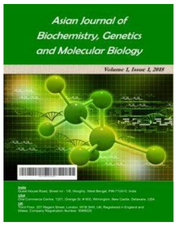

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Morphological Characterisation of Global Finger Millet (*Eleusine coracana,* L. Gaertn) Germplasm Reaction to Striga in Kenya

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Authors' contributions

This work was carried out in collaboration between all authors. Author SPN designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors OC, DSW and ODA managed the analyses of the study. Authors RP, ML and DG managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Finger millet (*Eleusine coracana,* L. Gaertn) is an important food crop in Africa and Asia. Its grain is richer in protein, fat and minerals than other major cereals. The parasitic weed *Striga hermonthica* (Del.) Benth seriously limits finger millet production through reduced yield in agro-ecologies where they co-exist. The damage of *Striga* to cereal crops is more severe under drought and low soil fertility. The main objective of this study was to determine genetic basis for reaction to

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S. hermonthica among the selected germplasm of finger millet through genotyping by sequencing (GBS). One hundred finger millet genotypes were evaluated for reaction to *S. hermonthica* (Del) Benth infestation under field conditions at Alupe and Kibos in Western Kenya. The experiment was laid out as a randomized complete block design (RCBD) consisting of 10 x 10 square (triple lattice). The genotypes were planted both under *Striga* (inoculated) and no *Striga* conditions and plant growth was monitored to maturity. Statistical analysis of phenotypic data using Statistical Analysis System (SAS) PROC ANOVA revealed highly significant differences among genotypes for morphological traits at $P<0.05$.

Keywords: Striga hermonthica; genotyping by sequencing; genome; susceptible; genetic diversity.

1. INTRODUCTION

Food security is a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life [1]. Fahey [2], food security could be improved by focusing on locally important crops such as finger millet, commonly known as orphan crops as well as major crops of the world. Finger millet is the most important minor millet in the tropics and grown in more than 25 countries where Africa and Asia, accounts for 12% of the global millet area [3]. The demand of finger millet is high in Kenya and fetches prices of over twice that of sorghum and maize in local markets [4]. The major biological constraint to increased finger millet production in small holder (SH) sector in Africa is attacked by *Striga* or witch weeds [5]. *Striga hermonthica* is particularly harmful to sorghum, maize and millet, but it is also increasingly being found in sugar cane and rice fields [6]. The parasitic weeds lack their own root system and therefore compensate this by penetrating the roots of the host plants, depleting them of essential nutrients for growth resulting to stagnation and finally low yields [7].

In Kenya, *Striga* infects about 210,000 ha, causing an annual crop loss of US$40.8 million [8]. These loses largely depend on the level of infection, crop variety, soil fertility and rainfall patterns where greatest impact is on the infertile soils and most affected being subsistence farmers [9]. The control of *S. hermonthica* in cereals has proven elusive. The presence of *Striga* and its interaction with host plant can lead to high yield loss of 10-70%, especially under heavy infestation depending on crop cultivar [10]. Economically feasible and effective technologies are still to be developed for the cash strapped subsistence farmers in most *Striga* –stricken areas [11]. Research on *Striga* control has been carried out for a long time and a wide range of technologies developed that have not been widely adopted due to a mismatch between technologies and the farmers' socio-economic conditions [6]. The control of the weed has also been difficult because of its high fecundity, and it's biology that allows the seed to remain viable underground for more than 10 years allowing it to persist and increase in magnitude [12]. Also complete control of *Striga* on cereals has been a challenge to scientists for a long time and therefore the need to search for farmer satisfying strategies through identifying of *Striga* tolerant varieties of finger millet.

The major challenge, therefore, is to develop methods or varieties that will help small scale farmers control *Striga* effectively within a sustainable and profitable farming system [13]. Scholes and Press [14], the use of resistant crop cultivars is considered to be one of the most effective strategies, however, their effective deployment has been limited due to lack of understanding of phenotypic basis of adaptation of *Striga* population to their new host resistance phenotypes. Similarly, finger millet genotypes for *Striga* resistance have not been developed. Therefore knowledge of the extent and distribution of *Striga* resistance variation within finger millet could be an important tool for efficient collection, conservation and development of improved varieties against *Striga*.

2. MATERIALS AND METHODS

One hundred finger millet genotypes of unknown genetic background to *Striga* reaction including local and international accessions obtained from breeding programme at Kenya Agricultural and Livestock Research Organizations (KALRO), Kakamega were grown both under *Striga* inoculation and no *Striga* conditions at two different agroecological conditions during two rainy seasons at Kibos and Alupe. *Striga* seeds

Table 1. The 100 Finger millet accessions used in the experiment

Entry no	Genotype	Entry no	Genotype	Entry no	Genotype	Entry no	Genotype	Entry no	Genotype
1	I.E 4491	21	GBK000463	41	KACIMI20	61	GBK008278	81	GBK029798
2	I.E 6165	22	GBK027300	42	KACIMI6	62	GBK008292	82	GBK029820
3	I.E 4497	23	I.E 4816	43	KACIMI65	62	GBK008299	83	GBK033414
4	I.E 6537	24	I.E 2217	44	KACIMMI17	64	KACIMMI77	84	GBK033416
5	OMUGA-P	25	KACIMMI7	45	KACIMMI22	65	GBK029199	85	GBK039217
6	KACIMMI15	26	KACIMMI47	46	KACIMMI24	66	GBK029678	86	GBK043268
7	I.E 4115	27	VL 149	47	KACIMMI49	67	GBK029715	87	GBK000369
8	GBK029661	28	GBK043081	48	KACIMMI72	68	GBK029722	88	UFM 138
9	I.E 5870	29	OKHALE-1	49	KACIMMI42	69	GBK029724	89	GBK000482
10	KACIMMI 11	30	OMUGA-G	50	GBK000516	70	GBK03821	90	GBK000909
11	I.E 5306	31	P 224	51	GBK000692	71	GBK040568	91	GBK008348
12	I.E 2957	32	P224 CV	52	GBK008339	72	GBK000409	92	GBK033446
13	PR 202	33	P 283	53	GBK029701	73	GBK000449	93	U15XP283
14	GBK000451	34	P4C3	54	GBK029793	74	GBK000462	94	GBK000784
15	I.E 5873	35	SERERE-1	55	GBK029805	75	GBK000493	95	GBK000831
16	I.E 4795	36	U-15	56	GBK029821	76	GBK000568	96	GBK026992
17	I.E 2606	37	N-BROWN	57	GBK029847	77	GBK0011082	97	GBK000900
18	I.E 2440	38	GULU-E	58	KACIMMI36	78	GBK011113	98	GBK000549
19	I.E 6337	39	BUSIBW-1	59	GBK000802	79	GBK011126	99	GBK029807
20	KACIMMI30	40	KACIMMI73	60	GBK000828	80	GBK029744	100	GBK000520

Key: I.E =International Eleusine, CV = Chakol Variant, U = Uganda, P = Purple
N = Nanjala, GBK = Gene Bank Kenya, G = Green, KACIMMI = KARI African Centre for Crop Improvement McKnight Foundation Millet

were collected from the experimental localities and used as inoculum for artificial inoculation. Alupe lies under an altitude of 1189 m above sea level, latitude of 0° 29' N and longitude of 34° 08' E. The soil is Ferralo-orthicAcrisol with pH of 5.0 [15]. Kibos lies under altitude 1135 m above sea level, latitude 0° S and longitude 34°49' E. The soil is black cotton with clay loam and pH of 6.55. The two sites are located in regions that are *Striga* endemic.

