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MORPHOLOGICAL AND ANATOMICAL STUDIES ON SOME KENAF GENOTYPES IN RELATION TO YIELD

G.H. EL-Shimy, Doaa I. Mahmoud and Maysa S. Abd AL-Sadek
Fiber Crops Res. Dep., field Crops Res. Inst., A.R.C., Giza

ABSTRACT

Four field experiments i.e., two in Giza Agric. Res. Stat. (clay loam soil) and two in Ismailia Agric. Res. Stat. (sandy soil), were carried out during 2018 and 2019 seasons to evaluate eleven kenaf genotypes in relation to yield, yield components, correlation and anatomical manifestation studies in stems. Results obtained Data indicated that either stalk or seed yield ad their components were significantly differed in both Giza and Ismailia experiments at the two studied seasons. The kenaf S.24 recorded maximum estimates, approximately, in all characters for the combined analysis across the two seasons in Giza and Ismailia locations. But the kenaf variety Tianung gave the lowest estimates in this case. Besides, correlation coefficient (r) values were highly significant and positive between total length and each of technical stem length, stalk yield/plant as well as per fad., fiber yield/plant as well as per fad., no. of seeds/plant, seed yield/plant and seed yield/faddan. Moreover, the r values were highly significantly positive between no. of capsules/plant and each of no. of seeds/plant, seed yield/plant and seed yield/faddan. In addition anatomical study for kenaf stems revealed that S.24 achieved highest estimates of total cross section area, cortex area, fiber area and xylem area. Meanwhile, the kenaf variety Giza 3 occupied second position. In addition, I.10 ranked third in this case. On the other hand, Tianung was also the latest genotype in major economic anatomical manifestations for both Giza and Ismailia experiments.

Key Words: ***Kenaf (Hibiscus cannabinus), Yield, Comparative, Correlation, Stem anatomy.***

INTRODUCTION

Kenaf is a part of Malvaceae family. It has a various names such as mesta (Bengal, India), Polongi (Madras), deccan hemp (Bombay, India), ambali (Taiwan), teel (Egypt and Northern Africa), Java jute (Indonesia) and rama (West Africa) According to Dempsey (1975), LeMahieu *et al* (2003) and Hossan *et al* (2012).

The main uses of kenaf fibers have been rope, twine, coarse cloth, paper and animal bedding and feed. In addition to kenaf seed oil which used for cosmetics, industrial lubricants, bio – fuel production and linoleic acid (omega 6) (Charles 2002, Bitzer *et al* 2000 and Faruq *et al* 2013).

In recent time, kenaf crop take great attention to increase its productivity from fibers and seeds through release new varieties characterize by high yielding ability to cover the local requirements and to reduce the importation of jute fibers from foreign countries. Gauch and Zobel (1997) indicated that successful genotypes need to possess high performance for yield and other essential agronomics.

Therefore, the aim of the present investigation is to evaluate some kenaf genotypes concerning yield, yield components and relation to yield. Moreover, study the anatomy of kenaf stems at two locations. Giza (clay loam soil) and Ismailia (sandy soil).

MATERIALS AND METHODS

Kenaf seeds of eleven genotypes i.e., Giza 3, Copa, Tianung, I.10, I.12, I.13, I.14, I.36, S.11, S.13 and S.24 were sown in Agricultural Research Center (A.R.C.), on 5th May 2018 and 3rd May 2019 in Giza location, in addition to 2nd May 2018 and 4th May 2019 in Ismailia location. Each location carried out in the two successive seasons (2018 and 2019) statistical analysis of each location separately and for the same kenaf genotypes mentioned before, because the soil texture differed in the two sites (clay loam in Giza and sandy in Ismailia). The experimental design was a randomized complete block in four replications; The plot size was 3 meters long x 2 meters width (four ridges/plot). Kenaf genotypes seeds were sown in hills 20 cm apart within each ridge. The plants were thinned out to two plants/hill when seedling reached 15 cm height. Normal agricultural practices for kenaf production as recommended were followed Tables (1 and 2).

At harvest time, ten guarded plants were taken at random from each plot to estimate kenaf yield components. In addition, two plants were chosen from each plot at only second season concerning each location to study anatomical stem characters. Stalks, fiber and seed yields/faddan (fad. = 4200m^2) were calculated on plot area basis.

Table 1. Pedigree of the eleven kenaf genotypes.

