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# SCREENING OF GROUNDNUT (Arachis hypogaea L.) GENOTYPES FOR THEIR RESISTANCE TO ROSETTE VIRUS DISEASE IN SOUTHERN GUINEA SAVANNA OF NIGERIA.

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## ABSTRACT

Rosette disease is one of the most destructive viral disease of groundnut in Nigeria and other parts of the World causing decline in yield and huge economic losses wherever the epidemic occurs. Field experiment was conducted in 2011 and 2012 cropping seasons to screen thirteen groundnut genotypes for their resistance to rosette virus disease under natural conditions at the Teaching and Research farm of the College of Agronomy, University of Agriculture Makurdi, Benue State of Nigeria. The treatments were laid in Randomized Complete Block Design (RCBD) and replicated 4 times. Each treatment was assigned to a plot measuring 3m x 2m. Borno Red and Shar-nya recorded significantly higher rosette incidence of 25 to 53.94% and 21 to 50.95%, respectively at 30 to 60DAS over the cropping season in 2011 and 2012; Samnut-10, Samnut-21 and samnut-22 recorded significantly the least disease incidence. Borno Red had the highest rosette virus severity of 17 to 66.55% at 30 to 60DAS over the study period; Samnut-21, Samnut-10 and Samnut-22 had the least severity of rosette. Based on genotypic responses at 60DAS, Borno Red, Ijiwanda and shar-nya were found to be susceptible; Tisha-1, Ex-Dakar, Campalla, Borno Brown, Benue AGR and Aloshi were moderately resistant; Samnut-10 Samnut-21 and Samnut-22 were resistant to the rosette disease over the study period; the resistance of Danbomboyo was variable. Significantly higher 100 seed weight was recorded on Samnut-22 and Campalla while Borno Red recorded the lowest in 2011. Samnut-21, Samnut-10 and Samnut-21 had significantly higher 100 seed weight while Aloshi recorded the lowest in 2012. Greater number of deformed groundnut pods was recorded on Borno Red while Samnut-10 recorded the lowest in2011. Similarly, greater number of deformed groundnut pods was recorded on Shar-nya and Compalla while Samnut-10 and Samnut-21 had the lowest in 2012. In conclusion, some genetic disease resistant and higher seed yielding traits has been identified among the groundnut genotypes evaluated which can be employed for effective management of rosette virus disease and for groundnut improvement program in Southern Guinea Savanna

**Keywords:** Groundnut genotype, rosette, incidence, disease severity seed yield.

## 1. INTRODUCTION

Groundnut (*Arachis hypogaea L.*) is an important oil seed and cash crop grown in more than 100 countries in the world (Mensah and Obadini, 2007; ICRISAT, 2012). The crop is grown on nearly 23.95 million hectares of land with total annual production of 36.45 million tons (FAO, 2011).

In Nigeria, the land area grown to groundnut annually from 2000 t0 2009 increased by 2.6% but the yield declined by 3.3% over the same period resulting in stagnation of production at 2.9 million tons (ICRISAT, 2012). Groundnut rosette transmitted by *Aphis craccivora*, is the most destructive viral disease of groundnut in Sub-Saharan Africa causing yield losses approaching 100% where ever an epidemic occurs (Reddy, 1984; Ntare *et al.,* 2002). However, this economically important foliar disease occurs wherever the groundnut crop is grown. Never the less, Global losses in food production due to diseases are important biotic yield limiting factors in world agriculture (Oluma and Nwankiti, 2003) and equally a major source of concern.

Rosette infection can cause plant stunted growth, loss of vigor, leaf curling, yellowing, browning, wilting, bunchy-top head, leaf defoliation, poor yield return and plant death (Abderrahmane and Laleen, 2012). Other groundnut virus disease like the stripe virus and groundnut mottle virus can reduce pod yield of groundnut by up to 50% and 40% respectively (Bock and Nigam, 1988) and the infected pegs may develop further to nuts but without seed formation (Yayock *et al*, 1976).

Several disease control approaches such as chemical spray after the disease appearance, seed dressing, planting date and use of plant extracts have been employed but with little or no feasible results. Also, since the disease is not soil nor air-borne but rather a particle with SSRNA genomes that undergoes complex interaction to produce various symptoms, chemical control does not provide the best control option once the disease have appeared. However, species in the genus *Arachis* have potential for improvement (Favero *et al*, 2006) but different accessions of a particular species may have varying levels of resistance to disease (Alessandra *et al*, 2009). Adu-Dapaah *et al*. (2004) reported that the most economic, ecological and environmentally friendly method of controlling the disease is the use of rosette resistance lines. The objective of this research was to screen groundnut genotypes for their resistance for the management of rosette virus disease in the Southern Guinea Savanna of Nigeria.

