

FLOWERING, FLORAL BIOLOGY AND POLLINATION IN HARD AND SOFT FLAKED TYPES OF JACK (*ARTOCARPUS HETEROPHYLLUS* LAM.)

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Abstract: Investigations on the floral characters of 'Varikka' and 'Koozha' types of jack (*Artocarpus heterophyllus* Lam.) were conducted at the Agricultural Research Station, Mannuthy, Trichur on 14 mature trees. There was no significant difference between 'Varikka' and 'Koozha' types in respect of any of the characters studied. The pattern of male and female catkin production was found to differ in jack, the former occurred from October to February while the later was confined to only three months starting from late November to February. In a male catkin, anthesis started by 6 a.m. and continued up to 6 p.m. in a day. This pattern continued for 5 to 7 days in a catkin. Anther dehiscence occurred between 6 p.m. and 7 p.m. on the day of its emergence. The sequence of emergence of stigma on the female catkin was highly erratic and continued for 3 to 4 weeks. Complete fading away of the stigma occurred in 21 to 35 days after anthesis started. The chief agent of pollination was found to be wind although certain amount of insect pollination cannot be ruled out.

Key words : *Artocarpus heterophyllus*, floral biology, jack types, pollination.

INTRODUCTION

Jack is a popular, indigenous fruit of India. Though a primitive crop, so far no serious attempt has been made on the improvement and management of this crop. Very few cultivars are in existence. The two types distinguished based on the texture of the flakes are 'Varikka' having crisp, hard flakes and 'Koozha' having soft mushy flakes.

Floral studies have been attempted by a few workers from different parts of the country (Sambamurthy and Ramalingam, 1954; Teotia and Chauhan, 1969; and Sinha, 1975) the results of which appear contradictory in respect of a number of attributes. Investigations were conducted in the Kerala Agricultural University to gather information on flowering pattern, floral biology and pollination in 'Varikka' and 'Koozha' types of jack.

MATERIALS AND METHODS

The investigations were conducted at the Agricultural Research Station, Mannuthy, Trichur on 14 mature, bearing trees eight belonging to 'Varikka' type and six belonging to 'Koozha' type. The trees were of the same age group (40 to 50 years) and maintained under uniform management conditions. Flowering pattern, anthesis, anther dehiscence,

stigmatic receptivity and mode of pollination were studied.

Observations were taken from the new flowering shoots arising from the main trunk and older branches. The lateral shoots bearing small male catkins alone, in the tree canopy were not considered in the present study. Anthesis was studied using 25 male catkin and 25 or available female catkin on each tree. To understand the peak time of anthesis in a day in male catkin, the number of flowers opened was counted at bihourly intervals. The flowers opened were counted from one of the longitudinal quarters of the catkin and approximate number of flowers opened in a catkin was worked out. Anther dehiscence was observed under a stereomicroscope in the laboratory and confirmed in the field by noting the change of shape of dehisced anthers. Stigmatic receptivity in the female catkin was assessed by visual observation. The pollinating agents were traced by trapping the air borne pollen on greased microscopic slides (Ogden *et al.*, 1974) and also by closely observing the catkins for insects visiting them.

RESULTS AND DISCUSSION

Data on number and length of flowering shoots, percentage of productive flowering shoots, number of male and female catkins per flowering shoot in the experimental trees revealed that the two types 'Varikka' and 'Koozha' did not differ significantly for the

above characters (Table 1). **Special flowering** shoots were found to come out from certain points on the tree trunk every year during the flowering season. The female catkins were produced only on these flowering shoots. There were productive as well as unproductive shoots. The unproductive shoots were thinner, **unbranched** and produced only male catkins, whereas productive shoots were stouter, branched and produced both male and female catkins.

The trend of production of male and female catkins, during the months of flowering was found to vary much as presented in Table 2. The male catkins were produced early in the season, i.e., by the end of October and continued for five months with a peak in the months of December and January in 'Varikka' and 'Koozha' trees respectively. In the case of female catkins, their production was confined to only three months starting from late November to February with a peak in December for 'Varikka' and January for 'Koozha'. The number of catkins produced in each month was not found to vary significantly in both types.

The data on duration of male and female catkin production and number of male and female catkins produced per tree is presented in Table 1. 'Varikka' and 'Koozha' types did not differ significantly for the above character. The catkins are axillary in position and are enclosed by two large amplexicaul stipules along with the terminal bud of the flowering shoot. They emerge out of the stipules just before anthesis in succession.

The data on duration of anthesis in male and female catkin in both 'Varikka' and 'Koozha' are presented in Table 1. There were no significant differences between 'Varikka' and 'Koozha' types for the above character. Anthesis in a male catkin started by the third to fourth day after its emergence from the enclosing stipules as indicated by the protrusion of anthers on the smooth surface of the catkin. The individual stamen took 6 to 7 h for complete emergence. The emergence of stamens continued for 5-7 days in a single

catkin. The pattern of anthesis for a day is presented in Table 3. The peak time of emergence of stamens was found to be between 12 noon and 4 p.m. After that there was a decrease in the number of flowers opened and sparse after 6 p.m. After anthesis the male catkins were found to be attacked by fungus and shed gradually. The present observations were in general agreement with those of Teotia and Chauhan (1969) who reported the peak time of anthesis between 1 p.m. and 3 p.m. at Basti. Singh (1975) however observed it between 9 a.m. to 1 p.m. under Kanpur conditions.

