Biological Forum – An International Journal **14(3): 1222-1225(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Seasonal Influence on Pollen Yield of different Coconut varieties in Coastal Andhra Pradesh

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(Received 11 July 2022, Accepted 13 August, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present investigation entitled "Seasonal influence on pollen yield of different coconut varieties in coastal Andhra Pradesh" was conducted during 2021-2022 at Horticulture Research Station, Ambajipeta, East Godavari District, A.P. The experiment is laid out in a Factorial Randomized Block Design with two factors at unequal levels and replicated thrice with the main aim to find out the effect of different seasons on floral/ inflorescence characters in different coconut varieties and pollen yield from fresh staminate male flowers *viz.*, East Coast Tall (ECT), Philippines Ordinary Tall (PHOT), Ganga Bondam Green Dwarf (GBGD) and Chowghat Orange Dwarf (COD). The results revealed that the varieties *viz.*, ECT & PHOT recorded the highest floral traits compared to dwarf varieties during rainy season. Maximum number of spikelets recorded in ECT (41.00), maximum mean length of spikelet (49.66 cm) and number of staminate flowers per spikelet (218.27) was recorded in PHOT in rainy season respectively. Maximum pollen yield was recorded in PHOT (1.07 g) in summer season.

Keywords: Coconut (*Cocos nucifera* L.), spikelets per spadix, spikelet, male flowers, pollen yield.

INTRODUCTION

The coconut palm - *Cocos nucifera* L. (2n=32) is a woody perennial monocotyledonous tree that belongs to the family Aceraceae, subfamily Cocoideae that includes 27 genera and 600 species. Harries (1990) proposed the ancestral home of coconut as coasts and islands of the Tethys Sea, where it dispersed to islands of Indian Ocean and Pacific Ocean by floating and domesticated in the continental coast and larger islands of Malesia. The palm is referred to as '*Kalpa Vriksha'* which means 'the tree which provides all the necessities of life'. It is also called 'The tree of Wealth' or 'The tree of Life' (Ahuja *et al.* 2014).

Coconut is distributed mainly in coastal regions between 20°N and 20°S from sea level to 1000 m above sea level in more than 86 countries which can be grouped into eight distinct coastal / oceanic regions on four continents (Harries 2001). The ideal growing temperature for coconut ranges between 24°C and 30°C (Woodroof, 1979). Coconut plays a significant role in the economy of India and is third largest coconut producing country in the world.

The coconut palm produces an inflorescence in the axil of each leaf that bears a large number of spikelets with male and female flowers. The female flowers are at the base of each spikelet, while large number of male flowers are closely arranged above the female flowers. Inflorescences open successively at intervals varying from 22 to 30 days, depending on the environmental conditions and age of the palm. From the second to the nineteenth day after opening of the inflorescence, the male flowers open. (Liyanage *et al.*, 1954). Anthesis occurs in the early hours of the day and proceeds from tip downwards in the spikelet.

Pollen yield per inflorescence varies from a little over 1 g in some dwarfs to about 10 g in talls. Gangolly *et al.* (1961) reported a seasonal influence on production of pollen in individual male flowers as well as total production of pollen in the inflorescences. Pollen production in individual flowers has been observed to be significantly higher in summer and cold seasons than in rainy season. Studies conducted in India have revealed a diurnal variation in pollen catches, with pollen catches during the night significantly lower than during the day. A seasonal variation was also observed in production of pollen. Atmospheric pollen catches in March and April were found to be significantly higher than during other months. There was an increase of yield of nuts during periods when pollen catches were heavy and vice versa.

Generally, coconut pollen is mainly utilized for the production of hybrids to supply to the farmers and also for creation of variability by breeders. The demand for quality hybrid seedlings is always high by the farmers. The hybrid seed production starts after the end of the rainy season, usually from November to May in Kerala State while in coastal Andhra Pradesh, it starts from second fortnight of September to June. Preliminary studies showed that there was no pollen yield in the spikelets during the months of June to August in Andhra Pradesh. In order to have continuous supply of pollen throughout year for hybridization, the present study on Seasonal influence on pollen yield of different coconut varieties in coastal Andhra Pradesh" with an objective to study the influence of seasons on floral traits and pollen yield.

