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# 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]

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#### Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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## 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*/m<sup>2</sup>/5min, respectively. The population of *Apis cerana indica* was received from controlled condition 5.67 and 2.92 *Apis cerana indica*/m<sup>2</sup>/5min at 10% and 50% flowering stage, respectively. This was followed by water spray (7.08 and 4.42 *Apis cerana indica*/m<sup>2</sup>/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 Compositae, Asteraceae, known as 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), sarquza (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 districts of Shahdol. Dindori. mountainous 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, guality 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. MATERIALS 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

SI.	Treatments/attractants
NO.	
1.	T <sub>1</sub> - Flower extract of Madhuca longifolia
	10%
2.	T <sub>2</sub> –Juice of Sachharum officinarum
	10%
3.	T <sub>3</sub> -Jaggery solution 10%
4.	T <sub>4</sub> -Honey solution 10%
5.	T5 -Fruit extract of Foenix dactylifera
	10%
6.	T <sub>6</sub> -Sugar solution 10%
7.	T <sub>7</sub> -Rose water (Marketed) 10%
8.	T <sub>8</sub> -Water spray.
9.	T <sub>9</sub> -Control

The above attractants were spraved 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 /m<sup>2</sup>/5min) followed by (16.50 Apis cerana indica/m<sup>2</sup>/5min) rose water 10% spray and honey solution 10% (13.25 Apis cerana indica/m<sup>2</sup>/5min) while it was lowest on control (5.67 Apis cerana indica/m<sup>2</sup>/5min) followed by water spray (7.08 Apis cerana indica/m<sup>2</sup>/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/m<sup>2</sup>/5min) followed by (10.08 Apis cerana indica/m<sup>2</sup>/5min) sugar solution 10% while it was lowest (2.92/m<sup>2</sup>/5min) on control followed by water spray (4.42 Apis cerana indica/m<sup>2</sup>/5min) and 10% juice of S. officinarum sprav (7.33/m<sup>2</sup>/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 florae, 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/m<sup>2</sup>/min) average ability to attract Apis cerena 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).

#### 3.1 Seed Yield (q/ha)

According to the seed vield 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 g/ha, followed by a 10% jaggery solution at 4.40 g/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% jaggary 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

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

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

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

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Fig. 1. Experimental field



Fig. 2. 10% flowering stage

*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 19:00and 17:00 at 19:00 and 17:00 (fruits).



Fig. 3. 50% flowering stage

#### 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.

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Author(s) hereby declare that NO generative Al technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

#### REFERENCES

- Abrol D.P. 2010. Foraging behavior of *Apis florea* F. an important pollinator of *Allium cepa* L. Journal of Apiculural Research, 49 (4): 318-325.
- Anonymous, 2005, observations made during "national seminar on strategies for enhancing production and export of sesame and niger" and "annual workshop of AICRP on sesame and niger research workers, 2005".
- Anonymous. 2020-21. 4<sup>th</sup> Advance Estimate, Agriculture Statistics Division, Directorate of Economics and statistics, New Delhi. Indian Journal of Natural Products and Resources, 2:221-226.
- Dwarka, Panday A.K., and Saxena A.K., 2022. To study the effect of bee attractants on the attraction of giant honey bees (*Apis dorsata*) and their impact on seed yield of Niger (*Guizotia abyssinica*) crop. The Pharma Innovation Journal, 11(12): 866-868.
- Dwarka, Panday A.K., Saxena A.K., Jain S., Marabi R.S., and Sahu R., 2023b. Impact of different weather parameters on the population of pollinators visited on Niger flowers. The Pharma Innovation Journal, 12(7): 619-621.
- Dwarka, Panday A.K., Saxena A.K., Jain S., Sahu R., and Marabi R.S., 2023c. The relative abundance of insect pollinators/visitors in Niger (*Guizotia abyssinica*) crop. The Pharma Innovation Journal, 12(2): 3579-3581.
- Dwarka, Panday A.K., Tare S., Thakur S., and Katara V.K., 2024b. Effect of Bee Attractants on the Attraction of Apis dorsata and their Impact on Seed Yield of Niger *Guizotia abyssinica* (L.f.) Cass Crop. Journal of Scientific Research and Reports, 30(6): 420-426.

- Dwarka, Panday A.K., Thakur S and Katara V.K., 2024a. Study on the Effect of Bee Attractants on the Giant Honey Bee, *Apis dorsata* and their Effect on Niger [*Guizotia abyssinica* (L.f.) Cass] Seed Yield. Journal of Experimental Agriculture International, 46(7): 903-908.
- Dwarka, Panday A.K., Thakur S., Katara V.K., Patel D.K., and Kurmi J.P., 2024c. Impact of different bee attractants on the attraction of Indian honey bee, *Apis cerana indica* and their impact on seed yield of niger, *Guizotia abyssinica* (*L.f.*) Cass, crop. Plant Archives, 24(2): 255-258.
- Dwarka, Saxena A.K., Panday A.K., Jain Sand Marabi R.S., 2023a. Succession of different insect pollinators on Niger flowers grown under different dates of sowing. The Pharma Innovation Journal, 12(7): 622-627.
- Getinet A., and Sharma S.M., 1996. Niger, *Guizotia abyssinica (L.f.)* Cass. Promoting the conservation and use of underutilized and neglected crops. Institute of Plant Genetics and Crop Plant Research. International Plant Genetic Resources Institute, Rome.
- Jayaramappa Kract V., Pattibhiramaiah M., and Bhargava H.R., 2011. Influence of bee attractants on yield parameters of Ridge gourd (*Luffa acutangulus* L.) (Cucurbitaceae). *World Applied Science Journal*, 15(4):547-462.
- Kalmath B.S., and Sattigi H.N., 2002. Effect of different attractants on attracting the bees to onion (*Alium cepa*) crop. Indian Bee Journal, 64(6): 68-71.
- Manchare R.R., Kulkarni S.R., and Chormale T.S., 2019. Effect of bee attractants on foraging activities of Indian bees *Apis cerena indica* in bitter gourd (*Momordica charantia* L.). Journal of Entomology and Zoology Studies, 7(5): 468-472.
- Mohana Rao, G.M., Lazar M., and Suryanarayana M.C., 1981. Foraging behaviour of honeybees in sesame (*Sesamum indicum* L.). *Indian Bee J.*, 43:97-100.
- Ranganatha A.R.G., Tripathi A., Jyotishi A., Paroha S., Deshmukh MR and Shrivastava N. 2009. Strategies to enhance the productivity of sesame, linseed and niger. In: Proceedings of Platinum Jubilee Celebrations, UAS, Raichur.
- Singh R.S., Amrendra Pratap B., Singh Singh D.V. 2015. Abundance and foraging

Dwarka et al.; Adv. Res., vol. 25, no. 6, pp. 528-534, 2024; Article no.AIR.129116

activity of bee visitors to pigeonpea. Progressive Agriculture, 15(1):116- 119. Venkataramegowda S., Koragandahalli V.J., Menon A. and Ruben M.C. 2013. Use

of Bee-attractants in Increasing Crop Productivity in Niger (*Guizotia abyssinica*. L). Braz. Arch. Biol. Technol. 56(3):365-370.

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