

The use of pheromones and lamps as traps for rhinoceros beetles (*Oryctes rhinoceros*) in young oil palm plants

Idum Satia Santi¹, Rianto¹, Agus Manto²,

¹Institut Pertanian Stiper Yogyakarta, Indonesia

²Akademi Komunitas Perkebunan Yogyakarta, Indonesia

*Corresponding author: idumsatiasanti25@gmail.com

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ABSTRACT

The rhinoceros beetle (*Oryctes rhinoceros*) is a fairly important pest in oil palm plants, especially in young or unproductive plants. The purpose of this study is to examine the use of pheromones and lamps as horn beetle traps. The research was carried out in a community plantation in Sungai Lala, Kelawat District, Indragiri Hulu, Riau. The research was carried out for 1 month, with tools in the form of lamp traps and pheromones, as well as a combination of both. The results showed that the combination of pheromones with trap lights provided the most catch compared to single treatment. There was no difference in the catch of male and female beetles in all treatments. It is hoped that the results of this research can be used to control rhino beetles in a simple way in community plantations.

Keywords: *Oryctes rhinoceros*, pheromones, light traps

INTRODUCTION

Rhinoceros beetle (*Oryctes rhinoceros*) is one of the main pests in oil palm plantations that can cause significant damage to young plants. These insects attack by punching holes in plant growth points, resulting in growth deformation and even death in young plants (Bedford, 2013). To control the *O. rhinoceros* population, various control methods have been developed, including the use of pheromones and light traps. The application of pheromones and light-based traps is part of an integrated pest control strategy (IPM)

that is environmentally friendly and effective in suppressing pest populations without damaging the plantation ecosystem (Haq et al., 2020).

Oryctes rhinoceros (Coleoptera; Scarabeidae) is better known as horn beetle or rhinoceros beetle or oil palm shoot borer beetle. Previously, this pest was known as a pest of other coconut and palm plants. The rhinoceros beetle is a serious threat to oil palm plantations because it can damage the growing point of young plants, lower crop yields, and increase the risk of disease.

Not only in Indonesia, until now the rhinoceros beetle has become a problem in Malaysia (Manjeri, 2014) and Tunisia (Soltani et al., 2008). Effective control must combine mechanical, biological, chemical, and habitat management methods to keep beetle populations under control and plantation productivity optimal. : Adult beetles attack oil palm growing points by digging holes and feeding on plant tissue. The attack causes young plants to die and need plant inserts. In addition, the holes caused by rhinoceros beetle attacks can be a breeding ground for fungi, bacteria and other insects.

The life cycle of *O. rhinoceros* consists of four main stages: egg, larva, pupa, and adult. The larvae usually live in decaying organic matter, such as felled or composted palm stems, and take about 8-10 months to develop into adult insects (Manjeri et al., 2014). Adult insects are nocturnal and are attracted to light sources, which is the basis for the application of light traps as a control tool (Jackson & Klein, 2006). In addition, females secrete pheromones that can attract large numbers of males, making pheromone trapping a very effective method of capturing adult individuals before they can reproduce (Hussein et al., 2022).

Rhinos (*Oryctes rhinoceros* L.) can live optimally with support from suitable ecological factors. The high population of rhino beetles is due to the availability of suitable breeding media for the beetle. The remains of oil palm trunks, weathered wood, and empty bunches of oil palm become ideal places for female beetles to lay eggs. The organic material waste that has the most influence on population development is tree trunks, litter and straw (Pamungkas & Ziqri, 2020). In addition, a humid environment supports larval growth. Poor management of plant residues or plantation waste will also increase the rhino beetle population (Fauzana et al., 2019) rapidly. Several control techniques have been widely reported, such as the application of *Metarhizium anisopliae* fungi as biological agents (Indriyanti et al., 2018)

The pheromones used in traps for *O. rhinoceros* are generally chemically synthesized sex pheromones and mimic the natural pheromones produced by females (Hallett et al., 1995). When released into the environment, these pheromones

attract males to traps, where they will be trapped and unable to reproduce. A study by Ginting et al. (2025) shows that pheromone traps can capture more than 70% of the *O. rhinoceros* population in oil palm plantations if placed with the right density and distribution.

