

Effect of bee attractants on the attraction of *Apis dorsata* and their impact on seed yield of niger, *Guizotia abyssinica* (L.f.) Cass, crop

Abstract

An A experiment study was conducted at experimental farm of PC Unit Sesame and Niger, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, during Kharif 2021. To determine the impact of bee attractants on the attraction of *Apis dorsata* and their impact on seed yield in-of niger crop, the experiment was set up using a RBD with nine treatments and three replications. Research-The results found showed that the both at 10% and 50% flowering stage *Apis dorsata* visit was numerically the highest with treatment,—flower extract of *Madhuca longifolia* 10% with 20.42 and 19.25 *Apis dorsata*/m²/5min, respectively. This was followed by rose water spray with 19.25 and 15.33 *Apis dorsata*/m²/5min, respectively. The population of *Apis dorsata* was received from the controlled condition (4.08 and 6.08 *Apis dorsata*/m²/5min at 10% and 50% flowering stage, respectively). This was followed by water spray (5.75 and 8.58 *Apis dorsata*/m²/5min at 10% and 50% flowering stage, respectively). The foliar spray of mahua flower extract and rose water 10% were found had significantly superior effects over than others treatments in respect to record higher seed yield and recorded 6.90 q and 6.70 q/ha seed yield, respectively.

Keywords: Flower extract, of *Madhuca longifolia* 10%, dates extract, bee, *Apis dorsata* 10% and significantly superior.

1. Introduction

Niger [*Guizotia abyssinica* (L. f.) Cass.] is a native crop plant of Tropical Africa and belongs to the family Asteraceae (Compositae). It is known as lifeline of tribal agriculture and economy in India. It is grown by tribals on marginal and sub-marginal lands with negligible inputs under rainfed conditions (Ranganatha *et al.*, 2009). Niger is produced on an area of 112.8 thousand hectares in India, with a production of 40.3 thousand tonnes and an average productivity of 357.2 kg per hectare. Madhya Pradesh supplies roughly 16.0 thousand hectares of land, with an annual yield of 4.9 thousand tonnes and a seed productivity of 308.8 kg per hectare (Anonymous, 2021-22). It is used as an oilseed crop in India where it provides about 3% of the edible oil requirement of the country (Getinet and Sharma, 1996). The niger seed content of quality oil of 32-40% with 18 to 24% protein in

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the seed-, niger oil, is pale yellow with nutty taste and a pleasant odour. The oil and seeds are free from any toxins and oil taste is similar to desi ghee.

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Niger is self-incompatible plant species with 100 per cent cross-pollinated crop. Insect pollination not only ensures the increase in seed yields of various cross pollinated crops including niger but also improves their quality. It ensures uniform maturity and early harvest of crops. Provision of bee colonies during the flowering period of crop is a simple but essential input. A planned bee pollination programme on national scale significantly contributes in solving the problem of edible oil shortage in the country even at the existing level of land use of oil crops (Mohana Rao *et al.*, 1981)^[7]. Studies on effect of honey bee pollinators in niger crop indicated that the yield was reduced by 11-78 per cent in the absence of honey bee as well as natural pollinators. An additional income of Rs. 252 to Rs. 2125 including Rs. 1015/ha from honey was estimated through beekeeping with niger over open pollinated crops (Anonymous, 2005)^[1]. Honey bees are considered as the most effective and ideal pollinators. Success of pollination with help of honey bees depends on their performance to the target crop over other following plants in the vicinity. Commercial and local bee attractants viz., bee line, bee here, bee scent, bee scent plus, fruit boost, Bee-Q, sugar solution, sugarcane juice, jaggery solution, Molasses, etc. are being used to boost the foraging activities in pea, peach, blue berries, watermelon and apple in the United States, Spain and Canada. However, the related studies on the use of bee attractants in India are scanty. The conservation and management of insect pollinators is gaining importance day by day. In this regard, the present experiment studies on effect of different bee attractants on attraction of rock honey bees and their impact on seed yield were studied.

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2. Material and methods

The studies on effect of bee attractants on foraging activities of rock honey bees in niger crop was conducted in a randomized block design with three replication at experimental farm of PC Unit (ICAR) Sesame and Niger, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, during Kharif 2021.

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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. T₅ -Fruit extract of *Foenix dactylifera* 10%
6. T₆-Sugar solution 10%
7. T₇ -Rose water (Marketed) 10%
8. T₈ -Water spray.
9. T₉-Control

The above mentioned attractants were sprayed two times, first at 10% and second at 50% flowering stages. Recommended agronomical package of practices were followed for raising good and healthy crop. From each plot one-meter square area were selected randomly and number of giant honey bees visited the flowers were recorded. The observations were recorded a day before and 1st, 3rd, 5th and 7th day after first and second spraying and seed yield obtained from different treatments were recorded separately.

