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Effectiveness of *Annona muricata* Leaf Extract as a Biopesticide Against *Strepsicrates sp.* in *Eucalyptus pellita* Seedlings

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Abstract

Background: *Industrial forest plantations, particularly Eucalyptus pellita, are widely cultivated for pulp and paper production. However, nurseries of E. pellita, including those in the R&D facilities of PT Arara Abadi, are frequently infested by pests such as Strepsicrates sp. Synthetic pesticides are commonly applied to manage these infestations, although their use may pose risks to the environment. As an alternative, botanical pesticides derived from Annona muricata leaf extract have gained attention. Therefore, this study aimed to evaluate the effectiveness of A. muricata leaf extract in controlling Strepsicrates sp. and to determine its optimal concentration for application in E. pellita nurseries.* **Methodology:** *The experiment employed a completely randomized design (CRD) consisting of four treatments with five replicates. Data were analyzed using Duncan's New Multiple Range Test (DNMRT) at a 5% significance level. The treatments consisted of concentrations of 10 g/L, 20 g/L, 30 g/L, and 40 g/L. Observed parameters included room temperature, relative humidity, time to initial mortality, time to 50% mortality, daily mortality rate, and total mortality.* **Findings:** *A. muricata leaf extract was effective in controlling Strepsicrates* sp. on *E. pellita. The results indicated that the optimal concentration was 40 g/L, resulting in the shortest initial mortality time of 5.2 hours, a median lethal time (LT_{50}) of 22.58 hours, and a total mortality rate of 100%.* **Contribution:** *The findings of this study indicate that A. muricata leaf extract at a concentration of 40 g/L has strong potential for application as an environmentally friendly, effective, and sustainable botanical pesticide, supporting integrated pest management in E. pellita nurseries and reducing reliance on synthetic chemicals.*

Keywords: *Annona muricata; Botanical pesticide; Eucalyptus pellita; Strepsicrates*

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INTRODUCTION

Eucalyptus is one of the plant species that is often used in the development of Industrial Forest Plantations (HTI) as a base material for pulp and paper. Compared to other species of Eucalyptus, *Eucalyptus pellita* grows faster and has certain advantages (Saputra & Mardaleni, 2023). The advantages of *E. pellita* include its rapid growth, short harvesting time, resistance to disease, and various benefits, all of which contribute to itsigh economic value (Sulichantini, 2016). One of the companies developing *Eucalyptus* is the Research and Development (R&D) division of PT Arara Abadi.

PT Arara Abadi R&D develops *Eucalyptus* seedlings in the nursery area using generative and vegetative techniques (Desiyanti et al., 2016). Good seedlings will eventually grow and acquire back into forests and restore their benefits as carbon sinks (Ambarita et al., 2025; Pebriandi et al., 2025), animal habitat (Angraini et al., 2024), bee feed (Khikmanisa et al., 2024), recreation and ecotourism sites (Pajri et al., 2023). Good seedlings will increase the survival rate in the field (Mardhiansyah et al., 2024). Various benefits can be obtained from high-quality seedlings.

The pests that attack *Eucalyptus* nurseries are *Strepsicrates* sp. Controlling *Strepsicrates* sp. pests in *Eucalyptus* nurseries in industrial plantation forest areas still relies on the use of synthetic pesticides as the primary method. Synthetic pesticides have a negative impact on the environment and human health. Another alternative that can reduce the use of synthetic pesticides is using botanical pesticides.

Botanical pesticides are generally made from plants that can control plant pest organisms. According to research by Sutikno et al., (2020), *Annona muricata* has the potential as a vegetable pesticide. According to Hasmila et al., (2019), A. leaves contain flavonoids, steroids, saponins, and tannins. These compounds are stomach poisons and have the potential to kill pests (Desiyanti et al., 2016). According to Sumantri et al (2014), *A. muricata* leaves also contain acetogenin compounds that can damage the stomachs of insects and disrupt their digestive functions. This study aims to determine the effect of *A. muricata* leaf extract in controlling leaf rolling caterpillar pests and the best concentration of *A. muricata* leaf extract in controlling *Strepsicrates* sp. pests in *Eucalyptus pellita* nurseries.

