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GENETIC STUDIES OF FIBRE YIELD-RELATED TRAITS AND DAYS TO ANTHESIS IN SOME KENAF (*HIBISCUS CANNABINUS L.)* ACCESSIONS

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Abstract: Kenaf (*Hibiscus cannabinus L.)* is an economically important and multi-purpose natural fibre crop with several industrial applications. However, its potentials have not been fully maximised due to poor yield and its narrow genetic base which limited the available hybrids. The low yield is attributed to high photoperiod sensitivity of most kenaf accessions because it reduces the vegetative growth. This study attempts to understand the genetic architecture of days to anthesis of kenaf towards the development of a photo-insensitive kenaf hybrid. Two early maturing Nigerian kenaf accessions: NHC (12)1 and NHC (3)2, and two late maturing accessions (NHC [9]2 and NHC 15) were crossed to generate F_1 population. The F_1 hybrid together with its parents and its reciprocals were planted in a randomised complete block experiment design with three replicates. Data were collected on days to anthesis (DTA), plant height (HAH), basal stem girth (GAH), base diameter (BDAH) and weight at harvest (WAH) for analysis. The mean squares were significant for DTA, HAH, DBAH, GAH and WAH. DTA exhibited the highest broad-sense heritability value (0.98) among other traits. The GCA: SCA ratio for DTA and BDAH signifies that the effect of non-additive genes was prevalent because it was lower than a unity while the additive gene action was predominant in HAH. The negative GCA estimates for NHC (12)1 and NHC (9)2 indicated a poor combining ability. Only NHC (3)2 x NHC (9)2 showed good specific combining ability (-5.75, 0.33, 0.85, 91.46) for DTA, GAH, BDAH and WAH respectively. NHC (12)1 x NHC (9)2, NHC (3)2 x NHC (9)2, NHC (3)2 x NHC 15, NHC (9)2 x 3NHC (3)2, NHC (9)2 x NHC 15, NHC 15 x NHC (3)2, NHC 15 x NHC (9)2 showed negative significant percent of F_1 heterosis above the mid-parent in days to anthesis and could be employed to breed photo-insensitive early maturing kenaf.

Key words: fibre yield, heterosis, photo-insensitive kenaf, combining ability, hybrids.

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Introduction

Kenaf (*Hibiscus cannabinus L.*) is one of the most important natural fibre crops. Its cultivation and improvement have been neglected due to its restricted old folkloric utilisations; for twine, rope, gunny-bag and sackcloth production. However, it is currently attracting tremendous attention due to its new application and future potentials. It has the potential to be used as an alternative raw material to replace wood fibre in pulp and paper industry. For instance, it has been reported that kenaf produces fibre approximately three to five times as Southern pine (Rymsza, 1999; Lemahieu et al., 2003). Kenaf biomass has been successfully investigated as an alternative renewable source and sustainable feedstock for the production of biofuel (Saba et al., 2015). Recently, kenaf fibres have become more attractive to the automotive industry, to enhance desired mechanical properties as automotive structural components (Hassan et al., 2017). It is also used in oil spill clean-ups and removal of heavy metals from aqueous solution (Yusof et al., 2015). The sorbent materials produced from kenaf fibres have shown a superior adsorption efficiency for heavy metal removal from water bodies as compared to activated carbon (Shamsudin et al., 2016). The stem core and fibre of different varieties of kenaf grown in Nigeria have been revealed to be effective absorbents (Balogun and Raji, 2016). Despite the potential application of kenaf, few hybrids are available, especially in developing countries where its production can serve as a reliable source of a sustainable livelihood.

