



The Difference of Lured Rat Number between Uncombined and Combined Bait Trapping

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Abstract

Live traps usually can only trap rats in the first day of trapping because the bait become not luring anymore after the first day of trapping. The purpose of this study was to determine the differences in lured rats number between uncombined bait trapping and combined bait trapping. This is a quasi-experimental study with a post-test only non-equivalent control group design. Each house has 5 traps setup with 6 replications. One trap was set with combined bait types (rice, anchovy, tofu and roasted coconut) and four other traps set with separated uncombined bait types; (1) rice, (2) anchovy, (3) tofu, (4) roasted coconut. The instruments used were house screening sheets, traps and observation sheets. The data obtained were tested with the Mann-Whitney test. The results showed that there were not significant differences in trapped rats number between combined bait and uncombined rice bait ($p=0.748$), between combined bait and uncombined anchovy bait ($p=0.355$), between combined bait and uncombined tofu bait ($p=1.000$), and also between combined bait and uncombined roasted coconut bait ($p=0.734$). Uncombined anchovies bait trapped rats most. Combined bait and uncombined anchovy bait were most consistent in trapping rats.

INTRODUCTION

Rats are vertebrate animals with clever and destructive characters. They have rapid cycle breeding. This causes rats difficult to be controlled (Ivakkdalam, 2014). Rats become important pests in human life, such as in agriculture, plantations, settlements, and health (Mulyana, 2017). In the world, there are almost 2000 species of rodents, but there are only a few species that cause serious problems. In Indonesia, the presence of *Rattus argentiventer* rats shows a serious problem, where damage to agriculture caused by rats reaches 25% (Lagwen, 2016). Rats attack food crops such as rice, corn and soybeans, horticulture such as vegetables and fruits, plantation crops such as oil palm, cocoa, and so on

(Mulyana, 2017). As a residential pest, losses caused by rats are damage in the form of corrosion on various household items made of wood, cloth, paper, plastic, metal and electrical equipment, as well as contamination in the form of hair, feces, and urine of rats on various materials human food (Martina et al., 2018).

In the field of health, today it is known that rodents can spread various diseases caused not only by various disease agents, but also psychological agents such as rodentophobia (fear of rats). Types of diseases carried by rats include bubonic plague, leptospirosis, murine typhus, scrub typhus, schistosomiasis, leishmaniasis, salmonellosis, and chagas disease (Supriyati & Ustiawan, 2013). Leptospiro-

sis is one of the diseases originating from rats that needs serious attention (Yunianto & Ramadhani, 2010). Central Java Health Profile 2018 had reported Semarang City as the 3rd rank for leptospirosis case number. One area in Semarang City that has increased cases of leptospirosis is the working area of the Public Health Center (*Puskesmas*) of Kedungmundu. In 2015 there were 1 case, then increased to 4 cases in 2016 and increased again in 2017 to 6 cases. In 2018 there were 6 cases with 1 case of death. A total of 4 cases occurred in Tandang Village (*Puskesmas* Kedungmundu, 2018).

Based on preliminary studies conducted by researchers to the community regarding rat control conducted in 10 houses in Tandang Village, it was found that 8 houses had controlled rats using live traps, snap traps and rodenticides and 2 houses had never done controlling rats. From the testimony of the people who control rats, it was found that the obstacles in using live traps were only able to catch mice in the first trap installation, for the following days it was very rare for mice to enter the trap even though the bait was installed. The effectiveness of using traps is determined by trap shyness, which is a trait in which mice can adapt to traps, so that at the beginning of trapping rats are easily trapped, but in subsequent traps rats are difficult to trap (Wibowo, 2016). Therefore, setting traps must use bait that can lure rats into the traps. If the bait is not luring anymore, then the type of bait needs to be replaced (Martina et al., 2018).

