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RESEARCH ARTICLE

INFLUENCE OF ASH ON THE MORTALITY OF ADULTS OF BRUCHIDIUS ATROLINEATUS PIC. (COLEOPTERA-BRUCHINAE), IMPORTANT PEST OF COWPEA (VIGNA UNGUICULATA WALP.) IN SAHELIAN ZONE

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Abstract

Bruchidius atrolineatus (pic) (Ba) is one of the most dangerous pests seeds of cowpea (Vigna unguiculata L. Walp). The infestation begins in the fields of crops and continues in stocks where damage can be considerable in the absence of any protective measure. The importance of these damage justifies the development of appropriate, less expensive and easily applicable peasant struggles. A recommended ash test for the traditional cowpea storage was evaluated on the mortality of Bruchidius atrolineatus (PIC) in the laboratory. During this study, several experiments relating to the influence of Ash on adults of B. atrolineatus were carried out. A negative witness has been made for each case. The treatments have been made according to gender and adults. Ash is a substance that seems to be very effective with respect to B. atrolineatus because has significantly reduced its population. Treatment due to the effect of ash has recorded a mortality rate of 85% on the first day. Then treatments with variations due to the increase in the amount of ash, insects and seeds have induced a respective mortality rate of 31.5%, 43.5%, 93.75% and 100%; 62.5%, 33.16%, 30%, 24% and 17.04% and 62.5%, 43.75%, 52.5% and 50% on the 1st after treatment. It is apparent from our study that the female seems to be more resistant than males in almost all treatments. This study showed that the ash could constitute an alternative to the use of chemical insecticides in the conservation of cowpea seeds in the Sahelian zone.

Introduction:-

West Africa alone contributes to 70% of this production. In the subregion, Nigeria produces 66% of the production followed by Niger with 14% of this production, far before other countries like Burkina Faso 6%. In Niger, in terms of cowpea production occupies third after millet and sorghum and, in terms of surface, it occupies second place. The production of this legume is limited by several biotic and abiotic constraints, including attacks of pests insects, climatic hazards, seedling dates very unfavorable, pathogens, soil poverty, high temperatures, limited access. Producers in the seeds of improved varieties, the non-availability of insecticides and fertilizers at affordable prices (Sani and Bagna, 2007, Ajeigbe et al. 2010, Boukarr et al. 2016). In Sahelian countries, where the dry season lasts most of the year, the need for harvest storage is a question of survival (Mikolo et al., 2007) because it makes possible the almost permanent availability of commodities in the markets and Ensures seeds for upcoming

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campaigns (NGAMO and HANCE, 2007). However, there is a problem of conservation by the peasants because the seeds undergo huge damage caused by bruchidae beetles. Among the species of Bruchidae depredress of cowpea Bruchidius atrolineatus is one of the most harmful bruche in the Sahelian zone. The adults of this insect appears in the crops at the end of the rainy season and reproduces during the cowpea fruiting period (Alzouma et al., 1985) reported by (Moumouni da. et al., 2013). Indeed, the larval stages of these pest insects develop inside the seeds and consume the reserves contained in the cotyledons (Glitho, 1990). During cowpea storage, the initial infestation rate by the bruches is generally less than 5% (Ouedraogo, 1991, Sanon et al., 2005). This rate goes to 30% after 1 month and then 80% to 100% in the space of 5 to 6 months of storage if no control measures are undertaken (Glitho, 1990, Seck et al., 1992, Ouedraogo et al ., 1996, Sanon et al., 1998) reported by (Ad Moumouni et al., 2013).Several methods are used in the fight against cowpea pests, among which the use of chemical pesticides that has always been privileged (Nasie et al., 2009). In addition the chemicals have adverse environmental consequences, among other things, by toxicity in the trophy chain and human health (Guitart et al., 2010, Schecter et al. 2010) as well as pollution of surface and underground water (Hela et al., 2005, Andrade and Stigter, 2009). In an attempt to respond to these questions, some more environmentally friendly and reassuring health methods, such as biological control, herbal medicine, the traditional and other method have been revisited. The current urgency is to find an alternative for conventional use, particularly in food premises. It is in this context that many researchers test the possibilities of uses of natural substances considered effective, less toxic and less polluting than synthetic insecticides (REGNAULT-ROGER et al., 2002, Doumma et al., 2011). The use of natural substances as biopesticides, such as ash, has also been the subject of the numerous investigations in order to explore and assess their biological activity against the main insects pests stored seeds (Ahmed et al., 1999, Kellouche et al., 2004, Bamaiyi et al., 2006, Kellouche et al., 2010; Abdoul Habou et al., 2014). This study returns in this same logic and deals with the effect of the center on adults of B. atrolineatus.

