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Evaluation of the Impact of *Mesostena picca* (Kraatz), a Predator of the Bruchid, *Caryedon serratus* (Olivier) on Stored Groundnut and Tamarind

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ABSTRACT

The impact of *Mesostena picca* (Kraatz), a predator of the bruchid, *Caryedon serratus* (Olivier) on stored groundnut and tamarind was evaluated in the Laboratory of the Department of Crop Protection, Modibbo Adama University of Technology, Yola. *Caryedon serratus* (Olivier) is one of the major insect pests of groundnut and tamarind. Infestation results in characteristic round holes which causes qualitative and quantitative losses. Considering the limitations of conventional insecticides, there is a need for an alternative method of control. In this study, a non-chemical means of control for both consumption and sowing was sought. Groundnut and tamarind seeds were treated with the bio- agent, *Mesotena picca* Kraatz. The bruchid infestation was significantly reduced in the treated seeds compared to the control. The least number of eggs laid and the least mean percentage damaged seeds was obtained in chemical treated seeds in both stored products (67.00 and 64.33; 6.00 and 4.67) significantly followed by the bio-agent treated seeds (93.33 and 92.00; 32.00 and 31.00) and the highest was recorded in the untreated seeds (303.67 and 301.33; 90.00 and 85.33). The result also shows that, the highest mean percentage mortality, least mean percentage adults emerged and the least mean percentage weight loss in both stored products were observed in chemical treated seeds (97.23 and 95.33; 0.67 and 0.70; 3.67 and 3.33) significantly followed by the bio-agent treated seeds (86.27 and 86.17; 3.67 and 3.67) respectively. It was observed that, in the presence of the bio- agent, the bruchids could not freely feed on the stored products compared to the control. This reduces the extent of damage on the stored products.

KEYWORDS: Evaluation, Loss, Bio-agent, *Mesostena, Caryedon,* Groundnut, Tamarind.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important source of protein for human and dietary oil for most Nigerians (Musa *et al*., 2009). Because of the unusually high nutritional value of the seeds and their pleasant flavour, groundnuts are one of the most important food crops in the tropics and sub-tropics (Orr, 1972). Groundnut is a premier oil seed crop and it holds 34% share of the total oil seed area (24 million hectare) and contributes nearly 40% of the total oil seed production (20 million tons) (Mamta *et al.,* 2010). Groundnut seed contains 44-56% oil and 22-30% protein on a dry matter basis and is a rich source of minerals (P, Ca, Mg, K) and vitamins (E, K, B group) (Savage and Keenan, 1994). The crop also serves as a raw material for some food industries and also as feed concentrate for livestock (Oaya *et al.,* 2013).

Tamarind (*Tamarindus indica* L.) from the Arabic ward tamar is a tree in the family fabacea (Hooker, 1991). There are commercial plantations of tamarind in Brazil, India and Central America (Malton, 1987). In India, the tamarind seeds are processed into powder used for sizing and finishing cotton and jute which is certified as 30% efficient and more economical than the cornstarch (Dalton, 1991). In Africa, tamarind has the potential to improve the nutritional status of the people, boost food security and support sustainable land care (Folsberg, 1993). In Nigeria, the seeds are processed and made into "dawa dawa" (a local sweetener) and the soaked pulp used as thickening in groundnut and rice or cereal pudding commonly known as "kunun geda" (Dalton, 1991).

Groundnut and tamarind are susceptible to insect pest infestation throughout their growing stages and in store especially the groundnut seed beetle, *Caryedon serratus* (Olivier) though the degree of damage varies from one area to the other (Hooker, 1993). The adults are short-lived and display concealment character remaining hidden most of the time but emerging for purposes of mating, oviposition and the exposure period (Musa *et al.,* 2009). To control the groundnut bruchids, various methods of control have been used by farmers and researchers have developed some effective control measures. These methods includes; air-tight control, use of botanicals, physical control and invert or inert materials (Adebowale *et al.,* 2006; Adedire and Lajide, 2000; Oaya *et al.*2011; 2013).

Conventional insecticides and fumigants appears to be the most efficient control method but it is associated with adverse health hazards to humans and livestock and pose high risk to the environment (Oaya *et al*., 2013; Malgwi *et al.,* 2011; Jadhau and Jadhau, 2006).

In view of the aforementioned, a search for natural enemy based control measures which are eco-friendly and save to the environment is on-going.

