RESEARCH ARTICLE

POLLINATORS DIVERSITY THROUGH COLOURED PAN TRAPS ON MUSTARD

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**All India Coordinated Research Project on Honey Bees and Pollinators*
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Abstract: The study was undertaken at Raj Mohini Devi College of Agriculture and Research Station, Ambikapur during 2019-20 for diversity of insect pollinators/ visitors in mustard ecosystem. Different insect pollinators/ visitors i.e. *Apis dorsata, A. indica, A. melifera, Syrphus ribesii, Musca domestica, Lasius niger Monomorium minimum* and *Coccinella septempunctata* were recorded in different fluorescent colored pan trap i.e. White, yellow and blue at different flowering period onset of bloom, full bloom and end of bloom of mustard at the onset of bloom maximum insect pollinators/visitors were recorded in blue pan traps (13.2 insect/trap) with mean (1.46 insect/trap) followed by in white coloured pan trap (11.03 insect/trap) with mean (1.22 insect/trap) and minimum in yellow pan trap (10.36 insect/trap) with mean (1.15 insect/trap) however, during full bloom period highest insect pollinators/visitors were observed in yellow pan trap (27.55 insect/trap) with mean (3.06 insect/trap) followed by in blue fluorescent coloured pan trap (21.82 insect/trap) with mean (2.42 insect/trap) and minimum population was recorded in white coloured pan trap (20.13 insect/trap) with mean (2.23 insect/trap). Similarly at the end of bloom maximum population was recorded in yellow fluorescent coloured pan trap (17.85 insect/trap) with mean (1.98 insect/trap) followed by white fluorescent coloured pan trap (16.22 insect/trap) with mean (1.80 insect/trap) and lowest in blue coloured pan trap (16.17 insect/trap) with mean (1.79 insect/trap).

Keywords: Colored pan traps, Mustard, Pollinator, Visitor diversity

INTRODUCTION

Indian mustard (*Brassica juncea* L.) is an important oilseed crop next to sunflower. Mustard commonly known as rai. Out of six cultivated oilseed species of genus *Brassica* more than 80% of total area occupied by Indian mustard (*Brassica juncea*) alone (Chandrashekhar *et al* 2013).

In India, rapeseed and mustard covers an area of 5.96 m/ha and production about 8.32 million tonnes. The productivity of rapeseed and mustard is about 1397 kg/ha. (Anonymous, 2018). In Chhattisgarh mustard is grown in an area of 47542 ha and with a production of 26999 metric tonn (Solvance and Pathak, 2016) and productivity of 564 kg/ha (Annonymous, 2018). Rapeseed and mustard are called by various names in different regions such as rai, sarson, raya or laha.

Pollination is a natural solution or service that an organism plays in the ecosystem which is essential in human life. The bees are one of the most important crop pollinators. They increase production up to about 75 per cent of the crop species. The research discovered that habitat fragmentation due to human activities reduces bees diversity causing shifting of bee species in another natural climate which ultimately affecting the pollination activities. The problem can be solved by planting fallow lands and road edges with flowering plants to support wild pollinators throughout the growing season and by reducing pesticide uses especially during crop flower when more bee activities are in the fields. Insect pollinators play an important role in improving the productivity of cross pollinated crops. In present time, mustard is recognized as a better crop for sustaining bee culture occupation.

For a pollinating agent to be effective, its foraging behavior should favour the transportation of anther pollen to flower stigmas on the same plant or different target species plants. Insect mediated pollen transfer in mass flowering *Brassica sp.* has been particularly well studied, as insect pollinator activity can contribute significantly to pollination.

Flowering is the most sensitive phase for high temperature damage as likely as not due to susceptibility during pollen development, and fertilization leading to reduce crop yield reported by Hall and Rao (1992). The high temperature in *Brassica species* inhibits plant development and causes flower termination with appreciable reduced yield in seed. The blooming period had a great impact up to growth greater than 30 ^{0}C morning temperature, leading to reduce seed in seed yield.