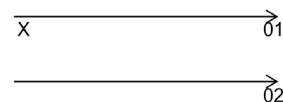
The things that need to be considered in using traps is about the bait providing. Sometimes rats are so observant of the installed baits, that rats are deterrent against a bait or memorized on a trap. Based on the results of interviews with the community, it was found that the baits normally used in trapping were white rice, anchovies, and tofu. Considering that rats have a sharp sense of smell, which can be demonstrated by the behavior of rats in sniffing the nose when smelling the bait ingredients, anchovy, can be used as an alternative bait. Dedi et al (2012) mentioned that anchovy was the most preferred bait of rats with SDR 19.54%, followed by instant noodles 13.69%, roasted coconut 12.38%, corn 11.73%, small shrimp (*Acetes japonicus*) 11.08%, 9.12% sand grilled coconut, cassava and unhulled rice 7.82% and 6.84% rice.

Rats are color-blind animals, but there is a tendency for rats to be more attracted to the yellow color which is considered a bright gray color (Dedi et al., 2012), so the yellow tofu can also be used as an alternative bait. Besides having a color that is loved by rats, tofu is also easy to get in the community. While roasted coconut bait was chosen because roasted coconut is the standard bait from WHO which

is commonly used in trapping. Rats caught with roasted coconut had the highest trap success at 12%, followed by anchovy 9.14% and traps without feed 0.29% (Junianto & Siwiendrayanti, 2015). The purpose of this study was to determine the differences in lured rats number between uncombined bait trapping and combined bait trapping. The uncombined baits consist of some baits which are installed separately everyday (rice, tofu, anchovy and roasted coconut). The combined bait is installed with different baits on each day (rice, tofu, anchovy and roasted coconut). This research is expected to be able to provide information about ways of bait that can attract rats for rat control.

METHOD

This type of research used in this study is quasi experimental. The research design used is a post-test only non-equivalent control group.



Description:

X : Treatment (combination bait)

01 : Observations in the experimental group

02 : Observations in the control groups

The variables used in this study are the independent variables and the dependent variable. The independent variable used is the way of bait, which consists of combined and uncombined bait. The uncombined baits consist of some baits which are installed separately everyday (rice, tofu, anchovy and roasted coconut). The combined bait is installed with different baits on each day (rice, tofu, anchovy and roasted coconut). Setting traps using different bait and with a size of $\pm 3 \text{ cm} \times 2 \text{ cm} \times 1 \text{ cm}$ each bait in each trap. The anchovies and tofu that are used have previously been fried first. It aims to make the aroma that comes out more stinging. Setting of bait is done by linking the bait directly to the hook that is inside the trap. Specially for rice bait, it has been put into a plastic clip size of $4 \text{ cm} \times 6 \text{ cm}$ beforehand and left open with the aim that the rice bait can be attached to the trap hook. The dependent variable in this study was the number of rats that were lured to the bait.

Confounding variables were controlled by: (1) using the same rat trap that is a single live trap, (2) laying traps in places that are different from the previous laying place, and (3) equalizing the time length of trapping, ie by starting trapping at 16:00 West Indonesia Time and taking the trapping result on the next day, considering that rats are animals that are active at night.

The number of repetitions was considered with the following equation:

$$(t-1)(r-1) \geq 15$$

Description:

t = treatment

r = replication

when t = 5 then:

$$(5-1)(r-1) \geq 15$$

$$(5-1)(r-1) \geq 15$$

$$4r-4 \geq 15$$

$$4r \geq 15+4$$

$$4r \geq 19$$

$$r \geq 4.75$$

Based on this calculation, replication is rounded up to 5 times. Furthermore, this research was replicated 6 times. One replication is done in 1 house, so as many as 6 houses are needed to do the 6 replications. This replication is done at home that meets the inclusion criteria and exclusion.

Inclusion criteria of house selection for trapping: (1) Houses that have rats, seen from traces of rats, rat droppings, rat pits, rat urine / feces odor, or from the rat presence itself, (2) House sanitation that supports the survival of the rats, such as waterways / sewers, rubbish heaps and the location of houses that coincide, and (3) There is a room or yard that becomes the runway of rats that allows for setting up 5 traps with a minimum distance between traps as far as 2 meters.

Exclusion criteria of house selection for trapping is when homeowners are not willing their houses to be used as research sites.