Genotypes	Pedigree
Giza 3	Local cultivar Land race
Copa	Gregg X Doling
Tianung	Endora X Hibiscus sp.b
I. 10	Introduced from Nigeria
I. 12	Introduced from Nigeria
I.13	Introduced from Nigeria
I.14	Introduced from Nigeria
I.36	Introduced from Nigeria
S.11	Giza 3 X I.13
S. 13	S.16/63 x S.4/59/3
S.24	Giza 3 X I. 10

Table 2. Soil physical and chemical analysis upper 30 cm of experimental sites at Giza and Ismailia.

Variables	2018	2019	2018	2019
Soil physical analysis	**Giza**		**Ismailia**	
Coarse sand%	**3.56**	**3.51**	**63.19**	**60.75**
Fine sand%	**17.04**	**17.12**	**35.14**	**36.29**
Silt%	**26.21**	**26.13**	**7.03**	**6.84**
clay%	**51.87**	**54.05**	**8.49**	**8.65**
Soil type	**clay**	**clay**	**Sandy**	**Sandy**
Chemical analysis				
pH value in 1:5	**8.00**	**8.04**	**8.89**	**8.45**
EC (mhos/cm)	**3.81**	**3.87**	**0.13**	**0.15**
Available N (ppm)	**40.49**	**40.43**	**7.10**	**7.12**
Available P (ppm)	**6.25**	**6.22**	**2.14**	**2.16**
Available K (ppm)	**190**	**187**	**37.34**	**39.50**
CO_3 (meq/100g soil)	**-**	**-**	**-**	**-**
HCO_3 (meq/100gsoil)	**2.12**	**2.08**	**0.19**	**0.40**
Cl (meq/100g soil)	**9.14**	**9.12**	**0.25**	**0.34**
SO_4^- (meq/100g soil)	**11.34**	**11.28**	**0.12**	**0.17**
Ca^{++} (meq/100g soil)	**6.87**	**6.81**	**0.21**	**0.23**
Mg^{++} (meq/100g soil)	**4.40**	**4.44**	**0.14**	**0.21**
Na^{++} (meq/100g soil)	**11.02**	**11.07**	**0.20**	**0.32**
K^+ (meq/100g soil)	**49**	**47**	**0.14**	**0.16**
Fe (meq/100g soil)	**3.59**	**3.63**	**6.50**	**6.24**

1. Yield and yield component characters

The following characters were recorded

Total length (m), technical stem length (m), fruiting zone length (m), stalk weight/plant (g), stalks yield/fad. (ton), fiber yield/plant (g), fiber yield/fad. (kg), number of capsules/plant, number of seeds/capsule, seed yield/plant (g) and seed yield/fad. (kg)

Statistical analysis

Analysis of variance was done according to Senedecor and Cochran (2014) and mean values were compared by least significant differences (L.S.D at 0.05). Homogeneity of the error was done according to Bartlett's test, by Snedecor *et al* (1989). Therefore, combined analysis was performed for each character across the two seasons in relation to each location as described by Le Clerg and Adams (1966).

Correlation coefficient study

The relationship among kenaf characters as average of the two seasons for each location were used to determine simple correlation coefficient values (r).

Anatomical study

At full maturity of kenaf plants when standing in the field, specimens had taken from the middle region of technical stem length, after killing (in killing solution) and fixing these samples for 36 hours by using formalin, Acetic acid and Alcohol (F.A.A. Solution). Paraffin wax method was used to obtain cross sections from kenaf stems, which microtomed at 25 microns by using sliding microtome. The slides were smeared with mayer albumen solution before mounting the ribbon of transverse sections which stained in 0.5% saffranin solution to make nucleus and lignified tissues with red colour. Moreover, these sections were stained after this with 1% light green dissolved in clove oil which gave the cytoplasm and cell wall green in colour.

Stem anatomical characters

Total cross section area (mm^2), cortex area (mm^2), fiber area (mm^2), xylem area (mm^2) and pith area (mm^2).

RESULTS AND DISCUSSION

Yield and yield components

Giza location:

Mean values of twelve kenaf characters for eleven genotypes in Giza location as the combined analysis across the two successive seasons of 2018 and 2019 are presented in Table (3).

Results obtained showed significant differences within each of the twelve characters concerning all the eleven kenaf genotypes. Data revealed that the kenaf Strain 24 ranked first in the most traits under study such as total length (3.84m), fruiting zone length (1.44 m), stalk weight/plant (188.98g), stalks yield/fad. (18.19 ton), fiber yield/plant (8.33g), fiber yield/fad. (699.300 kg), no. of capsules/plant (38.09), no. of seeds/capsule (18.34), no. of seeds/plant (697.62), seed yield/plant (16.81g) and seed yield/fad. (707.66 kg).

