Indian J. Genet., **65**(2): 149-150 (2005)

Short Communication

Stigma receptivity and pollination success in potato (*Solanum tuberosum* L.)

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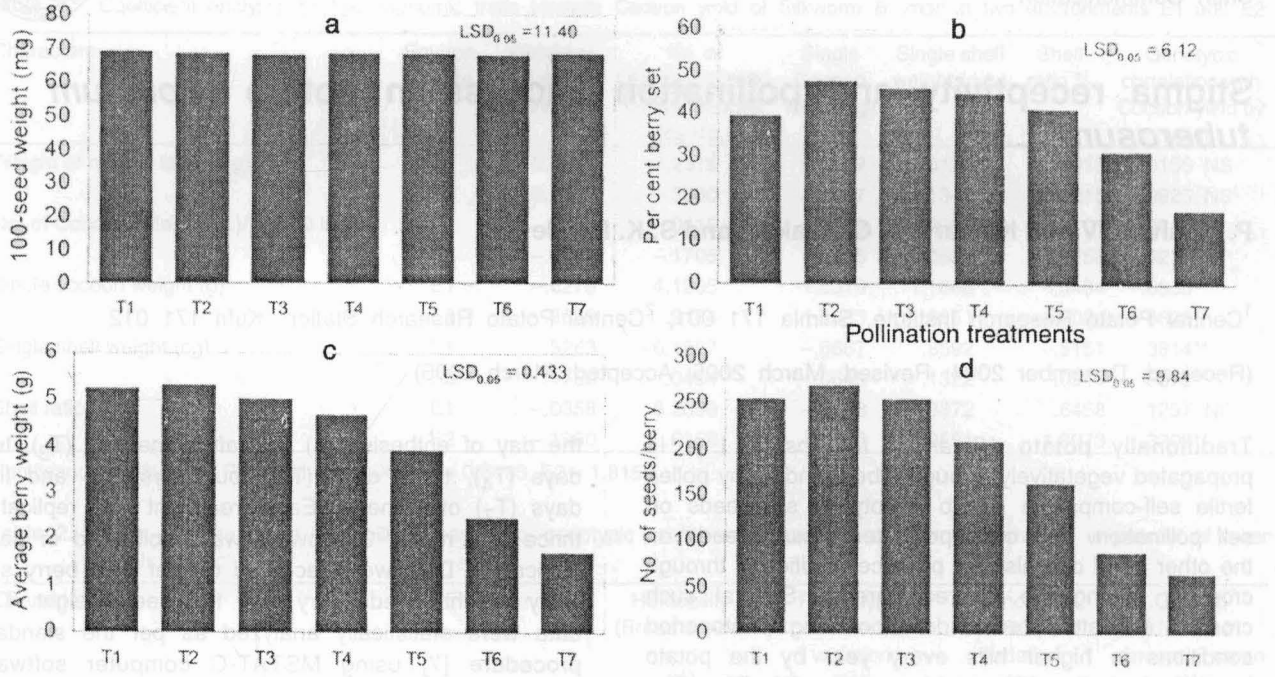
(Received: December 2004; Revised: March 2005; Accepted: March 2005)

Traditionally potato (*Solanum tuberosum* L.) is propagated vegetatively through tubers and many pollen fertile self-compatible potato genotypes set seeds on self pollination. The cross-pollinated sexual seeds on the other hand can also be produced artificially through crossing among the desired parents. Several such crosses are attempted under cool long photoperiod conditions in higher hills every year by the potato breeders in India with variable success [1]. Often few or no viable seeds are formed largely due to the genetic and environmental factors affecting cross pollination [2, 3], however, the pollinating method/technique also determines the success rate in hybridization [4]. Prolonged stigma receptivity in female parents may be useful when anthesis in male parent is delayed by a few days and the synchronization of flowering is lacking in the pollen donor and pollen receptor parents. Although there is very little information available on the fruit/seed set in relation to stigma receptivity [3, 5], but no such information is available under Indian condition. The present study was conducted at the Central Potato Research Station, Kufri (32° N and 77° E and 2500 m asl) during the summer of 2003 to ascertain duration of stigma receptivity *vis-a-vis* time of highest stigma receptivity for use in effective hybridization.