Field screening for *Striga* resistance was done in two seasons i.e. during long and short rainy seasons. The seeds of finger millet in long rainy season were planted on 10th June, 2012 at Alupe and on 20th June, 2012 at Kibos. After harvesting, the collected seeds were planted at KALRO Alupe on 19th September 2012 and at Kibos on 23rd September for the second rainy season trials.

The experimental design was a Randomized Complete Block Design (RCBD) with a 10 x 10 triple lattice. A plot was made of three rows of two meters length spaced 30 cm apart between rows and later thinned to intra-row spacing of 15cm. Plots were spaced 50 cm apart reps separated by 1m paths. Planting was in shallow furrows where DAP basal fertiliser was applied followed by seed by drill before being loosely covered. For the inoculated plots, a *Striga* seed/sand mixture was applied by drill before fertiliser and seed application.

2.1 Field Data Collection

Seedling vigor was taken at three week after emergence on a scale of 1 to 3 where 1 = highly vigorous, 2 = vigorous and 3 = less vigorous. Ear shape was also rated on a scale of 1 = open, 2 = curved and 3 = fist. *Striga* count at the vegetative stage was done up to but before the crop began to flower. The days to 50% flowering was done on the day when half of the plants in each plot had flowered and finally *Striga* counting was done when the crop had reached physiological maturity. Lodging percentage was the number of lodged plants in a plot expressed as a percentage of plant stand. Ear length was taken as a distance from receptacle to the tip of head while ear width was taken as distance across and near the tip of the mature head. Plant height was the length in cm from the base of the plant at soil level to tip of the main stalk head at physiological maturity. This was done on five representative plants in each plot and average recorded. The ear exertion was taken as the distance between ligule of the flag leaf and the base of the head. The number of fingers was obtained by dividing the total number of fingers from five plants by five plants measured. Plant stand was a count of the number of plants per plot at physiological maturity. Yield per plot was the weight of clean grain resulting from threshed and winnowed plot harvest. Yield in kg ha^{-1} was extrapolated from yield per plot.

2.2 Statistical Analysis

Data on morphological traits and *Striga* effect were subjected to analysis of variance (ANOVA) procedure using Statistical Analysis System (SAS) software. Means were separated using Fischer's least significant (LSD) test at $P \leq 0.05$).

3. RESULTS AND DISCUSSION

3.1 Effects of *Striga* Infestation on Finger Millet Morphological Traits

The mean for seedling vigour was slightly high in the genotypes that were infested with *Striga* compared to *Striga* free plots. This is in tandem with report by Ranson and Odhiabo [16] where studies done on maize varieties in Kenya found that early maturing maize landraces were more tolerant to *Striga* than late maturing land races through a mechanism termed 'the escape mechanism'. Thus genotypes that had high seedling vigour had least *Striga* count or none from vegetative crop stage, through days to 50% flowering up to crop maturity. Seedling vigour was found to be an important trait in yield and biomass determination in other crops such as wheat [17]. Therefore the effect of *Striga* on plant vigour influences above ground biomass and seed production capacity hence the need to measure how vigorous the plant is at various stages and how this is affected by various treatments.

For instance six poor yielding genotypes (VL149, I.E 6165, PR 202, I.E 2957, GBK 029661 and I.E 4497) did not support *Striga* suggesting they could be carrying *Striga* resistance genes but deficient in yield conferring genes. The results showed high mean *Striga* count at maturity compared to that at vegetative and 50% flowering (Table 5). The early attachment of *Striga* seedlings to roots is a function of *Striga* seed density, and host plant characteristic such as root architecture [18]. Early attachments result in severe damage to the host under controlled conditions [19] or in the field [20]. This is in agreement with the findings in this study where by genotypes that had high *Striga* count at maturity of the crop had low mean yield. *Striga* count at flowering and at maturity were highly related and the two negatively affected yield. This is in agreement with [21] who reported of *Striga* being dangerous parasitic weed on cereals.

The high significant difference between *Striga* inoculated and non-inoculated plots, in *Striga* counts at days to 50% flowering, plant height and crop yield all point to the fact that *Striga* has deleterious effect on finger millet [21]. This shows that infected plants struggle to reach maturity earlier in order to survive as reported by Shah et al. [22].

Early maturity is one attribute to avoid *Striga* infestation as was demonstrated in most genotypes of finger millet. The nutrient uptake by host plant (finger millet) was reduced by the *Striga* and could be a factor affecting the flowering and reduced millet production. This is an indication that *Striga* causes adverse effects on the growth and development of agro-morphological traits in host plant.

The results obtained with respect to ear shape showed no significance difference between the *Striga* inoculated and *Striga* free plots. This was an indication that ear shape in finger millet is not affected by *Striga* infestation. No literature exists that supports or deny these findings so far.

The varieties that had long ears also gave high yields, for example, KACIMMI 42, GBK 000802, KACIMMI 72, KACIMMI 17 and GBK 027300. Similarly, Bondale et al. [23] found grain yield per plant to be significantly influenced by finger length and finger width among finger millet genotypes from diverse regions of India. This is tandem with Shawemimo [24], who reported that *Striga* infestation in sorghum reduced panicle weight and 1000 grain weight by 35.9% and 52.9% respectively. Thus *Striga* weed had a serious effect on growth and development of ear length particularly in the highly susceptible genotypes of finger millet.

There was a high significant difference ($P \leq 0.01$) in ear width and *Striga* counts between inoculated and non-inoculated plots. Ear width is a morphological trait that indicates growth in plants. Therefore the smaller the ear size the smaller the panicles hence limiting proper formation and development of finger millet seeds. These results were in agreement with Press et al. [25] who reported that *Striga* can impose effects on the hosts even in its early stage of development, which might be attributed to the production of toxins by parasite affecting growth and physiology of the hosts.

The mean yield for *Striga* inoculated genotypes was 609.9 kgha^{-1} while the mean for *Striga* free genotypes was 1074.4 kgha^{-1}. The reduction in yield due to *Striga* infestation was approximately 43%. This is in tandem with report by M'Boob [26] that yield losses of maize due to *Striga* infestation in Nigeria alone was estimated at 70%, while losses in Africa as a whole was about 40% representing an annual losses of about US $7 billion. The infestation of crop by *Striga* results in chlorosis, wilting, stunting and death, with losses ranging from 40% to 100% [27]. It is also in agreement with Press et al. [25], who reported that *Striga* infestation in sorghum reduced plant height, panicle weight, 1000 grain weight and grain yield by 13.7, 35.9, 52.9, 64.5 and 52.6% respectively.

3.2 Field Results

Eleven parameters showed significant difference in the mean while four showed insignificant mean difference at $P \leq 0.05$. The 100 genotypes of finger millet in plots infected with *Striga* had significantly higher negative effects compared with their respective *Striga* free control plots.

