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Effect of bee pollination on quantitative parameters of muskmelon (*Cucumis melo* L.)

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ABSTRACT:

The present study was carried out with the object of "Effect of bee pollination on quantitative parameters of muskmelon (Cucumis melo L.)" during summer 2020 at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat). In the present experiment, the highest (90.00%) fruit set was recorded in Open pollination (OP), Hand pollination (HD) (88.00%) and Pollination by A. mellifera (86.00%), followed by Pollination by A. cerana and Pollination by the stingless bee. While in the case of Absolute control, the lowest 20.00 per cent fruit set was observed. The highest weight of fruit (704.92 g) was recorded in HP followed by OP (607.78 g) and Pollination by A. mellifera (597.82 g) as compare to other treatments. The lowest fruit weight was observed in Absolute control (225.34 g).The maximum number of seed settings in single fruit (302.98 seeds/fruit) was noted in OP, HP (289.49 seeds)and Pollination by A. mellifera(270.23 seeds), followed by Pollination by A. cerana (251.35 seeds)and Pollination by the stingless bee(242.21 seeds). The horizontal diameter of fruit (35.50 cm/fruit) was noted extreme in OP, Pollination by A. mellifera (33.70 cm/fruit) and HP (33.25 cm/fruit), the minimum fruit diameter (14.50 cm) was recorded in Absolute controlin muskmelon crop.

Keywords: Pollination, *Apis mellifera*, *Apis cerana*, Stingless bees, Honey bees, Muskmelon

1.INTRODUCTION

Muskmelon is an important truck and kitchen garden crop. It is named 'muskmelon' because of the delightful musky flavour of the ripened fruits. It is a good source of water, minerals, carbohydrates, protein, lipid, iron and vitamins in human diet. The muskmelon pollen is heavy and sticky, so it does not move through wind flows. The muskmelons are pollinated by many insects, including bees. Exploration of insect pollinators on muskmelon flowers provided food (nectar and pollen) to them. The anthesis and dehiscence are the important characters to understand the plant-pollinator interaction. Honey bees play an important role in the production of greater fruit quality, fruit set, seed set, fruit weight and fruit circumference of muskmelon (Al-Ghzawi and Zaitoun**,** 2007). The information on the foraging behaviour and the effect of bee pollination on quantitative parameters of muskmelonis scanty in South Gujarat situations. Therefore, it is necessary to evaluate the effect of bee pollination on quantitative parameters of muskmelon (*Cucumis melo* L.).

2.MATERIALS AND METHODS

The studies on "Effect of bee pollination on quantitative parameters of muskmelon (*Cucumis melo* L.)"were conducted during summer 2020 at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat. The effect of bee pollination on quantitative parameters of muskmelon crop was investigated using pollination by three different domesticated bee species *viz*., *Apis cerana indica*, *Apis mellifera* and stingless bees and compared with open pollination (OP), hand pollination (HP) and crop without insect pollination (WIP).The data was subject to analyzed of variance by a completely randomized design (CRD).

The experimental plots of treatment T_1, T_2, T_3, T_5 and T_6 were covered by insect-proof double sewed nylon net measuring 9x 6x 3.25m having a fastener at one side, before initiation of flowering in the muskmelon crop. Healthy colonies with a young queen and large brood area of test species *viz*.,*A. cerana indica*, *Apis mellifera* and stingless bees having around three thousand bee workers were kept at the initiation of flowering in the caged crop. Twenty female flowers were hand-pollinated in a hand-pollinated plot. The hand-pollinated flower was immediately covered with a butter paper bag. In the open pollination treatment, twenty female flowers were tagged in each replication.Fruit setting, fruit weight, seed setting and fruit diameter were recorded from randomly selected 10 fruits from each treatrment.

3.RESULTS AND DISCUSSION

3 .1 Per cent fruit setting

During the summer of 2020, the result showed that the highest (90.00%) fruit set was recorded in T_4 - Open pollination, which was found at par with T_5 - Hand pollination(88.00%)and T_2 - Pollination by *A. mellifera*(86.00%), followed by T_1 - Pollination by *A. cerana*(80.00%)and T_3 - Pollination by the stingless bee (76.00%)in muskmelon crop. While in the case of T_6 - Absolute control, the lowest 20.00 per cent fruit set was observed. The descending order of the effect of different pollinators on the fruit set was recorded as $T_4 \geq T_5 \geq T_2 > T_1 \geq T_3 > T_6$(Table and Fig. 1).The present work is in confirmation with the work of Sarwar *et al.* (2008) who showed that the treatment of open plot gave a maximum (85.4%) fruit set in cucumber and the lowest 12.60 per cent in crop covered without bees at Rawalpindi, Pakistan.The results of the present works are in corroboration with Al-Ghzawi and Zaitoun (2007) who noted significantly higher fruit setting in pollination by *A. mellifera* as compared to covered plants inJordan in muskmelon crop. According to Hossain *et al.* (2018) the fruit set was significantly higher in hand pollination (70.68%) and open pollination (62.09%) than without honey bee pollination (48.96%) in Dhaka, Bangladesh.