The analysis used in this study is univariate analysis. In general, this analysis only produces the frequency distribution and the percentage of each variable. Analyzed variables included the number of rats that were lured by (1) combined bait, (2) rice bait, (3) anchovy bait, (4) tofu bait, (5) and coconut roasted bait. A bivariate analysis was performed using the Mann Whitney test. This test is carried out to measure the difference of lured rat number between combined bait and rice bait, between combined bait and anchovy bait, between combined bait and tofu bait, and between combined bait and roasted coconut bait. Lured condition was defined as a condition of rat being trapped or a condition of disappeared bait without the rat being trapped.

The procedure of conducting this research includes research preparation, research implementation and post-research. In the preparation stage of the study includes the preparation of implementation is the preparation of tools and materials. The tools and materials needed in this research were single live trap, baits (rice, anchovy, tofu and roasted coconut), label paper, observation sheets,

gloves, masks, plastic, sacks, 50 cc chloroform, water bucket, brush, washing soap, and water. At the implementation stage, the setting of trapping rats is carried out for 4 consecutive days with 6 repetitions. Installation of 5 traps carried out in homes that have met the inclusion criteria and exclusion of house selection. Before setting of traps, feed filling is done first using rice, anchovy, tofu and roasted coconut, with details of bait: (1) Traps with combined bait (day 1 with rice bait, day 2 with anchovy bait, day 3 with tofu bait and day 4 with roasted coconut bait), (2) Traps with rice bait, (3) Traps with anchovy bait, (4) Traps with tofu bait, (5) Traps with roasted coconut bait. Traps are placed inside the house which is on the rat path. The setting of the trap is carried out in the afternoon at 16.00-17.00 WIB, then the next day between 06.00-09.00 a.m the trap is taken back. The five traps are placed with a minimum distance of 2 meters each. Every trap that is placed is placed in different places from the previous location. Observations were made of trapped rats and then recorded based on the day and type of feed.

At the stage after capture, rats that die during capture are put in plastic bags. If the captured rats are still alive, the live rats along with their traps are put in a black plastic bag and then put in a sack. In this study, living rats trapped were then anesthetized using chloroform of 50 cc. The process of killing rats is to soak the rat in water for 15-20 minutes until the rats die. The dead rats were then buried around the residents' houses. Traps that have caught rats are then washed and brushed using soapy water. Traps that have been washed are then dried in the sun to dry and ready to be used again for setting traps in the afternoon.

RESULTS AND DISCUSSION

The number of lured rats tends to decrease from the first day to the fourth day of trapping. On the first day, the number of lured rats was 14, then reduced to 8 on the second day. Then on the third day, the number of lured rats obtained decreased again to 7 and on the fourth day to 4 rats. The trapping results show that the most lured rats were only on the first day of trapping, then on the following days the lured rats were getting reduced (Table 1). This is allegedly due to several reasons. First, rats have memorized the traps set. Rats are animals that have very well-developed brains. Rats can learn from previous experiences (Syamsuddin, 2007). Second, allegedly because rats experienced a deterrent trap. The use of the same type of trap from the first day to the last day of trapping makes rats memorized, so the rats will avoid the trap. Traps that are used continuously in efforts to control rats can cause a deterrent trap factor in rats (Ivakdalam, 2014). Third,

given that rats are animals that have four kinds of senses that can develop well, namely the sense of taste, touch, smell and hearing (Permada, 2009), then with the four senses that they have properly, can be used by trapped rats to provide signals that can be used as a sign of danger for the rats of the environment.

Based on observations, all types of bait are eaten by rats both in combined and uncombined bait. Of the several ways of bait, there are two baits that remain consistent in luring rats, namely combined bait and anchovy bait. Bait in this way can lure rats into the trap from day one to day four. Although the number of rat lured in bait for combined bait is not as much as this one in anchovy bait, rats which are lured to the combined bait tend to increase from previous days.

Different from combination bait and anchovy, rice bait and tofu bait can only lure rats until the third day. In contrast, for roasted coconut bait, rats are only lured on the first and third day. This may be due to rats picking from several available bait. Each bait has a content that is needed by rats, namely rice as a source of carbohydrates, anchovies and tofu sources of protein, and roasted coconut as a source of fat. According to Priyambodo (2003), it states that rats are omnivorous animals that will choose food that have a balanced nutritional content from several kinds of existing food.

