



The Comparison between Tree Sorrel and Snake Plant on the Hatchability Inhibition of Apple Snail Eggs

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ABSTRACT

This study aimed to compare and determine the hatchability inhibition of the tree sorrel extract (*Averrhoa bilimbi* L.) and snake plant as natural ovicide of apple snail (*Pomacea canaliculata* L.). This study employed the completely randomized design (CRD). The negative controls were the extracts with the concentrations of 1%, 1.5%, 2%, 2.5%, 3%, and a positive control. Data analysis used was one-way ANOVA and then continued by Least Significant Difference (LSD) test. The results showed that tree sorrel extract with 3% concentration had the highest inhibitory on the hatchability of apple snail eggs compared to the snake plant extract (*Sansevieria trifasciata* P.) with a comparison value of 19.47%.

Perbandingandaya Hambat Tetas Telur Keong Mas dari Buah Belimbing Wuluh dan Daun Lidah Mertua

Abstrak: Tujuan penelitian ini untuk membandingkan dan mengetahui daya hambat tetas telur keong mas dari ekstrak buah belimbing wuluh (*Averrhoa bilimbi* L.) dan daun lidah mertua sebagai ovisida alami keong mas (*Pomacea canaliculata* L.). Desain penelitian menggunakan Rancangan Acak Lengkap (RAL) dengan konsentrasi yaitu kontrol negatif, 1%, 1,5%, 2%, 2,5%, 3% dan kontrol positif. Analisis data menggunakan uji One Way Anova dilanjutkan dengan ujiBeda NyataTerkecil (BNT). Hasil penelitian menunjukkan bahwa ekstrak buah belimbing wuluh dengan konsentrasi 3% mempunyai daya hambat tertinggi terhadap penetasan telur keong mas dibandingkan ekstrak daun lidah mertua (*Sansevieria trifasciata* P.), yaitu sebesar 19,47%.

INTRODUCTION

Apple snail (*Pomacea canaliculata*L.) is the rice filed pest that can cause crop failure (Andriyanto, 2016; Handayani, 2015; Hidayanto, 2017). Apple snails have a ten to forty percent chance to cause damage to

plants in reservoirs, rice fields, ponds, swamps, and also standing water (Latifah & Suharti, 2018; Umi & Suharti, 2019). Apple snails can survive in dry soil for up to 6 months (Handayani, 2015; Saputra dkk., 2018) and one apple snail can consume one rice clump in

fifteen minutes (Faisal dkk., 2016; Wiratno dkk., 2017).

Pest control by farmers generally uses chemical pesticides which, if used continuously, can leave negative residues on the environment and the killing of non-targeted organisms. The natural material that can reduce the impact of environmental damage is needed. One of them is by utilizing natural plants. Several studies state that various types of plants contain active compounds and can be used as natural pesticides, especially natural ovicide which consists of saponins, steroids, terpenoids, and flavonoids (Yana, 2018). Naria (2005) states that the plant compounds of cyanide, tannins, alkaloids, and essential oils can act as natural pesticides.

Apple snail eggs are generally clustered like mulberry fruit. They are orange in color and hard-shelled but break easily when they are pressed (A. Abdullah dkk., 2017; A. N. Abdullah & Reyhan, 2017; Asadatun A dkk, 2017). Apple snail eggs' hatchability might be reduced by impacts and changes of external conditions such as erratic temperatures (Maria J. Tiecher.et.al., 2013). Active compounds can enter and disturb the embryo through chorionic cracks so that the embryo is damaged and fails to hatch (Yana, 2018).

Tree sorrel (*Averrhoa bilimbi* L.) is one of the plants that have secondary metabolites, such as saponins, tannins, flavonoids, and terpenoids (Syah & Purwani, 2016). It has low oxidity so it is relatively safe to the environment (Yana, 2018). The snake plant (*Sansevieria trifasciata* P.) contains phytates, carotenoids, flavonoids, saponins, alkaloids, and tannins (Ifada dkk., 2018; Mayangsari dkk., 2015, 2015; Phillip D; Kaleena PK; Vallivittan K; and Kumar CP, 2011; THAHIR dkk., 2019). Several studies have been carried out related to the use of natural ingredients as natural

ovicide for apple snails. However, there have been no studies that are focused on the comparison between tree sorrel and snake plant on the apple snail eggs' hatchability inhibition. Therefore, this study was conducted to compare and determine the highest inhibition rate between the tree sorrels extract and snake plants extract on apple snails' hatchability.

