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REVIEW ARTICLE

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ABSTRACT

A sound knowledge on flowering and fruiting characters of the parental types is essential for starting up with hybridization programme in mango. General aspects on flowering and fruiting in *Mangifera indica* L. has been comprehensively studied by different workers in the past. But varietal variation is often noted with respect to the ecoregional changes.

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INTRODUCTION

A sound knowledge on flowering and fruiting characters of the parental types is essential for starting up with hybridization programme in mango. General aspects on flowering and fruiting in *Mangifera indica* L. has been comprehensively studied by different workers in the past. But varietal variation is often noted with respect to the ecoregional changes. It is conspicuous with the popular varieties of other states when grown in the humid tropic situation of Kerala. Not much information is at present available on the pollen characters, compatibility of many of the local types of Kerala which is essential when these local types are involved in hybridization programme

Flowering

In mango, flowering starts in November or early December in Andhra Pradesh and West coast of India (Gandhi, 1955). Singh (1958) reported that flowering in mango is preceded by the differentiation of flower bud which occurs in October-December depending upon the local climatic condition. Gunjate *et al.* (1977) noted fruit bud differentiation started in August and continued till end of October and flowering starts by December under konkan condition.

According to Yadav and Singh (1985) observed the south Indian mango varieties attain physiological status of flowering earlier than north Indian cultivars. Radha and Nair (2000) reported that mango in Kerala commences flowering by November-December which was supported by Anila (2002) while studying flowering and fruit development in the varieties namely Alphonso, Neelum, Priyur, Kalapady and hybrids Ratna and H-151 under Kerala conditions.

Inflorescence characters

Thimmappaiah and Suman (1987) noted that the panicle size in mango varied from 11.25 to 42.20 cm. In Alphonso the length of flower panicle ranged from 12.4 to 38.6 cm and number of male flowers/ panicle was maximum when grown under coastal Karnataka condition (Uthaiah *et al.*, 1988). Desai *et al.* (1994) studied the floral biology of variety Sai sugandh and found that the inflorescence was conical panicle and the rachis were light green to bright pink in colour. Anila (2002) reported that inflorescence length ranged from 15 to 30 cm, Ratna showed maximum inflorescence size in terms of length and breadth. Number of inflorescence per square metre showed significant difference between the varieties in which Prior showed maximum number of inflorescence/ square metre and Neelum and Alphonso showed minimum number of inflorescence / square metre. The number of hermaphrodite was noticed to be highest in Ratna and H-151 and least in Muvandan.

Anthesis

Wagle (1929) recorded that most of the mango flower buds start opening in the early morning and maximum opening was reported between 9- 10 am. (Sen *et al.*, 1946). Spencer and Kennard (1955) also observed that anthesis starts early in morning and completes at noon which was later confirmed by (Randhwa and Damodaran, 1961). The floral biology of the variety Sai sugandh was studied and it was found that the anthesis occurs throughout the day but especially between 7.00 and 11.00 hours (Desai *et al.*, 1994).

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Sex ratio

Sex ratio varies among mango cultivars and also influenced by the environmental conditions. Naik and Gangolly (1950) described the South Indian mangoes and a monograph was prepared accordingly. Kalyansundaram (1976) reported the highest percentage of perfect flowers in Neelum and lowest in Malgoa. In Sai sugandh variety the average of 947.9 flowers/panicle was observed of which 75.73% were perfect flowers (Desai *et al.*, 1994) Muhammad (1999) reported that difference in sex ratio may be due to their genetic makeup, time of flowering, response to prevailing climatic condition and endogenous growth hormones. They also noted that the percentage of hermaphrodite flowers is important to decide the fruit set. The percentage of flowers among the cultivars varied significantly and ranged from 21.1%- 90.6%, more number of flowers was observed in cv. Samar Behisht and Langra. Afifi *et al.* (2000) studied the flowering behavior of Langra and Fajri kalan, and noted that male/ perfect flower ratio of Langra was lower than Fajri Kalan especially in 'on' year for Langra and 'off' year for the variety Fajri kalan. Studies on sex ratio of cultivars Anwar Rataul, Langra and Deshehari showed more number of male flowers in Anwar Rataul and Deshehari than Langra on south and west side of plant and Langra with more number of hermaphrodite flowers on the south side (Muhammad *et al.*, 2002). Anila (2002) reported that percentage of hermaphrodite flowers ranged from 15.77 to 43.39 in Muvandan and Alphonso under Kerala condition.

