

Performance of 'Alphonso' as a source of pollen for its hybrids 'Sonpari' and 'Neelphonso' as female parents in mango

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ABSTRACT

To incorporate the desirable traits of 'Alphonso' into its hybrids, a new breeding programme of back crossing the developed hybrids such as 'Sonpari' ('Alphonso' × Baneshan) and 'Neelphonso' ('Neelam' × Alphonso) with 'Alphonso' as pollen donor parent was undertaken to find out the compatibility of 'Alphonso' with its hybrids, 'Sonpari' and 'Neelphonso'. The results revealed that fruit set was 88.91% in cross 'Sonpari' × 'Alphonso' and 78.43% in cross 'Neelphonso' × 'Alphonso'. Fruit retention (%) was reduced drastically from fruit set stage till 14 days after pea stage (DAPS) but attained almost steady value from 35 DAPS onwards till harvest. The fruit retention (%) at harvest was higher in the crossed fruits of 'Sonpari' × 'Alphonso' (3.13%) compared to 'Neelphonso' × 'Alphonso' (0.94%). The crossed fruits of 'Sonpari' × 'Alphonso' produced fruit length of 13.4 cm, which was at par with Sonpari (13.5 cm), however lesser fruit width (9.9 cm) than Sonpari (11.1 cm). Crossed fruits of 'Neelphonso' × 'Alphonso' with fruit length (10.8 cm) and fruit width (5.7 cm) were higher than fruit length and width of Neelphonso. Similarly, fruit weight of hybrid fruits derived from crossed 'Sonpari' × 'Alphonso' (512.4 g) was significantly less than its female parent (527.2 g) but superior over Alphonso (331.4 g). Hybrids fruits of 'Neelphonso' × 'Alphonso' (235.2 g) was significantly higher than its female parent (216 g) but less than Alphonso. Based on this experiment, pollens of 'Alphonso' showed good compatibility with both 'Sonpari' and 'Neelphonso', which may be utilized as pollen parent for pollination in these two newly developed hybrid varieties for their further improvement.

Key words: Alphonso, fruit-set, hybrids, hybridisation, pollen parent.

INTRODUCTION

Mango (*Mangifera indica* L.) is the premier fruit among the tropical fruits grown in the world. It is also called as "King of the fruits" in India due to its historical and religious importance, attractive aroma, and capitative taste. It originated in the Indo-Myanmar region and is highly heterozygous (Mukherjee, 6). It has been under cultivation in the Indian subcontinent for the several thousand years (Brown *et al.*, 3). This crop occupied an area of about 2.5 million ha and production of 18.0 million MT in India, which accounts for about 50% of world's production (Anon, 1). In India, more than one thousand varieties of mango are available. However, only about 30 cultivars are of commercial importance (Chadha and Pal, 4) and majority of these cultivars possess narrow adaptability and show eco-geographical preferences for growth and yield (Yadav and Rajan, 11). Among these cultivars, 'Alphonso' is one of the major commercial cultivars in India. The major appealing trait of this cultivar is its 'unique flavour' besides good appearance and shelf-life. However, its limitation is the occurrence

of spongy tissue, which hamper the economics of production, as well backfoot the mango industry in the export world. In addition, this cultivar is an alternate bearer and produces very little or no yield in some years. Therefore, to incorporate the desirable traits and eliminate the undesirable ones, 'Alphonso' was used as one of the parent in hybridization programme at Agriculture Experimental Station (AES), Paria, Navsari Agricultural University, Gujarat. This programme has resulted into the development of two superior hybrids such as 'Neelphonso' (1986) and 'Sonpari' (2000) from the crosses 'Neelam' × 'Alphonso' and 'Alphonso' × Baneshan, respectively (Anon, 2). Therefore, to incorporate the desirable traits of 'Alphonso' lacking in its hybrids, breeding programme through back crossing was initiated for further improvement of 'Neelphonso' and 'Sonpari'. Furthermore, to the best of our knowledge, on the ability of 'Alphonso' as pollen donor for these hybrids is meagre. Therefore, we attempted for the first time to use 'Alphonso' as pollen donor for 'Sonpari' and 'Neelphonso' as female parents.

MATERIALS AND METHODS

The studies were conducted during 2012 & 2013

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in the Division of Fruit Science, RHRS, ASPEE College of Horticulture & Forestry, NAU, Navsari. Three mango varieties including 'Alphonso' as pollen donor and two half-sib hybrids, viz., 'Neelphonso' ('Neelam' × 'Alphonso') and 'Sonpari' ('Alphonso' × 'Baneshan') were used as female parents for hybridization. The fully grown healthy grafted plants, free from diseases and insect-pests of each mango varieties were selected in the orchard. The selected trees were maintained uniformly as per recommended cultural management practices.