MATERIAL AND METHODS

The experiment was conducted during 2021-2022 at Horticulture Research Station, Ambajipeta, Andhra Pradesh in Factorial Randomized Block Design with two factors (Varieties & Seasons) at unequal levels and replicated thrice with four palms in each. In the present study two coconut types *viz.,* Talls (East Coast Tall (ECT) & Philliphinnes Orinary Tall (PHOT)) and Dwarfs *viz.,* Ganga Bondam Green Dwarf (GBGD) and Chowghat Orange Dwarf (COD) and different seasons *viz.,* winter, summer and rainy were taken. The data on mean number of spikelets per spadix, spikelet length and number of male flowers per spadix were recorded in different seasons.

Collection of pollen from male flowers: After the complete emergence from the leaf axils (once every 20-25 days) and just before the natural opening of the male flowers, inflorescences were bagged to prevent contamination by foreign pollen. After 6 to 7 days, spikes were collected on a bright sunny day between 8 – 10 am when the male flowers started opening from the tip. Male flowers were stripped off from the spikelets. The male flowers were placed between the folds of thick paper and gently crushed with the help of a roller and 100 g of staminate flowers were weighed. The dried male flowers were sieved (mesh size - 0.2 mm) and pollen was weighed. Pollen yield of different coconut varieties was calculated from fresh staminate male flowers (g/100 g).

The results of floral traits and pollen were subjected to one-way ANOVA and significant differences were evaluated by DMRT using the SPSS 16.2 software.

RESULTS AND DISCUSSION

The results on mean spikelets per spadix, mean spikelet length (cm) and mean number of staminate flowers per spikelet was depicted in Table 1 showed significant difference among the varieties and seasons whereas the interaction between varieties and seasons with all the parameters showed non-significant. The mean number of spikelets per spadix, mean length of the spikelet and number of staminate flowers per spikelet in different varieties ranged from 29.43 to 39.68, 33.89 to 47.52 and 166.46 to 205.76 respectively where as the mean number of spikelets per spadix ranged from 34.18 to 37.58, mean length of spikelet from 36.82 to 41.00 and mean number of staminate flowers from 183.96 to 195.68 in various seasons

Among the different varieties, the highest number of spikelets per spadix and maximum spikelet length (cm) were recorded in Talls *viz.,* East Coast Tall (39.68 & 36.13) & Philippines Ordinary Tall (38.88 & 47.52) compared to dwarfs *i.e.,* Ganga Bondam Green Dwarf (34.64 & 33.89) and Chowghat Orange Dwarf (29.43 & 36.46). Among the varieties, highest number of spikelets was noticed in East Coast Tall (39.68) and minimum in Chowghat Orange Dwarf (29.43) and maximum spikelet length (cm) was observed in Philippines Ordinary Tall (47.52) and minimum in Ganga Bondam Green Dwarf (33.89). With respect to the number of staminate flowers per spikelet, Talls *viz.,* Philippines Ordinary Tall (205.76) and East Coast Tall (197.17) compared to dwarfs *i.e.,* Ganga Bondam Green Dwarf (166.46) and Chowghat Orange Dwarf (188.10). Maximum number of staminate flowers was observed in Philippines Ordinary Tall (205.76) while minimum in Chowghat Orange Dwarf (188.10). Variations among the different cultivars of coconut in respect of floral characteristics were reported by many works. (Panda, 1982; Ratnambal *et al.* (2003); Kumaran *et al.,* 2004; Hemavathy & Balaji, 2008). These findings are also harmony with those found by Singh *et al.,* (2021) where floral traits of thirteen local tall coconut genotypes were studied and significant differences among the traits were observed, except the number of inflorescences. Hemavathy & Balaji (2008) found more number of spikelets per spadix in Ganga bondam (41.5) among dwarf cultivars.

