

# Studies on succession of insect pest complex and their natural enemies in pigeonpea [*Cajanus cajan* (L.) Millsp.]

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## ABSTRACT

A field experiment was conducted at experimental field of Department of Entomology, Live Stock Farm, Adhartal, J.N. Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during *Kharif* season 2009-2010. Thirteen different species of insects and one insectivorous bird species were recorded on the pigeonpea at Jabalpur during 2009-2010. Data collected revealed that fauna belonging to seven orders and fourteen families were associated with the pigeonpea crop. The first group of insects included jassid, leaf webber, tussock caterpillar and red pumpkin beetle which appeared when the crop age was about 39 days old *i.e.* during vegetative stage and remained available upto the reproductive stage. The next group of insects to appear on the crop were jassid, thrips, blister beetle, pod bug, gram pod borer, pod fly, green stink bug and red gram plume moth. These appeared when the crop age was about 102 days old *i.e.* at the reproductive stage and remained available upto the maturity of the crop. These pests were the major key pests which caused colossal yield losses. The natural enemies observed were lady bird beetle and a parasitic wasp *Cotessia*(= *Apanteles*)sp. which remained active from vegetative to reproductive stage of the crop. An insectivorous bird, black drongo was also observed to feed on different stages of insect pests infesting pigeonpea during the entire crop growth period.

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## INTRODUCTION

India is the largest producer of pulses in the world and the domestic pulses production is about 14 - 15 million tonnes, but the demand is higher, of about 18 - 19 million tonne (Anonymous, 2009). The average productivity of pulses in India is 625 kg/ha. To meet the growing demands, this needs to be increased at least by 28 per cent in the next 10 years (Nadarajan, 2009).

Pigeonpea crop accounts 5 per cent of global acreage

(4.16 million ha) and production (2.85 million tonnes), of which Asia is nearly the sole contributor (Ahlawat *et al.*, 2005). In the country, the crop is extensively grown in Uttar Pradesh, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh and Gujarat. Pigeonpea is a rich source of protein (21.71%) and supplies a major share of protein requirement of the vegetarian population of the country, besides it is also a rich source of iron, iodine and essential amino acids like arginine, cysteine and lysine (Singh *et al.*, 2007).

Yields of pigeonpea vary considerably among locations,

cultivars, seasons and cropping systems. In most areas, insects are the most important yield constraint and the greatest cause of yield variation. Diseases and the use of low yielding genotypes are also cited as constraints to improving pigeonpea yields (Manjunath *et al.*, 1989 and Nene *et al.*, 1990). More than 200 species of insects have been found feeding on pigeonpea, although only a few of these cause significant and consistent damage to the crop (Lateef and Reed, 1990); (Reed and Lateef, 1990).

Insect pest complex is the most limiting factor in pigeonpea production. These pests cause adequate economic damage leading to very low yield levels of 500 - 800 kg/ha as against the potential yield of 1800 - 2000 kg/ha (Lal *et al.*, 1997 and Upadhyay *et al.*, 1998).

In the light of these facts and changing scenario of pest complex, investigations were planned to find out pigeonpea ecosystem associated insectan pests and their natural enemies.

## MATERIAL AND METHODS

Succession of insect pests and their natural enemies were studied on pigeonpea cv. ICPL-88039 by raising crop following all recommended agronomic practices. The crop was sown in plot of size 10 m×20.4 m with spacing 0.60 m×0.20 m. Regular observations were initiated immediately after germination and continued upto harvest of the crop. The sequence in which the pests and natural enemies appeared

was noted on 25 tagged plants, once in a standard week. The crop was kept unprotected for this purpose.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

### Jassid, *Empoasca fabae* Harris (Hemiptera : Cicadellidae):

Both nymph and adult jassids were the damaging stages and feed by sucking on the leaflets. First appearance of the jassid was observed when the crop age was about 25 days, 32<sup>nd</sup>SW (Table 1). From Fig. 1, it is evident that the pest was present on the crop during the vegetative stage and remained available upto the first week of January, 1SW *i.e.* maturity stage of the crop (172 CAD). Similar findings have been reported by Kumar and Nath (2003), Mahalle (2008) and Landge (2009). They also reported that jassid infested pigeonpea during the vegetative and flowering stage of the crop.