Seedling vigour showed no significant difference between the plots of finger millet that were inoculated with those that were not inoculated with *Striga* amongst the replicas at $P < 0.05$(Tables 4 and 5). The genotypes that were highly vigorous included I.E 4491, I.E 6165, KACIMMI 15, GBK 029661, KACIMMI 11, I.E 2957, I.E 4795, PR 202, GBK 000463, VL 149 and GBK 043081(Table 2).

The overall mean *Striga* count at a vegetative stage for inoculated plots was 5.27 while in the un-inoculated plots was 0 giving a high significance difference (Table 5). The *Striga* count mean ranged from 0 to 13.4 plants in respective genotypes (Table 2). The genotypes that showed immunity to *Striga* at vegetative stage included; I.E 4497, I.E 4795, VL 149, GBK 000516, I.E 2217, GBK 027199, KACIMMI 24, GBK 026992, GBK 008339, GBK 029724, KACIMMI 36 and KACIMMI 7 (Table 2). The only genotype that was recorded to have the highest mean significant difference at this stage was GBK 000409 and had mean *Striga* count of 13.4 (Table 2).

Table 2. Morphological traits mean from *Striga* inoculated plots

Entry no	Genotype	1	2	3	4	5	6	7	8	9	10	11	12	13
1	I.E 4491	3.0	0.8	1.5	3.5	84.7	43.3	5	2	2.8	8.3	2.8	5.6	113
2	I.E 6165	3.0	0.2	0.0	0.0	87	67.5	7.3	5.7	0	12.6	12.5	7	200
3	I.E 4497	2.5	0.0	0.0	0.0	82	50.0	4.0	1.0	0	7.5	1	5.5	22.2
4	I.E 6537	1.9	0.0	0.8	0.9	87.8	53.5	5.8	3	24	13.4	7.8	4.9	318.1
5	OUGA P	2.3	0.6	1.0	2	90	52.3	6.5	2.5	19.2	12.7	11.6	5.8	83.4
6	KACIMMI 15	3.0	0.3	0.3	1.0	93.7	48.6	5.3	3	0	9	1.3	3.7	66.67
7	I.E 4115	2.2	0.4	2.8	6.4	84.4	49.6	5.6	2.8	9.6	11.4	29	5.3	618.9
8	GBK029661	3.0	0.0	0.5	0.5	89	55.0	4	1	5	13	1	4	66.7
9	I.E 5870	2.5	0.0	1.5	15.5	83	50.0	5.5	2.5	0	12	3	5.5	155
10	KACIMMI 11	3.0	1.0	1.0	1.0	90	45	4	2	0	14	1	4	83
11	I.E 5306	2.2	2.0	12.2	69.2	91.7	58.7	5	1.7	9.7	12	25.7	5.2	213.9
12	I.E 2957	3.0	0.0	0.0	9.0	87	30.0	5	2	3.5	10.5	1	5.5	41.65
13	PR 202	3.0	0.0	0.0	12	88	60.0	8	3	30	12	1	7	63.9
14	GBK000451	1.9	6.6	15.1	38.5	74	58.3	5.7	2.7	7	12	28.2	5.4	861.1
15	I.E 5873	2.4	0.2	0.8	1.0	91.5	46.1	4.5	2.5	14.4	15.2	3.8	4.8	7.43
16	I.E 4795	3.0	0.0	0.0	0.0	90	55.0	8	3	0	14.1	1.3	6	63.9
17	I.E 2606	2.7	0.14	1.9	19.9	92.3	38.3	4.3	2	0	11.7	22	5.4	358
18	I.E 2440	2.8	0.25	0.0	0.25	98.5	39.5	4	2	15.5	12	2	4.5	59.3
19	I.E 6337	2.8	1.5	5.0	19.3	91.7	49.0	5	2.3	14.5	12.1	22.5	6.2	859
20	KACIMMI 30	1.8	1.0	4.6	6.2	84.2	53.5	6	2.7	14.7	10.4	28.5	5.1	537.1
21	GBK000463	3.0	0.0	0.0	0.0	101.2	60.0	7	2	0	16	1	5	94.4
22	GBK027300	1.9	1.1	3.1	63.8	93.2	61.3	5	2.8	12.6	12.9	23.8	4.9	510.2
23	I.E 4816	1.7	6.2	18.1	31.0	83.3	55.0	6.2	2.8	12.5	11.3	23.4	5.6	1019.5
24	I.E 2217	2.7	0.0	0.7	0.83	89	43.3	4	2	1.5	11.7	2.7	4.8	36.7
25	KACIMMI 7	2.1	0.3	1.2	1.7	94.3	40.4	5.5	2.3	6.4	11.7	17.1	4.7	75
26	KACIMMI 47	1.6	0.5	2.3	5.1	83	64.4	6.8	3	21.3	13.4	27.9	5.5	1094.4
27	VL 149	3.0	0.0	0.0	0.0	53	53.2	8	4	0	10.1	2	5.7	113.9
28	GBK043081	3.0	0.0	0.0	0.0	85	60.0	7	3	0	11	2	5	88.9
29	OKHALE-1	2.2	7.5	14.4	31.0	87.8	67.2	8.2	2.8	18.3	13.2	30	5.7	774
30	OMUGA G	1.9	2.2	7.1	10.7	90	59.9	6.3	2.3	23.4	13.6	23.4	5.4	947.2
31	P 224	2.3	2.0	5.1	11.3	84.2	48.5	5.5	2.5	15.7	11.1	22.5	4.6	577.8
32	P 224 CV	2.1	4.5	13.3	27.2	84.3	57.9	5.8	2.5	23.4	12.4	22.9	5.2	520.4
33	P 283	2.0	3.8	11.1	19.1	88	56.4	5.8	2.2	11	13.2	26.7	5.1	534.3
34	P4C3	2.3	7.8	17.8	31.3	84.3	48.5	4.8	2.3	9	13.9	25	5.3	562.0

