



ANALYSIS OF RAT DEMAND WITH FLEAS INDEX IN CLASS WORK AREA I TANJUNG PERAK SURABAYA PORT

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Abstract: The distribution of bubonic plague in Indonesia is inseparable from the role of the port as an entrance for passenger and goods transportation. PES is a zoonotic disease caused by the bacterium *Yersinia Pesti* which infects rodents such as mice and can spread to humans through the fleas bite of *Xenopsylla cheopis*. This study aims to analyze the density of rats and index fleas in the working area of Class 1 KKP Tanjung Perak Surabaya. This type of research is analytical descriptive with approach *cross sectional*. Research variables are rat density and fleas index. The study population was a total trap installed by the CTF of 150 traps. The research sample was 110 traps using the method *cluster random sampling*. Data analysis used test *chi-square*. The results showed that success rat trappings of 15.45% belonged to the high density category ($> 7\%$) and fleas index results *Xenopsylla cheopis* of 2.64% were included in the high fleas index category ($> 1\%$). The density of mice is related to the index of fleas with a value of $\rho = 0,000 < 0,05$. The conclusion of the study is that there is a relationship of density of mice with index fleas in the working area of Class 1 KKP Tanjung Perak Surabaya. Suggestions for institutions are to improve environmental sanitation by maintaining the cleanliness of the warehouse, making efforts to *improve the building*.

Keywords: *density of mice, index fleas, harbor, xenopsylla cheopis.*

1. Introduction

The spread of bubonic plague in Indonesia is inseparable from the role of the port as an entrance to the flow of passenger and goods transportation. At present there is an increase in the flow of transportation, so the observation efforts are not only carried out in the focus areas and former pes regions, but observations must be carried out and improved in the port area to prevent bubonic transmission and ward off pes between countries and regions (RI Ministry of Health, 2008)^[2]. The problem of bubonic plague is still a public health emergency problem that is of international concern or quarantine disease. PES is a zoonotic disease caused by the bacterium *Yersinia Pesti* and infects rodents such as mice that can spread to humans through fleas bites. The fleas on PES are *Xenopsylla cheopis*. *Xenopsylla cheopis* is a fleas found in rodents who forage and live in human environments such as mice.

Based on the epidemiology of the PES case in Indonesia, the PES case in Indonesia first occurred in the Tanjung Perak Port of Surabaya in 1910. Its distribution was allegedly through rice vessels carrying rats infected with PES (Indonesian Ministry of Health, 2008)^[2]. The last Pes Extraordinary Event (KLB) occurred in 2007 in Sulorowo Hamlet, Kayukebek Village, Tatur Nongkojajar Subdistrict, Pasuruan Regency, East Java Province, but the results of laboratory examinations showed serologically positive PES found in mice and fleas in the focal area so it is necessary control (RI Ministry of Health, 2010)^[5]. The life of fleas is influenced by several factors

including temperature and humidity, light, parasites, and predators (Ristiyanto, *et al.*, 2014)^[10], while other studies mention the presence of hosts (mice) can affect the index of fleas (Widjaja *et al.*, 2016)^[13].

Based on the annual report of the Class 1 KKP of Tanjung Perak Surabaya, when viewed from the total rats caught and the number of traps installed after being calculated using the formula *trap success* in 2018 for 8 examinations all had a *success rate of* > 7% while the fleas index results *Xenopsylla cheopis* in 2018, during 8 examinations the fleas index value was not > 1%, but in the last 2 months the measurement of fleas index value was almost close to 1.

Based on the background described above, researchers were interested in researching the density analysis of mice with fleas index in the region work of Class 1 KKP of Tanjung Perak Port, Surabaya

2. Research Methods

The type of research used in this study is descriptive analytic with approach *cross sectional*. The variables of this study are rat density and fleas index. The population of this study is the total traps installed by the CTF of 150 traps. The research sample of 110 traps was taken by method *cluster random sampling*. The primary data collection technique was taken by installing mouse traps and secondary data from the annual report of Class 1 KKP Tanjung Perak Surabaya. Data analysis using test *chi-square*.

3. Results and Discussion

3.1 Overview of Rat Density

Table 1. Rat Density Results in Tanjung Perak Port Surabaya.

No	Trap location	Rats caught	∑ Trap	Trap success (%)
1	Warehouse Kalimas	6	73	8,2
2	Terminal Roro	1	22	4,5
3	Gapura Surya Nusantara (GSN)	10	15	66,6
Overall		17	110	15,4

Source: Primary Data, 2019

Based on Table 1 the calculation results of the formula *trap success* can be informed that the overall density of mice in the Tanjung Perak Port of Surabaya was 15.4% and included in the high density category (> 7%). Whereas rats based on 3 trapping locations in the Tanjung Perak Port of Surabaya, can be informed that the highest rat density is at the location of Gapura Surya Nusantara (GSN) with a *trap success* of 66.6% and included in the high density category.

3.2 Identification of Types of Rat Species

Table 2. Results of identification of species of rats as a whole in Tanjung Perak Port Surabaya

No	Mouse type	Frequency	Persentase
1	<i>Rattus norvegicus</i>	4	23,5
2	<i>Rattus tanezumi</i>	13	76,5
Total		17	100,0

Source: Primary Data, 2019

Based on Table 2, it can be informed that there are 2 types of rats caught in the Tanjung Perak Port of Surabaya, namely *Rattus norvegicus* and *Rattus tanezumi*. However, almost all (76.5%) type *Rattus tanezumi* or house mice.