METHOD

This study was conducted in August 2018. The manufacture of the tree sorrel extract and the snake plant extract was carried out at the Organic Chemistry Laboratory of Chemistry Study Program, The Faculty of Mathematics and Natural Sciences, University of Lampung. The hatchability of apple snail eggs was observed at the Biology Laboratory of Biology Education Study Program, Tarbiyah, and Teacher Training Faculty, UIN Raden Intan Lampung.

The tools used are were cutter, injection, ruler, petri dish, blender, scale, spatula, rotary evaporator, dropper, measuring cup, beaker glass, camera, Erlenmeyer flask, and stationery. The materials used were 4 kg of fresh tree sorrels' fruit, 5 kg of fresh snake plant leaves, tissue, label paper, gauze, 28 spray bottles, aluminum foil, and 96% ethanol. The apple snails (*Pomacea canaliculata* L.) were acclimatized to lay eggs. Approximately 3 grams of eggs were taken from each group. The data obtained was tested using the one-way ANOVA to determine the effective extracts' concentration. The assumption of the test is that; if $F_{\text{observed}} > F_{\text{critical}}$, then the treatment has a significant effect, which means H_1 is accepted. The follow-up test was the Least Significant Difference Test (LSD) at the significance level of 0.05 or 5%.

RESULTS AND DISCUSSION

Based on the research data, it was known that the tree sorrel extract with a concentration of 1%, 1.5%, 2% 2.5%, and 3% influenced the hatchability of apple snail eggs (*Pomacea canaliculata L.*). In this experiment, the apple snail eggs were put into a petri dish that had been coated with taro leaves for one group with three repetitions. In positive control, the apple snail eggs were

sprayed with 100 ml of Bentan solution while in the negative control, the eggs were sprayed with 100 ml of distilled water. In the treatments, the tree sorrels extract (*Averrhoa bilimbi L.*) was added a portion of distilled water so that the test solution became 100 ml. The apple snail eggs' mortality rate was significant in each cup with various concentrations of tree sorrels' solution (*Averrhoa bilimbi L.*). The data can be seen in Figure 1.

