

this study have shown that a sub-lethal dose of neem powder (0.1g) mixed with pirimiphos-methyl (0.1g)/ 20grams of cowpea seeds produced 100% adult mortality of *C. maculatus* at 24hrs post-infestation. This result further, established that there is great potential in reducing the rate of application of synthetic organic insecticides by mixing with sub-lethal doses of insecticidal plant materials or botanicals. Botanicals are usually perceived to be relatively safe and non-toxic to humans and more environment-friendly [9] and may reduce the undesirability of synthetic organics in this duration. [8]reported that an application rate of 0.4 g/20 g of *E. aromatic* and *P.guineese* powder was effective in the control of *C.maculatus* as 100% adult mortality was recorded at 48 and 72 hrs post-infestation.

In this study, neem powder singularly applied produced highly significant mortality (60%) of *C.maculatus* before being mixed with synthetic insecticides, this confirmed its potency as a pesticide plant. However, when mixed with a sub-lethal dose of 0.1g of Neem powder mixed with a low rate (0.1g) of pirimiphos-methyl/ 20 grams of cowpea seeds, the synergy produced 100% adult mortality of *C.maculatus* at 48 and 72 hrs, respectively.

Some workers, like [6], [5], and [13] had opined that a few plants in the tropical flora with confirmed biological efficacies against species of stored products insects were sufficient insecticidal to merit scientific formulation. Mixing insecticidal plant materials with synthetic organics can be regarded as a mixed formulation of insecticidal [6]. The low rate of the synthetic organic appeared to have synergized the sub-lethal dose of the botanical to produce increased toxicity to the insects. For instance, the low rate of each synthetic organic used did not cause mortality of the insects at the times of observations, but when mixed with 0.08 g and especially 0.1g of each botanical, the mortality caused to the insects was about doubled. Synergism in mixed formulations of insecticides has been reported by [7],[10], and[16] in their various research works, and the synergy triggered homologous phenomenon in insects has been used as a case study.

Homologous is a phenomenon in which a stimulating effect is induced in insects or other arthropods with a sub-lethal dose of possible combinations which causes the female to lay more viable eggs that develop into adults [2]. In this study, there appears to be the semblance of this

phenomenon when neem powder alone was applied for the control of *C.maculatus*, a significantly higher number of adult weevils, as indicated by the number of exit holes that emerged.

5. Conclusion

The result of this work has further substantiated the good potential of combining low doses of insecticidal plant powder and low doses of synthetic organic dust for effective protection of stored grains against insect infestation and arid damage. The adoption of this application rate especially in cowpea storage across the entire country will over time increase the quality and quantity to producers and decrease the environmental impact of the management of pests in crop production, storage, and a well-balanced eco-system with little or no residual effect.

6. Recommendation

The best rate of application was the treatment involving a sub-lethal dose of neem powder (0.1g) mixed with pirimiphos-methyl (0.1g)/ 20grams of cowpea seeds which produced 100% adult mortality of *C. maculatus* at 24hrs post-infestation, therefore this study recommends the above rate as the most effective to achieve desired pest control of *C.maculatus* in cowpea storage.

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