Methodology of the study:-

Mother strains of adults used

The first strain of adults used in the different experiences come from pods harvested with producers in Tahoua. The cloves of the cowpea once harvested were brought to the laboratory and let in incubation until the emergence of adults that will be used for mass livestock.

Breeding en masse

Adults of *B. atrolineatus* come from seed samples or infested pods naturally and taken from the producers' fields. These samples are first stored in the bags and brought back to the laboratory for emergence monitoring. After emergence, the seeds are sifted and adults of B. atrolineatus obtained are introduced into boxes of cylindrical and parallelepipestic forms containing about 700 to 800 healthy seeds of cowpea of variety KVX. One week later, insects are removed and the contaminated seeds are left in incubation until the emergence of adults. At emergence, the contents of the box is sift to eliminate adults. Twenty-four hours (24h) after, the contents of the sampled box the day before is sumbed again to get older adults at most 24 hours. These are these adults who are used for experimentation. The mass breeding is carried out at the average temperature of 35 ° C and an average relative humidity of 15%.

Conducting different experiences

Study of the influence of the same amount of ash on adults of *B. atrolineatus*

The experience involves putting, in the same box, 3g of the center in the presence of a single couple of B. atrolineatus and 10 healthy ducts, for four days. The experience is repeated 10 times. Every day old adults are counted and at the end the adult mortality rate has been determined. Negative witnesses have been made.

Study of the variation of the quantity of ash on adults of *B. atrolineatus*

A variable number of the amount of the center (2g, 4g, 6g, 8g and 10g) is set in the presence of two couples and 10 healthy seeds. The experiment is repeated four times in each case. Every day old adults are counted and at the end the adult mortality rate has been determined. For each amount of ash, negative controls have been done.

Effect of the same amount of ash on the variation in the number of adults of *B. atrolineatus*

A variable number of couples (1; 3; 5, 9 and 11) is set in the presence of three grams (3G) of the ash and 10 healthy seeds. In each case, the experiment is repeated four times. Every day old adults are counted and at the end the adult mortality rate has been determined. For each amount of ash, negative controls have been done.

Effect of the same amount of ash on the variation in the number of seeds

A variable number of seeds (5; 10; 15 and 20) is set in the presence of three grams (3G) of the ash and 2 couples of Bruchidius atrolineatus. The experiment is repeated four times in each case. Every day adults are counted and at the end the rate of mortalities of adults has been determined. For each amount of ash, negative controls have been done.

Effect of ash on the increase in the number of couples of B. atrolineatus and seeds

In the same box 5G of the ash is put in the presence of five couples and 20 healthy seeds. The experience is repeated 4 times. A negative witness is realized. Every day adults words are counted and at the end the rate of adult mortalities has been determined. For each amount of ash, negative controls have been done.

Parameters studied

At the end of the experiments carried out, the following parameters are determined:

1. the daily mortality of adults of *B. atrolineatus* for each treatment;
2. The mortality rate: which is the percentage of dead insects a day compared to the total numbers of insects introduced to treatment for each experiment.

Data analysis and processing

The data collected were entered in a data model under the 2013 version Software. Then, the data submits a variance analysis (ANNOVA) Factorial plan under Staview. The daily averages of the mortalities of adults of B. atrolineatus were therefore determined. The comparison of the two to two averages is carried out by the smallest significant difference at the 5% threshold (Fischer test, p = 0.05).

Result:-

Effect of the ash on BA mortality

Depending on adults

The result of Figure 1 shows the evolution of adult mortality according to the day. The treatment recorded a mortality rate of 85% on the first day and a maximum of 100% on the 2nd days after treatment (JAT). With regard to the witness a mortality of 25% was observed only on the 3rd days after treatment (JAT) and a maximum of 100% on the 5th day after treatment.