METHOD

This research was conducted using the experimental method of a completely randomized design (CRD). The treatments were assigned randomly to each experimental unit to minimize variability and ensure unbiased results. This design was selected because it is effective for controlling experimental error and suitable for studies evaluating the effect of different concentrations of plant extracts.

Sample or Participant

This study consisted of four treatments and five replications, so there were 20 experimental units. The experimental unit consisted of 10 *Strepsicrates* sp. instar III

pests so that the number of pests used was 200 individuals. The treatments in this study were:

P1 = Concentration of *A. muricata* leaf extract 10 g/liter of water.
P2 = Concentration of *A. muricata* leaf extract 20 g/liter of water.
P3 = Concentration of *A. muricata* leaf extract 30 g/liter of water.
P4 = Concentration of *A. muricata* leaf extract 40 g/liter of water.

Extraction

The soursop leaves used were 500 g. The soursop leaves were picked, then washed and then dried naturally at room temperature. After reaching the desired dryness level the leaves are cut into small pieces and crushed using blender until it forms a powder. The smooth soursop leaves were then filtered and weighed using an analytical scale according to the treatments of 10 g, 20 g, 30 g, and 40 g. Then, 1 liter of distilled water was added to each treatment, then soaked for 24 hours. The next step is to filter each extract using a 60-mesh sieve, resulting in a soursop leaf extract that is ready for use.

Data collection

Data collection was conducted over 72 hours, recording temperature and humidity, as well as the initial death time of leaf roller caterpillar pests, specifically Lethal Time 50 (LT50). Daily Mortality (%) and total mortality (%).

Procedure

The soursop leaf extract solution was mixed with a solvent with a concentration of 2 ml using detergent. Then the Eucalyptus leaves were dipped for 1 minute and air-dried. Eucalyptus leaves were placed in a jar container as many as 10 sheets and the leaves used as feed were young leaves. After that, 10 individuals of instar III *Strepsicrates* sp. pests were put into the jar container, then the jar was covered with gauze and provided with information on the application date and treatment concentration using label paper.

Data analysis

The results obtained were analyzed using SPSS Statistics 29, and further tests were carried out using Duncan's New Multiple Range Test (DNMRT) at a significance level of 5%. Parameters in this study include: Temperature and humidity, Initial Mortality time, 50% Mortality Time, Daily mortality and Total mortality.

RESULT AND DISCUSSION

Temperature and Humidity

Environmental factors such as temperature and humidity play a crucial role in regulating leaf development by affecting physiological processes, cellular growth, and

overall plant vigor. When these factors fluctuate beyond optimal ranges, they can alter metabolic activity and disrupt the normal formation of leaf tissues. As a result, understanding how temperature and humidity interact is essential for predicting leaf growth patterns and maintaining healthy plant development (Abdelghany & Fields, 2017). According to Rani et al., (2023), the optimal temperature for the development of this pest ranges from 20 – 35 °C and relative humidity of 40 – 80 %. Temperature and humidity measurement data in the laboratory indicated an average temperature of 25.67 °C and a humidity level of 69.89%. The resulting temperatures and humidity levels were relatively consistent across each treatment. It is suspected that pest mortality is not influenced by environmental factors but is caused by the concentration of *A. muricata* leaf extract, which contains active compounds that are toxic.

Initial Mortality Time

The initial mean mortality of *Strepsicrates* sp. based on the results of DNMRT further test at the 5% level can be seen in Table 1. Concentrations of *A. muricata* leaf extract in Table 1. showed different time of death of *Strepsicrates* sp. The concentration of *A. muricata* leaf extract with a concentration of 40 g/1 water produced the fastest initial death time of 5.20 hours (5 hours 12 minutes). Then, the concentration of *A. muricata* leaf extract at 10 g/L water produced the slowest initial death time of 11.61 hours (11 hours and 36 minutes). The difference in concentration between treatments is one of the factors that affects the initial time of death of the test insects.

Table 1. Mean initial mortality of *Strepsicrates* sp.

