

FORAGING BEHAVIOR OF EUROPEAN HONEY BEE, *APIS MELLIFERA* (HYMENOPTERA-APIDAE) IN MARIGOLD FLOWERS IN CHHATTISGARH, INDIA

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Received-02.03.2020, Revised-24.03.2020

Abstract: A study was undertaken at Raj Mohini Devi College of Agriculture and Research station, Ambikapur (Chhattisgarh) substation of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) India. The foraging behavior of European honey bee, *Apis mellifera* was observed in unmanaged French marigold red cherry (Genda) during January to February 2020. The maximum foraging activity of honey bee was observed third week of January 2020 (2.05 bees/5min/plant) followed by fourth week of January 2020 (1.87 bees/5min/plant) and first week of January 2020 (1.53 bees/5min/plant) however the lowest population was recorded during third week of February 2020(0.73 bees/5min/plant). Similarly during the different hours of the day the maximum population of honey bees were recorded at 10.00-12.00 Noon (2.41 bees/5min/plant) followed by at 12.00-2.00PM(1.63 bees/5min/plant)and at 2.00-4.00PM (0.74 bees/5min/plant). However the lowest population was recorded at 8.00-10.00AM (0.64 bees/5min/plant).

Keywords: Foraging behavior, French marigold red cherry, *Tegetes patula*, European honey bee, *Apis mellifera*, Marigold

INTRODUCTION

Red genda also called in India a red marigold or French marigold Red Cherry (*Tegetes patula* nana) belongs to family Asteraceae. It is a low growing French marigold variety with beautiful, attractive red-orange double flowers with a contrasting and striking yellow eye. The flowers stand on short stems and are surrounded by light green, feather-like and very fragrant foliage. Very well suited as cut flowers, in flower beds, in pots and for the colorful filling of holes in Your garden. Deadhead the flowers to enjoy this lovely flower for a longer period. French marigolds remove nematodes from the soil and are very attractive for honey bees for nectars and pollens and other beneficial insects. Red Cherry is a very early flowering *Tegetes* variety. Genda is an erect, branched and hardy annual, usually growing about 60 cm high. Recently, commercial cultivation of marigold in India has risen to an estimated 13,000 hectares with annual production of 200,000 tones of flowers, the highest for any flowers grown in India. This increasing demand of growing *Tegetes* is not due to only religious or social purposes but for its valuable essential oil components.

Marigold requires mild climate for good growth, development and flowering. It requires optimum temperature 18-20 °C. Temperature above 35 °C restricts its growth of the plant which leads in reduction in flower size and number. In severe winter, plants and flowers are damaged by frost.

This flower can be grown all type of soils, as it is adopted in different soil types. French marigolds are best cultivated in light soil where as a well drained. It

requires the sandy loams soils whose pH is 5.6 -6.5 ideal for its cultivation.

There are two species of Marigold first namely African marigold (*Tegetes erecta*) and French marigold (*Tegetes patula*). Some are French cultivars like- Rusty red, Naughty, Marietta, Flame, Star of India and Harmony.

In view of above, a study was conducted in an unmanaged Marigold field to study the foraging behavior of European honey bee in marigold flowers. Marigold plants take long times to complete its life cycle about 4-5 months. It provides to honey bees abundant quantity of pollen and nectar so honey bees visits this flowers during morning to evening.

MATERIALS AND METHODS

The study was undertaken at Raj Mohini Devi College of Agriculture and Research station, Ambikapur (Chhattisgarh) substation of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) India during 2020. This station is situated at an attitude 23^o8'33.7596"N and a longitude 83^o10'44.0184"E. The foraging behavior of European honey bee, *Apis mellifera* was observed in unmanaged French marigold red cherry during January to February 2020. The population of above honey bee sp. was recorded at seven days intervals per 5min/plant. 50 plants were randomly selected and count the number of honey bees visiting by visually observation starting from 8.00AM to 4.00PM with a two hours intervals, its total population was recorded and at the end it was averaged.

