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INSECTICIDAL ACTIVITY OF SELECTED WEEDS EXTRACT FOR CONTROLLING RICE WEEVIL, *Sitophilus oryzae*

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ABSTRACT

Rice, *Oryza sativa* (Linn.), is a valuable grain that has become a staple food for a large part of the global population. It is widely consumed in Malaysia and is persistently infected with a variety of insect pests during the storage period. The rice weevil, *Sitophilus oryzae*, is the major pest of stored product insects. For the control of insects, synthetic pesticides have been used, which have detrimental effects on the environment and health. Therefore, botanical pesticides from weeds are currently being suggested as an alternative to synthetic insecticides. The present study was conducted to evaluate the insecticidal activities of selected weed extracts against *S. oryzae*, using *M. malabatrichum, C. hirta, C. odorata*, and *A. conyzoides* extracts. Different application techniques were used to determine the effective active extracts for controlling *S. oryzae*, and the phytochemical compounds of the insecticidal activity in the extracts needed to be determined. Crude extracts were extracted using the maceration technique. Mortality tests of contact toxicity, fumigation tests with and without rice grain, and antifeedant tests were conducted using Petri dishes, fumigation chambers, and plastic containers, respectively. A repellency test was conducted using an area preference bioassay. To find plant compounds that can kill insects, phytochemical screening, total phenolic content, total flavonoid content, GCMS, and HPLC were all used. The highest mortality for the contact toxicity test were from *M. malabatrichum, C. hirta* (ethanol extract), and *C. odorata, A. conyzoides* (acetone extract), with 100% mortality. The fumigant toxicity tests were for *C. hirta* and *C. odorata* ethanol and acetone extracts, respectively, with 100% mortality. The highest mortality for the fumigant toxicity test without rice grain was from all the samples with 100% mortality except *C. odorata* acetone extract. *M. malabatrichum* ethanol extract had the highest antifeedant test mortality (100% mortality). The highest mortality (100%) for the repellent test was from ethanol extract (*C. odorata, A. conyzoides*) and acetone extract (*C. hirta, C. odorata*, and *A. conyzoides*). Ethanol extracts had a higher mortality percentage compared to acetone extracts. The mortality of *S. oryzae* was higher when using the method of fumigation without rice grain. *C. odorata* has good potential to be used as a botanical pesticide, with a high mortality percentage and a high repellency percentage against *S. oryzae*. It is recommended for further analysis using liquid chromatography-mass spectrometry (LCMS) to analysed active compounds of insecticidal activity, conduct field tests, and formulate *C. odorata* leaves as biopesticides in the future.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Rice (*Oryza sativa*) is the most vital and most generally consumed staple food for most of the world's population, particularly in Asia and Africa (Madhu et al., 2023). More than 60% of people worldwide eat rice as their primary food source, and it provides the body with nutrients like carbohydrates, protein, fibre, vitamins, and minerals (Ashamo, 2005; Akhtar et al., 2015; Da Silva Costa et al., 2016; Babendreier et al., 2020). All socioeconomic strata of Malaysians consume rice, an essential staple food crop in Malaysia. In 2016, the average annual rice consumption per person was 80 kilograms. According to Omar et al. (2019), this translates to over 2.7 metric tonnes (mt) of rice consumed by Malaysians in 2016 at an average monthly cost of RM44 per family. The Department of Statistics Malaysia (DOSM) (2018) reports that from 2014 to 2017, Malaysia's rice cultivation area increased, reaching a record high of 688,770 hectares (ha) in 2016. However, poor weather, pests, and diseases have all contributed to a drop in rice production (USDA, 2018).

Insect pests were partly responsible for losses of grains (wheat, maize, rice, and soybean) in pre-harvest, post-harvest, and storage, which totalled up to 1.741 metric tonnes (Mesterházy et al., 2020). For example, a report revealed that up to 0.557 metric tonnes of rice were lost in Malaysia from post-harvest losses (PHL) activities (Nodin et al., 2021). In addition, an insect that disperses into stored grain can stimulate physiological processes, such as the ageing of the grain, and decline germination potential, making it unsuitable for planting (Cruz et al., 2016). According to reports from Padiberas Nasional Berhad (BERNAS), the rice weevil, commonly referred to as Bubuk or Kutu Beras in Malaysia, is responsible for almost 50% of the damage to the rice storage. The rice weevil, *Sitophilus oryzae* L. (Coleoptera: Curculionidae), is one of the most disruptive and severe major pests of stored grains in the world (Thangaraj et al., 2019). It feeds on a variety of cereals, with wheat and rice being two of the most