# THE DISTRIBUTION AND LEVELS OF DAMAGE OF SEED-BORNE ORGANISMS ON GROUNDNUT (*Arachis hypogaea* L.) IN BENUE STATE

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## *ABSTRACT*

***An experiment was carried out at the Crop Science Laboratory of the University of Agriculture, Makurdi to isolate and identify disease causing organisms in groundnut seeds and determine the levels of damage. The findings from this study revealed six fungal organisms viz Aspergillus tamari, Aspergillus niger, Rhizopus spp, Aspergillus flavus, Lasiodiplodia spp and Fusarium spp. were present. Rhizopus spp and Aspergillus flavus had the highest frequency of occurrence among the organisms causing seed deterioration. They had 89.17 and 75.67 frequency of occurrence respectively. Also, shriveling of seeds, reduce or small seeds, rottening of seeds, insect damage, white and black stains were found to be the types of damage of groundnut seeds in Benue State. In general, the organisms that cause deterioration of the seeds have the following percentage of occurrence. A. niger 51.56, Fusarium sp. 5.0 and Rhizopus spp has 89.77%.***

**Keywords**: Frequency, Occurrence, Damage, Deterioration, Organism, Seeds.

## INTRODUCTION

Groundnut *(Arachis hypogaea L.)* is a leguminous oilseed crop cultivated in the semi-arid and subtropical regions of the world. It is an important food and fodder crop in the farming systems of developing countries (Farid and Abdulla, 2013). It is grown in nearly 100 countries on six continents between 40° N and S of the equator on nearly 24.6 million (m) hectares (ha), with a production of 41.3 m. tons (t) and productivity of 1676 kg $ha^{-1}$ during 2012. China, India, Nigeria, USA and Myanmar are the leading groundnut producing countries in the world. (Ajeigbe *et al*., 2014). It is a warm season crop and is killed by frost; mostly grown in areas with 100 cm or more rainfall. It needs 50 cm rain during the growing season and dry weather for ripening. It is a small erect or trailing herb, 15 - 60 cm high and the seeds are produced underground in pods (Ajeigbe *et al*., 2014).

Groundnut is a rich source of protein and it contains about 45–55% oil and 27–33% of protein (Janila *et al*., 2013). Its seeds are also a source of minerals and vitamins like vitamin E, niacin, falcin, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine, and potassium (Jibrin *et al*., 2016). Groundnut kernels are consumed directly as raw, roasted or boiled kernels or oil extracted from the kernel is used as culinary oil. Surendranatha *et al*., (2011) also reported that groundnut is used as animal feed (oil pressings, seeds, green material and straw) and industrial raw material (oil cakes and fertilizer). It also contributes to maintaining soil fertility by fixing atmospheric nitrogen. These multiple uses of groundnut plant make it an

excellent cash crop for domestic markets as well as for foreign trade in several developing and developed countries (Surendranatha *et al*., 2011). The poor productivity of groundnut cultivation in African countries may be attributed to a combination of factors such as unreliable rains, mostly non-irrigated nature of cultivation, traditional small-scale farming with little mechanization, outbreaks of pests and diseases, use of low-yielding varieties, increased and/or continued cultivation on marginal land, poor adoption of agronomic practices and limited extension services. Nigeria is the largest groundnut producing country in West Africa, accounting for 51% of production in the region. The country contributes 10% of total global production and 39% that of Africa (Ajeigbe *et al*., 2014).

Despite the potentials of groundnut production in Benue State, the State is posed with the challenge of huge losses arising from seed-borne organisms. These organisms feed on the seeds thereby affecting the growth, productivity and availability of healthy groundnut. There is dearth or paucity of information regarding the distribution and levels of damage caused by these seed-borne organisms on groundnut in Benue State. This present study was therefore undertaken in order to isolate and identity the various disease causing organisms of groundnut seeds and to determine the distribution and levels of damage of seed borne organisms on groundnut in Benue state.

## MATERIALS AND METHODS

### Physical Examination of Seeds without Incubation

Four hundred seeds of groundnut each from six locations (Adikpo, Agatu, Gboko, Guma, Makurdi and Otukpo) were physically examined with the unaided eye and classified into damage categories. The seeds used were the local variety grown in the locations. The damage categories included black stained seeds, shriveled seeds, rotted seeds, apparently healthy seeds, white stained seeds, insect damaged seeds and small seeds. The damage categories formed the treatments and were arranged in a completely randomized design and replicated four times (100 seeds per replicate). Data were subjected to analysis of variance and means were separated using Duncan's New Multiple Range Test (DNMRT).