Different bee species are commercial importance are found in India *viz.*, Rock bee (*Apis dorsata*), Indian bee (*Apis cerana indica*), Dwarf bee (*Apis florea*) and European or Italian bee (*Apis mellifera*). *Apis dorsata* are aggressive and cannot be maintained in habitat but they are harvested from the wild. The honey is also harvested from dwarf bees in the wild as these are nomadic and produce very low yield. *A. cerana indica* and *A. mellifera* introduced from the cool climate temperate zone are more suitable to culturing in artificial honey bee boxes.

A standard method for capturing bees is the use of coloured pan traps, also called 'bee bowls'. These are plastic bowls or cups painted fluorescent white, fluorescent blue and fluorescent yellow and that contain soapy and Detergent water. Bees are

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attracted to the colour, fall into the water and drown. As the knowledge says that the foraging area around a beehive extends for two miles (3.2 km), although bees have been observed foraging two and three times this distance from the hive. Experiments have shown that beehive within four miles of a food source will gain weight, but beyond that the energy expended is greater than that gained during the foraging flight (Eckert 1933).

MATERIALS AND METHODS

Experimental details

A field experiment will be conducted during *rabi* season 2019 at Research Cum Instructional Farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.).At the GPS location of bitter gourd ecosystem N 23.1417520 and E 83.1804720. Three fluorescent coloured pan traps white (10), yellow (10), blue (10) were taken at different flowering period (onset of bloom, full bloom and end of bloom) the pan trap were fill with water 1/3rd and mix the detergent powder and collect the number of insect pollinators. Bowls were place to 9.00 am in morning and picked up after 3.00 pm in the afternoon.

Crop	:	Mustard (*Brassica juncea*)
Variety	:	Chhattisgarh Sarson
Date of sowing	:	20-09-2019
Treatment	:	3 (Yellow, Blue and White Pan Traps)
Replication	:	10
Design	:	RBD (Randomized Block Design)

RESULTS AND DISCUSSION

The result shows in Table 1, the average population of insect visitors/pollinators were recorded maximum population in yellow colored pan trap at full bloom period in mustard crop however the low population of insect visitors/pollinators was recorded at onset of bloom, full bloom and end of bloom at Ambikapur, Surguja of Chhattisgarh, India. Result obtained from the study of different fluorescent coloured pan traps were used i.e. white, yellow and blue for attract the different insect pollinators during different flowering period *viz…*onset bloom, full bloom and end of bloom in mustard ecosystem. Insect pollinators i.e. *Apis dorsata, A. indica, A. melifera, Syrphus ribesii, Musca domestica*, *Lasius niger Monomorium minimum* and *Coccinella septempunctata* were recorded. During onset of bloom it was concluded that insect pollinators were recorded higher population in blue coloured pan trap (13.2 insect/trap) with mean (1.46 insect/trap) followed by in white coloured pan trap (11.03 insect/trap) with mean (1.22 insect/trap) and yellow coloured pan trap (10.36 insect/trap) with mean (1.15 insect/trap). During the full bloom period maximum insect pollinators/visitors were observed on yellow fluorescent coloured pan trap (27.55 insect/trap) with mean (3.06 insect/trap) followed by in blue fluorescent coloured pan trap (21.82 insect/trap) with mean (2.42 insect/trap) and minimum population was recorded in white coloured pan trap (20.13 insect/trap) with mean (2.23 insect/trap). Similarly at the end of bloom maximum population was recorded in yellow fluorescent coloured pan trap (17.85 insect/trap) with mean (1.98 insect/trap) followed by white fluorescent coloured pan trap (16.22 insect/trap) with mean (1.80 insect/trap) and lowest in blue coloured pan trap (16.17 insect/trap) with mean (1.79 insect/trap).