Entry no	Genotype	1	2	3	4	5	6	7	8	9	10	11	12	13
35	SERERE-1	2.3	0.9	5.3	10.7	88.8	44.6	5.5	2	25.8	11.7	21.3	4.8	414
36	U-15	2.3	2.8	4.3	15.1	90	47.7	5.8	2.5	7.9	11.8	28.7	5.5	618.5
37	N BROWN	1.6	5.3	9.9	19.2	87	48.1	6	2.3	23.5	12.5	19.1	4.2	430.6
38	GULU-E	2.2	6.3	11.8	21.3	86.8	54.6	6	2.3	12.9	12.5	26.7	5.1	630.6
39	BUSIBWABO-1	1.4	2.8	7.8	16.9	85.3	55.1	5	2.3	43.6	12.9	28	4.7	1200
40	KACIMMI 73	1.4	1.6	4.1	10.2	84	68.0	7.3	3.2	20.8	13.8	28.7	5.8	1134.2
41	KACIMMI 20	1.8	3.7	8.0	40	91.7	63.4	7.8	3.7	19.3	12.7	26.5	5.5	916.7
42	KACIMMI 16	2.3	2.3	7.8	12.8	82.7	55.5	6.5	2.5	14.5	14.8	30.1	5	917.6
43	KACIMMI 65	2.4	6.2	12.2	25.7	77	52.9	6	2.3	9.4	10.4	27.3	5.1	751.9
44	KACIMMI 17	1.6	2.7	8.4	14.5	82.8	62.9	5.8	2.5	12.2	12.9	31.6	5.2	1165.7
45	KACIMMI 22	1.8	2.4	4.2	9.2	85	61.3	6	2.5	24.7	11	27.3	5.2	994.4
46	KACIMMI 24	2.1	0.1	0.8	7.58	90.3	55.8	7.2	2.5	3.7	11.2	25.4	5.3	1013
47	KACIMMI 49	1.8	4.8	14.3	21	84.5	65.7	7.2	3.2	17.7	13.4	28.8	6.2	983.3
48	KACIMMI 72	1.7	2.5	7.8	18.4	87.8	62	6.7	2.3	11.1	14.8	31	4.8	1040.8
49	KACIMMI 42	2.2	4.3	11.4	22.3	87	54.9	7.8	2.7	8.8	13.2	28.5	5.8	926.9
50	GBK000516	2.0	0.0	1.7	6.73	84.4	57.4	6.4	2.6	5.2	13.6	26.7	5.1	1133.3
51	GBK000692	1.9	3.8	8.9	35.7	97.5	59.2	5	2.3	14.7	14.1	24.8	5.2	563
52	GBK008339	1.5	0.3	1.3	8.17	84.3	59.8	5.3	2.8	10.4	13	25.8	5.3	775
53	GBK029701	2.1	2.4	7.3	18.9	96.3	53.4	5.7	2.5	16.6	10.4	21.4	5.2	742.2
54	GBK029793	1.4	2.0	11.1	20.1	81.2	58.4	5.2	2.6	7.5	13.9	26.9	5.3	1103.3
55	GBK029805	2.0	0.5	2.9	17.2	87.7	48.9	5.2	2.3	8.7	10.2	24.8	5.3	371.3
56	GBK029821	2.2	1.1	2.8	28.8	96.3	57.5	4.8	2.3	8.3	10.5	27.3	5.5	413
57	GBK029847	2.0	0.8	2.3	19.1	97.2	58.9	7.2	3	3.7	12.2	25.7	5.3	427.8
58	KACIMMI 36	2.2	0.1	1.8	5.42	83.8	52.5	6.2	2.3	10	14.2	24.1	5.2	748.2
59	GBK000802	1.8	1.4	2.4	30.6	88.7	52.1	5	2.2	6.3	12.8	26.9	5	976,9
60	GBK000828	2.6	0.7	1.8	20.6	99	50.3	5.8	2.5	9.7	11.4	20.8	5.1	315.7
61	GBK008278	2.2	3.0	9.7	29.6	92.4	53.2	6.8	2.4	14.4	12.6	26.3	5.6	589.9
62	GBK008292	1.9	1.7	6.1	43.8	92.8	52.6	6	2.7	8.3	12.5	26.8	6	719.5
63	GBK008299	1.8	3.3	4.8	25.3	89.2	42.9	5.2	2.3	12.7	10.4	25.3	5.3	452.8
64	KACIMMI 77	2.3	5.6	14.2	26.8	84	48.7	5	2.2	11.2	13.4	28	6.4	803.7
65	GBK029199	2.1	0.1	2.1	21.8	96.2	55.4	5.5	2	8.8	11.3	22	5.6	467.6
66	GBK029678	2.4	2.8	7.7	16.9	89	39.2	4.3	2	12.6	9.4	23.3	5.3	462.9
67	GBK029715	1.8	2.1	8.7	45.6	98	59.3	7.3	2.7	15.8	13.5	67.4	5.8	824.1
68	GBK029722	1.8	0.4	2.3	22.7	93.7	58.5	6.7	2.3	12.8	13.7	27.5	5.3	1055
69	GBK029724	2.2	0.3	1.1	21.8	97.8	62.8	4.8	2.3	7.8	12.3	23.1	5.7	608.3
70	GBK003821	1.4	1.0	6.7	13	72.7	73.3	8	2.7	15.1	13.8	30.1	6	1670

Entry no	**Genotype**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
71	GBK040568	2.7	4.8	7.2	31.2	93.5	41.3	4	2.2	9.7	10	23.7	4.9	512
72	GBK000409	1.5	13.4	14.7	40.9	71.3	47.8	4.3	3.3	11.2	8	24.4	4.5	901.4
73	GBK000449	2.2	1.3	4.0	14	81	48.9	6.3	2	18.4	12	26	5.1	572.2
74	GBK000462	1.9	0.7	3.8	49.6	91	48.4	4.3	2.5	2.5	11.7	27.7	5.3	665.7
75	GBK000493	1.9	1.8	6.6	15.1	83.2	51.4	3.8	2.2	22.8	15.2	22.5	4.8	620.4
76	GBK000568	2.2	3.8	12.0	34.3	96.7	46	5.3	2.3	12.5	10.6	21.2	4.9	143.5
77	GBK011082	2.3	2.0	4.7	38.6	98	50.7	5.4	3	2.2	10	25.1	5.7	475
78	GBK011113	1.4	0.9	4.0	45.3	98.8	55.9	5	2.3	12.8	11.4	27.6	5.2	304.7
79	GBK011126	1.9	3.7	7.9	43.8	91	53.8	5.8	2.3	8.3	11.3	27	5.2	708.3
80	GBK029744	2.0	3.5	6.5	59.5	90.8	63	6.2	2.4	16	11.9	22	4.9	706.5
81	GBK029798	1.7	2.3	8.5	20.3	92.2	47.3	5.2	2.5	15.3	10.4	24.8	5.4	408.4
82	GBK029820	1.7	0.8	5.8	33.4	91.8	67.3	6.5	3	5.9	13.7	25.7	5.6	575.9
83	GBK033414	2.2	2.2	12.1	25.2	90.6	53.9	7.4	2.8	6.8	12.7	20.6	4.8	442.6
84	GBK033416	2.7	1.3	2.8	20	83.8	55.2	5.8	2.5	13.8	11	21.8	5.8	557.4
85	GBK039217	2.4	1.5	5.3	31.7	99.7	51.4	5.5	2.7	2.2	9.1	27.1	5.8	398.2
86	GBK043268	1.9	2.1	7.8	28.8	92.4	62	5.4	2.2	18.3	13.1	26.6	5.5	464.4
87	GBK000369	2.0	8.5	16.0	42.3	84	59.2	5.3	2.5	32	11.9	22	5.1	339.8
88	UFM 138	1.9	3.3	9.3	15.4	86.2	48.6	4.8	2	6.5	12.5	26.4	5.1	638
89	GBK000482	2.3	1.8	9.4	34.9	90	52.1	5.2	2.2	14	10	25.2	5	568.5
90	GBK000909	1.8	3.3	15.3	40.3	94.8	56.9	6	2.5	10.7	13.1	27.1	5.3	463.9
91	GBK008348	2.1	8.3	15.9	29.3	93.8	44.3	4.2	1.8	18.3	12.7	24.8	5	620.4
92	GBK033446	2.2	0.7	1.8	14.8	94.4	52.2	5.5	2.7	3.9	12.1	23.8	5.4	447.2
93	U-15XP283	1.9	6.6	14.5	26.58	84.8	49.9	4.8	2.5	9.8	12.9	27.8	5	708.3
94	GBK000784	2.2	2.6	11.8	25.3	90.7	47.9	5	2.3	7.3	9.4	23.6	5.3	400.9
95	GBK000831	2.4	0.5	3.0	13.8	94.6	42.5	4.8	2.6	6.5	10.9	23.2	5.6	245.4
96	GBK026992	2.2	0.1	1.5	16.4	86.4	54.3	5	2	16.2	11.4	17.9	5	412
97	GBK000900	2.1	2.5	9.4	68.1	92.8	54.2	5.7	2.5	9.3	12.7	22.3	5.4	367.6
98	GBK000549	2.1	1.1	5.6	41.5	93.0	50.2	4.8	1.8	9.6	11.7	23.8	5.3	613
99	GBK029807	2.2	0.4	1.7	13.8	101	56.8	5.7	2.2	2.4	12.2	20.3	5.6	878.7
100	GBK000520	1.8	8.3	3.2	20.3	65	58.8	4.8	3.3	5.5	10.4	27.6	6.8	906.5

