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EFFECTIVENESS OF *IPOMOEA AQUATICA* AND *PELTHOPORUM PTEROCARPUM* FOR CONTROLLING THE GOLDEN APPLE SNAIL, *POMACEA CANALICULATA*

Latip S. N. H. M., M. N. F. Abrahim and 'A. S. N. Othman
Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA,
40450 Shah Alam, Selangor
Corresponding e-mail: noorhajar@salam.uitm.edu.my

ABSTRACT

Pomacea canaliculata Lamark (golden apple snail, GAS) which known as *siput gondang emas* among Malay farmers is dangerous pest to the paddy field feeds on stem and young leaves of paddy plant. Frequently, usage of synthetic pesticides may cause pollution to the environment which became harmful to human and other living things. Hence, to control GAS, the usage of biopesticides is become the most popular control method. Biopesticides formed from animals, plants, bacteria and minerals. About 247 families from 2500 plants have the role of secondary metabolites to protect themselves from the pests. Some of the plants have their own mechanism to protect themselves from enemies like pests, diseases due to its chemical compound, which acts as toxicity to the pest, repellency, antifeedant and insect growth regulatory activities. The aim of

this study is to evaluate the effectiveness of *Ipomoea aquatica* and *Pelthoporum pterocarpum* extracts for controlling GAS by using different solvents. From the study, methanol extraction showed the highest mortality rather than using ethanol for both plants. It showed that methanol is the most effective solvent due to mortality of the GAS by 50% concentration (24 hours) and 100% concentration (48 hours) is 53.33%. Based on probit analysis, *Pelthoporum pterocarpum* extracts by using methanol as solvent showed the strongest toxicity test result (LC_{50} = 4.683%). In the future, *Pelthoporum pterocarpum* extracts using methanol can be used to replace the usage of synthetic pesticides for controlling GAS.

Keywords: Golden apple snail, *Pomacea canaliculata*, biopesticide, *Ipomoea aquatica*, *Pelthoporum pterocarpum*

ABSTRAK

Siput Gondang Emas, *Pomacea canaliculata* Lamark merupakan perosak yang makan batang dan pucuk muda padi. Penggunaan pestisid sintetik yang kerap mencemarkan alam dan membahayakan manusia dan benda-benda hidup yang lain. Oleh itu, biopestisid menjadi pilihan popular untuk mengawal populasi GAS. Biopestisid dihasilkan daripada haiwan, tumbuhan, bakteria dan mineral. Hampir 247 famili daripada 2500 tumbuhan memiliki metabolit sekunder untuk melindungi diri dari perosak. Sesetengah tumbuhan memiliki mekanisme tersendiri untuk melindungi diri daripada musuh seperti perosak dan penyakit dengan menghasilkan bahan kimia yang berperanan sebagai toksik terhadap perosak, antimakan dan mengawal perkembangan aktiviti serangga. Tujuan kajian ini adalah untuk menilai keefektifan ekstrak *Ipomoea aquatic* dan *Pelthoporum pterocarpum* dalam mengawal GAS dengan menggunakan pelbagai larutan. Pengekstrakan metanol menunjukkan kadar mortaliti yang tinggi berbanding penggunaan etanol untuk kedua-dua tumbuhan. Metanol dicatat

sebagai larutan yang paling efektif kerana menyebabkan kadar mortality GAS pada kepekatan 50% (24 jam) dan 100 % (48 jam). Hasil Analisis Probit menunjukkan ekstrak *Pelthoporum pterocarpum* menunjukkan catatan ketoksikan yang paling tinggi (LC_{50} = 4.683%) dengan larutan metanol. Pada masa akan datang, ekstrak *Pelthoporum pterocarpum*dengan menggunakan larutan metanol boleh digunakan untuk mengantikan penggunaan pestisid sintetik dalam mengawal populasi GAS.

Kata kunci: Siput Gondang Emas, *Pomacea canaliculata*, biopestisid, *Ipomoea aquatica*, *Pelthoporum pterocarpum*

INTRODUCTION

In ASEAN countries, cultivation of paddy encompassed approximately 90% of an area and become staple food up to 60% of the population in the world (Massaguni and Latip, 2012).The government was encouraged farmers to increase the yield production of paddy to implement a food security policy for the rice industry towards self-sufficiency by 2020 (Nurul et al., 2012). The main problem that farmers need to face when involve in paddy field is an infestation by the main pests which is golden apple snail (GAS), *Pomacea canaliculata* (Lamarck) also known as Siput gondang emas among Malay farmers. GAS can bring the bad effect to the system of ecology around the world can be competed with origin species and lead to the adverse impact in the natural systems (Trexler, 2011). Many methods has been done for controlling GAS infestation in paddy field such as cultural control, biological control and chemical control. Nowadays, farmers used synthetic pesticide because this method was more effective to control GAS infestation due to the chemical role itself. Using synthetic pesticides may give negative impact to the non- target organisms. Biopesticides are alternative way to replace the usage of synthetic pesticides for controlling GAS infestation. Sae- Yun et al. (2006) reported that the alternative way used to reduce the environmental pollution

problem, lower the production and purchase costs and reduce food contamination by pest. According to Silva- Aguayo (2009), about 247 families from 2500 plants have the role of secondary metabolites to protect themselves from the pests. The secondary metabolites in plant parts are tannins, glycosides, alkaloids, phenols, flavonoids, steroids, terpenols, glucosinolates, quinines and non- proteic amino acids. Some of the plants have their own mechanism to protect themselves from pests and diseases due to its chemical compound, which acts as toxicity to the pest, repellency, antifeedance and insect growth regulatory activities (Prakash et al., 2008).From the previous study, it was reported that several parts of this plant can be used in medicinal treatment likes insomnia, constipation and stomatitis. Otherwise, the extraction of flower can be used as reduce insomnia patient and encourage a good night's sleep (Nathan et al., 2012). Nathan et al. (2012) found that the presence of alkaloids, tannins and flavonoids which the plant metabolites (defenses) against the microorganism such as pest (quoted by Bonjar, 2004 cited in Nathan et al., 2012). Biswas et al. (2010) conducted an experiment by using leaves of golden flamboyant against paracetamol prompted severe liver damage in mice. The purpose of this study is to evaluate the effectiveness of *Ipomoea aquatica* and *Pelthoporum pterocarpum* extracts using various solvents for controlling GAS.

