individual species and possible control strategies. Natural enemies occurred in an overlapping manner and one or other was continuously observed at different stages of growth. The natural enemies of insects pest in pigeonpea crop were first observed during the last week of July i.e. 31<sup>st</sup> SMW with 0.20 natural enemies per plant when the crop was at two leaf stage. The maximum number of natural enemies associated and their peak activity was recorded during the periods of flowering and pod maturity. The natural enemies recorded from seedling to podding are Hymenopteran wasps (*Apanteles* sp. and *Vespa orientalis*), ladybird beetles (*Coccinella septempunctata* and *Cheilomenes sexmaculata*), mirid bug (*Cyrtorrhinus lividipennis*), praying mantis (*Mantis religiosa*), dragonfly (*Crocothemis servilia*), and green lacewings (*Chrysoperla carnea*). Among spiders (*Neosconatheisi* sp. *Oxyopes* sp. *Araneus* sp. and *Clubiona* sp.) were observed.

**Keywords:** Natural enemies, pigeonpea, insects' pest, crop period, SMW.

**Introduction**

Our country has the distinction of being the largest producer of legumes with over a dozen of pulse crops, grown on about 25.43 million hectares of land and 18.24 million tonnes of production with the average productivity of 679 kg/ha (Anonymous 2011-12) [2, 3]. Pulses occupy an area of 67.8 million hectares and contribute 55.2 million tonnes to world's food basket (Pushpa, 2007) [10]. The level of productivity of pulses in India lies between 600-650kg/ha, which is far below when compared to average productivity of the world being the largest producer and consumer of pulses throughout the world.

Pigeonpea is cultivated in more than 25 countries of the world. As compared to the other Pulses produced in the world, pigeonpea holds the sixth rank in production. It covers 6.5 per cent of the world's total pulses area and contributes 5.7 per cent to the total pulses production (Rao *et al.*, 2010) [11], and is grown in an area of 4.7 million ha with a production of 3.69 million tonnes in the world with the productivity of 784 kg/ha (FAOSTAT, 2010) [6]. Among the pulses, pigeonpea is the second major pulse crop grown in India after chickpea (*Cicer aritinum* L.), accounting for 15.8% of total pulse production (Anonymous, 2012) [3], is an important drought tolerant pulse crop, grown mainly in the semi-arid tropics, though it is well adopted to several environments (Treason *et al.*, 1990) [15], lying between 30°S and 30°N of the world.

In India, pigeonpea is grown in 3.86 million hectares with an annual production of 2.65 million tonnes and 741 kg ha<sup>-1</sup> of productivity (FAOSTAT, 2012) [7], which is 4/5<sup>th</sup> share in the world total pigeonpea produced. About 90% of the global pigeonpea area falls in India (Anonymous, 2012) [3]. In Chhattisgarh, acreage under pigeonpea is 51.9 thousand hectares with a total production and productivity of 31 thousand tonnes and 597 kg/ha, respectively (Anonymous, 2013) [4].

Insect pests are major biological constraints to production of pigeonpea crop. However, the yield levels of this crop are not very encouraging. Among the factors responsible for low yield, the damage caused by insect pests is one of the major factors. It is attacked by several insect pests from seedling stage till harvesting. Management of pigeonpea pest is complicated as the crop is affected by three groups of insects with different biology and variable population dynamics occurring throughout the year across wider geographical areas. There is every need to study the role of bioagents in pigeonpea. Hence, the present study was mainly focused on the effective management strategies on pest of pigeonpea at Chhattisgarh, and keeping the

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above points in view, the present study was formulated. Srinivas and Jayaraj carried out survey between 1983 and 1985 to record the natural enemies of *Heliothis armigera* [*Helicoverpa armigera*] in Coimbatore district of Tamil Nadu, India. Parasitized and healthy larvae of the noctuid in different stages of development were collected from pigeonpeas [*Cajanus cajan*], green gram [*Vigna radiata*], lablab [*Lablab purpureus*], chickpeas [*Cicer arietinum*] and cowpeas [*V. unguiculata*] in the field and reared in the laboratory until emergence of the adults. Early larval stages were more prone to attack than later stages. Sixteen species of natural enemies belonging to the Trichogrammatidae, Braconidae, Ichneumonidae, Sarcophagidae, Coccinellidae, Chrysopidae and Eumenidae were recorded.

