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Evaluation of different indigenous bee attractants on muskmelon

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Abstract
The experiment was conducted to investigate the evaluation of different indigenous bee attractants with seven different treatments and three replications on muskmelon (*Cucumis melo* Linnaeus) with each plot measuring 5.0 m × 5.0 m size with plant spacing of 1.5 m × 1.0 m. Among the different bee attractants 20% jaggery solution was the best treatment which attracted maximum number bees and helps for pollination in the flowering stage. Table sugar solution 20%, sugarcane juice 20% and jaggery solution 10% were also equally effective in attraction of bees in muskmelon.

Keywords: Bee attractants, *Cucumis melo* L, indigenous and muskmelon

Introduction
Muskmelon (*Cucumis melo* L.) an annual vining plant belongs to the family of Cucurbitaceae, is a native of tropical Africa and also are extensively cultivated in various states of India. It is a tender and warmth loving fruit grown mainly in tropical and sub-tropical regions of the world. Muskmelons consumed fresh or dry as an excellent source of vitamins 'A' and 'C' and also good source of potassium. It is low in calories and high in skin-boosting, eye-strengthening. The fruit help in remedy for constipation, bladder infections, ulcers, fatigue, colitis and stabilize blood pressure. Seed oil is useful in relieving painful discharge and suppression of urine (Parle and Singh, 2011) [3]. Pollination is one of the most important mechanisms in the maintenance and conservation of biodiversity and life on earth. To increase the honey bee, visit to muskmelon would be of great practical value to harvest the benefits of cross pollination. Commercial and local bee attractants *viz.*, bee line, bee here, bee scent plus, fruit boost, bee-Q, sugar solution, sugarcane juice, jaggery solution, honey solution, molasses proved as beneficial to boost the productivity of cross-pollinated crops. Thus, keeping in view the importance of bee attractants on muskmelon, the present study has been proposed.

Materials and Methods
The study was carried out during summer, 2021 with seven different treatments and three replications on Muskmelon crop (Gujarat Muskmelon - 3) with each plot measuring 5.0 m × 5.0 m size with plant spacing of 1.5 m × 1.0 m at Horticultural Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Gujarat.

Treatment details

Tr. No.	Treatment	Concentration (%)	Dose (g or ml)/ 10 litre waters
T_1	Table sugar solution	10 (w/v)	1000
T_2	Table sugar solution	20 (w/v)	2000
T_3	Sugarcane juice	10 (v/v)	1000
T_4	Sugarcane juice	20 (v/v)	2000
T_5	Jaggery solution	10 (w/v)	1000
T_6	Jaggery solution	20 (w/v)	2000
T_7	Untreated control	-	-

The crop was raised by adopting standard recommended agronomical practices. Two foliar sprays of each treatment were applied with the help of Knapsack sprayer fitted with hollow cone nozzle. The sprayer was washed thoroughly prior to the application of each treatment.
In each plot one square meter area was selected and number of bees visited the flowers per one minute was recorded during its peak period. Such observations were recorded a day before,

and 1st, 3rd, 5th and 7th days after first and second spray. First spray was applied at ten% flowering and second spray was applied at ten days after first spray.

Preparation of different indigenous bee attractants

Required quantity of table sugar was added to the water and mixed properly with glass rod till sugar completely dissolved in water, then it was used as spray.

For sugarcane juice, the raw sugarcane was purchased from the nearby market and cleaned the sugarcane with knife and juice was extracted from sugarcane crusher machine. The collected juice was utilized for the spray.

To obtain the jaggery solution, small pieces of jiggery was added in to water and kept for boiling in a medium-sized pan, then kept for cooling in a room temperature. The solution was sieved and utilized for the spray.

Results and Discussion

Evaluation of different indigenous bee attractants on muskmelon

First spray

The data on indigenous bee attractants at one day after spray (DAS) revealed that jaggery solution 20% attracted higher number of bees (3.03 bees/m^2/min.) which was at par with table sugar solution 20% (2.99 bees/m^2/min.), sugarcane juice 20% (2.93 bees/m^2/min.), jaggery solution 10% (2.68 bees/m^2/min.). It was followed by table sugar solution 10% (2.51 bees/m^2/min.). Whereas, least number of bees was recorded in untreated control condition (1.90 bees/m^2/min.). Which was significantly differs from rest of the treatments.

