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# Effect of *Apis mellifera* pollination on yield parameters of cucumber under polyhouse condition

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**ABSTRACT**

During the study on different modes of pollination under polyhouse it was observed that mean per cent fruit set under Bee + Hand pollinated (84.29%) condition was at par with Bee pollinated (82.45%) or Hand pollinated condition (79.99%) irrespective of cucumber hybrids. The fruit length was under Bee pollination (13.31cm), which was at par with Bee pollination + Hand pollination (13.30cm) and significantly higher than Hand pollination (13.19cm). Mean Fruit weight (135.25gm) was observed under Bee pollination + Hand pollination, which was at par with (134.91gm) under Bee pollination and significantly higher than (132.83gm) under Hand pollination. While mean fruit diameter under Bee pollination and Bee pollination + Hand pollination was observed maximum (3.51cm), which was significantly higher than Hand pollination (3.49cm). Hybrid Pusa Sanyog and Pant Sankar Khira recorded with maximum mean per cent fruit set and fruit diameter, whereas hybrid Rani shows highest mean fruit weight and fruit length. While, minimum mean value of per cent fruit set, fruit weight and fruit length were recorded on hybrid Sheetal and minimum mean fruit diameter was observed in Pusa Sanyog.

**Key words:** *Apis mellifera*, cucumber, diameter, fruit, length, pollination, polyhouse, weight

## INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a member of cucurbitaceae family and locally known as 'Khira'. It is widely cultivated throughout India and in the tropical and sub tropical parts of the world. Cucumber bears unisexual flowers, i.e. male (staminate) produces the pollen while female (pistillate) produces the fruits. These flowers are short lived, they begin to open with rising sun and remain open only for a day. If they are not pollinated during that time, the flower aborts and drops from the vine. Poor fruit-set and deformed fruits are the results of inadequate pollination. Therefore, pollination of crops by insects has great influence on the quality and quantity of marketable fruits and seed production (Free, 1993). Inadequate pollination will result in small and mis-shaped fruits and low marketable yield. Hence, adequate pollination by insects results in good fruit setting, quality and quantity of seed production. There are large numbers of insects, which visit the flowers of cucumber for the collection of nectar and/or pollen (McGregor, 1976; Grewal and Sidhu, 1978; Free, 1993) in the field. The honeybees play an important role in pollination of cucumber (Rorry, 2000). Role of honey bee as powerful pollinator in different crops and vegetables was reported by Munawar *et al.* (2009) from Pakistan, Viraktamath (2010), Lal and Singh (2012) from India, Liu *et al.* (2011) and Wang (2011) from China and Munyuli (2011) from Uganda. Honeybees were observed the largest group (77.2%) of pollinating agents in cucurbits (Grewal and Sidhu, 1978). Out of 37 species of insects visiting to cucumber blossom at Louisiana, (USA) honeybees were most dominant (Kauffeld *et al.*, 1978). Dag *et al.* (1992) reported that in Israel *A. mellifera* was the only pollinator used for melon pollination in greenhouses. Nogueira-couto and Calmora (1993) reported that honeybee (*A. mellifera*) constituted 82.6 per cent of visitors to cucumber flowers. High yield and better quality of cucumber fruits, when pollinated by bees has been reported (Tulzenkova, 1955; Stambera, 1962; Steinhauer, 1971). The need for rapid, efficient pollination has thus greatly increased and this has required better understanding of pollination and their effluences on quality and quantity of produce, hence present study was planned to record effect of different modes of pollination on yield parameters of different hybrids of cucumber under polyhouse conditions.

## MATERIALS AND METHODS

The present experiment was conducted at Greenhouse/polyhouse area of Department of Vegetable Science CCS Haryana Agricultural University, Hisar, Haryana (India) on five hybrids of cucumber viz., Pant Sankar Khira, Sheetal, Rani, Pusa Sanyog and Mohini investigation. A three frames colony of *A. mellifera* with young bees was introduced in poly house for promotion of bee pollination. The humidity, light intensity and temperature under polyhouse were recorded with the help of hygrometer, lux meter and thermometer, respectively. The experiment was laid in randomized block design with three replications. Data were recorded on different yield parameter *viz* per cent fruit set, fruit weight, fruit length, and fruit diameter. For hand pollination two plants of each hybrid covered with removable netting to prevent bee from visiting and were checked daily to ensure the absence of bee. Observations on Bee pollination + Hand pollination were taken after manual pollination in bee pollinated plants. Ten female flowers of each hybrid were analysed after pollination for recording percent fruit set, while recording fruit weight, fruit length, and fruit diameter ten fruits of each hybrid were harvested after 10 days of fruit set for above measurements.

## RESULTS AND DISCUSSION

**Effect of modes of pollination on per cent fruit set:** From the perusal of data in table 1, it was reported that the difference in mean per cent fruit set in different modes of pollination was non significant, however the value under Bee + Hand pollinated condition was higher (84.29%) than Bee pollinated (82.45%) or Hand pollinated condition (79.99%). The per cent fruit set under Bee + Hand pollination condition for Pant Sankar Khira, Pusa Sanyog and Mohini was 82.50, 91.08 and 83.95 per cent, respectively, which was again numerically higher than under Bee pollination or Hand pollination. The per cent fruit set during peak flowering was significantly higher than the flower initiation and cessation of flowering, irrespective of modes of pollination.

Honeybee pollination produced more fruits/plant, higher seed weight and greater seed viability than hand pollination in melon (Kuti and Rovelo, 1992). They further reported that under honeybee pollination more than 85 per cent of flowers set fruit, as compared with less than 20 per cent for hand pollination. No malformed fruits were observed in any

of the hybrids of cucumber under different modes of pollination.