Sahoo and Senapati, (2000) [12] reported the natural enemies of pod borers in pigeon pea (*Cajanus cajan*) in Bhubaneswar, Orissa. During the rainy season of 1994 and 1995, the occurrence of both nymphs and/or adults of mud wasps, spiders and praying mantis were recorded in the crop. In the field, the maximum abundance of predators was recorded during the last week of September which coincided with high population of pod borers. Spiders, praying mantis and hymenopterous wasps (*Delta* spp.) predated larvae of *M. vitrata*, *Nanaguna breviscula*, *Grapholita critica* and *Helicoverpa armigera*. The braconid, *Apanteles taragamae* parasitized larvae of *M. vitrata* and *G. critica* during mid-September to late December. Parasitization by *Brachymeria atteviae* on *N. breviscula* and *Microdes* sp. on *M. vitrata* are the first records of their kind from Orissa.

Neerja *et al.*, (2010) [9] conducted survey in chickpea, pigeonpea and lentil crops in different districts of Uttar Pradesh. A total of 22 districts were surveyed to record the natural enemies of gram pod borer *Helicoverpa armigera*. *Campoletis chlorlidae* was recorded as natural enemy feeding on *H. armigera* larvae. In pigeonpea crop, 20 insect pests and a total number of 16 parasites and predators belonged to Order Dictyoptera, Neuroptera, Hemiptera, Hymenoptera, Diptera and Coleoptera were observed in these crops during the period of study.

Rani *et al.*, (2011) in their survey for two consecutive years observed *Chilomenus sexmaculata*, as the only coccinellid species in pulses ecosystem. Among the spiders, *Argiope* sp., *Oxyopes* sp., *Thomisus* sp., *Chrysilla* sp., *Tetragnatha* sp., *Neosconattheisi*, *Telemonia dimidata*, *Curba* sp. *Peucetia viridans*, *Araneus diadematus*, *A. anasuja* (Thorell) were noticed in pulses ecosystems.

## Materials and Methods

The Present study entitled "Record of natural enemies in pigeonpea at Raipur region of Chhattisgarh state" was conducted during July 2013 to January 2014, at the Research cum Instructional Farm of Indira Gandhi Krishi Vishwa vidyalaya, Raipur (C.G.), which comes under the tropical region of India. It is situated in central part of Chhattisgarh

plains at 21.16 north latitude and 81.36 east longitude with and altitude of 293 M above the mean sea level. A field experiment was laid on 30<sup>th</sup> June 2013 in plot size of 19.6 m<sup>2</sup> replicated three times. Daily observations were recorded for natural enemies from ten randomly selected plants during sowing to harvesting of the crop and the mean thus obtained is represented for each standard metrological week. In this experiment, the occurrence of both nymphs and/or adults of wasps, spiders and praying mantis were recorded in the crop. The maximum abundance of predators was recorded during the third week of October which coincided with high population of pod borers. Spiders are mostly recorded at the pod maturity stage.

## Results and Discussion

The data recorded on various aspects reflects some interesting facts; in the absence of natural enemies, the abundance of the crop pest increases. If natural enemies are present, the abundance of crop pest decreases with increasing plant quality due to more effective suppression by the natural enemies. Early larval stages were more prone to attack than later stages. The abundance of crop pest with natural enemies can either increase or decrease with increasing depending on the compensatory abilities of natural enemies.

Natural enemies' population and their peak activities were observed during the study period (July 2013-January 2014) based on weekly observations. The maximum abundance of natural enemies were recorded during the pod maturity stage. The natural enemies were first observed during the last week of July i.e. 31<sup>st</sup> SMW with 0.2 natural enemies /plant. The population gradually increased and reached at its peak of 5.7 natural enemies /plant in the 4<sup>th</sup> week of September i.e. 39<sup>th</sup> SMW. Thereafter, their population went down in a fluctuating manner and again reached to a peak of 6.1 natural enemies /plant recorded during the first week of November i.e. 45<sup>th</sup> SMW. The recorded natural enemies are represented under Table No. 1.

