

Evaluation of Various Bee Attractants on the Foraging Behavior of Indian Honey Bee (*Apis cerana indica*) and Their Impact on the Seed Yield of Niger [*Guizotia abyssinica* (L.f.) Cass]

Abstract

Experiment was done at the PC Unit Sesame and Niger Experimental Farm, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh. The study took place in during *Kharif* 2022. A total of nine treatments with three replications were arranged for the experiment using Randomized Block Design to check whether there was a result of bee attractants regarding attraction by *Apis cerana indica* and their effects on seed production of niger crops. The number of *Apis cerana indica* visits was found the highest at both the 10% and 50% blooming stages at which *Madhuca longifolia* flower extract 10% and rose water were 10% (16.50 *Apis cerana indica*/m²/5min), with 17.50 and 12.17 *Apis cerana indica*/m²/5min, respectively. This was followed by rose water 10% with 16.50 and (sugar solution 50%) 10.08 *Apis cerana indica*/m²/5min, respectively. The population of *Apis cerana indica* was received from controlled condition 5.67 and 2.92 *Apis cerana indica*/m²/5min at 10% and 50% flowering stage, respectively. This was followed by water spray (7.08 and 4.42 *Apis cerana indica*/m²/5min) at 10% and 50% flowering stage, respectively. The foliar spray of flower extract of *Madhuca longifolia*, sugar solution 10% and rose water 10% were found significantly superior over others in respect to record higher seed yield and recorded 6.90 q and 6.70 q/ha seed yield, respectively.

Keywords: *Madhuca longifolia*, bee attractants, flowering stage and niger crop.

1. Introduction

Native to Tropical Africa, Niger [*Guizotia abyssinica* (L.f.) Cass.] is the family of Asteraceae, known as Compositae, and considered as the backbone of Indian tribal agriculture and the country's economy. There are several names given to it in the country; some of which include uhechellu (Kannada), payellu (Tamil), verrinuvvulu (Telugu), alashi (Oriya), sarguza (Bengali), karale or khurasani (Marathi), jagni or jatangi (Hindi), and ramtal or kharsani (Gujarati) (Dwarka *et al.*, 2024a). Tribal people grow it in rain-fed marginal and submarginal fields with meagre input (Ranganatha *et al.*, 2009). The country covers 112.8 thousand hectares and has an average yield of 357.2 kg per hectare. India grows Niger to a production amount of 40.3 thousand tons. With an annual output of 4.9 thousand tons and a seed productivity of 308.8 kg per hectare, Madhya Pradesh offers about 16,000 hectares of

land (Anonymous, 2021-22). In India, it is cultivated as an oilseed crop, contributing about 3% of the country edible oil requirement (Getinet and Sharma, 1996). Niger oil is pale yellow, with nutty flavor and has a pleasant aroma. It has 32-40% high-quality oil and 18-24% protein. The oil has a Desi ghee flavor, and the seeds and oil have no toxins. It can only be cultivated in Madhya Pradesh on eroded soils, especially in the mountainous districts of Shahdol, Dindori, Mandla, Seoni, Jabalpur and Chhindwara (Dwarka *et al.*, 2023b). 100% cross-pollinated crops are not compatible with Niger (Dwarka *et al.*, 2022, 2023a, 2023c, 2024b, 2024c). Besides, through pollination, it ensures larger seed yields of cross-pollinated crops like niger, quality seeds, crop harvest and uniform maturity, which ensure that the whole crop can be harvested all at once. According to Dwarka *et al.* (2022), bee colony provision throughout the crop flowering season is straightforward and highly essential. Even with the existing level of land use for oil crops, a concerted national bee pollination programme highly helps in addressing the scarcity of edible oil in the country (Mohana Rao *et al.*, 1981). The research on the niger crops and honey bee pollinators revealed that without the presence of honey bees and natural pollinators, production declined by 11–78%. Beekeeping with niger over open pollinated crops was expected to generate an additional income of Rs. 252 to Rs. 2125, including Rs. 1015/ha from honey (Anonymous, 2005). Honey bees are considered the best and most effective pollinators. How well honey bees have been performing compared to those neighboring plants will determine their efficiency in pollinating that particular crop. To enhance the foraging activity of niger in Jabalpur, Madhya Pradesh, Dwarka *et al.* (2022) use both commercial and local bee attractants, which include bee line, bee here, bee smell, bee scent plus, fruit boost, Bee-Q, sugar solution, sugarcane juice, jaggery solution, molasses, *etc.* There are not so many studies on the utilization of bee attractants in India, though. This has been increasing every day due to the need to control and conserve insect pollinators. The current experiment tested several bee attractants on the attraction of *Apis cerana indica* and their effect on seed production.

