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EFFECT OF DIFFERENT LEVELS OF *STRIGA GESNERIOIDES* ON THE GROWTH AND YIELD OF SOME LOCAL AND IMPROVED COWPEA (*Vigna unguiculata* (L) Walp) VARIETIES

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ABSTRACT
Experiment was carried out at International Institute for Tropical Agriculture (IITA), Kano, Nigeria. The aim of the study was to evaluate the effect of different levels of Striga infestation on the growth and yield of some varieties of cowpea. Four cowpea genotypes were selected for the study. The experiment was laid out in randomized complete block design with two treatment regimes of Striga infestation. The levels of Striga infestation include 0.05g, 0.1g and 0.0g (control). The results showed that IT97K-499-35 recorded higher plant height at 0.5g and 0.1g of Striga infestation, but DANILA showed lower plant height at 0.1g of Striga infestation. The result for chlorophyll content (SPAD) indicates that at 30 days after Striga infestation, IT99K-241-2 recorded higher chlorophyll SPAD value of 39.2. But IT97K-499-35 had lower chlorophyll SPAD value of 16.3. Higher number of days to 50% flowering was recorded in IT99K-241-2 across the treatment. IT98K-205-8 recorded early days to 50% flowering across the treatment. IT99K-241-2 and DANILA recorded Striga emergence and attachment to their roots. But IT97K-499-35 and IT98K-205-8 had no Striga attachment and emerged. Higher grain yield was recorded in IT97K-499-35, but IT99K-241-2 and DANILA recorded lower grain yield. Higher Fodder yield was recorded in DANILA. The result indicates that fodder yield was reduced in 0.5g and 0.1g of Striga infestation in all the varieties. The present study conclude that varieties IT99K-241-2 and DAN'ILA were susceptible to Striga at 0.1g of infestation, while IT97K-499-35 was tolerant to Striga at 0.5 and 0.1g of Striga infestation.
Keyword: Striga gesnerioides, Cowpea, growth and Yield

INTRODUCTION

Striga gesnerioides is an obligate root-parasitic flowering plants that belong to the family Scrophulariaceae that affect cowpea productions in dry savana (Omoigui *et al*., 2007). The productivity of cowpea in dry region is hampered by low yield due to constraints , which include insects pest, disease, drought, low soil fertility and temperature extremes. But among the most serious yield reducing factors in cowpea production are the parasitic weeds such as *Striga gesnerioides* (Singh 1997).

Striga is one of the very few flowering plants that are parasitic on other plants, *dodder* and *mistle toe* being other examples. *Striga* has been given the common name of *"witchweed"* because of the various debilitating effects inflicted upon its host in addition to attaching to the roots and robbing the host of water and nutrients.

Crop yield losses as a result of *Striga* infestation may be up to 70% depending on the severity of the damage (Aggarwal and Ouedraogo, 1989). *Striga* infestation is most severe in low moisture; low fertility soils and thousands of its seeds can remain dormant but viable for so many years. Working with cowpea Kamara *et al*. (2005) reported that in susceptible cultivars, the yield losses may be up to 100% when the population of *Striga* was over 10/pant. Some of the practical control methods consist of a combination of crop rotation with non-hosts, weeding/sanitation. Others reported the use of chemical control and resistance varieties (Berner *et al*., 1995) Once *Striga* becomes established in the field, eradication is very difficult. Therfore, the aim of the present study was to evaluate the effect of different levels of *Striga* infestation on the growth and yield of local and improved varieties of cowpea. .

MATERIALS AND METHODS

Experiment was carried out in the screenhouse at International Institute for Tropical Agriculture (IITA) Kano station,(Latitude 12^0'03'N and Long. $08^{0'}$32 E). Four cowpea varieties exhibiting a wide range of variability were used. The experiment was conducted in pots, thirty-six (36) pots of average diameter with perforations at the bottom were used.