## 2.MATERIALS AND METHODS

The field experiment was conducted during the 2011 and 2012 cropping seasons at the Teaching and Research Farm of the University of Agriculture, Makurdi (Latitude 7.41N and Longitude 8.35E, 95m above sea level) Benue State, Nigeria. Benue State is located within the Southern Guinea Savanna Agro – ecological Zone of Nigeria (Agboola, 1979). The experimental site had been under intensive cultivation of different crops for several years. The soil type is sandy loam

The 13 groundnut genotype used for the experiments were: Samnut-22, Samnut-10 and Samnut-21 were obtained from IAR Zaria ,Kaduna State; Ex-Dakar, Borno Red, Danbomboyo, Borno Brown and Campalla were obtained from BOSADP, Borno State; Aioshi, and Tisha-1 were obtained from ADP, Nasarawa State while Ijiwanda, Benue-AGR and Shar-nya were obtained from BNARDA, Benue State all in Nigeria. The experimental field was cleared using cutlasses. Ridges were manually prepared using native hand hoes. The experimental area measured 40 x 17m = 680.0 (0.068m$^2$). The 13 groundnut genotype treatments were laid in a Randomized Complete Block Design and each was replicated 4 times. Each genotype was sown on a plot measuring 3 x 2m. Each plot had four ridges and each ridge had 10 plant stands.. There was a total of 40 plant stands in each plot with 20cm and 75cm as inter and intra-ridge spacing, respectively. Sowing was done on 2$^{nd}$ June, 2011 and on 25$^{th}$ May, 2012.Weeding was carried out with native hand hoe as the need arose and there was no any chemical application.

**Incidence of Rosette (%)**

Incidence of rosette was recorded at 30, 40, 50 and 60 DAS and assessed using the disease incidence formula according to Turaki *et al.* (2014) as:

$$Z = \frac{K}{Y} \times 100$$

Disease incidence was calculated as:

Z = Disease incidence, K = Number of infected plant stands in the net plot and Y = Total number of plant stands (infected and uninfected) in the net plot.

**Severity of Rosette (%)**

Severity of rosette disease was assessed at 40, 50, 60 and 70DAS. Ten groundnut plant stands were randomly selected in the net plot of each plot and tagged. Scored for disease severity were recorded using 1 – 5 disease rating scale according to Pande *et al*. (1997) and Olorunju *et al*. (2001) as follows:

0 = No visible symptoms on leaves (Highly Resistant);
2 = Rosette symptoms on 1 - 20% leaves, but no obvious stunting (Resistant);
3 = Rosette symptoms on 21- 50% leaves with stunting (moderately resistant);
4 = Severe symptoms on 51- 70% leaves with stunting (Susceptible), and
5 = Severe symptoms on 71-100% leaves with stunting (Highly susceptible).
Disease severity was determined as:

$$\frac{\sum n \times 100}{N \times 5}$$

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Where: $\sum n$ = summation of all individual assessments (ratings)

N = total number of plant stands assessed

**Pod deformity**: Eight plant stands were selected randomly from the net-plot of each plot and the total number of deformed groundnut pods was counted and divided by number of plant assessed

**One hundred seeds weight (g)**: One hundred seeds were picked randomly from the harvest of each net plot gram using a sensitive electronic weighing scale model, Sartorius (MBH Gottingen [Type Fabr-Nr.] )

**Data Analysis**

All the data generated were subjected to statistical analysis of variance (ANOVA) using SAS, 2009 version. The mean separation was done using Duncan's New Multiple Range Test (DNMRT) at 5% level of probability

## 3.RESULTS

**Incidence of rosette disease at 30, 40, 50 and 60 DAS in 2011 and 2012.**

Results on incidence of groundnut rosette at 30, 40, 50 and 60 DAS in 2011 and 2012 cropping seasons are presented in Table 1. Results revealed that there was statistically significant variation among the groundnut varieties in their levels of rosette incidence from 30 to 60 DAS.

In 2011, Samnut-10, Samnut-21, Samnut-22, Aloshi, Campalla and Tisha-1 did not show symptom of rosette viral disease at 30 and 40 DAS, the results were similar for Samnut-10 and Samnut-22 at 50 DAS. Bomo Red recorded significantly the highest incidence of rosette at 30 and 40 DAS. This was followed by genotype Ijiwanda and Shar-nya. Similarly, at 50 DAS Borno Red and Shar-nya recorded significantly higher disease incidence. Higher but statistically similar disease incidence was observed among Borno Red, Ijiwanda and Shar-nya at 60 DAS. Samnut-10, Samnut-22 and Samnut-22 recorded significantly the lowest incidence of rosette disease at 60 DAS.