Most local varieties are highly photosensitive, which leads to early flowering. This consequently terminates the vegetative growth (Webber and Bledsoe, 2002) and results in low fibre yields. The knowledge of a day-length effect on kenaf growth and biomass yield is fundamental for the selection of the best cultivar for the production (Webber et al., 2002). Therefore, it is important to develop hybrids that would continue to grow irrespective of flowering at a critical daylight period for maximum fibre yield. To improve kenaf fibre production, identification of superior parents as well as the promising cross combinations is paramount for its improvement. Information on phenotypic and genotypic variances as well as heritability estimates for fibre yield and other related characters are essential for designing a successful breeding program. The general combining ability (GCA) is directly related to the breeding value of parents and associated with the additive genetic effects. On the other hand, the specific combining ability (SCA) is the relative performance of a cross that is associated with non-additive gene action, predominantly contributed by dominance, epistasis, or genotype × environment interaction effects. Heritability is the measure of the proportion of the genetic variance out of the total phenotypic variance present in a population. It could either be broad-sense or narrow-sense heritability and it indicates the degree to which off-spring can be expected to resemble their parents for a specific trait. The knowledge on the magnitude of genetic variability and heritability estimates for fibre yields is penitent for kenaf improvement. This study evaluates the additive and dominance effects of genes involved in days to anthesis in kenaf as well as heterosis for days to anthesis and fibre yield-related traits. Our results provide important insights into the identification and selection of superior genotypes that are less sensitive to photoperiodism and indeterminate flowering.

Materials and Methods

Four accessions based on the state of origin and flowering habits (Table 1) were obtained from Gene Bank at the Department of Crop Protection and Environmental Biology, University of Ibadan, Nigeria. According to the formula designed by Griffing (1956) method 1, 16 crosses were made from the four parents (Ps), where the number of crosses = P (P-1). The total entries were therefore 16 (parents, crosses and reciprocals).

The mature F_1 (hybrids) seeds obtained from all possible crosses of the parents (two early maturing and two late maturing) and the parents were planted in a randomised complete block design with three replicates. Data were taken on numbers of days to flowering, plant height at harvest, basal girth at harvest, basal diameter at harvest and weight at harvest.

Table 1. Kenaf accession names based on the state of collection.

Accession name	Flowering habit	State of collection
NHC 12(1)	Early flowering	Plateau
NHC 9(1)	Late flowering	Adamawa
NHC 3(2)	Early flowering	Niger
NHC 15 (Improved variety)	Late flowering	

NHC = Nigeria *Hibiscus cannabinus*.

Statistical analysis

Genetic parameters were evaluated by analysis of variance and means were separated by the least significant difference (LSD < 0.05 and LSD < 0.01). Analysis of the combining ability of the parents and the hybrid plants was done following Griffing's Method 1 (Grifting 1956), where parents, F_1s and reciprocals were included. The magnitude of heterosis (MP: mid-parent) and heterobeltiosis (BP: better parent) were calculated using the formula of Pace et al. (1998):

BP= $\frac{(F1-P0)}{P0} x\ 100$ and MP = $\frac{(F1-P1)}{P1} x\ 100$, where F_1 is the value of a cross; P_0 is the mean value of both parental populations; and P_1 is the value of the better parental population.

Results and Discussion

The mean squares for various traits (DTA, HAH, DBAH, GAH and WAH) studied in association with days to flowering of parents and their F_1 hybrids (Table 2) revealed highly significant variations for all characters. It shows that there were significant differences between genotypes for these characteristics. The reciprocals were significant in days to anthesis ($p<0.05$) and HAH ($p<0.01$). This indicates a wide genetic variability for studied characters, which can facilitate genetic improvement using such kenaf accessions. The significant GCA and SCA for DTA, HAH, GAH indicate that the characters measured were controlled by both additive and non-additive gene actions. The current finding concurred with the earlier reports of Su et al. (2004). Genetic variability has been reported in the evaluation studies of kenaf agronomical traits (Siepe et al., 1997; Ogunbodede and Ajibade, 2001). Likewise, Balogun et al. (2007) reported variations in the photo and thermal sensitivities among local, improved and exotic kenaf accessions in Nigeria. The GCA: SCA ratio for DTA and BDAH indicates that effect of non-additive genes was prevalent because it was less than a unity while additive gene action was predominant in HAH. The significant difference observed in the reciprocal crosses for DTA and HAH suggested a high degree of recombinants that can be explored to identify which accession is the best for male or female parent. Furthermore, a cytoplasmic effect could influence the genetic control due to the significant reciprocal in days to anthesis and HAH which is similar to the result reported in flax (Mohammadi et al., 2010).

