Comparison of the effectiveness of fumigant storin to control insect pests warehouse *Lassioderma serricorne* and *Pholcus phalangioides*

N Subekti*, M A Syahadan and R R Milanio

Biology Department, Faculty of Mathematics and Natural Sciences, State University of Semarang, Semarang, Indonesia.

Corresponding author: nikensubekti@mail.unnes.ac.id

**Abstract.** Insects warehouse pests contained in commodities, especially tobacco, can cause a decrease in the quantity and quality of commodity. The main pest insects found in tobacco storage warehouses are *Lassioderma serricorne* and *Pholcus phalangioides*. This study aims to analyze and compare the effectiveness of the use of fumigant storin to control insect pests *L. serricorne* and *P. phalangioides*. Methods used in this study include preparation of test insects, fumigation application, identification, calculation of mortality, and data analysis. The data were analyzed statistically using the One Way ANOVA test. The results showed that there was a significant difference in morphility between groups of test insects. Mortality is highest in the *L. serricorne* test insect group, which indicates that fumigant storin is very effective in controlling barn pest insects, especially *L. serricorne*. To control insect pests warehouses in the future, it is recommended to use biopesticides to be safer for food.

1. **Introduction**

Cigarettes are one of the largest productions in Indonesia. According to a report from the Ministry of Finance of the Republic of Indonesia there was a sharp increase in cigarette production in 2019, reaching 365.5 billion cigarettes. There was no increase in cigarette excise compared to 2018, which is about 332.4 billion stems, with dried tobacco raw, not spared the threat of warehouse pests that can multiply very quickly. Pests such as *Lasioderma sp.* are often the biggest threat to cigarette manufacturers. Most commodities are ravaged by the time insects reach the larval phase and cause many small hole holes in the dried leaves of tobacco, which causes a decrease in the quality and quantity of the dried tobacco leaves [1].

*L. serricorne* is a Coleoptera type insect that has become one of the most significant pests in the cigarette industry in Indonesia. Every year these insects can reduce the yield in warehouses by 10-40% [2]. *L serricorne* damages dry tobacco by perforating the leaves, which will later reduce the mass of tobacco leaves and affect the taste, color, and smell of the tobacco leaves themselves [3]. Lasioderma has a life cycle of between 40-80 days depending on its environmental conditions; one fertilized Lasioderma female will lay as many as 45-110 eggs, and each female can lay 2x in her life period. Larvae of *L. serricorne* are the most damaging phase of dry tobacco. The larvae have 3 instar developments; the first instar measures 0.55-1.4mm, the second instar is ±3mm, and the third instar measures 4-5 mm [4].
Alpha cypermethrin, formerly known as alphamethrin, is a pyrethroid synthetic insecticide type II, an insecticide derived from a mixture of several esters called pyrethrin. This active ingredient is an insecticide of contact poison and stomach poison \([5,6]\). Pyrethroid synthetic insecticides are very commonly used for household insecticides that emphasize the importance of safety factors. This type of fumigant works as a contact poison and stomach poison. Alpha cypermethrin has a physical form of liquid, yellowish, and odorless. Alpha cypermethrin also has very safe chemical stability and is able to be stored for 3 years if stored up to 50 °C \([7,8]\).

2. Materials and methods
Fumigated storage warehouse is a dry tobacco storage warehouse that comes from many regions both domestically and abroad. Storage warehouses are distinguished into several parts using a certain number. Before fumigation, there is usually a trap to ascertain whether the warehouse is feasible to be fumigated or not. The storage warehouse is a tightly closed warehouse, with minimal ventilation, not exposed to direct sunlight and wind, so that the warehouse is moist and allows the development of tobacco pests, namely \(L. \text{serricorne}\) and \(P. \text{phalangioides}\).

2.1. Preparation of test insects
Pest sampling is done first before the closure of commodities using fumigation plastic, sampling is done at 8 predetermined points on commodities to be fumigated at tobacco storage warehouses in Kudus, Central Java. The samples taken are living insects that are in fumigation commodities. The samples are calculated and distinguished by the type and number of insects found at each point.

