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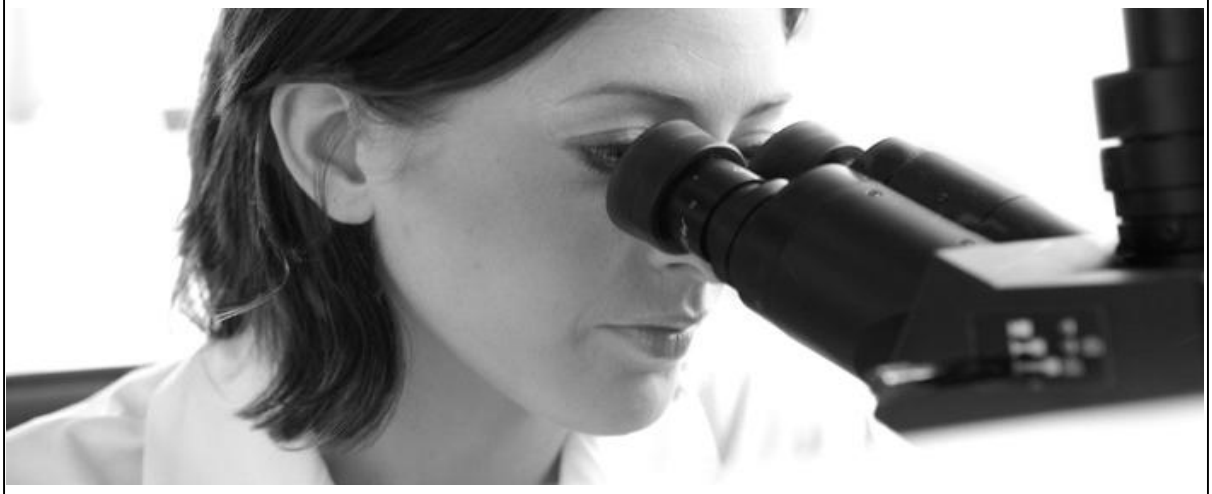

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RESEARCH ARTICLE

POLLINATION TECHNIQUE: EFFICACY ON FRUIT SET, SEED YIELD AND SEED QUALITY OF EGGPLANT

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ABSTRACT

An experiment was conducted to evaluate and compare the pollination technique on fruit set, seed yield and seed quality of eggplant at Bangabandhu Sheikh Mujibur Rahman Agricultural University during October 2012 to May 2013. Six eggplant varieties were grown separately with proper isolation and two pollination technique i.e. (i) hand pollination and (ii) natural pollination were used as experimental treatment. Full ripen standard size fruits (60 DAA) of eggplant were harvested and kept in ambient condition for five days post-harvest ripening to become soften and matured fully. Then seeds were extracted from the fruits by wet method. The treatment efficiency was evaluated by seed yield and seed quality components. The result indicated that seed production of eggplant is greatly influenced by pollination technique. Natural pollination with no flower protection gave higher result in seed yield and seed quality of eggplant then hand pollination.

INTRODUCTION

Eggplant (*Solanum melongena* L.) is an important and most popular vegetable crop in Bangladesh. It is a normally highly self-pollinated crop (Bose and Som, 1986). The cone like formation of anthers favours self-pollination (Kakizaki, 1924); but since the stigma ultimately projects beyond the anthers, where pollinating insects are more likely to contact it, there is an ample opportunity for cross-pollination (Hawthron and Pollard, 1954). The rate of cross-pollination may vary depending on genotype, location and insect activities. It has been reported that the extent of natural out crossing from 2 to 48% in eggplant varieties in India and from 3 to 7% in China (Chen, 2001). Kakizaki (1924) reported 0.2 to 46.8% cross-pollination occur in brinjal; while Sambandam (1964) found only 6.7% natural out crossing. At AVRDC, from 0 to 8.2% of natural out crossing rate have been observed. The natural out crossing is a great problem for the production of genetically pure and true to type seed of eggplant varieties. On the other hand, for successful hybridization program and hybrid seed production artificial or hand pollination must be done.

Artificial pollination always resulted in fewer seeds than natural pollination even when an excess of pollen was applied (Bailey, 1891). He stated that with hand pollination a few seeds were produced at the apex of the fruit, but most of the ovules remained undeveloped. Repeated pollination with pollen from different plants increases both fruit and seed set (Malarkodi *et al.*, 2006). Taller (1969) stated that within the variety the number of seeds per fruit is higher in cross-pollinated than in selfed plants, but substantially lower than in open-pollinated plants. Polverente *et al.*, (2005) reported that in eggplant, natural pollination, with no flower protection, showed superior results when compared to manual pollination, with larger weight, length and diameter of fruits and bigger seed production per fruit. Natural pollination, with no flower protector, enabled also to obtain of seeds with similar germination and vigour compared to other processes.