Chatterjee (2007) observed percentage of perfect flowers per panicle in Amrapali, Mallika, Prabhasankar, Mahmud Bahar, Alfazli, Sunder, Langra, Neelgoa, Neeluddin, Neelashan, Ratna, Arka Puneet, and Arka Anmol and noted that Amrapali exhibited maximum percentage of perfect flowers per panicle, while Neelashan showed highest number of flowers per panicle. Shu (2009) observed the sex distribution, sex ratio and natural pollination percentage of mango cultivars Viz., Haden, Irwin, Keitt and Tsai suan and it was noted that Keitt has highest sex ratio of 1.44 per cent, while Haden showed the lowest of 0.2 per cent. (Kundu, 2010) studied the flowering behaviour of mango cv. Amrapali in different directions (East, west, North, South) West Bengal. The hermaphrodite flowers were highest (22.20-42.91%) in western direction and the male flowers were highest (77.63-86.97%) in southern direction during the studies.

Anther dehiscence

Dehiscence occurs soon after the opening of flowers. Singh (1954) reported that cloudy days with consequent high humidity delays full opening and dehiscence in mango. Prapanopassin (1997) reported that under natural conditions anther dehiscence in mango takes place in morning during 8.00 and 10.00 hours in Thailand and most of the cultivars show high percentage of dehiscence when the inflorescence was collected and kept in chamber with relative humidity higher than 80 percent. Study on anther dehiscence in three cultivars namely Choke Anan, Nam Dok Mai and Khiew sawoey

showed highest anther dehiscence with average of 74.16% in Choke Anan and it was found that at high relative humidity (70-90%) the time of anther dehiscence exerted no effect on Choke Anan but affected Nam Dok Mai and Khiew sawoey showing anther dehiscence of 14.95% and 20.06% respectively leading to poor fruit set. (Jutamane,1999).

Stigma receptivity

In mango stigma receptivity remains receptive under favourable conditions for about two days Popenoe (1917). Wagle (1929) suggested that best receptivity is seen on the first day of the opening. Later report showed that stigma receptivity continues for 72 hours after flower opening. Singh (1954). Robbertese *et al.* (1994) reported that stigma is receptive as evidenced by pollen germination from 18 hours prior to anthesis to atleast 72 hours after anthesis with optimum receptivity occurring within 3 hours from anthesis. In variety Sai sugandh the stigma receptivity was greatest on the day of anthesis and ceased after 3 days (Desai *et al.*, 1994).

Pollen morphology

The percentage of viable pollen is quite high in mango. It was reported that all mango varieties possess oblong to oval pollen grains which are slightly broader in some varieties and narrower in others, but are of same shape in all when in normal dry state. When moistened the grains become spherical. In normal dry state they are almost oblong in shape. The other shape of mango pollen are ovalish round, triangular, elliptic, rhomboidal and round (Singh,1954; Randhawa and Damodaran,1961)Pollen size in different varieties of mango varied from 24 μ -30 μ (Mukherjee, 1950) and Singh (1954) observed the average size of pollen grains in Langra and Dasherri as 27.3 μ and 28.11 μ m respectively. Singh (1961) observed pollen grains of 50 Indian cultivars of mango and found that the length ranged from 25.3 μ m to 28.3 μ m. Parveen and Qaiser (2010) noted that the size of pollen in family Anacardiaceae is in the range of 22.5 μ m- 32.31 μ m.

Pollen viability

Pollen viability has great importance in hybridisation programme. Zirke (1937) described the method of mounting pollen on acetocarmine and the pollen which were stained are viable and unstained were considered non viable. Stanley and Linskens (1974) mentioned some other stains as aniline blue, potassium iodide, methyl green etc to indicate viability. Bolat and Pirlak (1997) estimated the pollen viability of stone fruits using TTC. Desai *et al.* (1994) observed the pollen viability of variety Sai sugandh while studying the floral biology of it and found that the pollen viability was 93.75%.Dag *et al.* (1999) studied pollen viability of 'Kent' mango in Isreal using scanning electron microscope and it was determined that the percentage of stained pollen grains increased significantly from 23-96%. Pichakum *et al.* (1999) determined viability using flurochromatic reaction (FCR) test in mango cultivars like Khiew Sawoey, Choke Anan and Dok Mai and the results indicated that all cultivars had high pollen viability between

81.33% - 91.29% and there was no temperature effect on pollen viability as all the three cultivars viability was about the same.

