Ipomoea aquatica AND *Pelthoporum pterocarpum* EXTRACTS AS BIOPESTICIDES FOR CONTROLLING GOLDEN APPLE SNAIL, *Pomacea canaliculata*

Siti Noor Hajjar Md Latip,
Faculty of Plantation and Agrotechnology,
Universiti Teknologi MARA, 40450 Shah Alam, Selangor
noorhajar@salam.uitm.edu.my

Mohmad Nor Firdaus Bin Abrahim
Faculty of Plantation and Agrotechnology,
UniversitiTeknologi MARA, 40450 Shah Alam, Selangor
mohmadnorfirdausabrahim@yahoo.com

'Amirah Sa'aidahNafisah Othman
Faculty of Plantation and Agrotechnology,
Universiti Teknologi MARA, 40450 Shah Alam, Selangor
amirahsaaidahnafisahothman@gmail.com

ABSTRACT

In Malaysia, Pomacea canaliculata Lamark (golden apple snail, GAS) was reported as a serious pest in paddy field as it can caused severe damages by completely eliminate the young leaf and stem from plant bases which will result in the death of damaged plants. However, these chemicals were used abusively that causing environmental pollution and toxic to non- target organisms. Therefore, the new approach emphasized on environmental friendly control measures has adopted to replace the chemical control such as biopesticides. Biopesticides which extracted directly from the plants that contain chemical compound used as repellent, antifeedant and insect growth regulatory activities. The purpose of this research is to evaluate the toxicity of Ipomoea aquatica and Pelthoporum pterocarpum extracts for controlling GAS by using different solvents. The result showed that plant extracts using methanol gave highest mortality of GAS rather than using ethanol for both plants. It showed that methanol is the most effective solvent to control GAS. Probit analysis of Pelthoporum pterocarpum extracts by using methanol as solvent showed the higher toxicity level (LC_{50} = 4.683%). Based on finding, Pelthoporum pterocarpum extracts by methanol compared with Ipomoea aquatica extracts has potential as biopesticides for controlling GAS.

Key words: *Pomacea canaliculata*, Biopesticide, *Ipomoea aquatica*, *Pelthoporum pterocarpum*, Mortality

Introduction

Paddy is mainly produced and consumed in the Asian region which becomes a staple food of more than 60% of the world population. The production of paddy in Asia is insufficient due to major pest infestation which is known as golden apple snail (GAS), *Pomacea canaliculata*. GAS originated from South America which have risen the invasion and lead to significant economic damage to the cultivation of paddy in North America and also ASEAN country (Joshi, 2005). The common method used by farmers is chemical control because this method was more effective to control GAS infestation due to the chemical role itself. However, chemical pesticides gave negative impact to the non- target organisms. Thus, biopesticides are alternative way to replace the usage of chemical pesticides for controlling GAS. Biopesticides which extracted directly from the plants which about 247 families from 2500 plants have potential as biopesticides (Silva- Aguayo, 2009).The plants contain chemical compound known as secondary metabolites such as phenols, flavonoids, steroids and terpenols act as repellent, antifeedant and insect growth regulatory activities (Prakash et al., 2008). Ayoola et al. (2011) found that the extraction of *Ipomoea aquatica* has piscicidal substances could be incorporated in use control and management of *Oreochromis niolticus* (Nile Tilapia). Biswas et al. (2010) conducted an experiment by using leaves of *Pelthoporum pterocarpum* against paracetamol prompted severe liver damage in mice. The purpose of this study is to evaluate the toxicity of *Ipomoea aquatica* and *Pelthoporum pterocarpum* extracts for controlling GAS by using different solvents.

Methodology

The test organisms (GAS) were collected from paddy field of Federal Land Consolidation and Rehabilitation Authority (FELCRA), assorted and measured by shell height. The procedure of soxhlet extraction was followed the procedure of Nathan et al. (2012) with some modification on *Ipomoea aquatica* and *Pelthoporum pterocarpum* using ethanol (70%) and methanol as solvents. The plants were extracted using soxhlet extractor using ethanol and methanol as solvent and evaporated in rotary evaporator.

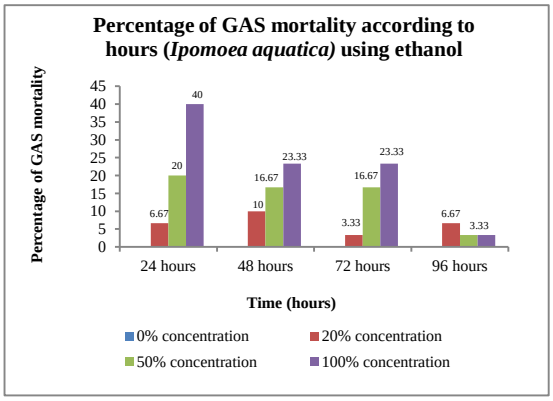
The procedure of bioassay was followed the procedure of Arunlertaree et al. (2003) with some modification. Bioassay was conducted with three concentrations and three replicates for each treatment (ethanol and methanol extraction) with control (water). The extracts were sprayed on the paddy seedlings and were introduced in the aquarium with different concentration (20%, 50% and 100%). Mortality of GAS were monitored on 24, 48, 72 and 96 hours after application. All data were analysed by analysis variance (ANOVA) to determine significant differences between the treatments.