At 3 DAS jaggery solution 20% attracted a greater number of bees (2.96 bees/m^2/min.) which was at par with table sugar solution 20% (2.94 bees/m^2/min.), sugarcane juice 20% (2.84 bees/m^2/min.), jaggery solution 10% attracted number of bees (2.52 bees/m^2/min.). It was followed by table sugar solution 10% (2.45 bees/m^2/min.). Whereas, the minimum number of bees was recorded in untreated control condition (1.91 bees/m^2/min.). Which was significantly differs from remaining treatments.

The similar trend of 3 DAS was also noticed at 5 DAS and 7 DAS. The jaggery solution 20% attracted a highest number of bees (2.69 bees/m^2/min.). Which was at par with table sugar solution 20% attracted (2.56 bees/m^2/min.), sugarcane juice 20% (2.43 bees/m^2/min.), jaggery solution 10% (2.38 bees/m^2/min.). It was followed by table sugar solution 10% (2.28 bees/m^2/min.). Whereas, the significantly minimum number of bees was recorded in untreated control condition (1.92 bees/m^2/min.). At 7 DAS jaggery solution 20% attracted a greater number of bees (2.49 bees/m^2/min.). Which was at par with table sugar solution 20% (2.36 bees/m^2/min.), sugarcane juice 20% (2.33 bees/m^2/min.) and jaggery solution 10% (2.32 bees/m^2/min.). It was followed by table sugar solution 10% (2.15 bees/m^2/min.). Whereas, the significantly least number of bees were recorded in untreated control condition (1.93 bees/m^2/min.).

Second spray

At 1 DAS jaggery solution 20% attracted significantly highest number of bees (3.11 bees/m^2/min.). Which was at par with table sugar solution 20% (3.10 bees/m^2/min.), sugarcane juice 20% (3.06 bees/m^2/min.) and jaggery solution 10% (2.98 bees/m^2/min.). It was followed by table sugar solution 10% (2.48 bees/m^2/min.). The minimum number of bees was recorded in untreated control condition (2.08 bees/m^2/min.). Which was significantly differs from other treatments.

At 3 DAS jaggery solution 20% attracted a greater number of bees (2.75 bees/m^2/min.). Which was at par with table sugar solution 20% (2.68 bees/m^2/min.), sugarcane juice 20% (2.58 bees/m^2/min.), jaggery solution 10% (2.44 bees/m^2/min.). It was followed by table sugar solution 10% (2.34 bees/m^2/min.). While, least number of bees were recorded in untreated control (2.10 bees/m^2/min.).

At 5 DAS jaggery solution 20% attracted a maximum number of bees (2.66 bees/m^2/min.). Which was at with sugar solution 20% (2.58 bees/m^2/min.), sugarcane juice 20% (2.56 bees/m^2/min.), jaggery solution 10% (2.37 bees/m^2/min.). It was followed by table sugar solution 10% (2.28 bees/m^2/min.). Whereas, the least number of bees was recorded in untreated control (2.14 bees/m^2/min.).

Similar trend of 5 DAS was noticed in 7 DAS also. Jaggery solution 20% attracted a greater number of bees (2.51 bees/m^2/min.). Which was at par with table sugar solution 20% (2.50 bees/m^2/min.), sugarcane juice 20% (2.45 bees/m^2/min.), jaggery solution 10% (2.23 bees/m^2/min.). It was followed by table sugar solution 10% (2.18 bees/m^2/min.). Whereas, the minimum number of bees was recorded in untreated control condition (2.15 bees/m^2/min.).

From the first and second spray of the indigenous bee attractants it is revealed that jaggery solution, sugar solution and sugarcane juice have attracted the greater number of bees compared to untreated control. Further, it will enhance the yield of the crops. These findings are in agreement with Pateel and Sattagi (2007) [4] who ascertained that jaggery solution 10% and sugar solution 10% were efficient in attracting more bees up to third day after first, second and third spray. Wankhede *et al*. (2019) [5] reported jaggery solution 10 and sugar solution 10% sugar solution, sugarcane juice 10% were found superior in attracting maximum number of bees like *Apis mellifera* and *A. cerana indica* in cucumber crop which is also close association with the present finding. The study by scientists Manchare *et al*. (2020a) [1] and Manchare *et al*. (2020b) [2] revealed that *A. dorsata* and *A. mellifera* were attracted maximum to jaggery solution 10% up to 5th day after first spray and 7th day after second spray which are also in close conformity with present findings.

