RESEARCH ARTICLE

FORAGING BEHAVIOR OF ROCK BEE (*APIS DORSATA*) ON MUSTARD ECOSYSTEM IN AMBIKAPUR, CHHATTISGARH

Shubham Yadav and G.P. Painkra*

**All India Coordinated Research Project on Honey Bees and Pollinators*
Indira Gandhi Krishi Vishwavidyalaya, Department of Entomology, Raj Mohini Devi College of Agriculture and Research Station, Ambikapur- 497001, (Chhattisgarh) India

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Abstract: An observation was undertaken for foraging activity of *Apis dorsata* on mustard that the *Apis dorsata* was recorded. After the entire study during the different flowering period *viz*...onset, full bloom and end of bloom it was concluded that no population of rock bee, *Apis dorsata* was recorded at 7.00-8.00 hrs. However, its reached its peak at 11.00-12.00 hrs (13.60 bees/5min/m^2) followed by at 9.00-10.00 hrs (6.20 bees/5min/m^2). The minimum population of rock bee, *Apis dorsata* was recorded at 1.00-2.00 hrs (5.20 bees/5min/m^2).During the present study maximum population was observed in the full bloom stage in mustard ecosystem.

Keyword: Rock bee**,** *Apis dorsata*, Foraging behaviour, Mustard ecosystem

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.

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.

MATERIALS AND METHODS

Experimental details

A field experiment was 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 mustard ecosystem N 23.1417520 and E 83.1804720. Rock bee was recorded at 7.00 AM, 8.00 AM, 9.00 AM, 10.00 AM, 11.00 AM, 12.00 Noon, 1.00 PM, 2.00 PM, 3.00 PM and 4.00 PM for five minutes at five day interval in 1 m^2 area. Observations were recorded from onset of bloom through peak and end of bloom on mustard.

*Corresponding Author

Crop	:	Mustard (*Brassica juncea*)
Veriety	:	Chhattisgarh Sarson
Plot size	:	4m x 3.5m
Date of sowing	:	20-09-2019

RESULTS AND DISCUSSION

The result showed in Table 1 that during first week of November to third week of November no population of rock bee, *Apis dorsata* was recorded. After the entire study during the different flowering period *viz*...onset, full bloom and end of bloom it was concluded that no population of rock bee, *Apis dorsata* was recorded at 7.00-8.00 hrs. However, it reached its peak at 11.00-12.00 hrs (13.60 bees/5min/m^2) followed by at 9.00-10.00 hrs (6.20 bees/5min/m^2). The minimum population of rock bee, *Apis dorsata* was recorded at 1.00-2.00 hrs (5.20 bees/5min/m^2).During the present study maximum population was observed in the full bloom stage in mustard ecosystem.

The results revealed that *Apis dorsata* showed non significant positive correlation with morning relative humidity (%) (r=0.169).

The present results are in close agreement with those of earlier workers. Kumar and Singh (2008) reported peak activity of *Apis dorsata* on safflower crop at 1100 hrs and the minimum at 1500 hrs. Whereas Singh (2008) recorded the maximum foraging activity of *Apis species* at 1200 hrs, followed by 1000, 1400 and 1600 hrs on parental lines of *Brassica napus*. The maximum foraging was noticed 36.90 to 45.56 bees/m^2/5min of *Apis dorsata* in between 1000 to 1600 hrs of the day reported by Dhurve (2008). Selvakumar *et al*. (2001) also recorded the activity of *Apis dorsata* on cauliflower constituted 28.23 per cent and the pollen gatherers reached to its peak at 1400 hrs while nectar collectors remained constant throughout the day. Ramya *et al.* (2014) reported that *A. dorsata* was the best pollinator of sunflower based on pollinator efficiency index among all the bee species.

The bee was found maximum visitation at 10.00-11.00hrs and the lowest was at 16.00-17.00hrs and followed by at 08.00-09.00hrs. In different day hours low average population was recorded at 08.00-09.00hrs (52.44 bees/5min/m2) and its peak population at 10.00-11.00hrs (140.33 bees/5min/m2) and found decreased lowest at 16.00-17.00hrs (16.22 bees/5min/m^2) (Painkra 2016)The population dynamic of honey bees foraging on litchi flowers. They observed that *Apis dorsata* was most dominant species (44.48%) followed by *Apis cerena indica* (41.86%) and *A.florea* (4.59%) (Chaudhary 2002).Recorded the *Apis cerana indica* with maximum number of 9.42 foragers visited flowers of lemon during 1000-1100 hrs Gogoi *et al.* (2007) .The highest activity of bees at 1000 and 1800 hrs (1.24 bees/min/ capitulum) with least number at 1400 hrs (0.69 bees/ min/capitulum) on sunflower Chakrabarty and Sharma (2007).

These findings are in close conformity with the earlier findings of Painkra (2016) on lajwanti grass, Painkra and Shaw (2016) on niger flowers, Joginder *et al.* (2017) on buckwheat, Painkra (2018) on *Ageratum conizoides* grass, Painkra (2019) on coriander flower, Painkra (2019) on broccoli flower, Painkra and Kumaranag (2019) on sunflower, Painkra (2019) on broccoli flower and Painkra (2020) who recorded the foraging activity on marigold flowers.