Table 2. Mean squares from analysis of variance, general combining ability (GCA), specific combining ability (SCA) and broad-sense heritability (H^2b) for days to anthesis and fibre yield-related traits.

Source	Df	DTA	HAH	BDAH	GAH	WWAH
Treatment	15.00	1466.82*	3142.11*	0.46*	3.47*	38059.082*
REP	2.00	6.57	1006.24	0.10	1.95	6128.34
GCA	2.00	777.90*	1712.68*	0.14	2*	6604.09
SCA	6.00	1689.51*	1218.10*	0.24	1.5*	23184.54*
Reciprocal	6.00	118.30*	829.43**		0.73	6330.00
ERROR	30.00	18.64	317.89		0.56	WWAH
H^2b		0.98	0.66		0.52	38059.082*
GCA/SCA		0.46	1.41		GAH	6128.34

* – significant at 0.05, ** – significant at 0.01, REP = Replicate, DTA = Days to anthesis, HAH = Height at harvest, GAH = Girth at harvest, WAH = Weight at harvest, BDAH = Base diameter at harvest.

A high broad-sense heritability observed in DTA (0.98), HAH and WAH (0.66) was due to larger additive and dominance variances than the environmental variance. This suggests the possibility of genetic improvement of these traits since the selection of superior individual plants is possible in segregating generations. Bhamre et al. (1991) reported that the day from emergence to 50% flowering was determined mainly by additive genetic effects, while Xu et al. (1994) found predominantly additive effects in the evaluation of the number of days from seedling emergence to first flowering in diallelic crosses between cultivated kenaf and its wild sources.

In Table 3, days to anthesis ranged from 53 to 127 days with an average mean of 67 days. The average means for HAH, GAH, BDAH, WAH were 225.84cm, 7.40cm, 2.25cm, 338.98g respectively. At harvesting, NHC (9)2 x NHC (12)1 had the maximum values in height, girth, base diameter and wet weight. NHC15 had the minimum values in height, girth, and base diameter. NHC (3)2 had the minimum wet weight. The higher mean values (89.50, 280cm, 8.91cm, 2.82cm, 542.50g) observed in NHC (9)2xNHC (12)1 for DTA, HAH, GAH, BBAH, WAH respectively indicated better performance over the other crosses in all the traits.

Table 3. Mean values of parents and F_1 hybrids for five characters in some selected Nigerian kenaf crosses.

CROSSES	DTA	HAH (cm)	GAH (cm)	BDAH (cm)	WAH (g)
NHC (12)1	54.93	191.47	7.36	2.07	237.08
NHC (3)2	110.20	191.13	6.11	1.67	151.33
NHC(9)2	55.53	212.47	6.08	1.74	167.50
NHC 15	127.25	163.40	5.14	1.55	220.00
NHC(12)1 X NHC(3)2	55.60	245.73	7.58	2.30	443.33
NHC(12)1 x NHC(9)2	53.47	239.80	7.69	2.35	343.33
NHC(12)1 x NHC 15	56.92	252.91	8.38	2.59	399.44
NHC(3)2x NHC(12)1	56.40	229.95	8.23	2.51	408.89
NHC(3)2x NHC(9)2	55.64	262.93	8.10	2.62	428.33
NHC(3)2x NHC 15	60.80	193.33	7.08	2.25	312.50
NHC(9)2x NHC(12)1	89.50	280.00	8.91	2.82	542.50
NHC(9)2x3 NHC(3)2	65.07	234.56	8.67	2.64	433.33
NHC(9)2x NHC 15	54.50	267.60	8.58	2.68	340.56
NHC 15x NHC(12)1	56.03	210.73	6.97	2.08	320.83
NHC 15x NHC(3)2	64.87	232.75	7.07	2.24	443.06
NHC 15x NHC(9)2	58.30	204.75	6.44	1.87	231.67
Minimum	53.47	163.40	5.14	1.55	151.33
Maximum	127.25	280.00	8.91	2.82	542.50
Mean	67.19	225.84	7.40	2.25	338.98
LSD	12.47	51.50	1.57	0.75	178.50

LSD = Least significant difference, DTA = Days to anthesis, HAH = Height at harvest, GAH = Girth at harvest, WAH = Weight at harvest and BDAH = Base diameter at harvest.