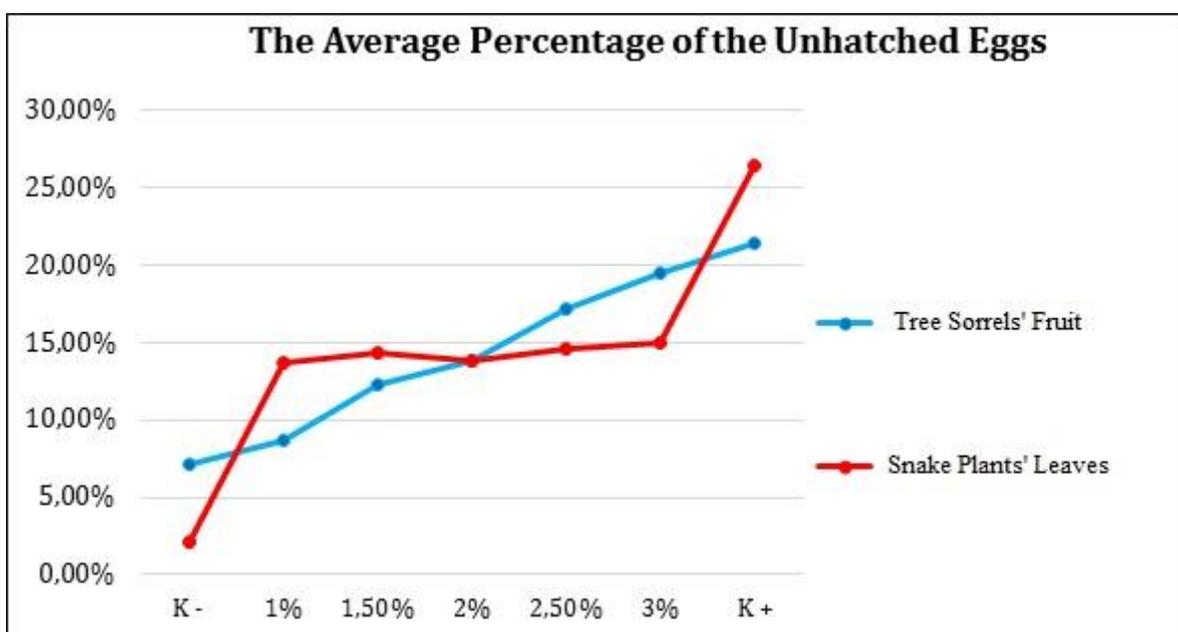


Figure 1. The Average Percentage of the Eggs

Figure 1 shows the results of observations for 14 days of the apple snails' eggs that had been sprayed with the test materials. The higher the

concentrations of the extracts, the higher their effects on the hatchability inhibition.

Table 2. The Results of Phytochemical Test

Contents	Tree Sorrels' Fruit Extract	Snake Plants' Leaves Extract
Saponin	+	+
Steroids	-	+
Terpenoids	+	+
Tannins	+	+
Alkaloids	+	+
Flavonoids	+	+

Description:

(+) : Identified

(-) : Not Identified

Based on Table 2, both test materials contained saponins, terpenoids, tannins, alkaloids, and flavonoids. These phytochemical compounds affected the apple snails' hatchability inhibition.

The eggshell has a polygon point that can be entered by metabolite compounds due to the entry of an active substance that triggers metabolic disorders so that the apple snails' eggs cannot hatch (Jemmy Jumadi, 2018).

Saponin is an entomotoxicity that inhibits the performance of the eggs' membrane cells (Martini et al, 2018). According to (Astuti, 2018), tannins can bind the proteins that can be potentially used as the apple snail eggs' inhibitors through the permeability mechanism for transiting plasma. Alkaloids are substances that contain one or more nitrogen atoms that have basic properties. They can degrade the cell membrane to get inside and damage the apple snails' eggs (Fazil Muhammad et al, 2017). Flavonoid active compounds

play a role in the activity of juvenile hormones when there is a change in mollusks, from the egg stage to become the apple snail (Candra saputra, 2017). The triterpenoid active compound affects hatchability inhibition due to the presence of triterpenes compounds. However, the tree sorrel extract contains no steroids while the snake plant extract contains the steroid compound. Steroid affected the growth hormone of apple snail eggs.

Nevertheless, based on the LSD test results, the average unhatched apple snail eggs can be found in tree sorrel extract groups of treatments. The varied concentrations produced significant differences, except for 1.5% and 2% concentrations. The concentration with the highest criteria was 3 % although it did not differ significantly from positive concentration. This means that the 3% concentration possessed similar effects to the positive control treatment and can be used as a natural ovicide.

Table 3. The Results of LSD Test on the Unhatched Eggs

Treatments	The Average of the Unhatched Eggs; Ex. Tree Sorrel Extract	The Average of the Unhatched Eggs; Ex. Snake Plant Extract
Control - (Sterilized Distilled Water)	101.3 ^a ± 15.2	17.00 ^a ± 20.00
1%	122.6 ^a ± 18.5	107.33 ^b ± 87.37
1.5%	173.3 ^b ± 21.5	112.33 ^b ± 83.86
2%	196.3 ^b ± 17.7	109.00 ^b ± 70.00
2.5%	243.3 ^c ± 11.0	114.67 ^b ± 56.58
3%	275.6 ^d ± 25.9	117.33 ^b ± 68.07
Control + (Bentan Chemical Ovicide)	302.6^d± 6.4	208.00 ^c ± 88.88

The snake plant extract at the concentrations of 1% to 3% showed insignificant differences and the concentration of 3% showed significant difference which was significantly different from positive control treatments. So, it can be said that

positive control treatment was more effective as ovicide.