2.2. Fumigation application
Fumigation conducted in this study is part of insect pest control routine measures in tobacco storage warehouses. Before the plastic closure, a volume measurement of the commodity is performed to determine the dose, and installation of the monitor hose is done first. Every 12 hours, the plastic will be opened to measure the level of Storin in the commodity. Commodities were marked and closed using large plastics that ensured no holes in the plastic cover. The installation of Sand Snake at the end of the plastic cover to minimize the occurrence of gas leaks, distribution of toxins is carried out using plastic stalls according to the predetermined dose. Fumigation is carried out for \(2 \times 24\) hours.

2.3. Identification, calculation of mortality, and data analysis
Every 12 hours, the plastic will be opened and calculate the mortality of the insect species found. Insect mortality calculation is done at a predetermined point. Some samples are taken and then inserted into 70% alcohol, which will be identified in the Biology Laboratory, Faculty of Mathematics and Natural Sciences, Semarang State University. The data obtained is analyzed statistically using the One Way ANOVA test.

3. Results and discussion
The calculation of the mortality of the tested insects was carried out every 2 hours until it reached a cumulative time of 48 hours. The trend of mortality values at each time of observation can be seen in Table 1.

From the Table 1, storin fumigants are very good at killing insects \(L. \text{serricorne}\) in commodities. Table 1 shows that at 12 hours of observation the mortality percentage of \(L. \text{serricorne}\) ranged from 10.75 – 16.75%, at 24 hours of observation the mortality percentage ranged from 32.50 – 42.50%, at 36 hours of observation the mortality percentage ranged from 72.50 – 85.50%, and at the end of the 48-hour observation the mortality percentage ranged from 92.25 – 100%.
The attack of pests can be caused by the administration of insecticides or exposed to residual residues after treatment due to its nature as a contact insecticide. Serricorne Lasioderma serricorne is research showed that the average mortality percentage after storin treatment was greater at 82.14% than at 36 hours of observation. That is, storin fumigants are very good at killing insects. Also, the mortality between treatments caused by fumigant storin with a value of Significance 0.000 (P < 0.05). Additionally, the types of warehouse pests that attack tobacco commodities vary. The types of insects found are Lasioderma serricorne and Pholcus phalangioides. The attack of L. serricorne is higher than that of P. phalangioides. These results agreed with the research that has been conducted by Ramadhan et al. [1], that L. serricorne is among the most important pests that attack tobacco commodities in storage warehouses. These warehouse pests can decrease the quality and quantity of tobacco commodities stored [9], causing high economic losses.

The statistical analysis results using the One Way ANOVA test showed a difference in average mortality between treatments caused by fumigant storin with a value of Significance 0.000 (P < 0.05). Also, this research showed that the average mortality percentage after storin treatment was greater at L. serricorne than at P. phalangioides. This fumigant can be directly absorbed by insect skin during the administration of insecticides or exposed to residual residues after treatment due to its nature as a contact poison. Alpha cypermethrin also acts as a stomach poison that can enter the body of insects through the mouth and feeding tract [10].

Descriptive test results showed higher mortality caused by storin fumigants in the L. serricorne treatment group than P. phalangioides. That is, fumigant storin is very suitable for controlling insect pests L. serricorne in warehouses. In line with this research, SEMEAO BIOTROP [11] stated that the application of 20 ml/L commercial Alfa Sipermetrin containing 30 g/L of active ingredients with high-

### Table 1. Mortality percentage of Lasioderma serricorne after storin treatments

| No | Individual | 12 hours | 24 hours | 36 hours | 48 hours |
|----|------------|----------|----------|----------|----------|
| 1  | 200        | 13.75±6.25 | 32.5±5   | 72.5±7.5 | 100±0    |
| 2  | 200        | 15±5.5   | 39.75±5.25 | 83.5±8 | 100±0    |
| 3  | 200        | 10.75±5.25 | 33±6.5   | 82±9     | 97.25±7.25 |
| 4  | 200        | 14.75±6.75 | 41.75±6.75 | 85.5±5 | 100±0    |
| 5  | 200        | 14.5±7   | 39.5±6   | 77.25±6.25 | 92.25±5.75 |
| 6  | 200        | 16.75±7.75 | 42.5±5.5 | 77±6.5  | 92.25±5.25 |
| 7  | 200        | 14.5±5   | 36.25±7.25 | 75.25±7.25 | 100±0    |
| 8  | 200        | 15.75±4.75 | 37±6     | 82.75±8.25 | 98.5±7   |

