



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2020; 8(6): 1510-1512

© 2020 JEZS

Received: 12-09-2020

Accepted: 25-10-2020

Mohaniraj Rajendra More
Department of Agricultural
Entomology, College of
Agriculture, Pune
Mahatma Phule Krishi
Vidyapeeth, Maharashtra, India

Santoshkumar Amyaji More
Department of Agricultural
Entomology, College of
Agriculture, Pune
Mahatma Phule Krishi
Vidyapeeth, Maharashtra, India

Uttam Bapurao Hole
Department of Agricultural
Entomology, College of
Agriculture, Pune
Mahatma Phule Krishi
Vidyapeeth, Maharashtra, India

Subhash Ganpat Bhalekar
Department of Agricultural
Entomology, College of
Agriculture, Pune
Mahatma Phule Krishi
Vidyapeeth, Maharashtra, India

Corresponding Author:
Mohaniraj Rajendra More
Department of Agricultural
Entomology, College of
Agriculture, Pune
Mahatma Phule Krishi
Vidyapeeth, Maharashtra, India

Effect of bee attractants on foraging behaviour of *Apis mellifera* L. on seed onion crop (*Allium cepa* L.)

Mohaniraj Rajendra More, Santoshkumar Amyaji More, Uttam Bapurao Hole and Subhash Ganpat Bhalekar

Abstract

A field experiment was conducted to study the foraging behaviour of European honeybee (*Apis mellifera* L.) on seed onion crop (*Allium cepa* L.). The peak foraging activity of *A. mellifera* (7.50 bees/m²/5 minute) were found during fourth week of flowering period and maximum at 12:00 hrs of day with an average of 12.00 bees/m²/5 minute. The foraging activity of *A. mellifera* initiated at early in morning at 8:00 hrs and continues till evening up to 18:00 hrs. On 1st, 3rd and 5th day after first spray of bee attractants, the treatment with Jaggery solution (10%) was found significantly superior in attracting a greater number of bees with an average of 12.68, 15.18 and 13.75 bees/m²/5 minute, respectively. The bee visits on one, three and five days after second spray of bee attractants was 13.57, 15.89 and 15.89 bees/m²/5 minute, respectively and for third spray it was 14.11, 16.25 and 14.82 bees/m²/5 minute, respectively.

Keywords: *Apis mellifera* L., *Allium cepa* L., bee attractants, jaggery solution, foraging

Introduction

Onion (*Allium cepa* L.) monocotyledons in the family Amaryllidaceae or Liliaceae. As a strongly protandrous cross pollinated requires an external agent for pollination. The absence of natural pollinators on onion seed plantation poses a serious problem of reduction in seed number and seed weight per umbel. Also, seeds from free pollination flowers show higher germination capacity than those isolated from insect visitors.^[1] As a commercial bee keeping and being a social insect, honeybee visiting number of flowers for nectar and pollen collection in a day and thus helps to increase yield and improves the qualitative yield parameters of various crops. Honeybees are responsible for 70-80 per cent of insect pollination and the value of additional yields obtained from pollination service of honeybee 15-20 times more than the value of all hive products.^[2] The non-availability of pollinators at the time of flowering of seed onion crop results in only 17 per cent seed setting while seed setting increased up to 73 percent in case of good availability of pollinators.^[4] Foraging activity honeybees starts early in the morning and continues to evening which coincides with stigma receptivity of onion flower. *A. mellifera* colony can be easily domesticated in hives and produces a good quantity of honey in addition to that bee wax, propolis, bee venom, royal jelly bee pollen can be obtained, while importance of other bee species in onion to boost pollination and seed production.^[5] Potassium content in onion nectar is slightly more than the nectar of other crops and bees prefer a nectar containing low potassium content and high carbohydrate content. Hence, there is need to increase the activity of pollinators artificially in onion seed crop. In developed countries different type of commercial bee attractants viz., bee line, bee here, bee scent, bee scent plus, fruit boost and bee-q are being used to boost the seed production of onion.^[4] Most of them are costlier and not readily available to farmers hence need to suggest a better bee attractant which can be easily and locally available and cheaper one.

Material and Methods

A field experiment was conducted at the experimental field of Entomology Section, College of Agriculture, Pune, and Maharashtra. In all there were six treatments replicated four times in Randomized Block Design. The bulbs of variety N-2-4-1 were used for planting on ridges and furrow layout with spacing was 60 cm X 20 cm and plot size was 3 × 2.4 m² for each treatment and replication.