Mesostena pica (Kraatz) [Coleoptera: Tenebrionedae] is a potential anti- feedant candidate. It was reported that, in the presence of the biological agent, oviposition, egg hatching feeding and the multiplication of the bruchid *C.*

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serratus (Olivier) is considerably suppressed (Oaya *et al.,* 2013).

MATERIALS AND METHODS

Location of the Study Area

The experiment was carried out in the Laboratory of the Department of Crop Protection, Moddibo Adama University of Technology, Yola. It is located within longitude 9° 14" North and latitude 12 13" East of the equator in the Northern Guinea Savannah agro-ecological zone of Nigeria (Adebayo, 1999).

Source of Insect Population

The insects used for the establishment of colony of *Caryedon serratus* (Olivier) was collected from a batch of infested groundnut and tamarind seeds purchased at the Jimeta main market. Bruchid were reared or cultured in a 2-L Kliner jar covered with muslin cloth to prevent the entry and escaping of insects and also to allow proper air circulation. Insect rearing was carried out at an ambient temperature of 29-33° and relative humidity of 54-56%. One day old bruchids were obtained by sifting the stock culture a day before the experiment.

The Bio-Agent

The bio-agent *Mesostena picca* (Kraatz) [Coleoptera: Tenebrionede] was identified at the Department of Crop Protection, Amadu Bello University, Zaria/Institute for Agricultural Research, Insect museum. The bio-agent was obtained in Song and Michika Local Government Areas where it was reported to be found.

Impact Test

Five pairs of freshly emerged adults of *Caryedon serratus* (Olivier) (0-24hrs) were introduced into containers containing 100grs of clean groundnut and tamarind seeds. Five unsexed adults of *Mesostena picca* (Kraatz) were also introduced into the various containers already containing the stored products and the test insects. The containers were covered with muslin cloth to prevent suffocation and entry/exit of insects. The initial weight of the stored products was taken and the moisture content was 11-12%.

Triplicate samples were prepared for each treatment and the control. The treatments were arranged on the Laboratory table at a room temperature of 35-37^{0c} and relative humidity of 45-48%.

The experimental set up was left undisturbed for three months to ascertain the impact of the bio-agent on the bruchid's ability to feed on the stored products. Results on the damaged and undamaged seeds, number of eggs laid, mortality count, adult emergence, and seed weight loss expressed in percentage were evaluated.

Statistical Analysis

Data obtained from the investigation were subjected to analysis of variance (ANOVA) appropriate to Completely Randomized Design according to Gomez and Gomez (1984). The treatment means were separated using the Student Newman- Keuls (SNK) at P≤0.05 level of probability.

RESULTS

The results as presented on Table 1 shows that the highest mean percentage damaged seeds for both groundnut and tamarind were observed in the controls (90.00 and 85.33) significantly followed by the stored products treated with the bio-agent *Mesostena picca* (Kraatz) (32.00 and 31.00) and the least was recorded in chemical treated seeds (6.00 and 4.67) respectively at P≤0.05 using the Student Newman Keuls test. On the other hand, the highest mean percentage damaged seeds for both groundnut and tamarind as also shown on Table 1 were observed in seeds treated chemical (94.00 and 95.33) significantly followed by bio-agent treated (*M. picca* Kraatz) seeds (68.00 and 69.00) and the least were emerged (18.33 and 18.00), significantly followed by the bio-agent (*M. picca* Kraatz) treated seeds (3.67 and 3.67) and the least were recorded in chemical treated seeds for both stored products (0.67 and 0.70) respectively at P≤0.05 using the Student Newman Keuls test. There was significant difference among the treatments especially when compared to the controls.

Table 1: Mean Percentage Damaged and Undamaged Seeds of Groundnut and Tamarind Treated against *Caryedon serratus* (Olivier)

Treatments	Mean percentage Groundnut	damaged seeds Tamarind	Mean percentage Groundnut	undamaged seeds Tamarind
Mesostena pica	32.00^{b}	31.00^{b}	68.00^{b}	69.00^{b}
Chemical	6.00^{c}	4.67^{c}	4.00^{a}	95.33^{a}
Control	90.00^{a}	85.33^{a}	10.00^{c}	14.67^{c}
Mean	42.67	40.33	57.33	59.67

Mean followed by the same letter vertically is not significantly different at P≤0.05 by Student Newman Keuls test.