Table 1. Foraging activity of *Apis dorsata* during *rabi* season-2019-20 on mustard

S.No.	Date of observations	No. of bees visit /5min/m^2, hours of the day (Hrs)					Total	Mean
		7.00-8.00	9.00-10.00	11.00-12.00	1.00-2.00	3.00-4.00		
1	05/11/2019	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
2	10/11/2019	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
3	15/11/2019	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
4	20/11/2019	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
5	25/11/2019	0.00	0.40	1.00	0.00	0.00	**1.40**	**0.50**
6	30/11/2019	0.00	0.60	1.80	0.20	0.00	**2.60**	**0.90**
7	05/12/2019	0.00	0.60	2.60	0.40	0.00	**3.60**	**1.20**

8	10/12/2019	0.00	0.80	2.40	1.00	0.00	**4.20**	**1.40**
9	15/12/2019	0.00	1.20	3.00	1.40	0.00	**5.60**	**1.90**
10	20/12/2019	0.00	1.20	1.00	1.20	0.00	**3.40**	**1.10**
11	25/12/2019	0.00	1.00	1.40	0.60	0.00	**3.00**	**1.00**
12	30/12/2019	0.00	0.40	0.40	0.40	0.00	**1.20**	**0.40**
13	05/01/2020	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
14	10/01/2020	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
	Total	**0.00**	**6.20**	**13.60**	**5.20**	**0.00**	**25.00**	**8.40**

Table 2. Correlation of *Apis dorsata* with abiotic factors on mustard during *rabi* 2019-20

S.N.	**Date of observations**	**Mean (no. of bees)**	**Temperature (^{0}C)**		**Rainfall (mm)**	**RH (%)**		**Wind speed (km/hr)**	**Sunshine hours**
			Max.	**Min.**		**RH-I**	**RHII**		
1	05/11/2019	0.00	29.50	16.50	0.00	89	50	1.50	5.40
2	10/11/2019	0.00	25.00	16.30	0.00	94	55	2.50	3.40
3	15/11/2019	0.00	29.00	10.00	0.00	93	29	0.90	9.50
4	20/11/2019	0.00	27.80	11.00	0.00	93	40	1.10	9.10
5	25/11/2019	0.50	26.80	12.30	0.00	94	37	1.40	8.50
6	30/11/2019	0.90	28.50	12.50	0.00	92	44	1.30	8.00
7	05/12/2019	1.20	23.50	5.70	0.00	95	30	1.20	8.40
8	10/12/2019	1.40	24.60	9.30	0.00	93	47	0.90	7.80
9	15/12/2019	1.90	24.00	14.50	0.00	96	87	1.40	5.80
10	20/12/2019	1.10	19.50	4.50	0.00	97	33	1.10	4.50
11	25/12/2019	1.00	26.00	12.70	0.00	94	55	1.20	6.40
12	30/12/2019	0.40	19..50	4.00	0.00	94	39	0.90	9.10
13	05/01/2020	0.00	19.20	9.00	0.00	98	52	1.30	0.00
14	10/01/2020	0.00	20.00	4.50	0.00	97	54	1.70	3.10
	Mean	**1.80**	-	-	-	-	-	-	-
	Correlation coefficient		-0.149	-0.045	0.000	0.169	0.330	-0.299	0.215

*Significant at 5% level of significance, ** Significant at 1% level of significance

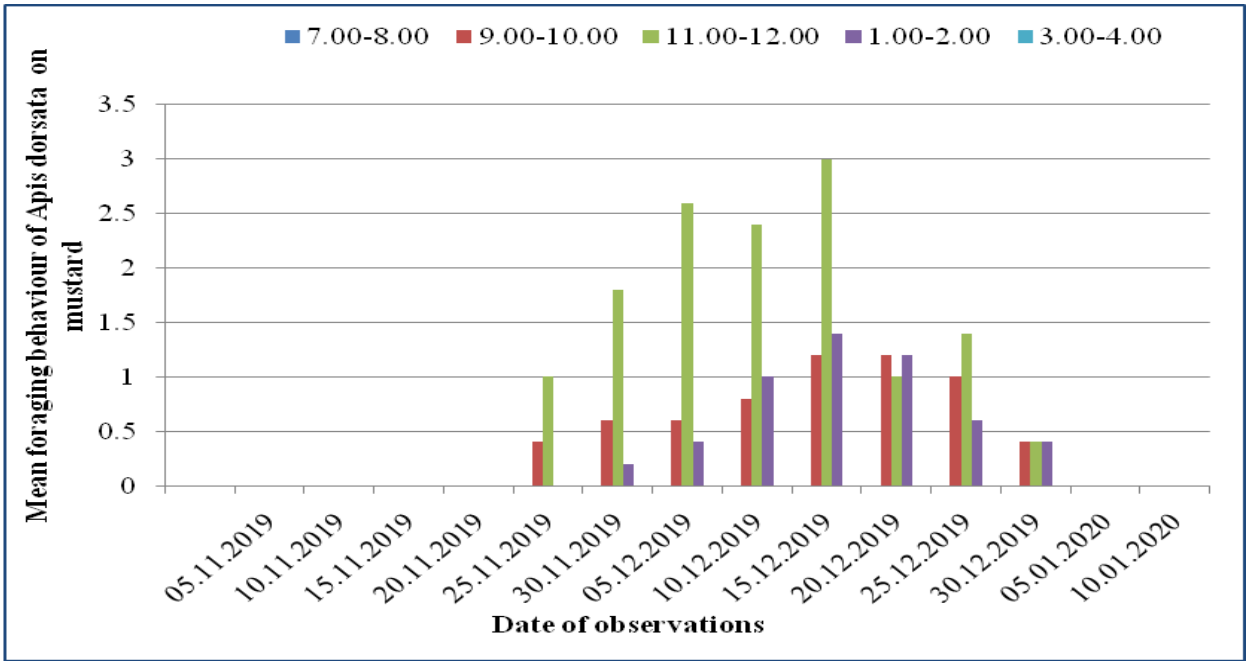

Fig.1. Foraging behaviour of *Apis dorsata* on mustard during *rabi* season 2019-20

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