UNIVERSITI TEKNOLOGI MARA

PHYTOCHEMICAL COMPOSITION AND MOLLUSCICIDAL EFFECTS OF ESSENTIAL OIL FROM SELECTED PLANTS TOWARDS *Pomacea canaliculata*

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ABSTRACT

Rice is an importance staple food in Asia. However, the rice production is insufficient because of major infestation by golden apple snail (GAS), *Pomacea canaliculata*. Mollucicides is the common chemical control method to control GAS which practiced by farmers because of their effectiveness and rapid effect. However, chemical molluscicides has caused hazard effect to applicators and environments. The botanical pesticide has become one of the best alternatives to reduce dependency on chemical pesticide in controlling GAS in rice fields. The characteristics of botanical pesticide was naturally degraded, different mode of action on target pest and no toxic residue after application make it the best alternative for GAS control. There were seven selected plants were studied for their effectiveness as botanical pesticides for controlling GAS to reduce dependency on chemical pesticide which are *Cymbopogon citratus* (lemongrass), *Pandanus amaryllifolius* (Pandan), *Piper betle* L. (betel), *Curcuma longa* (turmeric), *Centella asiatica* (Pennywort), *Citrus aurantifolia* (key lime) and *Sauropus androgenus* (*Cekur manis*). The aims of this research are to determine the active compounds from selected essential oils, to identify mode of action of selected plant essential oils and to compare the effective mode of action from selected plant essential oils towards controlling GAS. The qualitative analysis was screen for active compounds using Thin Layer Chromatography (TLC) and Gas Chromatography Mass Spectrometry (GCMS) for analyse and quantify active compounds from selected essential oils. Bioassay and antifeedant activity test were done with six (6) different treatments and controls. Mortality data analysed for ANOVA by SAS and antifedant was calculated using Antifeedant Index (AFI). From GCMS analysis result, four essential oils resulted with highest active compounds of citral, eugenol, α-phellandrene, turmerone, and limonene, has potential as GAS control. These four plants are fresh extract of lemongrass, Betel, turmeric essential oils and commercial essential oil of key lime were proceed for bioassay and antifeedant activity test towards GAS. Based on the LC_{50} value, betel essential oil is the most effective treatment for GAS mortality followed by lemongrass essential oil. The recommended treatment concentrations for betel essential oil was 0.057g/ml. While, lemongrass essential oil 0.09g/ml could be applied for GAS control on rice fields. Antifeedant activity test showed betel essential oil as most effective antifeedant source as it resulted with the highest AFI value (40.27%) and GAS mortality (58%) after 7 days of treatment exposure. Betel essential oil also resulted with highest GAS weight loss (58%) while giving lowest paddy weight loss (19.19%). Further study using commercial essential oils should be conducted by selecting pure essential oils which are higher in quality. The study for essential oil as potential botanical pesticide should be done further, with effective methodology and formulation suitable for field test, as natural compounds have limitation in term of compound stability outside the control laboratory conditions.

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CHAPTER ONE
INTRODUCTION

1.1 Background of Study

There are over 90% of rice grown in Asia (GRiSP, 2013), a staple food for more than half of the world population, and mainly produced and consumed in Asian region (Siwar et al., 2014; Latip et al., 2015). More than 100,000 farmers in Malaysia was rely on rice production and rice-related industry. The sustainable rice production is important for food security in addressing destitution (Siwar et al., 2014). Food security policy had been implemented by the government for rice industry in order to achieve 100% self-sufficiency level (SSL) by the year 2020 which can be achieved by encouraging farmers to increase rice production (Nurul et al., 2012). Rice production is to be sustained in order to fulfil the growing population demand. In the process of improving the efficiency and sustainability in rice production, maintaining higher productivity levels for different features related to rice production is important (Najim et al., 2007).

The golden apple snail (GAS), *Pomacea canaliculata* is considered as a major rice pest in Southeast Asia. This snail has voracious appetite and attacks both young rice seedlings of transplanted and direct seeded rice (Joshi, 2005a) where they prefer to consume the base part of young rice seedling up to 15 days of transplanting (Zhao et al., 2012; Latip et al., 2018). GAS is originated from South America and was introduced to various countries in Southeast Asia and North either as aquarium pets or for food trade. In early 1980s, GAS was accidently spread extensively in Asia when GAS farming project for food supplement been rejected because poor market value for GAS (Teo, 2004; Liu et al., 2006; Massaguni and Latip, 2012; Latip et al., 2018). Therefore, GAS project was abandoned while GAS were being released into natural waterways, irrigation ditches, and invaded into rice fields (Massaguni and Latip, 2012; Latip et al., 2018). GAS was first recorded in Peninsular Malaysia around 1991 (Cowie, 2002; Howells et al., 2006; Arfan et al., 2014). In rice producing country, it has given great losses to the rice farmers when young leaves and stem of rice were attacked (Salleh et al., 2012). GAS is one of the worst invasive pests due to its inherent characteristic such