Several studies have proven that pheromone traps are very effective in reducing the population of *O. rhinoceros* in oil palm plantations. A study by Ahmad & Kamarudin (2011) shows that the widespread use of pheromone traps can reduce pest attacks by up to 60% in a single growing season. However, its effectiveness largely depends on factors such as the number of traps installed, the distance between traps, and the frequency of pheromone replacement. If the trap is not installed correctly, then its attraction to insects will decrease, causing the trap's efficiency to decrease.

Light traps work based on the principle of positive phototropism, which is the tendency of insects to be attracted to light (Nurhadi et al., 2020). The most effective type of light in attracting *O. rhinoceros* is ultraviolet (UV) light, which has been shown to attract more individuals compared to white or yellow light (Wang et al., 2016). Light traps are often used as a complementary method of pheromone traps, as they can capture individuals that do not respond to pheromones, such as sexually immature females or individuals who are not in a breeding state.

Some studies suggest that a combination of pheromone traps and light traps may improve the effectiveness of *O. rhinoceros* control. According to Kamarudin & Washid (2004), the combination of these two methods results in a higher catch rate compared to the use of each method separately. This is due to the difference in the mechanism of action of the two traps: pheromone traps are more effective at catching adult males, while light traps are more effective at catching individuals that are actively flying at night.

The successful use of pheromone and light traps is greatly influenced by several factors, including the weather, the location of the trap installation, and the presence of natural food sources around the trap (Santi & Setyawan, 2023). Cloudy or rainy weather can reduce the

effectiveness of light traps due to lack of visibility, while the presence of alternative food sources such as decaying palm trunks can reduce insect responses to pheromones (Hussein et al., 2022). Therefore, the trap installation strategy must consider environmental conditions and pest population distribution.

MATERIALS AND METHODS

The research was conducted at PT. Tunggal Perkasa Plantations (PT. TPP), Lala River Plantation, Kelawat District, Indra Giri Hulu Regency, Riau for 1 month. The tool used in this experiment, a hoe, was used to make holes. Nails are used to hold wood together, hammers as tools to nail wood, and scissors as tools to cut zinc plates. The materials used are ferromonas, a 5-watt lamp, a 12-liter plastic bucket and a zinc plate installed on top of the bucket to trap the beetles.

The research was carried out on two blocks of oil palm plants, where each block was carried

This study aims to determine the extent of the catch obtained by the rhinoceros beetle control technique using pheromones, lamps or a combination of pheromones and lamps. Hopefully, this simple way can be done by smallholder farmers to catch rhinoceros beetle imago so as to reduce the impact of damage and losses due to the beetle.

out 3 treatments. *Oryctes rhinoceros* was captured using 3 treatments, namely pheromones, lamps and a combination of pheromones and lamps. The study used Completely Randomized Deseign. Observations are carried out for 1 month, and citations are carried out every 2 days. The lights are turned on from 17.00 to 22.00 local time. The results of the citations were calculated for further analysis by the T and Duncan 5% tests.

RESULTS AND DISCUSSION

Oryctes rhinoceros or rhinoceros beetle is a pest that is quite annoying both in coconut plants, oil palm and other types of palm families. The beetle attack can cause the death of the plant, especially if

it is young. After replanting, rhinoceros beetle infestation is very detrimental to unproductive plants because it causes death of leaf shoots or extinction

Table.1 Number of Oryctes caught over 30 days (tails).

Treatment	Day to day citation															Total	Average
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30		
Feromon	25	34	36	39	42	32	58	25	43	74	40	48	62	67	63	698	45,86(a)
Lamp	3	4	6	9	3	1	16	4	16	24	16	10	16	18	28	174	11,60(b)
Feromon + lamp	28	35	37	48	48	32	57	21	54	62	44	72	87	87	76	788	52,53(a)

The average followed by the same letter in a line shows no significant difference based on the Duncan test at the level of 5%.