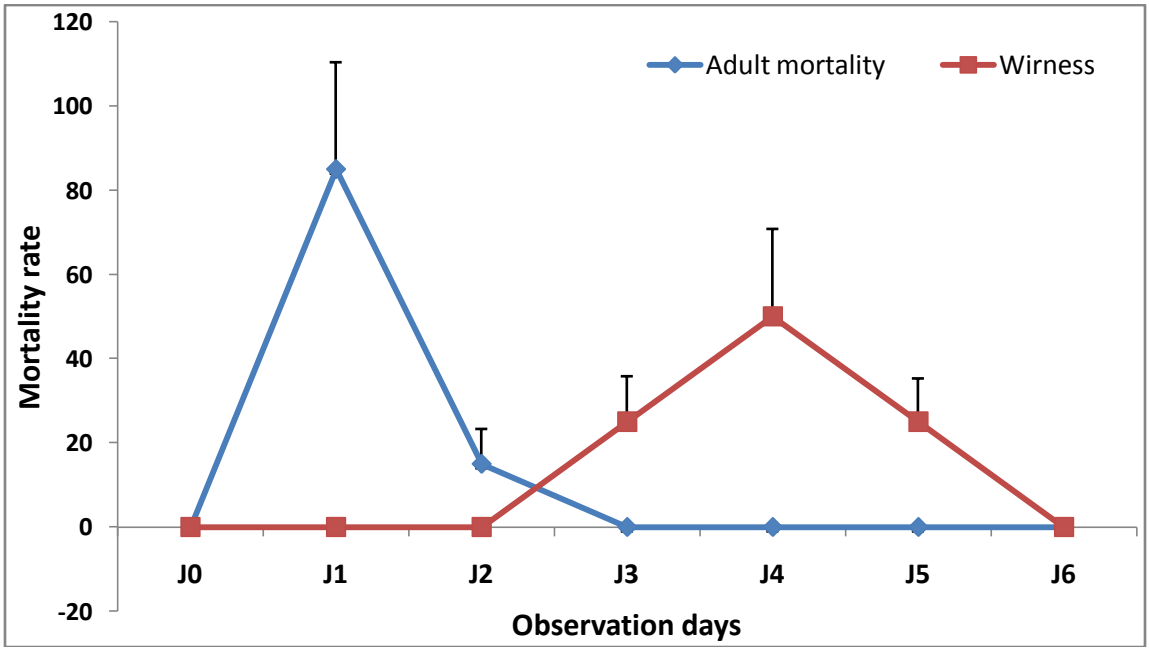

Figure 1:- Follow-up of daily mortality according to treatment.

Depending on sex

The results of Figure 2 show the evolution of B. atrolineatus mortality depending on sex. The treatment recorded a mortality rate of 90% in males and 80% in females on the 1st day after treatment and a maximum of 100% at 2nd

days after treatment (JAT) for all sexes. As for witness, an absence mortality was observed in 2nd days after treatment (JAT). From the 3rd day a 25% mortality was recorded and 100% at the 3rd days after treatment (JAT).