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RESULTS AND DISCUSSION

The result depicted in Table 1. and Figure 1. that the population of European honey bee was recorded maximum foraging activity during third week of January 2020 (2.05 bees/5min/plant) during this period the population was recorded lowest at 8.00-10.00 AM (1.10bees/5min/plant) and suddenly increased at 10.00-12.00Noon (3.78 bees/5min/plant) and started declined at 12.00-2.00PM (2.02 bees/5min/plant) and the lowest was recorded at 2.00-4.00PM (1.30 bees/5min/Plant). followed by fourth week of January 2020 (1.87 bees/5min/plant) during this week the population was recorded lowest at 8.00-10.00AM (0.98 bees/5min/plant) and suddenly increased at 10.00-12.00 Noon(3.18 bees/5min/plant) but it was started decreased at 12.00-2.00PM (2.22 bees/5min/plant) and (1.10 bees/5min/plant) at 2.00-4.00 PM. and second week of January 2020 the average population was recorded (1.53 bees/5min/plant) at the initial of day hours at 8.00-10.00AM (1.20 bees/5min/plant) and started increased at 10.00-12.00 Noon (3.02 bees/5min/plant) and suddenly decreased at 12.00-2.00PM (1.82 bees/5min/plant) and lowest at 2.00-4.00PM (0.1 bees/5min/plant). During the first week of February 2020 lowest population was found at8.00-10.00 (0.24 bees/5min/plant) suddenly increased at 10.00-12.00Noon (2.18 bees/5min/plant) and started declined at 12.00-2.00PM (1.90 bees/5min/plant) and at 2.00-4.00PM (0.98 bees/5min/plant) and total average was recorded (1.32 bees/5min/plant). During the second week of February 2020low population was observed at 8.00-10.00AM (0.30 bees/5min/plant) and increased at10.00-12.00Noon (1.92 bees/5min/plant) and started declined at 12.00-2.00PM (1.58 bees/5min/plant) and at 2.00-4.00PM(0.58 bees/5min/plant) and average population was

recorded 1.095 bees/5min/plant). During the third week of observation of February month minimum population was observed at 8.00AM -10.00AM (0.34 bees/5min/plant) and increased highest at 10.00-12.00Noon (1.30 bees/5min/plant) and started declined at 12.00-2.00PM (0.78 bees/5min/plant) and at 2.00-4.00PM (0.5 bees/5min/plant). The averaged population was recorded lowest of all the observation (0.73 bees/5min/plant).

Overall the population of honey bee was found highest at different hours of the day at 10.00-12.00Noon (2.41 bees/5min/plant) followed by at 12.00-2.00PM (1.63 bees/5min/plant) and at 2.00-4.00PM (0.74 bees/5min/plant) however the lowest population was recorded at 8.00-10.00AM (0.64 bees/5min/plant).

These findings are in agreement with the earlier workers Dalio (2013 and 2015) recorded the foraging behaviour of honey bee, *Apis mellifera* on Parthenium and Trianthema, Painkra et al (2014) noticed the comparative foraging activity of honey bees on buckwheat crop. Fazal Said et al (2015) who recorded the foraging activity of Himalayan bee, *Apis ceana* on sunflower, Painkra (2016) who observed the foraging activity of rock bee, *Apis dorsata* on lajwanti grass, Painkra and Shaw (2016) recorded the foraging activity of honey bees on niger flowers. Kumar and Singh (2016) noticed the foraging activity of bees on coriander flowers and Manhare et al (2017) observed the foraging activity of Indian honeybee on buckwheat. Painkra et al (2014 & 2014) recorded the foraging behavior of honey bees on niger flowers. Painkra (2018, 2019) observed the foraging activity of giant bee, *Apis dorsata* on *Ageratum conyzoides* and coriander flowers. Painkra and Kumaranag (2019) who were recorded the foraging activity of stingless bee in sunflower and in broccoli flowers.

Table 1. Foraging activity of honey bee on different hours of the day in marigold flowers

Population of honey bee at Different Hours of the day					Total	Mean
Date of observation	8.00-10.00AM	10.00-12.00Noon	12.00-2.00PM	2.00-4.00PM		
7-14 /01/ 2020	1.20	3.02	1.82	0.10	6.14	1.535
14-21/01/2020	1.10	3.78	2.02	1.30	8.20	2.05
21-28/01/2020	0.98	3.18	2.22	1.10	7.48	1.87
28-4/02/2020	0.24	2.18	1.90	0.98	5.30	1.325
4-11/02/2020	0.30	1.92	1.58	0.58	4.38	1.095
11-18/02/2020	0.34	1.50	1.12	0.62	3.58	0.895
18-25/02/2020	0.36	1.30	0.78	0.50	2.94	0.735
Total	4.52	16.88	11.44	5.18		
Mean	0.64	2.41	1.63	0.74		