The hybridization technique attempted was controlled hand pollination (Mukherjee *et al.*, 7; Dutta *et al.*, 5). Healthy panicles directly arising from secondary or tertiary branches were selected. These panicles were bagged on afternoon of the preceeding day of pollination with finely perforated alkathane bags (8" × 5") of 100 gauge thickness, after removing all opened flowers. The next morning, 10-12 freshly opened perfect flowers located on middle of each panicle were retained for pollination and all other unopened buds were removed. After selection of hermaphrodite flowers, the panicles were then rebagged. Pollens were collected from freshly opened flowers of the same parent from panicles bagged earlier. The collected stock of opened flowers was kept in separate petri dish under shade to dehisce anther. After pollen dehiscence, bags from panicles of female parent were removed and hand-pollination was done on stigma of the flowers. The pollinated panicle was immediately rebagged and labelled properly. The bags were removed after 72 h and fruit-set was recorded at different intervals.

Observations on number of fruit-set was recorded at seven days after pollination and fruit-set percentage was calculated by dividing the number of fruit-set by total number of pollinated flowers and multiplied by 100 (Pinto *et al.*, 9). Fruit retention percentage was recorded at weekly intervals from pea stage onwards and calculated by dividing the number of fruit retained after every seven days by the total number of fruit retained at pea stage. Similarly, physical characteristics of crossed fruits were recorded using

electrical balance (Adiar Dutt-1620C) for fruit weight (g) and Vernier callipers (Mitutoya Digimatic Calliper, Code No. 500-147) for fruit length (cm) and width (cm). Weather data was also recorded for maximum temperature (Tmax), minimum temperature (Tmin), maximum relative humidity (Rhmax) and minimum relative humidity (Rhmin). The experiment was laid out in RBD. Statistical analysis was carried for weight and size of hybrid fruits obtained from two crosses 'Sonpari × Alphonso' and 'Neelphonso × Alphonso' and open-pollinated fruits of their parents, viz., 'Alphonso', 'Sonpari' and 'Neelphonso'. Three fruits were taken for each replication with three replications per treatment. ANOVA was calculated to separate the means. Data were analysed to compare treatment means using statistical package for agricultural workers (Sheoran).

RESULT AND DISCUSSION

The average number of flowers pollinated per panicle was 7.05 and 6.87 in 'Sonpari' × 'Alphonso' and 'Neelphonso' × 'Alphonso', respectively. In both years, fruit-set percentage of 'Sonpari' × 'Alphonso' combination was higher than 'Neelphonso' × 'Alphonso' cross (Table 1). In the 'Sonpari' × 'Alphonso' combination, an average of 69.0 pollinated flowers set fruits out of average 80 total flowers pollinated, which recorded 88.91% of fruit-set. While, in the cross 'Neelphonso' × 'Alphonso', an average of 45 pollinated flower set fruits out of the 58 total pollinated flowers, which gave 78.43% of fruit-set. The result obtained in both the combinations showed higher fruit-set than 16.1% in 'Amrapali' × 'Tommy Atkins' (Pinto *et al.*, 9) and 29.3% on open-pollinated 'Amrapali' (Pandey and Kumar, 8). This indicated that high fruit-set percentage in 'Sonpari' and 'Neelphonso' can be obtained, when 'Alphonso' was used a pollen source. However, the difference in fruit-set between 'Sonpari' and 'Neelphonso' might be due to the role of the genetic background of a genotype under a particular set of environmental conditions (Shu, 10).

The fruit retention (%) of both the crosses showed a drastically decreasing trend from fruit set stage till

Table 1. Pollinated flowers and fruit setting in the crossed 'Sonpari' × 'Alphonso' and 'Neelphonso' × 'Alphonso' of mango.

