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Influence of bee attractants on yield parameters of sunflower

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Abstract

The present investigation was conducted to find out the influence of bee attractants on foraging activity of honey bee in sunflower. The research work was carried out on field of Division of Entomology RSCM College of Agriculture, Kolhapur during *summer* season 2023. The results obtained are summarized below. The results revealed that the highest number of seeds/capitulum (1164.07) was recorded in the treatment of jaggery solution 10%. Further, the lowest per cent of chaffiness (4.33%) was also found in treatment with jaggery solution 10%. Significantly, higher test weight (45.67 g) was recorded in jaggery solution 10%. The crop sprayed with jaggery solution 10 per cent recorded highest seed yield per plant (47.60 g) and the highest seed yield per hectare (26.50 q/ha). Subsequently, open pollination with water spray (19.97 q/ha) and pollination without insects (12.23 q/ha) was recorded lowest yield. It was followed by lemongrass oil 1% (25.87 q/ha), lemongrass oil 0.5% (24.97 q/ha), sugar solution 5% (24.43 q/ha) and jaggery solution 5% (23.83 q/ha).

Keywords: Sunflower, honey bees, bee attractants, jaggery solution 10%, lemongrass oil 1%, pollination without insect, open pollination

Introduction

The sunflower (*Helianthus annuus* L.) belongs to the Asteraceae family. Sunflower is a major oil seed crop in India, with both home and commercial applications. It is also known as 'Surajmukhi'. The world's sunflower acreage was 28.74 mh, with 50.70 mt production and a productivity of 2090 kg/ha. In India, total sunflower growing area was 0.28 mh, with 0.25 mt production and 905 kg/ha productivity. The total area of sunflower farming in Maharashtra was 0.03 mh, with a production of 0.01 mt and a productivity of 531 kg/ha (Anon, 2022). According to (Krishna *et al.*, 2014), sunflower seed has 35% edible oil and sunflower cake contains 40–45% protein. This crop is perfect for growing in any season due to its short lifespan, wide range of adaptation, tolerance for drought, and photo insensitivity traits. The desire to increase oilseed output is well known as a result of the imbalance between supply and demand for edible oils. Sunflower is protandrous and self-incompatible in which male and female parts mature at different times, there appears to be a time lag of 18.24 hrs in the maturity of male and female parts in Sunflower (Singh *et al.*, 2000) ^[12].

Sunflower is cross pollinated crop, pollination through anemophily is hampered by the morphological differences between stamens and pistils, self-incompatibility in breeding, and poorly wind-adapted pollen. When pollinating insects visit, the floral arrangement and timing of flower opening enable them to be helped (McGregor, 1976; Free, 1993) ^[7, 3]. According to Morgado *et al.*, (2002) ^[8], bees are the most significant insects in the pollination of sunflowers. Bees visit more flowers than other insects because they need to feed their colony, as opposed to other insects that simply go to flowers for their own sustenance (Muller *et al.*, 2006) ^[9].

Important agronomic traits of sunflower (*Helianthus annuus* L.) include resilience to heat, cold, and drought. Sunflower farming offers intercropping and crop succession in seed-producing regions, making it a significant economic alternative in crop rotation (Porto *et al.*, 2007) ^[11]. Sunflower is one of several oilseed crops that is valued for both home and commercial purposes. The Indian subcontinent is home to the sunflower plant, *Helianthus annuus*.

This plant is utilized in oil fields to produce significant amounts of oil. People are more interested in purchasing sunflower oil in place of mustard oil in the market today due to a diet low in cholesterol and high in unsaturated fatty acids (lipids). Doctors also advise replacing this oil with another cooking medium when a patient is obese. For large scale production sunflower field is now fetch money for farmers in India.