As fruit set, seed yield and seed quality of eggplant depends on pollination techniques and as there is scanty information about pollination techniques of eggplant, the present investigation was undertaken to evaluate and compare the effect of pollination technique on fruit set, seed yield and seed quality of eggplant.

MATERIALS AND METHOD

Field experiment was conducted at Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, during

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October 2012 to May 2013. The operation of emasculation and hand-pollination is usually done considering to coincide with better cycle of fruit setting. To obtain a period of concentrating flowering for efficient emasculation and pollination, fertilizer application and crop management are planned in such away that plant growth is most vigorous during the mid-stage of flowering. Before starting emasculation, all the opened flowers and set fruits were removed completely along with any undesirable flower buds. The experiment was laid out in Randomized Complete Block designe (RCBD) with three replications.

Emasculation

Flower buds about one to two days away from opening chosen for emasculation. To emasculate, use sharp-pointed forceps to open the unopened bud from upper part, and then carefully remove all the anthers inside leaving only the petals, ovary, and the style without disturbing the style. These emasculated flower buds were covered with butter paper bags.

Pollen Collection

The flowers of male parent from which pollen is going to be collected have to be bagged on the previous day evening. Next day morning by 7 am the pollen flowers are collected from the male plants before the anthers dehisce. After most of the anthers have dehisced in the container, the pollen was gathered inconvenient small-sized vessels by vibrating the flowers.

Pollination

The flowers emasculated one or two days earlier would have completely blossomed and were ready for cross-pollination. Using a small pair of scissors, cut two calyxes of the emasculated flower buds to mark them hand pollinated. Then, the stigma is dipped into pollen mass kept in a suitable pollen container. Pollination can also be done by dipping the tip of the little finger into a pool of pollen, then touch the stigma with the pollen-covered little finger.

Variables of the experiment

Experimental variable consisted of six eggplant varieties (var. BARI begun-1, BARI begun-5, BARI begun-6, BARI begun-8, BARI begun-9 and Khotkhotia local) with two pollination technique. Pollination techniques were (i) hand pollination and (ii) natural pollination.

Full ripen fruits of eggplant (60 DAA) were harvested from the experimental field. Standard size fruits (not the biggest one or the smallest) were selected for seed extraction purpose. The selected fruit were kept in ambient condition for five days after harvest ripening to become soften. The seed were extracted by washing under running tap water and dried to about 8% moisture content. Then the following parameters were determined for each treatment. For the calculation of number of seed per fruit, five fruits were selected randomly from each pollination and seeds were extracted from them and then counted. The value in gram of seed per fruit was taken as a mean of the five fruits to determine seed yield per fruit. 1000-seeds weight, germination percentage, co-efficient of germination, E.C. test, seedling length, dry weight of seedling and seedling vigour index were determined. The data collected on different parameters were subjected to analysis of variance (ANOVA). Microsoft EXCEL and CROPSTAT soft ware programs were used wherever appropriate and the mean were compared by least significant difference (LSD) test.

RESULTS AND DISCUSSION

Fruit set and seed production

Number of fruit per plant

Analysis of variance showed significant difference in the number of fruit per plant pollinated by hand and natural pollination in most of the variety except BARI begun-6. There was no significant difference in number of fruits per plant in BARI begun-6 but numerically highest numbers of fruit per plant (5.66) were observed from natural pollination (Fig.1A).