Table 3. Mean values of twelve kenaf characters for eleven genotypes in Giza location (combined analysis of 2018 and 2019 seasons).

Genotypes	Total length (m)	Technical stem length (m)	Fruiting zone length (m)	Stalk weight/plant (g)	Stalk weight/fad. (ton)	Fiber yield/plant (g)
Giza 3	3.27	2.30	0.97	172.05	17.04	7.60
copa	3.23	2.36	0.87	154.58	13.06	6.18
Tianung	3.02	2.34	0.68	147.63	12.49	5.75
I.10	3.41	2.45	0.96	158.90	13.40	6.67
I.12	3.15	2.15	1.00	139.48	11.72	5.78
I.13	3.30	2.59	0.71	152.51	12.82	6.32
I.14	3.17	2.33	0.84	150.96	12.70	6.19
I.36	2.87	1.93	0.94	140.45	11.79	5.85
S.11	3.07	2.29	0.78	146.55	12.32	5.92
S.13	3.22	2.17	1.05	159.11	13.39	6.57
S.24	3.84	2.40	1.44	188.98	18.19	8.33
General mean	3.23	2.30	0.93	155.56	13.27	6.47
C.V.%	7.71	7.52	22.21	9.26	12.45	12.61
L.S.D. 0.05	0.13	0.21	0.14	5.95	0.50	0.11
Genotypes	Fiber yield/fad. (kg)	Number of capsules/plant	Number of seeds/ capsule	Number of seeds/plant	Seed yield/plant (g)	Seed yield/fad. (kg)
Giza 3	636.30	32.96	15.13	502.11	12.28	517.99
copa	519.13	28.10	13.55	389.02	9.34	392.76
Tianung	481.74	19.28	13.46	256.61	6.17	260.80
I.10	556.50	29.38	11.38	334.63	8.10	342.39
I.12	485.09	18.74	13.03	244.73	5.91	249.08
I.13	529.68	33.47	13.20	414.93	10.85	455.70
I.14	520.80	38.31	13.13	502.54	12.05	508.27
I.36	494.70	32.10	11.96	384.96	9.24	388.87
S.11	497.28	33.64	11.01	370.06	8.92	376.92
S.13	551.45	33.10	16.40	543.28	13.13	552.30
S.24	699.30	38.09	18.34	697.62	16.81	707.66
General mean	542.91	30.65	13.69	421.59	10.25	432.07
C.V.%	12.54	21.23	15.94	31.33	31.28	32.18
L.S.D. 0.05	8.19	0.14	0.32	22.58	0.52	26.74

Moreover, it ranked third in relation to the technical stem length (2.40 m). On the other hand, the kenaf variety Tianung was the lowest in fruiting zone length (0.68 m), fiber yield/plant (5.75 g) and fiber yield/fad. (481.74 kg).while I.12 was lowest in stalk weight/plant (139.48 g), stalk

yield/fad. (11.72 ton) and most of the economic seed traits. The introduced entry 36 was shorter in total length (2.87 m) and technical stem length (1.93 m). The remain kenaf genotypes take an intermediate position between the highest genotype (S. 24) and the lowest one (either Tianung, I.12 or I.36). The total length ranged from 2.87m for I.36 to 3.84 m (S.24), technical stem length ranged from 1.93 m (I.36) to 2.59 m (I.13), fruiting zone length ranged from 0.68 m (Tianung) to 1.44 m (S.24), stalk weight/plant ranged from 139.489 g (I.12) to 188.98 g (S.24), stalks yield/fad. ranged from 11.72 ton (I.12) to 17.04 ton (Giza 3), fiber yield/plant from 5.85 g (Tianung) to 8.33 g (S.24), fiber yield/fad. ranged from 481.74 kg (Tianung) to 699.30 kg(S.24), no. of capsules/ plant ranged from 18.74 (I.12) to 38.69 (S.24), no. of seeds/capsule which ranged from 11.01(S.11) to 18.34 (S.24), no. of seeds/plant ranged from 244.93 (I.12) to 697.62 (S.24), seed yield/plant ranged from 5.91g (I.12) to 16.81g (S.24) and finally the seed yield/fad. Which ranged from 249.08 kg (I.12) to 707.66 kg for S.24.