Treatment Concentration (g/1 water)	Mean Initial Mortality (hours)
40	5.20[a]
30	7.25[b]
20	9.76[c]
10	11.61[d]

The initial symptoms of *Strepsicrates* sp. death are characterized by changes in behavior, specifically the caterpillars become less active and exhibit morphological changes, transitioning from green to blackish. This indicates that the more Strepsicrates sp. consumes eucalyptus leaves treated with *A. muricata* leaf extract, the more active compounds are toxic to the body of *Strepsicrates* sp. These toxic compounds can affect caterpillar behavior and reduce feeding activity, potentially leading to death (Juliati, 2016).

Mortality Time (50%)

The observation of a 50% mortality time with DNMRT at a 5% level showed a significant effect on the 50% mortality time of Strepsicrates sp., as shown in Table 2. Table 2 shows the varying time required for each treatment. *A. muricata* leaf extract

with 40 g/l concentration treatment showed the fastest time in killing 50% of *Strepsicrates* sp. compared to the other concentration treatments, namely 22.58 hours (22 hours 34 minutes). *A. muricata* leaf extract with a concentration of 10 g/l showed the slowest time in killing 50% of *Strepsicrates* sp. which was 35.97 hours (35 hours 58 minutes). The results showed that the increasing concentration of *A. muricata* leaf extract can increase the number of deaths of *Strepsicrates* sp.

Table 2. Mean value of 50% mortality time of *Strepsicrates* sp.

Treatment Concentration (g/l)	Mean 50% Mortality Time (hours)
40	22.58[a]
30	26.30[b]
20	29.64[c]
10	35.97[d]

The content of *A. muricarata* leaf extract contains compounds that can cause poisoning of the digestive and nervous systems of *Strepsicrates* sp. According to Zega & Fau (2021), acetogenin compounds in *A. muricata* leaves can disrupt the respiratory system and nervous system of insects and ultimately cell death (Nisa & Ardiansyah, 2024). The function of this acetogenin compound is similar to flavonoid compounds. Flavonoid compounds are insecticidal because they can target and attack insect nerve cells,esulting in death (Rahmadi et al., 2022). Flavonoid compounds can inhibit insect respiration, thereby disrupting electron transfer in insect mitochondria and affecting energy processes within these organelles (Muta'ali & Purwani, 2015).

A. muricata leaf extract also contains acetogenin compounds that function as antifeedants by reducing the ability to eat pests (Moniharapon et al., 2015) Acetogenin compounds can be released in the form of aroma, so that insects do not want to eat. According to Arimbawa et al., (2018) that *A. muricata* leaf extract contains saponin compounds that give a bitter taste, thus reducing the appetite of pests. Death in the test larvae occurs due to the lack of digestive processes in the body of the test pests, which is caused by tannin compounds contained in *A. muricata* leaf extract. The active compounds found in *A. muricata* leaf extract cause *Strepsicrates* sp. not to eat the eucalyptus leaves. This can result in a reduced level of damage, which supports the effectiveness of *A. muricata* leaf extract in killing 50% of the *Strepsicrates* sp. population.

Daily Mortality

Daily mortality is conducted to monitor the increase in mortality of the Strepsicrates sp. pest population on a daily basis. The results of daily mortality after 72 hours can be seen in Figure 1. Figure 1 shows that on the first day of observation, the use of *A. muricata* leaf extract resulted in the death of *Strepsicrates* sp. with a range of 12 - 52%. Concentrations of 10 g/l, 20 g/l, 30 g/l and 40 g/l produced mortality rates of 12%, 20%, 30% and 52%, respectively. Concentrations with the highest daily mortality rates on the first day were found at concentrations of 30 g/L water and 40 g/L water. This is because the different concentration levels in each treatment affect the daily

mortality obtained differently. Increasing the concentration of pesticide extracts used to control pests also increases the percentage of mortalityMoniharapon et al., 2021).