Pollen germination

Artificial germination of mango pollen is reported to be difficult by different workers. Singh (1954) reported the failure of pollen to germinate in 25 per cent sugar, 0.5 percent agar at temperature of 75⁰ to 80⁰ F and in other media concentrations. Randhawa and Damodaran (1961) recorded highest pollen germination in 10 per cent sugar solution (28.2%) in mango var. Chausa. Jutamaneet *et al.* (2000) noted that germination of pollen ranged between 24.10% - 32.51% in Nam Dok Mai and Khiew Sawoey cultivars of mango.

Khan and Perveen (2009) studied the pollen germination capacity of three mango cultivars viz., Chausa, Dashehari and Langra by hanging drop technique in different concentrations of sucrose solution (5%- 50%) with 1% agar and 0.01% boric acid, of which Langra pollen showed better germination even when kept upto 48 weeks.

Reference

- Abourayya, M.S., Kassim N.E., El-Sheikh, M.H and Rakha A.M.2011. Comparative study between inflorescences characteristics, pollen viability, germination and dimensions of Tommy Atkins, Kent and Keitt mango cultivars. *Life Sci. J.*, 8(1):100-105
- Afifi, M.M.G., Shaltout, A.D., El-Nasr, N.M.A., Mohmad, R.B. and Desouky, I.M.2000. Studies on flowering of some mango cultivars. II. Flowering behaviour. *Ann. Agric. Sci.*, 3 (special):1245-1257
- Anila, 2002. Performance studies in selected varieties and hybrids of Mango (*Mangifera indica L.*) M.Sc thesis, KAU, Thrissur
- Bally, I.S.E., Harris M.A., Johnson, P.R., Robinson, D., Kulkarni, V.J., Hamilton, D. and Lenordi, J.2000. The Australian National Mango Breeding Project. *Acta Hort.*, 509:225-231
- Boughanmi, K. and Harche, M.2009. Structure, Ultrastructure of the anther, pollen microsporogenesis and morphology of pollen grains of two populations of *Lygeum spartum L.* in Algeria. *American J. Agric. Biol. Sci.*, 4(3):201-205
- Chatterjee, D., Maurya, K.R. and Mandal, M.P.2007. Flowering behavior of some hybrids of mango (*Mangifera indica linn.*). *J. Interacademia.*, 11 (3):283-287
- Dag, A., Eisenstein, D. and Gazit, S.2000. Effect of temperature regime on pollen and the effective pollination of 'Kent' mango. *Israel. Sci. Hort.*, 86:1-11
- Desai, A.G., Limaye, V.P and Gunjate, R.T. 1986. Floral biology of Alphonso, Goamankur, and Kesar varieties of mango. *J. Maharashtra Agric. Univ.*, 10 (2): 193-195
- Desai, U.T., Masalkar, S.D., Choudhari, S.M., Kale, P.N. and Nagre, P.K.1994. Floral biology of mango hybrid Sai-Sugandh (RHR-M-1). *Recent Hort.*, 1:11-13
- Gandhi, S.R.1955. The mango in India. *Farm bull. Indian Coun. Agric. Res.*, 6.
- Griggs, W.H., Vansell, G.H. and Iwakiri, B.T.1953. The storage of hand collected and bee collected pollen in a home refrigerator. *Proc. Am. Soc. Hort. Sci.* 62:304-305.