In this way bulbs were planted with 1.5 m distance in between two treatments and 2.0 m distance between two replications. The experimental plot was kept free from application of any insecticide spray during flowering period. Honeybee colonies of *A. mellifera* were kept in the research plot. Cultural operations like irrigation, weeding was uniformly carried out to all treatments. Separate plot of 5 m x 5 m area was planted separately and one square meter area was randomly marked at three points in the plot. Number of *A. mellifera* honeybees present per square meter area was recorded for 5 minute period at 2 hours interval starting from 6:00 hrs to 18:00 hrs i.e. 6:00, 8:00, 10:00, 12:00, 14:00, 16:00 and 18:00 hrs once in a week during a flowering period of onion seed crop as per the methodology [7]. The onion plots were sprayed with bee attractants as per treatment and replication at 20 per cent flowering of the seed onion crop. The treatment details have been given in table 1. The first spray of bee attractants was given at 20 per cent flowering of onion crop and subsequent two sprays at weekly interval during flowering stage. The spraying was done early in the morning hours. Treatment T₅ were covered with a fine insect net and T₆ were control plot. In each plot, 1 m² area was randomly selected in each treatment and replication. The number of honeybees visiting the flowers/5 minutes/ m² was recorded a day before the spray and 1st, 3rd and 5th days after each spray (Patil *et al.*, 2010). Mean of all the observations were pooled time wise and further subjected to suitable statistical analysis for inference after $\sqrt{n + 0.5}$ transformation [8].

Results and Discussion

The data recorded revealed that at first week of flowering, number of European honey bee, (*Apis mellifera* L.) visited in 5 minute period was 5 bees per m². Bee activity increased gradually on 2nd and 3rd week with an average of 6.79 and 7.32 bees/m² in 5 minute period, respectively. European

honey bee activity seen maximum of 7.50 bees/m²/5 min during 4th week of flowering. However, on 5th week of flowering, least number of bees were recorded (6.07 bees/m²/5 minute). The foraging activity at different hours of the day indicated that the bee activity of *A. mellifera* started at 8:00 hr with an average of 5.00 bees/m² in 5 minute period. Foraging activity increased and found maximum at 12:00 hr (12.00 bees/m²/5 minute). During after foraging activity of *A. mellifera* reduced to 11.00 and 7.75 bees/ m² at 14:00 and 16:00 hrs, respectively; while least activity i.e. 1.00 bees/m² in 5 minute period was observed at 18:00 hr in evening. The results are presented in table1 and figure1. The present results are in the same line with the findings that workers of *A. mellifera* foraged on onion plant from 8:15 to 16:30 hrs of the day [11] and highest rate of foraging on *Guzzotia abyssinica* 14:30-15:30 pm [13].

The data recorded on effect of sprays of bee attractant on foraging activity of *A. mellifera* L. in seed onion crop in table 1 revealed that after first spray of bee attractants the treatment Jaggery solution (10%) was found significantly superior in attracting a greater number of bees on first, third and fifth days of spray with 12.68, 15.18 and 13.75 bees/m²/5 minute, respectively. On second and third spray of bee attractants, similar results were obtained with 13.57, 15.89 and 13.57 bees/m²/5 minute on first, third and fifth days of second spray, respectively; while 14.11, 16.25 and 14.82 bees/m²/5 minute on first, third and fifth days of second third, respectively

The Jaggery solution (10%) were the best bee attractants which attract a greater number of honeybees to the treated seed onion crop leads to enhancement of foraging activity and pollination [6]. Jaggery solution (10%) were efficient in attracting more bees up to third day after first, second and third spray, whereas their efficacy decreased at 5th day of first, second and third spray in cucumber (*Cucumis salivas* L.) crop [9]

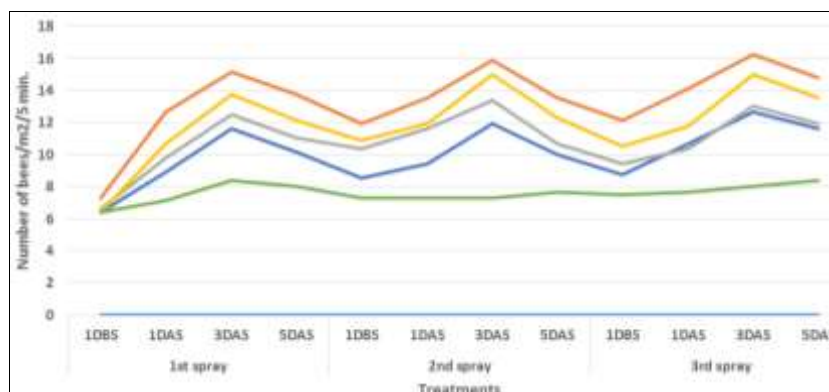


Fig 1: Effect of bee attractant on activity of *A. mellifera* in onion

Table 1: Effect of different bee attractant on foraging behaviour of *Apis mellifera* L. in seed onion crop