The germplasm accession CP-2376 (CRUZA-27), which flowers profusely, was used as female parent and advanced hybrid MP/97-1008 producing high fertile pollens (> 80%) was used as male parent. Both the genotypes were planted in the hybridization block on 30th April 2003. At peak blooming, flowering shoots along with the stem containing 5-6 leaves were cut from the female plants and kept in wide mouthed glass bottles of one litre capacity filled with water and transferred to the glass house. Hoagland's nutrient solution [6] was added at 15 days interval in the bottles. Flower buds in each inflorescence were trimmed to retain only 5-6 buds of nearly uniform size and emasculated a day before anthesis. They were pollinated manually with the fresh pollens from the male parent at different days i.e. one day before anthesis (T_1), on the day of anthesis (T_2) and after one day (T_3), two days (T_4), three days (T_5), four days (T_6) and five days (T_7) of anthesis. Each treatment was replicated thrice and nearly 36 flowers were pollinated in each replication. Data were recorded on per cent berry set, berry weight, seeds/berry and 100 seed weight. The data were statistically analyzed as per the standard procedure [7] using MSTAT-C computer software (Michigan State University, USA).

The analysis of variance showed highly significant differences for only per cent berry set, average berry weight and seeds/berry. However, the different treatments remained at par for 100 seed weight (Fig. 1a). Highest berry (fruit) set (47.75%) was achieved for the pollination done at anthesis (T_2) and was at par for the subsequent pollinations in next three days after anthesis (Fig. 1b). Low berry set was observed when the stigma was pollinated a day before or after third day of anthesis. This indicated that prior to flower opening stigma is not fully receptive. It either affected the germination of pollens and subsequent penetration of the pollen tube into the stylar tissue and/or the ovules were probably immature [5]. The rapid decline in stigma receptivity after third day of anthesis could be attributed to the decaying of stigma tissue with aging/cessation of exudates needed for pollen germination. Li *et al.* [8] stated that Sk2 proteins, the most abundant member of the pistil-specific proteins of potato, accumulate to a high level one day before anthesis and helps in pollen tube growth and these proteins cease to be formed with the aging of stigma. Average berry weight (Fig. 1c) and number of seeds per berry (Fig. 1d) were observed to be at par in T_1, T_2 and T_3, whereas significantly low values for these two traits were observed in T_4 to T_7. Results (Fig. 1) clearly showed that the stigmas were highly receptive for 4-5 days starting a day before and until next three days after anthesis. This supports the contention of Thakur and Upadhya [4] of repeated pollination during this period to get higher seeds/ berry. Stigma receptivity



Figs. 1(a-d). a) 100 seed weight; b) Per cent berry set; c) Average berry weight and d) Number of seeds per berry in different pollination treatments, where T_1 = pollination done one day before anthesis, T_2 = pollination on the day of anthesis, T_3, T_4, T_5, T_6 and T_7= pollinations done after one, two, three, four and five days after anthesis, respectively.

persisted even at five days (17.59%) after anthesis but resulted in iow seed set, which was nearly one-fourth the number of seeds obtained from pollination done at anthesis. This situation may be useful and could be exploited in case of delayed flowering in the male parents to obtain at least few seeds in desired crosses.

Average berry weight (Fig. 1c), though highest (5.312g) at anthesis (T_2), was at par with the pollinations done a day before and two days after anthesis. Similar was the case for number of seeds/berry (Fig. 1d), which declined significantly when pollination was effected two days after anthesis. Pandey and Gupta [1] reported a wide variation for seeds per berry in large number of crosses.

Highly significant and positive correlation was observed between per cent berry set and average berry weight (r = 0.870*); per cent berry set and number of seeds/berry (r = 0.839*); and average berry weight and number of seeds/berry (0.969*) indicating that higher stigma receptivity not only increased the berry set, but also increased the average berry weight and seeds/berry. Hence, the pollinations during higher stigma receptivity period should be attempted to get more number of hybrid seeds, which could be used effectively in potato breeding programme. The study clearly indicated that pollination in potato should be done within three days i.e. a day before, on the day of anthesis and one day after anthesis for better success in hybridization in potato.

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