Key: 1= Seedling vigor 2= Mean striga count at vegetative stage 3= Mean Striga count at 50% flowering
4= Mean Striga count at crop maturity 5= Mean days to 50% crop flowering 6= Mean plant height
7= Ear length 8=Ear width 9= Lodging percentage 10= Ear exertion 11= Stand count
12= Number of fingers 13= Mean Yield in $kgha^{-1}$

Table 3. Morphological traits mean from *Striga* free plots

Entry no	Genotype	1	2	3	4	5	6	7	8	9	10	11	12	13
1	I.E 4491	3.0	0	0	0	97	58	8	3	1	7	2	4	155.6
2	I.E 6165	3.0	0	0	0	101	67.5	7.3	5.7	0	12.6	12.5	7	300
3	I.E 4497	3.0	0	0	0	114	65	6	4.0	0	5	10	7	61
4	I.E 6537	1.8	0	0	0	91.5	63	6.5	5.1	40.5	14.5	7	4.8	422
5	OUGA P	1.5	0	0	0	96	70.6	7.6	5.8	19.3	12.5	15.3	6.3	701
6	KACIMMI 15	2.0	0	0	0	96.7	56	5.8	4	0	9	2	3.7	600
7	I.E 4115	2.2	0	0	0	88.8	61.3	7.1	5.3	8	11.9	26.2	5.2	1212
8	GBK029661	3.0	0	0	0	100	63	5	2	10	18	1	4	200
9	I.E 5870	2.5	0	0	0	88	56.0	6	2.5	0	12	3	5.5	750
10	KACIMMI 11	3.0	0	0	0	90	54	5	2.6	0	14	4	4	650
11	I.E 5306	2.0	0	0	0	94.6	61.3	7.3	5.5	11	12.3	23.3	5.2	783
12	I.E 2957	3.0	0	0	0	107	45	6	2	7	14	1	6	27.8
13	PR 202	3.0	0	0	0	97	55.0	9	2	60	13	1	3	38
14	GBK000451	2.3	0	0	0	88.8	64	7.7	7.6	3.2	12.8	23	5.4	1018.8
15	I.E 5873	2.7	0	0	0	100	61	7.3	3.7	23.3	16	2	4.7	135
16	I.E 4795	3.0	0	0	0	98	68	6.7	6.5	0	14.7	1.5	5.5	130.5
17	I.E 2606	2.0	0	0	0	97	60.5	5.8	5.1	0	13.3	21	5.8	695
18	I.E 2440	3.0	0	0	0	106.5	67	5	1	30	13.5	1.5	5	100
19	I.E 6337	3.0	0	0	0	92.3	58	7	5.9	3.7	13.8	18.3	6.7	777.8
20	KACIMMI 30	1.5	0	0	0	84.7	58.2	7.7	6.2	16.7	10.6	25.7	4.8	1000
21	GBK000463	2.1	0	0	0	107	60.0	7.8	4.8	0	16	4	5	300
22	GBK027300	1.8	0	0	0	98.3	76	7.3	5.1	17	13.8	23.2	4.8	1303.7
23	I.E 4816	1.0	0	0	0	78.8	70.3	9.2	9.0	8	12.8	30.5	6.3	1805
24	I.E 2217	2.7	0	0	0	103.3	61	7.3	5.3	2.7	14	3.3	4.3	307
25	KACIMMI 7	1.8	0	0	0	89	60	7.0	5.8	4.5	14.1	22.5	5.3	1187.8
26	KACIMMI 47	1.8	0	0	0	81.5	72.3	9.5	7.8	12.2	14.3	25.3	5.5	1453.7
27	VL 149	3.0	0	0	0	97.5	52.5	6.5	4	0	9.2	1	5.0	150
28	GBK043081	3.0	0	0	0	91	44	7	3	0	11	2	5	178
29	OKHALE-1	1.8	0	0	0	86.7	73.3	9.6	8.3	13.8	13.7	26.8	6	1641
30	OMUGA-G	1.8	0	0	0	87	71.8	8.0	6.3	12.7	14.9	22.7	5.3	1321
31	P 224	2.0	0	0	0	89.7	62.3	7.4	6.8	20.3	11.3	25	4.3	840
32	P 224 CV	2.0	0	0	0	89.5	65.3	7.5	4.6	33.3	13.4	21.8	5.0	1011
33	P 283	1.8	0	0	0	90.2	69.3	7.7	6.1	9.7	13.6	28.6	5.3	814
34	P4C3	1.8	0	0	0	87.7	65.2	7.3	6.5	9	13.9	28.3	5.2	1627