3. Results and discussion

The results of the present investigation revealed that all the bee attractants sprayed were significantly affect-effective on foraging activities of rock honey bee in niger crop. They proved superior in recorded parameters over control *i.e.*, unsprayed and without pollinators.

The result revealed that all the treatments were differed significantly to each other in respect to attract the population of *-Apis dorsata*. At 10% flowering stage *Apis dorsata* visit was numerically the highest with treatment, flower extract of *Madhuca longifolia* 10% (20.42/m²/5min) followed by (19.25/m²/5min) lated to the rose water spray and juice of *S. officinarum* 10% (16.42/m²/5min) while it was least-the lowest on-at control (4.08/m²/5min) followed by water spray (5.75/m²/5min) and 10% sugar solution (11.50/m²/5min). At 50% flowering stage, the highest population of *Apis dorsata* was attracted with the plants sprayed with flower extract of *Madhuca longifolia* 10% (19.25/m²/5min) followed by (16.33/m²/5min) fruit extract of *Foenix dactylifera* while it was least (6.08/m²/5min) on control followed by water spray (8.58/m²/5min) and 10% sugar solution spray (10.92/m²/5min). Present findings are also supported by the findings of Nidagundi (2004) they-who reported that spraying cacambe at (10 per cent), Bee-Q at (1.25 per cent) and jiggery solution at (10 per cent) enhanced bee visitation to the flowers of bitter gourd. These findings are in close conformity with the earlier reports of Dwarka *et al.*, (2022) they-who reported that the 10% and 50% flowering stage *Apis dorsata* visit was numerically highest with treatment, mahua flower extract 10% with 50.71 and 52.46 giant honey bees/m²/5min, respectively followed by rose water spray with 43.58 and 44.96 giant honey bees/m²/5min, respectively. The population of giant honey bees was received from the open pollination without any spray (15 and 17.21 giant honey bees/m²/5 min at 10% and 50% flowering stage, respectively) followed by water spray (18.67 and 19.76 giant honey bees/m²/5min at 10% and

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50% flowering stage, respectively). Present findings are corroborated with the findings of Kalmath and Sattigi (2002) ~~they who~~ reported that spraying of cacambe (10 per cent) and jaggery (10 per cent) attracted maximum number of *Apis dorsata* up to 15 days after first and second spray.

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3.3. Seed yield (q/ha)

The data of seed yield revealed that all the treatments were differed significantly to each other in respect to record the higher seed yield. The highest seed yield (6.90 q/ha) was recorded with the treatment in which foliar spray of flower extract of *Madhuca longifolia* 10% was applied followed by (6.70 q/ha) rose water 10 % and (6.30 q/ha) fruit extract of *F. dactylifera* spray while the ~~least-lowest~~ seed yield (3.15 q/ha) was recorded from the controlled condition followed by (4.40 q/ha) 10% jiggery solution and water spray (4.80 q/ha). These findings corroborated with the findings of Chandrashekhar and Sattigi (2009)^[3] they observed that spraying of bee attractant like cacambe (10%) and jaggery solution (10%) were significantly superior in enhancing both quantitative and qualitative parameters of radish seed.

Similarly Jayaramappa *et al.*, (2011)^[5] observed that spraying of fruit ~~boost@0.5ml~~ litre enhanced yield parameters like number of fruits/plants to 19:00 and 17:00 ~~fruits when~~ compared to 10.66 fruits /plant in open pollinated plots.

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4. Conclusion

From the ~~above~~ results of this study, it is concluded that for the attraction of *Apis A. dorsata*, flower extract of *Madhuca M. longifolia* 10% was the best when sprayed at 10% and 50 % flowering stages, followed by rose water 10%, they attracted comparatively higher number of *Apis dorsata* and simultaneously recorded higher seed yield over others.

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Table 2: Effect of different attractants on the attraction of giant honey bee, *Apis-A. dorsata*, Fab. and their impact of seed yield in niger crop.