The pots were filled with sterilized top soil. Experiment was laid out in randomized complete block design. The experimental treatments include two (2) *Striga* levels of infestation i.e 0.05g 0.1g and a control (0.0g) arranged in three replications.*Striga* infestation was done according to the procedure outlined by IITA(1997). Three seeds were planted at a distance of 2cm and plants were thinned to two plants per pot. Data were collected on plant height, chlorophyll content (SPAD), *Striga* emergance and grain yield. The data were subjected to analysis of variance and means were separated using least significant difference (LSD) at 5% probability.

RESULTS AND DISCUSSION

The result for plant height are presented in Fig. 1, the result showed that IT99K-241-2 recorded higher plant height at 0.5g and 0.1g when compared with that of control (0g). This is followed by DAN'ILA that recorded higher plant hieght at 0.05g of *Striga* infestation.Variety IT98K-205-8 recorded lower plant height at 0.05g and 0.1g respectively.

At 19 days after Striga infestation, the result of the statistical analysis showed that there is significant difference ($P<0.05$) at chlorophyll SPAD content and genotype by treatment interaction, but there is no significant difference ($P>0.05$) at genotype and treatment (Table 1b and 1c).

The chlorophyll content (SPAD) at 19days after *Striga* infestation showed that lower mean values were recorded in 0.1g with mean of 30.1, while higher mean SPAD value of 42.5 was recorded under 0.5g.

At 30 days after *Striga* infestation, the result of statistical analysis indicate that there is no significant difference ($P>0.05$) at genotype, treatment and genotype by treatment interaction. At 30 days after Striga infestation, genotype IT97K-499-35 recorded lower chlorophyll content with SPAD value of 16.3. But IT99K-241-2 had higher SPAD value of 39.2 under the same infestation level. (Table 1a).

The chlorophyll content was observed to differ significantly as the non-infested plants having higher chlorophyll content than the infested plants with the resistant varieties (IT97K-499-5 and IT98K-205-8) having a higher chlorophyll content than the tolerant with the least observed in the susceptible line (IT99K-241-2). This reduction in chlorophyll content could be due to reduction in leaf area in the infested lines (Aggarwal and Ouedrago, 1989).

The SPAD values at 30 Days after *Striga* infestation were observed to be lower than at 19days, this may be due yellowish and drying of the leaves a disease called chlorosis which is caused by *Striga* infestation.

The statistical analysis for days to 50% to flowering indicate that there is highly significant difference at genotypes ($P<0.001$), but there is no significant difference at treatment and genotype by treatment interaction (Table 2b). Days to 50% flowering and days to maturity are presented in Table 2a andb. The result showed that variety IT98K-205-8 recorded early days to flowering across the treatment. Higher number of days to 50% flowering was recorded in IT99K-241-2 across the treatment (Table 2a).

The result of the statistical analysis for number of days to maturity showed that there is highly significant difference at genotypes ($P<0.001$), but no signifcant difference was observed at treatment and genotype by treatment interaction (Table 2b). The result indicate that variety IT97K-499-35 at 0.1g of *Striga* infestation recorded lower number of days to maturity (58.0d), this is followed by IT98K-205-8 (81.0d). Variety IT99K-241-2 had higher number of days to maturity across the treatment (Table2a).

The result of statistical anlysis showed that there is highly significant difference in genotype, treatment and genotype by treatment interaction ($P<0.001$) in Days to *Striga* emergence, Number of *Striga* emerged and Number of *Striga* attached Table 3b).

Number of *Striga* emerged and attached at different levels of *Striga* infestation are presented in Table 3a. The results showed that higher number of days to *Striga* emergence was recorded in IT99K-241-2 (24.67d) followed by DAN'ILA (20.33d) at 0.1g of *Striga* infestation. At 0.05g of *Striga* infestation, DAN'ILA had the higher number of days to *Striga* emergence (29d) followed by IT99K-214-1 (19d). Variety IT97K-499-35 and IT98K-205-8 had no Striga emergence and attachment in their roots at all the levels of Striga infestation. Higher number of *Striga* emerged were recorded at 0.1g of *Striga* infestation with IT99K-241-2 recording 7.67 number of *Striga* and DAN'ILA with 5.33.