Entry no	Genotype	1	2	3	4	5	6	7	8	9	10	11	12	13
35	SERERE-1	1.8	0	0	0	93	68.3	7.3	6.4	25.8	11.7	26	5.3	1723
36	U-15	2.0	0	0	0	87.3	59.8	7.1	6.3	7.9	11.8	29.8	5.2	1131
37	N-BROWN	1.2	0	0	0	92	75	8.5	6.1	23.5	12.5	21	4.5	1064
38	GULU-E	2.3	0	0	0	87.6	63.5	7	6.3	12.9	12.5	28	4.8	1196.3
39	BUSIBW-1	1.5	0	0	0	84.2	70.2	5.7	6.8	18.8	13.7	27.2	4.3	1388
40	KACIMMI 73	1.6	0	0	0	87.5	69.2	9.5	7.1	22.7	13	26	5.8	1354
41	KACIMMI 20	1.6	0	0	0	90.2	76.3	9.2	7	18.7	12.4	27.6	5.6	1555
42	KACIMMI 16	2.2	0	0	0	88.3	69.2	8.7	7.1	12.3	16	32	4.8	1184
43	KACIMMI 65	2.5	0	0	0	91	52.2	7.3	7	5.7	10.5	25	5.4	1104
44	KACIMMI 17	1.6	0	0	0	85.5	67.3	7.8	6.4	9.2	13	31.5	5.0	1503.7
45	KACIMMI 22	1.7	0	0	0	89	71.2	8	7.3	30.2	11.9	29	5.0	1830
46	KACIMMI 24	2.2	0	0	0	88.5	66.3	6.6	7.6	4.2	11.3	26.7	5.5	1202
47	KACIMMI 49	1.6	0	0	0	83.6	68.2	8.9	6.8	17.3	13.6	28.8	6.3	1518.5
48	KACIMMI 72	1.5	0	0	0	89.2	75.6	8.4	7.4	7.7	15.6	30.8	4.5	1666.7
49	KACIMMI 42	1.8	0	0	0	88.3	65.8	10.3	8.0	4.8	13.3	33.2	5.8	1638
50	GBK000516	2.2	0	0	0	86.5	62.8	8	6.9	5.5	14.5	26.3	4.7	1062.9
51	GBK000692	2.0	0	0	0	98.7	76.8	6.3	5.5	11.8	15.9	22.7	5.3	664
52	GBK008339	1.5	0	0	0	93.8	65.8	6.6	5	2.7	13.4	22.2	5.2	936
53	GBK029701	2.0	0	0	0	93	74.8	8.4	5.7	20.8	11.9	24.5	5.7	1422
54	GBK029793	1.7	0	0	0	87	64	5.8	5.2	10.3	14.4	24	5.2	1033
55	GBK029805	1.8	0	0	0	96.5	66	7	5.3	10.7	11.4	26.3	5.6	889.8
56	GBK029821	2.3	0	0	0	104	71.3	6.7	5.1	0.8	10.8	26.5	5.7	736.1
57	GBK029847	2.0	0	0	0	100.2	74	9	6.7	5.7	12.5	24.3	5.3	618.5
58	KACIMMI 36	2.0	0	0	0	89	65.3	8	6.7	7.8	14.8	27.3	5.3	1228.7
59	GBK000802	1.5	0	0	0	92.2	70.3	7.2	6.9	5.7	14.4	26.3	5.2	1672
60	GBK000828	2.6	0	0	0	98.8	69.7	7.9	5.2	8.2	12.5	20.2	5.7	426.8
61	GBK008278	2.0	0	0	0	102.2	68.7	8.7	6.3	11.2	13.4	27.8	5.7	1224
62	GBK008292	1.8	0	0	0	100	76	7.6	5.8	4.3	13.9	28.5	6.3	607
63	GBK008299	1.7	0	0	0	97.2	72.9	6.7	5.7	2.7	11.3	26.5	5.7	1224
64	KACIMMI 77	2.0	0	0	0	89.2	67.3	7	6.4	10.3	14.7	28.8	8.2	1529
65	GBK029199	2.3	0	0	0	102.3	76.2	7.7	5.4	12	11.7	26.5	6	807
66	GBK029678	1.8	0	0	0	91.7	73.5	6.1	6.3	15	11.1	26.6	5.7	853
67	GBK029715	2.0	0	0	0	99.7	80.5	8.7	7.1	26.2	14.6	25	5.8	1478.7
68	GBK029722	1.7	0	0	0	97.3	79	7.5	5.5	18.3	15.4	28.2	5.2	1722
69	GBK029724	2.2	0	0	0	105.5	74.5	6.3	4.6	12.3	12.4	20	5.5	661
70	GBK003821	1.5	0	0	0	92.3	73.5	9.5	9.9	15.1	14.2	25.5	6.3	1444

Entry no	Genotype	1	2	3	4	5	6	7	8	9	10	11	12	13
71	GBK040568	2.4	0	0	0	92	63	5.3	5.1	7.8	11.9	28.3	5.3	1552
72	GBK000409	2.0	0	0	0	91.2	59.8	6.1	4.2	12.8	8.1	24	5.5	1056
73	GBK000449	2.0	0	0	0	92.2	71	7.4	7.5	7.2	13.4	27	5.0	867
74	GBK000462	2.0	0	0	0	95.6	61.6	6.1	5.4	10.2	11.8	28.4	5.8	916
75	GBK000493	1.7	0	0	0	89.7	75.8	4.4	4.4	4.8	16.9	25.6	4.7	1046
76	GBK000568	2.0	0	0	0	97.8	65.7	6.9	5.7	18.3	12.2	25.8	5.3	1016.6
77	GBK011082	2.3	0	0	0	102.2	72.5	6.5	5.5	6.3	10.9	22.5	5.5	756
78	GBK011113	1.8	0	0	0	100	78.2	6.3	5.7	1.5	12.5	27.8	5.5	891
79	GBK011126	2.0	0	0	0	94.2	69.2	7.1	7.6	7.3	12.3	24.6	5.2	1112.9
80	GBK029744	2.4	0	0	0	97.5	67.5	6.8	5.4	26.5	12.2	16.7	5.0	799
81	GBK029798	1.2	0	0	0	92	74.1	7.7	6.9	11	11.2	27	5.5	1535
82	GBK029820	1.5	0	0	0	99.2	73.3	7.2	5.4	7.7	14.8	22.5	5.3	1050
83	GBK033414	2.2	0	0	0	95.5	76.7	10.1	6.6	4.7	14.1	20.2	4.7	812
84	GBK033416	3.0	0	0	0	94	64.2	7.5	6.3	6.8	11.4	22.2	5.3	558
85	GBK039217	2.6	0	0	0	104.5	62.5	7.4	5.1	19.2	9.8	27	5.7	934
86	GBK043268	1.8	0	0	0	82.8	75.9	6.6	6.7	19	3.7	25.3	5.3	950.9
87	GBK000369	1.8	0	0	0	82.2	69.5	6.8	4.9	35.8	12.1	19.5	5.3	405
88	UFM 138	1.8	0	0	0	97.3	63.5	6.0	5	1.3	13.3	28.2	5.2	1075
89	GBK000482	2.4	0	0	0	98.2	64.3	6.5	4.9	17	10.5	23.2	5	556
90	GBK000909	1.7	0	0	0	98.7	82.2	7.7	4.9	10.8	14.2	27.5	5.5	1498
91	GBK008348	1.5	0	0	0	88.5	73.1	5.6	5.4	17	10.6	29.2	5	1552.2
92	GBK033446	1.8	0	0	0	101	72.7	7.1	4.4	3.6	13.5	29.8	5.5	885
93	U-15XP283	1.8	0	0	0	88.8	62.2	7.4	6.8	4.3	13.3	28.2	5.2	1181.4
94	GBK000784	2.2	0	0	0	91.8	66	5.9	5.2	1.3	10.8	23.5	5.5	1140.7
95	GBK000831	2.3	0	0	0	101.8	64.2	5.3	5.4	5.7	12.5	25.5	6.0	897
96	GBK026992	2.2	0	0	0	94.6	62.4	6.1	5	21.4	12.3	13.4	5.2	269.4
97	GBK000900	2.0	0	0	0	100.7	76.8	7.3	6.2	4.8	13.3	22.2	5.3	799
98	GBK000549	2.0	0	0	0	101.8	70.7	6.8	4.7	18	12.7	25.3	5.5	737.9
99	GBK029807	2.2	0	0	0	96.4	85.7	7.4	5.8	1.4	13.7	19.6	6.2	898.9
100	GBK000520	2.0	0	0	0	92.8	56.3	5.7	5.2	1.3	12.3	27.3	5.5	1070