Accessions NHC (12)1 and NHC (9)2 showed negative GCA effects for days to anthesis, whereas accessions NHC (9)2 and NHC 15 showed positive GCA effects for the same (Table 4). GCA for NHC (3)2 and NHC 15 was negative for HAH, GAH, BDAH, and WAH, but it was significantly positive for DTA. NHC

(12)1 showed good combining ability for GAH and WAH while NHC (9)2 exhibited good combining ability for HAH with significantly negative DTA. The negative GCA estimates for NHC (12)1 and NHC (9)2 indicated poor ability to transfer its genetic superiority to hybrids. The negative DTA GCA estimates and significantly positive GCA estimates for other traits are important for selection in breeding photo-insensitive kenaf. Significant GCA demonstrates that an evaluation of parental phenotypes would be sufficient for determining their breeding potentials since the GCA effects of parents are the measure of their 'breeding value' as an average of their performance in hybrids. The existence of this significant GCA effect implies the possibility of using such parent as a source for earliness and higher yield components because the suitable traits are easily transmitted to its progenies.

Table 4. Estimates of general combining ability on five characters in some selected Nigerian kenaf accessions.

PARENTS	DTA	HAH	BDAH	GAH	WAH
NHC (12)1	-7.47*	4.41	0.10	0.41*	27.58*
NHC (3)2	5.16*	-3.15	-0.01	-0.03	7.53
NHC (9)2	-6.25*	13.48*	0.06	0.17	-7.14
NHC 15	8.55*	-14.74*	-0.15*	-0.55*	-27.97*
SE	1.32	5.46	0.08	0.23	18.92

* – significant at 0.05, NHC = Nigeria *Hibiscus cannabinus*, DTA = Days to anthesis, HAH = Height at harvest, GAH = Girth at harvest, WAH = Weight at harvest and BDAH = Base diameter at harvest, SE = Standard error.

Table 5 shows the SCA estimates of each inbred line in a series of crosses. Six crosses NHC (12)1 x NHC (3)2, NHC (12)1 x NHC 15, NHC (3)2 xNHC (9)2, NHC (3)2 x NHC 15, NHC (9)2 x NHC 15 and NHC (12)1 x NHC (9)2 had significant negative SCA effects for days to anthesis. However, among all the crosses only NHC (3)2 x NHC (9)2 had a significant positive SCA effects for base diameter, girth and wet weight at harvest. However, SCA was significantly negative for days to anthesis in the reciprocal crosses. The cross NHC (12)1 x NHC (9)2 was significantly positive for DTA and WAH, with the highest value in HAH while its reciprocal cross NHC (12)1 x NHC (9)2 was significantly negative for all traits. Reciprocal cross NHC (9)2 x NHC 15 showed significant negative SCA effects on days to anthesis but was significantly positive for plant height, girth and base diameter at harvest. The significant SCA effects suggest a deviation of a specific cross from the mean performance of the inbred parents. Generally, high SCA effects from parents with combining abilities (i.e. good GCA × good GCA) are attributed to additive × additive gene action. When high SCA effects cross resulted from good × poor general combiner parents, additive effects of the good general combiner parent and epistatic effects of the poor general combiner are usually involved. Similarly, complementary gene action, as well as dominance ×

