



**EVALUATION OF MOLLUSCICIDAL PROPERTY OF *Euphorbia milii* L.  
LEAVES USING INDIGENOUS EXTRACTS ON GOLDEN APPLE SNAILS  
(*Pomacea canaliculata* L.)**

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An Undergraduate Thesis Submitted to the Faculty of Department of  
Biological Science, College of Arts and Sciences, Central Luzon  
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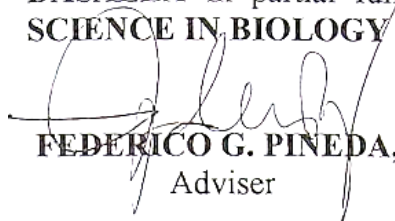


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ABSTRACT

**DASALLA, LYKA FAITH M.** Bachelor of Science in Biology, Department of Biological Sciences, College of Arts and Sciences, Central Luzon State University, Science City of Munoz, Nueva Ecija, Philippines, June 2017. **EVALUATION OF MOLLUSCICIDAL PROPERTY OF *Euphorbia milii* L. leaves USING INDIGENOUS EXTRACTS ON GOLDEN APPLE SNAILS (*Pomacea canaliculata* L.)**

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This study was conducted to determine the molluscicidal property of *Euphorbia milii* L. leaves using indigenous solvents; lambanog and vinegar against young and adult golden apple snails (*Pomacea canaliculata* L.). A phytochemical screening was performed to know the phytochemicals present in the plant .

The *E. milii* leaves extract showed molluscicidal activity against golden apple snail. The indigenous extracts was subjected to bioassay for the determination of the mortality at 24, 48 and 72 hours after exposure to the extract treatment. The percent mortality of the golden apple snails in the positive control was consistently high. The indigenous extract of *E. milii* leaves using lambanog were effective and at the last (72) hour can kill almost 70% and *E. milii* leaves using vinegar can kill 60% of golden apple snails.



The highest mortality were obtained in 1000 ppm for both indigenous (lambanog and vinegar) extracts of *E. milii* leaves and results showed that the lambanog extract is more effective in killing golden apple snails than of the vinegar extracts.

Results proves that leaves of *E. milii* leaves can kill both young and adult golden apple snails and also the lambanog and vinegar is an effective solvent in killing golden apple snails. The study provides considerable scope in locating indigenous solvents for snails molluscicidal agents and *E. milii* leaves is potential source of natural molluscicide.



LITERATURE CITED

- AGARWAL, R.A. and D. K. SINGH.(1988).** Harmful gastropods and their control. *Acta Hydrochimistry Hydrobiology*, 16, 113-138
- AHMED, S. (1984).** The use of plant species for pest control in South Asia: some observations. Working Paper, East-west center, Honolulu, Hawaii.
- ALARD, F., S. GEERTS, and E. T. L.TRIEST.(1991).** Toxicite D' Ambrosia Maritima L. PlanteMolluscicide, sur les organismes Aquatiques Non-cibles. *Toxicon* 29, 745-750.
- ANDERSON, T.M. and A. DUBINOVSKIY.(2005).** *Euphorbia milii* Hybrids in Thailand. Retrieved November 19, 2006 from the World Wide Web: <http://www.lapshin.org/cultivar/N32/milii-e.htm>
- ANDREWS, P. et al.** 1983 *Pharmac Ther* 19: 245-295
- ANG, W. (1984).** Snails in the human diet. *Greenfields*, 14:30–31.
- BANERJEE, S. and H. REMBOLD. (1992).** Azadirachtin A interferes with control of serotonin pools in the neuroendocrine system of locusts. *Naturwissenschaften*, 79, 81-84.
- BROUILLARD, R., S. CHASSAING, G. ISOREZ, M. KUENY-STOTZ, and P. FIGUEIREDO (2010).** The saponins; from research to application
- CAGUAN, A.G. and R.C. JOSHI. (2002).** Golden Apple Snail *Pomacea* spp. in the Philippines. Presented at the 7th ICMAM Special Working Group on Golden Snail, Freshwater Aquaculture Center, Science City of Muñoz, Nueva Ecija Philippines
- CAGAYAN, A. (2001).** Golden Apple Snail in the Philippines. A Special Report Philippines Rice Research Institute, Science City of Muñoz, Nueva Ecija.
- DAHOT, M.U.(1998).** Vitamin contents of the flowers and seeds of *Moringa oleifera* Lam. *J. Biochem.* 21, 21-24.
- DE FIGUEIREDO, D.R., U. M. AZEITEIRO, S. M. ESTEVES, F. J. GONCALVES, and M. J. PEREIRA. (2004).** Microcystin-producing blooms-- a serious global public health issue. *Ecotoxicology Environment* 59, 151- 163.
- DOS SANTOS, A. F., DE AZEVEDO, D. P., DOS SANTOS MATA, R. D. C., DE MENDONÇA, D. I. D. and A. E. G. SANT'ANA. (2012).** The lethality of



