



Research Article

INFLUENCE OF AQUEOUS EXTRACTS OF NEEM (*AZADIRACHTA INDICA*) AGAINST *NOORDA BLITEALIS* (R.), A MORINGA PEST IN THE SAHELIAN ZONE

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ABSTRACT

Moringa cultivation is growing in importance in Niger. It is cultivated for its leaves eaten in the form of porridge or as a fresh vegetable. It contributes to improving the nutritional quality of the diet of Nigeriens because it is rich in trace elements (mainly calcium, iron and vitamins) and in proteins. Despite its importance; Moringa cultivation is attacked by many insect pests, drastically reducing yields when precautions are not taken. A comparative study of the efficacy of the aqueous extract made from neem seeds and the entomopathogen *Beauveria bassiana* (Beauverie) on the caterpillars of *Noorda blitealis* (R.) was carried out in the laboratory. The treatments consisted of 14 replicates each containing 10 larvae of three early stages of development. Only one treatment was carried out on leaves and caterpillars. Data was collected daily for ten days. The analysis showed that the aqueous extract of neem seeds and *B. bassiana* were comparable to the chemical pesticide with respective larval mortality rates of $90 \pm 13.87\%$ and $66.43 \pm 11.45\%$. The neem seed and *B. bassiana* treatments generated an increase in larval mortality rates of 64.29% and 87.86% respectively compared to the control. It is also noted that the control treatment recorded the highest number of pupae ($91 \pm 14.1\%$). The performance of these biopesticides on pest mortality can contribute to ecological management and their introduction as alternative methods in moringa production basins in Niger.

Keywords: Moringa, *Noorda blitealis*, Neem extract, *Beauveria bassiana*, Entomology laboratory, Maradi.

INTRODUCTION

Moringa (*Moringa oleifera*) is a plant of the Moringaceae family and is native to the Indian subcontinent (Pandey *et al.*, 2011). In Niger, it is cultivated for its leaves eaten in boiled form or as a fresh vegetable. It is produced under irrigation in market garden sites in its purest form or in association with vegetable crops such as onions, lettuce, peppers, tomatoes or squash. The main production areas are located in the regions of Niamey and Maradi. The areas devoted to it are estimated to be around 100,000 ha (USAID, 2011). Statistics on production are very poorly known because very little attention is paid to it by the national agricultural services. The production is entirely self-consumed and, to cover the needs of the population, more than 1500 t are imported from Nigeria. Moringa contributes to improving the nutritional quality of the diet

of Nigeriens because it is rich in trace elements (mainly calcium, iron and vitamins) and in proteins (Price *et al.*, 2007). Moringa cultivation despite its importance in Niger is faced with several constraints including the problem of valuing *Moringa oleifera* products (transformation of leaves and seeds); low productivity of varieties; attacks by pest insects such as termites, grasshoppers; locusts, snails and *Noorda blitealis*. The latter is responsible for the total loss of moringa crop yield (Abasse *et al.*, 2006). Faced with this damage, different methods are used. This concerns the use of synthetic chemical pesticides including DDT in the Maradi region (De Saint Sauveur & Hartout, 2001; Abasse *et al.*, 2006). The use of synthetic chemical pesticides is the most effective method but it also has harmful effects on human health and the environment, biological control, physical control, etc. According to (Gomgnimbou *et al.*, 2009), the use of pesticides is a source of health risks,

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water and soil pollution and the development of resistance in the parasites targeted by insecticide treatments. These reflections and observations have led to the promotion of biopesticides. These are compounds obtained from the organs of other plants that have insecticidal effects and not any effect on health and the environment. The aqueous extracts of neem seed kernels effectively control *M. vitrata* larval populations (Abdoulaye *et al.*, 2018; Harouna *et al.*, 2019; Jackai *et al.*, 1992). On the other hand, entomopathogens are also potential biological control agents and constitute an important component within integrated insect pest management systems (McGuire *et al.*, 2005). According to the same author, entomopathogens have been developed around the world for the control of many pests of agricultural importance. The genus *Beauveria* attacks a diverse range of insects, hence its observed efficacy on *N. blitealis* (Prior, 1992). *B. bassiana* was tested on insect pests of Cowpea (*Maruca vitrata*) where it increased the yield by 933.03 kg/ha (Mehinto *et al.*, 2014). This is the perspective of our study, the theme of which is entitled: The comparative study of biopesticides based on neem seeds and the entomopathogen against the defoliating caterpillar *Noorda blitealis*. The objective of this study to improve moringa production by reducing losses due to *N. blitealis* through the use of natural insecticides made from neem seeds and the entomopathogen, *Beauveria bassiana*.

