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Original Research Article

Population Density of *Campoletis chlorideae* Influenced by Different Genotype and Phonological Stages of Chickpea

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A B S T R A C T

The experiment to study population fluctuation of *Campoletis chlorideae* parasitising *Helicoverpa armigera* on chickpea crop was undertaken at experimental research farm, Agricultural Research Station, Badnapur during *Rabi* season of 2016-2017on different varieties during two phonological stages of chickpea with a view to find out the peak period of parasitisation on gram pod borer, *H. armigera*. The mean population of natural enemy as *Campoletis chlorideae*, a larval parasitoid of *H. armigera* was observed on different chickpea genotypes was range between 0.23 to 0.78 pupae of *C. chloridae*/ plant. The maximum pupae of *C. chloridae* was observed on genotypes PKV kabuli 2 which was found at par with other genotypes BDNG 798 followed by AKG 13033, PKV kabuli 4, Phule G 12403, Phule kripa, and Digvijay.

Keywords

Chickpea, *Helicoverpa armigera*, *Campoletis chlorideae* and parasitisation

Introduction

Among the pulses, nutritionally chickpea is relatively free from various anti-nutritional factors, has a high protein digestibility and rich in phosphorus and calcium than other pulses. Beside its nutritional importance, chickpea has the medicinal property in that malic acid and oxalic acid secreted by plant parts of this crop are prescribed for intestinal disorders. The main season for chickpea cultivation in India as well as in Maharashtra is '*Rabi*' season. In India, Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharastra and Andhra Pradesh are the important chickpea producing states (Jodha and SubbaRao, 1987). It is valued for its nutritive seeds with high protein content, 25.3-28.9 per cent, after dehulling (Hulse, 1991). Even though India is the largest producer of chickpea, it still imports chickpea from other countries. Keeping in view, the ever-increasing demand for this legume crop; it is essential to increase the production and area under cultivation, at the same time minimizing the stress on this crop plant.

H. armigera is known to be the key pest and most important limiting factor in the successful cultivation of chickpea (Lateef, 1985 and Reed *et al.*, 1987) due to high reproduction rates, a fast generation on turn over, wide genetic diversity occurs location and an ability to withstand, metabolize and avoid toxic chemicals. This pest starts

infesting the shoot/tips few weeks after crop emergence and feed on buds, flowers and pods till harvesting, causing heavy yield losses. Larvae of *H. armigera* are voracious foliar feeder as early instars and later shift to the developing seeds and fruits leading to drastic reduction in yield Reed. The pod borer *H. armigera*, is the most serious pest which cause high economic losses to the chickpea crop (Sarwar *et al.,* 2009).

The chickpea is damaged by *H. armigera* to the extent of 40 to 50% in Madhya Pradesh (Bindra, 1968), 6.6 to 10.7 per cent in Punjab (Singh and Singh, 1975) Sithananthan *et al.,* (1984), has reported avoidable yield loss of 9 to 60 per cent due to *H. armigera.* Also, Lal (1996) reported the yield losses in chickpea up to 75 to 90 per cent due to this pest. The yield losses in chickpea due to pod borer were observed to be 10 to 60 per cent by Gupta and Thakur (1990) and 90 to 95 per cent by Sachan and Katti (1994). A single larva can consume 30-40 pods in its life time (Taggar and Singh, 2012). Yield losses due to gram pod borer in chickpea may range from 70 to 95 per cent (Prakash *et al.,* 2007). Therefore present study was undertaken to asses as to what extent *Campoletis chlorideae* can influence the existence of the pest on different cultivar of chick pea.

Materials and Methods

A field experiment was conducted at Research Farm, Department of Agricultural Entomology Agricultural Research Station, Badnapur during *Rabi* season of 2016-2017. The soil of this farm can be classified in two soil series. Antisol with soil shallow to moderate shallow in depth. Whereas, Vertisol which is major soil covering about 65% of the farm. These soils are moderately deep to very deep. The soil of this station is also classified on the basis of depth. About 50% soils are low in "N", medium in available P_2O_5 and K_2O. In general, soils are normal in respect of pH and electrical conductivity (EC).

Experimental detail

The experiment was conducted at experimental farm of Entomology section at Agriculture Research Station, Badnapur during *rabi* -2016-17.

