

Evaluation of Different Bee Attractants for *Apis florea* and Their Effect on the Seed Yield of Niger (*Guizotia abyssinica* (L.f.) Cass)

Abstract

An experiment was conducted during the *Kharif* season of 2022 at the experimental farm of the PC Unit S & N, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, to investigate the impact of various bee attractants on the visitation rate of *Apis florea* and their subsequent influence on the seed yield of niger ~~erepcrops~~. The study employed a ~~Randomized Block Design~~ randomized block design comprising nine treatments with three replications. ~~Results~~The results indicated that the ~~highest~~ greatest number of *Apis florea* visitors was observed at both the 10% and 50% flowering stages with the application of the 10% flower extract of *Madhuca longifolia* (14.67 bees/m²/5 min) and the 10% fruit extract of *Phoenix dactylifera* (14.00 bees/m²/5 min), respectively. These mixtures were followed by 10% rose water solution (13.75 bees/m²/5 min) and 10% sugar solution (13.67 bees/m²/5 min). In the control plots, the bee visitation was lower, ~~reecorded~~ at 5.00 and 3.50 bees/m²/5 min during the 10% and 50% flowering stages, respectively. ~~Water~~The water spray treatments ~~reecorded~~ resulted in slightly ~~higher~~ greater visitation than ~~did~~ the control, with 7.33 and 4.75 bees/m²/5 min. Notably, foliar sprays of *Madhuca longifolia* flower extract, rose water, and *Phoenix dactylifera* fruit extract at 10% concentrations led to significantly ~~higher~~ greater seed yields, producing 6.96 q/ha, 6.42 q/ha, and 6.90 q/ha, respectively, ~~outperforming than did the~~ other treatments.

Keywords: Foliar spray, *Apis florea*, significantly superior, fruit extract of *Phoenix dactylifera* and 10% and 50% flowering ~~stage~~ stages.

1. Introduction

Niger (*Guizotia abyssinica* (L. f.) Cass.), a member of the Asteraceae (Compositae) family, originates from Tropical Africa and holds significant importance in the tribal agricultural systems of India. Often referred to as the "lifeline" of tribal farming and economy, it is typically cultivated by tribal communities on marginal to ~~sub-~~submarginal lands with minimal inputs, primarily under rainfed conditions

(Ranganatha *et al.*, 2009). In India, niger is cultivated over approximately 112.8 thousand hectares, yielding ~~around~~approximately 40.3 thousand tonnes, with an average productivity of 357.2 kg/ha. Madhya Pradesh contributes to this, with ~~about~~approximately 16.0 thousand hectares under cultivation, producing nearly 4.9 thousand tonnes annually, and achieving an average yield of 308.8 kg/ha (Anonymous, 2021–22). Recognized as a minor oilseed crop, niger contributes ~~roughly~~approximately 3% ~~to~~of the country's total edible oil supply (Getinet and Sharma, 1996). The seeds contain 32–40% oil and 18–24% protein. Niger oil is light yellow in color, has a nutty ~~flavour~~flavor, and emits a pleasant aroma (Dwarka *et al.*, 2024a,b,c,d,e). It is free from toxins, and its taste is often compared to that of desi ghee.

Niger is a fully cross-pollinated crop and lacks the ability to self-fertilize (Dwarka *et al.*, 2022). Insect-mediated pollination plays a vital role in improving seed yield, promoting uniform crop maturity, and facilitating earlier harvests in cross-pollinated crops such as niger. One effective yet straightforward approach to ~~boost~~increase pollination is the strategic placement of bee colonies during the flowering phase (Dwarka *et al.*, 2022). A well-organized national-level bee pollination strategy could ~~significantly~~address the country's edible oil deficit ~~significantly~~, even without increasing the ~~amount of~~ land under oilseed cultivation (Mohana Rao *et al.*, 1981). Research on niger has demonstrated yield reductions ranging from 11% to 78% in the absence of honey bees and other natural pollinators. ~~Incorporating~~The incorporation of honey bee colonies alongside niger crops can lead to additional earnings, with estimates ranging from Rs. 252 to Rs. 2125 per hectare, averaging Rs. 1015/ha compared ~~to~~with open-pollinated plots (Anonymous, 2005). Honey bees are considered the most efficient pollinators ~~due to~~because of their foraging behavior and affinity for floral resources. Their effectiveness largely depends on their preference for the target crop over competing flora in the vicinity. To ~~enhance~~increase bee visitation, various attractants—both commercial and ~~traditional~~—have been employed in agricultural settings. These include products such as Bee Line, Bee Here, Bee Scent, Bee Scent Plus, Fruit Boost, Bee-Q, sugar solution, sugarcane juice, jaggery solution and molasses (Dwarka *et al.*, 2022; 2023a,b,c). However, there is limited region-specific information on the use of these attractants within India. ~~With~~Given the growing concerns over pollinator conservation and sustainable agriculture, the present study aims to evaluate the effectiveness of different bee attractants in enhancing the visitation of *Apis florea* and their subsequent impact on seed yield in niger.