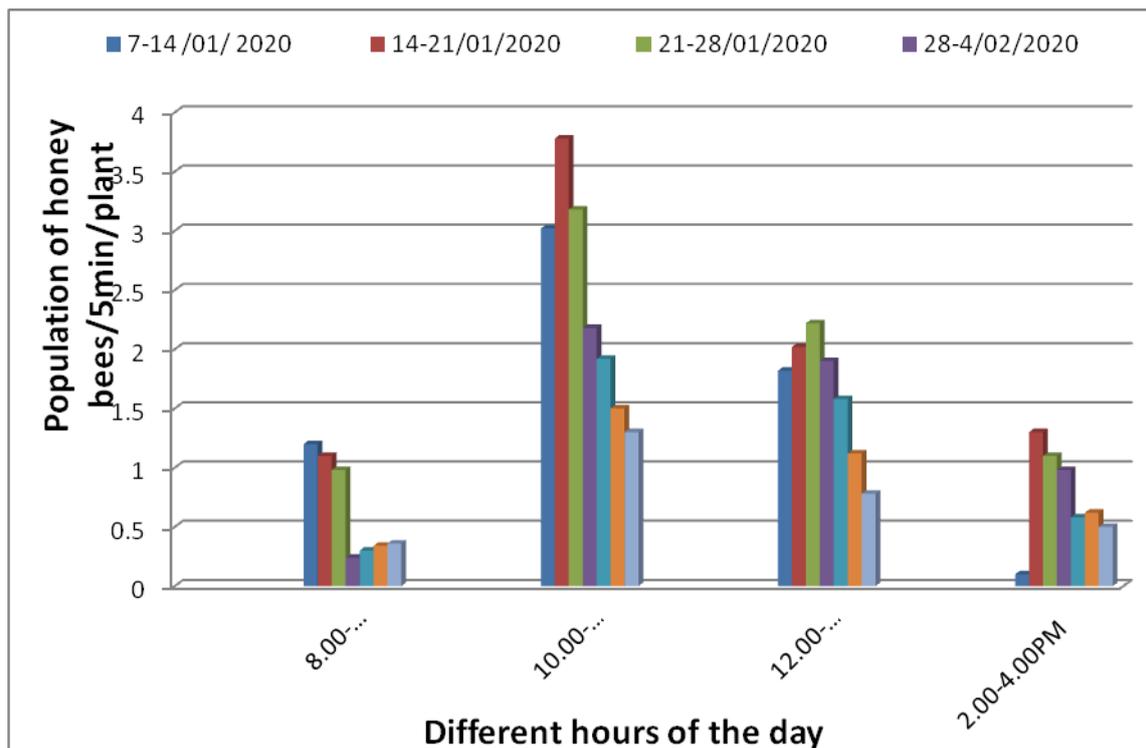


Fig 1. Showing the foraging activity of honey bee at different hours of the days.

CONCLUSION

During the study of the foraging behavior of European honey bee, *Apis mellifera* it was observed in French marigold red cherry (Genda) during January to February 2020. Maximum foraging activity of honey bee was observed during third week of January 2020 (2.05 bees/5min/plant) followed by fourth week of January 2020 (1.87 bees/5min/plant) and first week of January 2020 (1.53 bees/5min/plant) however the lowest population was recorded during third week of February 2020(0.73 bees/5min/plant).Similarly during the different hours of the day the maximum population of honey bees were recorded at 10.00-12.00 Noon (2.41 bees/5min/plant) followed by at 12.00-2.00PM(1.63 bees/5min/plant)and at 2.00-4.00PM (0.74

bees/5min/plant). However the lowest population was recorded at 8.00-10.00AM (0.64 bees/5min/plant). It is indicated that the morning hours the activity of bees was recorded low as compared to noon and after noon however, the maximum was recorded during the forenoon because it was the availability of nectar and pollen ample quantity.

ACKNOWLEDGEMENT

The author is highly thankful to Project Coordinating Unit, All India Coordinated Research Project on Honey Bees and Pollinators, Division of Entomology, ICAR-IARI, New Delhi-110012 for providing the financial support and technical guidance during the whole research work.

A view of marigold flowers and honey bee foraging on flowers



A. Marigold Plants



B. European bee foraging on marigold



C. European bee foraging on marigold



D. European bee foraging on marigold

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