In Randomized Block Design (RBD) with Three Replication with Gross plot size 1.80 m x 2.0 m and Net plot size0.90 m x 1.60 m and spacing of 45 × 10 cm. the crop was sown in2nd fortnight of October 2016 with below mentioned twenty genotypes, as BDNG-797, BDNG-9-3,BDNG-2013-1, BDNG-798, Vijay, Digvijay, Virat Vishal, PhuleKrupa, Phule-G-12403, PKV Kabuli-2, PKV Kabuli-4, JG-11, Jaki-9218, ICCL-86111, ICC-3137, BDNG-807, ICCV-07306, ICCV-97105 and AKG-13033

The observations on natural enemies i.e. *Campoletis chloridae* on five randomly selected plants from each test genotype and from each replication was recorded during vegetative, 50 per cent flowering and pod formation and pod development stage of the crop.

Results and Discussion

The studies on degree of parasitization of *Helicoverpa armigera* larvae by *C. chloridae* during different stages of crop period were undertaken in relation to crop phenology based on different chickpea genotypes. Data collected during the course of study were summarized. The population of *Helicoverpa armigera* larvae parasitization by *C. chloridae* recorded at vegetative stage and 50 per cent flowering stage on different chickpea genotypes under field condition.

The natural enemy as *Campoletis chlorideae*, a larval parasitoid of *H. armigera* was observed on different chickpea genotypes at vegetative stage Table 1 depicted in Figure 1 was ranged between 0.00 and 0.47 pupae of *C. chloridae*/ plant. The maximum pupae of *C. chloridae* was observed on genotypes PKV kabuli 2 (0.47 *C. chloridae*/ plant) which was at par with the genotypes Phule G 12403 (0.40 *C. chloridae*/ plant) followed by PKV kabuli 4 (0.33 *C. chloridae*/plant) and AKG 13033 (0.33 *C. chloridae*/plant), respectively. The lowest pupae of *C. chloridae* were observed on genotypes BDNG 2013-1, JG 11, BDNG 9-3, Vishal, and ICCV 97105 i. e. (0.00, 0.00, 0.07, 0.07 and 0.07 pupae of *C. chloridae*/plant), respectively.

The pupae of *C. chloridae* were observed during 50 per cent flowering stage and ranged in between 0.17 to 1.00 pupae of *C. chloridae*/plant. The maximum pupae of *C. chloridae* was observed on genotypes BDNG 798 (1.00 *C. chloridae*/ plant) which was at par with the genotypes Vijay (0.93*C. chloridae*/plant) followed by Digvijay (0.80*C. chloridae*/plant), PKV kabuli 2 (0.80 *C. chloridae*/plant), ICCV 97105 (0.80 *C. chloridae*/plant), AKG 13033 (0.80 *C. chloridae*/plant), Virat (0.73 *C. chloridae*/ plant) and PKV kabuli 4 (0.73*C. chloridae*/ plant), respectively. The lowest pupae of *C. chloridae* were observed during 50 per cent flowering on different genotypes, BDNG 9-3, BDNG 798, Vishal ICC 3137 and BDNG 807 i. e. (0.17, 0.30, 0.30, 0.33 and 0.33 pupae of *C. chloridae*/plant), respectively.

The natural enemy as *Campoletis chlorideae*, a larval parasitoid of *H. armigera* was observed on different chickpea genotypes at pod initiation stage was range between 0.33 to 1.07 pupae of *C. chloridae*/plant (Table 2 and depicted in Fig. 2). Maximum pupae of *C. chloridae* was observed on genotypes BDNG 798 and Phule G 12403 i.e. (1.07 *C. chloridae*/plant) which was found significantly superior over other genotypes. The next set of the genotypes were maximum pupae of *C. chloridae* was observed on genotypes Phule kripa (0.93 *C. chloridae*/plant) followed by BDNG 797 (0.87*C. chloridae*/plant), Digvijay (0.87 *C. chloridae*/plant), ICCV 97105 (0.87 *C. chloridae*/plant) and AKG 13033 (0.87 *C. chloridae*/plant), respectively. The lowest pupae of *C. chloridae* were observed during pod initiation stage on genotypes BDNG 807, ICCV 3137, ICCV 86111, PKV kabuli and BDNG 9-3 i. e. (0.33, 0.40, 0.47, 0.47 and 0.53 pupae of *C. chloridae*/plant), respectively.