MATERIALS AND METHODS

Management of the breeding of *Noorda blitealis*

The rearing of the pest *Noorda blitealis* was carried out at the entomology laboratory of CERRA/Maradi. *Moringa oleifera* leaves showing eggs of the pest were collected at the nursery of the Center and the hydro-agricultural development of Djirataou. These leaves were put in breeding buckets covered with mosquito net and tied with plastic thread to prevent the larvae from escaping. Moringa leaves are added to the containers every other day to ensure a food source for the caterpillars. The pupae observed during the counting are transferred to other vials. These are then placed in breeding cages until the adults emerge. The operation is repeated several times until the desired population is obtained for the conduct of the experiment.

Preparations of solutions

Neem seed solution

The aqueous neem seed extract is prepared from the neem seeds which are shelled to extract the almonds. The almonds are then crushed to obtain a fine powder which is then mixed with water and left for 24 hours after which the solution is filtered using a clean cloth or a fine mesh sieve. Then sprayed onto the culture medium, the dose prepared and used is 10g of neem seed powder to which 90 ml of water are added.

Preparation of the *Beauveria bassiana* solution

The solution has been prepared from 1g of powder from the *B. bassiana* mushroom in which 100ml of soy milk and 100ml of water are added.

Preparation of the chemical pesticide

For the preparation of the chemical pesticide solution the information given on the product has been taken into account. The solution was obtained by mixing 0.5 ml of the registered chemical pesticide "Pacha" in 100 ml of water.

Experimental apparatus

The plastic cans with a capacity of 378 ml served as the experimental unit. Inside each box were introduced 5g of moringa leaves which served as substrates for the caterpillars. The growing medium is sprayed with each of the 3 products prepared beforehand, namely the neem extract, the *B. bassiana* solution and the chemical pesticide solution. The treatments consisted of 14 replicates each containing 10 larvae of the first three stages of development. Only one treatment was carried out on leaves and caterpillars. All of the boxes are stored on a bench. Observations were made daily for 10 days for treatments. They focused on daily mortality and the number of pupae formed.

Data analysis

The data collected was entered into the Excel spreadsheet. The mean of the daily mortality as well as the standard errors of the means were calculated with this software. The ANOVA test and the SNK test were used to compare daily mortality between treatments. Analyses were performed with SPSS version 16 software.

RESULTS AND DISCUSSION

The results on the mortality of the larvae of the L1, L2 and L3 stages show that from the first to the fourth day the difference was significant for all the treatments ($F = 81.24$; $P < 0.001$) (Figure 1). Treatment with chemical pesticide was the most effective with an average mortality of $47.14 \pm 5.8\%$ recorded from the first day after treatment and total larval mortality only on the 3rd day after treatment. The chemical pesticide is followed by the treatment based on the aqueous extract of neem seeds which recorded a minimum average of $12.1 \pm 4.1\%$ on the 1st day after treatment and a maximum of $90 \pm 13.87\%$ of larvae. Dead on the 4th day after treatment (JAT). As for the treatment based on the entomopathogen *B. bassiana*, it recorded an average percentage of $6.4 \pm 2.3\%$ of dead larvae on 1st JAT and a maximum of $66.43 \pm 11.43\%$ of dead larvae on 5th JAT. As regards the control, a slight mortality was observed only on the 5th JAT (Figure 1). Figure 2 below shows the average mortalities as a function of the treatments after 10 (Ten) days.

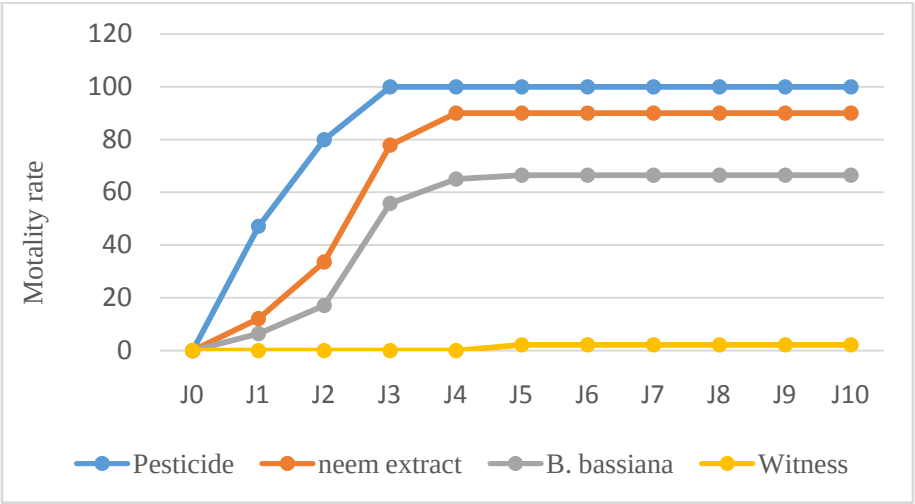


Figure 1. Daily mortality according to treatment.