### Leaf webber, *Grapholita critica* Meyr (Lepidoptera : Tortricidae) :

First appearance of the leaf webber was observed when the crop age was about 25 days, 32<sup>nd</sup>SW (Table 1). Larva was the damaging stage. It produces silk like substance with which

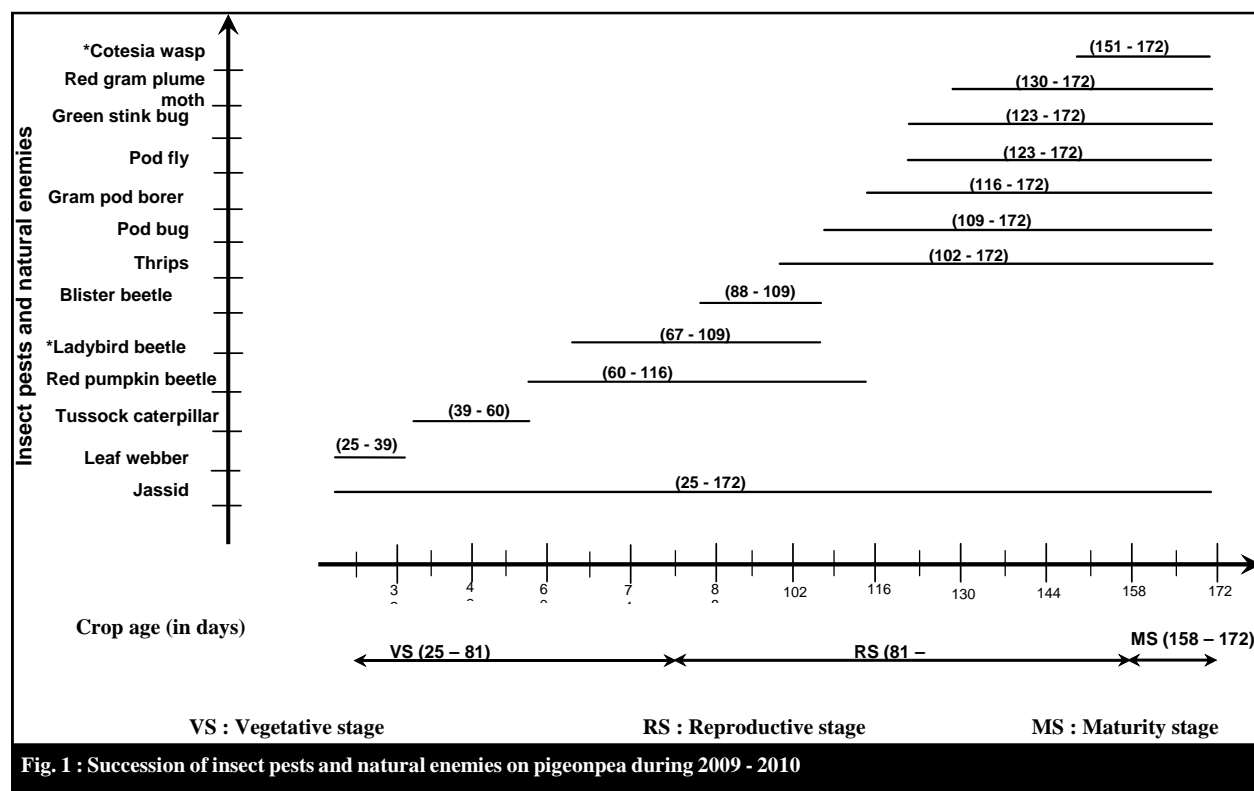


Fig. 1 : Succession of insect pests and natural enemies on pigeonpea during 2009 - 2010