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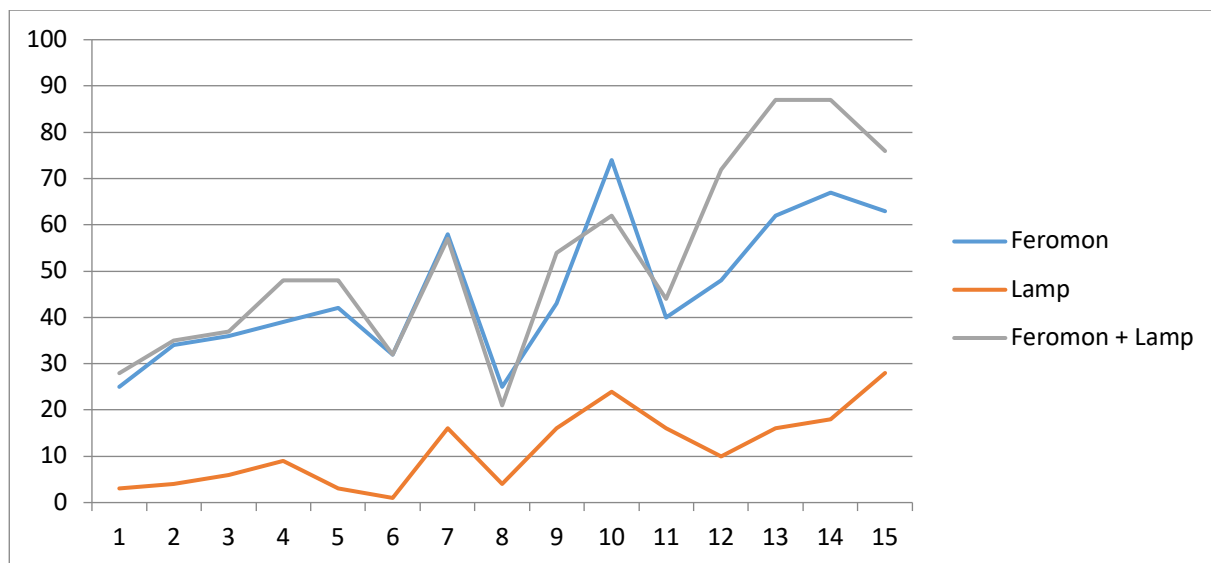


Figure 1. The rhinoceros beetle that is trapped at every citation

Table 3. Number of *Oryctes* caught on Lamp traps by gender (tail)

Treatment	<i>Oryctes</i>	Citation of the Day															Total	Average
		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30		
Lamp	Male	2	1	3	3	2	0	6	1	8	13	6	3	5	9	12	74	4,93(a)
	Female	1	3	3	6	1	1	10	3	8	11	10	7	11	9	16	100	6,66(a)

The average followed by the same letter in a row shows no significant difference based on the t-test at the level of 5%.

Table 3 shows that the capture of rhinoceros beetles with lamps does not affect sex. And the daily catch is also relatively small. However, the use of lamps can be used as an alternative to controlling rhino beetles.

Rhinoceros beetles (subfamily Dynastinae) are known as nocturnal insects that are attracted to light. This phenomenon is called positive phototaxis, which is the behavior of moving towards the light source. Many insects use natural

light such as the moon or stars as a means of navigation. However, the presence of artificial light can interfere with this navigation system, causing insects to be attracted and move towards the light source. Additionally, some insects may be attracted to light due to their natural instincts. For example, moths and some other insects use light for navigation. However, artificial light can interfere with their orientation, causing them to fly towards the light source