Environmental factors such as the temperature and acidity can affect the inhibition of apple snails' eggs hatchability. Adetha (2018) states that the content of chemical elements such as

oxalic acid and potassium can be found in tree sorrel fruit. Besides, the sprayed $pH > 5.2$ causes a decreased number of eggs because the shells become brittle. Also, Devy N.F. dkk., (2010) states that higher content of flavonoids is found in the older leaves rather than the younger

leaves. The flavonoids move from the leaves to the flowers and parts of fruit so that they can be used as natural ovicide (Melati dkk., 2014; Rahman dkk., 2014; Tehubijuluw dkk., 2018).

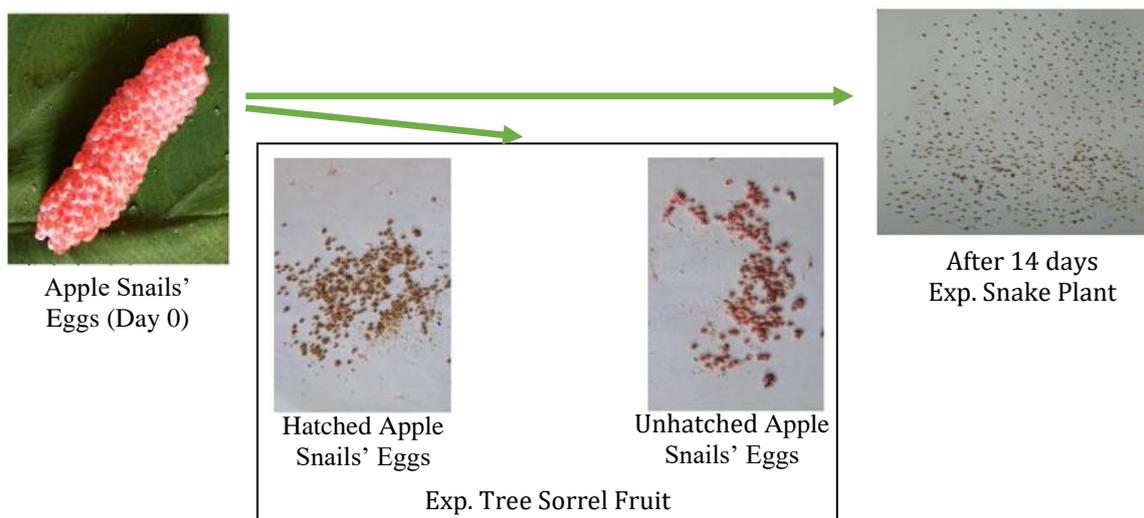


Figure 2. Observation Results on the 14th day

Figure 2 shows the results of the observation after 14 days of treatment. Some eggs hatched within 7-14 days while some others did not hatch after 14 days, so the eggs were considered dead. Physical changes can be seen after the eggs had been sprayed for 14 days. Initially, the shape of the eggs was round with pink color and then they turned white and fragile. When the eggshells were pierced, they were destroyed with bad smell, and sometimes they were overgrown with fungus.

The same thing happened when the eggs were sprayed with snake plant extract. The originally normal color turned white, fungus-riddled, and thick liquid can be found inside the eggs which were suspected as the failure to grow embryos.

CONCLUSIONS AND SUGGESTIONS

The results of this study can be concluded that the tree sorrel extracts (*Averrhoa bilimbi L.*) and snake plant extract (*Sansevieria Trifasciata P.*) contain saponins, terpenoids, tannins, alkaloids, and flavanoids. However, no steroid compounds were found in the tree sorrel. Based on the results of the LSD test, the tree sorrel extract with a concentration of 3% had a higher inhibitory effect on the hatchability of apple snail eggs compared to the snake plant extract (*Sansevieria trifasciata P.*) by 19.47%. the percentage was not significantly different from positive control and can be used as a natural ovicide.

Based on the conclusions of this study, there are suggestions for further researchers regarding the need for further testing of the phytochemical content of the tree sorrel extract and

snake plant extract. It is expected that this study can be used as a reference for further studies.