From preliminary observations it was found that anther dehiscence took place in the evening after 4 p.m. When observed under a stereomicroscope in the laboratory it was seen that dehiscence started by 5 p.m. in anthers at random and continued till 8 p.m. The peak was observed between 6 p.m. and 7 p.m. and all anthers emerged on a single day dehiscence on the same day. The dehiscence was longitudinal. Dispersal of pollen was gradual after anther dehiscence. Sambamurthy and Ramalingam (1954) reported peak time of dehiscence at 2 p.m. at Coimbatore while Singh (1975) observed it between 1 p.m. and 3 p.m. at Kanpur. At Basti dehiscence was found to occur between 6 to 7 p.m. which is in conformity with the results obtained in the present study.

In a female catkin, the stigma of individual flowers started appearing on the apex of its perianth tube between 6 a.m. and 8 a.m. mostly on the third and fourth day after emergence of the catkin. In rare cases, anthesis started while the catkin was still inside the stipules. On the first day of anthesis, stigma appeared as a white spot at the apex of the perianth tube. The growth rate of stigma was considerably slow, it took 6-9 days for complete emergence. However, there was no regularity in the emergence of stigma at the apices of the perianth tubes except that it started always at the basal end of catkin. In the distal end anthesis started only on the fifth to sixth day after anthesis started at the stalk end. In the area in between, the

Table 1. Data on flowering shoots catkin production and duration of anthesis in jack types 'Varikka' and 'Koozha'

Characters	Jack type		t value
	'Varikka'	'Koozha'	
<i>Flowering shoots</i>			
Total no. of tree	41.25	76.83	0.98 ^{NS}
Mean length, cm	40.65	39.72	0.48 ^{NS}
Percentage of productive shoots	55.92	61.07	0.91 ^{NS}
Mean no. of male catkins per shoot	5.85	9.02	1.81 ^{NS}
Mean no. of female catkins per shoot	2.53	3.14	1.32 ^{NS}
<i>Catkin production</i>			
Duration of male catkin production in a tree, days	90.50	71.33	1.67 ^{NS}
Duration of female catkin production in a tree, days	37.57	37.80	0.64 ^{NS}
Mean no. of male catkins per tree	290.88	976.50	1.02 ^{NS}
Mean no. of female catkins per tree	45.63	135.83	1.33 ^{NS}
<i>Duration of anthesis</i>			
Male catkin	6.74	7.22	1.78 ^{NS}
Female catkin	23.96	20.97	0.49 ^{NS}

Table 2. Monthly percentage increase in catkin production

Jack type	Sex of catkin	Percentage increase in catkin production					
		October	November	December	January	February	March
Varikka	Male	3.65	25.57	36.66	28.78	3.90	0.44
Koozha	Male	0.20	13.03	23.85	41.43	19.94	1.73
t value		NS	NS	NS	NS	S	NS
		0.15	0.26	1.26	1.48	2.76	0.87
Varikka	Female	0	4.50	48.52	41.37	5.61	0
Koozha	Female	0	4.61	31.76	47.99	16.23	0
t value		-	NS	NS	NS	NS	-
		-	1.79	1.82	0.89	1.49	-

NS - Not significant

S - Significant

Table 3. Trend of anthesis on the second day of anther emergence

Time	Mean no. of flowers opened per catkin (approx.)		't' value	
	'Varikka'	'Koozha'		
6 a.m.	93.73	70.33	0.69	NS
8 a.m.	152.67	216.33	0.52	NS
10 a.m.	319.33	483.33	1.34	NS
12 a.m.	641.00	755.33	0.62	NS
2 p.m.	636.00	799.67	0.66	NS
4 p.m.	364.00	808.67	0.72	NS
6 p.m.	120.00	129.67	0.07	NS

emergence of stigma was highly erratic and continued for 18-36 days. The stigma surface was found fresh and moist from the time of its first appearance at the apex of the perianth tube till complete emergence. Stigma started to fade in 1 to 12 days after their emergence. The complete withering of all the stigmas on a catkin occurred in 21-4 days after anthesis started. Due to the highly irregular pattern of emergence of stigma, no conclusive study on the receptivity of individual stigma was possible.

The pollination in jack was found to be effected mainly by wind as the female flowers were seldom visited by any insects. The fact that jack pollen was present in the air samples collected from around the experimental trees confirmed the above view (Table 4). Sambamurthy and Ramalingam (1954) Teotia and Chauhan (1969) and Ram and Pal (1978) also have suggested that pollination may be taking place with the aid of wind. During the present investigations, some honey bees were found to visit the male catkins in the morning hours, which may be for collecting only pollen as nectar is not present in them. Occurrence of bee visits to anemophiles to collect pollen have been mentioned by Faegri and Pijl (1979). The scented nature of the male catkins and slow dispersal of pollen grains after

Table 4. Intensity of atmospheric pollen during the flowering season

Month	No. of slides observed	Av. no. of pollen / cover slip (4 x 2 cm)
November	20	5.6
December	20	7.8
February	20	2.1

dehiscence are the adaptations for entomophily, whereas the absence of nectar, attractive colour and scent in the female catkin, numerous small inconspicuous flowers etc are indicative of anemophily. Thus considering this dual adaptation for both, wind and insect pollination, it can be concluded that although wind is the chief agent involved in pollination of jack there may be chance for a small extent of insect pollination.

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