The natural enemy as *Campoletis chlorideae*, a larval parasitoid of *H. armigera* was observed on different chickpea genotypes (Table 2 and depicted Fig. 2) at pod development stage was ranged between 0.27 to 1.30 pupae of *C. chloridae* / plant. Maximum pupae of *C. chloridae* was observed on genotypes Jaki 9218 i.e. (1.30 *C. chloridae*/plant) which was found at par with other genotypes BDNG 798, ICC 3137, BDNG 797, JG 11, Virat, BDNG 807, and Digvijay (1.23, 1.07, 1.03, 1.00, 0.97, 0.97 and 0.93 pupae of *C. chloridae*/plant). The lowest pupae of *C. chloridae* was observed on genotypes ICCV 86111 (0.27 pupae of *C. chloridae*/plant), ICCV 97105 (0.33 pupae of *C. chloridae*/plant) and BDNG 9-3 (0.37 pupae of *C. chloridae*/plant), respectively.

The natural enemy as *Campoletis chlorideae*, a larval parasitoid of *H. armigera*, observed on different chickpea genotypes at pod maturity stage, was ranged between 0.16 and 0.62 pupae of *C. chloridae*/ plant. (Table 3 and depicted in Fig. 3) Maximum pupae of *C. chloridae* was

observed on genotypes PKV kabuli 4 i.e. (0.62 *C. chloridae*/ plant) which was found at par with other genotypes PKV kabuli 2, BDNG 798, ICC 3137, ICCV 97105, AKG 13033, BDNG 807, and Phule G 12403 (0.52, 0.48, 0.47, 0.45, 0.45, 0.44 and 0.43 pupae of *C. chloridae*/plant). The lowest pupae of *C. chloridae* was observed on genotypes JG 11 (0.16 pupae of *C. chloridae*/plant), ICCL 86111 (0.17 pupae of *C. chloridae*/plant), Vishal (0.19 pupae of *C. chloridae*/plant) and Vijay (0.20 pupae of *C. chloridae*/plant), respectively.

The above results are in accordance with,

The mean population of natural enemy as *Campoletis chlorideae*, a larval parasitoid of *H. armigera* was observed (Table 3) on different chickpea genotypes was range between 0.23 to 0.78 pupae of *C. chloridae*/ plant. The maximum pupae of *C. chloridae* was observed on genotypes PKV kabuli 2 i.e. (0.78 *C. chloridae*/ plant) which was found at par with other genotypes BDNG 798 followed by AKG 13033,PKV kabuli 4, Phule G 12403, Phule kripa, and Digvijay (0.69, 0.60, 0.57, 0.56, 0.54, and 0.53 pupae of *C. chloridae*/ plant). The lowest pupae of *C. chloridae* was observed on genotypes BDNG 9-3 (0.23 pupae of *C. chloridae*/ plant) followed by ICCL 86111 (0.26 pupae of *C. chloridae*/ plant), respectively.

The findings in relation to population of pupae of *C. chliridae* on chickpea are pursuant to the observations recorded by Pandey and Kumar (2006) who reported that *Campoletis chlorideae* parasitoid preferred the late instars or early 2nd instars host larvae for parasitization, and pupated outside the host in the form of cocoon within a week. A survey conducted in the chickpea fields during 15 November to 5 December 2005 revealed that the parasitism ranged from 25.0 to 59.2%. *C. chloride* has proved to be a potent parasitoid in chickpea ecosystem and has a great significance in biological control of *H. armigera* on chickpea. Similarly, Rai *et al.,* (2003) reported the higher parasitization by *Campoletis chloridae* Uchida to be 43.9, 80.64, 68.50 and 41.00 percent during, December, January, February and March, respectively. Agnihotri *et al.,* (2011) who observed the peak period of activity of *C. chloridae* in both the years (2008-09) and (2009-10) was during 6th standard week parasitizing 89.56 and 90.93 per cent larval population of *H. armigera*, in both the cropping season respectively. Singh and Ali (2006) who reported seasonal activity of the gram pod borer, *Helicoverpa armigera*, and its parasitoid, *Campoletis chlorideae*, on chickpea cv. K-850. The Maximum parasitization by *C. chlorideae was* observed in 4th standard weeks. Parasitization declined from 44th to 50th standard weeks.