The general means which recorded in Giza location were 3.23 m, 2.30 m, 0.93 m, 155.56 g, 13.27 ton, 6.47 g, 542.91 kg, 30.65, 13.69, 421.59, 10.25 g and 432.07 kg for total length, technical stem length, fruiting zone length, stalk weight/plant, stalk yield/fad., fiber yield/plant, fiber yield/fad., no. of capsules/plant, no. of seeds/capsule, no. of seeds/plant, seed yield/plant and seed yield/fad., respectively. These results are consistent with those reported by Cheng (2004), Ogunkanmi *et al* (2010), Coetice *et al (*2013) and Faruq *et al* (2013). They reported high variation among kenaf genotypes.

The coefficient of variation (C.V.%) illustrated that the fruiting zone length, no. of capsules/plant, no. of seeds/capsule, no. of seeds/plant, seed yield/plant and seed yield/fad. revealed high estimates. Besides, the three traits i.e., stalks yield/fad. fiber yield/plant and fiber yield/fad. showed very high coefficient of variation.

A- Ismailia location:

Mean values of the twelve kenaf characters for the eleven genotypes in Ismailia location for the combined analysis across the two successive seasons of 2018 and 2019 are presented in Table (4).

Table 4. Mean values of the twelve kenaf characters for the eleven genotypes in Ismailia location (combined analysis of 2018 and 2019 seasons).

Genotypes	Total length (m)	Technical stem length (m)	Fruiting zone length (m)	Stalk weight/plant (g)	Stalk weight/fad. (ton)	Fiber yield/plant (g)
Giza 3	2.52	1.23	1.29	136.57	11.47	5.61
copa	2.44	1.20	1.25	93.94	7.89	3.80
Tianung	2.39	1.15	1.24	86.31	7.25	3.32
I.10	2.45	1.32	1.13	143.51	12.15	5.81
I.12	2.84	1.94	0.90	88.87	7.47	3.56
I.13	2.45	1.22	1.23	82.95	6.97	3.35
I.14	2.53	1.49	1.04	105.28	8.84	4.29
I.36	2.39	1.11	1.28	104.98	8.82	4.35
S.11	2.54	1.26	1.27	128.33	10.54	5.14
S.13	2.85	1.62	1.24	138.88	11.67	5.83
S.24	2.98	1.28	1.70	162.08	13.52	7.03
General mean	2.58	1.35	1.23	115.61	9.69	4.75
C.V.%	8.07	18.23	15.93	23.55	23.43	25.43
L.S.D. 0.05	0.24	0.10	0.12	3.16	0.26	0.15
Genotypes	**Fiber yield/fad. (kg)**	**Number of capsules/plant**	**Number of seeds/ capsule**	**Number of seeds/plant**	**Seed yield/plant (g)**	**Seed yield/fad. (kg)**
Giza 3	470.06	19.69	11.90	235.39	5.69	240.38
copa	358.89	23.92	10.25	246.05	5.92	248.80
Tianung	283.58	16.67	9.85	165.56	4.01	168.02
I.10	481.80	25.21	10.02	252.49	6.09	256.26
I.12	300.11	16.92	10.58	180.56	4.36	183.01
I.13	296.87	25.23	10.45	262.91	6.31	264.96
I.14	359.11	30.50	12.08	368.01	8.82	371.70
I.36	364.09	28.13	10.37	292.82	7.06	296.32
S.11	429.67	25.02	9.73	243.28	5.84	243.61
S.13	488.03	24.84	11.04	252.27	6.07	256.19
S.24	591.97	32.64	13.83	450.67	10.73	447.92
General mean	402.20	24.43	10.92	268.18	6.45	270.65
C.V.%	24.34	20.83	11.31	30.02	29.48	29.35
L.S.D. 0.05	11.29	0.21	0.11	13.66	0.15	12.94

Data obtained indicated that kenaf genotypes significantly differed in all studied characters. The strain 24 recorded also the maximum estimates of

all traits for exception with technical stem length (1.28 m) which was the fifth site as the descending order among kenaf genotypes. Moreover, this strain (S.24) was the highest and also adapted to both soil types i.e., clay loam in Giza location and sandy soil in Ismailia. The mean values achieved by S.24 were 2.98 m for total length, fruiting zone length (1.70 m), stalk weight/plant (162.08), stalk yield/fad. (13.52 ton), fiber yield/plant (7.03 g), fiber yield/fad. (591.97 kg), no. of capsules/plant (32.64), no. of seeds/capsule (13.83), no. of seeds/plant (450.67), seed yield/plant (10.73 g) and seed yield/fad (447.92 kg).