During the study it was observed that on onset of bloom the maximum syrphid fly was trapped on yellow fluorescent coloured pan trap (1.10 insect/trap) followed by in blue fluorescent coloured pan trap (0.80 insect/trap) and minimum population was recorded in white coloured pan trap (0.70 insect/trap). During the full bloom period maximum syrphid fly was observed on yellow fluorescent coloured pan trap (1.43 insect/trap) followed by in white coloured pan trap (1.27 insect/trap) and minimum population was recorded in blue fluorescent coloured pan trap (0.93 insect/trap). Similarly at the end of bloom maximum syrphid fly population was recorded in yellow fluorescent coloured pan trap (2.85 insect/trap).

On the other hand on onset of bloom the maximum black ant was trapped on blue fluorescent coloured pan trap (2.20 insect/trap) followed by in white coloured pan trap (1.50 insect/trap) and minimum population was recorded in yellow fluorescent coloured pan trap (1.03 insect/trap). During the full bloom period maximum black ant was observed on blue fluorescent coloured pan trap (3.50 insect/trap) followed by in white coloured pan trap (2.83 insect/trap) and minimum population was recorded in yellow fluorescent coloured pan trap (2.03 insect/trap). At the end of bloom no black ant population was recorded in coloured pan trap.

The present findings are agreement with the findings of Painkra *et al,* 2018 who studied the pollinators diversity in bitter gourd ecosystem using the colored pan trap i.e yellow, white and blue for trapping the various insects. The present findings are agreement with the findings of Painkra *et al,* 2019 who studied the insect pollinators diversity in mustard ecosystem using different fluorescent colored pan trap *i.e.* White, blue and yellow at onset of bloom, full bloom and end of bloom. In the colored pan traps maximum population was noticed in yellow pan trap (14.31 insect/tarp) followed by blue trap (13.99 insect/trap) and minimum in white (6.3 insect/trap) at onset of bloom. However, at the full bloom highest population was recorded in yellow pan trap (24.65 insect/trap) followed by blue pan trap (20.98 insects/trap) and lowest in white trap (20.65 insects/trap). Similarly at the end of bloom higher population was recorded in yellow pan trap (14.32 insects/trap) followed by blue pan trap (13.99 insects/trap) and the lowest in white pan trap (5.99 insects/trap).

Vrdoljak and Samways (2012) had also reported the optimizing coloured pan traps to survey flower visiting insects.

Table 1. The pollinator diversity through various coloured pan traps on mustard ecosystem during 2019-20.

SN	**Visitors**	**Mean population of pollinators / Trap**								
		Onset of Bloom			**Full Bloom**			**End of Bloom**		
		White	Yellow	Blue	White	Yellow	Blue	White	Yellow	Blue
1	*Apis dorsata*	0.73	0.93	0.63	3.93	5.43	4.33	3.20	3.60	3.30
2	*Apis indica*	1.07	1.17	0.77	4.57	5.80	4.43	3.00	3.85	3.03
3	*Apis melifera*	0.60	0.87	0.60	2.83	3.50	2.03	2.58	2.80	2.63
4	*Syrphus ribesii*	0.70	1.10	0.80	1.27	1.43	0.93	2.51	2.85	2.53
5	*Musca domestica*	1.33	1.63	1.00	2.13	5.43	3.00	1.43	1.25	1.18
6	*Lasius niger*	1.50	1.03	2.20	2.83	2.03	3.50	0.00	0.00	0.00
7	*Monomorium minimum*	1.97	1.30	3.57	0.77	0.83	1.00	0.00	0.00	0.00
8	*Chinavia nezara*	1.90	1.40	2.80	1.10	2.40	1.80	2.80	3.00	2.90
9	*Coccinella septempunctata*	1.23	0.93	0.83	0.70	0.70	0.80	0.70	0.50	0.60
	Total	**11.03**	**10.36**	**13.2**	**20.13**	**27.55**	**21.82**	**16.22**	**17.85**	**16.17**
	Mean	**1.22**	**1.15**	**1.46**	**2.23**	**3.06**	**2.42**	**1.80**	**1.98**	**1.79**