In 2012, Tisha-1 Samnut-10, Samnut-21, Campalla Samnut-22, and Aloshi at 30 and 40 DAS, and Samnut-10, Samnut-21 and Samnut-22 at DAS had no rosette disease symptom. Borno Red recorded significantly higher rosette incidence of at 30 and 40 DAS. At 50 DAS, Borno Red recorded significantly the highest disease incidence compared to other varieties. Similarly, results at 60 DAS revealed that Borno Red recorded significantly the highest disease incidence, followed by Shar-nya. The least disease incidence was observed among Samnut-10 and Samnut-22 followed by Samnut-21, while Tisha-1, Ijiwanda , Ex-Dakar, Campalla , Borno Brown, Benue AGR and Aloshi were moderate in their reaction to the disease at 60 DAS.

**Table 1: Incidence of Rosette on Thirteen Varieties of Groundnut at 30, 40, 50, and 60 DAS in 2011 and 2012 Cropping Seasons.**

| Varieties | 2011 Cropping Season | | | | 2012 Cropping Season | | | |
|---|---|---|---|---|---|---|---|---|
| | **30 DAS** | **40 DAS** | **50 DAS** | **60 DAS** | **30 DAS** | **40 DAS** | **50 DAS** | **60 DAS** |
| Aloshi | $0.00±0.00^{d}$ | $10.05±0.03^{e}$ | $13.77±2.38^{ef}$ | $23.77±2.39^{ef}$ | $0.00±0.00^{d}$ | $0.00±0.00^{c}$ | $12.91±1.21^{g}$ | $26.23±4.35^{e}$ |
| Benue-AGR | $10.41±0.26^{c}$ | $17.50±2.50^{d}$ | $34.87±2.12^{bc}$ | $31.66±4.19^{de}$ | $7.14±1.78^{c}$ | $16.75±0.69^{b}$ | $22.33±0.93^{de}$ | $30.15±0.86^{de}$ |
| Borno Brown | $10.06±1.98^{c}$ | $19.01±3.29^{d}$ | $31.66±0.96^{cd}$ | $40.92±1.45^{bc}$ | $5.45±0.18^{c}$ | $15.05±1.22^{b}$ | $24.96±1.00^{cd}$ | $27.90±2.61^{de}$ |
| Borno Red | $25.55±2.60^{a}$ | $37.65±3.24^{a}$ | $46.00±2.44^{a}$ | $53.94±1.31^{a}$ | $21.27±0.46^{a}$ | $33.02±2.93^{a}$ | $42.82±1.58^{a}$ | $50.95±2.20^{a}$ |
| Campalla | $0.00±0.00^{d}$ | $0.00±0.00^{f}$ | $16.54±2.36^{ef}$ | $26.66±3.84^{ef}$ | $0.00±0.00^{d}$ | $0.00±0.00^{c}$ | $19.83±1.85^{ef}$ | $30.13±1.16^{de}$ |
| Danbomboyo | $10.00±2.04^{c}$ | $21.66±3.72^{cd}$ | $34.16±2.09^{cd}$ | $38.53±1.88^{bcd}$ | $5.13±0.07^{c}$ | $17.96±1.50^{b}$ | $26.65±1.24^{c}$ | $33.35±1.56^{cd}$ |
| Ex-Dakar | $12.77±1.30^{bc}$ | $18.91±1.31^{d}$ | $28.3±3.18^{d}$ | $35.37±5.37^{cd}$ | $10.00±0.00^{b}$ | $15.19±0.19^{b}$ | $22.76±1.30^{de}$ | $29.14±1.43^{de}$ |
| Ijiwanda | $15.19±2.05^{b}$ | $28.83±1.27^{b}$ | $37.58±2.41^{bc}$ | $46.27±3.77^{ab}$ | $10.47±2.21^{b}$ | $17.34±1.29^{b}$ | $26.58±1.63^{c}$ | $37.26±1.46^{de}$ |
| Samnut-10 | $0.00±0.00^{d}$ | $0.00±0.00^{f}$ | $0.00±0.00^{g}$ | $11.66±1.66^{h}$ | $0.00±0.00^{d}$ | $0.00±0.00^{c}$ | $0.00±0.00^{h}$ | $10.00±0.00^{g}$ |
| Samnut-21 | $0.00±0.00^{d}$ | $0.00±0.00^{f}$ | $10.27±0.27^{f}$ | $15.00±1.66^{gh}$ | $0.00±0.00^{d}$ | $0.00±0.00^{c}$ | $0.00±0.00^{h}$ | $17.64±1.57^{f}$ |
| Samnut-22 | $0.00±0.00^{d}$ | $0.00±0.00^{f}$ | $0.00±0.00^{g}$ | $10.00±0.00^{h}$ | $0.00±0.00^{d}$ | $0.00±0.00^{c}$ | $0.00±0.00^{h}$ | $11.25±1.25^{g}$ |
| Shar-nya | $14.13±2.26^{bc}$ | $26.41±2.37^{bc}$ | $40.83±3.43^{ab}$ | $50.30±0.30^{a}$ | $10.41±0.26^{b}$ | $17.12±1.35^{b}$ | $30.37±1.83^{b}$ | $40.84±1.61^{b}$ |
| Tisha-1 | $0.00±0.00^{d}$ | $0.00±0.00^{f}$ | $18.83±1.31^{e}$ | $20.83±3.15^{fg}$ | $0.00±0.00^{d}$ | $0.00±0.00^{c}$ | $16.86±1.09^{f}$ | $24.70±2.46^{e}$ |
| *P-Value* | *<0.01* | *<0.01* | *<0.01* | *<0.01* | *<0.01* | *<0.01* | *<0.01* | *<0.01* |
| *CV* | *12.55* | *19.98* | *23.10* | *11.12* | *18.25* | *19.63* | *21.31* | *12.24* |

