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EFFICACY OF *Carica papaya, Manihot esculenta* Crantz AND *Artocarpus integer* EXTRACTS AS POTENTIAL BOTANICAL PESTICIDES FOR CONTROLLING GOLDEN APPLE SNAIL, *Pomacea canaliculata*

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ABSTRACT

Golden apple snail (GAS), *Pomacea canaliculata* is an invasive alien snails species which seriously affects rice cultivation in Asia. These freshwater snail damages devourly by completely eliminating the young leaves and stems of rice seedling from plant bases which resulting in the death of the rice seedlings. Farmers mostly rely on commercial available synthetic molluscicides for immediate control of GAS, without considering the toxic hazards towards themselves and non-target organisms. Botanical pesticides are an excellent alternative to synthetic pesticides as a means to reduce negative impacts to human health and the environment. Botanical pesticides are naturally occurring derived from chemical extracted from potential plants. Potential plants of secondary metabolites have role to protect themselves from pests and diseases due to its chemical compound, which caused mortality to pest, repellency and insect growth regulatory activities. The objective of this research is to quantify an active compound from selected indigenous plants (*Carica papaya*, *Manihot esculenta* and *Artocarpus integer*) and to impetus a potential plant extracts from selected indigenous plants using bioassay and antifeedants test that responsible in controlling GAS. Phytochemical screening using UV spectrophotometric analysis methods were used to detect the active compound in selected plants. From obtained UV spectrophotometric results, total saponins content (12,713 ppm) and total phenolic acid (10,772 ppm) were highly found in methanol extractions of *Carica papaya*. While, total flavonoids content (7,360 ppm) was highly found in methanol extractions of *Artocarpus integer*. Mortality and antifeedants test were conducted with five different concentrations ranging from 10,000 to 50,000 ppm. The obtain results from bioassay test shows that methanol extracts of *Carica papaya* gave a higher mortality towards GAS within 96 hours with LC_{50} (18,511 ppm), followed in order by methanol extracts of *Manihot esculenta* (19,517 ppm) and methanol extracts *Artocarpus integer* (25,715 ppm). High antifeedants activity (AI) of GAS was imposed by methanol extracts of *Carica papaya* with highest weight loss of GAS (13.91 %) compared with other extracts. While, lowest feeding deterrent index (FDI) was also imposed by methanol extracts of *Carica papaya* with lowest weight loss of paddy seedlings (42.11%). Mortality of GAS was increased with higher concentrations of plant extracts and exposure time from 24 hours to 96 hours. This research showed that methanol extracts of *Carica papaya* have higher potential to be used as botanical molluscicides and an as repellent agents for controlling GAS. Therefore, further analyses should be carried out to formulate the botanical molluscicides based from leaves of *Carica papaya* and test for field testing.

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CHAPTER ONE
INTRODUCTION

1.1 Background of Study

Rice is the most important staple food sources in Malaysia and is able to influence livelihoods and economic of human population. Due to that, based on the strategic importance of food commodity, rice has been put as the top priority as predominant food. Apart from being food sources, paddy also provides the livelihood to 172, 000 to the paddy farmers in Malaysia (Ramli et al., 2012). Nurul et al., (2012) stated that as to encourage paddy farmers to increase their yield, Malaysia government has implemented a food security policy for the rice industry towards self-sufficiency by 2020. It is the government policy to ensure that the country's rice output is maintained at 65 % of current need and increased to 90 % by 2020 (Yahaya et al., 2017).

Keni and Latip, (2013) as cited in Murad et al., (2008) stated that Malaysia government has sustained a self-sufficiency food security program targeting on paddy including restriction of import quota, fertilizers subsidies and price supports. Insufficient production of rice in Malaysia is due to many factors which include competition of weeds resulting insufficient nutrient, sunlight and water for growing, besides infection of diseases, birds and rodents as well as infestations from pests. As eloquently stated by Hajjar et al., (2017a) and Massaguni and Latip, (2012), major problem which is decreasing the rice yields in Malaysia had been identified due to the uncontrolled of major pest infestations, golden apple snail (GAS), *Pomacea canaliculata*. Since 2002, GAS has infested almost 20,000 hectares of rice growing areas and has threatened the livelihoods of farmers.

Pomacea canaliculata, golden apple snail (GAS) has been classified as 100 of the world worst invasive alien species (GISD, 2016). This invasive freshwater snail is natives from South America and Northern Argentina (Du et al., 2007; Joshi, 2005). GAS was first seen in Keningau, Sabah, Malaysia in 1992 as GAS was reported infesting in rice field and it caused huges paddy field's damage (Massaguni and Latip, 2012; Teo, 1999b). GAS has become a major of rice pest due to its ability to grow and make an adaptation in high water level and voracious in feeding behaviors resulted in