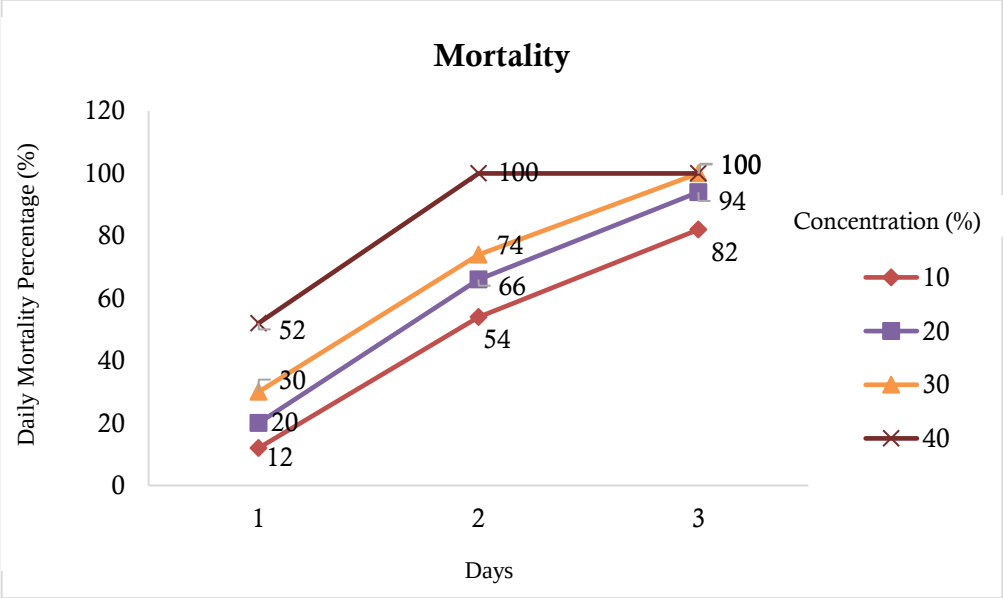

Figure 1. Daily Mortality *Strepsicrates* sp

The increase in mortality on the second day is consistent with several studies reporting that active compounds in botanical pesticides, such as acetogenins, alkaloids, and flavonoids contained in *Annona muricata* leaves, act gradually through stomach and contact toxicity mechanisms that disrupt the digestive, respiratory, and nervous systems of insects (Isman, 2006; Leatemia & Isman, 2004). Acetogenins are known to inhibit mitochondrial activity by interfering with the electron transport chain, thereby reducing energy production and causing insect death in a slow but effective manner (Alali et al., 1999). In addition, the increased mortality observed on the second day may be attributed to the accumulation of toxic compounds in the larval body following repeated feeding, leading to tissue damage and failure of physiological functions (Dubey et al., 2010). Several studies on lepidopteran pests have shown that the effectiveness of botanical pesticides generally increases with exposure time, particularly at higher concentrations, as sublethal effects gradually develop into total mortality (Pavela, 2016). This further supports the finding that the 40 g/l concentration exerted the maximum effect on Strepsicrates sp. mortality on the second day of observation.

The Muricata leaf extract used on the third day was associated with the peak mortality for *Strepsicrates* sp. The increase in mortality on the third day ranged from 82 to 100%. Concentrations of 10 g/L water, 20 g/L water, 30 g/L water, and 40 g/L water produced daily mortality percentages of 82%, 94%, 100%, and 100%, respectively. The highest daily mortality was observed at concentrations of 30 g/L water and 40 g/L water. In accordance with the Tarumingkreng (1992) opinion that the active ingredients of vegetable pesticides are able to poison pests and work effectively two days to three days after application.

The higher the concentration, the more active ingredients it contains, thus increasing its toxicity. High toxicity will cause *Strepsicrates* sp. to die. According to

Kolo et al., (2018), that the killing power of *A. muricata* extract is caused by the content of toxic secondary metabolites, namely acetogenin compounds. Acetogenin can inhibit growth, affect the nervous system, and disrupt insect reproductive development, potentially leading to respiratory failure and death.

Total Mortality

The results of the total mortality observation of Strepsicrates sp. after analyzing the DNMRT test at the 5% level are presented in Table 3.

Tabel 1. Mortality of *Strepsicrates* sp.