On the other hand, the kenaf variety Tianung recorded lowest estimates in the majority of economic traits such as total length (2.39 m), fiber yield/plant (3.32 g), fiber yield/fad. (296.87 kg), no. of capsules/plant (16.67), no. of seeds/capsule (9.85), no. of seeds/plant (165.56), seed yield/plant (4.01 g) and seed yield/fad. (168.020 kg). The remain nine kenaf genotypes were intermediate between the highest estimates which achieved by S.24 and the lowest one by Tianung in this case. The general means for all twelve kenaf characters were 2.58 m, 1.35 m, 1.23 m, 115.61, 9.69 ton, 4.75 g, 402.20 kg, 24.43, 10.92, 268.18, 6.45 g and 270.65 kg. for total length, technical stem length, fruiting zone length, stalk weight/plant, stalk yield/fad., fiber yield/plant, fiber yield/fad., no. of capsules/plant, no. of seeds/capsule, no. of seeds/plant, seed yield/plant and seed yield/fad., respectively. The estimates of C.V. % for the same arrangement characters mentioned before were 8.07, 18.23, 15.93, 23.55, 23.43, 25.43, 24.34, 20.83, 11.31, 30.02, 29.48 and 29.35 %, respectively. The coefficient of variation previously mentioned reported high values in all kenaf traits except with total length which appeared to be relatively low. Several investigators recorded genotypes differences such as Zahana and El-Refaie (2013), Adeniyan *et al* (2014), Faruq *et al* (2015), Kamalu *et al* (2016), Ryu *et al* (2017) and Akinrotimi and Okocha (2018).

It is worth noting that the general means for all the studied characters of Giza site (clay loam soil) surpass and were higher than the means of the Ismailia location (sandy soil) due to the deficiency of many nutrients in the latter location.

Correlation coefficient study

Estimates of correlation coefficient values (r) among 12 kenaf characters for the eleven genotypes are presented in Table (5).

Table 5. Estimates of correlation coefficient values (r) among 11 characters for 11 kenaf genotypes.

	Total length (m)	Technical stem length (m)	Fruiting zone length (m)	stalk weight/ plant (g)	Stalk yield/fad. (ton)	Fiber yield/ plant (g)	Fiber yield/ fad. (kg)	Number of capsules/ plant	Number of seeds/ plant	Seed yield/ plant (g)	Seed yield/ fad. (kg)
Total length (m)	**1**										
Technical stem length (m)	**0.794****	**1**									
Fruiting zone length (m)	**-0.162**	**-0.643****	**1**								
stalk weight/ plant (g)	**0.598****	**0.687****	**-0.411****	**1**							
Stalk yield/Fad. (ton)	**0.525****	**0.626****	**-0.408****	**0.883****	**1**						
Fiber yield / plant (g)	**0.458****	**0.592****	**-0.429****	**0.869****	**0.901****	**1**					
Fiber yield / Fad. (kg)	**0.460****	**0.603****	**- 0.442****	**0.855****	**0.829****	**0.848****	**1**				
Number of capsules / plant	**-0.013**	**-0.009**	**0.129***	**0.005**	**0.115**	**0.104**	**0.015**	**1**			
Number of seeds / plant	**0.137**	**0.204***	**0.406****	**0.189***	**0.262***	**0.202***	**0.191***	**0.845****	**1**		
Seed yield /plant (g)	**0.271***	**0.312****	**0.284***	**0.181***	**0.057**	**0.013**	**0.090**	**0.126***	**0.175***	**1**	
Seed yield / Fad. (kg)	**0.347****	**0.547****	**0.437****	**0.636****	**0.586****	**0.654****	**0.691****	**0.911****	**0.325****	**0.449****	**1**

Results obtained indicated that total length was highly significantly and positively correlated with each of technical stem length, stalk weight/plant as well as per fad., fiber yield/plant as well as per fad., no. of seeds/plant, seed yield/plant and seed yield/fad. The interrelationships between technical stem length and each of stalk weight/plant, stalk yield/fad., fiber yield/plant, fiber yield/fad., seed yield/plant as well as per fad. recorded highly significant and positive for exception with no. of seeds/plant which was only positively significant. The r values between fruiting zone length and each of no. of capsules/plant, no. of seeds/plant, seed yield/plant and seed yield/fad. revealed highly significant and positive. The correlation coefficient values between stalk weight/plant among stalk yield/fad., fiber yield/plant as well as per fad., and seed yield/fad. were highly significant and positive, while it was only significant and positive with both no. of seeds/plant and seed yield/plant. The association between stalk yield/fad. and each of fiber yield/plant, fiber yield/fad., no. of seeds/plant and seed yield/fad. recorded highly significant and positive values.