Table 1: Evaluation of indigenous bee attractants on activity of bees on muskmelon flower

Tr. No.	Treatments	Number of bees/m²/min.									
		DBS	1st spray				DBS	2nd spray			
			1 DAS	3 DAS	5 DAS	7 DAS		1 DAS	3 DAS	5 DAS	7 DAS
T1	Table sugar solution 10%	1.95 (3.28)	2.51 (5.80)	2.45 (5.52)	2.28 (4.68)	2.15 (4.12)	2.02 (3.58)	2.48 (5.65)	2.34 (4.97)	2.28 (4.68)	2.18 (4.27)
T2	Table sugar solution 20%	1.90 (3.10)	2.99 (8.46)	2.94 (8.14)	2.56 (6.03)	2.36 (5.05)	2.20 (4.33)	3.10 (9.10)	2.68 (6.70)	2.58 (6.17)	2.50 (5.76)
T3	Sugarcane juice 10%	1.96 (3.36)	2.40 (5.26)	2.43 (5.40)	2.17 (4.19)	2.12 (3.98)	2.13 (4.03)	2.37 (5.12)	2.32 (4.88)	2.20 (4.33)	2.16 (4.17)
T4	Sugarcane juice 20%	2.01 (3.54)	2.93 (8.09)	2.84 (7.57)	2.43 (5.40)	2.33 (4.93)	2.23 (4.49)	3.06 (8.87)	2.58 (6.17)	2.56 (6.03)	2.45 (5.50)
T5	Jaggery solution 10%	1.95 (3.28)	2.68 (6.70)	2.52 (5.87)	2.38 (5.14)	2.32 (4.88)	2.20 (4.33)	2.98 (8.40)	2.44 (5.45)	2.37 (5.12)	2.23 (4.49)
T6	Jaggery solution 20%	1.99 (3.45)	3.03 (8.66)	2.96 (8.24)	2.69 (6.74)	2.49 (5.70)	2.20 (4.33)	3.11 (9.18)	2.75 (7.06)	2.66 (6.58)	2.51 (5.80)
T7	Untreated control	1.89 (3.07)	1.90 (3.10)	1.91 (3.15)	1.92 (3.19)	1.93 (3.22)	2.04 (3.67)	2.08 (3.83)	2.10 (3.92)	2.14 (4.08)	2.15 (4.12)
S.Em. ±		0.14	0.14	0.15	0.11	0.11	0.11	0.17	0.13	0.11	0.10
C. D. (P = 0.05)		NS	0.43	0.45	0.35	0.33	NS	0.51	0.40	0.35	0.30
C. V. %		12.67	9.14	9.89	8.34	8.23	9.14	10.47	9.11	8.21	7.19

Note: DBS: Days before Spray, DAS: Days after Spray, Figures in parentheses are retransformed values of $\sqrt{X + 0.5}$ transformation

Conclusion

First spray

At 1 day after spray (DAS) jaggery solution 20% attracted higher number of bees (3.03 bees/m^2/min.). Whereas, least number of bees were recorded in untreated control condition (1.90 bees/m^2/min.). At three DAS jaggery solution 20% attracted a greater number of bees (2.96 bees/m^2/min.). Whereas, the minimum number of bees were recorded in untreated control condition (1.91 bees/m^2/min.).

At five DAS jaggery solution 20% attracted highest number of bees (2.69 bees/m^2/min.). The minimum number of bees was recorded in untreated control condition (1.92 bees/m^2/min.). At seven DAS jaggery solution 20% attracted a maximum number of bees (2.49 bees/m^2/min.). Whereas, least number of bees recorded in untreated control condition (1.93 bees/m^2/min.).

Second spray

The data on indigenous bee attractants at one DAS revealed that jaggery solution 20% attracted higher number of bees (3.11 bees/m^2/min.). Significantly minimum number of bees were attracted to untreated control condition (2.08 bees/m^2/min.). At three DAS jaggery solution 20% attracted a highest number of bees (2.75 bees/m^2/min.). However, the least number of bees were recorded in untreated control condition (2.10 bees/m^2/min.).

At five DAS jaggery solution 20% attracted a maximum number of bees (2.66 bees/m^2/min.). Significantly least number of bees was recorded in untreated control condition (2.14 bees/m^2/min.). At 7 DAS recorded that jaggery solution 20% attracted a greater number of bees (2.51 bees/m^2/min.). Whereas, the minimum number of bees was recorded in untreated control condition (2.15 bees/m^2/min.).

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