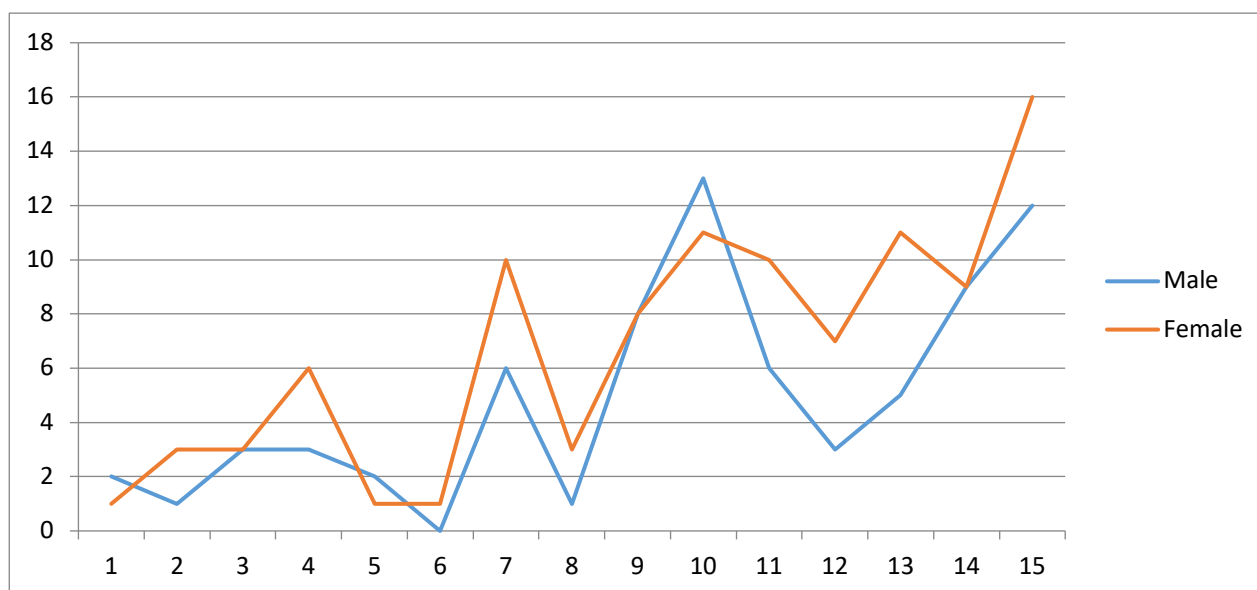


Figure 2. Beetle catch on lamp traps by sex

From the picture above, it can be seen that the average catch of beetles using lightrap is relatively small. This is because the use of lamps as a light source is not optimal, namely only using a flashlight of 5 watts. So that the light produced is not optimal to attract the attention of *Oryctes*. The use of lamps should use petromak lamps or electric lamps with an electric generator. So that it produces optimal light and gets maximum results.

The use of pharoon with light traps provides a lot of catch compared to the use of lights and pheromones alone. The use of ferotrap itself has been able to attract rhino beetles to come, especially with the addition of lights, the beetles that come are also getting taller. The results of the insect catch can be seen in table 4 below.

Table 4. Number of *Oryctes* in Phenomone and Lamp Combination Traps by Sex

Treatment	<i>Oryctes</i>	Citation of the Day															Total	Average
		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30		
Feromon + Lamp	Male	12	16	18	21	20	16	26	8	24	26	18	35	40	42	35	357	23,80(a)
	Female	16	19	19	27	28	16	31	13	30	36	26	37	47	45	41	431	28,73(a)

The average followed by the same letter in a row shows no significant difference based on the t-test at the level of 5%.

The catch of rhino beetles is almost the same based on gender. The table above also shows that the use of traps in the treatment of phenomons combined with lamps obtained the highest catch, which was

357 male *O. rhinoceros* and 431 female *O. rhinoceros*. The results of the movement of *O. rhinoceros* catch in pheromone combination lamp treatment can be seen in figure 4 below.