Treat. No.	Treatment Details	1 st spray				2 nd spray			3 rd spray		
		Pre count	Post count (DAS*)			Post count (DAS)			Post count (DAS)		
			1	3	5	1	3	5	1	3	5
Average Number of forager <i>Apis mellifera</i> L. honeybees/m²/5 minute period											
T ₁	Sugarcane juice 10%	6.43 (2.61)**	8.93 (3.07)	11.61 (3.48)	10.18 (3.27)	9.46 (3.15)	11.96 (3.53)	10.00 (3.24)	10.71 (3.35)	12.68 (3.63)	11.61 (3.48)
T ₂	Jaggery solution 10%	7.32 (2.77)	12.68 (3.62)	15.18 (3.95)	13.75 (3.77)	13.57 (3.75)	15.89 (4.04)	13.57 (3.75)	14.11 (3.82)	16.25 (4.09)	14.82 (3.91)
T ₃	Molasses 10%	6.61 (2.65)	9.82 (3.21)	12.50 (3.60)	11.07 (3.40)	11.61 (3.48)	13.39 (3.73)	10.71 (3.35)	10.36 (3.30)	13.04 (3.68)	11.96 (3.53)
T ₄	Sugar solution 10%	6.43 (2.62)	10.71 (3.35)	13.75 (3.77)	12.14 (3.55)	11.96 (3.53)	15.00 (3.93)	12.32 (3.58)	11.79 (3.51)	15.00 (3.94)	13.57 (3.75)

T ₅	Insect net cover	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
T ₆	Control	6.43 (2.62)	7.14 (2.76)	8.39 (2.97)	8.04 (2.92)	7.32 (2.79)	7.32 (2.78)	7.68 (2.86)	7.68 (2.86)	8.04 (2.92)	8.39 (2.98)
	S.E. ±	0.16	0.08	0.09	0.05	0.08	0.10	0.09	0.06	0.07	0.05
	C.D. at 5%	0.47	0.25	0.28	0.14	0.23	0.29	0.27	0.17	0.21	0.14
	CV	13.45	5.90	6.03	3.11	5.30	6.15	6.09	3.76	4.34	3.08

*DAS- Days after Spray

**Figures in parenthesis are $\sqrt{n + 0.5}$ transformed values



Plate 1: European honeybee, *Apis mellifera* L. colony in seed onion plot



Plate 2: European honeybee, *Apis mellifera* L. foraging onion umbel

Conclusions

The results from the present investigation revealed that spraying of Jaggery solution (10%) in seed onion crop as a honey bees and other pollinator attractant was found to be the most beneficial in improving foraging activity of *A. mellifera*. Ultimately, it increases a pollination in seed onion crop. However, its efficacy decreases after 5th day of spray so it can be repeated after five days or a week during flowering period. Thus, it can be concluded that the Jaggery solution (10%) may be incorporated into the spraying schedule of seed onion crop to obtain better pollination.

Acknowledgements

The authors wish to thank Head and Faculty members, Department of Entomology Section, College of Agriculture, Pune for their valuable encouragement and kind assistance.

References

1. Adel MR, Namsgbi HS, Hosseini M. Effect of insect pollinators on onion seed production quality and quantity. *Journal of Crop Protection* 2013;2(4):395-402.
2. Bakere T, Addi A. Effect of honeybee pollination on seed and fruit yield of agricultural crops in Ethiopia. *MOJ*

Economics and Environmental Science 2019;4(5):205-209.

3. Gebremedhn H. Pollination activity and foraging behavior of local honeybee (*Apis mellifera*) under open and caged conditions in Mekelle, Tigray, Ethiopia. *African Journal of Agricultural Research* 2017;12(33):2620-2624.
4. Kumari S, Rana K. Efficacy of bee attractants in attracting insect pollinators in onion seed crop. *Journal of pharmacognosy and phytochemistry* 2018;7(5):2239-2243.
5. Moritz RFA, Harlet S. Global invasions of the western honeybee (*Apis mellifera*) and the consequences for biodiversity. *Ecoscience* 2005;2(3):289-301.
6. Naik JM, Gopali JB, Ganiger VM, Patil SR, Kumar V, Patil B. Influence of honey bee attractants in enhancing the seed productivity and quality of onion seed crop. *International Journal of Chemical Studies* 2019;7(4):2958-2962.
7. Padamshali S, Gupta DB, Kumar A. Foraging Behaviour of *Apis mellifera* and *Apis dorsata* on onion (*Allium cepa*) flower. *Journal of Pharmacognosy and Phytochemistry* 2018;1:405-408.
8. Panse VS, Sukhatme PV. *Statistical Methods for Agricultural Workers*, ICAR, New Delhi, 1985.
9. Pateel MC, Sattagi HN. Effect of different bee attractants on attracting the bees to cucumber (*Cucumis sativus* L.). *Karnataka Journal of Agricultural Science* 2007;20(4):761-763.
10. Patil JS, Mokate RB, Kamate GS, Mupade RV. Studies on influence of bee attractants on bee visitation of *Apis dorsata* and *Trigona* sp. On onion (*Allium cepa* L.). *International Journal of Plant Protection* 2010;3(2):174-178.
11. Yucel B, Duman I. Effects of foraging activity of honeybees (*Apis mellifera* L.) on onion (*Allium cepa* L.) seed production and quality. *Pakistan Journal of Biological Science* 2005;8(1): 123-126