Treatment	Population of <i>Apis dorsata</i> /m ² /5 minutes											
	1 st spray at 10% flowering						2 nd spray at 50% flowering					
	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%	15.67 (4.02)	25.00 (5.03)	22.33 (4.75)	17.00 (4.17)	17.33 (4.18)	20.42 (4.55)	9.00 (3.08)	18.33 (4.31)	19.33 (4.43)	21.33 (4.66)	19.67 (4.27)	19.25 (4.43)
T ₂ -Juice of <i>S. officinarum</i> 10%	10.67 (3.34)	17.67 (4.24)	19.33 (4.45)	21.67 (4.69)	7.00 (2.67)	16.42 (4.10)	9.67 (3.15)	15.33 (3.97)	14.67 (3.89)	16.67 (4.13)	15.56 (3.39)	14.50 (3.86)
T ₃ -Jaggery solution 10%	9.00 (3.02)	16.00 (3.93)	18.67 (4.36)	20.00 (4.52)	8.33 (2.91)	15.75 (4.02)	9.00 (3.08)	17.67 (4.11)	14.67 (3.87)	15.67 (3.99)	16.00 (3.55)	15.08 (3.94)
T ₄ -Honey solution 10%	8.33 (2.96)	19.33 (4.44)	17.67 (4.24)	19.00 (4.38)	9.33 (3.12)	16.33 (4.08)	7.33 (2.78)	11.67 (3.46)	18.33 (4.33)	15.00 (3.89)	15.00 (3.06)	13.50 (3.73)
T ₅ - Fruit extract of <i>F. dactylifera</i> 10%	8.33 (2.97)	15.33 (3.86)	15.67 (3.95)	14.00 (3.77)	12.00 (3.50)	14.25 (3.83)	6.67 (2.64)	18.00 (4.19)	17.00 (4.16)	17.67 (4.26)	17.56 (3.60)	16.33 (4.08)
T ₆ -Sugar solution 10%	8.00 (2.89)	10.33 (3.29)	15.00 (3.80)	13.33 (3.70)	7.33 (2.66)	11.50 (3.41)	4.33 (2.18)	8.33 (2.94)	15.67 (3.90)	9.00 (3.01)	11.00 (3.27)	10.92 (3.34)
T ₇ -Rose water 10%	8.33 (2.96)	21.00 (4.63)	25.33 (5.07)	20.00 (4.52)	10.67 (3.24)	19.25 (4.43)	8.33 (2.96)	17.67 (4.25)	16.67 (4.08)	17.33 (4.20)	17.22 (3.07)	15.33 (3.96)
T ₈ -Water spray	9.33 (3.12)	5.33 (2.39)	5.67 (2.45)	9.00 (3.07)	3.00 (1.81)	5.75 (2.48)	6.33 (2.60)	7.33 (2.73)	7.00 (2.73)	13.67 (3.76)	9.33 (2.59)	8.58 (3.01)
T ₉ -Control	5.33 (2.40)	4.67 (2.22)	5.00 (2.34)	4.67 (2.24)	2.00 (1.52)	4.08 (2.14)	4.67 (2.26)	4.67 (2.27)	6.00 (2.54)	9.00 (3.03)	6.56 (2.27)	6.08 (2.56)
SEm±	0.22	0.41	0.39	0.29	0.39	0.25	0.22	0.45	0.36	0.31	0.35	0.24
CD at 5%	0.66	1.24	1.17	0.88	1.18	0.74	0.66	1.36	1.07	0.92	1.05	0.71

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

5. References

- Abrol DP. 2010. Foraging behavior of *Apis florea* F. an important pollinator of *Allium cepa* L. J. Apicul. Res., 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. 4th Advance Estimate, Agriculture Statistics Division, Directorate of Economics and statistics, New Delhi. Indian Journal of Natural Products and Resources, 2:221-226.
- Chandrasekhar GS and Sattigi HN. 2009. Influence of bee attractants on bee pollination on seed setting and yield in raddish. Karnataka Journal Agric. Science, 22 (4):777-780.
- Dwarka, Panday AK and Saxena AK. 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.
- Getinet A and Sharma SM. 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 HR. 2011. Influence of bee attractants on yield parameters of Ridge gourd (*Luffa acutangulus* L.) (Cucurbitaceae). *World Applied Science Journal*, 15(4):547-462.
- Kalmath BS and Sattigi HN. 2002. Effect of different attractants on attracting the bees to onion (*Allium cepa*) crop. Indian Bee Journal, 64(6): 68-71.
- Mohana Rao, GM, Lazar M and Suryanarayana MC. 1981. Foraging behaviour of honeybees in sesame (*Sesamum indicum* L.). *Indian Bee J.*, 43:97-100.
- Nidagundi B. 2004. Pollination potentiability of honeybees on yield of bitter gourd (*Momordica charantia* L.). *M.Sc. (Agri.) Thesis*, Univ. Agril. Sci., Bangalore (India).
- Ranganatha ARG, 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.
- Venkataramgowda S, Koragandahalli VJ, Menon A and Ruben MC. 2013. Use of Bee-attractants in Increasing Crop Productivity in Niger (*Guizotia abyssinica*. L). *Braz. Arch. Biol. Technol.* 56(3):365-370.