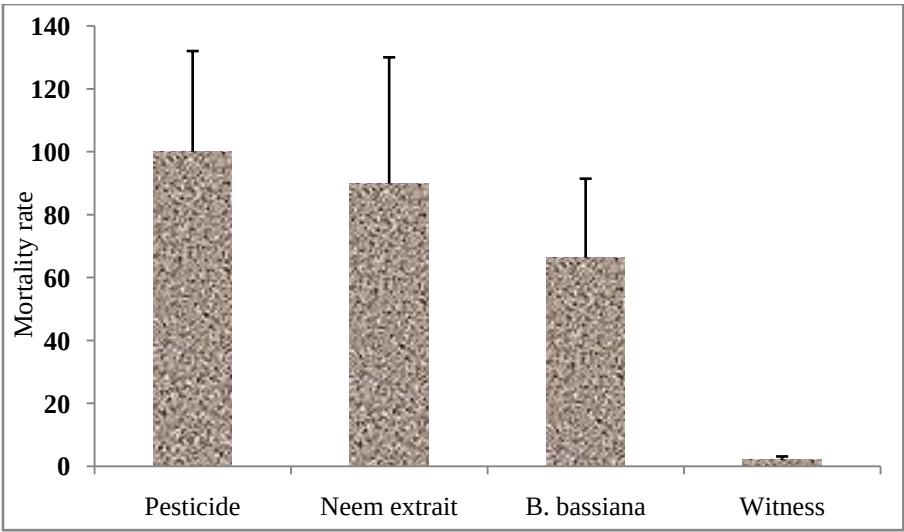


Figure 2. Cumulative mortality rate per treatment.

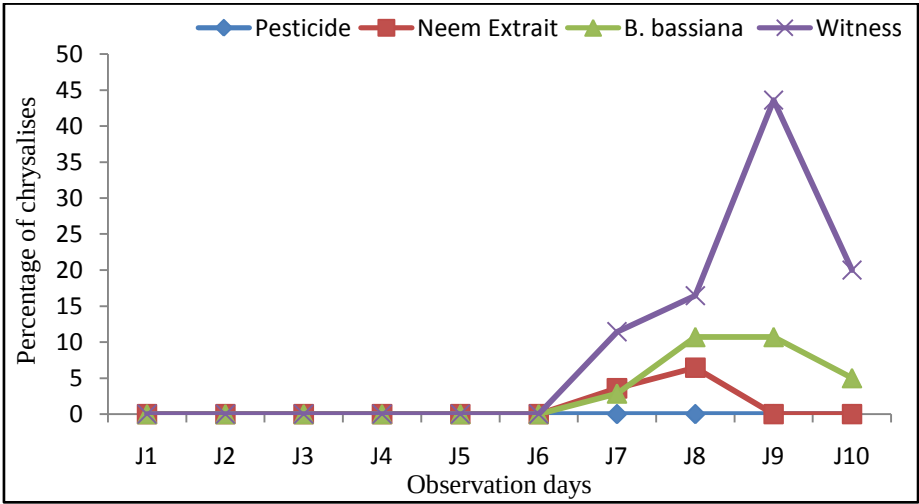


Figure 3. Evolution of chrysalis as a function of the day by treatment.

The results on the cumulative larval mortality show a significant difference for all the treatments ($F=12.73$ and $P<0.001$) (Figure 2). Neem grain treatments; *B. bassiana* and synthetic chemical pesticide were comparable with respective mortalities of $90\pm13.87\%$, $66.43\pm11.45\%$ and $100\pm16.78\%$. As for the control, he recorded an average mortality of $2.14\pm1.59\%$. The results on the number of pupae obtained for each of the treatments are listed in the table (Figure 3). An absence of pupae was observed for all treatments from the first to the sixth day after treatment. The pupae were observed from the 7th to the 8th day for

the neem seed treatment and from the 7th to the 10th for the control and *B. bassiana* treatments. No pupae were observed for the chemical pesticide treatment. Figure 4 shows the distribution of pupae according to treatment. The difference was significant for all treatments ($F=27.58$; $P<0.001$). The control treatment gave a maximum pupa of $91\pm14.1\%$ followed by the *B. bassiana* treatment with an average percentage of 29 ± 5.9 percent and the neem seed treatment which recorded an average percentage of pupae of $10\pm3.4\%$. The chemical pesticide treatment did not produce any pupae.