Materials and Methods

The experiment was conducted in *summer* season 2022-23 at the farm of Division of Agricultural Entomology Rajarshree Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur and Kolhapur is situated at 16° 41’ North Latitude and 74° 14’ East Longitude and at an altitude of 545.6 m above the mean sea level (MSL) and has tropical climate. The place lying in Western Ghat Mountain zone (Zone-9), receives an annual rainfall of about 1100-1190 mm with hot and dry summer with cool winter. The field selected for the experiment was uniform with medium laterite soil with medium fertility and good drainage. The experimental field was prepared by deep ploughing once followed by two harrowing. Then field was subsequently cleaned by picking stubbles of previous crops and ridges and for row made with the help tractor. The seeds were sown by dibbling method in the field. The variety Kaveri champ was used for sowing. Seeds were sown on 31. 01. 2023 at the spacing of 60 cm x 30 cm.

Experimental details

Season	Summer- 2023
Crop	Sunflower
Insect	Honey bee (<i>Apis cerana indica</i>)
Variety	Kaveri Champ
Spacing	60x30 cm
Seed rate	6 kg/ha
Plot size	6 x4 m
Design	Randomized Block Design
Treatment	11
Replication	3

Treatment Details

Treatment No.	Treatment	Dose/L
T ₁	Jaggery solution 5%	50gm
T ₂	Jaggery solution 10%	100gm
T ₃	Lemongrass oil 0.5%	5ml
T ₄	Lemongrass oil 1%	10ml
T ₅	Cumin oil 0.5%	5ml
T ₆	Cumin oil 1%	10ml
T ₇	Orange oil 0.5%	5ml
T ₈	Orange oil 1%	10ml
T ₉	Sugar solution 5%	50gm
T ₁₀	Pollination without insect	Nylon net
T ₁₁	Open pollination	water

Methodology

Number of seeds per capitulum: This observation will be made by selecting 5 heads at random from each replication of treatment during harvesting. The seeds in each head will be counted and mean seeds per head will be calculated as per method suggested by (Osman and Siham, 2015) [10].

Seed yield /plant: Observation was made by selecting five heads after threshing of individual heads weight by using electronic balance as per method suggested by (Osman and Siham, 2015) [10].

Test weight (weight of 1000 seeds)

This observation will be made by weighing 1000 dried seeds sample randomly from each treatment by using electronic balance as per method suggested by (Osman and Siham, 2015) [10].

Per cent chaffiness

This observation will be record from 5 randomly selected head, number of healthy seeds and crinkled seeds will be separated and percentage of crinkled seeds will be calculated by given formula as per method suggested by (Osman and Siham, 2015) [10].

$$\text{Per cent of chaffiness} = \frac{\text{Number of unfilled seeds/head}}{\text{Total number of seeds/plant}} \times 100$$

Yield of sunflower

The observations were recorded for seed yield on five randomly selected heads form each treatment and the yield per treatments were later converted into yield in q/ha by given formula as per method suggested by (Osman and Siham, 2015) [10].

$$\text{Yield / ha} = \text{Weight of seeds per head} \times \text{number of plants per hectare}$$

Results and Discussion

The result of the present investigation revealed that, all the bee attractants sprayed were significantly influence on seed yield and yield attributing characters.

Influence of bee attractants on yield parameters of sunflower

Number of seed / capitulum: The data presented in table no.3 and figure no. 1 revealed that the maximum number of seed per capitulum was observed in the plots treated with jaggery solution 10% (1164.07 seeds/capitulum) and found superior. It was followed by lemongrass oil 1% (1120 seeds/capitulum), lemongrass oil 0.5% (1096.67 seeds/capitulum), sugar solution 5% (1033.47 seeds/capitulum) and jaggery solution 5% (1022.67 seeds/capitulum). The lowest number of seeds per capitulum was found in pollination without insect (730.93 seeds/ capitulum) it was followed by open pollination with water spray (901.47 seeds / capitulum) and cumin oil 0.5% (935.27 seeds/capitulum).

Seed yield per plant: The data presented in table no.3 and fig no. 3 indicated that the plot sprayed with jaggery solution 10% was found superior over all treatments by recording highest seed yield per plant (47.60 g). It was followed by lemongrass oil 1% (46.67 g), lemongrass oil 0.5% (45.00g), sugar solution 5% (44.00g) and jaggery solution 5% (43.00g). The lowest seed yield per plant recorded in pollination without insect (22.07 g) it was followed by open pollination (36.00g), cumin oil 0.5% (36.50g).

