

Evaluation of cashew, *Anacardium occidentale* L hybrids for flowering parameters

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ABSTRACT

A field experiment was carried out under All India Coordinated Research Project on Cashew at Orissa University of Agriculture and Technology, Odisha to evaluate the cashew hybrids for various flowering parameters. The experiment was laid out by adopting augmented statistical design with 71 genotypes including 60 hybrids, 8 parents and 3 check varieties. The analysis of results based on adjusted mean values on various flowering parameters showed significant variations among the entries. The results clearly revealed that the selection of suitable parents and their combinations should be based on flowering parameters towards developing new hybrids or varieties of cashew. The parents like RP-2 and M-44/3 were identified as ideal female parents while VTH-711/4 and KBN as ideal male parents for development of better hybrids. Irrespective of cashew type (hybrids, cross parents and check varieties), the flowering duration varied from 78 days in check varieties Jagannatha (BH-6) to 126 in hybrid, A-71 and H-6. Considering the overall flowering parameters, relatively better hybrids identified in the present study were A-71, B-27, C-41, D-19, F-28 and G-8.

Keywords: Cashew; hybrids; flowering; sex ratio; perfect flowers

INTRODUCTION

Cashew, *Anacardium occidentale* L belonging to the family Anacardiaceae was introduced from Brazil to India by the Portuguese during 16th century for afforestation as well as soil conservation purposes. But later on India became the world leader in cashewnut production as well as export of kernel. The total production of cashewnut in India was 7.28

lakh tons from an area of 9.82 lakh hectare during 2012-13 (Saroj et al 2014). Although during last 13 years there is steady increase in both area and production of cashew in India but the productivity rate is very low ranging from 600 to 800 kg/ha with an average of hardly 772 kg/ha as against potential productivity of 2000 kg/ha. The primary reasons of low productivity of Indian cashew are existence of large areas under old senile plantation.

This low productivity of cashew can be addressed effectively by developing cashew genotypes having high nut yielding potential associated with better yield attributing traits (like flowering parameters) and adoption of scientific orchard management practices including proper plant protection measures.

Keeping these in view the present investigations were undertaken to evaluate the developed F_1 hybrids for flowering parameters.

MATERIAL and METHODS

The present investigations were carried out at Cashew Research Station of All India Coordinated Research Project on Cashew operating under Orissa University of Agriculture and Technology, Bhubaneswar, Odisha. Ten year old 60 hybrid plants from each cross combination (Table 1) along with their 8 parents and 3 check varieties were planted at a spacing of 4 x 4 m by adopting recommended package of practices uniformly.

The parents and check varieties along with their source of collection are depicted in Table 2. Data on various flowering parameters obtained during 2011 and 2012 were analyzed following augmented design (Petersen 1985) and adjusted mean values were used to calculate the significance of the hybrids.

RESULTS and DISCUSSION

A perusal of the results presented in Table 3 indicate significant variations among tested entries for different flowering laterals/m² and panicle characters among the tested hybrids, cross and check varieties.

The flowering laterals/m² were found significant among the hybrids studied ranging from 13.14 in E-12 (RP-1 x Kankady) to maximum of 22.87 in A-71 (RP-1 x KBN). The cross parent M-44/3 recorded the maximum flowering laterals of 17.37 and lowest in KBN (13.25). Most of the hybrids produced more number of laterals as compared to their cross parents. The check variety BPP-8 (H-2/16) also recorded higher number of lateral/m² (16.18) as compared to other check varieties. The hybrid B-27 recorded longest panicle of 25.37 cm and minimum was recorded in G-23 (12.28 cm). Among the cross parents VTH-711/4 produced the highest panicle length of 25.17 cm. Panicle breadth was also highest in B-27 (31.49 cm) and minimum was in G-23 (14.47 cm). The length and breadth of the panicles was also inherited from cross parents.

Similar results of wide variations among different cashew types for length and breadth of panicles have also been reported by Chandra Gowda et al (1989), Krishnappa (1991), Sena et al (1995) as well as Desai et al (2008).