*Euphorbia conspicua* to adults of *Biomphalaria glabrata*, cercaria of *Schistosoma mansoni* and larvae of *Artemia salina*. Bio resource technology, 98(1), 135-139.

- DUKE, J.A. (1987).** Moringaceae: horseradish-tree, drumstick-tree, sohnja, moringa, murunga-kai, mulungay, in: Benge, M.D. (Ed.), Moringa a multipurpose tree that purifies water. Science and Technology for Environment and Natural Resources, Boston, 19-28.
- EBIHARA K. and A. NAKAJIMA. (1988).** Effect of acetic acid and vinegar on blood glucose and insulin responses to orally administered sucrose and starch. AgricBiolChem 52:311-2.4
- EL-SHERBINI, G. T., R. A. ZAYED, and E.T. EL-SHERBINI. (2010).** Molluscicidal activity of some Solanum species extracts against the snail *Biomphalaria alexandrina*. Journal of parasitology research, 2009, 5.
- FOOD STANDARDS AUSTRALIA NEW ZEALAND.(2004).** Cyanogenic Glycosides in Cassava and Bamboo shoots. Retrieved January 25, 2006 from the WWW:[http://www..foodstandards.com.gov.au/\\_srcfiles/Cyanogenic%20glycosides.doc](http://www.foodstandards.gov.au/_srcfiles/Cyanogenic%20glycosides.doc)
- FOLKHART, G.K., SUTHERLAND, J.P. and W.D.GRANT. (1993).** Natural coagulants at pilot scale, in: Pickford, J. (Ed.), Water, Environment and Management: Proceedings of the 18<sup>th</sup> WEDC Conference, Aug 30-Sept 3 1992, Kathmandu, Nepal. Loughborough University Press, University Press, 51-54.
- FUSHIMI T., K. TAYAMA, M. FUKAYA, K. KITAKOSHI, N. NAKAI, Y. TSUKAMOTO and Y. SATO. (2001).**The efficacy of acetic acid for glycogen repletion in rat skeletal muscle after exercise. Intl J Sports, Med 23:218-22
- HALLGENTEN, F. (2006).**Wine scandal. (2nd ed.). Sphere books Ltd, London. Pp 1-55
- HASMAR, S.N. and S. ISMALI.(2001).** Tannins. Retrieved December 3, 2006 from the WWW: <http://launc.tased.edu.au/online/sciences/agsci/wine/tannins.htm>
- HASSAN, A. A., MAHMOUD, A. E., HASSAN, R. A and E.M. HUSEEIN.(2012).** Evaluation of *Euphorbia aphylla*, *Ziziphusspina-christi* and *Enterolobium contortiliquum* as Molluscicidal Agents. J Am Sci, 7, 511-520.
- HIGDON, J. (2005).** Flavonoids. Retrieved December 3, 2006 from the World Wide Web: <http://www.healthnotes.com/>
- HILDEBRAND, D. (2001).** Nitrogen Metabolism – Alkaloids. Retrieved December 1, 2006 from the World Wide Web: <http://www.uky.edu/-dhild/biochem/html>