The findings in relation to population of pupae of *C. chliridae* on chickpea are also coforms to the observations recorded by Sachan and Bhaumik, (1998) who reported natural parasitization by *Campoletis chlorideae* of larvae of *Helicoverpa armigera* on chickpea varied between 12.69 to 56.28% during 1995-96 and 3.57 to 80.64% during 1996-97. Similarly, Kaur *et al.,* (2000) found that the larval parasitoid *C. chloridae* was the most important mortality factor for the larvae of *H. armigera* Parasitism due to *C. chloridea* ranged from 0.98 to 68.50% throughout the crop season.

Sharma *et al.,* (2008) who reported that two parasites *C. chlorideae* (Uchida Hymenoptera) *ichnumonidae* and *Carcelia sp*. (Diptera: Tachnidae) were found to parasitize the *H. armigera* larvae from vegetative to pod initiation stage. *H. armigera* larval parasitization by *C. chloridae* ranges from 3.69 to 14.83%, maximum parasitization was observed during 4th SW *i.e.* vegetative stage.

Similarly, Bisane *et al.*, (2008) studied the parasitization of *Helicoverpa armigera* (Hubner) larvae and pupae during 2004-05 and 2005-06 from field collected life stages on pigeonpea. The other ichneumonid, *Campoletis chlorideae* was observed to be active in December (16.67 per cent).

Table.1 Population of pupae of *C. chloridae* on different chickpea genotypes at vegetative and 50% flowering stage

Sr. No.	Genotype	Pupae of *C. chloridae*/ plant			
		Vegetative stage of the crop		50 % flowering of the crop	
1	BDNG-797	0.13	(0.80)	0.30	(0.89)
2	BDNG-9-3	0.07	(0.75)	0.17	(0.82)
3	BDNG-2013-1	0.00	(0.71)	0.43	(0.97)
4	BDNG-798	0.20	(0.84)	1.00	(1.22)
5	Vijay	0.13	(0.80)	0.93	(1.20)
6	Digvijay	0.27	(0.88)	0.80	(1.14)
7	Virat	0.13	(0.80)	0.73	(1.11)
8	Vishal	0.07	(0.75)	0.30	(0.89)
9	PhuleKrupa	0.27	(0.88)	0.70	(1.10)
10	Phule-G-12403	0.40	(0.95)	0.53	(1.02)
11	PKV Kabuli-2	0.47	(0.98)	0.80	(1.14)
12	PKV Kabuli-4	0.33	(0.91)	0.73	(1.11)
13	JG-11	0.00	(0.71)	0.40	(0.95)
14	Jaki-9218	0.27	(0.88)	0.53	(1.02)
15	ICCL-86111	0.13	(0.80)	0.41	(0.95)
16	ICC-3137	0.27	(0.88)	0.33	(0.91)
17	BDNG-807	0.20	(0.84)	0.33	(0.91)
18	ICCV-07306	0.13	(0.80)	0.47	(0.98)
19	ICCV-97105	0.07	(0.75)	0.80	(1.14)
20	AKG-13033	0.33	(0.91)	0.80	(1.14)
	SE(m) ±	0.05		0.06	
	CD at 5%	0.14		0.18	
	CV %	10.45		10.76	

Figures of population in parenthesis are √x+0.5

Table.2 Population of pupae of *C. chloridae* on different chickpea genotypes at pod initiation & pod development stage

Sr. No.	Genotype	Pupae of *C. chloridae*/ plant			
		Pod initiation stage of the crop		Pod development stage of the crop	
1	BDNG-797	0.87	(1.17)	1.03	(1.24)
2	BDNG-9-3	0.53	(1.02)	0.37	(0.93)
3	BDNG-2013-1	0.67	(1.08)	0.73	(1.11)
4	BDNG-798	1.07	(1.25)	1.23	(1.32)
5	Vijay	0.73	(1.11)	0.87	(1.17)
6	Digvijay	0.87	(1.17)	0.93	(1.20)
7	Virat	0.70	(1.10)	0.97	(1.21)
8	Vishal	0.52	(1.01)	0.90	(1.18)
9	PhuleKrupa	0.93	(1.20)	0.67	(1.08)
10	Phule-G-12403	1.07	(1.25)	0.87	(1.17)
11	PKV Kabuli-2	0.80	(1.14)	0.67	(1.08)
12	PKV Kabuli-4	0.47	(0.98)	0.77	(1.13)
13	JG-11	0.57	(1.03)	1.00	(1.22)
14	Jaki-9218	0.57	(1.03)	1.30	(1.34)
15	ICCL-86111	0.47	(0.98)	0.27	(0.88)
16	ICC-3137	0.40	(0.95)	1.07	(1.25)
17	BDNG-807	0.33	(0.91)	0.97	(1.21)
18	ICCV-07306	0.53	(1.02)	0.83	(1.15)
19	ICCV-97105	0.87	(1.17)	0.33	(0.91)
20	AKG-13033	0.87	(1.17)	0.80	(1.14)
	SE(m) ±	0.07		0.08	
	CD at 5%	0.19		0.23	
	CV %	11.00		12.07	