Test weight: The data presented in table no.3 and figure no. 3 revealed that the maximum test weight was recorded in the treatment of jaggery solution 10% (45.67 g) and found superior. It was followed by lemongrass oil 1% (43.33g), lemongrass oil 0.5% (42.00g), sugar solution 5% (41.67g) and jaggery solution 5% (41.33g). The lowest test weight was obtained from pollination without insect (27.67 g) it was followed by open pollination (36.67 g), cumin oil 0.5% (37.33 g).

Chaffiness percentage: The data in table no.3 and figure no.4 revealed that the lowest chaffiness percentage was found in plots treated with jaggery solution 10% (4.33 %) it was followed by lemongrass oil 1% (5.17 %), lemongrass oil 0.5% (6.00 %), sugar solution 5% (7.00 %) and jaggery solution 5% (7.40 %). The maximum chaffiness were found in the pollination without insect (35.67 %) it was followed by open pollination with water spray (11.00 %), cumin oil 0.5% (10.33 %).

Yield per hectare: The data presented in table no.3 and figure no. 2 indicated that the highest yield was obtained from the plots treated with jaggery solution 10% (26.50 q/ha) and found superior. It was followed by lemongrass oil 1% (25.87 q/ha), lemongrass oil 0.5% (24.97 q/ha), sugar solution 5% (24.43 q/ha) and jaggery solution 5% (23.83 q/ha). The lowest yield obtained from pollination without insect (12.23 q/ha) followed by open pollination with water spray (19.97 q/ha), cumin oil 0.5% (20.23 q/ha).

The impact of various treatment on yield parameters of sunflower at flowering stage treated with bee attractants which attracts the activity of pollinating agent mostly the honey bees then it leads to increasing the pollination activity. In oilseeds *i.e.*, Sunflower 32-48 per cent yield increase due to honey bee pollination. Honey bee plays a major role in the production of the sunflower. The present study is based on the

influence of bee attractant spraying on sunflower yield contributing characters.

The bee attractant spraying on sunflower at 50 % flowering period significantly attracts honey bees and its positive impact on the yield contributing characters of sunflower. All the yield parameters of sunflower recorded were higher than open pollination (Water). The yield contributing character recorded highest in the plots treated with Jaggery solution 10%. The lowest yield parameters of sunflower recorded in plots which are excluded from pollinating agent (PWI).

These results are in close agreement with findings of Jayarammappa and Bhargava (2015) ^[4] indicate that applications of Bee-Q at 12.5 g/l and Fruit boost at 0.75 ml/l on sunflower plots significantly increased the number of bee foragers compared to open pollinated crop. The plot receives the bee attractants significantly enhanced the seed set, seed weight, and germination of sunflower. Also, revealed lowest number of Chaffee seed (3.87) was produced in the crop that received Jaggery solution 15% in sunflower Thousand seed weight (47.00g) was maximum in sunflower treated with 15% jaggery solution and minimum recorded on 10% glucon-D solution (39.00g). Similarly highest seed yield q/ha observed on 15% jaggery solution treated plot and minimum without treated plot was (14.76q/ha and 9.27q/ha). As evidenced in the present investigation are in conformity with Krishna *et al.* (2014) on sunflower, Manchare *et al.* (2019) ^[6] on buckwheat and Das and Jha (2019) ^[2] on sesame.