Parentage	Total pollinated flowers		Mean	Pollinated flowers per panicle		Mean	Total fruit set at 7 DAP		Mean	Fruit set at 7 DAP (%)			Mean
	2012	2013		2012	2013		2012	2013		2012	2013	2013	
'Sonpari' × 'Alphonso'	110	50	80	7.33	6.77	7.05	90.00	48.00	69.00	81.82	96.00	88.91	
'Neelphonso' × 'Alphonso'	71	45	58	7.38	6.36	6.87	53.00	37.00	45.00	74.65	82.22	78.43	

DAP = days after pollination

14 days after pea stage. Thereafter, this decreasing trend in fruit retention percentage slowed down and then showed steady trend from 35 DAPS onwards till harvesting (Fig. 1). It was interesting to note that the fruit retention (%) of 'Sonpari' × 'Alphonso' cross throughout the entire stage of fruit growth was always higher than that of 'Neelphonso' × 'Alphonso' cross, excepting at 21 DAPS (6.32% in 'Sonpari' × 'Alphonso' and 6.88% in 'Neelphonso' × 'Alphonso'). The rapid decrease in fruit retention (%) between fruit setting stage to 14 days after pea stage seems to be due to low relative humidity and comparatively high evaporation (Fig. 4), which existed under Navsari conditions during the period of experimentation.

The fruit retention at harvest was higher in the crossed fruits of 'Sonpari' × 'Alphonso' (3.13%) than

'Neelphonso' × 'Alphonso' (0.94%). The fruit retention at harvest in both the crosses was in accordance with the observation of Pinto *et al.* (9) who reported the range of 0.5-3.3% at harvest when 'Amrapali' was used as one of the parents. This indicating that 'Alphonso' has a good genetic compatibility with 'Sonpari' and 'Neelphonso' when used as male parent.

Fruit size of the two crosses and their parents (Fig. 2), showed that combination of 'Sonpari' × 'Alphonso' produced fruit length (13.4 cm), which was *at par* with fruit length of female parent 'Sonpari' (13.5 cm). However, width of fruit (9.9 cm) obtained from 'Sonpari' × 'Alphonso' cross was less than 'Sonpari' (11.1 cm). Fruit length (10.8 cm) and fruit width (5.7 cm) of crossed 'Neelphonso' × 'Alphonso'

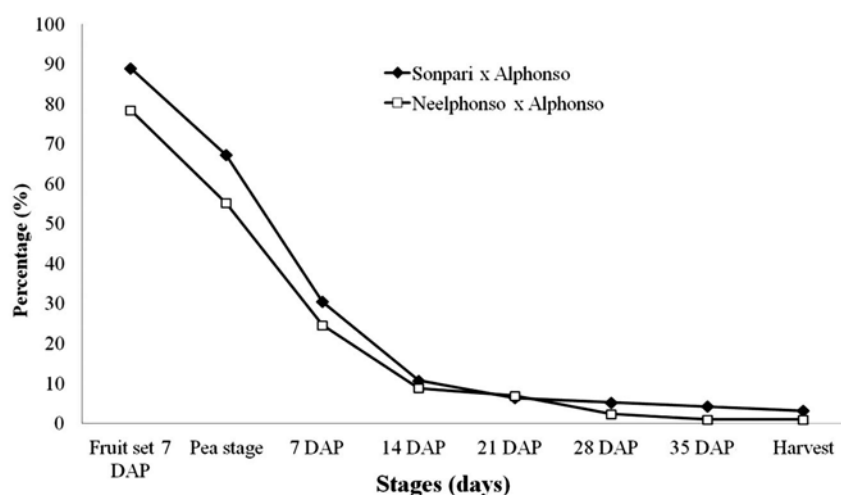


Fig. 1. Fruit retention (%) of hybrid fruits from crosses 'Sonpari × Alphonso' and 'Neelphonso × Alphonso' of mango at various intervals of fruit growth.

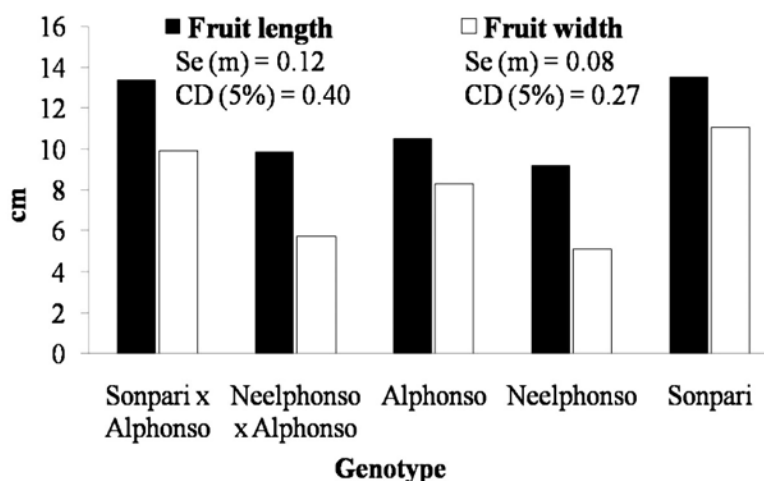


Fig. 2. Fruit size of hybrid fruits from crossed 'Sonpari × Alphonso' and 'Neelphonso × Alphonso' and their parents at ripening stage.

were significantly higher than fruits of 'Neelphonso' with respect to length (9.2 cm) and width (5.1 cm).