REFERENCES

- Abdullah, A. N., & Reyhan, M. (2017). Karakterisasi dan Identifikasi Senyawa aktif ekstrak pigmen telur keong mas. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 20(2), 286–295.
- Abdullah, A., Nurjanah, N., & Reyhan, M. (2017). Identification and Profiling of Active Compounds from Golden Apple Snail's Egg Pigments. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 20(2), 286–295.
- Adetha, P. (2018). *Ekstrak Buah Belimbing Wuluh (Averrhoa Bilimbi L.) Sebagai Ovisida Keong Mas (Pomacea canaliculata L.)*. 1–126.
- Andriyanto, A. (2016). *Kelimpahan Hama Penyakit Pada Berbagai Tipe Sistem Tanam Jajar Legowo dan Jenis Pupuk Terhadap Hasil Padi Varietas Bestari*. UPN" Veteran" Yogyakarta.
- Asadatun A dkk. (2017). Karakterisasi dan Identifikasi Senyawa Aktif Ekstrak Pigmen Telur Keong Mas. *Jurnal IPB*, 20(2), 289.
- Astuti, R. B. (2018). Pengaruh Pemberian Pestisida Organik Dari Mindi Daun Pepaya dan Campuran Daun pepaya Terhadap Hama dan Penyakit Tanaman Cabai Merah. *Universitas Sanata Dharma*, 3.
- Candra saputra. (2017). Efektifitas kulit dan biji buah duku (*Lancium domesticum* Corr.) sebagai ovisida terhadap nyamuk *Aedeo aegypti*. *IAIN Lampung*, 68.
- Devy N.F., Yulianti, F., & Andrini. (2010). Kandungan Flavonoid dan Limonoid pada Berbagai Fase Pertumbuhan Tanaman Jeruk Kalamondin (*Citrus mitis Blanco*) dan Purut (*Citrus hystrix Dc.*). *Jurnal Hortikultura*, 20(1), 360–367.
- Faisal, S., Husni, H., & Sapdi, S. (2016). Pengaruh penggunaan saponin dan serbuk bijik pinang terhadap mortalitas keong mas (*Pomacea canaliculata L.*) dan keamanan ikan lele. *Jurnal Kawista Agroteknologi*, 1(1), 23–29.
- Fazil Muhammad et al. (2017). Analisis Senyawa Alkaloid dan Flavonoid dari Ekstrak Kitolod dan Uji Aktivitasnya Terhadap Bakteri Penyebab Karises Gigi. *Jurnal ITEKIMA*, 2(1).
- Handayani, D. (2015). Uji efektivitas pengendalian keong mas (*Pomacea canaliculata Lamark*) pada padi sawah dengan menggunakan rendaman air kapur sirih (CaCo_3) dan ekstrak daun ubi karet (*Manihot Glaziovii MA*). *Jurnal EduBio Tropika*, 1(2).
- HIDAYANTO, N. (2017). *Sistem Pakar Diagnosa Dan Pengendalian Hama Tanaman Padi Dengan Metode Forward Chaining*. STMIK Sinar Nusantara Surakarta.
- Ifada, R., Hermayanti, D., & NurHasan, Y. T. (2018). Pengaruh ekstrak Daun Lidah Mertua (*Sansevieria trifasciata laurentii*) Terhadap Kadar Hemoglobin Tikus Putih Jantan (*Rattus norvegicus strain wistar*) Yang Diinduksi Timbal