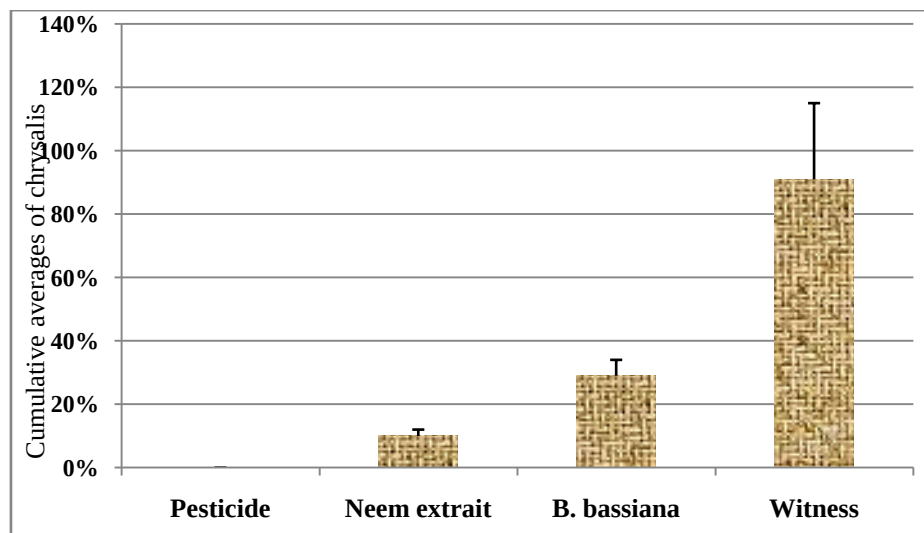


Figure 4. Cumulative mean of pupae according to treatment.

This study showed the effectiveness of sprayed pesticides on three larval stages of *Noorda blitealis*. The mortality of $47.14\pm5.8\%$ observed from the first day after treatment and that of 100% on the 3rd day after treatment in L1, L2 and L3 larvae demonstrates the rapidity of action of the synthetic chemical pesticide announced. by Deravel *et al.*, (2013). The similarity of the synthetic chemical pesticide to the control on day 4 after treatment could be explained by the fact that no mortalities were recorded in untreated caterpillars. The mortality caused by the neem seed and *B. bassiana* treatments from the first to the fourth day for the neem seed treatment and from the first to the fifth day for the *Beauveria bassiana* treatment after the treatment proves that these acted slowly on the larvae of *Noorda blitealis*. The activity of biopesticides, often dependent on climatic and environmental conditions, could explain this slowness of action, unlike their chemical counterparts (Deravel *et al.*, 2013). This effectiveness has already been confirmed by Dieudonné *et al.*, (2015) on a cowpea insect pest *Maruca vitrata* where its population was reduced by 92.16% in flowers and 95.41% in pods compared to untreated control plots. The 87.86% increase in mortality for the Neem seed treatment and 64.29% for the *B. bassiana* treatment compared to the control treatment demonstrates the effectiveness of both biopesticides. Indeed, the efficacy of *B. bassiana* probably due to Beauvaisine has already been reported by several authors (Abdel-Raheem & Abd Allah, 2011; Firouzbakht *et al.*, 2015; Halouane, 2008). The

efficacy of Neem against the caterpillars of *Noorda blitealis* in this study is certainly due to the main active compound of Neem which is *Azadirachtin*, a triterpenoid inhibitor of nutrition in insects (Redfern, 1981), regulator of their growth (Schluter *et al.*, 1985) and oviposition inhibitor (Rice *et al.*, 1985). Gahukar, (1988) confirmed the efficacy of Neem kernel extracts comparable to that of Dimethoate and Deltamethrin in the control of *Helicoverpa armigera* caterpillars on peanut plants.

CONCLUSION

The absence of mortality observed from the 5th to the 6th JAT for the neem seed treatments, a low mortality on the 5th day and none observed on the 6th day for the *Beauveria bassiana* treatment could be due to the cessation of food intake by the caterpillars which prepare to form pupae on the 7th to 10th day after treatment. The absence of pupae observed for all treatments from the first to the sixth day after treatment could be explained by the fact that the caterpillars did not reach the stage required to develop into pupae. The presence of pupae observed for the neem seed and *Beauveria bassiana* treatments could be explained by the fact that the caterpillars escaped the treatment. The absence of pupae observed in chemical pesticide treatment could be due to its speed of action. The synthetic chemical pesticide was the most effective causing an increase in

mortality of L1, L2 and L3 larvae of 97.86% compared to the control.

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