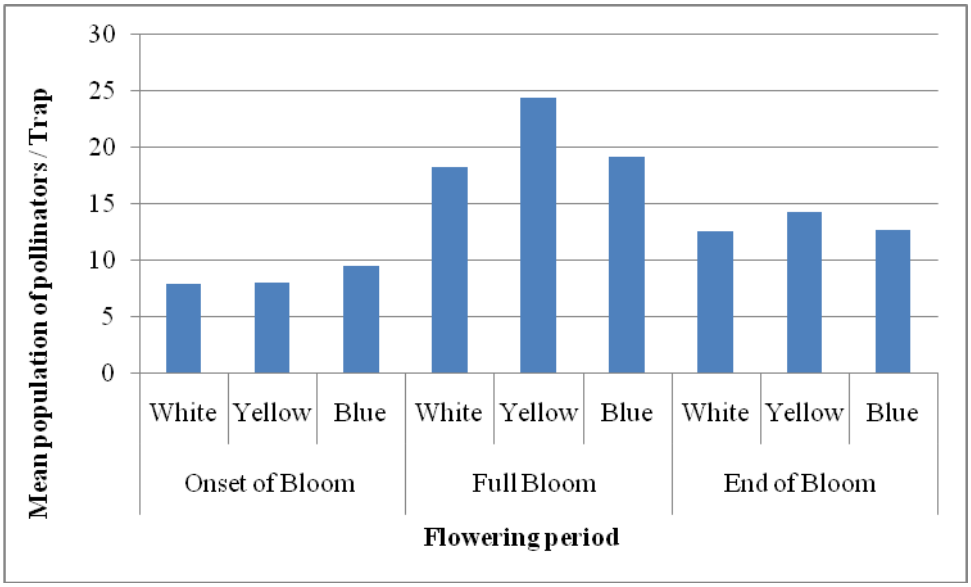

Fig. 1. The pollinator diversity through various coloured pan traps on mustard during 2019-20