- Per-Oral. *Saintika Medika: Jurnal Ilmu Kesehatan dan Kedokteran Keluarga*, 12(2), 68–74.
- Jemmy Jumadi. (2018). Penggunaan Ekstrak Daun Lidah Mertua (*Sansevieria trifasciata* P.) Sebagai Ovisida Keong Mas (*Pomacea canaliculata* L. *UIN Raden Intan Lampung*.
- Latifah, U., & Suharti, P. (2018). *Efektivitas Pemberian Pestisida Nabati Filtrat Daun Widuri (Calotropis Gigantea) terhadap Tingkat Mortalitas Siput Murbai (Pomaceae Canaliculata Lamarck) Sebagai Pengembangan Bahan Ajar Materi Bioteknologi SMA Kelas XII. Universitas Muhammadiyah Surabaya*.
- Maria J. Tiecher.et.al. (2013). Mating behavior, egg laying, and embryonic development in the South American apple snail *Asolene pulchella* (Ampullariidae, Caenogastropoda). *Journal laboratorio de Biologia Reproductiva y Evolución Argentina*, 3.
- Martini et al. (2018). Keefektifan Daun Kecubung Dalam Menghambat Penetasan dan Siklus Hidup *Aedes aegypti*. *Jurnal Entomologi Indonesia*, 15(1).
- Mayangsari, P. W., Suratno, S., & Wahono, B. (2015). Pengaruh Strategi Pembelajaran MURDER (Mood, Understand, Recall, Digest, Expand, Review) Berbasis Media Interaktif Flash terhadap Kemampuan Berpikir Kritis, Metakognisi dan Pencapaian Hasil Belajar Siswa (Mata Pelajaran Biologi Kelas XI Materi Sistem Ekskresi). *Jurnal Edukasi*, 2(2), 7–11.
- Melati, I., Mulyasari, M., Sunarno, M. T. D., Bintang, M., & Kurniasih, T. (2014). Produksi Enzim Selulase Dari Bakteri TS2b Yang Diisolasi Dari Rumput Laut Dan Pemanfaatannya Dalam Menghidrolisis Kulit Ubi Kayu Dan Daun Ubi Kayu Sebagai Bahan Baku Pakan Ikan Irma. *Jurnal Riset Akuakultur*, 9(2), 263–270.
- Naria. (2005). Insektisida nabati untuk rumah tangga. *Insektisida nabati untuk rumah tangga.*, 9(01).
- Phillip D; Kaleena PK; Vallivittan K; and Kumar CP. (2011). Phytochemical Screening and Antimicrobial Activity of *Sansevieria roxburghiana*. *Middle-East Journal of Scientific Research*, 10(4), 512–518.
- Rahman, N., Bahriul, P., & Diah, A. W. M. (2014). Uji aktivitas antioksidan ekstrak daun salam (*Syzygium Polyanthum*) dengan menggunakan 1, 1-Difenil-2-Pikrilhidrazil. *Jurnal Akademika Kimia*, 3(3), 143–149.
- Saputra, K., Sutriyono, S., & Brata, B. (2018). Populasi dan Distribusi Keong Mas (*Pomacea canaliculata* L.) sebagai Sumber Pakan Ternak pada Ekosistem Persawahan Di Kota Bengkulu. *Jurnal Sain Peternakan Indonesia*, 13(2), 189–201.
- Syah, B. W., & Purwani, K. I. (2016). Pengaruh Ekstrak Daun Belimbing Wuluh (*Averrhoa bilimbi*) Terhadap Mortalitas dan Perkembangan Larva Spodoptera

- litura. *Jurnal Sains dan Seni ITS*, 5(2), 23–28.
- Tehubijuluw, H., Watuguly, T., & Tuapattinaya, P. M. (2018). Analisis Kadar Flavonoid Pada Teh Daun Lamun (Enhalus acoroides) Berdasarkan Tingkat Ketuaan Daun. *Biopendix: Jurnal Biologi, Pendidikan dan Terapan*, 5(1), 1–7.
- THAHIR, A., KOMARUDIN, K., HASANAH, U. N., & RAHMAHWATY, R. (2019). MURDER Learning and Self Efficacy Models: Impact on Mathematical Reflective Thingking Ability. *Journal for the Education of Gifted Young Scientists*, 7(4), 1123–1135.
- Umi, L., & Suharti, P. (2019). Efektivitas Pemberian Pestisida Nabati Filtrat Daun Widuri (Calotropis Gigantea) Terhadap Tingkat Mortalitas Siput Murbai (Pomaceae Canaliculata Lamarck). *PEDAGO BIOLOGI*, 7(1), 43–51.
- Wiratno, W., Rizal, M., & Laba, I. W. (2017). Potensi ekstrak tanaman obat dan aromatik sebagai pengendali keong mas. *Buletin Penelitian Tanaman Rempah dan Obat*, 22(1), 54–64.
- Yana, Y. (2018). Uji Ekstrak Daun Jambu Biji (*Psidium guajava L.*) Sebagai Ovisida Keong Mas (*Pomacea canaliculata L.*) (Sebagai Alternatif Sumber Belajar Peserta Didik untuk Meningkatkan Materi Pencemaran Lingkungan SMA Kelas X Semester Genap) Skripsi Diajukan Untuk.