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Table 1. List of sixty hybrids with their cross combinations

Hybrid series	Cross combination	Hybrids selected from each cross (#)	Hybrids used in the study
A	RP-1X Kalyanpur Bold Nut (KBN)	6	A-33, A-48, A-62, A-71, A-95, A-99
B	RP-1 x VTH -711/4	6	B-5, B-6, B-27, B-31, B-35, B-58
C	RP-2 x Kankadi	6	C-7, C-14, C-30, C-41, C-44, C-52
D	M-44/3 x VTH-711/4	6	D-9, D-10, D-15, D-19, D-29, D-47
E	RP-1 x Kankady	6	E-2, E-3, E-12, E-16, E-22, E-28
F	RP-2 x VTH-711/4	6	F-16, F-20, F-27, F-28, F-32, F-38
G	RP-2 x Kalyanpur Bold Nut	6	G-8, G-9, G-16, G-17, G-23, G-25
H	M-44/3 x Kalyanpur Bold Nut	6	H-2, H-6, H-8, H-10, H-20, H-26
I	Vittol- 44/3 x VTH-711/4	6	I-3, I-7, I-12, I-16, I-20, I-22
J	BPP-30/1 x Kalyanpur Bold Nut	6	J-1, J-6, J-12, J-13, J-14, J-20

Table 2. Parents and checks used in the study

Parent/check genotype	Source of collection
Parent	
RP-1	Ranasinghapur, Bhubaneswar, Odisha
Kalyanpur Bold Nut	Khurda, Odisha
VTH- 711/4	Directorate of Cashew Research, Puttur, Karnataka
RP-2	Ranasinghapur, Bhubaneswar, Odisha
Kankady	Cashew Research Station, Vengurla, Maharastra
M-44/3	Regional Cashew Research Station, Vridhachalam, Tamil Nadu
Vittol-44/3	Directorate of Cashew Research, Puttur, Karnataka
BPP-30/1	Cashew Research Station, Bapatla, Andhra Pradesh
Check	
BPP-8 (H-2/16)	Cashew Research Station, Bapatla, Andhra Pradesh
Jagannatha (BH- 6)	Cashew Research Station, Ranasinghapur, Bhubaneswar, Odisha
Balabhadra (BH-85)	Cashew Research Station, Ranasinghapur, Bhubaneswar, Odisha

The panicle shape varied from 12.50 (broadly pyramidal) to 87.50 per cent as pyramidal shape of panicle among the parents (Table 3). The present investigations indicated that among the hybrids developed from different combinations of parents the panicle shape varied from 66.67 to 83.33 per cent as pyramidal while only 16.67 to 33.33 per cent as either narrowly pyramidal or broadly pyramidal in shape indicating the dominance of pyramidal shape in their progenies.

The data presented in Table 4 for different flowering characters of cashew types reveal significant variations among the tested hybrids. Significantly highest number of perfect flowers/panicle was recorded in F-28 (233.43) followed by B-27, C-41, D-47 and F-27 (117.5 to 188.48). On the other hand significantly minimum perfect flowers/panicle were recorded in H-2 and I-22 (37.56 each). Among the cross parents KBN recorded lowest perfect flowers/panicle (15.41) while highest in BPP-8 (106.08) followed by M-44/3 (103.33) and RP-2 (99.00). In most of the hybrids where RP-2 or M-44/3 was used as one of the parent showed higher number of perfect flowers/panicle. Hence the parent should be selected on the basis of perfect flowers/panicle in hybridization programme which would be reflected in the subsequent progenies. These findings are in agreements with the findings of Nawale and Salvi (1990). According to them percentage of perfect flowers should be considered for selection of cashew parents which could be

transmitted to the hybrid progenies of cashew.

Regarding production of staminate flowers the results showed significant variations and hybrid B-5 recorded maximum number of staminate flowers (526.57) and minimum was recorded in H-26 (266.89) (Table 4) and among the cross and check varieties BPP-30/1 (248.50) recorded minimum and maximum was recorded in BPP-8 (426.50). The results also indicated significantly higher number of staminate flowers in parents like RP-1 (418.16), VTH-711/4 (366.33) and RP-2 (353.50) which were inherited to their respective hybrid such as A-95 (462.57), B-5 (526.57), C-30 (450.57), D-47 (440.53), E-16 (466.03), F-16 (442.53), F-20 (483.53) and F-27 (501.03).