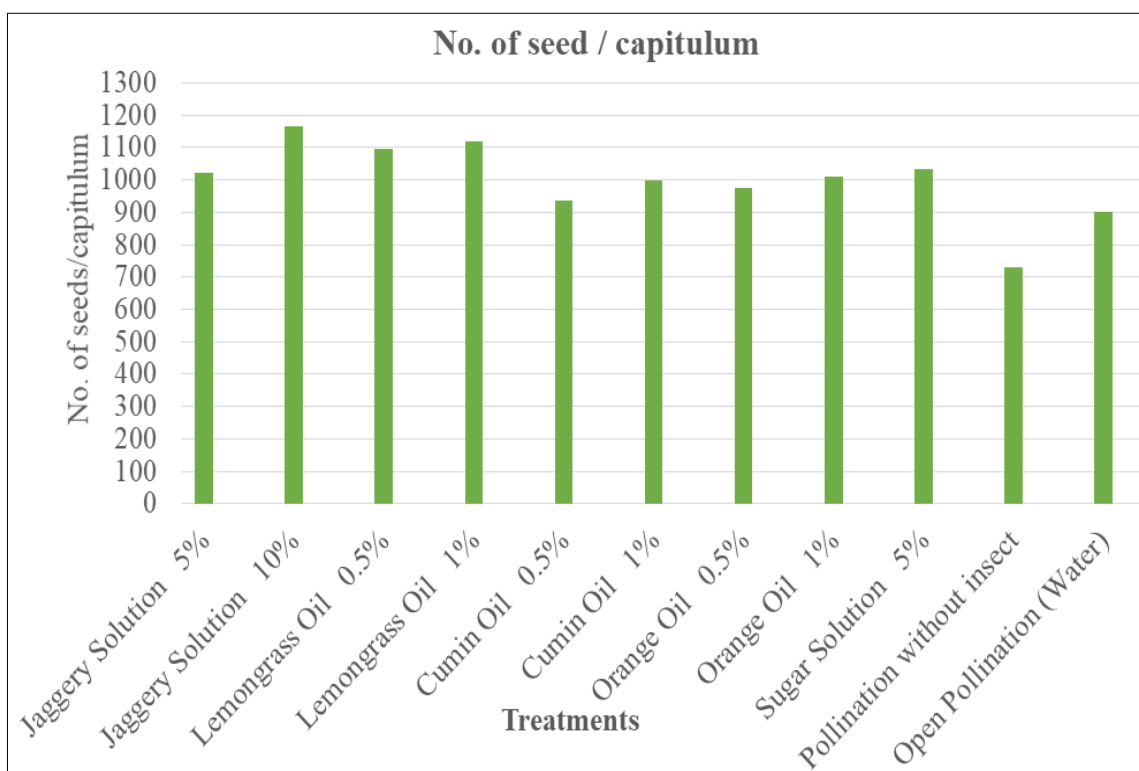


Fig 1: Influence of bee attractants on yield parameters of sunflower (Number of seeds/ capitulum)