dominance type of non-allelic gene interaction producing overdominance could lead to high SCA effects between low × low crosses. Hybrids having significant positive SCA are due to favourable combinations of dominance effects when those parents are crossed. Only NHC (12)1 x NHC (9)2 cross resulted in significant positive SCA while its reciprocal cross had negative SCA for DTA. This result implies that a maternal effect in the inheritance for the cross should be taken into consideration because selection for the better accession as a female parent would be valuable to breed a photo-insensitive hybrid. Gray et al. (2006) demonstrated that some dominance effects also occurred in the form of a partial dominance for early flowering in kenaf. Among all the crosses made, only NHC (3)2 x NHC (9)2 showed good specific combining ability (-5.75, 0.33, 0.85, 91.46) for DTA, GAH, BDAH and WAH respectively. Hybrids having significant positive SCA are due to favourable combinations of dominance effects when those parents are crossed. The specific combinations with negative SCA effects for DTA and positive SCA effects for other traits can be explored in improvement of early maturity of photo-insensitive kenaf.

Table 5. Estimates of the specific combining ability effect and the reciprocal effect on five traits in some selected kenaf accessions.

SPECIFIC COMBINING EFFECTS	DTA	HAH	BDAH	GAH	WAH
NHC (12)1xNHC (3)2	-8.88*	10.74	0.07	0.13	52.02
NHC (12)1xNHC (9)2	18.01*	16.17	0.18	0.32	83.49*
NHC (12)1 x NHC 15	-11.80*	16.30	0.13	0.41	21.55
NHC (3)2xNHC (9)2	-5.75*	12.58	0.33*	0.85*	91.46*
NHC (3)2x NHC 15	-18.07*	5.09	0.16	0.26	59.24
NHC (9)2x NHC 15	-13.09*	11.59	0.11	0.49	-17.76
Standard error	2.41	9.97	0.14	0.42	34.55
RECIPROCAL EFFECTS					
NHC(12)1xNHC (3)2	-0.40	7.89	-0.11	-0.32	17.22
NHC(12)1xNHC (9)2	-18.02*	-20.10*	-0.23	-0.61	-99.58*
NHC (12) x NHC15	0.44	21.09*	0.26	0.71	39.31
NHC (3)2xNHC (9)2	-4.71	14.19	-0.01	-0.28	-2.50
NHC (3)2x NHC 15	-2.03	-19.71	0.01	0.01	-65.28
NHC (9)2x NHC 15	-1.90	31.43*	0.41*	1.07*	54.44
Standard error	3.05	12.61	0.18	0.53	43.70

* – significant at 0.05, NHC = Nigeria *Hibiscus cannabinus*, DTA = Days to anthesis, HAH = Height at harvest, GAH = Girth at harvest, WAH = Wet weight at harvest and BDAH = Base diameter at harvest.

Mid-parent and better parent heterosis for five characters in some selected Nigerian kenaf accessions

Percentage heterosis relative to mid-parents (MPs) was negatively significant for eight out of the fourteen crosses in days to anthesis (-48.79 to -3.20), whereas the mid-parents were significantly positive in all crosses for height (8.95–42.54), and girth (11.52–42.23). However, eight crosses in base diameter (34.45 to 62.65) and ten crosses in weight at harvest (19.57–171.82) were significantly positive mid-parents (Table 6). The lowest significantly negative DTA value (-48.79; MP and -44.83; HP) was recorded for cross NHC (3)2 x NHC15. The evaluation of heterosis in half diallel crosses: NHC (12)1 x NHC (9)2, NHC (3)2 x NHC (9)2, NHC (3)2 x NHC 15, NHC (9)2 x 3NHC (3)2, NHC (9)2 x NHC 15, NHC 15 xNHC (3)2, NHC 15 x NHC (9)2 showed a negative significant effect on percentage of F_1 heterosis above mid-parent's days to flowering. They could be employed to breed photo-insensitive early maturing kenaf accessions while NHC (9)2 x NHC (12)1 with positive heterosis would do well where late maturing kenaf accessions perform well.

Table 6. Mid-parent heterosis (%) for five characters in some selected Nigerian kenaf crosses.