Fiber yield/plant was positive and highly significant with fiber yield/fad. and seed yield/fad,. but only significant and positive with no. of seeds/plant. Meanwhile, the r values of fiber yield/fad. and each of no. of seeds/plant as well as per fad. appeared to be highly significant and positive, while it was only significant and positive with no. of seeds/plant. The association was highly significantly positive correlated between number of capsules/plant and no. of seeds/plant, seed yield/plant and seed yield/fad. the r values were highly significant and positive between number of seeds/capsule and each of no. of seeds/plant, seed yield/plant and seed yield/fad. number of seeds/plant affected significantly correlated and positive with the both seed traits i.e., seed yield/plant and seed yield/fad., in addition to also between seed yield/plant and seed yield/fad. Similar results were observed by Bahtoee *et al* (2012).

It can be concluded that the r results in this investigation promote principal knowledge to kenaf breeders about the possibility for selecting genotypes having either tallest plants or more technical stem length

characters for giving and obtaining great fiber yield. Moreover, the more number of capsules/plant give indication for high seed production.

Anatomical study

Estimates of different tissue areas per cross section at the middle region of kenaf genotypes stems were sown in Giza location are presented in Table (6) and plate (1).

Table 6. Mean values of different tissue areas per cross section (c.s.) at the middle region of kenaf genotypes stems for Giza location.

Genotypes	Total cross section area $(mm)^2$	Cortex area $(mm)^2$	Fiber area $(mm)^2$	Xylem area $(mm)^2$	Pith area $(mm)^2$
Giza 3	**142.05**	**4.26**	**20.94**	**67.98**	**48.87**
copa	**115.40**	**3.85**	**17.11**	**46.61**	**47.83**
Tianung	**104.72**	**3.96**	**15.60**	**43.50**	**41.66**
I.10	**123.24**	**3.98**	**18.35**	**50.37**	**50.54**
I.12	**107.80**	**3.42**	**15.98**	**45.08**	**43.32**
I.13	**117.16**	**3.86**	**17.35**	**49.22**	**46.73**
I.14	**113.96**	**3.75**	**17.27**	**48.75**	**44.19**
I.36	**107.82**	**2.88**	**16.01**	**47.84**	**41.09**
S.11	**110.24**	**3.72**	**16.58**	**43.60**	**46.34**
S.13	**121.66**	**3.87**	**18.05**	**45.85**	**53.89**
S.24	**153.86**	**4.57**	**29.14**	**75.94**	**44.21**
General mean	**119.81**	**3.83**	**18.40**	**51.34**	**46.24**
C.V.%	**12.76**	**11.27**	**20.96**	**20.61**	**8.41**
L.S.D. 0.05	**3.10**	**0.24**	**0.51**	**1.46**	**2.01**

Plate 1. Giza location.

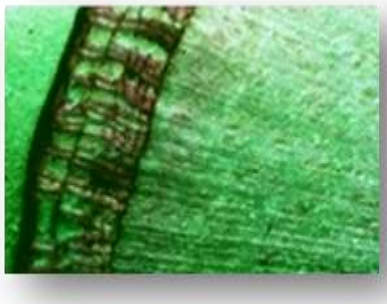

Fig. 1. Sector magnified for The fiber region of kenaf S.24 from Giza location.

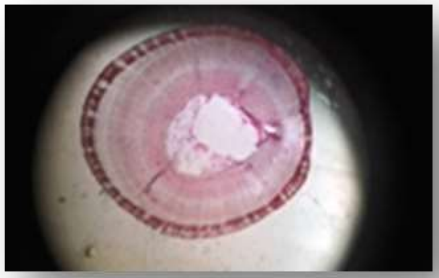

Fig. 2. Cross section of kenaf S.24 stem from Giza location (greatest fiber production).