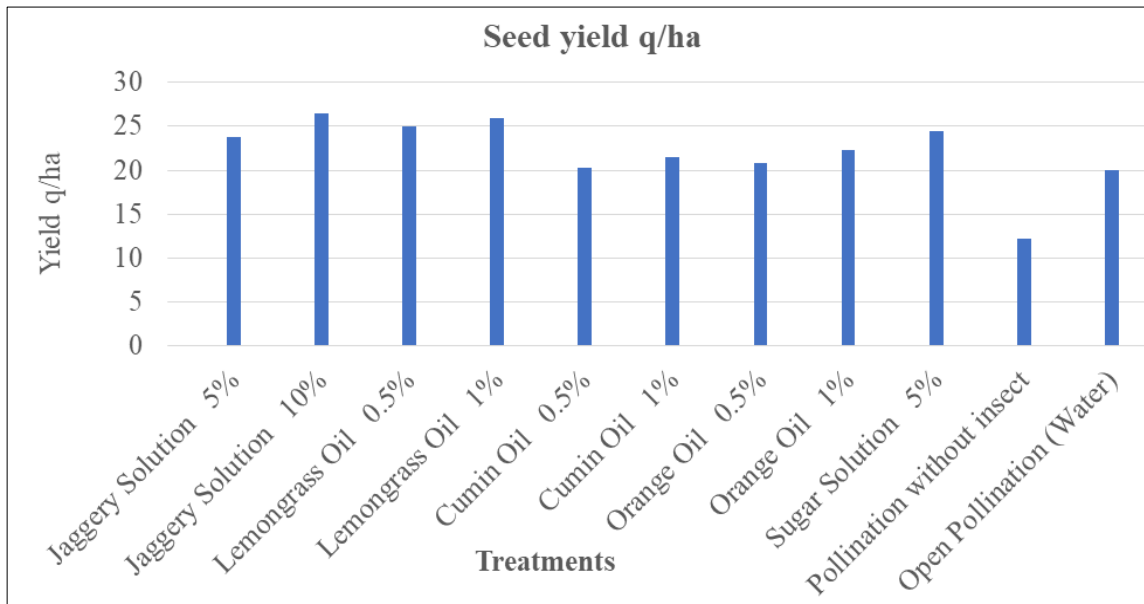


Fig 2: Influence of bee attractants on yield parameters of sunflower (Seed yield q/ha)

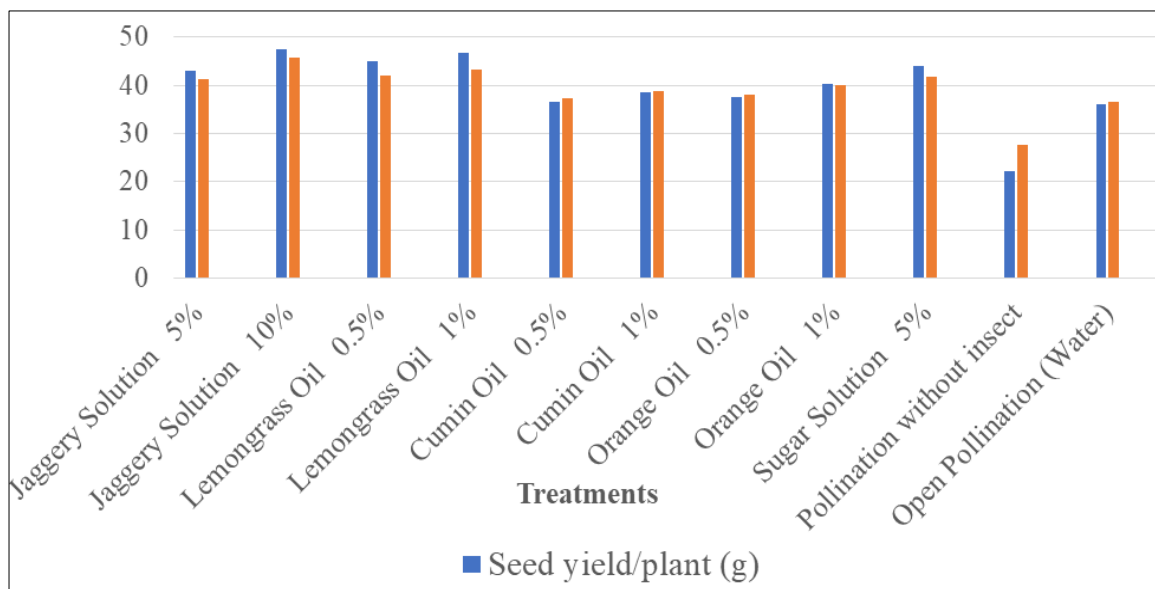


Fig 3: Influence of bee attractants on yield parameters of sunflower (Seed yield/plant (g) and Test weight (g))