Table 2 shows that, the highest mean percentage mortality for both groundnut and tamarind were recorded in chemical treated seeds (97.33 and 95.33) followed by the bio-agent *(M. picca* Kraatz) treated seeds (86.27 and 86.17) and the least were observed in the controls (20.80 and 17.47) respectively. Controls for both stored products as presented also in Table 2, gave the highest mean number of adults

Table 2: Mean Percentage Mortality and Mean Percentage Adult Emergence of Groundnut and Tamarind Treated against *Caryedon serratus* (Olivier)

Treatments	Mean percentage Groundnut	Mortality Tamarind	Mean percentage Groundnut	Adult emerged Tamarind
Mesostena pica	86.27^{b}	86.17^{b}	3.67^{b}	3.67^{b}
Chemical	97.23^{a}	95.33^{a}	0.67^{c}	0.70^{c}
Control	20.80^{c}	17.47^{c}	18.33^{a}	18.00^{a}
Mean	68.1	66.32	7.56	7.46

Mean followed by the same letter vertically is not significantly different at P≤0.05 by Student Newman- Keuls test.

observed in the controls (10.00 and 14.67) respectively. There was high significant difference among the treatments especially when compared to the controls.

Table 3 suggested that, the highest mean number of eggs laid for both stored products were observed in the controls (303.67 and 301.33) significantly followed by the bio-agent (*Mesostena picca* Kraatz) treated seeds (93.33 and 9200) and the least were recorded in chemical treated seeds (69.00 and 64.33) respectively.

The mean percentage weight loss of seeds as presented in Table 3 showed that, the highest were recorded in both controls (70.67 and 68.33) significantly followed by the bio-agent (*Mesostena picca* Kraatz) treated seeds (8.33 and 8.67) and the least were observed in chemical treated seeds (3.67 and 3.33) respectively at P≤ 0.05 using the Student Newman- Keuls (SNK) test. There were significant different among the treatments especially when compared to the

Table 3: Mean Number of Eggs Laid and Mean Percentage Weight Loss treated against the the Bruchid *Caryedon serratus* (Olivier)

Treatments	Mean percentage Groundnut	eggs laid Tamarind	Mean percentage Groundnut	weight loss Tamarind
Mesostena pica	86.27^{b}	86.17^{b}	3.67^{b}	3.67^{b}
Chemical	97.23^{a}	95.33^{a}	0.67^{c}	0.70^{c}
Control	20.80^{c}	17.47^{c}	18.33^{a}	18.00^{a}
Mean	68.1	66.32	7.56	7.46

Mean followed by the same letter(s) vertically is not significantly different at P?0.05 by Student Newman-Keuls test.

DISCUSSION

There is no controversy against the background that chemical method of storage is still the most effective means of control which this work has shown. This is because of its quick action or knock down effect, that is the ability to kill within a short period of time and its long time effects on the stored products (residual effects). This is consistent with Ayensu (1995), who reported that, the use of synthetic insecticide against the bruchids had considerable effect on oviposition and the bruchids respiratory system. Tremendous success has been achieved in the use of synthetic insecticide to control this notorious principal insect pest of groundnut and tamarind in store (Oaya *et al*., 2013). However, the high mammalian toxicity and ecological safety of the synthetic insecticides are of great concern to both environmentalist and researchers worldwide.

The result also shows that, there could be an alternative to comprehensive use of synthetic insecticides in controlling storage insect pests. The bio-agent *Mesostena picca* (Kraatz) is indeed a biological agent for the control of the bruchid *Caryedon serratus* (Olivier) in stored groundnut and tamarind. It was observed that, in the presence of the bio-agent, the bruchids could not freely feed on the stored products compared to the controls. This reduces the extent of damage on the stored products. Since the bio-agent is nocturnal in nature, it might have coincided with the active period of the bruchids. For both stored products, the parameters measured shows that, the bio-agent was significant in controlling the bruchids compared to the controls. The average performance of the bio-agent in some of the parameters measured was supposedly due to the slow build-up of the natural enemies to an effective level in storage. This agrees with Lale (2001), who reported that, many natural enemies attack bruchids, but before the population build-up becomes high in storage, considerable damage had already been done to the stored products by the bruchids.

CONCLUSION

The use of synthetic insecticide for the control of bruchids was effective but they are likely to cause or create health problems to humans, livestock and the environment. Their expensive nature make them unaffordable to local farmers while their technology of application require skills which may be understood by literate farmers who are few among the farming population. There is also the fear over their abuse, toxic residues, workers safety and the increasing cost. The study has shown that, the use of bio-agent as a means of insect pest control could reduce the over dependence on synthetic insecticides. It was confirmed that, in the presence of the bio-agent feeding by the bruchid was

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hampered as a result, most of them were starved to death. This means that, as long as the bio-agent exit along with the bruchid, infestation is reduced if not prevented.

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