2. Method

Jabalpur, situated in the state of Madhya Pradesh, lies along the banks of the Narmada River. The city is positioned at an elevation of approximately 411.78 meters above sea level, between latitudes 22°49' and 24°8" North and a longitude of 78°21" East.

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>Phoenix 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 bee attractants were applied twice, once at the 10% flowering stage and again at 50% flowering. Standard agronomic practices were followed throughout the trial to ensure optimal crop health. Within each treatment plot, a one-square-meter area was randomly selected to record the number of *Apis florea* visiting the flowers during the blooming period. Observations were conducted a day before each application, and subsequently on the 1st, 3rd, 5th, and 7th days following both the first and second applications. Seed yield data were also recorded accordingly. The identification of insect specimens collected during the study was carried out with the support of the Regional Centre of the Zoological Survey of India (ZSI), located in Jabalpur, Madhya Pradesh.

Commented [mw1]: Reference

3. Results and discussion

The findings of the current present study indicated that all the bee attractants applied, were, indeed, had significant effects on the foraging activities of *Apis florea* in niger crops and demonstrated to be the were superior to the indicated parameters in the control situation conditions of unsprayed and without pollinating action are taking place on pollinating plants.

The findings indicated that all the treatments were significantly different differed from one another in attracting *Apis florea*. At the 10% flowering stage, *Apis florea* was attracted to the 10% *M. longifolia* solution (14.67 individuals/m²/5 min), followed by the fruit extract solution of *P. dactylifera* (14 individuals/m²/5 min), rose water (13.75 individuals/m²/5 min) and then the lowest on the control (5 individuals/m²/5 min), followed by water (7.33 individuals/m²/5 min) and 10% honey (10 individuals/m²/5 min).

min). At the 50% flowering stage, the highest population of *Apis florea* was attracted with the flower extract of *M. longifolia* 10% solution (13.50 individual/m²/5min), the fruit extract of *F. dactylifera* 10% solution (11.75 individual/m²/5min), the rose water 10% solution (11.25 individual/m²/5min) followed by the (10.25 individual/m²/5min) juice of *S. officinarum* 10% solution, while it was the lowest (3.50 individual/m²/5min) in the control, followed by the water spray (4.75 individual/m²/5min) and the 10% jaggery solution spray (7.25 individual/m²/5min). The present findings are also supported by the findings of Singh (2015), who reported that bees were observed that visiting the flowers of *Apis florea*. The present results are supported by those of other authors, Manchare *et al.* (2019) reported that a honey solution with 10% flowering had the highest average capacity to attract *Apis cerana indica* to it, averaging (2.32 bees/m²/min), while whereas common jaggery solution 10% solutions with 10% flowering (2.16 bees/m²/min) and molasses with 10% flowering (2.04 bees/m²/min) were the next two highest.

3.3. Seed yield (q/ha)

The analysis of the seed yield data revealed significant differences among the treatments. The highest yield was recorded with the application of a 10% foliar spray prepared from *Phoenix dactylifera* flower extract, which resulted in a yield of 6.96 q/ha. This was closely followed by the 10% rose water treatment, which produced 6.90 q/ha, and the 10% sugar solution treatment, which yielded 6.08 q/ha. The lowest seed yield was produced under the control conditions (3.25 q/ha) and in the presence of water (5.16 q/ha). These findings observed, as it aligns with the findings of Chandrashekhar and Sattigi (2009), who also reported that treatment with bee attractants, such as 10% cacambe and 10% jaggery solution, improved both the quantitative and qualitative characteristics of the radish seeds. The same findings were accomplished by Dwarka *et al.* (2022), which study who reported that a 10% foliar spray treatment with *Madhuca longifolia* flower extract demonstrated a maximum seed yield (6.90 q/ha), which also supporting these findings. This is supported by Jayaramappa *et al.* (2011) and Dwarka *et al.* (2023^{a,b,c}).



