Standard Research Journal of Agricultural Sciences Vol 2 (3): 033 - 039, March 2014 **(ISSN: 2311-2751)**
http://www.standresjournals.org/journals/SRJAS

Research Article

Effect of *alectra vogelii* (benth) infestations on the growth of some genotypes of cowpea *(vigna unguiculata* (l.) walp)

***[1]Kutama AS, [2]Hayatu M, and [3]Umar S**

[1]Department of Biological Sciences, Federal University Dutse, Jigawa state, Nigeria
[2]Department of Plant Biology, Bayero University, PMB 3011, Kano Nigeria
[3]Department of Biological Sciences, College Of Arts and Sciences, Kano

*Corresponding author E- mail: kutamasak@yahoo.com; Tel: +2347067371893

Accepted 15 March 2013

Abstract

An experiment was conducted in the screenhouse of International Institute for Tropical Agriculture Kano state, Nigeria in 2012. The aim of the study was to evaluate the effect of *Alectra* infestations on the growth of some cowpea genotypes. The experiment comprised of three treatment regimes of Alectra infestations (0g, 0.05g and 1g) which are arranged in complete randomized block design with three replications. The results showed that plant height at different

Keywords: *Alectra vogelii*, cowpea infestation

INTRODUCTION

Cowpea (*Vigna unguiculata*(L.) Walp) is attacked by a parasitic plant *Alectra vogelii* (Benth) which belong to the family scrophuralariaceae (Kuijt ,1969). *Alectra vogelii* is presently predominant in Africa as reported by Musselman *et al*. (1991) and Parker and Riches (1993). The parasitic plant causes considerable damage to cowpea, with substantial yield reductions, especially in Africa (Emechebe *et al*., 1991; Lagoke *et al*., 1994). *Alectra vogelii* is becoming a serious threat in several countries in East and Southern Africa particularly Botswana, Kenya, Tanzania and Zimbabwe as reported by Riches (1989) and Singh *et al*, (1993) with more mono cropping under growing population pressure ,the *Alectra vogelii* infestation is becoming even more acute, particularly in areas with sandy soils, poor fertility and low rainfall. The plant parasites are rather difficult to control because it produce large amount of seeds, and the adaptation/dormancy mechanisms permit the seeds to stay alive in the soil for several years (Saunders1933; Kust, 1963).Therefore a combination of different control options, including host plant resistant, crop rotation, chemical/biological control, seed treatment and other phytosanitary practices, needs to be developed to achieve satisfactory and sustainable control of *Alectra*. *Alectra vogelli* (Benth) is an important weed of Sahel and savanna in Africa, it is a vigorous parasite on both groundnut and cowpea and is also able to parasitize on other legumes to be up to 100% (Riches, 1988).Reduces yield of (50-100%). Yellowing of host, drying and change in taste have been part of effect due to *Alectra* on Legumes.

Alectra vogelii is a hemi-parasite of the family Scropholariaceae or orobanceae that parasites a wide range of legumes in the West, East and South Africa. Although *Alectra* vogelii is less severe than that of *Striga* when infected in crops. Total yield loss is not uncommon in field heavily infested by this parasite when susceptible yield varieties are planted (Emechebe *et al*., 1983). Serious legumes including cowpea, Broad and velvet groundnut's (Riches, 1987; Lagoke *et al*., 1988) several cultivated lands have abandoned due to high infestations of these noxious parasitic weed (Lagoke *et al.,* 1988). Fields infested by the parasitic weed are difficult to clean, because of the large amount if seeds

produced and the dormancy mechanisms that enable it to stay in the soil for several years (Emechebe *et al*., 1983).Therefore, a combination of different control options including host plant resistance, crop rotation, chemical, mechanical e.t.c needs to be developed to achieve chemical satisfactory and sustainable control. The International Institute of Tropical Agriculture (IITA) is working closely with several national and regional programs, as well as with selected research stations in Europe and the USA to develop an integrated scheme for controlling these plants parasites and good progress is been made (Singh, 1994, Berner *et al.*, 1995). Cowpea is of considerable importance particularly in W/Africa as a nutritious legume crop, it is widely grown in the semi-arid zones of W/Africa, where *Alectra vogelli* (Benth.) is an important weed of Sahel and Savanna in Africa, and it affects the growth and development of cowpea which as a result leads to reduced yield. Destruction could be worse as resistance varieties of *Alectra vogelii* host offers the most sustainable and reliable control of *Alectra vogelii* infestation. As a result it is important to understand and find all the variety that could tolerate or be susceptible to the parasitic weed. The study was aimed at evaluating the effect of *Alectra vogelii* infestation on some genotypes of cowpea.