- Gunjate, R.T and Burondkar, M.M.1993. Parthenocarpic mango developed through hybridization. *Acta Hort.*, 341:107-114
- Gunjate, R.T., Jorwekar, D.P. and Lad, B.L. 1983. Pollination, fruit set and fruit drop in Alphonso mango. *J. Mah. Agric. Uni.*, 8: 168-170.
- Issarakraisila, M., Considine, J.A., Tumer, D.W.1994. Effects of temperature on pollen viability in mango cv Kensington. *Acta Hort.*, 341:112-124
- Jutamaneet, K., Pichakum, A., Krisanapook, K. and Phavaphutanon, L.2000. Anther dehiscence, pollen viability and pollen germination of three mango cultivars with different fruit set characters. *Acta Hort.*, 509:553-558
- Jyothi, M.L. 2000. Variability and character association of pickling type mango. Ph.D thesis, KAU, Thrissur
- Kalyanasundram, P. 1978. Studies on floral biology of mango (*Mangifera indica L.*) *AUARA* 6:38-48.
- Kannan, K.1982. *Mavum Mangayum*. State Institute of Languages, Kerala. P.300
- Khan, S.A. and Parveen, A.2009. Pollen germination capacity of three mango cultivars (*Mangifera indica L.*, *Anacardiaceae*) from Pakistan. *Pak. J. Bot.*, 41:1009-1012
- Kumar, N. 2006. *Breeding of horticultural crops principles and practices*. New India Publishing Agency, New Delhi 110 088,
- Kundu, S., Yamben, Y. and Ghosh, B. 2010. Flowering behavior of mango cv Amrapali under West Bengal condition. *Env. Eco.*, 28:105-106
- Lakshminarayana, S. and Aguliar, P.H. 1975. Effect of orchard heating in reducing parthenocarpic fruits in Haden mango. *Proc. Amer. Soc. Hort. Sci.*, 88:502-505
- Litz, R.E. 1997. *The Mango*, Botany, production and uses. 1st Ed. CAB international, New York, 587pp.
- Mellenthin, W.M.C., Wang, C.Y. and Wang, S.Y.1972. Influence of temperature on pollen tube growth and initial fruit development in 'D Anjou' pear. *Hort. Sci.* 7: 557-559
- Muhammad, A., Muhammad, U., Muhammad, J.J and Muhammad, M.K.2002. Comparative study of flower sex ratio in different cultivars of Mango (*Mangifera indica L.*). *Int. J. Agric. Biol.*, 4(2): 220-221
- Mukherjee, S. K.1953. The mango, its botany, cultivation, uses and future improvement. *Econ. Bot.*, 7: 130-162
- Mukherjee, S.K. 1949. The mango and its relatives. *Sci. cult.*, 15:5-7
- Mukherjee, S.K., Singh, R.N., Majumder, P.K and Sharma, D.K.1968. Present position regarding breeding of mango (*Mangifera indica L.*) in India. *Euphytica.*, 17: 262-267
- Mukherjee, S.K.1949. A monograph on the genus *Mangifera L.* 12: 73-136
- Mukherjee, S.K.1950. Mango: its allopolyploid nature. *Nat.*, 166:196-197
- Naik, K. C. and Gangolly, S.R.1950. Classification and nomenclature of South Indian mangoes. The Madras Department of Agriculture, Sudt. Printing press, Madras pp.31