Figures of population in parenthesis are √x+0.5

Table.3 Population of pupae of *C. chloridae* on different Chickpea genotypes at pod maturity & mean population

Sr. No.	Genotype	Pupae of *C. chloridae*/ plant			
		Pod maturity stage of the crop		Mean population	
1	BDNG-797	0.26	(0.87)	0.36	(0.93)
2	BDNG-9-3	0.22	(0.85)	0.23	(0.86)
3	BDNG-2013-1	0.28	(0.88)	0.39	(0.94)
4	BDNG-798	0.48	(0.99)	0.69	(1.09)
5	Vijay	0.20	(0.83)	0.43	(0.97)
6	Digvijay	0.31	(0.90)	0.53	(1.01)
7	Virat	0.25	(0.86)	0.44	(0.97)
8	Vishal	0.19	(0.83)	0.34	(0.92)
9	PhuleKrupa	0.35	(0.92)	0.54	(1.02)
10	Phule-G-12403	0.43	(0.96)	0.56	(1.03)
11	PKV Kabuli-2	0.52	(1.01)	0.78	(1.13)
12	PKV Kabuli-4	0.62	(1.06)	0.57	(1.04)
13	JG-11	0.16	(0.81)	0.37	(0.93)
14	Jaki-9218	0.28	(0.88)	0.52	(1.01)
15	ICCL-86111	0.17	(0.82)	0.26	(0.87)
16	ICC-3137	0.47	(0.99)	0.49	(0.99)
17	BDNG-807	0.44	(0.97)	0.49	(0.99)
18	ICCV-07306	0.35	(0.92)	0.43	(0.96)
19	ICCV-97105	0.45	(0.97)	0.49	(0.99)
20	AKG-13033	0.45	(0.97)	0.60	(1.050
	SE(m) ±	0.04		0.05	
	CD at 5%	0.13		0.13	
	CV %	9.36		8.72	

Figures of population in parenthesis are √x+0.5

Fig.1 Population of pupae of *C. chloridae* on different chickpea genotypes of pod initiation and pod development stage