The types of traps used in this study are single live traps that can only trap one rat. The size of the rats can affect the number of trapped rats. This was proven by 5 lost bait but the rat were not trapped,

including 1 rice bait, 1 tofu bait, 1 roasted coconut bait and 2 combined bait. This indicated that the size of the rat is too large so that when the rat take the bait, the trap door is held back by the rat's body which causes the rats to get back out of the trap. In addition, it is also possible because the bait hook is difficult to move when the rat eats the bait in the hook, so that the trap does not close.

Table 2 showed that there was no difference in lured rat number between combined bait and rice bait. The number of rats that are lured to the rice bait is more than the combined bait. This is presumably because rats are more interested in rice which has the nutritional composition needed for the growth and development of rats, as it is known that rice contains a lot of carbohydrates as a source of energy needed by rats (Rusdy & Fatmal, 2008).

The number of lured rats in rice bait tends to decrease every day. On the first day, there were 4 rats trapped, then on the second day of bait there were 2 rats. However, only 1 tail was successfully entered and trapped while the other 1 only took bait but was not trapped successfully. Then, on the third day of rice bait only 1 rat was obtained, and on the following day, there were no trapped rats at all. This is suspected because the mice experienced a deterrent trap. An ability possessed by rats to learn and deter against the dangers experienced previously (Ivakdamlam, 2014).

Rice bait is the most interesting rat than any other feed on the first day of bait. The number of rats that were attracted to the feed was 4. This is thought to be due to the nature of the rats that is easily sus-

Table 1. Number of lured rats in bait based on day of trapping

No	Days	The way of bait					Total
		Rice	Anchovy	Tofu	Roasted Coconut	Combined	
1	Day 1	4	3	2*	3*	2	14
2	Day 2	2	3	2	0	1	8
3	Day 3	1	1	2	2	1	7
4	Day 4	0	2	0	0	2	4
Total (%)		7(21.2%)	9(27.3%)	6(18.2%)	5(15.1%)	66(18.2%)	33(100%)

* : There was a shrew trapped

Table 2. Statistical tests on the difference of lured rats number among the way of bait

The way of bait	<i>p value</i>
Between combined bait and rice bait	0.748 ^a
Between combined bait and anchovy bait	0.355 ^a
Between combined bait and tofu bait	1.000 ^a
Between combined bait and roasted coconut bait	0.734 ^a

^a : Mann Whitney Test

picious of objects they encounter, including their feed. In consuming feed, rats first tasted to find out the reaction to the body and if not dangerous it will immediately eat it (Anggara & Sudarmaji, 2008). According to Ivakdalam (2014), rats have a sense of taste that affects when rats choose the food to be consumed. Rats flavored senses will be able to detect substances that taste bitter, sour, sweet, salty, which are toxic or taste bad making rats will avoid the feed.

In contrast to the number of rats in rice bait which tends to decrease, the number of rats that are attracted to the combined feed tends to be consistent every day. On the first day of combined bait, 2 rats were obtained, then on the second and third days each received 1 rat and on the fourth day got 2 more rats. However, every rat on the first day to the third day is not really trapped. Rats only eat feed that is set, while the trap does not close. This is thought to be due to the size of the rats that are too large so that when the rats take the feed, the trap door is held back by the body of the rat which causes the rat to get back out of the trap. In addition, it is also possible because the bait hook is difficult to move when rats eat feed in the hook, thus making the trap does not close.

Table 2 showed that there was no difference in lured rat number between combined bait and anchovy bait. The number of rats that are lured to the combined bait and anchovy bait are equally likely to remain daily. In addition, the bait of anchovy is the most luring bait for rats. Of 33 rats, 9 (27.3%) of them were trapped in traps with anchovy bait. This is presumably because anchovy has a pungent aroma, so rats are easier to find it.