- HOSTETTMANN, K. and P.J. LEA. (1987).** Biologically active natural products. Oxford Science Publication, Oxford
- HUANG, J.L. and J. MICHAEL.(2004).** Saponins. Retrieved December 3, 2006 from the WWW: <http://ansci.cornell.edu/plants/toxicagents/saponin.html#plant>
- ISLAM, N. U., KHAN, I., RAUF, A., MUHAMMAD, N., SHAHID, M. and M. R. SHAH. (2015).** Antinociceptive, muscle relaxant and sedative activities of gold nanoparticles generated by methanolic extract of *Euphorbia milii*. BMC complementary and alternative medicine, 15(1), 1.
- JACKSON, E.(2011).** From whence come coconuts?. *The Panama News* (Volume 12, Number 16). Retrieved April 10, 2011.
- JAVED, F. AL-HEZAIMI, K. and S. WARNAKULASURIYA.(1995).**Chemical Irritant Dermatitis. Retrieved June 15, 2006 from the World Wide Web: <http://www.telemedicine.org/botanica/bot4.htm>.
- JOSHI, R.C., N. S. BAUCAS, E. E. JOSHI, and E. A. VERZOLA. (2003).**CD-ROM:Information database on the golden apple snail (golden kuhol),*Pomacea canaliculata* (Lamarck): A terminal report submitted tothe Department of Agriculture-Cordillera Highland Agricultural Resource Management Project. 18.
- JOSHI, R.C. (2005).**The golden apple snail: Raiders of the rice fields. *Outlooks on Pest Management*, 16:23–26.
- KLOOS, H. and F.S. MCCOLLOUGH.(1987).** Plants with recognized molluscicidal activity. Mott KE, ed. *Plant Molluscicides*. Chicester: John Wiley & Sons and Geneva: UNDP/World Bank- WHO, 45–108.
- KONDO, S., K. TAYAMA, Y. TSUKAMOTO, K. IKEDA, and Y. YAMORI.(2001).** Antihypertensive effects of acetic acid and vinegar on spontaneously hypertensive rats. *Biosci Biotechnology Biochemical* 65:2690–4.
- LILJEBERG, H., and I. FJORCK.(1998).** Delayed gastric emptying rate may explain improved glycaemia in healthy subjects to a starchy meal with added vinegar. *Eur J ClinNutr* 52:368–71.
- MARSTON, A. and E. HECKER.(1983).** On the active principle of the Euphorbiaceae VI. *PlantaMedica* 47: 141–147.
- MARSTON, A. and K. HOSTETTMANN. (1985).** Plant molluscicides. *Phytochemistry* 24: 639–652



- MASSAGUNI, R. and S. N. H. M. LATIP.(2015).**Assessment of the molluscicidal properties of azadirachtin against golden apple snail, *Pomacea canaliculata*. Malaysian journal of analytical sciences, 19(4), 781-789.
- MCGRAW-HILL, J. ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY.(2005).** Alkaloids. Retrieved December 1, 2006 from the World Wide Web: <http://www.answers.com/topics/alkaloids/copyright>
- MCLAUGHLIN, J. and J. GAROFALO. (2002).** Crown – of – Thorns, *Euphorbia milii*. Retrieved November 19, 2006 from the World Wide Web: <http://www.tropicalnursery.com/euphorbia/story.htm>
- MELLO-SILVA, C. C., VILAR, M. M., VASCONCELLOS, M. C. D., PINHEIRO, J. and M. D. L. D. A. RODRIGUES.(2010).**Carbohydrate metabolism alterations in *Biomphalaria glabrata* infected with *Schistosoma mansoni* and exposed to *Euphorbia splendens* var. *hislopii* latex. Memórias do Instituto Oswaldo Cruz, 105(4), 492-495.
- MENDES, N.M., D. F. BAPTISTA, M. C. VASCONCELLOS, and V.T. SCHALL.(1992).** Evaluation of the molluscicidal properties of *Euphorbia splendens* var. *hislopii* (N.E.B) (Euphorbiaceae). I. Experimental test in a lentic habitat. Mem Inst Oswaldo Cruz 87: 21– 23.
- MENDES, N. M., VASCONCELLOS, M. C., BAPTISTA, D. F., ROCHA R.S., and V. T., SCHALL. (1997).** Evaluation of the molluscicidal properties of *Euphorbia splendens* var *hislopii* (N.EB.) latex; experimental test in an endemic area of Minas Gerais, Brazil. Me, Inst Oswaldo Cruz; 92:719-24
- MORALLO-REJESUS, B. (1986).**Botanical insecticides against the diamondback moth.In Eds. Proceeding of the First International Workshop, 241-256.
- MOTT, K.E.(1987).** Plant Molluscicides. Chichester: John Wiley Sons and Geneva: UNDP/World Bank/WHO
- MULDER, P., N. NIVARLET, and H. VAN EGMOND. (2014)** Detection of antihelmentic effects of tannins in anima: Part A: 31 (7), pp. 1165-1176.
- MUSMAN, M. (2010).**Toxicity of *Barringtonia racemosa* (L.) kernel extract on *Pomacea canaliculata* (Ampullariidae). Tropical life sciences research, 21(2), 41.
- NAIR, S. and K.N. VARALAKSHMI. (2011).** Anticancer, cytotoxic potential of *Moringa oleifera* extracts on HeLa cell line. J. Nat. Pharm. 2, 138-142