Total number of flowers/panicle among the hybrids ranged from 311.01 in hybrid H-20 (M-44/3 x KBN) to 723.06 in hybrid F-38 (RP-2 x VTH-711/4). Among the check and cross varieties significantly lowest number of total flowers was recorded in KBN (268.33) while that of highest in BPP-8 (532.50) followed by RP-1 (503.66), RP-2 (452.66) and Vittol-44/3 (431.16). Invariably in most of the hybrids having the parents RP-1, RP-2 or Vittol-44/3 recorded relatively higher number of total flowers/panicle (Table 4).

The sex ratio which contributes towards fruit set ranged from 0.095 to 0.550 whereas the cross parent M-44/3

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Table 3. Mean performance of cashew genotypes for flowering laterals and panicle characters

S/N	Hybrid (#)	Flowering laterals/m ²	Panicle length (cm)	Panicle breadth (cm)	Panicle shape
1.	A-33	16.51	17.50	23.44	Pyramidal
2.	A-48	21.88	16.21	21.92	Pyramidal
3.	A-62	21.13	15.11	20.42	Pyramidal
4.	A-71	22.87	16.35	24.90	Pyramidal
5.	A-95	18.83	16.00	25.20	Pyramidal
6.	A-99	20.25	19.05	25.96	Narrowly pyramidal
7.	B-5	16.09	20.77	28.14	Pyramidal
8.	B-6	14.80	24.13	27.13	Broadly pyramidal
9.	B-27	20.45	25.37	31.49	Pyramidal
10.	B-31	18.92	23.96	24.89	Pyramidal
11.	B-35	15.09	15.22	20.93	Pyramidal
12.	B-58	14.57	19.29	23.15	Pyramidal
13.	C-7	18.69	19.21	23.55	Pyramidal
14.	C-14	14.04	22.27	28.52	Pyramidal
15.	C-30	18.76	21.94	28.51	Pyramidal
16.	C-41	17.98	21.83	28.80	Pyramidal
17.	C-44	15.21	23.55	29.05	Pyramidal
18.	C-52	14.41	20.66	25.01	Pyramidal
19.	D-9	16.73	20.10	25.03	Pyramidal
20.	D-10	17.43	18.32	22.03	Broadly pyramidal
21.	D-15	18.71	18.80	24.98	Pyramidal
22.	D-19	20.03	20.46	27.20	Pyramidal
23.	D-29	17.89	20.52	27.13	Pyramidal
24.	D-47	19.47	19.38	22.88	Pyramidal
25.	E-2	15.36	17.25	20.96	Broadly pyramidal
26.	E-3	16.46	16.87	20.58	Pyramidal
27.	E-12	13.14	19.24	24.76	Pyramidal
28.	E-16	15.02	19.83	24.88	Pyramidal
29.	E-22	15.86	18.52	23.79	Broadly pyramidal
30.	E-28	14.41	23.52	27.32	Pyramidal
31.	F-16	14.48	22.67	26.25	Pyramidal
32.	F-20	17.18	19.47	24.05	Pyramidal
33.	F-27	14.31	21.22	22.80	Broadly pyramidal
34.	F-28	19.22	18.14	21.53	Pyramidal
35.	F-32	13.38	15.63	18.23	Broadly pyramidal
36.	F-38	12.60	19.82	25.72	Pyramidal
37.	G-8	18.27	20.10	23.84	Pyramidal
38.	G-9	17.08	20.77	22.11	Pyramidal
39.	G-16	17.71	19.30	22.09	Narrowly pyramidal
40.	G-17	13.65	21.42	22.27	Pyramidal
41.	G-23	16.76	12.28	14.47	Broadly pyramidal
42.	G-25	15.56	20.27	27.76	Pyramidal
43.	H-2	17.04	18.08	21.92	Pyramidal