### Table 2. Mortality percentage of Pholcus phalangioides after storin treatments

| No | Individual | 12 Hours | 24 Hours | 36 Hours | 48 Hours |
|----|------------|----------|----------|----------|----------|
| 1  | 70         | 13.57±5   | 35.71±4.28 | 62.14±9.28 | 91.42±7.14 |
| 2  | 70         | 6.42±2.14 | 29.28±7.85 | 55±5     | 84.28±8.57 |
| 3  | 70         | 12.85±5.71 | 32.14±6.42 | 56.42±6.42 | 85±7.85 |
| 4  | 70         | 15±5.57   | 32.85±4.28 | 57.14±4.28 | 82.14±7.85 |
| 5  | 70         | 16.42±6.42 | 37.85±6.42 | 59.28±3.57 | 83.57±10.71 |
| 6  | 70         | 11.42±4.28 | 35±5     | 60.71±7.85 | 86.42±6.42 |
| 7  | 70         | 19.28±6.42 | 37.14±5.71 | 57.85±10.71 | 87.85±6.42 |
| 8  | 70         | 12.85±4.28 | 37.14±4.28 | 60±7.14  | 88.57±8.57 |

Table 2 described the mortality percentage of P. phalangioides after storin treatments for 12 hours, 24 hours, 36 hours, and 48 hours. From the table above, storin fumigants are very good at killing insects P. phalangioides in commodities. Table 2 shows the mortality of Pholcus phalangioides at 12 hours of observation the mortality percentage ranges from 6.42 – 19.28%, at 24 hours of observation the mortality percentage ranges from 29.28 to 37.85%, at 36 hours of observation the mortality percentage ranges from 56.42 – 62.14%, and at the end of the 48-hour observation the mortality percentage was 82.14 – 91.42%. The types of warehouse pests that attack tobacco commodities vary. The types of insects found are L. serricorne and P.s phalangioides. The attack of L. serricorne is higher than that of P. phalangioides. These results agreed with the research that has been conducted by Ramadhan et al. [1], that L. serricorne is among the most important pests that attack tobacco commodities in storage warehouses. These warehouse pests can decrease the quality and quantity of tobacco commodities stored [9], causing high economic losses.
pressure spraying techniques using effective power sprayers ludicrous opt targets was effective against woodchips commodities.

Storin is a liquid-shaped toxic applied by spraying directly into the commodity cardboard then closed using plastic nets to be more efficient and safe. Storin contains alpha cypermethrin. High toxicity indicated by alpha cypermethrin belonging to the chemical group organophosphate is associated with their mechanism of action that inhibits the transmission of nerve impulses in synapses [12]. In neural tissues and neuromuscular connections, organophosphate Insecticide binds to the enzyme acetyl cholinesterase (AChE) right in the active place responsible for the degradation of the neurotransmitter acetylcholine (ACh), which accumulates because AChE does not degrade this neurotransmitter. Incorporating insecticidal organophosphates and AChE enzymes by hydroxyl groups often disables enzymes and forms complexes called organophosphates-AChE. Organophosphorus complex- AChE is slowly hydrolyzed and causes the accumulation of neurotransmitters in both neuron-neuron and neuromuscle junction; this greatly alters the synaptic transmission of nerve impulses, leading to hyperexcitation of the nervous system and result in the death of insects [13,14].

The results of the field survey showed the price of Storin is much lower compared to the use of Methyl Bromide, and more environmentally friendly because it does not leave residues and exhaust gases do not damage such as Methyl Bromide is a destructive substance ozone layer/ozone- depleting substance (ODS) [15,16]. Easy use should still be done with the proper procedures because exposure to direct contact is also dangerous.

Pest control of warehouse pests in the future is necessary to consider using effective biological control such as biopesticides. To be safer for food safety. Biopestisida is a pesticide made from plants and rich in active ingredients that serves as a natural defense against gadfly (such as insects) [17,18].

4. Conclusion
Fumigant storin is very effective for controlling insect pests warehouse Lassioderma serricorne and Pholcus phalangioides. In the future, pest control warehouses are recommended to use biopesticides to be safer for food.

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