The data pertaining to the natural enemies in pigeonpea crop and their peak activity are presented in the table No. 2. It is obvious from the data that different natural enemies of insects' pest occurred in an overlapping manner and one or other was continuously observed in the crop of pigeonpea at different stages of growth during kharif 2013-14. Different natural enemies observed in the crop are ladybird beetles (*Coccinella septempunctata* and *Cheilomenes sexmaculata*), black ants (*Lasius niger*), praying mantid (*Mantis religiosa*), dragonfly (*Crocothemis servilia*), green lacewing (*Chrysoperla* sp.), hymenopterous wasps (*Chalybion* sp.), braconid wasp (*Apanteles* sp.) and mud wasp (*Diachasmimorpha* sp.). Among the spiders, garden spiders (*Araneus* sp.), lynx spider (*Oxyopes* sp.) and orb weaver spider (*Neosconattheisi* sp.) were observed. The recorded natural enemies are depicted graphically under fig 1.

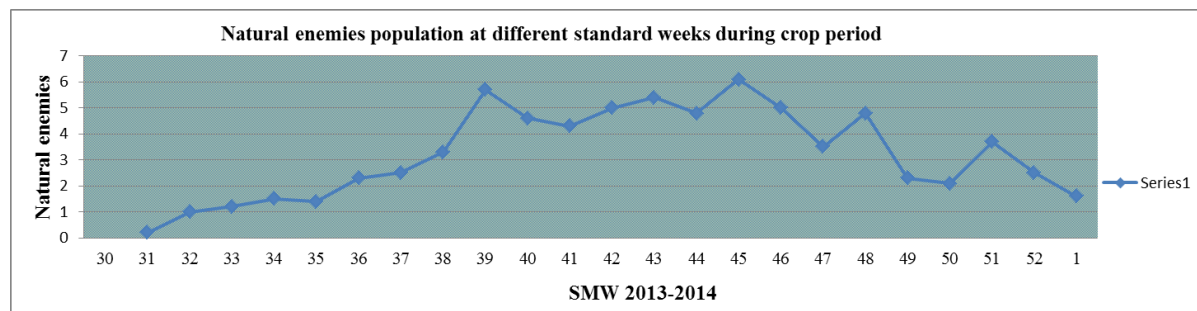
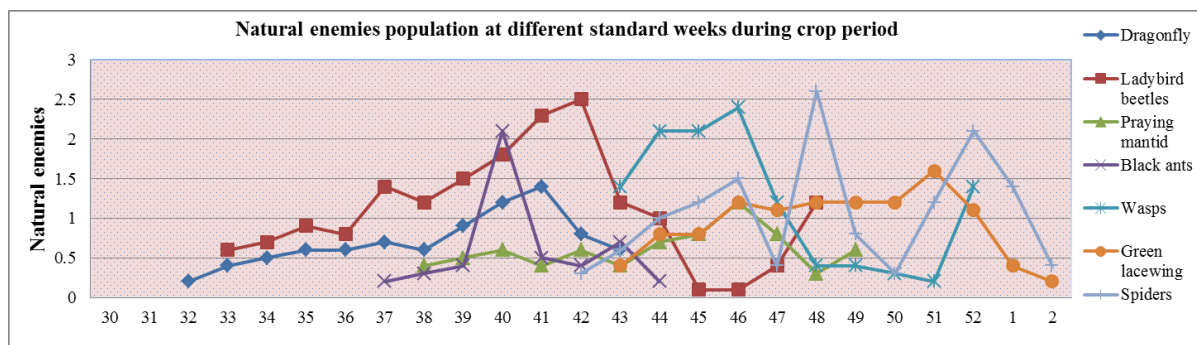
**Table 1:** Natural enemies' population and their activity recorded during the study period 2013-14 in pigeonpea crop

Natural enemies	July			August				September				October				November				December				January				
	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2		
Dragonfly	0.0	0.0	0.2	0.4	0.5	0.6	0.6	0.7	0.6	0.9	1.2	1.4	0.8	0.6														
Ladybird beetles				0.6	0.7	0.9	0.8	1.4	1.2	1.5	1.8	2.3	2.5	1.2	1.0	0.1	0.1	0.4	1.2									
Praying mantis									0.4	0.5	0.6	0.4	0.6	0.4	0.7	0.8	1.2	0.8	0.3	0.6								
Black ants								0.2	0.3	0.4	2.1	0.5	0.4	0.7	0.2													
Wasps														1.4	2.1	2.1	2.4	1.2	0.4	0.4	0.3	0.2	1.4					
Green lacewing														0.4	0.8	0.8	1.2	1.1	1.2	1.2	1.2	1.6	1.1	0.4	0.2			
Spiders														0.3	0.6	1.0	1.2	1.5	0.4	2.6	0.8	0.3	1.2	2.1	1.4	0.4		

