B.O.P.I : Black Pepper, Oregano and Pineapple Peel Insecticide as an Novel, Cost-Effective and Eco-friendly Fumigant to Eradicate Sitophilus oryzae

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Sitophilus oryzae, commonly known as the rice weevil, is a stored grain pest responsible for potentially destroying up to 90% of stored grain worldwide. In an effort to eradicate it, various synthetic fumigants have been utilized but often at the cost of human health and the environment. This research proposes Black pepper essential oil, Oregano essential oil and Pineapple peel oil Insecticide (B.O.P.I) as a novel, cost effective, eco-friendly and non-toxic, fumigation agent to effectively eradicate Sitophilus oryzae. B.O.P.I contains beta-caryophyllene and 3-carene from black pepper essential oil, carvacrol, thymol and beta-pinene from oregano essential oil and limonene from pineapple peel oil. These compounds were shown to inhibit AChE, agonize tyramine receptors and inhibit detoxifying enzymes. Black pepper and oregano essential oil are extracted via hydrodistillation and pineapple peel oil was extracted by maceration. The major chemical constituents are tested in silico via Protox 3.0 for toxicity. Results showed that all chemical constituents have low toxicity. Main constituents of B.O.P.I also had a higher binding affinity to AChE compared to ACh as shown by ensemble docking results. The fumigant toxicity bioassays of seven different treatments and 2 control treatments were performed. Fumigant treatments are introduced to 20 Sitophilus oryzae at concentrations ranging from 167µl/L of air to 830µl/L of air. The LC50 and LC90 were found to be 27.235µl/L of air and 144.475µl/L of air. 2-way ANOVA was conducted against types of treatment and concentration [$F(6,24)=6.315$, $p<0.001$]. B.O.P.I is an effective fumigant that is able to eradicate Sitophilus oryzae in stored grain, while safeguarding the environment and being non-toxic.