**Effect of modes of pollination on fruit length:** It was observed that the mean fruit length of Pant Sankar Khira was maximum (13.22cm) under Bee pollination and Bee pollination + Hand pollination, which was significantly higher than Hand pollination (13.16cm). In Sheetal the mean fruit length was maximum (11.77cm) under Bee pollination which was significantly higher than Bee pollination + Hand pollination (11.17cm) and Hand pollination (11.03cm). Likewise in Rani maximum fruit length (15.01cm) was observed under Bee pollination, which was statistically higher than Bee pollination + Hand pollination (14.97cm) and Hand pollination (14.83cm). In case of Pusa Sanyog maximum fruit length was observed under Bee pollination (14.55cm), which was significantly higher than Bee pollination + Hand pollination (14.48cm) and Hand pollination (14.31cm). Maximum fruit length of Mohini was observed under Bee pollination + Hand pollination (12.64cm), which was statistically at par with Bee pollination (12.63cm) and higher than Hand pollination (12.59cm). Irrespective of hybrids, the maximum fruit length was observed under Bee pollination (13.31cm), which was at par with Bee pollination + Hand pollination (13.30cm) and significantly higher than Hand pollination (13.19cm).

**Effect of modes of pollination on fruit weight:** Irrespective to the hybrids the mean fruit weight was observed maximum (135.25gm) under Bee pollination + Hand pollination, which was at par with (134.91gm) under Bee pollination and significantly higher than (132.83gm) under Hand pollination. The fruit weight of Pant Sankar Khira was observed maximum (154.16gm) under Bee pollination and Bee pollination + Hand pollination and was significantly higher than Hand pollination (150.83gm). In Sheetal maximum fruit weight was observed under Hand pollination (88.66gm), which was at par with Bee pollination + Hand pollination (88.33gm) and Bee pollination (88.12gm). The maximum fruit weight of Rani (165.41gm), Pusa Sanyog (135.20gm) and Mohini (133.12gm) was observed under Bee pollination + Hand pollination which was at par with Bee pollination and statistically higher than Hand pollination. Similar results were also obtained by Cervancia and Bergonia (1991) from Philippines, who reported that fruits from bee-pollinated plants were heavier (0.87kg) and more uniform than those of open-pollinated plants (weight 0.60kg) while fruits from non-pollinated plants were shortest and lightest (0.36kg).

**Effect of modes of pollination on fruit diameter:** Data in table 1 revealed that the mean fruit diameter was observed maximum (3.51cm) under Bee pollination and Bee pollination + Hand pollination, which was significantly higher than Hand pollination (3.49cm). The fruit diameter of Pant Sankar Khira, Sheetal and Mohini was observed maximum (3.72, 3.42 and 3.38cm), respectively under bee pollination, which was at par with Bee pollination + Hand pollination (3.71, 3.41 and 3.38cm), respectively and was significantly higher than Hand pollination (3.69, 3.39 and 3.34cm), respectively. Likewise the fruit diameter of Rani and Pusa Sanyog was observed maximum (3.72 and 3.35cm), respectively under Bee pollination + Hand pollination, which was at par with Bee pollination (3.70 and 3.33cm) and significantly higher than Hand pollination (3.59 and 3.32cm), respectively. Present results support the finding of Nogueira-Couto and Calmora (1993), who reported that experimental plots netted with honey bees, yielded more fruits/$m^2$ and heavier and higher quality fruits than other plots and concluded that *A. mellifera* was the main pollinating agent of *Cucumis sativus*.

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Table: 1 Effect of different modes of pollination on yield parameters of different cucumber hybrids under polyhouse

| | Per cent Fruit Set (%) | | | Average Fruit Length (cm) | | | Average Fruit Weight (gm) | | | Average Fruit Diameter (cm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hybrids | Bee Pollination | Bee Pollination + Hand Pollination | Hand Pollination | Bee Pollination | Bee Pollination + Hand Pollination | Hand Pollination | Bee Pollination | Bee Pollination + Hand Pollination | Hand Pollination | Bee Pollination | Bee Pollination + Hand Pollination | Hand Pollination |
| Pant Sankar Khira | 81.04(65.91) | 82.50(67.66) | 79.16(67.62) | 13.22 | 13.22 | 13.16 | 154.16 | 154.16 | 150.83 | 3.72 | 3.71 | 3.69 |
| Seetal | 82.91(66.59) | 81.87(68.80) | 77.91(67.13) | 11.17 | 11.17 | 11.03 | 88.12 | 88.33 | 86.66 | 3.42 | 3.42 | 3.39 |
| Rani | 82.70(66.33) | 82.08(65.74) | 79.58(75.17) | 15.01 | 14.97 | 14.83 | 164.79 | 165.41 | 163.12 | 3.70 | 3.72 | 3.59 |
| Pusa Sanyog | 82.29(68.51) | 91.08(65.32) | 81.66(64.54) | 14.55 | 14.48 | 14.31 | 134.79 | 135.20 | 133.54 | 3.33 | 3.35 | 3.32 |
| Mohini | 83.33(66.75) | 83.95(67.05) | 81.66(67.23) | 12.63 | 12.64 | 12.59 | 132.70 | 133.12 | 130.00 | 3.38 | 3.38 | 3.34 |
| Mean | 82.45(66.82) | 84.29(66.91) | 79.99(68.34) | 13.31 | 13.30 | 13.19 | 134.91 | 135.25 | 132.83 | 3.51 | 3.51 | 3.49 |

*Figures in the parenthesis are angular transformed values.

| C.D. (p=0.05) | For % Fruit Set | For Fruit Length | For Fruit Weight | For Fruit Diameter |
|---|---|---|---|---|
| For mode of pollination | N.S. | 0.03 | 1.35 | 0.02 |
| For hybrid | N.S. | 0.03 | 1.75 | 0.02 |