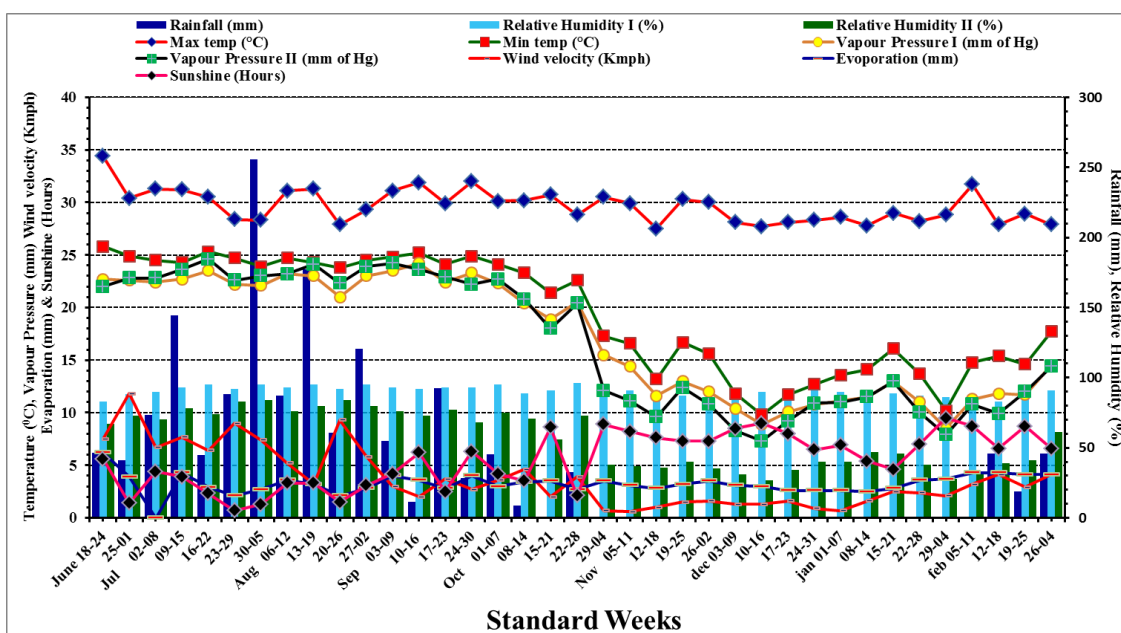
Average population of natural enemies at each SMW	00	00	0.2	1	1.2	1.5	1.4	2.3	2.5	3.3	5.7	4.6	4.3	5	5.4	4.8	6.1	5.0	3.5	4.8	2.3	2.1	3.7	2.5	1.6	0.4
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**Table 2:** Natural enemies and their peak activity recorded in pegoipea during the crop period

S. No.	Natural enemies	Range	Period of activity	Host insect species	Period of maximum population
1	Dragonfly <i>Crocothemis servilia</i>	0.4-1.4	Jul-Oct	Nymphs/adults of thrips, jassids and other larvae	40 <sup>th</sup> SMW
2	Ladybird beetles <i>Coccinella septempunctata</i> <i>Cheilomenes sexmaculata</i>	0.1-2.5	Aug-Nov	Nymphs/adults of thrips and jassids	41 <sup>st</sup> SMW
3	Praying mantid <i>Mantis religiosa</i>	0.3-1.2	Sep-Nov	Pod borers' larvae	45 <sup>th</sup> SMW
4	Black ants <i>Lasius niger</i>	0.2-2.1	Sep-Oct	Nymphs/adults of thrips and jassids	39 <sup>th</sup> SMW
5	Wasps <i>Apanteles sp.</i> <i>Chalybion sp.</i> <i>Diachasmimorpha sp.</i>	0.2-2.4	Oct-Dec	Pod borers' larvae	45 <sup>th</sup> SMW
6	Green lacewing <i>Chrysoperla carnea</i>	0.2-1.6	Oct-Jan	Nymphs/adults of aphids, jassids and other larvae	50 <sup>th</sup> SMW
7	Spiders <i>Neosconatheisi sp.</i> <i>Araneus sps.</i> <i>Oxyopes sp.</i>	0.3-2.6	Oct-Jan	All stages of thrips and jassids and pod borers' larvae	48 <sup>th</sup> SMW