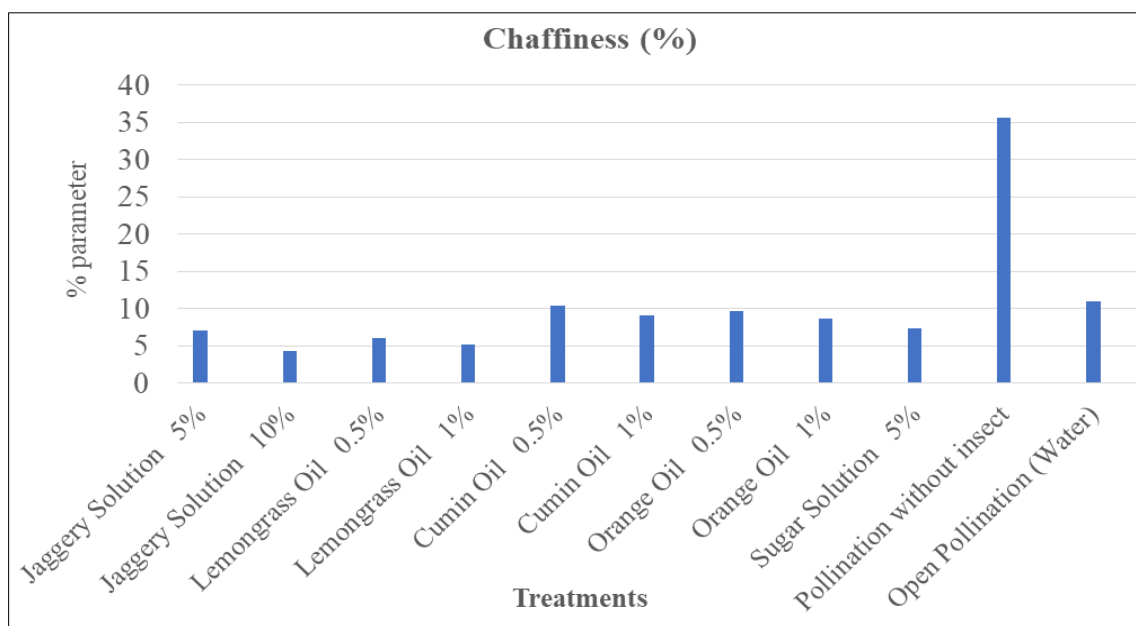


Fig 4: Influence of bee attractants on yield parameters of sunflower (Chaffiness %)

Table 3: Influence bee attractants on yield parameters of sunflower

Tr. No.	Treatment name	*No. of seed /capitulum	Seed yield/Plant(g)	Test weight (g)	**Chaffiness (%)	Seed yield q/ha
T ₁	Jaggery Solution 5%	1022.67(31.73)	43.00	41.33	7.40(15.75)	23.83
T ₂	Jaggery Solution 10%	1164.07(35.01)	47.60	45.67	4.33(11.93)	26.50
T ₃	Lemongrass Oil 0.5%	1096.67(32.61)	45.00	42.00	6.00(14.14)	24.97
T ₄	Lemongrass Oil 1%	1120.00(33.26)	46.67	43.33	5.17(13.09)	25.87
T ₅	Cumin Oil 0.5%	935.27(30.32)	36.50	37.33	10.33(18.74)	20.23
T ₆	Cumin Oil 1%	999.00(30.83)	38.60	38.87	9.13(17.58)	21.43
T ₇	Orange Oil 0.5%	973.67(30.31)	37.47	38.00	9.67(18.07)	20.80
T ₈	Orange Oil 1%	1010.33(31.45)	40.20	40.00	8.67(17.09)	22.33
T ₉	Sugar Solution 5%	1033.47(32.00)	44.00	41.67	7.00(15.24)	24.43
T ₁₀	Pollination without insect	730.93(26.46)	22.07	27.67	35.67(37.53)	12.23
T ₁₁	Open pollination (Water)	901.47(29.27)	36.00	36.67	11.00(19.21)	19.97
	SE±	1.22	2.02	1.85	1.04	1.12
	CD@5%	3.61	5.96	5.49	2.99	3.32
	CV%	7.10	8.80	8.19	9.73	8.83

*Figures in the parenthesis are $\sqrt{(x + 0.5)}$ transformed values

**Figures in the parenthesis are arc sin transformed values

Conclusion

The higher yield contributing characters like number of seeds (1164.07 seeds/capitulum), test weight (45.67 g), Seed yield/plant (47.67g), total yield (26.50 q/ha) and chaffiness (4.33%) were recorded in 10 per cent jaggery solution and found to be the best attractant followed by lemon grass oil (1%), lemon grass oil (0.5%), sugar solution (5%) and jaggery solution (5%). As against, lowest yield and yield related attributes recorded in pollination without insects and open pollination.

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