MATERIALS AND METHODS

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 slightly modification on *Ipomoea aquatica* and *Pelthoporum pterocarpum* by using ethanol (70%) and methanol as a solvent. The leaves powder was primary extracted by using soxhlet extractor with the methanol for six

hours. Next, the crude extracts were evaporated in rotary evaporator.

The procedure of bioassay was followed the procedure of Arunlertaree et al. (2003) with modification. The test was done with three concentrations and three replicates for each treatment (ethanol and methanol extraction) with control (water). 10 The extractions were sprayed on the paddy seedling and placed in the aquarium with different concentration at 20%, 50% and 100%. The mortality of GAS was observed and recorded for every 24, 48, 72 and 96 hours (4 days). The data were analysed by using Minitab 16 and POLO PLUS software version 2.0. ANOVA was used to determine significant differences between the treatments. Probit analysis was used to determine the relative toxicity of chemicals to living organisms because it is commonly used in toxicology (Robertson et al., 1980).

RESULT AND DISCUSSION

Table 1. Analysis of variance (ANOVA) for different plants and concentration of ethanol extracts.

Source	DF	Seq SS	Adj SS	Adj MS	F	P*
Plant	1	12.042	12.042	12.042	11.56	0.003
Concentration	3	313.125	313.125	104.375	100.20	0.000
Error	19	19.792	19.792	1.042		
Total	23	344.958				

*P- value <0.05 indicate significant differences between treatment

Table1 showed that the probability value for different plants of ethanol extracts is 0.003 which is below than 0.05. The result indicated that there was a significance difference in plant extracts caused different effects on GAS. However, the result of concentration showed that there was significant differences between different concentrations of ethanol extracts of both

plants toward controlling GAS with p- value indicated 0.000 < 0.05. This shows that all the concentrations of ethanol extracts did not cause similar effect to each other toward controlling GAS. There was no significant differences among the plants that used in this study with p- value was 0.003 > 0.05.

A previous study done by Musman (2010) stated that the effects of the ethanol solvent was gradually increasing with different concentration (50, 100, 200, 400 and 800ppm) on controlling GAS. The above result also supported by Hassanein et al. (2008) stated that extraction from neem by using ethanol will increase progressively with different concentration on controlling mycelial growth was similarly with this study where the mortality rate of GAS increase when the highest concentration was applied.

Table 2. Analysis of variance (ANOVA) for different plants and concentration of methanol extracts

Source	DF	Seq SS	Adj SS	Adj MS	F	P*
Plant	1	6.000	6.000	6.000	1.90	0.184
Concentration	3	353.333	353.333	117.778	37.30	0.000
Error	19	60.000	60.000	3.158		
Total	23	419.333				

*P- value <0.05 indicate significant differences between treatment

Table 2 showed that there was significant differences between different concentrations of methanol extracts of both plants toward controlling GAS with p- value was 0.000 < 0.05. This value indicated that there was very strong evidence to suggest all the concentrations of methanol extracts did not cause similar effect to each other toward controlling GAS. There was no significant differences between the plants that used in this study with p- value was 0.184 > 0.05.

A previous study done by Musman (2010) stated that the effects of the methanol solvent was dramatically increased with different concentration (50, 100, 200, 400 and 800ppm) on controlling GAS. Results of this study consistent with the findings of Ayoola et al. (2011) showed there was significant difference ($P<0.05$) between all the concentrations at 24, 48,72 and 96 hours of exposure. This result is contradicted from the study because ethanolic extract of the leaf of *Ipomoea aquatica* against *Oreochromis niloticus.*

Table 3. Probit analysis for *Ipomoea aquatica* and *Pelthoporum pterocarpum* extracts by using methanol and ethanol

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

LC_{50} at 95% confidence level for *Ipomoea aquatica* extracts by using ethanol was ranging from 27.144% until 48.233% concentration.LC_{50} at 95% confidence level for *Ipomoea aquatica* extracts by using ethanol was ranging from 25.145 % until 34.788% concentration.LC_{50} at 95% confidence level for *Pelthoporum pterocarpum* extracts by using ethanol was ranging from 16.048% until 28.417 % concentration.LC_{50} at

95% confidence level for *Pelthoporum pterocarpum* extracts by using methanol was ranging from 0.647% until 33.907% concentration.

This occurred due to methanol is more polar than ethanol and this solvent extract more chemical compounds rather than using ethanol. The above results also supported by Das et al. (2007) shows the similar result where methanol extract was found to be most effective followed by ethanol extracts of plants. Musman (2010) stated that the data exposed to the mortality rate of the tested *Pomacea canaliculata* was higher in extracts encompassing both saponins and flavonoids.

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 (quoted by Harbone, 1988 cited in 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 (quoted by Dinan et al., 2001 cited in Narciso et al., 2011).

CONCLUSION

Methanolic extract of *Ipomoea aquatica*, and *Pelthoporum pterocarpum* are able to be used in controlling *Pomacea canaliculata.* But, the most effective concentration rate of *Pelthoporum pterocarpum* is 20% concentration within 24 hours with methanolic extract has potential to be formulated and commercialized as biopesticides. Its application could provide an alternative way for pest management control in paddy field.

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