Mean values with the same alphabet in a column are not significantly different from each other according to Duncan's New Multiple Range Test (DNMRT) at ($P < 0.05$) probability level. CV = coefficient of variation, NS = not significant

**Severity of rosette disease at 30, 40, 50 and 60 DAS in 2011.**

Results on severity of groundnut rosette disease at 30, 40, 50 and 60 DAS in 2011 cropping season are presented in Table 2. Results revealed that the groundnut genotypes exhibited highly significant variation in their disease severity from 30 to 60 DAS. Results indicated that among the varieties, Aloshi, Campalla, Samnut-10 Samnut-10 and Samnut-22 and Tisha-1 at 30 DAS and Campalla, Samnut-10 Samnut-10 and Samnut-22 and Tisha-1at 40 DAS had no disease infection. In contrast, Borno Red significantly ($P < 0.05$) recorded the highest rosette severity at 30 DAS and 40 DAS. Ex-Dakar, Ijiwanda and Shar-nya at 30 DAS; and Ex-Dakar and Ijwanda at 40 DAS recorded moderately low disease severity. At 50 DAS, Samnut-10 and Samnut-22 had no disease severity, while the highest rosette severity were observed among Borno red and Shar-nya, followed by Borno Brown and Danbomboyo. The results at 60 DAS revealed that Borno red recorded significantly ($P <0.01$) the highest disease severity, followed by Ijiwanda and Shar-nya. The least severity of rosette was observed among Samnut-22, Samnut-21 and Samnut-10 at 60 DAS.

**Table 2: Severity of Rosette on Thirteen Varieties of Groundnut Varieties at 30, 40, 50 and 60 DAS in 2011 Cropping Season.**