CROSSES	DTA	HAH	GAH	BDAH
NHC(12)1xNHC(3)2	-32.66	28.45*	12.57*	23.04
NHC(12)1xNHC(9)2	-3.20*	18.73*	14.38*	23.57
NHC(12)1xNHC 15	-37.52	42.54*	34.12*	43.08*
NHC(3)2xNHC(12)1	-31.69	20.20*	22.20*	34.45*
NHC(3)2x NHC(9)2	-32.85*	30.29*	32.93*	53.59*
NHC(3)2x NHC 15	-48.79*	9.06*	25.96*	40.07*
NHC(9)2xNHC(12)1	62.04*	38.64*	32.59*	47.82*
NHC(9)2x3NHC(3)2	-21.48*	16.23*	42.23*	54.71*
NHC(9)2x NHC 15	-40.37*	42.39*	52.94*	62.65*
NHC 15xNHC(12)1	-38.49	18.77*	11.52*	14.82
NHC 15x NHC(3)2	-45.36*	31.30*	25.67*	38.98*
NHC 15x NHC(9)2	-36.21*	8.95*	14.82*	13.42
minimum	-48.79	8.95	11.52	13.42
maximum	62.04	42.54	52.94	62.65
CD	3.22	7.03	1.44	0.85

CD = Critical difference, DTA = Days to anthesis, HAH = Height at harvest, GAH = Girth at harvest, WAH = Wet weight at harvest and BDAH = Base diameter at harvest.

Heterosis percentages relative to better parents (BPs) were negatively significant for three out of fourteen crosses for days to anthesis (range of -44.83 to -2.67) but positively significant for all crosses for base diameter (0.45 to 53.56) as shown in Table 7. At maturity, eleven crosses had significant percentage heterosis for plant height (1.15 to 32.09), nine crosses for base girth (2.99 to 41.92) and ten crosses for wet weight (5.30 to 128.82). Meanwhile, crosses NHC (12)1 x NHC (9)2, NHC (3)2 x NHC 15, NHC 15 x NHC (3)2 were negatively significant in terms of percentage F_1 heterosis above high-parent in days to flowering in addition to other traits, but NHC (9)2 x NHC (12)1 and NHC (9)2 x 3NHC (3)2 crosses had significant positive days to anthesis and other traits. Higher heterosis value over the better parent and the mid-parent suggested the absence of epistasis and prevalence of partial or complete dominance of genes for yield and days to flowering. The percent F_1 heterosis above the high-parent could be explored to identify crosses that would lead to superior photo-insensitive transgressive segregants. However, further research on F_2 and backcross populations and correlation coefficient among crosses is important to know the extent and nature of the relationship between these contributing characters and final yield.

Table 7. High-parent heterosis (%) for five characters in some selected Nigerian kenaf crosses.

CROSSES	DTA	HAH	GAH	BDAH	WAH
NHC(12)1xNHC(3)2	1.21	28.34*	2.99*	11.16*	86.99*
NHC(12)1xNHC(9)2	-2.67*	2.86*	4.44*	13.94*	44.82*
NHC(12)1xNHC 15	3.61	32.09*	13.89*	25.18*	68.48*
NHC(3)2xNHC(12)1	2.67	20.10*	11.80*	21.47*	72.47*
NHC(3)2x NHC(9)2	0.20*	23.75*	3.22*	50.22*	155.72
NHC(3)2x NHC 15	-44.83*	1.15*	15.99	35.10*	42.05*
NHC(9)2xNHC(12)1	62.92*	31.79*	21.06*	36.30*	128.82*
NHC(9)2x3NHC(3)2	17.17*	10.40*	1.92*	51.31*	158.71
NHC(9)2x NHC 15	-1.86	25.95*	41.12*	53.56*	54.80*
NHC 15xNHC(12)1	2.00	10.06*	-5.30*	0.45*	35.33*
NHC 15x NHC(3)2	-41.14*	21.77*	15.72	34.05*	101.39*
NHC 15x NHC(9)2	4.98	-3.63	5.95*	7.08*	5.30*
min	-44.83	-3.63	-5.3	0.45	5.30
max	62.92	32.09	41.92	53.56	158.71
CD	3.22	6.54	1.34	0.79	12.18

CD = Critical difference, DTA = Days to anthesis, HAH = Height at harvest, GAH = Girth at harvest, WAH = Wet weight at harvest and BDAH = Base diameter at harvest.