**Examination of Seeds of Groundnut from Six Locations (Adikpo, Agatu, Gboko, Makurdi and Otukpo)** Which represent the three zones in Benue State that is Zone A, Zone B and Zone C were surface disinfected for 1 minute in 5% Sodium hypochloride and rinsed with sterile water.

About 10 seeds were plated per Petri-dish using the blother method. The plates were incubated for 7 days at atmospheric temperature and under 12 hours of light each day. The seeds were then examined and each micro-organisms seen growing on them was identified by making slides and viewing them through the stereomicroscope using their characteristics growth. Each location constituted a treatment which were replicated four times and arranged in completely randomized design. Data collected included percentage germination, percentage infection, Organisms found and frequency of isolation of each organism. Data were subjected to analysis of variance and means separated using Fisher's Least Significant Difference (F.LSD).

## RESULTS AND DISCUSSION

Table 1 shows the result of the physical examination of seeds without incubation. The kind of damage observed from the six (6) locations were insect damaged shriveling of seeds, small seeds, white stain seeds black stain seeds and rottening of seeds.

From the table, Makurdi has the highest number

of good quality seeds with 71.0% followed by Otukpo with 70.5% Agatu 66.5%. Adikpo 54.75%, Gboko 47.5% and Guma which has the least with 46.75% Shriveling of seeds is the most common and most severe kind of damage found in all the locations with Gboko and Guma having the highest number of shriveled seeds 42.5% each and Adikpo 27.75%, Agatu 25.0%, Makurdi 24.0%. Otukpo has the least number of shriveled seeds with 21.0%.

Makurdi has no insect damage seeds with little or no rotten seeds of about 0 25%. Adikpo has no rotten seeds and has little white seeds with 1.5% also has the highest number of small seeds of about 10.75%. Gboko also has the highest number of black seeds with 4.75% and lowest number of white seeds with 0.75%. Otukpo also has lowest number of small seeds with 0.25%.

**Table 1: Types and levels of seed damage on groundnuts obtained from six (6) different locations in Benue State.**

| Treatment (Damage categories %) | Locations | | | | | |
|---|---|---|---|---|---|---|
| | Gboko | Guma | Makurdi | Adikpo | Agatu | Otukpo |
| Shriveled seeds | 42.5 | 42.5 | 24 | 27.75 | 25 | 21 |
| Small seeds | 3.0 | 2.0 | 1.25 | 10.75 | 3.0 | 0 .25 |
| Rotten seeds | 0.75 | 1.25 | 0.25 | 0 | 1.0 | 3.0 |
| Insect damage | 0.75 | 0.25 | 0 | 2.5 | 0.25 | 1.0 |
| White seeds | 0.75 | 0 | 2 | 1.5 | 2.25 | 1.5 |
| Black seeds | 4.75 | 1 | 1.5 | 2.75 | 2 | 2.75 |
| Good quality seeds | 4.75 | 46.75 | 71 | 54.75 | 66.5 | 70.5 |
| LSD (0.05) | 5.1 | 5.2 | 4.0 | 6.0 | 4.3 | 3.0 |

Table 2 shows the result of the percentage germination, percentage infection and frequency of isolation of each organism after incubation of 400 seeds each from six (6) locations. The organisms isolated from seeds collected from six (6) locations were *Aspergilius niger*, *A.taman*, *Rhizopus* spp, *A. flavus, Lasiodiplodia* spp.*and Fusarium* spp.

Analysis of variance showed that there were significant differences recorded among the treatment in all the parameters measured. *Rhizopus* spp. seems to be the highest in the frequencies of occurrence of each organism in the six (6) locations. The high percentage infection showed the poor condition of the seeds obtained from the six (6) locations. Gboko, Makurdi and Agatu recoded 100% infection while Guma, Adikpo and Otukpo recorded 81.67%, 50.83% and 99.17% respectively. Also average germination was very low in seeds from all locations with Makurdi recording 0.0% Gboko and Guma recorded 1.67% each, Adikpo 2.42%, Agatu 3.33% and Otukpo 2.5%.

Seeds from Gboko, Agatu, and Otukpo were more infected with *Rhizopus* sp. (89.17%, 77.5% and 75% respectively) while those from