**Table 1 : Succession of insect pests and natural enemies on pigeonpea at Jabalpur during 2009-2010**

Date of obs.	Insects						CA (D)	CGS
	SW	Common name	Scientific name	Order	Family	PP		
11 Aug. 2009	32	Jassid	<i>Empoasca fabae</i> (Harris)	Hemiptera	Cicadellidae	✓	25	VS
		Leaf webber	<i>Grapholita critica</i> Meyr.	Lepidoptera	Tortricidae	✓		
18 Aug. 2009	33	Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓	32	VS
		Leaf webber	<i>G. critica</i> Meyr	Lepidoptera	Tortricidae	✓		
25 Aug. 2009	34	Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓	39	VS
		Leaf webber	<i>G. critica</i> Meyr	Lepidoptera	Tortricidae	✓		
01 Sep. 2009	35	Tussock caterpillar	<i>Euproctis subnotata</i> Walker	Lepidoptera	Lymantridae	✓	46	VS
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
08 Sep. 2009	36	Tussock caterpillar	<i>E. subnotata</i> Walker	Lepidoptera	Lymantridae	✓	53	VS
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
15 Sep. 2009	37	Tussock caterpillar	<i>E. subnotata</i> Walker	Lepidoptera	Lymantridae	x	60	VS
		Red pumpkin beetle	<i>Raphidopalpa foveicollis</i> (Lucas)	Coleoptera	Chrysomelidae	✓		
22 Sep. 2009	38	Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓	67	VS
		Red pumpkin beetle	<i>R. foveicollis</i> (Lucas)	Coleoptera	Chrysomelidae	✓		
29 Sep. 2009	39	Lady bird beetle	<i>Cheilomenes sexmaculatus</i> Fab.	Coleoptera	Coccinellidae	✓	74	VS
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
06 Oct. 2009	40	Red pumpkin beetle	<i>R. foveicollis</i> (Lucas)	Coleoptera	Chrysomelidae	✓	81	VS
		Lady bird beetle	<i>C. sexmaculatus</i> Fab.	Coleoptera	Coccinellidae	✓		
13 Oct. 2009	41	Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓	88	RS
		Red pumpkin beetle	<i>R. foveicollis</i> (Lucas)	Coleoptera	Chrysomelidae	✓		
20 Oct. 2009	42	Lady bird beetle	<i>C. sexmaculatus</i> Fab.	Coleoptera	Coccinellidae	✓	95	RS
		Blister beetle	<i>M. pustulata</i> Thunberg	Coleoptera	Meloidae	✓		
27 Oct. 2009	43	Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓	102	RS
		Red pumpkin beetle	<i>R. foveicollis</i> (Lucas)	Coleoptera	Chrysomelidae	✓		
03 Nov. 2009	44	Lady bird beetle	<i>C. sexmaculatus</i> Fab.	Coleoptera	Coccinellidae	✓	109	RS
		Blister beetle	<i>M. pustulata</i> Thunberg	Coleoptera	Meloidae	✓		
10 Nov. 2009	45	Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓	116	RS
		Pod bug	<i>Clavigralla gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
		Red pumpkin beetle	<i>R. foveicollis</i> (Lucas)	Coleoptera	Chrysomelidae	✓		
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
		Pod bug	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
		Gram pod borer	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
			<i>Helicoverpa armigera</i> Hub.	Lepidoptera	Noctuidae	✓		

Contd.... Table 1.

Table 1 contd...