44.	H-6	18.79	17.77	22.41	Pyramidal
45.	H-8	16.57	18.37	24.30	Pyramidal
46.	H-10	15.23	20.07	22.72	Pyramidal
47.	H-20	16.92	17.04	19.22	Pyramidal
48.	H-26	18.43	17.37	21.49	Pyramidal
49.	I-3	15.00	20.41	26.47	Pyramidal
50.	I-7	13.89	13.72	18.33	Pyramidal
51.	I-12	18.55	14.73	19.55	Pyramidal
52.	I-16	17.17	17.63	19.02	Pyramidal
53.	I-20	16.70	20.53	23.02	Narrowly pyramidal
54.	I-22	13.58	22.31	22.02	Narrowly pyramidal
55.	J-1	16.34	16.37	25.73	Pyramidal
56.	J-6	17.71	19.37	22.38	Pyramidal
57.	J-12	17.86	18.14	25.90	Pyramidal
58.	J-13	18.72	20.27	25.52	Pyramidal
59.	J-14	15.48	21.20	24.78	Pyramidal
60.	J-20	18.41	18.20	21.28	Pyramidal
Parent					
61.	RP-1	16.24	22.07	24.68	Pyramidal
62.	KBN	13.25	16.63	19.79	Pyramidal
63.	VTH-711/4	14.36	25.17	26.80	Pyramidal
64.	RP-2	16.47	21.44	31.34	Pyramidal
65.	Kankady	13.71	20.31	24.85	Pyramidal
66.	M-44/3	17.37	17.72	21.98	Pyramidal
67.	Vittol-44/3	16.99	22.46	26.52	Pyramidal
68.	BPP-30/1	16.21	21.19	23.91	Pyramidal
Check					
69.	BPP- 8 (H-2/16)	16.18	17.52	20.99	Pyramidal
70.	Jagannatha (BH-6)	14.68	17.33	20.96	Pyramidal
71.	Balabhadra (BH-85)	15.31	16.08	20.16	Pyramidal
CD for hybrid, parent and check varieties mean		2.82	4.34	5.85	-

recorded highest value of 0.417 followed by RP-2 (0.283) and minimum was in KBN (0.063) (Table 4). Significantly higher sex ratio was observed in hybrid D-47 (0.433), F-28 (0.550) and F-38 (0.403) which might be due to high sex ratio of the parent RP-2 in hybrid, F-28 and F-38 and M-44/3 in D-47 hybrid. Sena et al (1995) also observed wide sex ratio among different cashew types which varied from 0.093 to

1.038 per cent under Bhubaneswar, Odisha conditions. Since higher percentage of hermaphrodite flower is expressed by wider sex ratio, the varieties having broader sex ratio would be potential higher yielders. Thus sex ratio may be considered for effective selection of parents and their combinations in cashew breeding programme. These results corroborate the findings of Dashmohapatra et al (2012) who

reported that the sex ratio can be used directly for selection in improvement of cashew.

Similar significant variations were also observed for percentage of perfect flowers and staminate flowers among the hybrids, check varieties and cross parentage (Table 4). The percentage of perfect flowers ranged from 35.61 in F-28 to lowest 7.70 in hybrid F-16. Significantly higher percentage of perfect flowers was recorded in M-44/3 (29.25), RP-2 (21.82), BH-85 (20.53) and BPP-8 (20.01) as compared to other checks and parents. Significantly higher percentage of perfect flowers was recorded in hybrids such as F-28 (35.61%) followed by D-47 (29.81%), F-38 (28.34%), F-32 (27.90%) and C-41 (26.16%) which might be contributed by their respective parent either M-44/3 or RP-2. Similar report of transmission of percentage of perfect flowers to the F_1 progenies in cashew has been reported by Nawale and Salvi (1990).

In cashew lower percentage of staminate flowers in a panicle is considered to be a desirable parameter. The results of present study indicated wide variations for percentage of staminate flowers among the hybrids, parents and check varieties ranging from 64.38 in hybrid F-28 to 94.10 per cent in cross parent KBN. The study also revealed significantly lowest percentage of staminate flowers in M-44/3 (70.74%) and RP-2 (78.17%) which might be inherited to the hybrids resulting significantly lower

percentage of staminate flowers in hybrid C-14 (74.30%), C-41 (73.85%), D-47 (70.18%), F-28 (64.38%), F-38 (71.68%) and G-8 (73.36%).

The results obtained from the present investigations regarding flowering parameters clearly revealed the selection of suitable parents and their combinations towards developing new hybrids or varieties in cashew. These findings are well corroborated with the reports of Kumar and Udupa (1996). According to them about 99.7 to 99.9 per cent of the total variability in cashew nut yield was found to be controlled by only five important characters viz the number of reproductive shoots, number of bisexual flowers per panicle, fruit set, fruit retention and the total number of nuts produced/tree.