Similarly, weight of hybrid fruits derived from crossed 'Sonpari' × 'Alphonso' (512.4 g) was significantly less than its female parent (527.2 g) but significantly higher than fruit weight of Alphonso (331.4 g). Hybrids fruit of 'Neelphonso' × 'Alphonso' (235.2 g) was significantly more than its female parent (216 g) but less than Alphonso. Comparatively, fruit weight of hybrid derived from crossed 'Sonpari' × 'Alphonso' (512.4 g) was more than hybrids fruit (235.2 g) of 'Neelphonso' × 'Alphonso' cross (Fig. 3).

The relationship among number of fruits at various stages and weather parameters was observed (Fig. 4) that drastic reduction in number of fruits from fruit-set stage at 7 days after pollination (DAP) upto

14 DAP was coincidence with wide variation of temperature and low humidity with wide variation between maximum and minimum RH.

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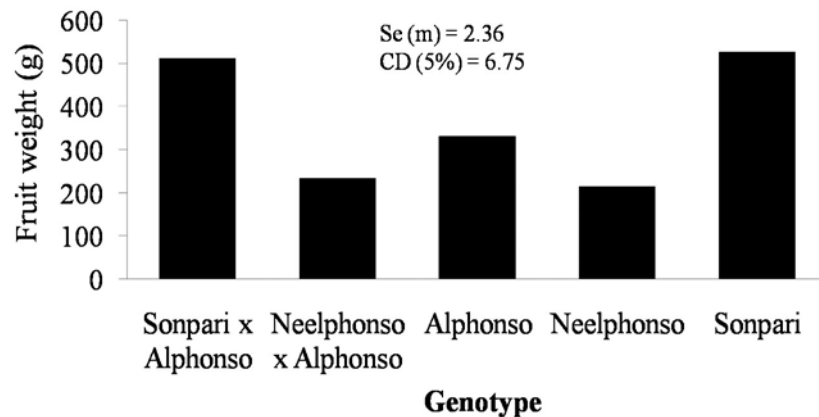


Fig. 3. Fruit weight of hybrid fruits from crossed 'Sonpari × Alphonso' and 'Neelphonso × Alphonso' of mango at ripening stage.

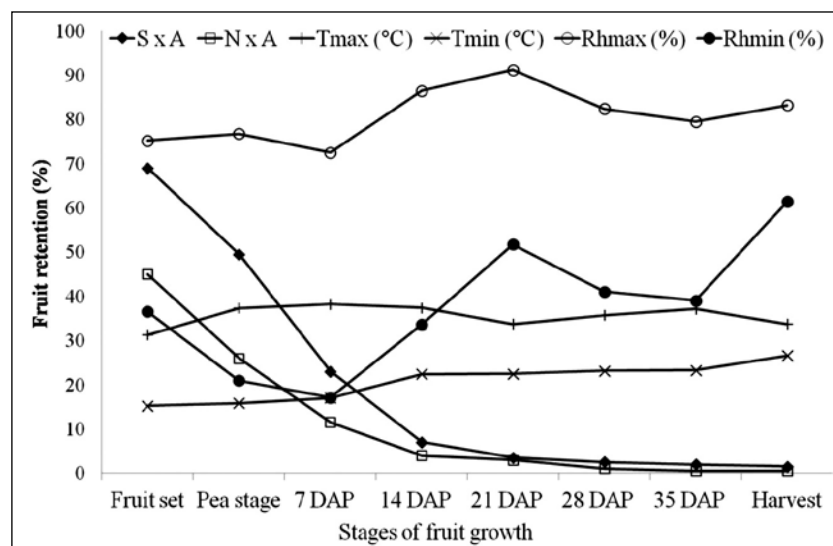


Fig. 4. Relationship between number of fruits retained and weather parameters at various stages of fruit growth. S × A = 'Sonpari × Alphonso'; N × A = 'Neelphonso × Alphonso'; DAPS = days after pea stage.

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