| Vavieties | 30 DAS | Severity Index | 40 DAS | Severity Index | 50 DAS | Severity Index | 60 DAS | Severity Index |
|---|---|---|---|---|---|---|---|---|
| Aloshi | $0.00±0.00^{d}$ | (0) | $9.50±0.95^{e}$ | (2) | $26.30±3.09^{cd}$ | (3) | $39.83±2.58^{ef}$ | (3) |
| Benue-AGR | $9.00±1.29^{c}$ | (2) | $18.00±1.15^{cd}$ | (2) | $31.16±1.31^{c}$ | (3) | $43.33±4.08^{de}$ | (3) |
| Borno Brown | $8.50±0.95^{c}$ | (2) | $16.00±2.30^{cd}$ | (3) | $39.02±0.97^{b}$ | (3) | $47.00±1.00^{cd}$ | (3) |
| Borno Red | $19.00±1.00^{a}$ | (2) | $33.33±2.35^{a}$ | (3) | $56.75±3.35^{a}$ | (4) | $66.55±2.79^{a}$ | (4) |
| Campalla | $0.00±0.00^{d}$ | (0) | $0.00±0.00^{f}$ | (0) | $22.50±2.50^{d}$ | (3) | $32.33±1.45^{g}$ | (3) |
| Danbomboyo | $9.50±0.50^{c}$ | (2) | $19.00±1.00^{c}$ | (2) | $38.33±1.66^{b}$ | (3) | $52.50±1.44^{bc}$ | (4) |
| Ex-Dakar | $11.50±0.50^{b}$ | (2) | $14.50±1.50^{d}$ | (2) | $30.82±0.83^{c}$ | (3) | $47.00±2.38^{cd}$ | (3) |
| Ijiwanda | $11.50±0.50^{b}$ | (2) | $14.50±1.50^{d}$ | (2) | $30.83±0.83^{c}$ | (3) | $57.75±1.38^{b}$ | (4) |
| Samnut-10 | $0.00±0.00^{d}$ | (0) | $0.00±0.00^{f}$ | (0) | $0.00±0.00^{f}$ | (0) | $19.00±1.29^{h}$ | (2) |
| Samnut-21 | $0.00±0.00^{d}$ | (0) | $0.00±0.00^{f}$ | (0) | $10.00±3.46^{e}$ | (2) | $18.00±2.00^{h}$ | (2) |
| Samnut-22 | $0.00±0.00^{d}$ | (0) | $0.00±0.00^{f}$ | (0) | $0.00±0.00^{f}$ | (0) | $18.00±1.15^{h}$ | (2) |
| Shar-nya | $11.77±0.22^{b}$ | (2) | $29.83±1.4^{b}$ | (3) | $51.25±2.74^{a}$ | (4) | $57.37±3.79^{b}$ | (4) |
| Tisha-1 | $0.00±0.00^{d}$ | (0) | $0.00±0.00^{f}$ | (0) | $23.61±2.19^{d}$ | (3) | $35.33±2.26^{fg}$ | (3) |
| *P-Value* | *<0.01* | | *<0.01* | | *<0.01* | | *<0.01* | |
| *CV* | *21.22* | | *23.23* | | *25.16* | | *8.75* | |

Mean values with the same alphabet in a column are not significantly different from each other according to Duncan's New Multiple Range Test (DNMRT) at ($P < 0.05$) probability level. CV = coefficient of variation, NS = not significant

**Severity of rosette disease at 30, 40, 50 and 60 DAS in 2012.**

Severity of groundnut rosette at 30, 40, 50 and 60 DAS in 2012 cropping season are presented in Table 3. Results revealed significant difference, ($P < 0.05$) in severity of rosette disease among the groundnut genotypes evaluated (Table 3).

Results indicated that Aloshi, Samnut-10, Samnut-21 Campalla, Tisha-1 and Samnut-22 had no rosette disease at 30 and 40 DAS. At 30 DAS, the highest severity of rosette disease was recorded on Borno Red followed by Ijiwanda. At 40 DAS, Borno Red also recorded the highest disease severity while Shar-ny, Ijiwanda, Ex-Dakar, Danbomboyo and Benue AGR recorded moderate disease severity. Similarly, at 50 DAS, results revealed that Borno Red had significantly the highest disease severity. Shar-nya had moderate disease severity which did not vary from the other diseased genotypes. Samnut-22, Samnut-21 and Samnut-10 were not diseased at 50 DAS. At 60 DAS, the highest disease severity was recorded on Borno Red. This was followed by Shar-nya and Ijiwanda which recorded moderate rosette severity but which did not significantly differ from each other. The least severity of rosette was observed an Samnut-22, Samnut-21and Samnut-10 at 60 DAS.

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**Table 3: Severity of Rosette on Thirteen Varieties of Groundnut at 30, 40, 50 and 60 DAS in 2012 Cropping Seasons.**