- MASSAGUNI, R. and S. N. H. M. LATIP.(2015).**Assessment of the molluscicidal properties of azadirachtin against golden apple snail, *Pomacea canaliculata*. Malaysian journal of analytical sciences, 19(4), 781-789.
- MCGRAW-HILL, J. ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY.(2005).** Alkaloids. Retrieved December 1, 2006 from the World Wide Web: <http://www.answers.com/topics/alkaloids/copyright>
- MCLAUGHLIN, J. and J. GAROFALO. (2002).** Crown – of – Thorns, *Euphorbia milii*. Retrieved November 19, 2006 from the World Wide Web: <http://www.tropicalnursery.com/euphorbia/story.htm>
- MELLO-SILVA, C. C., VILAR, M. M., VASCONCELLOS, M. C. D., PINHEIRO, J. and M. D. L. D. A. RODRIGUES.(2010).**Carbohydrate metabolism alterations in *Biomphalaria glabrata* infected with *Schistosoma mansoni* and exposed to *Euphorbia splendens* var. *hislopii* latex. Memórias do Instituto Oswaldo Cruz,105(4), 492-495.
- MENDES, N.M., D. F. BAPTISTA, M. C. VASCONCELLOS, and V.T. SCHALL.(1992).** Evaluation of the molluscicidal properties of *Euphorbia splendens* var. *hislopii* (N.E.B) (Euphorbiaceae). 1. Experimental test in a lentic habitat. Mem Inst Oswaldo Cruz 87: 21– 23.
- MENDES, N. M., VASCONCELLOS, M. C., BAPTISTA, D. F., ROCHA R.S., and V. T., SCHALL. (1997).** Evaluation of the molluscicidal properties of *Euphorbia splendens* var *hislopii* (N.EB.) latex; experimental test in an endemic area of Minas Gerais, Brazil. Me, Inst Oswaldo Cruz; 92:719-24
- MORALLO-REJESUS, B. (1986).**Botanical insecticides against the diamondback moth.In Eds. Proceeding of the First International Workshop, 241-256.
- MOTT, K.E.(1987).** Plant Molluscicides. Chichester: John Wiley Sons and Geneva: UNDP/World Bank/WHO
- MULDER, P., N. NIVARLET, and H. VAN EGMOND. (2014)** Detection of antihelmentic effects of tannins in anima: Part A: 31 (7), pp. 1165-1176.
- MUSMAN, M. (2010).**Toxicity of *Barringtonia racemosa* (L.) kernel extract on *Pomacea canaliculata* (Ampullariidae). Tropical life sciences research, 21(2), 41.
- NAIR, S. and K.N. VARALAKSHMI. (2011).** Anticancer, cytotoxic potential of *Moringa oleifera* extracts on HeLa cell line. J. Nat. Pharm. 2, 138-142