The result from the present study **s**hows that there are major differences in cowpea varieties for their reactions to *Striga,* both in terms *Striga* emergence/attachment per plant as observed by Emechebe *et al,* (1991). Effect of *Striga* at initially was characterized by its emergence while underground symptoms were evident by the presence of *Striga* attachment after root washing in susceptible and tolerant varieties. Based on this, the varieties were classified as tolerant or susceptible to *Striga* (Lane *et. al.,* 1991).

According to the present study, appreciable numbers of *Striga* were emerged and attached in DAN'ILA and IT99K-241-2. There was neither emergence nor attachment of *Striga* in IT97K-499-35 and IT98K-205-8. These indicate that these genotypes may be completely *Striga* resistant. The emergence of *Striga* seedlings on susceptible plants begins at 19 days after sowing (DAS) and differences between tolerant and susceptible plants were much significant at 35DAS.

There were slight differences in plant heights at flowering and at maturity both in infested and non-infested cowpea varieties. DAN'ILA which is a late maturing variety and flower very late as against its counterpart has the highest plant height; this may be due to its photosensitive (Patel and Hall, 1990).

The result of statistical analysis for yield component showed that there is significant difference in the treatment (P<0.05) but no significant difference were observed in the genotype and genotype by treatment interaction in the pod weight and pod number. Significant difference was observed in the treatment and genotype by treatment interaction (P<0.05) in Seed weight, but in the number of seed significant difference was observed only in the treatment (P<0.05). The results indicate that IT98K-205-8 recorded higher Pod weight (4.04g/plant) at 0.05g of *Striga* infestation. IT97K-499-35 recorded higher Pod weight (3.29g/plant) at 0.1g of *Striga* infestation. Lowest Pod weight was recorded by IT99K-241-2 (Table 5a). Higher numberof Pods were observed in genotypes IT97K-499-35, IT98K-205-8 and IT99K-241-2 at 0.05g of *Striga* infestation. higher Seed weight and Seed Number were recorded in genotypes IT97K-499-35, IT98K-205-8 and IT99K-241-2 at 0.05g of *Striga* infestation. The yield components were observed to reduce significantly at 0.1g of *Striga* infestation. Reduction in the yield component may be due to reduced chlorophyll content leading to leaf wilting and chlorosis followed by exudation of nutrient by the *Striga* reactions. Among the reaction groups to *Striga* (resistant, tolerant and susceptible), yield loses ranged from as low as 5% in the resistant and tolerant groups to as high as 95% in susceptible group (Obilana, 1983). Yield losses associated with *Striga* damage could be as high as 100% also grain yield reduction per plant can be as high as 30% relative to the number of *striga* per unit area (Patel and Hall, 1990).