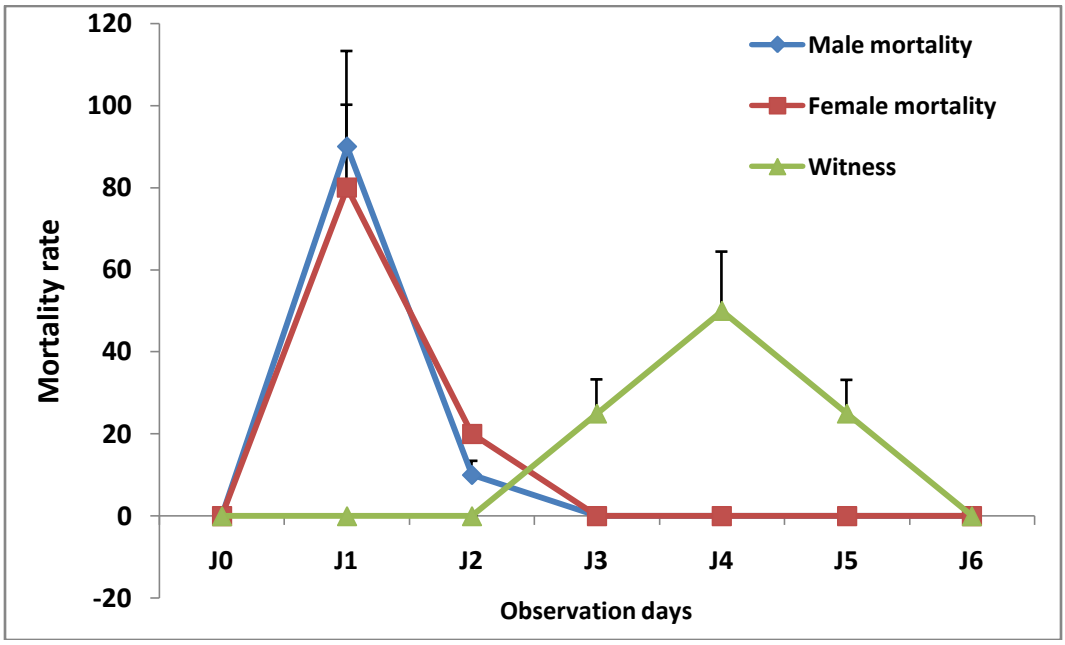

Figure 2:- Daily Mortality Depending on sex.

Effect of increase of the quantity of the ash on the mortality of *B. atrolineatus*

The results of figure 3 indicate that all the doses tested significantly reduce the life of Bruchidius atrolineatus (PIC) compared to the control. Treatment with a 1gram, 3grams, 5grams and 7grams of ash a respective rate of mortalities of 31.5%, 43.5%, 93.75% and 100% were observed on the 1st days after treatment (JAT) and a maximum of 100% at 2nd day after treatment with 5g. Then with a 1G and 3G total mortality was observed in the 4th days after treatment (JAT). With regard to the witness No mortality was recorded in the 2nd days after treatment (JAT) and 3rd days after treatment (JAT) a 25% mortality rate was observed.