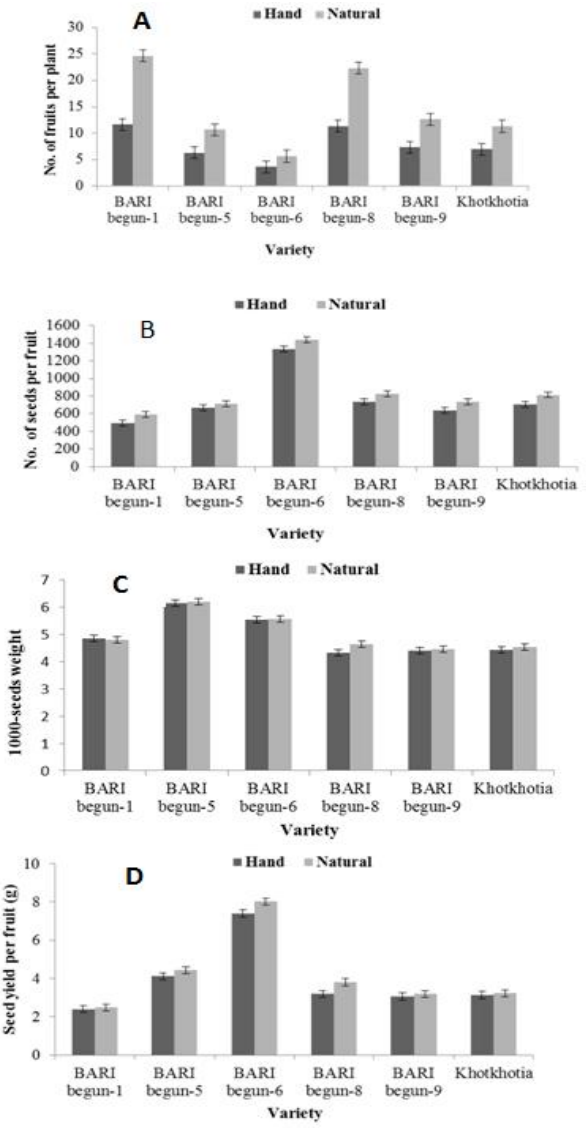


Figure1 Effect of pollination technique on seed yield component **(A)** fruit per plant, **(B)** seed per fruit, **(C)** 1000-seeds weight and **(D)** seed yield per fruit.

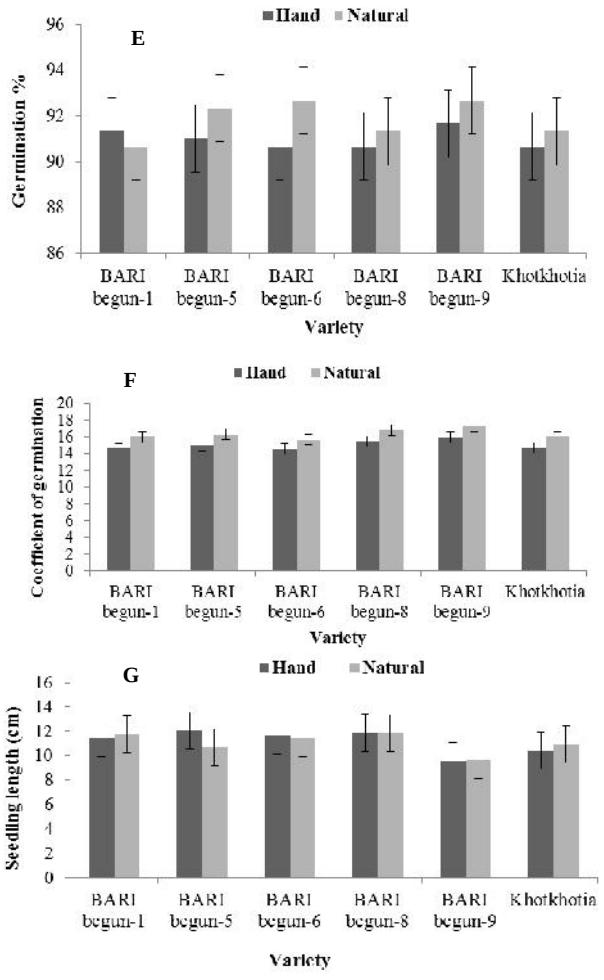
The results indicated that fruit setting of eggplant is better under natural pollination. Similar results also reported by Dempsey and Boynton (1965) in tomato and Marcelis and Hofman (1997) in chilli that natural pollination affects the number, the mass, the length and the size of fruits.

Number of seed per fruit

Number of seed per fruit of eggplant also influenced significantly by pollination technique. Higher number of seeds per fruit was found in all variety of eggplant when pollination occurs naturally (Fig.1B). The lower number of seed per fruit was found in case of hand pollination. Probably, the large variation by insects favours the deposition of greater quantity of pollen and enabling increased quantity of seed. This is in accordance with Bailey (1891) who reported artificial pollination always resulted in fewer seeds than natural pollination even when an excess of pollen was applied. He also stated that with hand pollination a few seeds were produced at the apex of the fruit, but most of the ovules remained undeveloped.

1000-seed weight

The 1000-seed weight was not influenced significantly by pollination technique within variety but significant different was found among the varieties (Fig.1C). The highest 1000-seed weight (6.20 g) was obtained from BARI begun-5 and the lowest (4.32 g) from BARI begun-8.