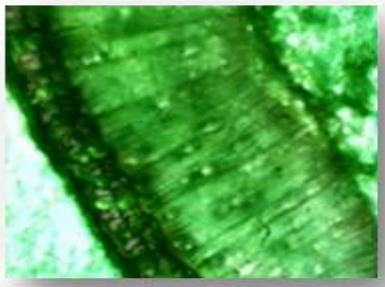

Fig. 3. Sector magnified for the fiber region of kenaf I.14 from Giza location.

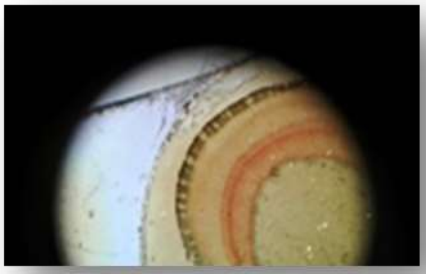

Fig. 4. Cross section of kenaf I.14 stem from Giza location (intermediate fiber production).

Fig. 5. Sector magnified for the fiber region of kenaf Tianung from Giza location.

Fig. 6. Cross section of kenaf Tianung stem from Giza Location (Lowest fiber production).

Data obtained illustrated that the kenaf strain 24 achieved the highest estimates of all tissue areas per cross section (c.s.) with total c.s. area 153.86 mm^2, cortex area (4.57 mm^2), fiber area (29.14 mm^2) and xylem area (75.94 mm^2). Meanwhile, the kenaf variety Giza 3 ranked second position in this case, by means that its measurements in the previous characters arrangement in addition to pith area were 142.05, 4.26, 20.94, 67.98 and 48.87 mm^2, respectively. Moreover, the introduced kenaf no.10 occupied the third site in all cross section tissue areas which mentioned before as descending order. On the other hand, the variety Tianung gave the lowest estimates in total c.s. area (104.72 mm^2), fiber area (15.60 mm^2) and xylem area (43.50 mm^2). The remain kenaf genotypes ranked intermediate between the highest and the fewest ones.

Results obtained from Table (7) and plate (2) deals with the Ismailia experiment for the same anatomical traits. Data showed that the S. 24 ranked first and achieved also the maximum estimates in all stem tissues such as total cross section area (94.85 mm^2), cortex area (3.86 mm^2), fiber area (16.30 mm^2), xylem area (57.80 mm^2) and pith area (16.89 mm^2). While Giza 3 was the second in all c.s. tissues except with fiber area which occupied the forth position, in addition to Introduction 10 was in the third site in relation to fiber area (12.64 mm^2). The kenaf variety Tianung recorded the minimum estimates for total c.s. area (44.85 mm^2), cortex area (1.82 mm^2), fiber area (10.20 mm^2) and xylem area (27.45 mm^2).

Data obtained revealed that, the total cross section area ranged from 44.85 to 94.85 mm^2, cortex area from 1.82 to 3.86 mm^2, fiber area from 10.20 to 16.30 mm^2, xylem area from 27.45 to 57.80 mm^2 and pith area from 4.54 mm^2 for I.13 to 16.89 mm^2 for S. 24.

Table 7. Mean values of different tissue areas per cross section (c.s.) at the middle region of kenaf genotypes stems were sown in Ismailia location.

Genotypes	Total cross section area $(mm)^2$	Cortex area $(mm)^2$	Fiber area $(mm)^2$	Xylem area $(mm)^2$	Pith area $(mm)^2$
Giza 3	**78.73**	**2.36**	**12.60**	**47.50**	**16.27**
copa	**51.40**	**1.97**	**10.82**	**31.42**	**7.19**
Tianung	**44.85**	**1.82**	**10.20**	**27.45**	**5.38**
I.10	**77.64**	**2.30**	**12.64**	**46.78**	**15.92**
I.12	**45.62**	**2.00**	**10.46**	**28.16**	**5.00**
I.13	**46.20**	**2.18**	**10.28**	**29.20**	**4.54**
I.14	**57.98**	**2.15**	**11.27**	**35.45**	**9.11**
I.36	**58.90**	**2.30**	**11.78**	**36.04**	**8.78**
S.11	**69.35**	**2.23**	**12.15**	**41.52**	**13.45**
S.13	**77.92**	**2.96**	**12.90**	**46.80**	**15.26**
S.24	**94.85**	**3.86**	**16.30**	**57.80**	**16.89**
General mean	**63.95**	**2.38**	**11.95**	**38.92**	**10.71**
C.V.%	**26.24**	**24.07**	**14.64**	**25.42**	**45.92**
L.S.D. 0.05	**5.23**	**0.12**	**0.56**	**3.89**	**1.27**

Plate 2. Ismailia location

Fig. 7. Sector magnified for the fiber region of kenaf S.24 from Ismailia location.