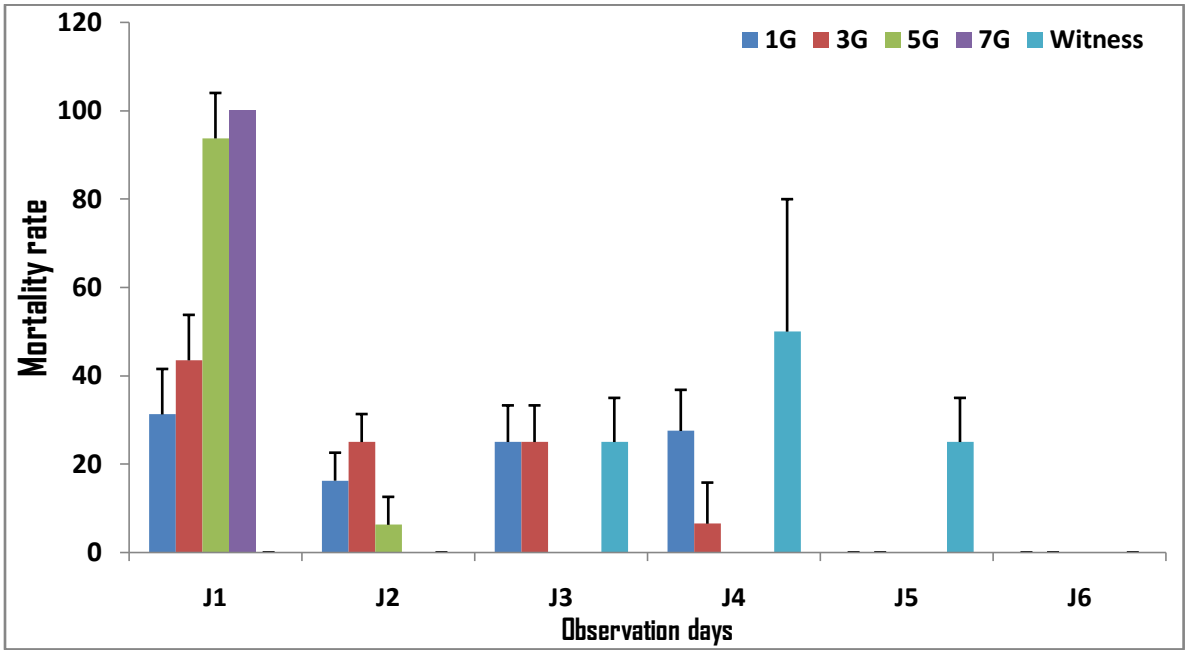

Figure 3:- Adult mortality due to variation in the amount of ash.

Effect of increased insects on *B. atrolineatus* mortality in the presence of ash

The results of Figure 4 obtained show that recorded mortality decreases with increased insects. The treatment in the presence of a couple, 3 couples, 5 couples, 9 couples and 11 couples a rate of the respective mortalities of 62.5%, 33.16%, 30%, 24% and 17.04% were recorded at 1st days after treatment (JAT). Then a 100% mortality rate was observed for each case after: 2nd JAT (1 couple), 3rd JAT (3 pairs), 4th JAT (5 couples and 9 couples) and 5th JAT (11 couples). For the witness, a 30% mortality rate was recorded in the 3rd JAT.

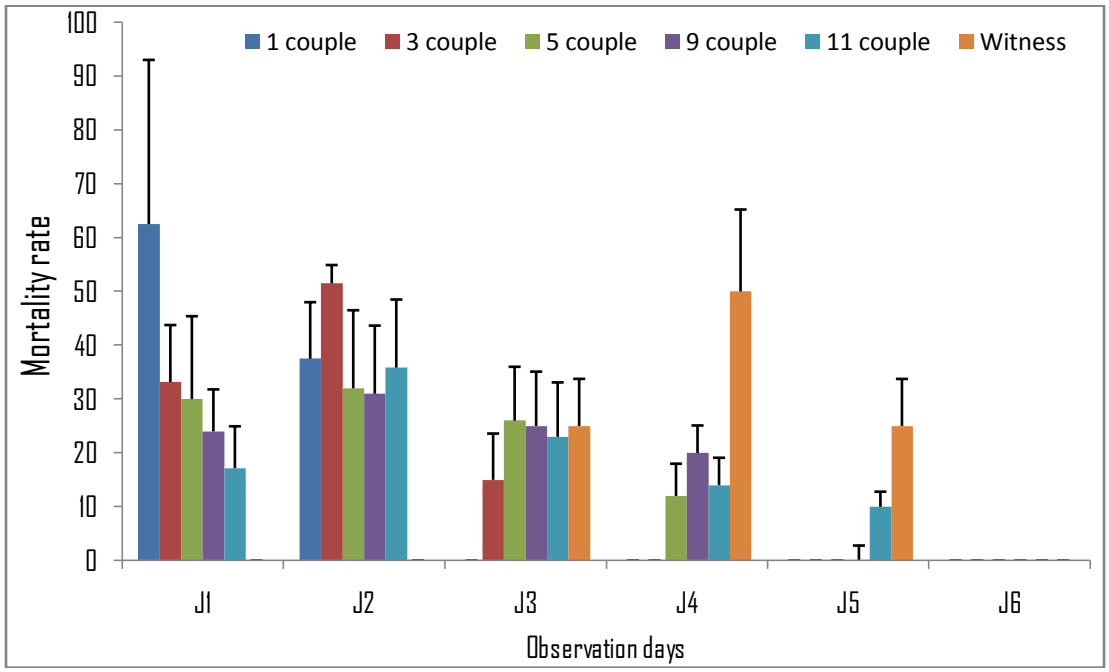

Figure 4:- Adult mortality due to the variation of insects.