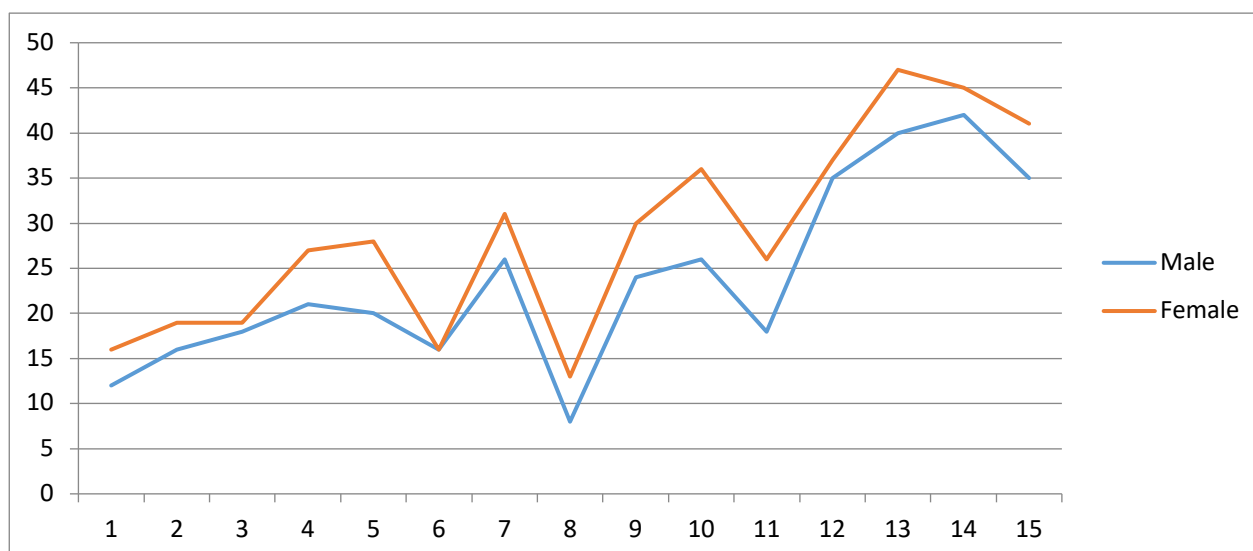


Figure 4. Graph of rhinoceros beetle catch using a combination of Lamp and Pheromone by gender

From the figure above, it can be seen that the results obtained are in accordance with the hypothesis, that the treatment of lamps in combination with lamps gets more results, compared to pheromones or lamps alone.

Basically, beetles or insects use light as a navigation system (direction), then move closer towards the light source. At night beetles or insects use moonlight as their navigation system. When there is a light bulb, a light source closer to the moon, the insect will catch and perceive the incoming light from one of its eyes. The light of the lamp interferes with its natural navigation system, causing one of its wings to move faster, thus moving in a spiral closer to the lamp (Shimoda & Honda, 2013). In addition to emitting light, lamps also emit ultraviolet rays and heat which can also

attract the attention of beetles. Some insects are attracted to the ultraviolet colors emitted from light (Katsuki et al., 2013). However, there was no effect of the trap color given to the lamp on the rhinoceros beetle catch (S.Santi & Sumaryo, 2008). Meanwhile, pheromones are chemical substances released by an organism in its environment that enable the organism to communicate intraspecifically with other individuals. This pheromone has the active ingredient Ethyl-4 methyloctanoate where this active ingredient is developed from the isolation of male pheromones, so that female beetles are more interested.

Of the three traps, the combination of lamp phenolic treatment obtained a higher catch, compared to the treatment of pheromone and lamp alone.

CONCLUSION

The combination of lamp and pheromone treatments can provide a larger rhinoceros beetle catch than a single treatment of both lamps and pheromones. There is no difference in the catch of

both male and female beetles. In the future, alternative control techniques can be found by combining more effective and efficient types of lightrap

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