The data recorded on date of flowering, date of flower completion as well as flowering duration (days) in the present investigations (Table 4) revealed wide variations in these parameters among the tested hybrids, cross parents and check varieties. Out of the sixty hybrids evaluated only 8.33 per cent showed earliness in both initiation of flowering within second week of December with completion of flowering in 4th week of March. Similarly 11.67 per cent hybrids were late in both initiation of flowering from 4th week of January onwards with completion of flowering after 1st week of May onwards. Interestingly 80 per cent of tested hybrids were found to be mid-season types with initiation of flowering from

Table 4. Mean performance of cashew genotypes with respect to number of flowers per panicle, time and duration of flowering

S/N	Hybrid (#)	Perfect flowers	Staminate flowers	Sex ratio	Total flowers	% perfect flowers	% staminate flowers	Date of initiation of flowering	Date of completion of flowering	Duration of flowering
1.	A-33	65.50	329.07	0.192	394.42	16.50	83.51	Dec 4 th week	April 3 rd week	112
2.	A-48	77.5	365.57	0.212	443.42	17.42	82.59	Dec 4 th week	April 3 rd week	117
3.	A-62	82.5	360.07	0.222	442.42	18.55	81.46	Dec 4 th week	April 3 rd week	110
4.	A-71	67.0	252.57	0.262	319.42	20.71	79.30	Dec 3 rd week	April 4 th week	126
5.	A-95	72.5	462.57	0.152	535.42	13.57	86.44	Jan 1 st week	April 4 th week	97
6.	A-99	71.0	280.07	0.252	351.42	20.03	79.98	Dec 4 th week	April 4 th week	93
7.	B-5	60.5	526.57	0.112	587.42	10.38	89.63	Jan 2 nd week	April 4 th week	103
8.	B-6	71.5	296.57	0.232	368.42	19.26	80.75	Jan 2 nd week	April 3 rd week	97
9.	B-27	117.5	384.07	0.302	501.42	23.33	76.68	Jan 2 nd week	April 2 nd week	90
10.	B-31	48.0	303.57	0.152	351.42	13.56	86.45	Jan 1 st week	April 4 th week	104
11.	B-35	55.0	292.57	0.182	347.42	15.69	84.32	Jan 1 st week	April 4 th week	100
12.	B-58	92.5	391.57	0.232	484.42	19.04	80.97	Jan 2 nd week	April 3 rd week	95
13.	C-7	55.0	222.07	0.242	277.42	19.54	80.47	Jan 2 nd week	April 2 nd week	91
14.	C-14	90.5	257.57	0.342	348.42	25.71	74.30	Jan 4 th week	April 4 th week	94
15.	C-30	116.50	450.57	0.252	567.42	20.51	79.50	Feb 1 st week	April 4 th week	83
16.	C-41	136.00	381.57	0.352	517.42	26.16	73.85	Jan 4 th week	May 1 st week	95
17.	C-44	61.50	311.07	0.192	372.42	16.39	83.62	Jan 4 th week	May 1 st week	100
18.	C-52	38.50	301.57	0.122	340.42	11.25	88.76	Jan 4 th week	April 4 th week	91
19.	D-9	56.00	375.57	0.152	431.42	12.95	87.06	Feb 1 st week	April 4 th week	87
20.	D-10	53.00	311.57	0.172	364.42	14.44	85.57	Feb 1 st week	April 4 th week	80
21.	D-15	62.93	348.03	0.183	411.06	15.09	84.90	Jan 1 st week	April 4 th week	98
22.	D19	106.43	345.53	0.313	452.06	23.45	76.54	Jan 1 st week	May 1 st week	112
23.	D-29	102.43	362.53	0.283	465.06	21.89	78.10	Dec 4 th week	April 3 rd week	109
24.	D-47	188.43	440.53	0.433	629.06	29.81	70.18	Jan 2 nd week	May 1 st week	110
25.	E-2	45.93	380.03	0.113	426.06	10.64	89.53	Jan 1 st week	April 3 rd week	105
26.	E-3	62.43	324.53	0.193	387.06	15.95	84.04	Dec 2 nd week	March 3 rd week	98
27.	E12	89.43	361.03	0.243	451.06	19.66	80.33	Dec 2 nd week	March 3 rd week	92
28.	E-16	55.68	466.03	0.113	521.81	10.31	89.68	Jan 1 st week	April 4 th week	110