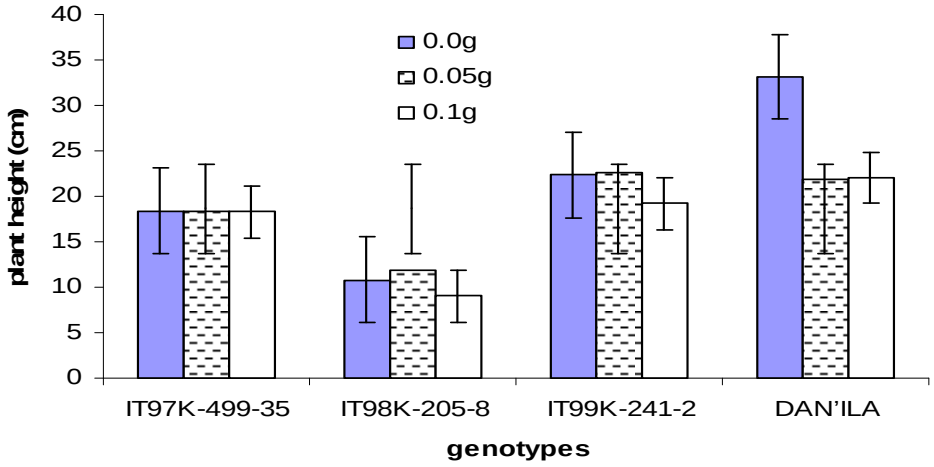

Figure 1 Effect of different *Striga* levels of infestation on the plant height of cowpea, vertical bar represent ± of standard error with three replications

Table 1a: Mean data for chlorophyll content from SPAD meter reading of four cowpea varieties grown under different levels of *Striga* infestation.

		Days after *Striga* infestation					
			19			30	
S/N	genotype	0.0g	0.05g	0.1g	0.0g	0.05g	0.1g
1	IT97K-499-35	50.2±2.52	45.6±0.833	11.1±3.19	34.2±1.66	27.4±3.26	16.3±4.71
2	IT98K-205-8	18.8±2.72	46.1±2.42	27.0±4.1	36.3±0.14	45.0±0.50	23.4±3.75
3	IT99K-241-2	44.3±1.19	40.8±0.72	47.8±0.75	37.0±0.81	34.7±1.20	39.2±0.45
4	DAN'ILA	37.1±0.13	37.5±1.05	34.6±	33.4±0.81	38.0±0.30	35.1±0.70
	Mean	37.6	42.5	30.1	35.2	36.3	28.5
	l.s.d.	25.56	17.37	27.2	12.87	19.58	34.06
		df	MS(19D)	MS(20D)			
	G	3	287.16NS	233.46NS			
	T	2	467.95NS	212.40NS			
	G*T	2	3079.20**	139.28NS			

Lsd: Least significant difference**;** ± Standard error, ** significant at p<0.001, MS; mean Square, G; genotype, T; treatment. G*T; genotype by treatment interaction

Table 1b: effect of genotype and levels of *Striga* on the chlorophyll content at 19 and 20 days after *Striga* infestation.

	days after *Striga* infestation	
genotype	19D	20D
IT99K-241-2	44.27aa	36.95aa
DAN'ILA	36.40ab	35.48aa
IT99K-499-35	35.63ab	25.96aa
IT98K-205-8	30.61bb	34.96aa
Lsd	12.31	12.33
treatment		
0.5g	42.50aa	36.26aa
0	37.59ab	35.20aa
1.0g	30.10bb	28.50aa
Lsd	10.66	10.68

Means followed by same letter(s) are not significantly different at 5% level of significance

Table 2a: Mean data for days to 50% flowering and days to maturity of four cowpea varieties grown under different level of *Striga* infestation

		days to 50% flowering			days to maturity		
S/N	GENOTYPE	0.0g	0.05g	0.1g	0.0g	0.05g	0.1g
1	IT97K-499-35	61.0±0.57	53.0±1.45	51.3±2.58	78.7±0.78	86.0±0.0	58.0±7.50
2	IT98K-205-8	54.0±1.36	49.0±0.83	47.0±1.74	81.0±0.86	79.3±1.34	81.0±0.86
3	IT99K-241-2	77.3±0.53	78.7±1.33	86.3±0.50	101.3±0.53	99.0±0.28	101.7±0.53
4	DAN'ILA	71.01±1.60	74.0±1.20	81.0±0.60	93.7±1.93	100.3±0.38	98.7±0.25
	Mean	65.8	63.7	66.4	88.7	91.2	84.8
	Ls.d (5%)	12.44	16.35	21.46	15.96	8.4	46.7
		df	MS(DTF)	MS(DTM)			
	G	3	30.62**	7.30**			
	T	2	0.38NS	0.60NS			
	G*T	2	1.22NS	0.90NS			

Lsd: Least significant difference**;** ± Standard error, ** significant at p<0.001, MS; mean Square, G; genotype, T; treatment. G*T; genotype by treatment interaction

Table 2b: Effect of genotype and levels of *Striga* on Days to 50% flowering and Days to maturity.