Table 1: Effect of different pollination treatments on quantitative parameters of muskmelon

Treatments		Fruit set (%)	Fruit weight (g)	Seed setting (No. of seeds/fruit)
T_1	Pollination by *A. cerana*	64.11 (80.00)	22.46 (505.44)	15.85 (251.35)
T_2	Pollination by *A. mellifera*	68.75 (86.00)	24.45 (597.82)	16.42 (270.23)
T_3	Pollination by stingless bees	61.43 (76.00)	22.11 (489.30)	15.55 (242.21)
T_4	Open pollination	72.05 (90.00)	24.64 (607.78)	17.42 (302.98)
T_5	Hand pollination	70.40 (88.00)	26.54 (704.92)	17.00 (289.49)
T_6	Absolute control	26.64 (20.00)	15.01 (225.34)	9.97 (98.99)
SEm±		2.10	0.50	0.40
CD (P=0.05)		6.14	1.45	1.17

Note: Figure in parentheses is the original value, those outside are arc sin (In fruit set) and SQRT(In fruit weight and seed setting) transformed values

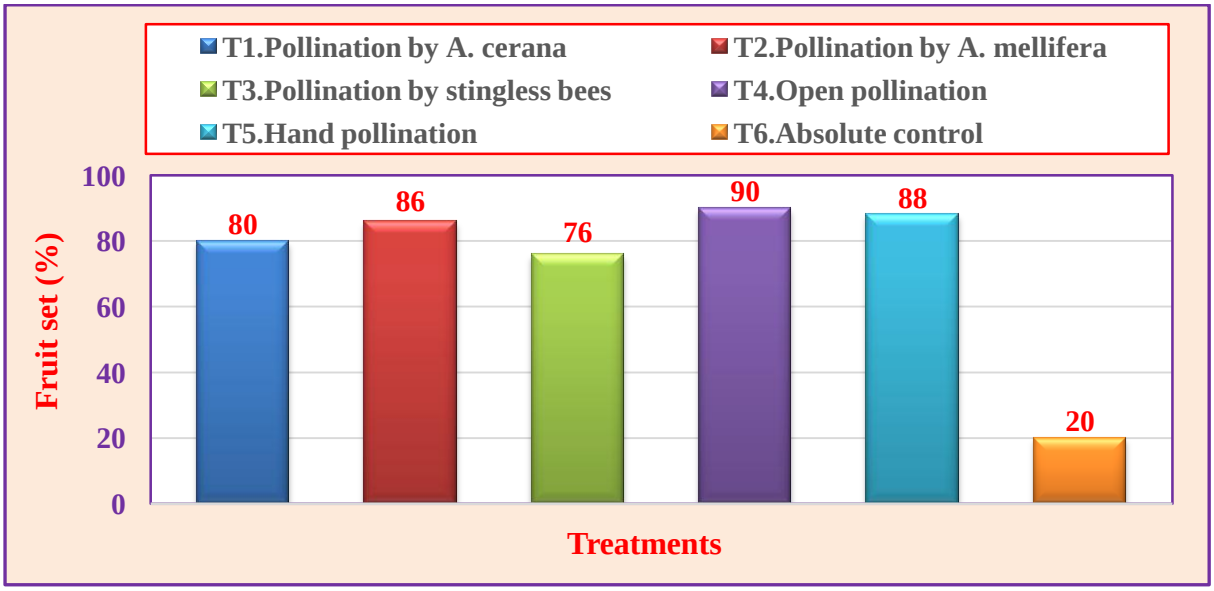

Fig 1: Effect of different pollination treatments on fruit setting of muskmelon

3.2 Fruit weight

In summer 2020, the highest weight of fruit (704.92 g) was recorded in T_5 - Hand pollination followed by T_4 - Open pollination(607.78 g) and it was found at par with T_2 - Pollination by *A. mellifera*(597.82 g). The next in order T_1 - Pollination by *A. cerana*(505.44 g)was found at par with T_3 - Pollination by the stingless bee(489.30 g). The lowest fruit weight was observed in T_6 - Absolute control (225.34 g). The descending order of the effect of different treatments was recorded as $T_5 > T_4 \geq T_2 > T_1 \geq T_3 > T_6$(Table 1).The results of the present study are more or less similar to the results of Al-

Ghzawi and Zaitoun (2007) who recorded the higher fruit weight in muskmelon due to pollination by *A. mellifera* as compared to covered plants in Jordan.Present work closelymatched with work done by Bhowmik *et al*. (2017) who reported the higher fruit weight of coriander in open pollination conditions. The results are in corroboration with Hossain*et al*. (2018) who recorded equally higher fruit weight in hand (985.13 g) and open pollination (977.87 g), whereas lower fruit weight was found in without bee pollination in cucumber crops in Dhaka, Bangladesh.Gothi (2021) at Dantiwada also recorded higher fruit weight in open pollination in muskmelon.Present work is a little bit deviated from Rasool (2018), who reported the highest fruit weight in *A. cerena* (11.73 g/1000 seeds) followed by open pollination (10.82 g/1000 seeds), *A. melliferra* (10.50 g/1000 seeds) and control 8.77 g/1000 seeds at Wadura (Jammu and Kashmir) in coriander, these might be due to pollinators' deficiency in the open pollination crop plot during investigation.