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29.	E-22	56.63	324.53	0.173	381.26	14.65	85.34	Dec 3 rd week	April 2 nd week	107
30.	E-28	80.93	399.03	0.203	480.06	16.62	83.37	Jan 1 st week	April 4 th week	110
31.	F-16	38.93	442.53	0.083	481.56	7.70	92.20	Dec 4 th week	April 1 st week	103
32.	F-20	105.43	483.53	0.213	588.06	17.65	82.34	Dec 4 th week	April 2 nd week	98
33.	F-27	164.93	501.03	0.323	666.06	24.54	75.45	Jan 1 st week	April 4 th week	87
34.	F-28	233.432	420.53	0.550	654.56	35.61	64.38	Jan 1 st week	April 4 th week	105
35.	F-32	155.93	401.53	0.393	556.56	27.90	72.09	Jan 1 st week	April 3 rd week	99
36.	F-38	206.43	516.53	0.403	723.06	28.34	71.65	Jan 1 st week	April 3 rd week	101
37.	G-8	104.93	386.03	0.363	527.06	26.63	73.36	Jan 1 st week	April 4 th week	110
38.	G-9	120.43	399.53	0.303	520.06	23.00	76.99	Jan 1 st week	April 3 rd week	104
39.	G-16	99.93	342.03	0.293	442.06	22.52	77.49	Dec 3 rd week	April 2 nd week	102
40.	G-17	80.43	393.03	0.203	473.56	16.75	83.24	Dec 4 th week	April 2 nd week	100
41.	G23	107.56	380.39	0.285	488.01	22.30	77.68	Dec 4 th week	April 3 rd week	112
42.	G-25	49.06	437.39	0.115	486.51	10.40	89.58	Dec 3 rd week	April 2 nd week	105
43.	H-2	37.56	403.89	0.095	441.51	8.84	91.14	Dec 4 th week	April 3 rd week	112
44.	H-6	87.56	510.89	0.175	598.51	14.92	85.06	Dec 3 rd week	April 4 th week	126
45.	H-8	73.06	424.89	0.175	498.01	14.97	85.01	Dec 3 rd week	April 2 nd week	111
46.	H-10	51.06	383.89	0.135	435.01	12.05	87.93	Dec 4 th week	April 3 rd week	112
47.	H-20	41.56	269.39	0.155	311.01	13.68	86.30	Dec 3 rd week	April 3 rd week	115
48.	H-26	50.06	266.89	0.195	317.01	16.09	83.89	Dec 3 rd week	April 3 rd week	119
49.	I-3	52.56	344.89	0.165	387.51	13.87	86.11	Dec 3 rd week	April 2 nd week	110
50.	I-7	40.56	320.89	0.135	361.51	11.54	88.44	Jan 1 st week	April 3 rd week	108
51.	I-12	69.56	337.89	0.215	407.51	17.35	82.63	Dec 3 rd week	April 2 nd week	117
52.	I-16	62.56	343.39	0.185	406.01	15.07	84.28	Dec 3 rd week	April 1 st week	95
53.	I20	51.56	334.89	0.155	386.51	13.65	86.33	Jan 1 st week	April 4 th week	108
54.	I-22	37.56	303.39	0.125	341.01	11.34	88.64	Jan 1 st week	April 3 rd week	101
55.	J-1	56.06	372.39	0.155	428.51	13.39	86.59	Dec 4 th week	April 1 st week	101
56.	J-6	71.06	353.89	0.205	425.01	17.01	82.97	Dec 4 th week	April 4 th week	111
57.	J-12	97.56	290.39	0.345	388.01	25.38	74.60	Dec 3 rd week	April 4 th week	119
58.	J-13	48.56	379.89	0.135	428.51	11.65	88.33	Dec 1 st week	March 3 rd week	98
59.	J-14	61.06	318.39	0.195	379.51	16.38	83.60	Dec 1 st week	March 3 rd week	102
60.	J-20	83.06	305.39	0.275	388.51	21.64	78.34	Dec 3 rd week	April 1 st week	104
Parent										
61.	RP- 1	85.33	418.16	0.203	503.66	16.99	82.91	Dec 1 st week	April 2 nd week	110
62.	KBN	15.41	252.83	0.063	268.33	5.89	94.10	Jan 2 nd week	April 3 rd week	82
63.	VTH-711/4	47.91	366.33	0.130	414.33	11.61	88.38	Jan 1 st week	April 2 nd week	102