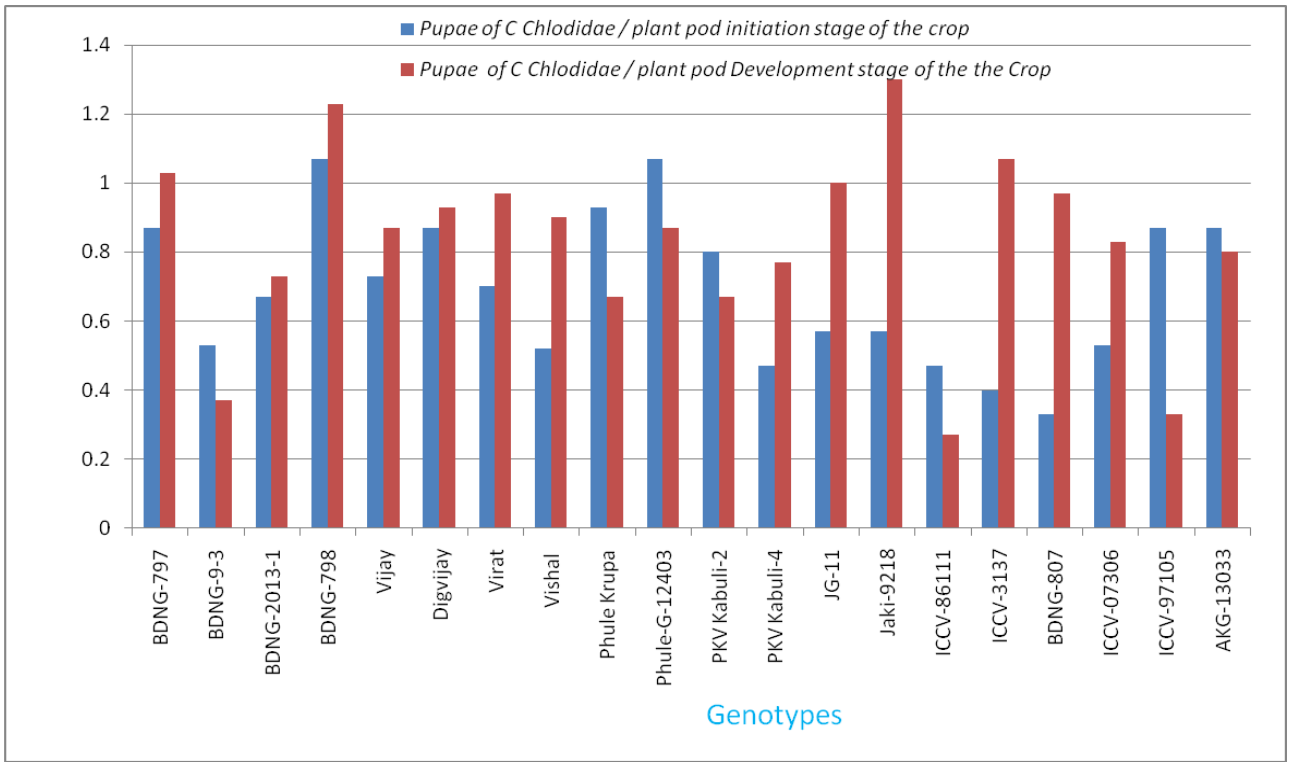


Fig.2 Population of pupae of *C. chloridae* on different chickpea genotypes of pod maturity and average