| Varieties | 30 DAS | Severity Index | 40 DAS | Severity Index | 50 DAS | Severity Index | 60 DAS | Severity Index |
|---|---|---|---|---|---|---|---|---|
| Aloshi | 0.00±0.00$^{e}$ | (0) | 0.00±0.00$^{d}$ | (0) | 29.00±1.73$^{de}$ | (3) | 32.00±0.81$^{f}$ | (3) |
| Benue-AGR | 6.50±1.89$^{cd}$ | (2) | 25.00±1.29$^{bc}$ | (3) | 34.00±1.41$^{d}$ | (3) | 42.00±1.63$^{d}$ | (3) |
| Borno Brown | 5.50±0.50$^{d}$ | (2) | 21.00±2.64$^{c}$ | (3) | 33.50±2.36$^{d}$ | (3) | 43.00±1.00$^{d}$ | (3) |
| Borno Red | 17.00±2.51$^{a}$ | (2) | 40.00±3.55$^{a}$ | (3) | 54.00±0.81$^{a}$ | (4) | 65.00±2.08$^{a}$ | (4) |
| Campalla | 0.00±0.00$^{e}$ | (0) | 0.00±0.00$^{d}$ | (0) | 24.50±0.50$^{e}$ | (3) | 37.00±1.29$^{e}$ | (3) |
| Danbomboyo | 6.00±0.81$^{d}$ | (0) | 23.50±2.21$^{bc}$ | (3) | 33.50±3.59$^{d}$ | (3) | 48.00±2.70$^{c}$ | (3) |
| Ex-Dakar | 9.00±1.29$^{bcd}$ | (2) | 21.50±1.50$^{bc}$ | (3) | 31.00±1.73$^{d}$ | (3) | 43.75±1.03$^{cd}$ | (3) |
| Ijiwanda | 11.00±2.64$^{b}$ | (2) | 26.00±2.16$^{bc}$ | (3) | 40.50±2.75$^{c}$ | (3) | 54.50±2.50b | (4) |
| Samnut-10 | 0.00±0.00$^{e}$ | (0) | 0.00±0.00$^{d}$ | (0) | 0.00±0.00$^{f}$ | (0) | 18.00±0.81$^{g}$ | (2) |
| Samnut-21 | 0.00±0.00$^{e}$ | (0) | 0.00±0.00$^{d}$ | (0) | 0.00±0.00$^{f}$ | (0) | 19.50±0.50$^{g}$ | (2) |
| Samnut-22 | 0.00±0.00$^{e}$ | (0) | 0.00±0.00$^{d}$ | (0) | 0.00±0.00$^{f}$ | (0) | 20.00±0.00$^{g}$ | (2) |
| Shar-nya | 10.00±0.81$^{bc}$ | (2) | 26.50±2.06$^{b}$ | (3) | 47.50±0.95$^{b}$ | (3) | 55.00±1.29$^{b}$ | (4) |
| Tisha-1 | 0.00±0.00$^{e}$ | (0) | 0.00±0.00$^{d}$ | (0) | 25.00±2.08$^{e}$ | (3) | 33.00±1.7o$^{ef}$ | (3) |
| *P-Value* | *<0.01* | | *<0.01* | | *<0.01* | | *<0.01* | |
| *CV* | *23.69* | | 21.34 | | 23.14 | | 9.56 | |

Mean values with the same alphabet in a column are not significantly different from each other according to Duncan's New Multiple Range Test (DNMRT) at ($P < 0.05$) probability level. CV = coefficient of variation, NS = not significant

**Plate 1: Bunchy- Top symptom of Rosette infection.**

**Campalla groundnut**

**Plate 2: Chlorotic leaf symptom of Rosette disease.**

**Borno-Red groundnut**

**Plate 3: Leaf curl symptom of Rosette disease.**

**Ijiwanda groundnut**

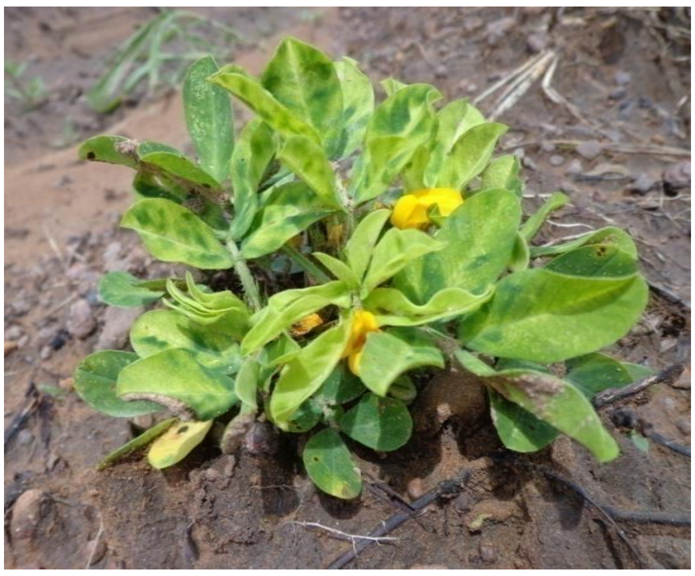

**Plate 4: Stunted growth symptom of Rosette disease.**

**Shar-nya groundnut**

**100 seed weight (g) and number of deformed groundnut pods**

Results on 100 seed weight (g) and number of deformed groundnut pods in 2011 and 2012 cropping seasons are presented in Table 4. The results of 2011 and 2012 showed that three were significantly difference among the groundnut genotypes in 100 seed weight and number of deformed groundnut pods

The results indicated that in 2011, 100 seed weight was significantly higher in Samnut-22 and Campalla than in other treatments which were followed by Tisha-1, Shar-nya, Samnut-21and Samnut-10 which recorded moderately high 100 seed weight but did not differ statistically from each other. Lower 100 seed weight was observed in Borno Brown, Benue AGR, Ijiwanda and Aloshi, while Borno red recorded the lowest 100 seed weight.