Variety	DT50%F	Variety	DTM
IT99K-241-2	80.77aa	IT99K-241-2	100.66aa
DAN'ILA	75.33ab	DAN'ILA	97.55a
IT97K-499-35	55.11bb	IT98K-205-8	80.44bb
IT98K-205-8	50.00b	IT97K-499-35	74.22b
lsd	7.8		13.58
treatment			
0	65.83aa		88.66aa
0.5g	63.66aa		91.16aa
1g	66.41aa		84.83aa
Lsd	6.75		11.76

Means followed by same letter(s) are not significantly different at 5% level of significance.

Table 3a: Mean data for number of emerged and attached *striga* of Four cowpea varieties grown under different *striga* infestation levels.

		NDSE			NSE			NSA	
S/N	genotype	0	0.05g	0.1g	0	0.05g	0.1g	0	0.05g	0.1g
	IT97K-499-35	0.00±	0±	0.00±	0.00±	0.00±	0.00±	0.00±	0.00±	0.00±
1		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	IT98K-205-8	0.00±	0±		0.00±	0.00±	0.00±	0.00±	0.00±	0.00±
2		0.00	0.00	0±0.00	0.00	0.00	0.00	0.00	0.00	0.00
	IT99K-241-2	0.00±	19±	24.67±		3.33±	7.67±	0.00±	3.33±	6.0±
3		0.00	0.33	0.33	0.000.00	0.09	0.41	0.00	0.09	0.16
	DAN'ILA	0.0±	29±	20.33±	0.00±	2.67±	5.33±	0.00±	2.33±	3.66±
4		0.00	0.71	0.08	0.00	0.09	0.34	0.00	0.09	0.09
	Mean	0	12	11.25	0	1.5	3.25	0	1.41	2.41
	l.s.d	0	5.25	7.36	0	1.59	3.19	0	0.88	1.15

Lsd: Least significant difference**;** ± Standard error, NDSE; number of days to *Striga* emergence., NSE; number of *Striga* emerged., NSA; number of *Striga* attached

Table 3b: Effect of genotype and treatment on the Days to *Striga* emergance, Number of *Striga* emerged and Number of *Striga* attached.

Variety	DTSE	variety	NSE	variety	NSA
DAN'ILA	16.44aa	IT99K-241-1	3.66aa	IT99K--241-2	3.11a
IT99K--241-2	14.55a	DANILA	2.66a	DAN'ILA	2.00b
IT97K-499-35	0.00b	IT97K-499-35	0.00b	IT97K-499-35	0.00c
IT98K-205-8	0.00b	IT98K-205-8	0.00b	IT98K-205-8	0.00c
lsd	2.44		1.02		0.397
treament				treament	
0	0.00aa		0.00c	0	0.00c
0.5	12.00ab		1.50b	0.5	1.41b
1.0g	11.25a		3.25a	1.0g	2.41a
lsd	2.11		0.88	lsd	0.344

Means followed by same letter(s) are not significantly different at 5% level of significance

Table 4a: Pod weight (g/plant), pod number, seed weight (g/plant) and seed number of some varieties of cowpea at different levels of *Striga* infestation