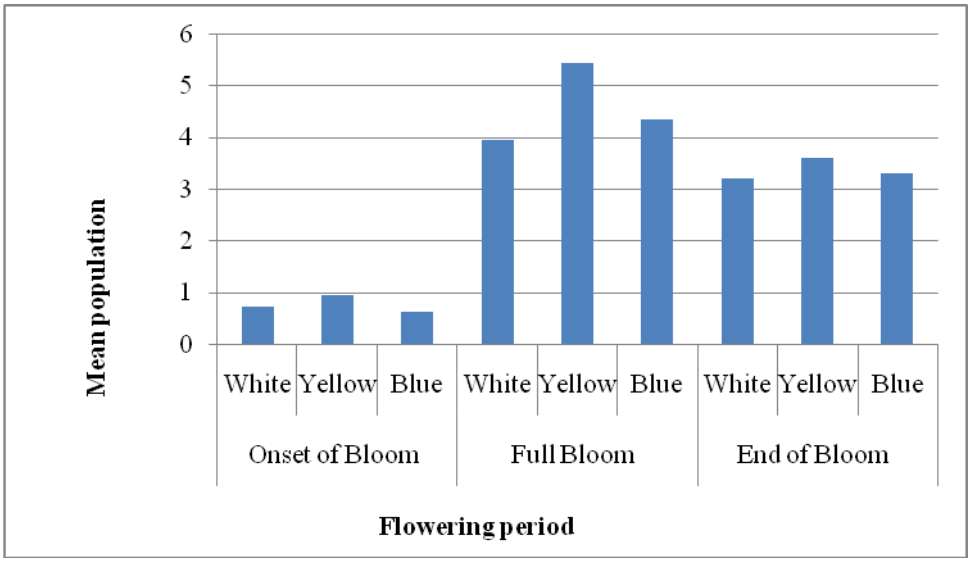

Fig. 2. Average population of *Apis dorsata* in Mustard ecosystem

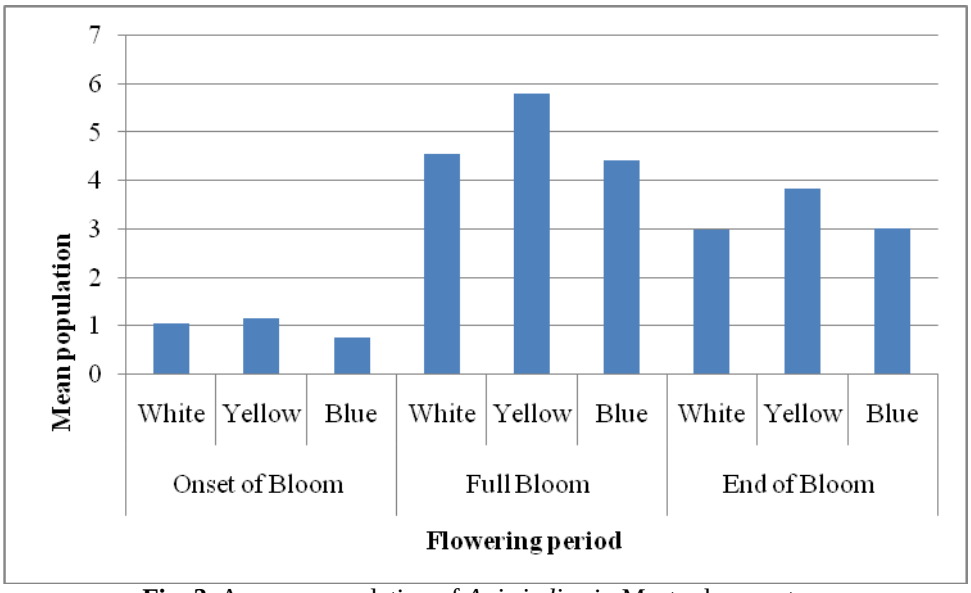

Fig. 3. Average population of *Apis indica* in Mustard ecosystem

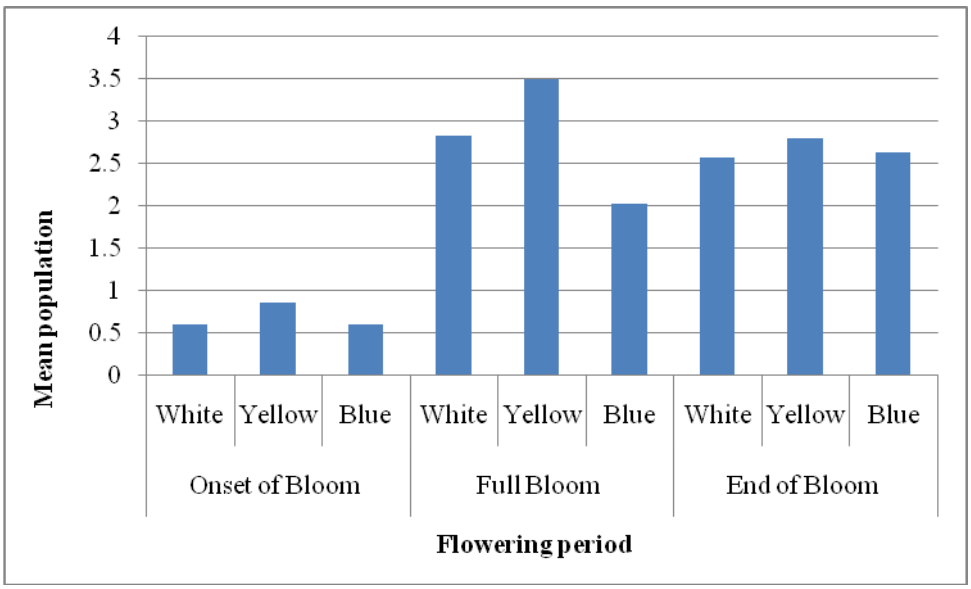