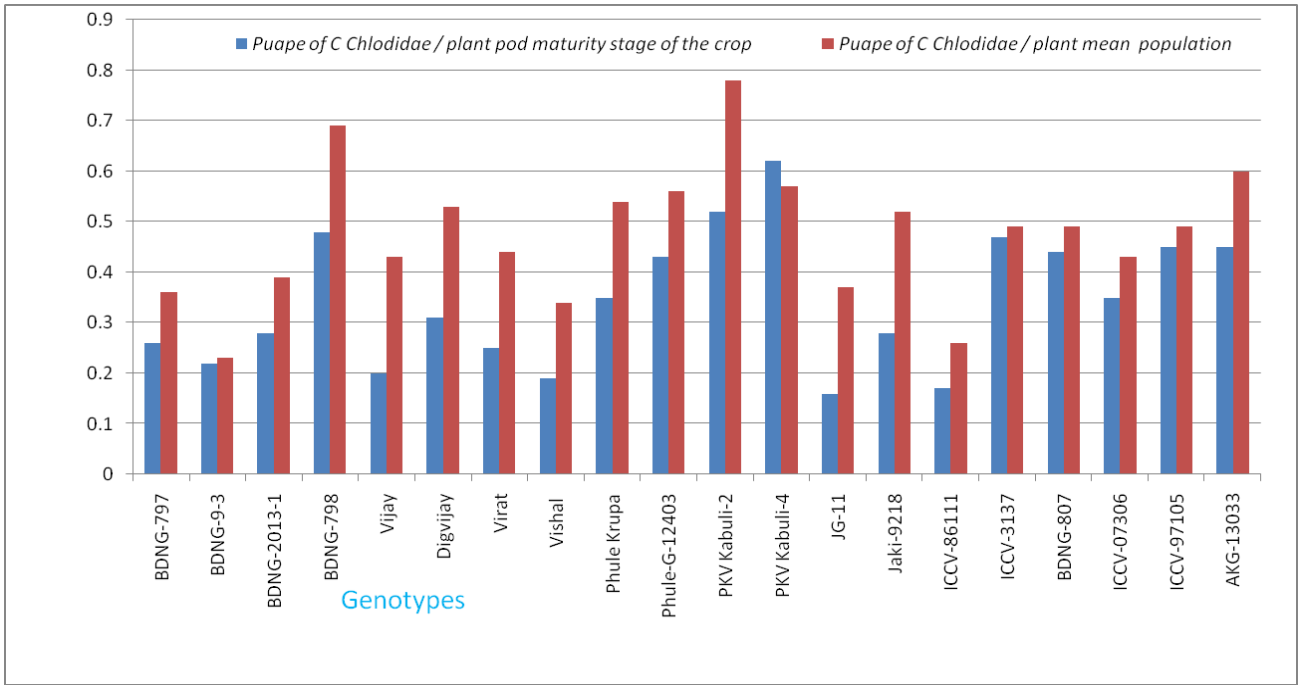
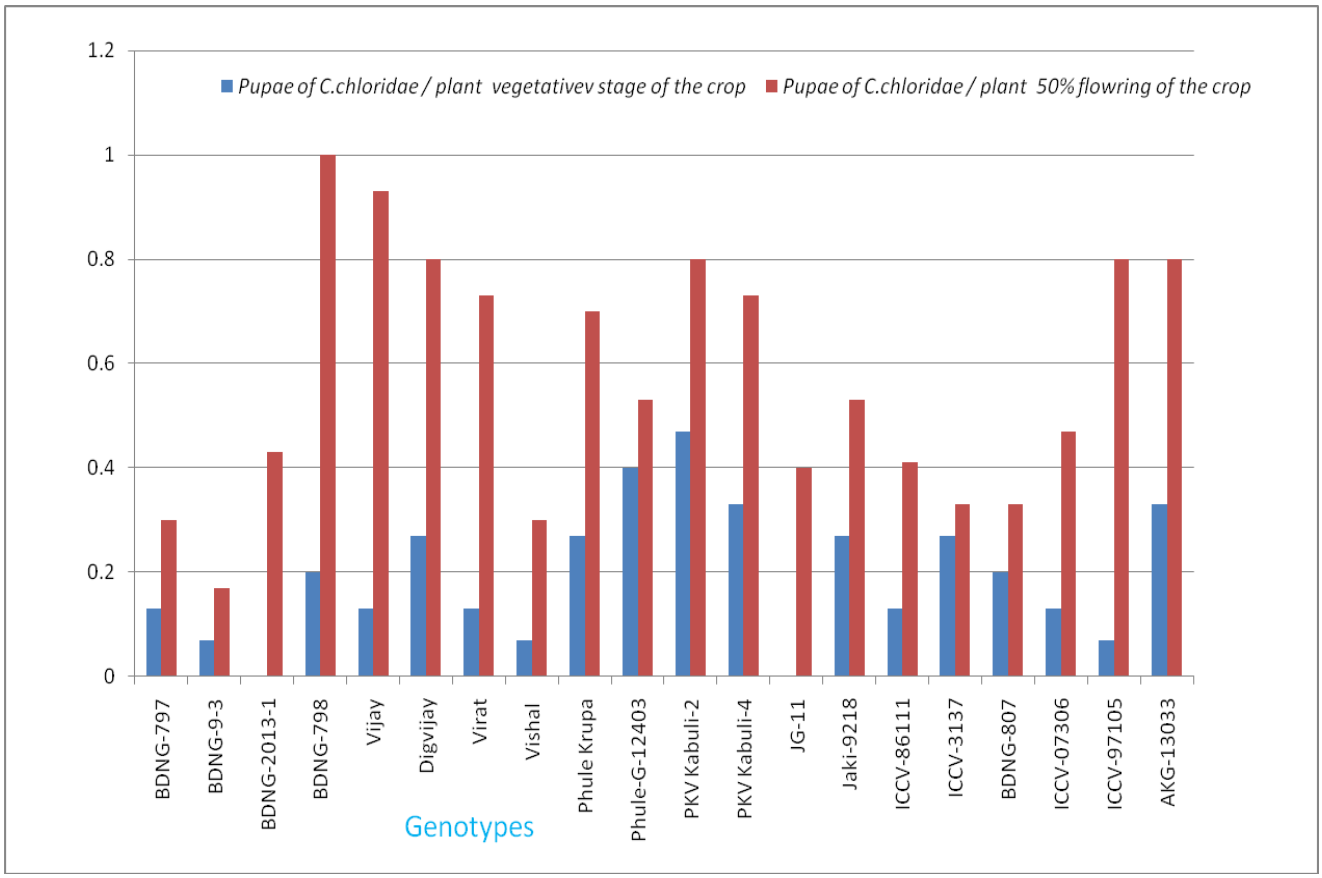


Fig.3 Population of pupae of *C. chloridae* on different chickpea genotypes at maturity and mean population



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