Effect of increased seeds on *B. atrolineatus* mortality in the presence of ash

The results of Figure 5 show that the mortality of *Bruchidius atrolineatus* (peak) decreases as the quantity of seeds increases. The treatment with 5 seeds, 10 seeds, 15 seeds and 20 seeds recorded a respective mortal rate of 62.5%, 43.75%, 52.5% and 50% on the 1st JAT. Then a 100% mortality rate was observed for each case after: 2nd JAT in the treatment with 5 seeds and 10 seeds, 3rd days after treatment (JAT) in the treatment with 15 seeds and finally 4th JAT with 20 seeds. For the witness, a 25% mortality rate has been recorded and 100% mortality on the 6th day after treatment.

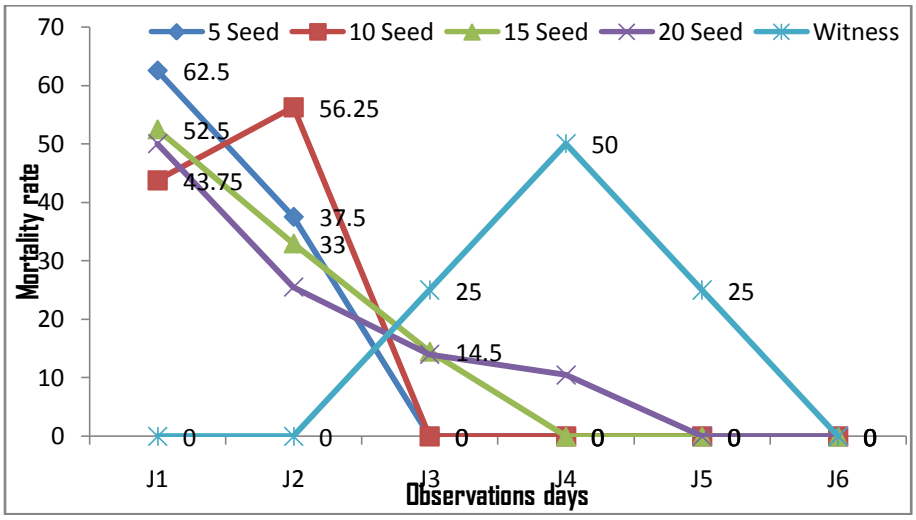

Figure 5:- Adult mortality due to the variation of seeds.

Discussion:-

The results of this study have shown that ash has a very interesting insecticide activity against *Bruchidius atrolineatus* at different doses tested. Most of the studies that have been devoted to *B. atrolineatus* have been mostly on its biology and the dynamics of its populations both in the field and in storage structures (Doumma et *al.*, 2006 ...). Very few studies have concerned its morphological characteristics (Moumouni DA et *al.*, 2018). To our knowledge, this study seems to be the first bearing the use of the ash on the adults of *B. atrolineatus*. The results obtained from our study have shown that ash has a very interesting insecticide activity against *Bruchidius atrolineatus* (PIC) at all doses tested.

Indeed the follow-up of daily mortality notes that many of the dead insects have been observed in the processed lots than the control lots. The mortality observed by 90% in the male and 80% in the female is 85% in adults on the 1st day could be explained by the fact that the insects completely breathe into the ash. These results are in accordance with those of Otitodum et *al.* (2017) who obtained 91.1% mortality for *Sitophilus Oryzae* when wheat is treated with rice ball ash.

The mortalities observed due to the increase in the amount of ash at various doses of 1g, 3g, 5g and 7g have induced 31.5%, 43.5%, respectively, 93.75% and 100% from the first day After treatment could be explained by the fact that the higher the dose, the more efficiency increases. Also, if the amount of the ash increases the insects will not have the possibility to go up and survive, because the dust of the ash prevents breathing and mouth the stigma. This efficiency has been confirmed by Tamgno et al. (2018) on the insects pests of sorghum and corn where this powder has considerably reduced its populations with the use of various doses 10%; 15% and 20% ash have induced 83.32 ± 4.58b%; 95 ± 8.66C% and 100 ± C% at Mortality *Sitophilus* (F = 279.95 ***; NDL = 23) against 86.25 ± 10.82b%; 100 ± 0c% and 100 ± c% at *Sitophilus Zeamais* mortality (F = 213.84 ***; NDL = 23).