Treatment Concentration (g/l water)	Total Mortality (hours)
40	10.00[a]
30	10.00[a]
20	94.00[a]
10	82.00[b]

Table 3 shows that higher concentration levels of *A. muricata* leaf extract will result in an increased percentage of total mortality. The mortality percentage of *Strepsicrates* sp. reached 100% in the treatment with 40 g/l concentration of *A. muricata* leaf extract and this result was not significantly different from the 30 g/l concentration treatment. The 20 g/L concentration treatment, with a mortality percentage of 94%, was significantly different from the 10 g/L concentration, with a mortality percentage of 82%. This is in accordance with the opinion of Dadang & Prijono (2008) who consider vegetable insecticides effective if they can kill insect pests by 80% or more, using water solvents not exceeding 10% and organic solvents not exceeding 1%.

CONCLUSION

Based on the research findings, *A. muricata* leaf extract demonstrates a significant effect in controlling *Strepsicrates* sp. The most effective treatment concentration is 40 g/L, which produces the fastest mortality time of 5.2 hours (5 hours 12 minutes) and achieves an LT_{50} value of 22.58 hours (22 hours 34 minutes) with a total mortality rate of 100%. These results indicate that *A. muricata* leaf extract has strong potential as a botanical insecticide and can serve as an effective, environmentally friendly alternative for managing leaf-roller pests in *Eucalyptus pellita* nurseries.

REFERENCES

Abdelghany, A. Y., & Fields, P. G. (2017). Mortality and movement of Cryptolestes ferrugineus and Rhyzopertha dominica in response to cooling in 300-kg grain bulks. *Journal of Stored Products Research*, *71*, 119–124. https://doi.org/10.1016/j.jspr.2017.02.004.

Ambarita, K. L. F., Pebriandi, P., Oktorini, Y., Maryani, M., Ikhsani, H., & Effendi, I. (2025). Estimating Biomass and Carbon Stock Potential in the Imbo Putui Customary Forest Ecosystem, Riau. *International Journal of Peatland Research and Innovation, 1*(2), 74–86. https://doi.org/DOI:https://doi.org/10.64125/c47qtk17

Angraini, R., Yoza, D., & Pebriandi, P. (2024). Diversity of Soil Surface Arthropods Species in Taman Hutan Raya Sultan Syarif Hasyim, Riau Province. Jurnal Pembelajaran Dan Biologi Nukleus, 10(1), 190–206. https://doi.org/10.36987/jpbn.v10i1.5346

Arimbawa, I. D. M., Martiningsih, N. Gst. Ag. E., & Javandira, C. (2018). Testing the Potential of Soursop Leaves (*Annona muricata* L) to Control Coffee Leafworm Pests (Crocidolomia pavonana F). *Agrimeta*, *8*(15), 60–71. **[*In Indonesian language*]**

Dadang, D., & Prijono, D. (2008). *Plant-based Insecticides: Principles, Utilisation and Development.* Bogor: Departemen Proteksi Tanaman, Institut Pertanian Bogor. 163 p. **[*In Indonesian language*]**

Desiyanti, N. M. D., Swantara, I. M. D & Sudiarta, I. P. (2016). Testing the Effectiveness and Identification of Active Compounds in Soursop Leaf Extract as a Natural Pesticide against Peach Leaf Aphid Mortality (*Myzus persicae* sulz) in Red Chili (*Capsipcum annum* L.). *Jurnal Kimia, 10*(1), 1–6. **[*In Indonesian language*]**

Hasmila, I., Natsir, H., & Soekamto, N. H. (2019). Phytochemical analysis and antioxidant activity of soursop leaf extract (*Annona muricata* Linn.). *Journal of Physics: Conference Series*, *1341*(3). https://doi.org/10.1088/1742-6596/1341/3/032027

Isman, M. B. (2006). Botanical Insecticides, Deterrents, And Repellents In Modern Agriculture And An Increasingly Regulated World. Annual Review of Entomology, 51(1), 45–66. https://doi.org/10.1146/annurev.ento.51.110104.151146