2. Material and methods

Jabalpur a city in Madhya Pradesh is situated on the bank of Narmada river geographically located between 22° 49'' and 24° 8'' North latitude and 78° 21'' East longitude and at an altitude of 411.78 m. above the mean sea level. The effect of bee attractants on foraging activities of *Apis cerana indica* in niger crops during *Kharif* 2022 at the experimental farm of PC Unit (ICAR) Sesame and Niger, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India was assessed under randomized block design with three replications.

Table. 1: List of attractants

Sl. No.	Treatments/attractants
1.	T ₁ - Flower extract of <i>Madhuca longifolia</i> 10%
2.	T ₂ –Juice of <i>Sachharum officinarum</i> 10%
3.	T ₃ -Jaggery solution 10%
4.	T ₄ -Honey solution 10%
5.	T ₅ -Fruit extract of <i>Foenix dactylifera</i> 10%
6.	T ₆ -Sugar solution 10%
7.	T ₇ -Rose water (Marketed) 10%
8.	T ₈ -Water spray.
9.	T ₉ -Control

The above attractants were sprayed twice at the 10% and 50% blooming stages, respectively. The recommended set of agronomic operations was followed to ensure the crop was productive and healthy. A one-meter square area was randomly selected from each plot, and the number of enormous honey bees visiting the flowers was recorded. The observations were recorded one day before the first and second spraying, and the seed production from each treatment was recorded separately on the first, third, fifth, and seventh days after the first and second spraying. I could confirm the insects that I had collected with the assistance of the Regional Center, ZSI, Jabalpur, Madhya Pradesh.

3. Results and discussion

Results from the present study indicated that all of the sprayed bee attractants resulted in a high impact on foraging activities of *Apis cerana indica* within niger crops. They had performed better than the control, which was unsprayed and lacked pollinators, within the recorded parameters. The outcome indicated that there existed a significant difference between all of the treatments in their ability to attract *Apis cerana indica* populations. 10% of the blooming stage *Apis cerana indica* visit was numerically highest with flower extract of *Madhuca longifolia* 10% (17.50 *Apis cerana indica* /m²/5min) followed by (16.50 *Apis cerana indica*/m²/5min) rose water 10% spray and honey solution 10% (13.25 *Apis cerana indica*/m²/5min) while it was lowest on control (5.67 *Apis cerana indica*/m²/5min) followed by water spray (7.08 *Apis cerana indica*/m²/5min) and 10% jaggery solution (8.17 *Apis cerana indica* /m²/5min). 50% of the blossoming stage is when the greatest number of *Apis cerana indica* was attracted with flower extract of *Madhuca longifolia* 10% (12.17 *Apis cerana indica*/m²/5min) followed by (10.08 *Apis cerana indica*/m²/5min) sugar solution 10% while it was lowest (2.92/m²/5min) on control followed by water spray (4.42 *Apis cerana indica*/m²/5min) and 10% juice of *S. officinarum* spray (7.33/m²/5min). Current findings are corroborated by the results of Dwarka *et al.* (2024c);Singh (2015) who reported that bees

were observed that visiting the flowers *Apis floreae*, *A. cerana indica* and *A. mellifera*. Present findings are corroborated with the findings of Manchare *et al.*, (2019) showed that honey solution 10 per cent flowering has highest (2.32 bees/m²/min) average ability to attract *Apis cerana indica* towards it followed by jaggery solution 10 per cent (2.16 bees/m² / min) and molasses 10 per cent (2.04 bees/m² /min).



Plate: 1. Experimental field



Plate: 2. 10% flowering stage



Plate: 3. 50% flowering stage

3.3. Seed yield (q/ha)

According to the seed yield statistics, there were substantial differences between all of the treatments in terms of recording a greater seed output. The treatment that produced the

highest seed yield (6.90 q/ha) was the one that applied a 10% foliar spray of *Madhuca longifolia* flower extract, followed by a 10% rose water spray (6.70 q/ha) and a 6.30 q/ha fruit extract of *Foenix dactylifera* spray. The controlled condition gave the lowest seed yield at 3.15 q/ha, followed by a 10% jaggery solution at 4.40 q/ha and water spray at 4.80 q/ha. These results were in agreement with Chandrashekhar and Sattigi (2009), who reported that spraying bee attractants like 10% cacambe and 10% jaggery solution improved the quantitative and qualitative characteristics of the radish seed significantly. These results were closely similar to the earlier observations of Dwarka *et al.* (2022;2024), where the treatment that applied 10% foliar spray of *Madhuca longifolia* flower extract exhibited the maximum seed yield 6.90 q/ha. In the same way, Jayaramappa *et al.*, 2011. Reports that in comparison with open pollinated plots it produce 10.66 fruit/plant, at similar treatment with spraying Fruitboost at 0.5 ml/liter increases and improved yield characteristics at same plot, such as more fruits/plants, to 19:00 and 17:00 at 19:00 and 17:00 (fruits).