In 2012, Samnut-21, Samnut-22 and Samnut-10 recorded higher 100 seed weight which did not differ significantly from each other. This was followed by Borno Brown, Tisha-1, Benue-AGR, Borno Red and Campalla which recorded moderate but statistically similar 100 seed weight. sLower 100 seed weight was recorded on Danbomboyo, Ex-Dakar, Ijiwanda and Shar-nya, while Aloshi recorded the least 100 seed weight.

In 2011, Borno Red, Aloshi, Campalla, Danbomboyo, Ex-Dakar, Ijiwanda, Shar-nya and Tisha-1 had significantly (P <0.05) greater number of deformed pods while Samnut-10 recorded no deformed pods followed by Samnut-21 which had the least number of deformed pods. In 2012, higher deformed pods was recorded on Shar-nya, Tisha-I , Samnut-22, Ijiwanda, Ex-Dakar, Danbomboyo, Campalla , Borno Red and Benue AGR, while Samnut-10 and Samnut-21 recorded no deformed pods.

**Table 4: Number of Deformed groundnut Pods and 100 Seed Weight among the Thirteen Varieties of Groundnut in 2011 and 2012 Cropping Seasons**

| | **2011 Cropping Season** | | **2012 Cropping Season** | |
|---|---|---|---|---|
| **Varieties** | **100 Seed Wt (gm)** | **Pod Deformity** | **100 Seed Wt (gm)** | **Pod Deformity** |
| Aloshi | 35.22±0.53$^{de}$ | 10.77±0.26$^{abc}$ | 35.13±7.56$^{e}$ | 5.31±3.07$^{bc}$ |
| Benue-AGR | 33.70±0.81$^{ef}$ | 7.00±4.12$^{cd}$ | 56.00±10.60$^{bcdef}$ | 10.27±0.02$^{ab}$ |
| Borno Brown | 32.47±0.33$^{ef}$ | 7.90±1.32$^{bcd}$ | 58.60±4.29$^{bcd}$ | 5.81±3.41$^{bc}$ |
| Borno Red | 29.10±0.45$^{g}$ | 16.36±1.28$^{a}$ | 54.41±6.41$^{bcde}$ | 9.59±3.31$^{ab}$ |
| Campalla | 45.20±2.99$^{a}$ | 11.57±0.60$^{abc}$ | 53.75±1.19$^{cde}$ | 14.04±2.45$^{a}$ |
| Danbomboyo | 37.92±0.17$^{cd}$ | 13.06±0.67$^{ab}$ | 43.69±4.90$^{de}$ | 12.07±2.67$^{ab}$ |
| Ex-Dakar | 30.65±0.76$^{fg}$ | 13.42±1.50$^{bc}$ | 39.25±7.38$^{de}$ | 0.00±1.77$^{ab}$ |
| Ijiwanda | 33.20±0.42$^{ef}$ | 13.42±2.25$^{ab}$ | 49.80±4.6$^{de}$ | 12.23±3.55$^{ab}$ |
| Samnut-10 | 41.87±0.60$^{b}$ | 0.00±0.00$^{e}$ | 74.42±7.27$^{abc}$ | 0.00±0.00$^{c}$ |
| Samnut-21 | 40.70±0.86$^{bc}$ | 2.78±2.78$^{de}$ | 94.32±4.90$^{a}$ | 0.00±0.00$^{c}$ |
| Samnut-22 | 45.40±0.86$^{a}$ | 10.85±0.49$^{abc}$ | 76.45±8.77$^{ab}$ | 10.87±0.57$^{ab}$ |
| Shar-nya | 38.73±1.59$^{bc}$ | 8.93±2.35$^{bc}$ | 45.90±16.40$^{de}$ | 15.87±2.56$^{a}$ |
| Tisha-1 | 40.87±0.80$^{bc}$ | 11.08±0.67$^{abc}$ | 56.71±4.98$^{bcde}$ | 12.69±1.37$^{ab}$ |
| *P-Value* | *<0.01* | *<0.01* | *<0.01* | *<0.01* |
| *CV* | *29.81* | *25.66* | *36.80* | *17.34* |

Mean values with the same alphabet in a column are not significantly different from each other according to Duncan's New Multiple Range Test (DNMRT) at (P < 0.05) probability level. CV = coefficient of variation, NS = not significant

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Plate 5: Deformed Bunches of Groundnut Pods