62.5% observed mortality, 33.16%, 30%, 24% and 17.04% were recorded at the 1st JAT due to the respective increase of a couple, 3 couples, 5 couples, 9 couples and 11 pairs of insects could be explained by the fact that the amount of ash used was not enough to breathe all insects. According to Salibo (1982) with low-dose use insecticidal insects do not completely breathe, but the antennas and legs of these insects are fucked by dust and strength to struggle to get rid of it, they spend Many energy, which slowly contributes to the reduction of their life.

The mortality observed by 62.5%, 43.75%, 52.5% and 50% on the 1st JAT in 5 seeds, 10 seeds, seeds and 20 seeds treated with the ash, this increase in seeds could be explained by The fact that the amount of ash used was not enough to completely overwhelm all seeds while occupying the existing measurement between them. It has been observed a reduction in mortality when the seed dosage increases could be explained by the fact that, a volume of the important ash that can cover all the air pockets is necessary during storage.

The absence of the mortality observed from 1 to 2nd day in the witness could be explained by the fact that the insects that did not follow the dead treatment when they reached their duration of minimum life. The mortalities recorded at the witness of 25% in almost all treatments in the 3rd JAT only could be explained by the fact that some adults introduced during the experience are older than 24 hours, in this case their life expectancy has already reduced .

It has been found that in almost all treatments the life of males seems to be shorter than that of females. This remark has already been done by Jean Asene (1982) who reports that the male insect to life smaller in the average dose while the female behaves as in the treatment with a pellucid of ash.

Bibliographic References:-

1. **Abdoul Habou Z., Haougui A., Basso A., Adam T., Haubuge E. & Verheggen JF (2014).** Insecticidal Effect of Jatropha Curcas L. Seed Oil on Callosobuchus Maculatus and Bruchidius atrolineatus Pic (Coleoptera: Bruchidae) On Stored Cowpea Seeds Vigna Unguiculata in Niger. *African Journal of Agricultural Research, 9: 2506-2510*
2. **Ahmed A, et al. (1999)** A molecular target for viral killer toxin: TOK1 potassium channels. *Cell 99(3):283-91*
3. **AJEIGBE H., DUGJÉ I.Y. , Omoigui L.o., Ekeleme F., Kamara Ay. , 2010.** Cowpea production in West Africa: Guide to the peasant. IITA document, p. 20;