Fig. 4. Average population of *Apis melifera* in Mustard ecosystem

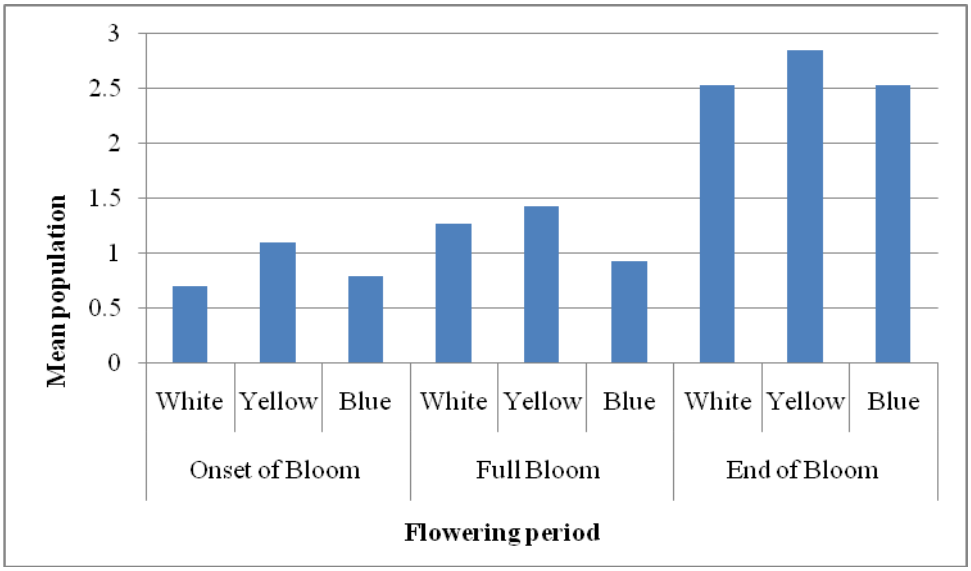

Fig. 5. Average population of *Syrphus ribesii* in Mustard ecosystem

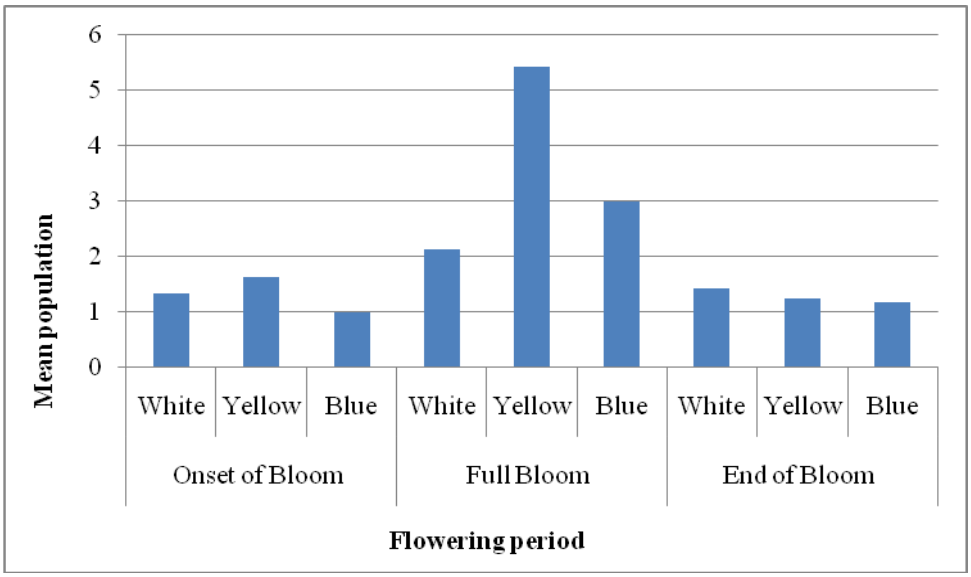

Fig. 6. Average population of *Musca domestica* in Mustard ecosystem