3.3 Seed setting

In summer 2020,the maximum number of seed settings in single fruit (302.98 seeds/fruit) was noted in T_4 - Open pollination, it was at par with T_5 - Hand pollination (289.49 seeds)and T_2 - Pollination by *A. mellifera*(270.23 seeds), followed by T_1 - Pollination by *A. cerana*(251.35 seeds)and it was found at par with T_3 - Pollination by the stingless bee(242.21 seeds). The minimum number of seeds (98.99 seeds) was noted in T_6 - Absolute control. The descending order of the effect of different pollinators on the seed set was recorded as $T_4 \geq T_5 \geq T_2 > T_1 \geq T_3 > T_6$(Table 1).The results of the current experiment are very close to the work of Al-Ghzawi and Zaitoun (2007) who noted a higher seed setting in pollination by *A. mellifera* treatment as compared to covered plants in muskmelon inJordan.The present work is more or less in agreement with Hossain *et al.* (2018) as they reported the highest seed yield of cucumber from netting with honey bees followed by an open field, whereas the lowest seed yield was recorded from netting without bees at Dhaka (Bangladesh). As per Lalita *et al.* (2018), the maximum number of seeds per fruit was found in open + hand pollination followed by open pollination and hand-pollination, no seed set was observed in without insect pollination treatment in the pumpkin at Hisar, India.Correspondingly, Gothi (2021) at Dantiwada recorded a higher number of seeds/fruit in open pollination than in close pollination.

3.4 Fruit diameter (cm)

In the summer of 2020, the maximum horizontal diameter of fruit (35.50 cm/fruit) was noted in T_4 - Open pollination, it was found at par with T_2 - Pollination by *A. mellifera*(33.70 cm/fruit)and T_5 - Hand pollination (33.25 cm/fruit), followed by T_1 - Pollination by *A. cerana*(30.60 cm/fruit)and T_3 - Pollination by the stingless bee(30.28 cm/fruit), the minimum fruit diameter (14.50 cm) was recorded in T_6 - Absolute control. While in the case of vertical diameter of fruit, the extremevertical diameter of fruit (37.13 cm/fruit) was noted in T_4 - Open pollination, it was found at par with T_2 - Pollination by *A. mellifera* (35.55 cm/fruit)and T_5 - Hand pollination (34.923 cm/fruit), followed by T_1 - Pollination by *A. cerana* (32.48 cm/fruit)and T_3 - Pollination by the stingless bee(32.35 cm/fruit), the minimum fruit diameter (15.13 cm) was recorded in T_6 - Absolute control. The descending order of the fruit diameter was recorded as $T_4 \geq T_2 \geq T_5 > T_1 \geq T_3 > T_6$ (Table 2).The results of the present study are in close conformity with the results of Hossain *et al*. (2018) who recorded higher fruit diameter in hand pollination (27.1 cm/fruit) followed by open pollination (26.8 cm/fruit) and lower fruit diameter was found in without bee pollination in cucumber crop at Dhaka, Bangladesh. According to Al-Ghzawi and Zaitoun (2007), fruit circumference was found significantly higher in muskmelon due to pollination by *A. mellifera* as compared to covered plants in Jordan.

Table 2: Effect of different pollination treatments on muskmelon fruit diameter

Treatments		HD* (cm)	VD* (cm)
T_1	Pollination by *A. cerana*	30.60	32.48
T_2	Pollination by *A. mellifera*	33.70	35.55
T_3	Pollination by stingless bees	30.28	32.35
T_4	Open pollination	35.50	37.13
T_5	Hand pollination	33.25	34.93
T_6	Absolute control	14.50	15.13
	SEm±	1.13	1.04
	CD (P=0.05)	3.31	3.05

N = Mean of 10 fruits, HD - Horizontal Diameter, VD - Vertical Diameter

CONCLUSION

The decreasing order of the effectiveness of different modes of pollination on fruit set, fruit weight, seed setting, and fruit diameter were recorded as Open pollination (OP) > Hand pollination (HP) > Pollination by *A. mellifera* > Pollination by *A. cerana* > Pollination by stingless bees during the experiment. The per cent increase in fruit set over pollination exclusion treatments showed HP (495%), OP (481%), *A. mellifera* (464%), *A. cerana* (437%) and the stingless bees (414%) of muskmelon. Plenty of pollinators' availability in research sites leads to the super effect on qualitative and quantitative parameters of muskmelon. Muskmelon crop requires bee pollination as an extra input in enhancing the yield in the pollinator's deficit area.

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