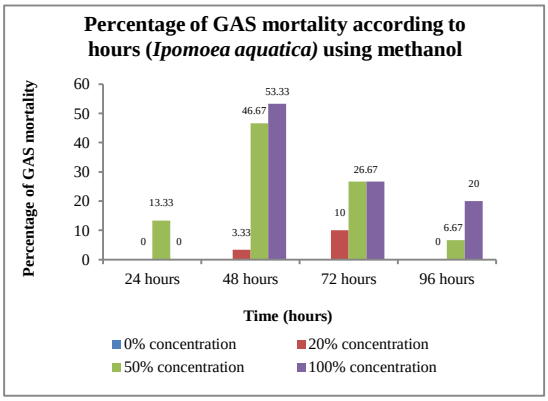
Result and discussion

All concentrations of *Ipomoea aquatica* and *Pelthoporum pterocarpum* extracts using ethanol and methanol showed effect on mortality of GAS within 96 hours.

Ipomoea aquatica extracts with ethanol (100% concentration) showed higher mortality after 24 hours of application. Meanwhile, *Ipomoea aquatica* extracts with methanol (100% concentration) showed higher mortality after 48 hours of application. Methanol solvent gave high mortality of GAS compared with ethanol as a solvent. After 96 hours of application, 100% concentration of *Ipomoea aquatica* extracts with methanol solvent gave 100% mortality of GAS while ethanol only gave 89.99% mortality of GAS. Low percentage concentration of *Ipomoea aquatica* extracts gave low mortality of GAS (Figure 1).

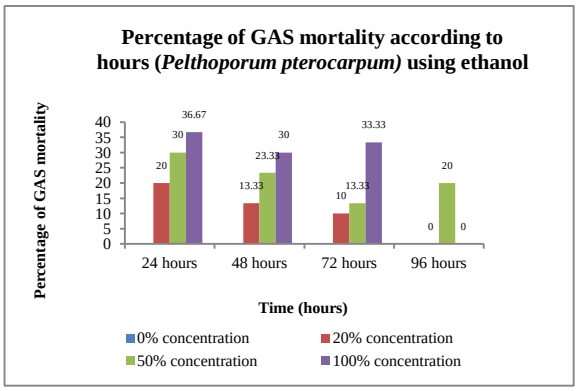
Figure 1: Comparison of percentage of GAS that treated with different solvent against time for *Ipomoea aquatic*

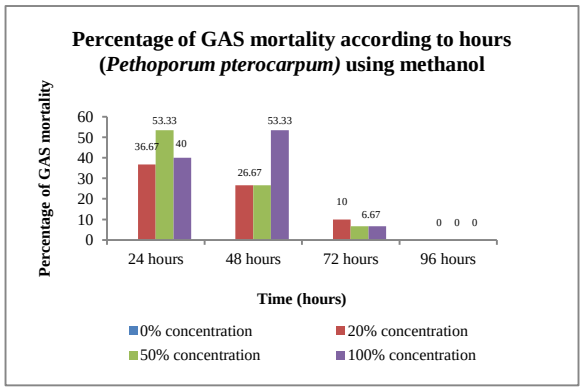




Pelthoporum pterocarpum extract with ethanol and methanol solvent gave effect on mortality of GAS 24 hours after application. However, methanol solvent (20%, 50% and 100% concentration) gave higher mortality of GAS after 24 hours of application compared with ethanol solvent. Both solvents showed high concentration (100%) caused 100% mortality of GAS after 72 hours of application (Figure 2).

Figure 2: Comparison of percentage of GAS that treated with different solvent against time for *Pelthoporum pterocarpum*





Both plant extracts with methanol solvent showed high concentration (100%) caused 100% mortality of GAS. *Pelthoporum pterocarpum* extracts with methanol showed 100% mortality of GAS after 72 hours of application while *Ipomoea aquatica*extracts 100% mortality of GAS after 96 hours of application.

For ethanol solvent, *Pelthoporum pterocarpum* extracts with 100% concentration gave 100% mortality of GAS after 96 hours. Otherwise, *Ipomoea aquatica* extracts gave 89.99% mortality of GAS.

Ipomoea aquatica extracts with methanol solvent is more effective with LC_{50}value (29.514%) compared with ethanol solvent (37.252%). Same result showed with *Pelthoporum pterocarpum* extracts with methanol solvent gave higher LC_{50} value (4.683%) compared with ethanol solvent (22.733%). The lowest percentage of LC_{50} showed more effective of the solvent for controlling GAS (Table 1).