Plate: 1:—View of [the niger field](#)



Plate: 2: 10% blooming



Plate: 3: 50% blooming

4. Conclusion

The best [spraying times number of applications](#) for *Apis florea* [werewas](#) obtained [by using via the use of](#) 10% flower extract of *M. longifolia*, 10% fruit extract of *Phoenix dactylifera* and 10% rose water, as [theythe plants](#) were attracted to these treatments, and the seed yield increased at the 10% and 50% flower spraying times.

Table 2: Influence of different attractants on *Apis florea*, and the subsequent seed yield of niger *erocrops* during Kharif, 2022.

Treatments	Population of <i>Apis florea</i> /m ² /5 minutes											Yield (q/ha)	
	1 st spray at 10% blooming					2 nd spray at 50% blooming							
	1DBS	DAS				Mean	1DBS	DAS					Mean
	1DAS	3DAS	5DAS	7DAS			1DAS	3DAS	5DAS	7DAS			
T ₁ -Flower extract of <i>M. longifolia</i> 10%	6.33 (2.61)	13.33 (3.71)	14.33 (3.76)	20.33 (4.56)	10.67 (3.34)	14.67 (3.89)	8.00 (2.86)	11.00 (3.39)	14.00 (3.81)	14.67 (3.86)	11.67 (3.48)	13.50 (3.65)	6.96 (2.73)
T ₂ -Juice of <i>S. officinarum</i> 10%	4.33 (2.18)	11.33 (3.41)	11.00 (3.35)	15.67 (3.98)	8.67 (3.02)	11.67 (3.49)	6.33 (2.60)	9.33 (3.09)	10.33 (3.27)	11.33 (3.44)	9.33 (3.13)	10.25 (3.25)	6.00 (2.55)
T ₃ -Jaggery solution 10%	3.33 (1.94)	14.33 (3.84)	15.00 (3.90)	13.33 (3.70)	9.67 (3.18)	13.08 (3.68)	5.67 (2.48)	6.67 (2.62)	9.67 (3.18)	10.33 (3.28)	8.67 (3.03)	7.25 (3.05)	4.50 (2.24)
T ₄ -Honey solution 10%	2.67 (1.77)	8.00 (2.90)	11.67 (3.48)	14.33 (3.84)	7.00 (2.72)	10.25 (3.28)	5.00 (2.34)	7.33 (2.76)	8.67 (3.01)	10.67 (3.33)	6.67 (2.66)	9.00 (2.97)	5.55 (2.46)
T ₅ - Fruit extract of <i>P. dactylifera</i> 10%	4.67 (2.27)	11.67 (3.48)	15.00 (3.91)	17.00 (4.18)	12.33 (3.58)	14.00 (3.81)	8.67 (3.02)	10.00 (3.24)	11.00 (3.38)	14.00 (3.81)	10.33 (3.29)	11.75 (3.44)	6.42 (2.63)
T ₆ -Sugar solution 10%	5.33 (2.41)	12.33 (3.57)	12.00 (3.53)	18.67 (4.37)	11.67 (3.45)	13.67 (3.76)	5.67 (2.46)	7.67 (2.86)	9.33 (3.13)	11.33 (3.43)	7.67 (2.85)	7.50 (3.08)	6.08 (2.56)
T ₇ -Rose water 10%	2.33 (1.68)	10.33 (3.29)	15.67 (4.02)	19.33 (4.44)	9.67 (3.18)	13.75 (3.77)	7.00 (2.73)	8.00 (2.81)	10.67 (3.34)	13.00 (3.63)	12.00 (3.53)	11.25 (3.38)	6.90 (2.72)
T ₈ -Water spray	2.00 (1.58)	7.00 (2.71)	7.33 (2.78)	11.00 (3.38)	4.00 (2.11)	7.33 (2.80)	3.33 (1.95)	4.00 (2.03)	6.00 (2.54)	7.00 (2.71)	4.33 (2.20)	4.75 (2.41)	5.16 (2.38)
T ₉ -Control	1.33 (1.34)	4.33 (2.09)	5.00 (2.34)	7.00 (2.72)	3.67 (2.02)	5.00 (2.32)	1.67 (1.44)	3.00 (1.86)	3.67 (2.00)	4.00 (2.11)	3.00 (1.86)	3.50 (1.98)	3.25 (1.92)
SEm±	0.12	0.26	0.31	0.21	0.20	0.11	0.20	0.35	0.20	0.25	0.12	0.09	0.03
CD at 5%	0.37	0.78	0.94	0.63	0.61	0.32	0.59	1.03	0.60	0.74	0.36	0.28	0.10

—*Figures in parenthesis are square roots of $\sqrt{x+0.5}$; DAS: Days Before Spraybefore spraying; DAS: Days After Sprayafter spraying.

5. References

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