It is noticed from the Table 1 that the mean spikelets per spadix, mean spikelet length (cm) and mean number of staminate flowers per spikelet showed significant

difference among various seasons and where as the mean number of spikelets per spadix ranged from 34.18 to 37.58, mean length of spikelet from 36.82 to 41.00 and mean number of staminate flowers from 183.96 to 195.68 in various seasons. Among various seasons, the highest mean number of spikelets per spadix (37.58), mean length of the spikelet (41.00 cm) and mean number of staminate flowers per spadix (195.68) were recorded during rainy season whereas the lowest number of spikelets per spadix (34.18), mean length of the spikelet (36.82 cm) and mean number of staminate flowers per spadix (183.96) were recorded during winter. The finding was in tune with the results Samanta *et al.,* 2009 who reported that maximum number of spikelets per inflorescence was observe in winter months whereas minimum number of spikelets per inflorescence was in summer months. Also notice maximum spikelet length during December while shortest spikelet length during February.

Interaction between varieties and seasons on mean length of the spikelet, mean length of spikelet (cm) and mean number of staminate flowers per spikelet were found non-significant (Table 1). The highest number of spikelets per spadix (41.00) is recorded in East Coast Tall during rainy season whereas maximum mean spikelet length (49.66 cm) and mean number for staminate flowers per spikelet (218.27) were recorded in Philippines Ordinary Tall during rainy season. Minimum number of spikelets per spadix (28.29) is registered in Chowghat Orange Dwarf during winter season whereas minimum mean length of spikelet (32.15 cm) and mean number of staminate flowers per spadix were observed in Ganga bondam Green Dwarf during winter season.

Pollen yield (g/100 g of fresh staminate male flowers). The data pertaining to the pollen yield from fresh staminate male flowers of different varieties as influenced by different seasons are presented in Table 2 and Fig. 1. Pollen yield (g/100 g of staminate flowers) in different varieties, seasons and their interaction between varieties and seasons were highly significant. The pollen yield (g/100 g of staminate flowers) in different coconut varieties ranged from 0.54 to 0.93 g whereas in various seasons from 0.53 to 0.80 g. Talls *viz.,* Philippines Ordinary Tall & East coast tall recorded the highest pollen yield compared to dwarfs viz., Ganga bondam Green Dwarf.

Among the different varieties (Fig 1), the highest amount pollen yield (g/100 g staminate flowers) was recorded in Philippines Ordinary Tall (0.93 g) followed by East Coast Tall (0.71 g) and lowest was recorded in Chowghat Orange Dwarf (0.54 g). Maximum pollen yield (g/100 g staminate flowers) was recorded during summer season (0.80 g) followed by winter season (0.74 g) and minimum during rainy season (0.53 g). It is noticed from Table 2 that the interaction between the varieties and seasons showed maximum pollen yield(g/100g of staminate flowers) in Philippines Ordinary Tall during summer season (1.07 g) followed by winter season (0.99 g) whereas minimum pollen yield was recorded in Chowghat Orange Dwarf during rainy season (0.40 g). These findings are also in good conformity with the observation of These results were in hormony with the finding of Manthriratna (1965) who stated that pollen yield per inflorescence varies from a little over 1 g in some dwarfs to about 10 g in talls.

Gangolly *et al. (*1961) who noticed seasonal influence on production of pollen in individual male flowers as well as total production of pollen in the inflorescences. Pollen production in individual flowers has been observed to be significantly higher in summer and cold seasons than in rainy season.

Table 1: Effect of different seasons on floral traits in different coconut varieties.