MATERIALS AND METHODS

An experiment was conducted at the screenhouse of the International Institute of Tropical Agriculture (IITA) Tarauni Kano Station. The area is located in the Sudan savanna ecological zone. The area lies between lat. $12^0$03N, long.$8^0$34E.The experiment was conducted in the period of 23th October, 2012 to 5th February, 2013. The cowpea genotypes used in the study were: B301, IT97K-499-35, TVU 10919 and TVU 10373. The experiment was arranged in Randomized complete block design (RCBD) with three treatment (0.00g, 1.00g, 0.05g) regime of *Alectra* infestation with three replications. Thirty six (36) plastic pots of 18.5cm in diameter and 17cm in height were used during the study. Sterilized Loamy soil was used to fill the pots.

Aletcra seeds were collected at tha IITA Kano, Each of the grams (1.00g and 005g) of the *Alectra vogelii* seeds were mixed with 5g of sand .The soil was used to fill the plastic pots up to the half of the pot, a scoop full of *Alectra vogelii* was sprinkled over the sand, then the dispersed mixture was covered with the remaining soil to fill the pot and then stirred in-order to ensure uniform *Alectra vogelii* infestation. Before planting the pots were watered for one (1) week so as to condition the *Alectra vogelii*

A hole was dug at the centre of each pot, and then three (3) seeds were planted per pot. Each pot was watered once in a day. Two weeks after the germination of the three (3) plants each pot was thinned to two plants per pot.

The data collected during the experimental period include; Plant height, Chlorophyll content, Days to first *Alectra vogelii* emergence, *Alectra vogelii* count, Number of *Alectra vogelii* attached, *Alectra vogelii*, root and plant Biomass. Statistical analysis was performed using GENSTAT and the data were subjected to two ways ANOVA (Analysis of variance).

RESULTS AND DISCUSSION

PLANT HEIGHT

Plant height the control values of TVU 10919 and IT97K-499-35 were observed to be a little higher than that of the infested ones (Figure 1). Results show that there is significant difference between the treatments at 0.05g *Alectra* infestations. B301 recorded the highest plant height while TVU10373 recorded the lowest reduction in plant height. The growth of TVU10919 at 0.05g *Alectra vogelii* infestation was faster, but after 7 weeks, most of the leaves turned to yellow while some to pale green. But B301 maintained it full growth and it leaves were in their normal size.

CHLOROPHYLL CONTENT

The effects of Alectra infestation on the chlorophyll SPAD content are presented in Table 1. The result showed that genotype TVU10373 had lower chlorophyll SPAD value at 1g of *Alectra* infestation at 21 and 63 days after infestation. But genotypes B301, IT97K-499-35 and TVU10919 recorded higher chlorophyll content at 21 and 63 days after *Alectra* infestation. The study revealed that there is a drop in the chlorophyll content (SPAD) among the genotypes with higher level of *Alectra* infestations. Reduced chlorophyll content could be due to competitive nature of the parasite to the host which is primarily due to nutrients absorption by the parasite that is attached to the roots of the host plant. Mugabe (1983) reports that reduction in chlorophyll content due to the effect of *Alectra vogelii* in susceptible variety of cowpea results in reduced leaves size and change in color to yellow or pale green.