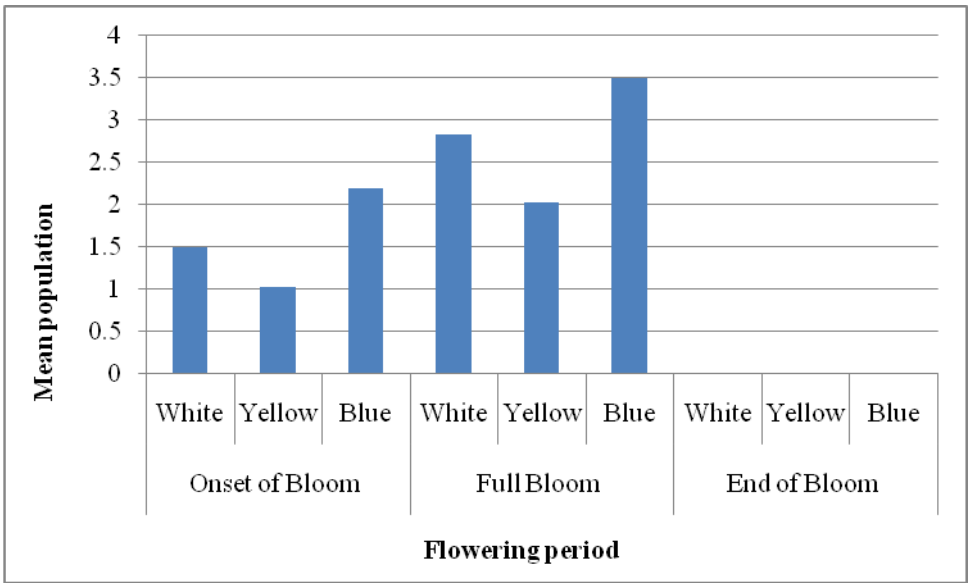

Fig. 7. Average population of *Lasius niger* in Mustard ecosystem

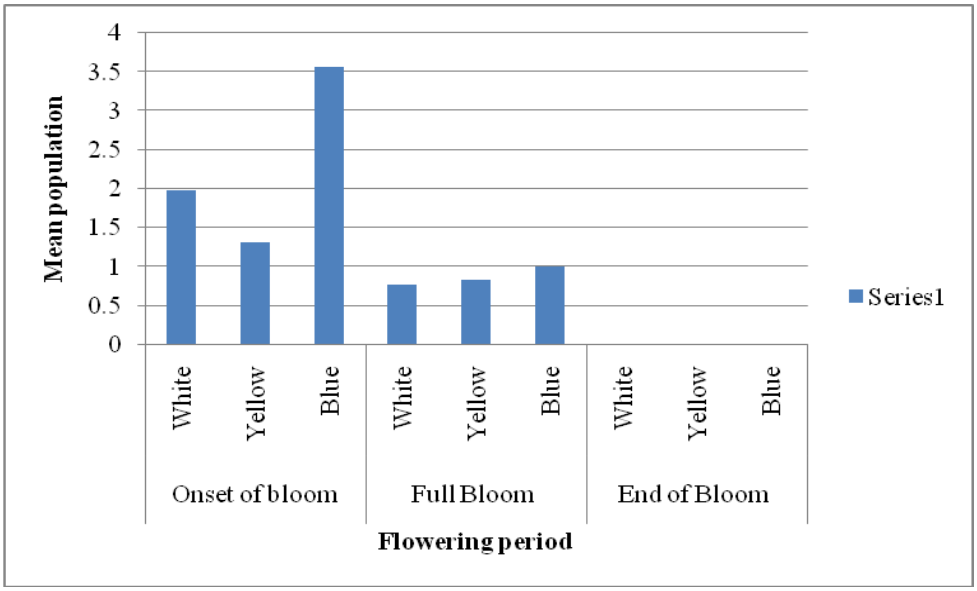

Fig. 8. Average population of *Monomorium minimum* in Mustard ecosystem

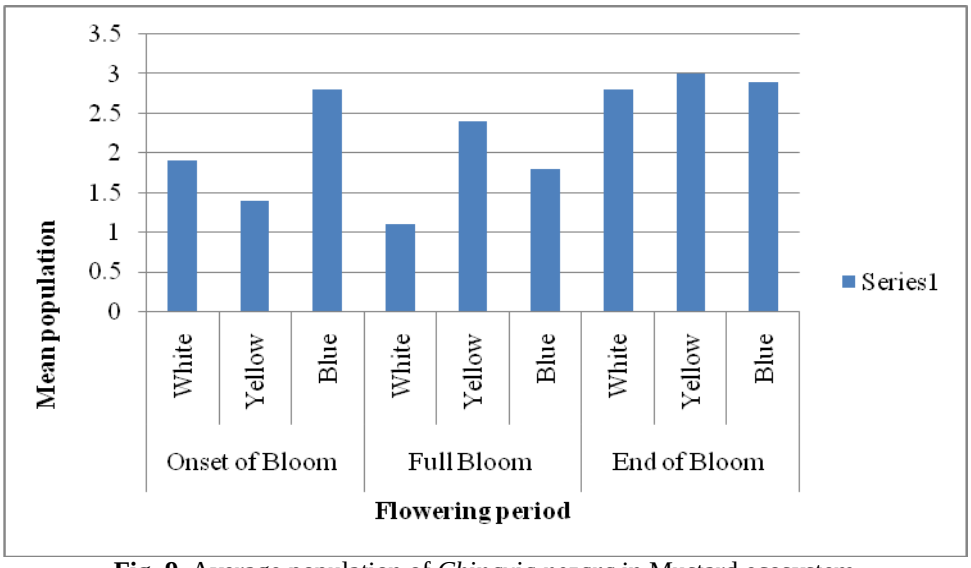