4. Conclusion

From the above facts, it was concluded that 10% flower extract of *Madhuca longifolia* was able to attract a higher number of *Apis cerana indica* during 10% and 50% flowering stages in comparison to others. Both rose water 10% and sugar solution 10% attracted comparatively higher *Apis cerana indica* also with a better seed production than the rest two.

Table 2: Impact of several attractants on the niger crop seed output and their ability to draw in *Apis cerana indica* Fabricius.

Treatment	Population of <i>Apis c. indica</i> /m ² /5 minutes											Yield (q/ha)	
	10% blooming for the first spray					50% blooming for the second spray							
	1DBS	Days after spray				Mean	1DBS	Days after spray					Mean
1DAS		3DAS	5DAS	7DAS	1DAS			3DAS	5DAS	7DAS			
T ₁ -Flower extract of <i>M. longifolia</i> 10%	4.00 (2.11)	11.00 (3.38)	17.67 (4.26)	25.33 (5.07)	16.00 (4.05)	17.50 (4.24)	6.00 (2.54)	8.00 (2.89)	13.67 (3.75)	14.33 (3.84)	12.67 (3.63)	12.17 (3.56)	6.90 (2.72)
T ₂ -Juice of <i>S. officinarum</i> 10%	5.67 (2.46)	12.33 (3.57)	9.67 (3.10)	8.67 (2.99)	7.67 (2.85)	9.58 (3.17)	6.00 (2.54)	7.67 (2.81)	8.67 (3.00)	7.67 (2.82)	5.33 (2.31)	7.33 (2.79)	5.82 (2.51)
T ₃ -Jaggery solution 10%	4.33 (2.20)	8.00 (2.91)	4.33 (2.20)	10.67 (3.30)	9.67 (3.19)	8.17 (2.94)	7.33 (2.80)	9.00 (3.06)	10.67 (3.31)	9.00 (3.04)	5.00 (2.30)	8.42 (2.98)	4.40 (2.21)
T ₄ -Honey solution 10%	4.67 (2.27)	8.33 (2.96)	11.33 (3.43)	19.33 (4.44)	14.00 (3.81)	13.25 (3.71)	8.33 (2.97)	9.33 (3.11)	11.67 (3.47)	11.33 (3.43)	7.67 (2.85)	10.00 (3.24)	5.45 (2.44)
T ₅ - Fruit extract of <i>F. dactylifera</i> 10%	3.00 (1.86)	7.67 (2.85)	13.00 (3.67)	15.67 (4.01)	12.33 (3.58)	12.17 (3.56)	8.67 (3.03)	10.33 (3.28)	11.33 (3.43)	10.67 (3.33)	6.00 (2.54)	9.58 (3.17)	6.30 (2.61)
T ₆ -Sugar solution 10%	4.00 (2.11)	11.00 (3.35)	9.33 (3.08)	11.33 (3.41)	9.33 (3.03)	10.25 (3.27)	8.00 (2.91)	9.67 (3.19)	12.67 (3.62)	11.33 (3.43)	6.67 (2.64)	10.08 (3.25)	6.00 (2.55)
T ₇ -Rose water 10%	5.00 (2.34)	9.33 (3.13)	18.33 (4.34)	21.00 (4.62)	17.33 (4.22)	16.50 (4.12)	8.67 (3.03)	10.33 (3.28)	11.33 (3.43)	10.00 (3.18)	7.00 (2.73)	9.67 (3.18)	6.70 (2.68)
T ₈ -Water spray	3.33 (1.95)	5.00 (2.33)	7.67 (2.86)	8.33 (2.96)	7.33 (2.79)	7.08 (2.75)	3.33 (1.95)	4.33 (2.10)	5.67 (2.48)	4.67 (2.26)	3.00 (1.86)	4.42 (2.22)	4.80 (2.30)
T ₉ -Control	2.00 (1.48)	3.33 (1.93)	6.33 (2.60)	7.33 (2.79)	5.67 (2.47)	5.67 (2.48)	2.33 (1.57)	3.33 (1.95)	3.67 (2.03)	2.67 (1.77)	2.00 (1.56)	2.92 (1.85)	3.15 (1.92)
SEm±	0.17	0.20	0.24	0.28	0.23	0.11	0.17	0.28	0.22	0.26	0.24	0.08	0.03
CD at 5%	0.51	0.61	0.72	0.85	0.68	0.32	0.51	0.85	0.66	0.79	0.72	0.25	0.09

*Figures in parenthesis are square root of $\sqrt{x+0.5}$

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5. References

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