Number of Alectra vogelii emerged and attached

The highest values of both the emergence and attachment of *Alectra vogelii* (Table 4 and 5) was recorded in TVU10373 in 0.05g and 1g Alectra treatment IT97-499-35 recorded the lowest Alectra vogelii emergence and attachment. There is no emergence or attachment in B301 variety of cowpea and the controls

Number of days to *Alectra vogelii* emergence

It is observed that the number of days to *Alectra vogelii* emergence varies In (Table 8) considerably with the level of infestation. The variety TVU10373 at 1g has the highest number days to *Alectra vogelii* emergence at 1g *Alectra* level of infestation followed by IT97k-499-35 and TVU10373 at 1g and 0.05g Alectra infestation respectively and TVU10919 with the lowest number of days to *Alectra* emergence.

PLANT BIOMASS

In terms of plant biomass, little difference was observed between the control and infested plant (Table 6).But the plant biomass of TVU10373 is most affected in infested ones and IT-97k-499-35 was recorded to have the highest plant biomass.

ROOT BIOMASS

The result of root biomass (Table 3) shows that IT97K-499-35 was recorded to have the highest root biomass and TVU10919 was recorded to have the lowest root biomass.

DISCUSION

TVU 10373 exhibited lower plant height, lower crop reaction to *Alectra* infection and thus highly susceptible to *Alectra vogelii* than TVU10919 and TVU97K-499-35. The durable and sustainable tolerance of *Alectra vogelii* in the cowpea varieties can be attributed to multiple genes which control various components of resistance (Berner *et al*., 1993).

There was slight variation in plant height in the infested plants of TVU10919, showing the effect of *Alectra vogelii* infestation .Even though plants of TVU10919 were less taller than that of the other susceptible varieties but this may be due to the photosensitive nature of some cowpea varieties at the time of planting where they were found to grow tall and flower late (Patel and Hall, 1990).

Infested plant of TVU10373 have the least chlorophyll content (Table 2) because the plants are highly susceptible to *Alectra vogelii* parasitism (Lagoke *et* al., 2003) and IT97K-499-35 have the highest chlorophyll content because it is a tolerant variety of cowpea .Tolerant variety of cowpea are not seriously affected by *Alectra vogelii* by hosting a few no of Alectra after emergence. (Emechebe *et* al.,1991).

Alectra vogelii do not have any effect on B301 because B301 is a resistant variety of cowpea (Singh and Emechebe 1990) and IT97-499-35 ,TVU10919, TVU10373

Plant biomass (Table 6) was found to be significantly lower in the infested plants of TVU10373 this is apparently due intensive *Alectra vogelii* infection thereby reducing the yield of the plants (Singh, 2004). But little difference was observed in the resistant varieties of both the infested and non-infested lines.

Infection was very high in TVU10919 (TABLE 7) due to effect of *Alectra vogelii* on roots causing reduction. *Alectra vogelii* causes infection by penetrating a root of its host by forming a haustorium (Visser, 1987).

TVU10919 has the lowest number of days to *Alectra* emergence because it is a highly susceptible variety, and shows early emergence to its host and may have high infection reduction when compared to other varieties of cowpea with late emergence. Early emergence of *Alectra vogelii* can cause up to 100% yield reduction (, 2008).

It was observed that the more the *Alectra vogelii* emerged and attached the more its effect on the plants of the susceptible lines: this might be attributed to the nature of parasitism of *Alectra vogelii* which is normally through the formation of haustorium 2-3 weeks after infection (Emechebe *et al*., 1991). This also agrees with the findings of (Berner *et al*., 1995) which says that most of the damage of *Alectra vogelii* occurs underground because there are haustorial attachments. So the ability of the resistant varieties B301 to escape *Alectra vogelii* damage may be attributed to several mechanisms. It might be due to short growth cycle (escape mechanism) that is the plant grow faster and complete it life cycle before *Alectra vogelii* begins to attach and draw assimilates, or root architecture (fewer roots in the upper soil layer (Singh *et al*., 1988). Among the tested various breeding lines of IITA only B301 maintain multiple *Alectra* resistance delivered from B301 (Satoru, *et al*., 2008).