Juliati., Mardhiansyah, M., & Arlita, T. (2016). Testing Several Concentrations of Bintaro Leaf Extract (*Cerbera manghas* L.) as a Natural Pesticide to Control Jengkal Caterpillar (*Plusia* sp.) on Trembesi (*Samanea Saman* (Jacq.)Merr.). *JOM Faperta UR*, *3*(1), 1-7. **[*In Indonesian language*]**

Khikmanisa, T., Yoza, D., & Pebriandi, P. (2024). Habitat Characteristics of Kelulut Bee Colonies in Baturijal Hulu Village, Peranap Subdistrict, Indragiri Hulu Regency, Riau. *Journal of Tropical Silviculture, 15*(3), 185–193. https://doi.org/https://doi.org/10.29244/j-siltrop.15.03.90-97 **[*In Indonesian language*]**

Kolo, S. M. (2018). The Effectiveness of Biolarvasida Extracts from Soursop Leaves and Lemongrass against Mosquito Larvae *Aedes aegypti*. *Jurnal Saintek Lahan Kering*, *1*(1), 13–16. https://doi.org/10.32938/slk.v1i1.441 **[*In Indonesian language*]**

Leatemia, J. A., & Isman, M. B. (2004). Insecticidal activity of crude seed extracts of Annona spp.,Lansium domesticum andSandoricum koetjape against lepidopteran larvae. *Phytoparasitica, 32*(1), 30–37. https://doi.org/10.1007/BF02980856

Mardhiansyah, M., Imanto, T., Pebriandi, P., Sribudiani, E., Somadona, S., & Suhada, N. (2024). Evaluating The Physical Quality of Trembesi Seedlings (Samanea saman) in The Permanent Nursery of BPDAS Indragiri Rokan, Pekanbaru City, Riau Province. *Jurnal Agronomi Tanaman Tropika (Juatika)*, *6*(3), 760-769. https://doi.org/10.36378/juatika.v6i3.3721

Moniharapon, D. D., Nindatu, M., & Bastian, A. (2021). The Effect of Lemongrass Stem Extract (Cymbopogon Citratus L.) on the Mortality of Plutella Xylostella L. Pests on Mustard Plants (Brassica juncea L.). *Biofaal Journal*, *2*(1), 47–56. https://doi.org/10.30598/biofaal.v2i1pp47-56 **[*In Indonesian language*]**

Moniharapon, D. D., Nindatu, M., & Sarbunan, F. (2015). The Effect of Soursop Leaves (*Annona muricata* L.) as a Botanical Insecticide on Mortality of *Sitophilus oryzae. Agologia,* 4(2*),*114-118. **[*In Indonesian language*]**

Muta'ali, R., & Purwani, I. K. (2015). The Effect of Beluntas Leaf Extract (Pluchea Indica) on Mortality and Larval Development of *Spodoptera litura* F. *Jurnal Sains Dan Seni ITS*, *4*(2), 2337–3520. **[*In Indonesian language*]**

Nisa, A. K. , & A. A. P. (2024). The Efficacy of Natural Pesticides from Soursop Leaves in Controlling Thrips Pests on Curly Pepper Plants. *Agotech Research Journal*, *3*(2), 13–17. **[*In Indonesian language*]**

Pajri, I., Sribudiani, E., & Pebriandi, P. (2023). Characteristics of visitors to the Bukit Candika Bangkinang Pine Forest ecotourism site, Kampar Regency, Riau Province. *Innovative: Journal of Social Science Research, 3*(6), 8041–8051. https://doi.org/https://doi.org/10.31004/innovative.v3i6.6086 **[*In Indonesian language*]**

Pasaribu, D. I., Mardhiansyah, M., & Sulaeman, R. (2016). Growth Quality of Eucalyptus sp. from Vegetative and Generative Propagation. *JOM Faperta*, 3(2), 10–13. **[*In Indonesian language*]**

Pebriandi, P., Yoza, D., Sukmantoro, W., Darlis, V. V., Qomar, N., Mardhiansyah, M., Oktorini, Y., Sribudiani, E., Somadona, S., & Muslih, A. M. (2024). Estimation of aboveground carbon stock in PT KOJO's forest in Riau, Indonesia. BIO Web of Conferences, 99(03), 1–7. https://doi.org/10.1051/bioconf/20249903002