4. **Alzouma, I. 1987**. Reproduction et développement de *Bruchidius atrolineatus* Pic. (Coleoptera: Bruchidae) aux dépens des cultures de *Vigna unguiculata* L. Walp (Leguminosae: Papilionaceae) dans un agrosystème sahélien au Niger. *Thèse de Doctorat d'Etat, Univ. François-Rabelais*, Tours France, 162p.
5. **Andrad et Strigter, 2009.**Évaluation multi-méthodes de la contamination par les nitrates et les pesticides dans les eaux souterraines alluviales peu profondes en fonction du cadre hydrogéologique et de l'utilisation des terres*Gestion de l'eau agricole 96(12):1751-1765 DOI : 10.1016/j.agwat.2009.07.014*
6. **Boukar O, Fatokun CA, Huynh BL, Roberts PA, Close TJ. 2016.** Genomic tools in cowpea breeding programs: status and perspectives. Frontiers in *Plant Science*, 757(7): 1-13. DOI: 10.3389/fpls.2016.00757
7. **Doumma A., Alzouma I., 2001.** Effects of Boscia Senegalensis (Pers) Lam. Exported. (Capparaceae) on the evolution of bruck populations in traditional cowpea storage systems (Vigna Unguiculata L. Walp) in Sahelian zone, *Tropicutura, 19 (4): 199-202;*
8. *DOUMMA, A. Liman, Ai Toudou, A. and Alzouma, I. 2006.* Behavior of 20 local cowpea varieties (V. unguiculata (L.) Walp) screw of B. atrolineatus P. and C. Maculatus F. , cowpea pests in Sahelian zone: agricultural notebooks, n ° 15; Flight. 2;
9. **Glitho, I. A. 1990.** Les Bruchidae ravageurs de *Vigna unguiculata* Walp. en zone guinéenne. Analyse de la diapause reproductrice chez les mâles de *Bruchidus atrolineatus* Pic. *Thèse de Doctorat, Université F. Rabelais*, Tours, 100 p.
10. **Guitart, T., Leon Bernardo, T., Sagalés, J., Stratmann, T., Bernués, J., Ribas de Pouplana, L. (2010).** New aminoacyl-tRNA synthetase-like protein in insecta with an essential mitochondrial function. *J. Biol. Chem. 285(49): 38157--38166.*
11. **Huignard H., I.A.Glitho, J.P.MONGE, C. REGNAULT-ROGER, 2011.** Insect pests of legume seeds, ISSN: 1773-7923;
12. **Kellouche, A. Soltani, N. et Huignard, J. 2004.** Activité de reproduction et capacité de développement de la descendance de *Callosobruchus maculatus* (Fabricius) (Coleoptera: Bruchidae) dans des graines de différents cultivars de *Vigna unguiculata* (Walp.) et de *Cicer arietinum* (L.). *International journal of tropic insects science, 24 (4) 304-310.*
13. **Moumouni AD, A. Doumma, Mr Sembène, 2015.** Influence of cowpea varieties on the biology and size of the African Bruche, *Bruchidius atrolineatus* (PIC), *cowpea pests in Sahelian zone, vol.12, ISSN 2028- 9324: pp.880-887;*
14. **Moumouni AD, A. Doumma, Mr. Sembène, 2013.** Influence of agro-ecological zones on the biological parameters of *Callobruchus maculatus* (Coleoptera-Bruchidae), pests of cowpea seed (Vigna Unguiculata L. Walp) in Niger, *int. J.Biol; Chem.sci.7 (5): 1866-1876*;
15. **Naseri B, Fathipour Y, Talebi AA. 2009.** Population density and spatial distribution pattern of *Empoasca decipiens* (Hemiptera: Cicadellidae) on different beans species. *J. Agric. Technol., 11: 239-248.*
16. **Ngamo T. S. L. & Hance T., 2007.** Diversity of food pests and alternative tropical struggle methods. *Tropicutura, 25* (4): 215-220;
17. **Ouedraogo, P. A. Sou, S. Sanon, A. Monge, J.-P. Huignard, J. Tran, B. and Credland, P. F. 1996.**Influence of temperature and relative humidity on population of *Callosobruchus maculatus* (Coleoptera: Bruchidae) and its parasitoid *Dinarmus basalis* (Pteromalidae) in two climatic zones of Burkina Faso. *Bull. Entomol. Res., 86, 695–702.*
18. **Ouedraogo, P.A. 1991.** Le déterminisme du polymorphisme imaginal chez *Callosobruchus maculatus* (Fab.) (Coleoptera: Bruchinæ). Importances des facteurs climatiques sur l'évolution des populations de ce Bruchidæ dans un système expérimental de stockage de graines de *Vigna unguiculata* (Walp.) *Thèse de Doctorat. Université de Côte d'Ivoire*, 117p.
19. **REGNAULT-ROGER C., Philogenus B.J.R. & Vincent C., 2002.** Biopesticides of vegetable origin, 2nd edition, Lavoisier, Paris. Edition: 550p;
20. **Salibo J.A., 1982.** The traditional cowpea storage in Upper Volta, study and proposal for improvement. Doctoral Thesis, University of Ouagadougou, Burkina Faso, 122p;
21. **Sani RM, Bagna A. 2007.** Adoption of improved seed s of millet and cowpea by farmers in Madarounfa district, Niger republic. *Continental Journal of Agricultural Economics*, (1): 1-6.
22. Sanon A., Sou S., Dabire C.B., Ouedraogo A.P. & HUIGNARD J. , 2005. Combinative Boscia Senegalensis Lam. (Capparaceae) Leaves and Increase and The Larval Parasitoid Dinarmus Bastalis Rondani (Hymenoptera: Pteromalidae) for Bruchids Control in Stored Cowpea. Journal of Entomology, 2 (1): 40-45;
23. **Tamgno B.R., NGAMO T., 2018.** Potentiation of the insecticide efficiency of the powders or almonds of Neemier Azardirachta A. jus by formulation with the ash of millet stems against sitophilus Zeamais chats. And Sitophilus Oryzae L., *AFR. J. Food Agric*, 18 (5): 13254-13270.