Date of obs.	Insects						CA (D)	CGS
	SW	Common name	Scientific name	Order	Family	PP		
17 Nov. 2009	46	Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓	123	RS
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
		Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>Melanagromyza obtusa</i> Malloch <i>Nezara viridula</i> Linn.	Diptera	Agromyzidae	✓		
24 Nov. 2009	47	Green stink bug		Hemiptera	Pentatomidae	✓	130	RS
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
		Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae	✓		
		Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae	✓		
01 Dec. 2009	48	Red gram plume moth	<i>Exelastis atomosa</i> Walsingham	Lepidoptera	Pterophoridae	✓	137	RS
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
		Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae	✓		
		Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae	✓		
		Red gram plume moth	<i>E. atomosa</i> Walsingham	Lepidoptera	Pterophoridae	✓		
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
08 Dec. 2009	49	Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓	144	RS
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae	✓		
		Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae	✓		
		Red gram plume moth	<i>E. atomosa</i> Walsingham	Lepidoptera	Pterophoridae	✓		
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
		Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae	✓		
15 Dec. 2009	50	Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae	✓	151	RS
		Red gram plume moth	<i>E. atomosa</i> Walsingham	Lepidoptera	Pterophoridae	✓		
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
		Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae	✓		
		Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae	✓		
		Red gram plume moth	<i>E. atomosa</i> Walsingham	Lepidoptera	Pterophoridae	✓		
		Wasp	<i>Cotessia</i> (= <i>Apanteles</i> ) sp.	Hymenoptera	Braconidae	✓		
22 Dec. 2009	51	Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓	158	RS
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
		Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae	✓		
		Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae	✓		
		Red gram plume moth	<i>E. atomosa</i> Walsingham	Lepidoptera	Pterophoridae	✓		
		Wasp	<i>Cotessia</i> sp.	Hymenoptera	Braconidae	✓		
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
		Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓		
29 Dec. 2009	52	Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓	165	MS
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae	✓		
		Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae	✓		
		Red gram plume moth	<i>E. atomosa</i> Walsingham	Lepidoptera	Pterophoridae	✓		
		Wasp	<i>Cotessia</i> sp.	Hymenoptera	Braconidae	✓		
		Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae	✓		
05 Jan. 2010	01	Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae	✓	172	MS
		Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae	✓		
		Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae	✓		
		Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae	✓		
		Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae	✓		
		Red gram plume moth	<i>E. atomosa</i> Walsingham	Lepidoptera	Pterophoridae	✓		
		Wasp	<i>Cotessia</i> sp.	Hymenoptera	Braconidae	✓		

Obs. = Observation, SW = Standard week, ✓=Insect species available, X = Insect species not available, PP = Pigeonpea, CAD = Crop age in days, CGS = Crop growth stage, VS = Vegetative stage, RS=Reproductive stage, MS = Maturity stage.

it webs the leaflets, buds and flowers and lives inside the web and feeds on them.

From Fig. 1, it is evident that the pest was present on the crop during the vegetative stage and remained available upto the fourth week of August, 34<sup>th</sup> SW *i.e.* vegetative stage of the crop (39 CAD). Similar findings have been reported by Kumar and Nath (2003 and 2013). They also reported that leaf webber infested pigeonpea during the vegetative stage of the crop.

**Tussock caterpillar, *Euproctis subnotata* (Lepidoptera : Lymantridae) :**

Tussock caterpillar found feeding on leaves of pigeonpea when the crop age was about 39 days *i.e.* the vegetative stage of the crop. From the (Table 1 and Fig. 1) it is observed that the pest was present on the crop from 34<sup>th</sup> SW, while it disappeared in the 37<sup>th</sup> SW *i.e.* second week of September when crop age was 60 days.

**Red pumpkin beetle, *Raphidopalpa foveicollis* (Lucas) (Coleoptera : Chrysomelidae) :**

First appearance of the adult red pumpkin beetle was observed when the crop age was about 60 days, 37<sup>th</sup> SW (Table 1). From the Fig. 1, it is evident that the pest was present on the crop from the vegetative stage and remained available upto second week of November 45<sup>th</sup> SW *i.e.* middle of the reproductive stage (116 CAD).

Adults of the pest were the damaging stage which feed by chewing the leaflets and tender pods.

**Lady bird beetle, *Cheilomenes sexmaculatus* Fab. (Coleoptera : Coccinellidae) :**

The natural enemy, lady bird beetle grub and adults were

the predators, which devour eggs of some lepidopteran insect pests, nymph and adult stages of soft bodied insect species *viz.*, aphids, jassids etc.

First appearance of the lady beetle was observed when the crop age was about 67 days, 38<sup>th</sup> SW (Table 1). From Fig. 1, it is evident that the natural enemy was present on the crop from the vegetative stage and remained available upto the first week of November, 44<sup>th</sup> SW *i.e.* reproductive stage of the crop (109 CAD).

**Blister beetle, *Mylabris pustulata* Thunberg (Coleoptera : Meloidae) :**

Adult beetles were the damaging stage they feed on buds and flowers of pigeonpea to lead heavy shedding of buds and flowers.