Conclusion

Most of the crosses showed the presence of sufficient hybrid vigour in days to flowering as well as other yield parameters. NHC (12)1 x NHC (9)2, NHC (3)2 x NHC (9)2, NHC (3)2 x NHC 15, NHC (9)2 x 3NHC (3)2, NHC (9)2 x NHC 15, NHC 15 x NHC (3)2, NHC 15 x NHC (9)2 showed significant negative percentage F_1 heterosis in days to anthesis and could be utilised in the breeding of photo-insensitive early maturing kenaf accessions.

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GENETIČKA ISTRAŽIVANJA KOMPONENTI PRINOSA VLAKNA I BROJA DANA DO PUNOG CVETANJA KOD NEKIH PRINOVA KENAFA (*HIBISCUS* CANNABINUS *L.)*

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R e z i m e

Kenaf (*Hibiscus cannabinus L.*) je ekonomski važna prirodna kultura za proizvodnju vlakna sa višenamenskom industrijskom primenom. Međutim, njegovi potencijali nisu u potpunosti iskorišćeni zbog niskog prinosa i njegove uske genetičke baze, koja je ograničila raspoložive hibride. Nizak prinos se pripisuje visokoj fotoperiodskoj osetljivosti kod većine genotipova kenafa, što utiče na smanjenje vegetativnog porasta. Ovim istraživanjem pokušava se shvatiti genetička arhitektura broja dana do punog cvetanja kenafa kako bi se razvio fotoneosetljiv hibrid kenafa. Dva ranostasna nigerijska genotipa kenafa: NHC (12)1 i NHC (3)2, i dva kasnostasna genotipa (NHC [9]2 i NHC 15) ukršteni su da bi se proizvela F_1 populacija. F_1 hibridi zajedno sa svojim roditeljima i recipročnim kombinacijama, posađeni su u eksperimentu po potpuno slučajnom blok sistemu sa tri ponavljanja. Za analizu su sakupljeni podaci o broju dana do punog cvetanja (engl. *days to anthesis* – DTA), visini biljke (engl. *plant height* – HAH), obimu stabljike (engl. *basal stem girth* – GAH), prečniku osnove (engl. *base diameter* – BDAH) i težini pri berbi (engl. weight at harvest – WAH). Sredine kvadrata su bile značajne za DTA, HAH, DBAH, GAH i WAH. U poređenju sa drugim osobinama najveća vrednost koeficijenta heritabilnosti u širem smislu (0,98) utvrđena je za DTA. Odnos GCA:SCA za osobine DTA i BDAH ukazuje da je efekat neaditivnih gena preovladao, dok je aditivno delovanje gena bilo preovlađujuće kod HAH. Negativne procene GCA za NHC (12) 1 i NHC (9) 2 ukazale su na njihovu lošu kombinacionu sposobnost. Dobru specifičnu kombinacionu sposobnost (-5,75, 0,33, 0,85, 91,46) za DTA, GAH, BDAH odnosno WAH pokazala je samo kombinacija ukrštanja NHC (3)2 x NHC (9)2. U kombinacijama ukrštanja NHC (12)1 x NHC (9)2, NHC (3)2 x NHC (9)2, NHC (3)2 x NHC 15, NHC (9)2 x 3NHC (3)2, NHC (9)2 x NHC 15, NHC 15 x NHC (3)2, NHC 15 x NHC (9)2 kod F_1 hibrida utvrđen je značajan, negativan procenat heterozisa u odnosu na srednju vrednost roditelja za broj dana do punog cvetanja i kao takve ove kombinacije bi se mogle iskoristiti za stvaranje ranostasnog fotoneosetljivog kenafa.

Ključne reči: prinos vlakna, heterozis, fotoneosetjiv kenaf, kombinaciona sposobnost, hibridi.

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