According to Priyambodo (2003), rats are animals that have a sharp sense of smell. Anchovy emits an aroma that can lure rats to enter the trap. As for combined bait, although the number of rats is equally likely to remain on a daily basis like anchovy bait, but the number of rats lured is not as much as in anchovy bait. This is presumably because rats did not experience suspicion of anchovy bait because of the bait behavior that often found anchovy in settlements, so that the rats did not experience any gout.

This study is in line with the study of Sholikhah (2017), which states that the bait most preferred by rats is anchovy compared to other baits, such as rice, corn, sweet potatoes and roasted coconut. According to Alviventiasari (2012), aroma can influence thoughts and behavior of rats. The smell that is inhaled can provide a strong stimulus to the sense of smell. The sense of smell of rats develops very well, this trait is shown by the behavior of rats which often sniffs the nose when facing material of food (Ivakdalam, 2014).

Table 2 showed that there was no difference

in lured rat number between combined bait and tofu bait. The number of rats who are lured in combined bait and tofu bait are as many as 6 rats, but the number of rats obtained each day on combined bait tends to be fixed compared to tofu bait. On the first day of combined bait and tofu bait, 2 rats were trapped each, then trapped again on the second and third day of 1 rats in combined bait trap and 2 rats in tofu bait trap. Then on the fourth day, 2 rats were trapped again in the combined bait trap, while none was trapped in tofu bait trap. This is allegedly because rats experience a deterrent trap, which means that rats will not enter the same trap. In addition, it is also possible because rats does not want to eat food that feels strange. Before eating food, usually rats make a recognition first. Rats will try the food little by little to taste while knowing the body's reaction to the food that comes in, to see whether there is a reaction or not from the eaten food (Ristiyanto, et al., 2014). If the rats have had the experience of eating a certain type of food will cause severe stomach pain, then they will not eat it again for the second time, but after a while it is forgotten, allowing it to try to eat the food again (Astuti, 2013).

S. murinus or shrews were also trapped during trapping. Shrews were trapped on the first day of tofu bait trap and roasted coconut bait trap (Table 1). Rats and shrews are very different animals. The difference is seen in the shape of the snout, body size, mobility, dirt and odor caused. The shape of the snout is sharper than the rats, the tail is shorter than the body, the tail is sometimes invisible / small, the mobility is lower because the path is relatively slow, the shit of shrews is wet and soft and gives off a very pungent odor (Rusmini, 2011).

Table 2 showed that there was no difference in lured rat number between combined bait and roasted coconut bait. Although there was no difference, the combined bait tends to lure rats consistently every day, compared to the roasted coconut bait. This is presumably because different types of food attract rats to get into the trap. According to Martina, et al. (2018), the type of bait needs to be replaced if the previous bait is not luring anymore, considering that rats are very smart animals.

The bait of roasted coconut only lured rats on the first and third days of trapping. On the first day, there were more rats interested in roasted coconut bait than in combined bait. There were 3 rats became lured in the roasted coconut bait, while there were 2 rats for the combined bait. Roasted coconut is a type of bait that is preferred by rats, allegedly because roasted coconut has a strong aroma. In addition, according to Junianto & Siwiendrayanti (2015), roasted coconut is a kind of food which is commonly used and is a standard bait from WHO in the trap-

ping rats. Roasted coconut can last a long time and is not easily damaged or rotten even if it is exposed to rain. Based on the results of previous studies, the most lured rat number was by using roasted coconut bait. The preferred bait types were roasted coconut by 40%, followed by corn 23.3%, meatballs 20% and salted fish 16.7% (Putri, 2013).

CONCLUSION

The differences in lured rat number between combined bait and uncombined bait in Tandang Village are elaborated as follow: (1) There is no differences in lured rat number between combined bait and rice bait, between combined bait and anchovy bait, between combined bait and tofu bait, between combined bait and roasted coconut bait; (2) The most luring bait is anchovy bait as much as 27.3%; (3) The most consistent luring bait is combined bait and anchovy bait. Suggestions that researchers recommend for the Tandang Village community is to control rats in their homes routinely and sustainably by using traps either with combined bait or anchovy bait. For researchers who will conduct research with a similar theme are expected to conduct further research on the combination of the bait as well as testing the deterrent trap. In addition, it is also expected to extend the time period of trapping.

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