Plate 6: Abnormal Elongatiosn of Groundnut Pods with Black Lesions

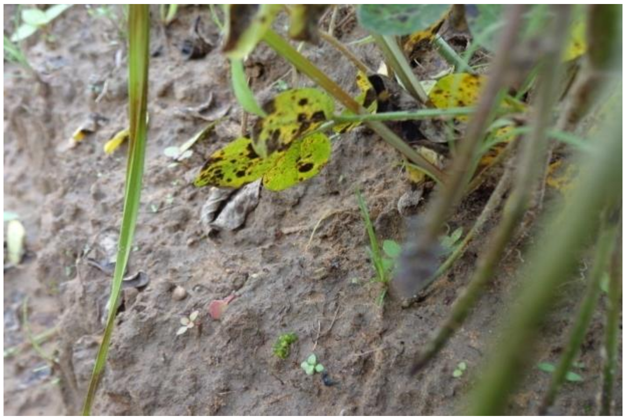

Plate 7: Pockets of Aphis craccivora attacking the tip end of the groundnut pegs.

## 4.DISCUSSION

Rosette of groundnut is a serious viral disease that destroys crops and limit yield in Nigeria and other parts of the developing countries. Infected crops are characterized by the appearance of dense clump or dwarf shoots with tuft of small leaves forming in a rosette-fashion (Umma *et al.*, 2014) and infected pegs may develop further to nuts but no seed formation (Yayock *et al*, 1976). According to Bock *et al.* (1990) the disease symptoms are caused by a complex of three groundnut rosette virus (GRV), a satellite RNA of GRV and groundnut rosette assistor virus (GRVA).

The groundnut genotypes evaluated in this study exhibited significant variation in their levels of rosette incidence and severity over the two cropping seasons. The susceptible groundnut genotypes exhibited various symptoms which include bunchy-top, chlorotic leaf, leaf curl and stunted growth as shown in plate 1, 2, 3 and 4 respectively. The results indicated that the groundnut genotypes Tisha-1, Campalla, Borno Brown, Ex-Dakar, Benue AGR and Aloshi were moderately resistant to rosette; Samnut-10, Samnut-21 and Samnut-22 were resistant; Borno Red, Shar-nya, and Ijiwanda were susceptible. The results have shown that there may exist some genetic inheritability trait among the varieties that mediates some degree of resistance to the disease and which can be utilized for crop improvement.

The degrees of deformed pods significantly vary among the varieties in the two cropping seasons. The deformed groundnut pods were associated with black lesions, abnormal small sizes and shapes, hardened shell and abnormal elongated carpospores (Plates 5 and 6). This could be as a results of direct attack by clusters of *Aphis craccivora* (Pate 7) which had sucked up the tender pegs, introduced the disease and prevented some of them from penetrating into the soil. The disease pressure could have equally prevented food partitioning which resulted to reduction in size and shape of the deformed pods. Yayock *et al.* (1976) reported that in groundnut infected by rosette, pegs may develop further to nuts but without seed formation. The lowest number of deformed groundnut pods was observed on Samnut-10, Samnut-21 and Samnut-22 compared with the other genotypes in both 2011 and 2012. Naidu *et al*. (1991) and Waliyar *et al*., 2007) stated that seedling stage infection by *Aphis craccivora* leads to 100% yield loss whilst infection at the pod filling stage causes negligible effects.

One hundred seed weight was significantly higher on Campalla and Samnut-22, moderate on Samnut-10, Samnut-22, Shar-nya and Tisha-1 but lower on Borno Brown, Borno Red, Ex-Dakar, Benue AGR and Ijiwanda in 2011 while in 2012 higher seed weights were recorded on Samnut-10, Samnut-21 and Samnut-22; Tisha-1, Benue AGR, Borno Brown, Borno Red and Campalla had moderate 100 seed weight and while Aloshi, Ijiwanda, Ex-Dakar and Danbomboyo recorded lower seed weight. The variation in 100 seed weight could be as result of difference, in the transfer of assimilates from other plant parts to the kernel for good development of the kernel during the pod filling stage. Khatum *et al.* (2009) reported that genotypic trait and environmental factors can play a major role in difference in 100 seed weight among groundnut genotypes.

## 5.CONCLUSION

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The resistance of Danbomboyo to rosette disease was inconsistent based on the disease severity index in the two cropping seasons. Disease resistant and high yielding genotypes such Samnut-10, Samnut21 and Samnut-22 should be employed in management strategy of rosette disease. Moderately yielding-resistant genotypes such as Campalla, Tisha-1, Benue AGR and Borno Brown should be subjected into further genetic improvement. Lastly, screening and breeding for resistant genotypes with good agronomic performances in other to increase food production is advocated.

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