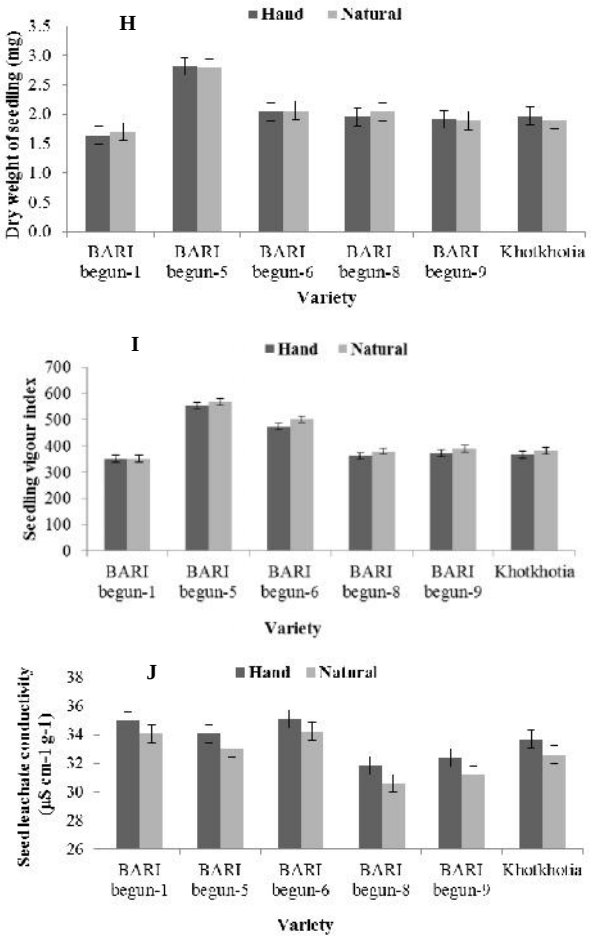


Figure2 Effect of pollination technique on seed quality component **(E)** germination percentage, **(F)** coefficient of germination, **(G)** seedling length,**(H)** dry weight of seedling, **(I)** seedling vigour index and **(J)** seed leach ate conductivity.

Pre-deployment were obtained averages over 5 grams, valued reported by George (1999) for the average mass of 1000 eggplant seed. The result indicated that BARI begun-5 and BARI begun-6 produced bolder seed than BARI begun-1, BARI begun-8, BARI begun-9 and Khotkhotia. This may be due to the genetically controlled character of the individual variety.

Seed yield

Seed yield per fruit was influenced significantly in BARI begun-6 and BARI begun-8 but unaffected in BARI begun-1, BARI begun-5, BARI begun-9 and Khotkhotia by pollination techniques (Fig.1D). Lower seed yield was obtained in each of the variety from hand pollination.

It might be due to that the handling of flowers or placing of pollen can negatively impact the feminine floral organs, reducing the production of seeds per fruit (George, 1999). Seed yield per fruit differentiated significantly among the variety. BARI begun-6 produced significantly higher seed yield per fruit than others. This may be varietal character because fruit size and shape were different among the tested varieties. As number of seed per fruit and seed size determines seed yield of eggplant, higher number of seed and higher 1000-seed weight increased seed yield of BARI begun-6.

Quality of seed

Germination and co-efficient of germination

Germination percentage remained unaffected by pollination technique within the variety. All variety showed more or less same germination trend that was above the seed standard level by both pollination techniques (Fig.2E). Co-efficient of germination remained unaffected by pollination technique within the variety (Fig.2F). However, numerically naturally pollinated seed showed the higher value of co-efficient of germination in all variety. Higher value of co-efficient of germination indicates the higher speed of germination and higher seed vigour. The seeds having lower or minimum vigour values cannot germinate well under field condition.

Seedling length

Seedling length remained unaffected by pollination technique within and among the variety of eggplant. Most of the variety showed the same trend of seedling length in case of both the pollination except BARI begun-5. Only BARI begun-5 showed the higher seedling length when pollinated by hand (Fig.2G).

Dry weight of seedling

Dry weight of seedling also remained unaffected by pollination technique within the variety. All variety showed the same trend of seedling dry weight in both pollination techniques. Among the variety, BARI begun-5 showed significantly higher dry weight and the other were statistically identical (Fig.2H).

Seedling vigour index

Seedling vigour index was remained unaffected by pollination technique within the variety. The highest seedling vigour index value was found in BARI begun-5 and the lowest in BARI begun-1 (Fig.2I). The result indicated that all variety showed the same trend of seedling vigour index value in both pollination techniques. Differentiation among the variety may be the genetical properties of that variety.

Seed leachate conductivity

Seed leachate conductivity remained unaffected by pollination technique within the variety. However, numerically higher seed leachate conductivity was found by hand pollinated seed in each and every variety (Fig.2J). Among the variety, BARI begun-8 showed the lowest seed leachate conductivity (30.59 $\mu S\ cm^{-1}g^{-1}$) and BARI begun-1 and BARI begun-6 showed higher (35.07$\mu S\ cm^{-1}\ g^{-1}$ and 34.97$\mu S\ cm^{-1}\ g^{-1}$) respectively. The result indicated that BARI begun-8 produced seed with better cell membrane integrity than other variety.

CONCLUSION

The result of the present study indicated that seed production of eggplant greatly influenced by pollination technique. Natural pollination with no flower protection gave higher result in fruit set and seed production. Enabled also obtaining seed quality such as germination, vigour, seedling length, dry weight of seedling and seed leachate conductivity with similar compared to hand pollination.

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