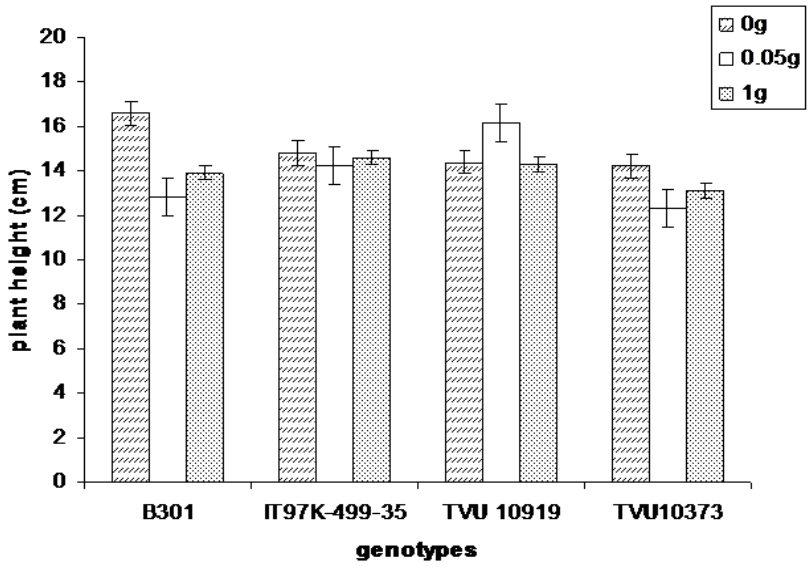

Figure 1. Plant heights at different levels of Alectra infestation, bars represent ± values of three replications

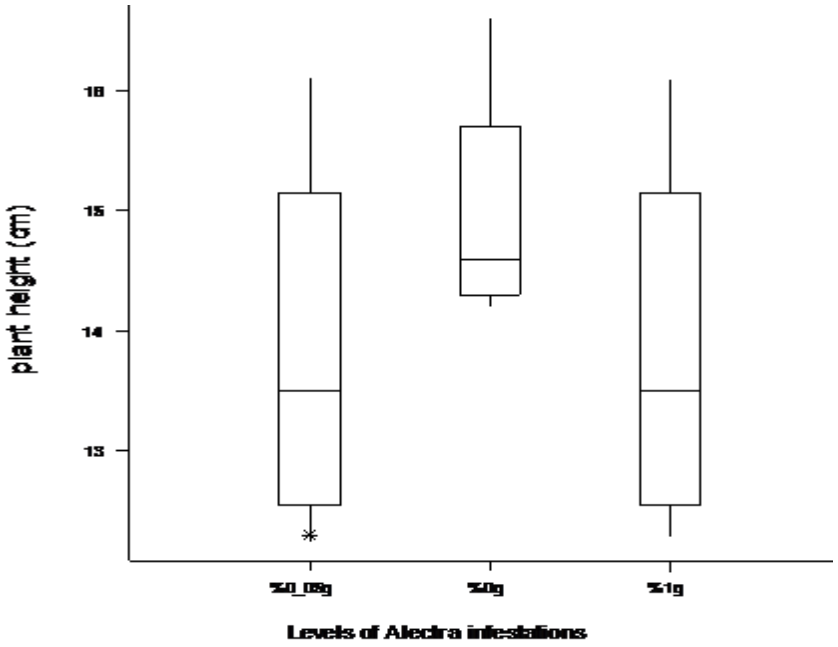

Figure 2. **Box and Whiskers plot**

Table 1. Effect of Alectra vogelii on the chlorophyll content of some cowpea genotypes at different weeks after infestation

S/N	Genotype	3W			9W		
		0g	**0.05g**	**1g**	**0g**	**0.05g**	**1g**
1	B301	53.23	36.53	48.7	37.03	25.4	41.63
2	IT97K-499-35	52.66	45.63	39.4	45.3	51.56	50.23
3	TVU10919	45.66	47.86	41.43	42.43	45.4	44.53
4	TVU10373	42.36	35.4	23.86	37.33	23.06	24.33
	MEAN	40.4	36.3	36	40.5	36.4	40.02
	SE	2.85	2.47	4.93	3.78	4.36	7.55
	LSD(5%)	8.31	7.2	14.4	11.02	12.73	NS

Table 2. Number of Alectra emerged, attached and number of days to Alectra emergence