64.	RP- 2	99.00	353.50	0.283	452.66	21.82	78.17	Dec 3 rd week	April 2 nd week	116
65.	Kankady	37.00	298.83	0.130	336.16	11.26	88.73	Dec 4 th week	April 4 th week	107
66.	M-44/3	103.33	252.00	0.417	353.33	29.25	70.74	Dec 2 nd week	March 2 nd week	85
67.	Vitol-44/3	64.16	367.00	0.173	431.16	14.87	85.12	Jan 2 nd week	April 3 rd week	94
68.	BPP -30/1	62.16	248.50	0.253	310.66	20.26	79.73	Dec 1 st week	March 4 th week	101
Check										
69.	BPP-8 (H-2/16)	106.08	426.50	0.250	532.50	20.01	79.98	Dec 1 st week	March 2 nd week	94
70.	Jagannatha (BH-6)	38.16	277.50	0.137	315.83	12.03	87.96	Dec 1 st week	April 2 nd week	78
71.	Balabhadra (BH- 85)	80.83	313.16	0.260	394.00	20.53	79.46	Jan 2 nd week	April 3 rd week	86
CD for hybrid, parent and check varieties mean										
		14.79	93.81	0.069	98.94	4.25	4.30	-	-	-
Grand mean										
		-	-	-	-	-	-	-	-	102.33

3rd week of December to 2nd week of January and completion of flowering from 1st to 2nd week of April.

The results also indicated that among the cross parents M-44/3 and BPP-30/1 exhibited both flower initiation from 1st week of December to completion of flowering within 2nd week of March while other parents except Kankadi exhibited mid-season type with initiation of flowering from 3rd and 4th week of December with completion of flowering from 2nd to 4th week of April. However Kankady showed lateness under Odisha conditions. The study also revealed that under Bhubaneswar, Odisha conditions the flowering season varied from last week of December to last week of February in different cashew types. Similar observations of flowering season of December to March were also observed by Dorajeero et al (2002) under Bapatla, Simandhra condition whereas mid-December to late May in parents of selection under Karnataka situation.

Regarding the days taken from flower initiation to completion of flowering the results of present study indicated that 33.33 per cent had early type of flowering duration within 100 days, 45 per cent had mid-season type of 101 to 110 days while only 21.67 per cent as long duration types of more than 111 days. The results revealed that in early flowering duration group 50 per cent hybrids of 'C' cross were early type although their corresponding parents RP-1 as well as

Kankady were mid-late types. Similarly when KBN was used as male parent, being shortest flowering duration of only 82 days, induced 50 per cent of hybrids of 'G' cross groups to mid-flowering duration of 101 to 110 days while that of 60 per cent of hybrids of 'H' cross groups induced late flowering duration of more than 111 days. In case of 'G' cross the female parent was RP-2, a mid season variety while that of 'H' crosses the female parent M-44/3 was an early season type which clearly indicated the heterosis of flowering duration in cashew.

Irrespective of cashew type (hybrids, parents and check varieties) the flowering duration varied from 78 days in check variety Jagannatha (BH-6) to 126 in hybrids A-71 and H-6. Similar observation of variation in duration of flowering ranging from 42 to 123 days in different cultivars under Bhubaneswar conditions was made by Samal (2002).

CONCLUSION

The selection of suitable parents and their combinations should be based on flowering parameters towards developing new hybrids or varieties in cashew. The parents like RP-2 and M-44/3 were identified as female parents while VTH-711/4 and KBN as male parents for development of better hybrids. On the basis of different flowering parameters relatively better hybrids identified were A-71, B-27, C-41, D-19, F-28 and G-8.

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