Varieties	Number of spikelets per spadix				Mean length of spikelet(cm)				Number of staminate flowers per spikelet			
	Winter	Summer	Rainy	Mean	Winter	Summer	Rainy	Mean	Winter	Summer	Rainy	Mean
ECT	38.54	39.50	41.00	**39.68**^{c}	34.61	34.79	39.00	**36.13**^{b}	192.32	197.96	201.25	**197.17**^{c}
PHOT	37.33	38.66	40.66	**38.88**^{c}	46.23	46.68	49.66	**47.52**^{c}	195.94	203.06	218.27	**205.76**^{c}
GBGD	32.54	33.73	37.65	**34.64**^{b}	32.15	32.86	36.65	**33.89**^{a}	162.26	165.81	171.32	**166.46**^{a}
COD	28.29	29.00	31.00	**29.43**^{a}	34.28	36.45	38.66	**36.46**^{b}	185.33	186.80	191.89	**188.10**^{b}
Mean	**34.18**^{a}	**35.20**^{b}	**37.58**^{c}	**35.65**	**36.82**^{a}	**37.70**^{b}	**41.00**^{c}	**47.81**	**183.96**^{a}	**188.41**^{b}	**195.68**^{c}	**189.37**
Factors	**SE(m)±**			**C.D@5 %**	**SE(m)±**			**C.D@5 %**	**SE(m)±**			**C.D@5 %**
Varieties(V)	0.37			1.08	0.31			0.92	1.54			4.71
Seasons(S)	0.32			0.94	0.27			0.79	1.08			3.33
V×S	0.64			NS	0.54			NS	2.17			NS

*ECT-East Coast Tall, PHOT-Philippines Ordinary Tall, GBGD-Ganga Bondam Green Dwarf and COD-Chowghat Orange Dwarf.

Table 2: Effect of different seasons on pollen yield in different coconut varieties.

Varieties	Pollen yield (g/100g) of staminate flowers			
	Winter	Summer	Rainy	Mean
East Coast Tall (ECT)	0.71	0.79	0.63	**0.71^{c}**
Philippines Ordinary Tall (PHOT)	0.99	1.07	0.75	**0.93^{d}**
Ganga Bondam Green Dwarf (GBGD)	0.66	0.68	0.45	**0.60^{b}**
Chowghat Orange Dwarf (COD)	0.59	0.65	0.40	**0.54^{a}**
Mean	**0.74^{b}**	**0.80^{a}**	**0.53^{c}**	**0.68**
Factors	**SE(m)±**			**C.D@5%**
Varieties	0.05			0.15
Seasons	0.04			0.13
Varieties×Seasons	0.09			0.25

*ECT-East Coast Tall, PHOT-Philippines Ordinary Tall, GBGD-Ganga Bondam Green Dwarf and COD-Chowghat Orange Dwarf.

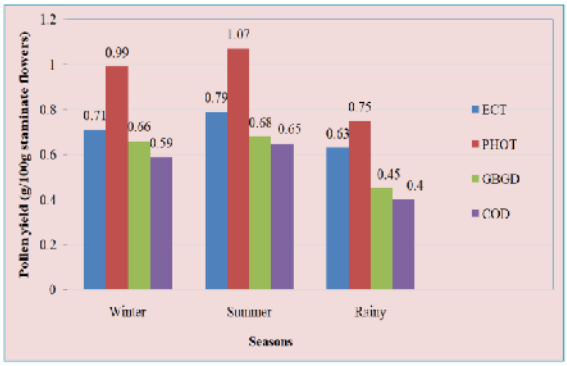

Fig. 1. Effect of different seasons on pollen yield of different coconut varieties.

CONCLUSION

From the study, it is inferred that the floral traits viz., number of spikelets, length of spikelets, number of male flowers and pollen yield have been performed better in the tall varieties like ECT and PHOT as compared to the dwarf varieties like GBGD and COD. With respect to seasons the pollen yield during summer season is high which can be stored for hybridization purpose in rainy season.

Acknowledgement. The authors are grateful to Dr. M. Kalpana, Professor and Head, Department of PSMA, Dr., V. Aparna, Scientist, ICAR-CPCRI, for the valuable guidance and support for the standardization of various protocols of coconut floral traits and pollen yield studies. We are also thankfull to Dr. L. Naram Naidu, Director of Research for his support and Dr. M. Paratpara Rao, Division of Genetics and Plant breeding for his assistance throughout the process of pollen harvesting.

Conflict of Interest. None.

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How to cite this article: Srinivasu P., Kalpana Motha, Aparna V., Naram Naidu L. and Paratpararao M. (2022). Seasonal Influence on Pollen Yield of different Coconut varieties in Coastal Andhra Pradesh. *Biological Forum – An International Journal*, *14*(3): 1222-1225.