S/N	genotype	No.of *Alectra* emerged			No.of *Alectra* attached			No. of days to *Alectra* emergance		
		0g	0.05g	1g	0g	0.05g	1g	0g	0.05g	1g
1	B301	0	0	0	0	0	0	0	0	0
2	IT97K-499-35	0	0	1	0	0	2	0	0	56
3	TVU10919	0	3	0	0	3	0	0	52	0
4	TVU10373	0	4	4	0	4	4	0	56	58
	MEAN	0	0.58	0.5	0	0.58	0.5	0	54	57
	SE	0	0.304	0.57	0	0.304	0.527	0		
	LSD(5%)	0	0.88	1.538	0	0.88	1.538	0		

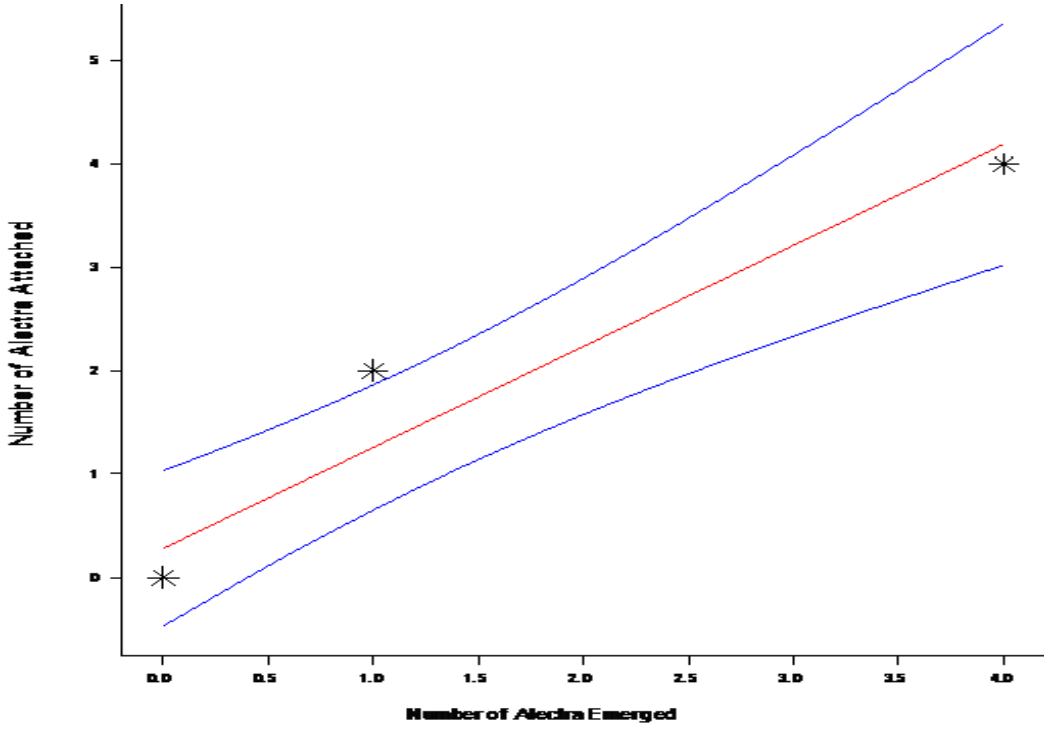

Figure 3. Correlation between Number of *Alectra* attached and number of *Alectra* Emerged

Table 3. Shoot and Root biomass of some genotypes of cowpea at different rates of *Alectra* infestation

S/N	Genotype	Shoot biomass g/plant			Root biomass g/plant		
		0g	0.05g	1g	0g	0.05g	1g
1	B301	1.46	2.43	42.2	0.86	2.2	1.4
2	IT97K-499-35	1.63	2.6	2.26	1.2	1.9	1.9
3	TVU10919	2.13	1.46	1.9	0.76	1.53	1.3
4	TVU10373	4.53	2.03	1.4	0.46	2.53	1.56
	MEAN	3.44	2.13	1.94	0.82	2.04	1.54
	SE	0.79	0.69	1.38	0.56	0.48	0.97
	LSD(5%)	1.64	1.42	2.84	1.64	1.42	2.84