- Naik, K.C.1948. Improvement of mango by selection and hybridization. Ind. J. Agric. Sci.,18: 35-41
- Oosthuysen, S.A.1991. Stages of development of mango panicle. *South African Mango Growers Association Yearbook* 11, 59-61
- Perveen,A and Qaiser,M.2010.Pollen flora of Pakistan:Anacardiaceae. Pak.J.Bot. 42(3):1401-1406.
- Pinto, A.C.Q., Andrade, S.R.M and Venturoli, S. 2004. Fruit set success of three mango (*Mangifera indica* L.) cultivars using reciprocal crosses. Acta Hort.645
- Pongsomboon, W., Stephenson, R.A., Whiley, A.W.and Subhadrabandu, S.1991. Development of water stress in juvenile mango (*Mangifera indica* L.) trees. Acta Hort :321, 496-503.
- Popenoe, W(1917). *The pollination of the mango*. Bull. 542 US Department of Agriculture, p.24
- Radha,T. and Nair, S.R.2000. Status of mango cultivation in Kerala. Acta Hort., 509:117-121
- Ram, S., Bist, L.D., Lakhanpal S.C., and Jamwal, I.S. 1976. Search of suitable pollinizers for mango cultivars. Acta Hort., 57:253-263
- Randhwa, G.S and Damodaran, V.K. (1961). Studies on floral biology and sex ratio in mango (*Mangifera indica* L.) var. 'Chausa', 'Deshehari' and 'Krishnabhog'. III. Anthesis, dehiscence, receptivity of stigma, pollination, fruit set and fruit development. Indian J. Hort., 18:51-64
- Robbertse, P.J., Coetzer, L.A., Tomer, E. and Smith, M.F.1994. Sexual compatibility between different mango cultivars. Year book- S. Afr. mango Growers Association.14;18-20
- Robbertse,P.J., Coetzer, L.A., Tomer, E. and Truscott, M.1993. Sexual compatibility between different mango cultivars.S. Afr.mango Growers Association Yearbook 13: 24-26.
- Roizman, Y.1984. The involvement of different factors in the process of pollination, fruit set and embryo development of monoembryonic and polyembryonic mango varieties. *M.Sc thesis*, Hebrew Univ. Jerusalem, Rehovot, Israel.
- Salvi, P.V.1983. 'Ratna' – a new mango variety. Indian Hort., 27:13.
- Sen, P.K., Mallik, P.C. and Ganguly, B.D.(1946).Hybridization of the mango. Indian J.Hort., 4: 4-15
- Sharma, D. K. and Singh, R.N.1970. Self incompatibility in mango (*Mangifera indica*L.). Hort. Res., 10: 108-115.
- Sharma, D. K.1987. Mango breeding. Acta Hort., 196: 61-67
- Sharma, D.K. and Singh, R. N. 1972.Investigations of self incompatibility in mango (*Mangifera indica* L.). Hort. Res.,10:108-115
- Shu, Z.H., Sheen, T.F. and Lee, K.C. 1989. Current researches on the unfruitfulness of mango in Taiwan. Acta Hort., 231:68.
- Singh R.N.1954. Studies on floral biology and subsequent developments of fruit in mango varieties Dashehari and Langra. Indian J.Hort., 11.1
- Singh, L.B.1960.*The Mango.Botany,Cultivation and Utilization*. Leonard Hill, London.
- Singh, R. N. 1954. Studies on the floral biology and subsequent development of fruit in the mango varieties Dashehari and Langra. Indian J.Hort., 11 (1):69-88
- Singh, R.L., Singh, K and Roy, R.N.1999. Pollen and pollination studies in mango (*Mangifera indica* L.). J. Res., Birsra agricultural university 11(1):83-84
- Singh, R.N.1958. Studies on differentiation and development of fruit in mango (*Mangifera indica* L.)II. Morphological and histological changes.Hort.Adv., 2: 37-40
- Singh, S.N.1961. Studies on the morphology and viability of the pollen grains of mango. Hort.Adv., 5:121-144
- Singh, S.N.1962. Studies on pollen storage of mango. Indian J.Hort., 19(3&4):92-103
- Soule, J.1985.*Glossary for Horticultural Crops*.Wiley, New York.
- Spencer, J.L. and Kennard, W.C. 1955.Studies on mango (*Mangifera indica* L.) fruit set in Puerto Rico. Trop.Agric., 32:323-330
- Stanley, R.G. and Linskens, M.P.1974. Pollen biology, biochemistry and management. Springer Verlag Bulin Hiedelburg, New York, p.265
- Sturrock, T.T.1944. Notes on the mango. Stuart daily News, Inc., Sturart, Fla., pp: 122
- Sturrock,T.T. 1966. The mango inflorescence. *Proceedings of the Horticultural Society*:53, 366-369.
- Sukhvibul, V., Hetherington, S.E., Vithanage, V., Whiley, A.W., and Smith, M.K.2000.Effect of temperature on pollen germination, pollen tube growth and seed development in mango(*Mangifera indica* L.).Acta Hort., 509:609-616
- Uthaiiah, B.C., Indires, K.M., Rao, I.S.A and Hannummaiah, N.1988. Flower and sex variation in mango varieties under coastal Karnataka. *Prog. Hort*.20: 120-122
- Wagle, P. V(1929). A preliminary study of the pollination of Alphonso mango. Agric.J.India, 24,259
- Young, T. W. 1942. Investigations of the unfruitfulness of the Haden Mango In florida. *Fla. St. Hort. Soc. Proc*.55:106-110
- Zirke, C.1937. Acetocarmine mounting media. Sci., 85:528.

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