**Fig. 1:** Natural enemies population and their activity recorded during the study period 2013-14 in pigeonpea crop



Weekly meteorological data during the crop period (July 15<sup>th</sup> 2013 to February 21<sup>st</sup> 2014)

**(A) Dragonfly**

Dragonflies were recorded during the last week of July with two leaf stage of plants and were continuously active till flowering stage with their peak activity in the first week of October (40<sup>th</sup> SMW). The range of dragonflies recorded was from 0.2 per plant to 1.4 per plant during the crop period.

**(B) Coccinellid beetles**

Coccinellid beetles appeared during the first week of August and remained active up to the third week of November with their peak activity in the second week of October (41<sup>st</sup> SMW). The range of beetles recorded was from 0.1 per plant to 2.5 per plant during the crop period.

**(C) Praying mantids**

The findings of mantids were observed from the second week of September to the last week of November, with their peak activity in the first week of November (45<sup>th</sup> SMW). The range of mantids recorded was 0.3 per plant to 1.2 per plant during the crop period.

**(D) Black ants**

Ants appeared from the first week of September to the fourth week of October when the crop was in vegetative stage. Their maximum activity was recorded in the last week of September (39<sup>th</sup> SMW). The range of ants recorded was 0.1 per plant to 2.5 per plant during the crop period.

**(E) Hymenopterous wasps**

Wasps appeared at the time of flower initiation from the third week of October and are continued throughout flowering and pod formation stage up to the third week of December with their maximum population in the first week of November (45<sup>th</sup> SMW). The range of wasps recorded was 0.2 per plant to 2.4 per plant during the crop period.

**(F) Green lacewing**

Green lacewings appeared at flowering stage and were active in third week of October to first week of January, with maximum activity in the second week of December (50<sup>th</sup> SMW). The range of lacewings recorded was 0.2 per plant to 1.6 per plant during the crop period.

**(G) Spiders**

Next in appearance as natural enemies at flowering stage were spiders, being active till second week of January with their peak activity in the last week of November (48<sup>th</sup> SMW). Spiders were found to be effective against pod borers. The range of spiders recorded was 0.3 per plant to 2.6 per plant during the crop period.

Present findings are similar to the work done by Sahoo and Senapati, (2000) [12] who reported the natural enemies of pod borers in pigeon pea (*Cajanus cajan*) in Bhubaneswar, Orissa. During the rainy season of 1994 and 1995, the occurrence of both nymphs and/or adults of mud wasps, spiders and praying mantis were recorded in the crop. In the field, the maximum abundance of predators was recorded during the last week of September which coincided with high population of pod borers. Natural enemies recorded in pigeonpea in the present study are similar to the observations of Akhilesh Kumar and Paras Nath (2003) [1] who recorded the natural enemies on pigeonpea Cultivars UPAS 120 during seedling to podding stages in Varanasi, Uttar Pradesh, India, during 1994/95 and 1995/96 which includes braconid wasp (*Apanteles* sp. and *Euderus lividus*), ladybird beetle (*Coccinella*

*septempunctata*), mirid bug (*Cyrtorrhinus lividipennis*), praying mantid (*Mantis religiosa*), dragonfly (*Crocothemis servilia*), green lacewings (*Chrysoperla carnea* common wasp (*Vespa orientalis*), ladybird beetle (*Cheilomenes sexmaculatus*), and spiders (*Araneus* sp. and *Clubiona* sp.)

**Conclusion**

The studies showed the peak activity of the natural enemies coincides with the larval population of pod borer complex. The natural enemies were first observed during last week of July i.e. 31<sup>th</sup> SMW with 0.2 natural enemies/plant when the crop is at two leaf stage. The population gradually increased and reached at its peak of 5.7 natural enemies /plant in last week of September i.e. 39<sup>th</sup> SMW. Thereafter, the population went down in a fluctuating manner and again in the 45<sup>th</sup> SMW highest population of 6.1 natural enemies /plant was recorded in the 1<sup>st</sup> week of November. The maximum number of natural enemies associated with pigeonpea and their peak activity was recorded during the periods of flowering and pod maturity. The counts of natural enemies were in proportion to the count of insects' pest in the field of pigeonpea.

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