Pebriandi, Qomar, N., Suhada, N., Metananda, A. A., Lestari, I., Sribudiani, E., Lumbantoruan, B. B., Maryani, & Safitri, R. (2025). Carbon stock in secondary peat swamp forests: a case study of the Rawa Mekar Jaya village forest, Siak, Riau, Indonesia. IOP Conference Series: Earth and Environmental Science, 1563(1), 012051. https://doi.org/10.1088/1755-1315/1563/1/012051

Rahmadi, R., Priyadi, P., & Rochman, F. (2022). The Effectiveness of Soursop Leaf Extract (Annona muricata L.) as an Organic Insecticide in Controlling Stink

Bugs (Leptocorisa acuta) in Paddy Fields. *Agricola*, *12*(2), 82–90. https://doi.org/10.35724/ag.v12i2.4558. **[*In Indonesian language*]**

Rahmadi, R., Priyadi, P., & Rochman, F. (2022). The Effectiveness of Soursop Leaf Extract (*Annona muricata* L.) as an Organic Insecticide in Controlling Stink Bugs (*Leptocorisa acuta*) in Paddy Fields. *Agricola, 12*(2), 82–90. https://doi.org/10.35724/ag.v12i2.4558 **[*In Indonesian language*]**

Rani, S, K., Pal, S., & Shivakumara, K. T. (2023). Lepidopteran pest complex of Dhataki, Woodfordia fruticosa with special reference to occurrence of leafroller, *Strepsicrates* sp. in India. *Jounal Pest Management in Horticultural Ecosystems*, *29*(1), 47–54.

Sopyan, R. T. N., & Rosamsi, S. (2024). Testing the Effectiveness of Natural Pesticides Extracted from Soursop Leaves (*Annona muricata*) in Controlling Leaf Lice Pests (*Aphis gossypii*). *Biosfer: Jurnal Biologi Dan Pendidikan Biologi, 9*(1), 119–123. https://doi.org/10.23969/biosfer.v9i1.35292 **[*In Indonesian language*]**

Saputra, P & Mardaleni. (2023). Morphological Characteristics and Essential Oil Content of *Eucalyptus pellita*. *Jurnal Agroteknologi Agribisnis dan Akuakultur,3*(2), 58–67. **[*In Indonesian language*]**

Sulaminingsih. (2025). Effectiveness of Soursop (*Annona muricata*) Leaf Extract As A Botanical Pesticide Against Armyworm (Spodoptera Litura) on Mustard Greens (*Brassica juncea*). *Multidisciplinary Indonesian Center Journal (Micjo), 2*(3), 3427–3434. https://doi.org/10.62567/micjo.v2i3.1032

Sulichantini, E. D. (2016). Growth of *Eucalyptus pellita* F. Muell Plants in the Field using Tissue Culture, Cuttings, and Seeds. *Jurnal Ziraa'ah*, *41*(2), 269–274. https://doi.org/10.1017/CBO9781107415324.004. **[*In Indonesian language*]**

Sumantri, I., Hermawan, G. P., & Laksono, H. (2014). Soursop Leaf Extraction (*Annona Muricata* L). *Momentum*, *10*(1), 37–34. **[*In Indonesian language*]**

Sutikno, A., Yoza, D., & Darlis, V. V. (2020). Potential Plants and Distribution of Biopesticide Plants on the Campus of the University of Riau. *Jurnal Ilmu-Ilmu Kehutanan*, *8*(75), 147–154. **[*In Indonesian language*]**

Tarumingkreng, R. C. (1992). *Insecticides: Properties, Mechanism of Action and Impact of Use*. Jakarta: Ukrida. **[*In Indonesian language*]**

Zega, U., Fau, A., & Sirsak, D. (2021). The Effect of Soursop Leaf Extract (Annona Muricata L) as a Natural Insecticide in Eradicating House Flies (Musca domestica). *Jurnal Education and development, 9*(2), 616–620. **[*In Indonesian language*]**

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