Key: 1= Seedling vigor 2= Mean striga count at vegetative stage 3= Mean Striga count at 50% flowering 4= Mean Striga count at crop maturity 5= Mean days to 50% crop flowering 6= Mean plant height 7= Ear length 8= Ear width 9= Lodging percentage 10= Ear exertion 11= Stand count 12= Number of fingers 13= Mean Yield in kgha^{-1}

Table 4. ANOVA tables for all the parameters studied on the field under Striga inoculated

Parameter	Source	DF	SS	MS	F-value	P>F	Significance
Seedling vigor	Rep.	2	12.15	6.07	9.98	<.001	**
	Striga	1	3.14	3.14	5.17	0.023	Ns
	Rep*striga	2	4.75	2.37	3.19	0.021	Ns
	Entry No.	99	104.4	1.05	1.73	<.001	**
	Striga*Ent.No.	99	46.82	0.50	0.83	0.874	Ns
Striga count at vegetative stage	Rep	2	568.7	282.9	4.57	0.0197	**
	Striga	1	4745.5	4745.5	76.59	<.0001	**
	Rep*Stg	2	565.84	282.9	4.57	0.0107	Ns
	Entry No	99	6331.78	63.95	1.03	.4013	Ns
	Stg*entNo	99	6122.74	65.83	1.06	.3319	Ns
Striga count at 50%Flowering	Rep	2	2763.2	1158.2	5.20	0.002	**
	Striga	1	33307.4	33307.4	149.45	0.0021	**
	Rep*Stg	2	2763.23	1381.6	620	.0021	**
	Entry No	99	22947.2	231.8	1.04	.3820	Ns
	Stg*entNo	99	21493.3	231.1	1.04	.3913	Ns
Striga count at maturity	Rep	2	45119.02	22559.51	13.79	<.0001	**
	Striga	1	148754.6	148754.6	90.92	<.0001	**
	Rep*Striga	2	45119.02	22559.51	13.79	<.0001	**
	Entry No	99	171500	1732.32	1.06	.3356	Ns
	Stg*entNo	99	171500	1732.32	1.06	.3356	Ns
Days to 50%Flowering	Rep	2	603.84	301.91	2.88	0.0566	Ns
	Striga	1	6078.31	6078.31	58.01	<.0001	**
	Rep*Striga	2	260.39	130.19	1.24	0.2892	Ns
	Entry No	99	30463.98	307.71	2.94	<.0001	**
	Stg*entNo	99	9086.33	97.70	0.93	0.6572	Ns
Plant height	Rep	2	10377.91	5188.96	45.62	<0.0001	**
	Stg	1	41735.18	41735.19	366.94	<0.0001	**
	Rep*Striga	2	3319.52	1659.76	14.59	<0.0001	**
	Entry No	99	28496.11	287.84	2.53	<0.0001	**
	Stg*entNo	99	13497.74	145.14	1.28	0.0483	*

Parameter	Source	DF	SS	MS	F-value	P>F	Significance
Ear shape	Rep	2	8.387	4.19	6.84	0.0011	**
	Striga	1	0.105	0.10	0.17	0.6793	Ns
	Rep*Stg	2	0.747	0.37	0.61	0.5440	Ns
	Entry No	99	271.66	2.74	4.48	<.0001	**
	Stg*entNo	99	61.357	0.65	1.08	0.302	Ns
Ear length	Rep	2	95.48	47.74	47.2	<.0001	**
	Striga	1	496.26	496.26	490.65	<.0001	**
	Rep*Stgct	2	40.36	20.18	19.95	<.0001	**
	Entry No	99	1009.91	10.20	10.09	<.0001	**
	Stg*entNo	99	83.33	0.90	0.89	0.7664	Ns
Ear width	Rep	2	23.18	11.59	2.1	0.1231	Ns
	Striga	1	2166.60	2166.60	392.65	<.0001	**
	Rep*Stgct	2	40.21	20.10	3.64	.0266	*
	Entry No	99	393.46	3.97	0.72	.9795	Ns
	Stg*entryNo	99	297.03	3.19	0.58	.9994	Ns
Lodging %	Rep	2	8641.82	4320.91	19.07	<.0001	**
	Striga	1	9.53	9.53	0.04	.8375	Ns
	Rep*Stgct	2	3164.78	1582.39	6.99	.0010	**
	Entry No	99	50891.6	514.06	2.27	<.0001	**
	Stg*entNo	99	24465.8	263.07	1.16	.01532	Ns
Ear exertion	Rep	2	114.52	57.26	13.51	<.0001	**
	Striga	1	713.33	713.33	168.33	<.0001	**
	Rep*Stgct	2	122.29	61.14	14.43	<.0001	**
	Entry No	99	2122.91	21.44	5.06	<.0001	**
	Stg*entNo	99	450.16	4.84	1.14	0.1808	Ns
Standcount	Rep	2	2734.43	1367.21	10.7	<.0001	**
	Striga	1	15.03	15.03	0.12	0.7316	Ns
	Rep*Stgct	2	756.59	378.29	2.96	.0523	*
	Entry No	99	32271.6	325.97	2.55	<.0001	**
	Stg*entNo	99	7009.24	75.37	0.59	0.9991	Ns
Number of fingers	Rep	2	25.22	12.61	7.23	.0008	**
	Striga count	1	1.06	1.06	0.61	.4353	Ns

Parameter	Source	DF	SS	MS	F-value	P>F	Significance
	Rep*Stgct	2	26.23	13.12	7.52	.0006	**
	Entry No	99	198.16	2.00	1.15	.1673	Ns
	Stg*entNo	99	182.48	1.96	1.12	.2092	Ns
Yield kgha^{-1}	Rep	2	25613766.0	12806883	30.59	<.0001	**
	Stgct	1	33959188.5	33959189	81.12	<.0001	**
	Rep*Stgct	2	13600848.1	6800424	16.24	<.0001	**
	Entry No	99	100543950.8	1015596	2.43	<.0001	**
	Stg*entNo	99	25206559.8	265332.2	0.63	.9971	Ns

Key: DF = degree of freedom, SS = sum of squares, MS = Mean squares, Vgr = vigour, stg veg = Striga count at vegetative, Stgct=Striga count,=significant at P ≤ 0.05, **=highly significant at p ≤ 0.01, ns=not significant.*

Table 5. Statistical summary for the means of parameters from *Striga* inoculated and un-inoculated finger millet genotypes

Variable	*Striga* inoculated mean	*Striga* un-inoculated
Seedling vigour	2.13^{ns}	1.97
Striga count at vegetative	5.27 **	0
Striga count at 50% flowering	13.80**	0
Days to 50% flowering	88.80**	93.47
Plant height	53.64**	68.72
Ear shape	2.30^{ns}	2.28
Lodging %	12.74^{ns}	11.76
Ear exertion	11.08**	12.97
Stand count	23.76^{ns}	24.43
Ear length	5.67**	7.32
Ear width	2.47**	5.99
Number of fingers	5.22^{ns}	5.37
Striga count at maturity	25.75**	0
Yield in kg ha^{-1}	609.94**	1074.4

The mean *Striga* count at 50% crop flowering in the inoculated plots was 13.80 giving a high significance difference at P ≤ 0.05 (Table 5). Nine genotypes were immune to *Striga,* having mean *Striga* count of 0 while the genotype with the highest mean *Striga* count at this stage was I.E 4816 (Table 2). The I.E 4816 genotype was the only one that showed high mean significance difference among the one hundred that were screened in the field for *Striga* resistance. At this stage those that showed immunity to *Striga* included; I.E 4497, I.E 6165, I.E 2957, I.E 2440, I.E 4795, PR 202, I.E 2217, GBK 043081 and GBK000463 (Table 2).