First appearance of the adult blister beetles was observed when the crop age was about 88 days, 41<sup>st</sup> SW (Table 1). From Fig. 1, it is evident that the pest was present on the crop during the reproductive stage and remained available upto the first week of November, 44<sup>th</sup> SW *i.e.* reproductive stage (109 CAD). However, Mahalle (2008) reported that blister beetle infested the vegetative stage and remained active upto the reproductive stage of the crop.

**Thrips, *Megalurothrips usitatus* Bagnall (Thysanoptera : Thripidae) :**

Both nymphs and adults were the damaging stages, they feed on buds and flowers. During periods of heavy infestation, it may lead to shedding of buds and flowers.

First appearance of the thrips was observed when the crop age was about 102 days, 43<sup>rd</sup> SW (Table 1). From Fig. 1, it is evident that the pest was present on the crop during the reproductive stage and remained available upto the first

**Table 2 : List of insect pests and natural enemies (insect and non-insect) observed on pigeonpea at Jabalpur during 2009-2010**

Insect pest			
Common name	Scientific name	Order	Family
Blister beetle	<i>M. pustulata</i> Thunberg	Coleoptera	Meloidae
Red pumpkin beetle	<i>R. foveicollis</i> (Lucas)	Coleoptera	Chrysomelidae
Pod fly	<i>M. obtusa</i> Malloch	Diptera	Agromyzidae
Pod bug	<i>C. gibbosa</i> Spinola	Hemiptera	Coreidae
Jassid	<i>E. fabae</i> (Harris)	Hemiptera	Cicadellidae
Green stink bug	<i>N. viridula</i> Linn.	Hemiptera	Pentatomidae
Red gram plume moth	<i>E. atomosa</i> Walsingham	Lepidoptera	Pterophoridae
Tussock caterpillar	<i>E. subnotata</i> (Scintillans) Waker	Lepidoptera	Lymantridae
Leaf webber	<i>G. critica</i> Meyr.	Lepidoptera	Tortricidae
Gram pod borer	<i>H. armigera</i> Hub.	Lepidoptera	Noctuidae
Thrips	<i>M. usitatus</i> Bagnall	Thysanoptera	Thripidae
Natural enemies			
Lady bird beetle	<i>C. sexmaculatus</i> Fab.	Coleoptera	Coccinellidae
Cotesia wasp	<i>Cotesia</i> (= <i>Apanteles</i> ) sp.	Hymenoptera	Braconidae
Black drongo	<i>D. macrocercus</i> Vieillot	Passeriformes	Dicruridae

week of January, 1<sup>st</sup> SW *i.e.* maturity stage of the crop (172 CAD). The present results are in accordance with the findings of Mahalle (2008) and Landge (2009), also reported that the thrips appeared during the reproductive phase of the crop and remained available up to the maturity stage of the crop.

**Pod bug, *Clavigralla gibbosa* Spinola (Hemiptera : Coreidae):**

First appearance of the pod bug was observed when the crop age was about 109 days, 44<sup>th</sup> SW (Table 1). From Fig. 1, it is evident that the pest was present on the crop during the reproductive stage and remained available upto the first week of January, 1<sup>st</sup> SW *i.e.* maturity stage of the crop (172 CAD). Singh *et al.* (1989) also reported that pest appeared during the first fortnight of the November, while Rana *et al.* (2008) reported that the pest appeared on the crop from December to February. Both nymph and adult stages of the bug sucksap of developing seeds through the pod wall. The seeds shrivelled with dark patches and the pods were distorted.

**Pod borer, *Helicoverpa armigera* Hub. (Lepidoptera : Noctuidae) :**

First appearance of the pod borer larva was observed when the crop age was about 116 days, 45<sup>th</sup> SW (Table 1). From Fig. 1, it is evident that the pest was present on the crop during the reproductive stage and remained available upto the first week of January, 1<sup>st</sup> SW *i.e.* maturity stage of the crop (172 CAD). These findings are in accordance with the observations of Reddy *et al.* (1998), Balikai and Yelshetty (2008). They also reported that pod borer infested pigeonpea from the flowering stage and remained active upto the maturity stage of the crop.