**Table 2: Examination of Mycoflora on groundnut seeds obtained from six6) locatuons in Benue State**

| Treatment | Percentage Germination | Percentage Infection | Occurrence of isolated organisms % | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | *A tamarii* | *A. niger* | *Rhizopus spp* | *A. Flavus* | *Lasiodiplodia spp.* | *Fusarium spp* |
| Gboko | 1.67 | 100 | 3.33 | 28.3 | 89.77 | 27.5 | 5.0 | 5.0 |
| Guma | 1.67 | 81.67 | 0.83 | 6.66 | 49.17 | 17.5 | 9.17 | 0.8 |
| Makurdi | 0 | 100 | 4.16 | 51.56 | 41.67 | 75.67 | 7.5 | 5.8 |
| Adikpo | 2.42 | 50.83 | 0 | 4.16 | 18.33 | 4.17 | 2.5 | 0 |
| Agatu | 3.33 | 100 | 6.66 | 30.8 | 77.5 | 72.5 | 1.67 | 0.8 |
| Otukpo | 2.5 | 99.17 | 14.16 | 30 | 75 | 50.8 | 1.67 | 0.8 |
| LSD (0.05) | 9.1 | 12.36 | 6.4 | 10.2 | 149.09 | 28.29 | 5.6 | 3.38 |

After physical examination of seeds the result showed that there were 6 types of physical damages seen on the groundnuts seeds in Benue State. Damages found on the seeds included rottening of seeds, insect damaged seeds, small seeds, shriveling of seeds, white and black stains on seeds. The result also indicated that groundnut seeds obtained from the six (6) locations in Benue State had high levels of physical damage with seeds from Guma being the most severe. It was also observed that shriveling of seeds most frequently occurred among the damage categories followed by small seeds and black stained seeds in the 3 zones. The poor quality or high level of damage on the seeds may be due to poor storage system, late harvesting and lack of seed treatment before storage. When seeds are not treated before storage, they are likely to be attacked under favourable conditions by different micro-organisms which will damage the seeds.

When the micro-flora of the seeds was examined, it was observed that the seeds from the six (6) locations had very high percentage infections (Table 2) with seeds obtained from Gboko. Makurdi and Agatu being the most severely infected. The high infection rate observed in the 3 locations must have accounted for the greater damage recorded in the areas. The high percentage infection on the seeds also explains the low germinability rate. The various organisms isolated from the seeds have been reported to cause one disease or the other on seeds or seedlings. *A. niger* and *A. flavus* causes seed disease of groundnut (Chavan and kakde, 2008; Syed and Mehre, 2013). *A. tamarii* is allergic and capable of producing a number of poisonous secondary metabolites, it is not regarded hazardous and is rarely found as a human pathogen (Valentino *et al.,* 2015).

*A niger, A. tamarii, Fusanum spp* and *Rhizopus spp* attack seeds and cause seed rot (Jackson, 1962; Chavan and kakde, 2008). Akinnibosun and Osawuru, (2015) reported that *Fusarium* spp. and *Rhizopus* spp. were the most abundant fungi encountered in groundnut seeds. Symptoms of *Lasiodiplodia* spp. infection include branch dieback, stem cankers, gum exudation, necrotic lesions, neck rot, seed and fruit decay, and foliage yellowing, all of which are caused by vascular tissue obstruction and ultimately lead to plant death (Lima *et al*., 2013; Marques *et al*., 2013; Machado *et al*., 2014; Netto *et al*., 2014). Akinseye and Ataga, 2014 reported the presence of *Lasidioplodia theobromae* in groundnut seeds causing collar rot disease.

The general overview of the occurrence of organisms in Table 2 showed that all the organisms isolated were present in all the locations with *Rhizopus spp*. *A.niger* and *A.flavas* showing heavy presence, and *A. tamarii* occurring more in Otukpo area while Adikpo recorded very low level of presence of

the organisms on the seeds. The low level of presence of the organisms in Adikpo could be as a result as low relative humidity compared to other locations studied. Fungi that occur in storage include members of genera *Aspergillus* which are adapted to environments with high relative humidity and can colonize the embryo, these fungi cause discolouration and rotting, affecting viability (Santos *et al*., 2013). The presence of the organisms isolated in all the location across the state agrees with the report of Vange *et al*., (2021) who similarly reported high levels of *Aspergillus spp* when fugal population was determined in Maize grains from Benue State.

## CONCLUSION

Groundnut seeds have been shown to be infected with several pathogenic organisms accounting for low viability and lose of seed quality. It is among the reasons why this research work is been carried out to isolate and identify these disease causing organisms.

The seeds quality and seed health of groundnut have been negatively affected resulting to poor viability of seeds and increasing the health risk arising certain chemicals produced by some organisms like aflatoxins produced by *A.flavus.*

It has been discovered that the seeds quality and seed health of groundnut in Benue State is very low resulting in poor viability of seeds and loss of thousands of kilograms of seeds in the state annually. Such farmers should treat their seeds before planting.

*Rhizopus* spp and *A. flavus* are the most abundant seed-borne organisms of the seed quality and seed health of groundnut in Benue State leading to poor viability of seeds in the state annually. The high occurrence of these organisms is detrimental to both human and animal health since these organisms have the ability to produce aflatoxins which cause liver damage to livestock and man.

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