	PdW			PN				SW			SN	
genotype	0.0g	0.05g	0.1g	0.0g	0.05g	0.1g	0.0g	0.05g	0.1g	0.0g	0.05g	0.1g
IT97K-499-35	3.69±0.1	2.86±0.3	3.29±0.2	5.00±0.6	4.33±0.4	4.67±0.3	2.58±0.1	2.53±0.2	2.68±0.1	25.30±0.6	18±1.8	22.3±2.1
IT98K-205-8	1.62±0.1	4.04±0.3	2.14±0.1	3.00±0.3	4.67±0.4	3.0±0.6	1.18±0.1	3.21±0.3	1.61±0.1	12.70±1.0	25±2.0	11±0.9
IT99K-241-2	4.56±0.2	3.42±0.4	1.05±0.2	6.00±0.3	3.67±0.6	1.33±0.2	3.16±0.2	2.17±0.3	0.30±0.1	27.30±1.1	16.7±2.8	1.7±0.5
DAN'ILA	5.47±0.1	3.49±0.1	2.66±0.04	7.33±0.3	4.67±0.5	3.00±0.2	3.56±0.1	2.38±0.1	1.71±0.1	36.00±1.3	18.00±2.5	9.70±0.3
Mean	3.83	3.45	2.29	5.33	4.33	3	2.62	2.57	1.58	25.3	19.4	11.2
l.s.d	1.67	2.93	2.09	3.1	3.64	3.03	1.56	1.77	1.14	9.33	NS	14.9

Lsd: Least significant difference**;** ± Standard error.,Pdw; Pod weight., PN; pod number., SW;seed weight., SN; Seed number

Table 4b: Effect of genotype and levels of Striga on the Pod weight (g), Pod number, seed weight (g) and seed number

genotype	pdw	pdn	sdw	sdn
DAN'ILA	3.87aa	5.00aa	2.55aa	21.22aa
IT97K-499-35	3.28aa	4.66aa	2.59aa	21..88aa
IT99K--241-2	3.00aa	3.66aa	1.87aa	15.22aa
IT98K-205-8	2.60aa	3.55aa	1.99aa	16.22aa
lsd	1.37	2.07	1.01	9.55
treatment				
0	3..83aa	5.33aa	2.62aa	25.33aa
0.5	3.45ab	4.33ba	2.57a	19.41ab
1.0g	2.28bb	3.00bb	1.57b	11.16bb
lsd	1.19	1.72	0.87	8.27

Means followed by same letter(s) are not significantly different at 5% level of significance

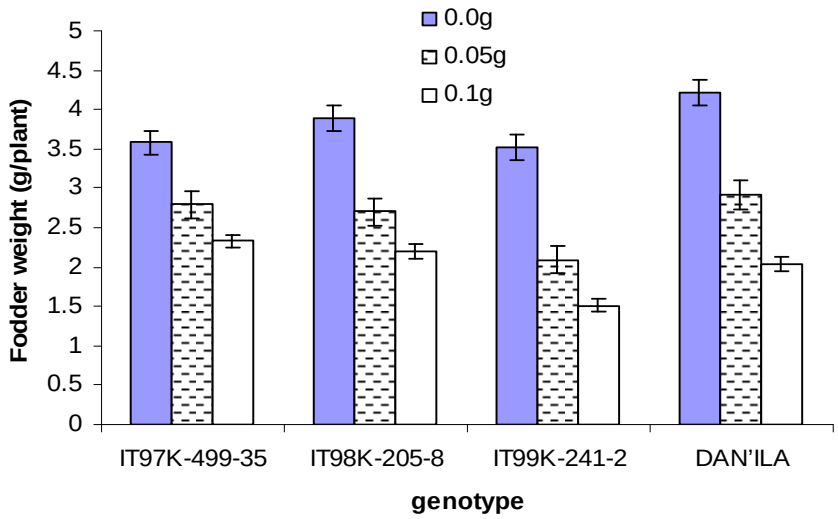

Figure 2: Fodder yield of cowpea genotypes at different levels of *Striga* infestation

CONCLUSION

The findings of this study show that an increase in the level of *striga* infestation significantly reduces the yield in the susceptible cowpea varieties. The *Striga gesnerioides* was found to highly infest the late maturing and local variety of cowpea compared with the improved variety (IT97K-499-5 and IT98K-205-8).

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