The mean *Striga* count at crop maturity among the inoculated genotypes was 25.75 (Table 5). The *Striga* count for mean obtained as per respective genotypes ranged from 0 to 69.2 (Table 2). The genotypes that had highest mean *Striga* at maturity were the checks which included; GBK000900, GBK027300, GBK011113, GBK029744, GBK029715, GBK008292, GBK000369 and GBK000549 (Table 2). The mean of 69.2 was obtained for genotype I.E 5306. The genotypes that were immune /or had lowest mean *Striga* count at 50% flowering displayed the same characteristic at crop maturity (Table 2).

The first genotype to flower was GBK036821 in 53 days (Table 2) and it was also a high yielding variety. None among the highly resistant and highly susceptible genotypes were in the early maturing bracket. The mean for days to 50% flowering in the *Striga* free plots was 93.5 days while the *Striga* inoculated plots was 88.8 days (Table 5). Thus the finger millet in the plots inoculated with *Striga* matured earlier compared to the *Striga* free plots. The days to 50% flowering ranged from 53 to 101. Thus there was a high significant difference between the *Striga* inoculated plots of finger millet and *Striga* free plots at P ≤ 0.05 (Table 5).

The mean height among *Striga* inoculated plants was 53.64 cm while for the *Striga* free plants was 68.72 cm (Table 5). The plots of finger millet that were inoculated with *Striga* had significantly shorter height compared to *Striga* free plots (P ≤ 0.05). Among the high yielding variety was GBK 036821 which was also resistant to *Striga* and it had no effect on its growth.

The mean of ear shape for *Striga* free plots was 2.30 while the *Striga* inoculated plots was 2.28 (Table 5), an implication of no significance difference between the two treatments. The mean of ear length for *Striga* free plots was 7.32 cm while the *Striga* inoculated plots had mean of 5.67 cm (Table 5). The results confirms high significant difference at between the *Striga* inoculated plots and the *Striga* free plots. The mean ear length in respective genotypes ranged from 4 cm to 9.05 cm (Table 2). Among the top resistant genotypes, KACIMMI 47 had the highest ear length of 8.4 cm. Among the least resistant genotypes, GBK 029715 had longest ear of8.12 cm. Of the top resistant genotypes with least ear length were I.E 2440 and GBK 029661 (Table 2).

The *Striga* free plots had a mean ear width of 5.99 cm while the *Striga* inoculated plot had 2.47 cm a measure of high mean significant difference at P ≤ 0.05 (Table 5). The mean ear width of respective genotypes ranged from 1.5 to 6.82 cm for *Striga* inoculated plots (Table 2). Among the resistant genotypes, KACIMMI 47 too had highest ear width. In the susceptible genotypes, GBK 008292 had highest ear width (Table 2).

Lodging percentage does not show mean significance difference between the *Striga* inoculated plots and the *Striga* free plots an indication that *Striga* has no effect on lodging in finger millet (Tables 4 and 5). The genotype with lowest lodging percentage in the resistant category was I.E 2217. The mean lodging percentage ranged from 0 to 43 (Table 2). None of the resistant genotypes was in the highly lodged accessions of finger millets. The highly susceptible genotypes to *Striga* and which was also highly lodged was GBK 000369.

Ear exertion showed a significant difference between the *Striga* inoculated and the *Striga* free plots of finger millet (Table 5). The ear exertion mean for *Striga* free plots was 12.97cm while the *Striga* inoculated plots was 11.08cm (Table 5). The mean ear exertion ranged from 7.5 cm to 16 cm (Table 2). In the resistant genotypes of finger millet KACIMMI 36 had the highest ear exertion value of 14.1cm (Table 2).

The mean stand count for *Striga* free plots was 24.43 while for *Striga* inoculated plots was 23.76 (Table 5), indicating lack of significance difference (P ≤ 0.05). The highest mean stand count was exhibited by KACIMMI 17 which had mean of 31.58 plants. Only genotype I.E 4115 among the resistant genotypes had high stand count.

The mean on number of fingers for *Striga* free plots was 5.37 cm while for *Striga* inoculated plots was 5.22 cm (Table 5), implying lack of mean significance difference ($P < 0.05$). The mean number of fingers in the genotypes ranged from 3.7 to 7 (Table 2). Among the resistant genotypes, I.E 4115 had the highest number of fingers while in the susceptible group was GBK 008292. The ones with least number of fingers in the resistant category were GBK 029661, I.E 2440 and KACIMMI 7. None among the highly susceptible genotypes had lowest number of fingers (Table 2).

The mean grain yield ranged from 35.5 kgha^{-1} to1573 kg ha^{-1} (Table 2). The mean grain yield for *Striga* free plots was 1074.4 kgha^{-1} and the *Striga* inoculated mean grain was 609.94 kgha^{-1} (Table 5) implying high significance difference ($P \leq 0.05$). The highest yielder was KACIMMI 47 which was also resistant to *Striga*. Genotypes GBK 029661 and I.E 2440 among the resistant category had a very low yield (Table 2). Among the low yielders in the susceptible group was GBK 000900. Some high yielders that were affected by *Striga* included GBK029722, GBK029793, KACIMMI 72, KACIMMI 22, KACIMMI 20, GBK 000802, KACIMMI 77 and KACIMMI 42 (Tables 2 and 3). Among the medium yielders that had high *Striga* count at maturity included GBK 027300 (Tables 2 and 3). The low yielders with high *Striga* count at maturity were; GBK 000900, GBK 011082, GBK 029744 and GBK 011113 (Tables 2 and 3).

4. CONCLUSIONS

1. The 100 genotypes of finger millet assessed using agronomic traits had various levels of response to *Striga* infestations:(i) The resistant genotypes immune to *Striga* infestation were; GBK029661, I.E 2217, I.E 6537, KACIMMI 7 and I.E 4491.(ii) Moderately resistant genotypes with a limited level of infestation included; KACIMMI 30,KACIMMI 36, KACIMMI 47 KACIMMI 73, BUSIBWABO-1, OMUGA-G, GBK029793, GBK000516. (iii) Genotypes susceptible to *Striga* menace included; I.E 5306, GBK000900, GBK027300, GBK029744 and GBK000462.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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