Plate 1. IT97K-499-35 A Susceptible Variety

Plate 2. TVU10919 A Susceptible Variety

CONCLUSION

According to this research cowpea suffers considerable damage due to *Alectra* and reduction can be up to 50% in severe cases. In this research work there was a marked distinction between resistant and susceptible cowpea varieties which has been established through the effect of *Alectra vogelii* infestation. There was more infection after *Alectra* emergence on chlorophyll content making the leaves to be wilted and stunted. Lack of emergence was observed in the resistant variety was B301 proved to be resistant with higher plant height. IT97K-499-35 was the tolerant variety. The variety that was susceptible to the witch weed was TVU10373 and TVU10919 where the symptoms manifested more at the vegetative stage (stunted growth, smaller leaves which are chlorotic). *Alectra* emergence and attachment was observed with reduced biomass in the infested lines of the susceptible variety.

References

Berner D K ,. Kling JG, Singh BB(1995). *Striga* research and control: a perspective from Africa. Plant disease. 79:652-660.

Berner DK, Award A E. Aigbokhan EI (1994). Potential of imazaquin seed treatment for control of *Striga gesneriodes* and *Alectra vogelii* in cowpea (*Vigna unguiculata) plant disease.* 78 (1): 18-23.

Emechebe AM, Singh BB, Leleji OI, Atokple IDK, Adu JK (1991).Cowpea *striga* problem and research in Nigeria.In:proceedings of the international workshop on combating *striga* in Africa,kim;S.K[ed].IITA,Ibadan, Nigeria. Pp.18-28.

Emechebe AM, Singh BB, Leleji OI, Atokple IDK, Adu JK(1991). Cowpea *striga* problem and research in Nigeria.In:proceedings of the international workshop on combating *striga* in Africa,kim;S.K[ed]. IITA,Ibadan,Nigeria. Pp.18-28.

Kuijt J(1969).Thebiologyofparasiticfloweringplants.UniversityofcaliforniaPress,Berkeley,CA,USA. Pp. 346.

Kust CA(1963). Dormancy and viability of witch weed seeds as affected by temperature relative humidity.weeds.11:247.

Lagoke STO, Isah KM, Elemo K, Ariyo OJ(1994). Differencial reaction of host crop varieties to striga hermonthica of different crops. *Nig. J. weed sci.* Vol.22.

Mugabe NR(1983). Effect of *Alectra vogelii* Benth on Cowpea *Vigna unguiculata (L.) Walp.* I. Some aspects of reproduction of cowpea. *Zimbabwe Journal of Agricultural Research* 21:135-147. Parker C and Riches C.R (1993). Parasitic weeds of the world*:* biology and control. Walingford, UK; CAB interational xx+. Pp. 332.

Musselman LJ, Hepper FN(1986). The witchweed[striga scrophulariaceae] sudan republic.*kew Bulletin*,41(1):205-221.

Parker C, Riches CR (1993). Parasitic weed of the world; biology and control.*CAB international*,Walling ford, uk. Pp. 332.

Riches CR(1989). The biology and control of *Alectra vogelii* Benth.(scropholarianceae) in Botswana. Ph.D thesis, university of reading, uk. Pp. 208.

Saunders AR(1933). Studies on phanerogamic parasitism with particular reference to *striga* lutea (Lour). South African Department of Agricultural Science Bulletin. 128:56

Sigh BB, Emechebe AM, Atokple IDK(1993). Inheritance of *Alectra vogelii* resistance in cowpea genotype B 301. *Crop Science.* 33:70-72.

Singh RP, Sinha NC, Mathnr PN, Singh SN(1988). Effect of seed size on germination, seed

Singh BB, chamblis OL, Sharma B(1997). Recent advances in cowpea breeding, Edited by B.B singh, D.R mohan Raj, K.E. Dashiell and L.E.N Jackai. Co publication by 117A and JIRCAS, Ibadan Nig.

Visser JH(1978). The biology of *Alectra vogelii* Benth, an angiospermous root parasite. Beitrage zur chemischen kommunikation in bio-ond okosyntemen. Pp. 279-294.