- SCHOELLHORN, R. (2003).** Crown of thorns makes a comeback. Retrieved November 19, 2006 from the World Wide Web: <http://www.wanapluk.com/tropical-plants-article/crown-of-thorns-comeback.html>
- SENGBUSCH, P.V. (2003).** Glycoside. Retrieved January 25, 2006 from the Worldwide Web: <http://www.biologie.uni-hamburg.de/b-online/e-20/20g.htm>
- SIN, T.S.(2003).**Damage potential and control of *Pomacea canaliculata* (Lamarck) in irrigated rice and its control by cultural approaches. International Journal of Pest Management 49:49–55.
- SINGH et al., (1999).** Molluscicidal properties of synthetic pyrethroids. J. Med. Appl. Malacol. 2: 141–144.
- SINGH, A. and D.K. SINGH.(1994).** Pestoban, a potent herbal molluscicide. Biological Agriculture and Horticulture 10, 175-178.
- SINGH, D.K. and A. SINGH. (1993).** Garlic *Allium sativum*, a potent new molluscicide. Biological Agriculture and Horticulture 9, 121-124
- SINGH, K.L., D. K. SINGH, and V.K. SINGH. (2012).** Characterization of the molluscicidal activity of *Bauhinia variegata* and *Mimusopselengi* plant extracts against the Fasciola vector *Lymnaea acuminata*. Revista do Instituto de Medicina Tropical de São Paulo, 54(3), 135-140.
- SINGH, S. K., YADAV, R.P., TIWARI, S. and A. SINGH. (2005).**Toxic effect of stem bark and leaf of *Euphorbia hirta* plant against freshwater vector snail *Lymnaea acuminata*. Chemosphere, 59(2), 263-270.
- SOUZA, C.A., M., DE-CARVALHO, R. R., KURIYAMA, S. N., ARAUJO, I. B., RODRIGUES, R. P., VOLLMER, R. S., and F. J. R. PAUMGARTTEN. (1997).** Study of the embryofeto-toxicity of Crown-of-Thorns (*Euphorbia milii*) latex, a natural molluscicide. Brazilian journal of medical and biological research, 30(11), 1325-1332.
- SUN., Y.X. and J.C. LIU.(2011).** Chemical constituents and Biological Activities of *Euphorbia fischeriana*, Chemistry and Biodiversity, 8: 1205-1214.
- TANZO, K.E.R. and B.R.F. BARROGA. (1988).**Winning over the golden snail. Manila journal, 11-13
- TANZO, K.E.R. and B.R.F. BARROGA. (1989).**Managing the golden kuhol pest problem. Agribusiness weekly, Manila, 11(1913):15



- TIILIKKALA, K., L. FAGERNAS, and J. TIILIKKALA.**(2010). History and use of wood pyrolysis liquids as biocide and plant protection product. *The Open Agriculture Journal*, Vol. 4, (October 2010), pp 111-118, ISSN 1874-3315
- VAN DER NAT, J.M., W. G. VAN DER SLUIS, K. T. D. DE SILVA, and R.P. LABADIE.** (1991). Ethnopharmacognostical survey of *Azadirachta indica* A. Juss (Meliaceae). *Journal of Ethnopharmacology* 35, 1-24.
- VASCONCELLOS, MC and VT SCHALL.**(1986 ). *Mem Inst Oswaldo Cruz* 81: 475-476)
- VEIRA-FILHO MASSAGUNI, R. and S. N. H. M. LATIP.**(2015).Assessment the molluscicidal properties of azadirachtin against golden apple snail, *Pomacea canaliculata*. *Malaysian Journal of Analytical Sciences*, 19(4), 781-789.
- VIJAY, P.** (2010). Evaluation of molluscicidal activity of some Indian medicinal plants against *Lymnaea acuminata*. *Int J Appl Biol Pharm Technol*, 1: 308-311.
- WEI, F. H., XU, X. J., LIU, J. B., DAI, Y. H., DUSSART, G., and J. TRIGWELL.** (2002). Toxicology of a potential molluscicide derived from the plant *Solanum xanthocarpum*: a preliminary study. *Ann. Trop. Med. Parasitol.* 96, 325–331.
- WILLIAMS, R.J., J.P.E. SPENCER AND C. RICE-EVANS.** (2004). Flavonoides antioxidants or Signaling molecule? *Free Radical. Biology and Medicine*, 7,36: 838-849.
- WHO - WORLD HEALTH ORGANIZATION.**(1983). Report of the scientific working group on plant molluscicides, Document WHO/TDR/SCH-SWE 4, 83.3, WHO, Geneva, 1-11.
- XU, Q.P., AO, Z.H. and W.Y. TAO.** (2004).Antioxidative activity of Hengshun aromatic vinegar extracts. *China Brewing* 7:16–8.
- YADAV, R. P. and A. SINGH.** (2011). Efficacy of *Euphorbia hirta* latex as plantderivedmolluscicides against freshwater snails. *Revista do Instituto de Medicina Tropical de São Paulo*, 53(2), 101-106.
- ZANI, C.L., A. MARSTON, M. HAMBURGER, and K.HOSTETTMANN.** (1993). Molluscicidal milliamines from *Eurphobia milli* var. hislopii. *Phytochemistry* 34: 89–95.