Fig. 8. Cross section of kenaf S.24 stem from Ismailia location (great fiber production).

Fig. 9. Sector magnified for the fiber region of kenaf I.14 from Ismailia location.

Fig. 10. Cross section of kenaf I.14 stem from Ismailia location (intermediate fiber production).

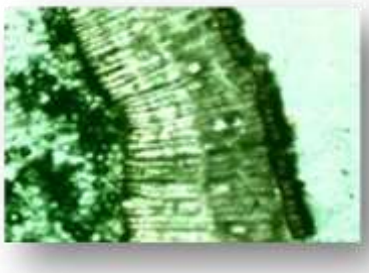

Fig. 11. Sector magnified for the fiber region of kenaf Tianung from Ismailia location.

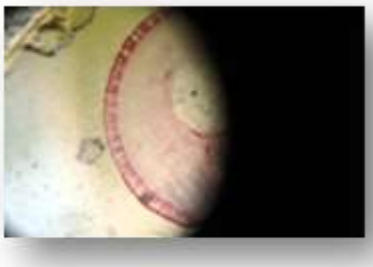

Fig. 12. Cross section of kenaf Tianung stem from Ismailia Location (lowest fiber production).

The coefficient of variation (C.V.%) estimates were high in all the five anatomical manifestation characters under study concerning Giza and Ismailia locations. These results were in agreement with those obtained by Voulgaridis *et al* (2000), H`ng *et al* (2009) and Abdul Khalil *et al* (2010).

Generally, it is clear that the grand means of Giza location was higher than Ismailia one in either yield and yield components or in anatomical studied characters. Moreover, that the kenaf strain 24 achieved maximum estimates in both soil types clay loam in Giza and sandy in Ismailia which enable kenaf growers to extent cultivation in new reclamation lands.

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دراسات مورفولوجية وتشريحية لبعض التراكيب الوراثية في التيل وعلاقتها بالمحصول

جمال الدين حسن الشيمي, دعاء إسماعيل محمود و مايسة سعيد عبد الصادق

قسم بحوث محاصيل الالياف – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية

أجريت أربعه تجارب حقليه: اثنتان منها أقيمت بمحطة البحوث الزراعية بالجيزة (تربة طينية جيرية) واثنان أيضا تم اجراؤهما بمحطة البحوث الزراعية بالإسماعيلية (تربة رملية) وذلك خلال الموسمين الزراعيين ٢٠١٨، ٢٠١٩ لتقييم ١١ تركيب وراثي من التيل بالنسبة للمحصول، مكونات المحصول، الارتباط بين الصفات، دراسة الصفات التشريحية في الساق. ويمكن تلخيص النتائج المتحصل عليها كما يلي: أشارت النتائج الي وجود فروق معنوية في محصولي السوق والبذور والصفات المكونة لهما في كلا من تجارب الجيزة والاسماعيلية وفي كلا الموسمين. حققت السلالة ٢٤ أعلي التقديرات في الغالبية العظمي من الصفات تحت الدراسة ومن التحليل التجميعي للموسمين في تجارب الجيزة والاسماعيلية. لكن أعطي صنف التيل تياننج أقل التقديرات في هذه الحالة. كان هناك ارتباط معنوي جدا وموجب بين الطو ل الكلي وكل من الطول الفعال، وزن الساق/النبات، وزن السوق/الفدان، محصول الالياف/النبات كما للفدان، عدد البذور/للنبات، محصول البذرة/النبات، محصول البذرة/الفدان. وكانت قيم معامل الارتباط (ر) معنوية جدا وموجبة بين عدد الكبسولات/النبات وكل من عدد البذور/النبات، محصول البذرة/الفدان. بالنسبة للدراسة التشريحية للساق: أشارت النتائج لتفوق السلالة ٢٤ في تحقيق أعلي التقديرات في المساحة الكلية للقطاع العرضي، مساحة القشرة، مساحة الالياف، مساحة الخشب. في حين أحتل الصنف جيزة ٣ المركز الثاني ومستورد ١٠ أحتل المركز الثالث في هذة الحالة. علي النقيض فقد أحتل الصنف تياننج المركز الاخير في معظم الصفات التشريحية المهمة في كلا من تجارب الجيزة والاسماعيلية.

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