**Pod fly, *Melanagromyza obtusa* Malloch (Diptera : Agromyzidae) :**

First appearance of the pod fly was observed when the crop age was about 123 days, 46<sup>th</sup> SW (Table 1). From Fig. 1, it is evident that the pest was present on the crop during the reproductive stage and remained available upto the first week of January, 1<sup>st</sup> SW *i.e.* maturity stage of the crop (172 CAD). Maggot was the damaging stage. Newly hatched maggots feed on the developing seed and form galleries on the seed. Fully-grown maggot makes a hole in the pod walls leaving a "window" through which the adult flies emerge after pupation.

The present results confirm the findings of Sirohi (1990) and Minja *et al.* (1999), They also reported pod fly to infest pigeonpea crop from pod filling stage to maturity stage of the crop.

**Green stink bug, *Nezaraviridula* Linn (Hemiptera : Pentatomidae) :**

First appearance of the green stink bug was observed

when the crop age was about 123 days, 46<sup>th</sup> SW (Table 1). From Fig. 1, it is evident that the pest was present on the crop during the reproductive stage and remained available upto the first week of January, 1<sup>st</sup> SW *i.e.* maturity stage of the crop (172 CAD).

Both the nymph and adult stages of the bug were the damaging stages and feed by sucking on the leaflets and tender pods.

**Red gram plume moth, *Exelastis atomosa* Walsingham (Lepidoptera : Pterophoridae) :**

First appearance of the red gram plume moth larva was observed when the crop age was about 130 days, 47<sup>th</sup> SW (Table 1 and Fig. 1). From the figure it is evident that the pest was present on the crop during the reproductive stage and remained available upto the first week of January, 1<sup>st</sup> SW *i.e.* maturity stage of the crop (172 CAD).

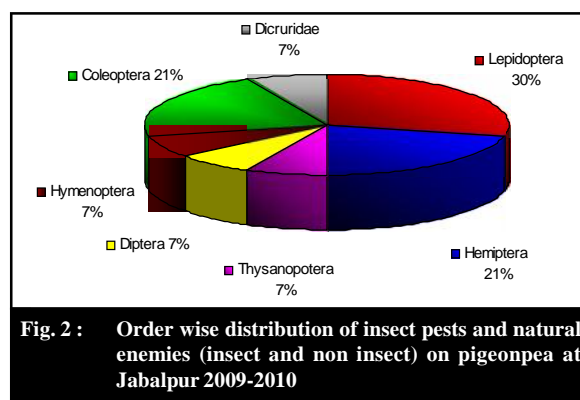
The larva was the damaging stage, which feeds on buds, flowers and young pods and as a result of feeding, small holes are seen on the buds and tender pods. Plume moth infested ripened pods show characteristic fungal attacked grains which were brittle, blackened and unfit for consumption. These findings are in accordance with the findings of Srilaxmi and Ravinda (2010); Subharani and Singh (2004) and Yadav *et al.* (2009).

**Wasp, *Cotesia* (= *Apanteles*) sp. (Hymenoptera : Braconidae):**

These are dark wasps and are larval parasitoid of lepidopteran pests. First appearance of *Cotesia* wasp pupae were observed when the crop age was about 151 days, 51<sup>st</sup> SW (Table 1). From Fig. 1, it is evident that the parasitoid was present on the crop during the reproductive stage and remained available upto the first week of January, 1<sup>st</sup> SW *i.e.* maturity stage of the crop (172 CAD).

**Black drongo, *Dicrurus macrocercus* Vieillot (Dicruridae Passeriformes) :**

Predatory bird black drongo was observed in the pigeonpea field from July 2009 *i.e.* vegetative stage upto the



first week of January 2010 *i.e.* maturity stage of the crop. Yelshetty *et al.* (2005) also reported the same predatory bird in pigeonpea ecosystem.

Compilation of the information on insect pest succession on pigeonpea revealed that thirteen insect species appeared at different stages of crop growth which constituted 3 species of Coleoptera (21%), 3 species of Hemiptera (21%), 4 species of Lepidoptera (30%), 1 species each of Diptera (7%), Hymenoptera (7%), Thysanoptera (7%) and an insectivorous bird (7%) (Table 2 and Fig. 2). These findings are more or less similar with the results found by Bosah *et al.*, 2013 and Nene *et al.*, 1990.

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