Fig. 9. Average population of *Chinavia nezara* in Mustard ecosystem

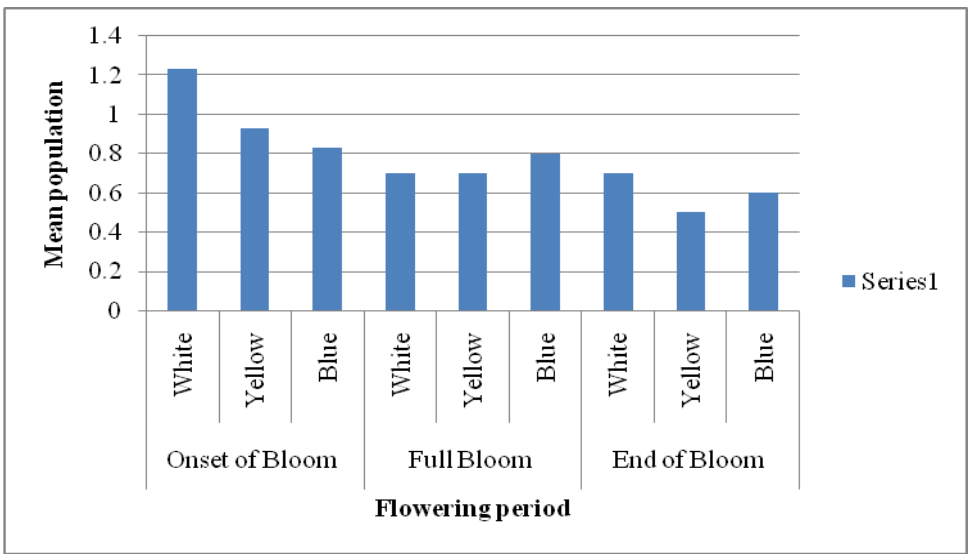

Fig. 10. Average Population of *Coccinella septempunctata* in Mustard ecosystem

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