Table 1: Probit analysis for *Ipomoea aquatica* and *Pelthoporum pterocarpum* extracts by using ethanol and methanol

Treatments	LC_{50}(%)	95% limit (%)
Ipomoea aquatica (ethanol solvent)	37.252	27.144- 48.233
Ipomoea aquatica (methanol solvent)	29.514	25.145 - 34.788
Pelthoporum pterocarpum (ethanol solvent)	22.733	16.048- 28.417
Pelthoporum pterocarpum (methanol solvent)	4.683	0.647-33.907

The result obtained from this study showed methanol is suitable solvent to extract the chemical compounds in both plants *(Ipomoea aquatica* and *Pelthoporum pterocarpum)* and this solvent have more potential for controlling GAS. Finding by Musman (2010) stated that the data exposed that the mortality rate of the tested GAS was higher in extracts encompassing both saponins and flavonoids contrasted to the extracts encompassing merely flavonoids within 48 hours.

As cited in Harborne and Williams (2000) found that insect consuming on plants clearly sensitive to flavonoids present has been established by many experiments. The proof of insect shows that the bioactive active such as flavonoid can affect the system of endocrine (Narciso et al., 2011) and this bioactive flavonoid has been demonstrated to give an impact to the diet behaviour of insectivorous (Narciso et al., 2011). It has been reported that flavonoids are able to modulate insect development and reproduction by interacting, directly or indirectly with the hormone system. These compounds inhibit transcription of the endysteroid gene receptor and reducing cell growth (Narciso et al., 2011). According to Latip et al. (2014), methanol extraction showed the highest mortality rather than using ethanol for *Ipomoea aquatica* and *Pelthoporum pterocarpum.*

Conclusion

Based on finding, *Pelthoporum pterocarpum* extracts with methanol solvent are effective as biopesticides for controlling GAS with good environmental stability and environmentally safe. Hence, it can be recommended as suitable control to provide an alternative way for pest management control in paddy field.

Acknowledgement

This work was supported by funds from the Ministry of Higher Education (MOHE), Malaysia through Fundamental Research Grant Scheme (FRGS) 600-RMI/FRGS 5/3 (150/2013) –Efficacy of extract from selected indigenous plants as a botanical pesticide for controlling golden apple snail, *Pomacea canaliculata* headed by Dr. Siti Noor Hajjar Md Latip. We also are gratefully acknowledge the contribution of Dr. Kamarul'Ain Mustafa from Universiti Sultan Zainal Abidin and Encik Badrulhadza Amzah from Malaysia Agriculture Research and Development Institute (MARDI).

References

Arunlertaree, C., Meeposom, C., Navanugraha, C., and Hutacharoen, R. (2003). The utilization of cashew nut shell crude extract for golden apple snail (*Pomacea canaliculata*) control. Environment and Natural Resources Journal, 1(2), 77-84.

Ayoola, S. O., Kuton, M. P., Idowu, A. A., and Adelekun, A. B. (2011). Acute toxicity of Nile tilapia (*Oreochromis niloticus*) juveniles exposed to aqueous and ethanolic extracts of *Ipomoea aquatica* leaf. Nature and Science, 9(3), 91-99.

Biswas, Kaushik, Arun Kumar, Bhavin A. Babaria, Prabhu K. and Ramachandra Setty S. (2010). Hepatoprotective effect of leaves of *Peltophorum pterocarpum* against paracetamol Induced acute liver damage in rats. Journal of Basic and Clinical Pharmacy.

Harborne, J. B., & Williams, C. A. (2000). Advances in flavonoid research since 1992. *Phytochemistry*, *55*(6), 481-504.

Joshi, R. E. 2005. Off- season mortality of golden apple snail, *Pomacea canaliculata* (Lamarck) and its management implications.

Latip, S. N. H. M., Mohmad Nor Firdaus Bin Abrahim and 'Amirah Sa'aidah Nafisah Othman. 2014. Effectiveness of *Ipomoea aquatica* and *Pelthoporum pterocarpum* for controlling the Golden Apple Snail, *Pomacea canaliculata*. International Symposium on Insect (ISoI 2014).

Musman, M. (2010).Toxicity of Barringtonia racemosa (L.) Kernel Extract on *Pomacea canaliculata* (Ampullariidae).Tropical Life Sciences Research, 21(2), p33-43.

Narciso, J. O.A, Soares de Souza, M. A., Geraldo de Carvalho, M., Gomes, M. S., Genestra, M., and Cabral, M. M. (2011). Flavonoids inhibited NADPH consumption and ecdysis processes in *Oncopeltus fasciatus*. Journal of Natural Pharmaceuticals, 2(3), 133.

Nathan, V. K., Antonisamy, J. M., Gnanaraj, W. E., and Subramanian, K. M. (2012).Phytochemical and bio-efficacy studies on methanolic flower extracts of *Peltophorum pterocarpum (DC.)*Baker ex Heyne.Asian Pacific Journal of Tropical Biomedicine, 2(2), S641-S645.

Prakash, A., Rao, J. and Nandagopal, V. 2008.Future of Botanical Pesticides in Rice, Wheat, Pulses and Vegetables pest Management.Journal of Biopesticides. 1(2): 154- 169.

Silva- Aguayo, G. 2009. Botanical Insecticides. University of Minnesota. http://ipmworld.umn.edu/chapters/SilviaAguayo.htm [2 April 2013]