Table 3 Results of identification of rat species based on location in Tanjung Perak Port Surabaya

No	Location	Mouse type	Total
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		<i>Rattus Norvegicus</i>		<i>Rattus Tanezumi</i>		n	%
		N	%	N	%		
1	Gudang Kalimas	3	50,0	3	50,0	6	100,0
2	Terminal Roro	1	100,0	0	0,0	1	100,0
3	Gapura Surya Nusantara (GSN)	0	0,0	10	100,0	10	100,0
Total		4	23,5	13	76,5	17	100,0

Source: Primary Data, 2019

Based on Table 3, it can be informed that the types of rats caught based on 3 locations in the Tanjung Perak Port of Surabaya were almost all (76.5%) species of mouse species *Rattus tanezumi* and located in the location of Gapura Surya Nusantara (GSN).

3.3 Identification of Rat Sex

Table 4. Results of rat sex identification in Tanjung Perak Port Surabaya

No	Sex Rat	Frequency	Persentase
1	Jantan	11	64,7
2	Betina	6	35,3
Total		17	100,0

Source: Primary Data, 2019

Based on Table 4 can be informed that the sex of mice caught in the Tanjung Perak Port of Surabaya is mostly (64.7%) male sex.

3.4 Index of Fleas

Table 5. Results of fleas index calculation at Tanjung Perak Port Surabaya

No	Trap Location	Fleas Found	∑ Rats Examined	Fleas Indeks (%)
1	Warehouse Kalimas	9	6	1,5
2	Terminal Roro	1	1	1,0
3	Gapura Surya Nusantara (GSN)	35	10	3,5
Overall		45	17	2,64

Source: Primary Data, 2019

Based on Table 5 the results of calculation of the fleas index formula can be informed that the overall fleas index in the Port of Tanjung Perak Surabaya is 2.64% and is included in high index index category (> 1%). Whereas the fleas index based on 3 locations for trapping at Tanjung Perak Port in Surabaya, can be informed that the highest fleas index is at the Gapura Surya Nusantara (GSN) location with a fleas index of 3.5% and is included in the high fleas index category.

3.5 Results of identification of rat fleas

Types of fleas in this study based on the results of identification of fleas found on the bodies of mice caught in the Tanjung Perak Port of Surabaya can be informed that the type of fleas found in the whole rat body (100.0%) is *Xenopsylla cheopis*

3.6 Analysis Relationship

Table 6. Analysis of the density relationship of mice with fleas index in the working area of Class 1 KKP Tanjung Perak Surabaya Port

No	Mouse Density	Index of Fleas				Total	
		High (>1 %)		Low (<1%)		n	%
n	%	n	%	n	%		

1	High (>7 %)	88	100,0	0	0,0	88	100,0
2	Low (<7 %)	0	0,0	22	100,0	22	100,0
Total		88	80,0	22	20,0	110	100,0
Significance: 0,001 (<0,05)							
<i>Phi</i> : 1,000							

Sumber: Data Primer, 2019

Based on Table 6 shows that out of 88 rat traps including high density rats all had a high index of fleas (100%). While the traps of mice with low rat density from 22 rat traps all (100%) had a low index of fleas. So the higher the density of mice in an area, the higher the index of fleas.

The results of the statistical test using the test *chi-square* with a significance level of $\alpha = 0.05$ obtained the significance of *fisher's exact test* $0.001 < 0.05$, then H_0 is rejected and H_a is accepted. This means that there is a significant relationship between the density of mice with fleas index in the working area of Class 1 KKP of Tanjung Perak Port, Surabaya. The relationship of density of mice with fleas index is very strong, namely 1.

3.7 Discussion

3.7.1. Rat Density Analysis

The density of rat populations in the environment can be seen by estimating the density *relative* as the percentage of success of catching (Ristiyanto, 2007)^[9]. The success of catching mice seen from the results of *trap success* carried out both at home and outside the home is expressed by the formula (Rusmini, 2011)^[11]. The results of the overall rat density study at the Tanjung Perak Port in Surabaya showed that the density of mice was included in the high density category (> 7%) with a percentage of *trap success* of 15.45% whereas, if observed based on 3 locations the results were different, the rat density was highest at the location of Gapura Surya Nusantara (GSN) with a percentage of *trap success* 66.6%.

That is because they found bangunan who do not *rat proofing* that is the hole in the ceiling of the roof is used as a rat's nest and is located in the kitchen, trash in the kitchen that is not covered, their source of food or leftover groceries considering place *the food court*, where many stalls selling food thus inviting mice, given the nature of mice that are happy to live in places where there is food, or food scraps. Besides that it is supported by poor environmental sanitation because it is found that kiosks that are unused and not maintained so that they are used as nest by mice are proven by the smell of urine, scattered table woods, and mouse droppings. When compared to Roro Terminal, the condition of Gapura Surya Nusantara is very different because Roro Terminal has good environmental sanitation, namely the absence of open trash bins, a clean environment and buildings that are *rat proof* so that the density of mice in Roro Terminal is low at <7%.

In line with the results of a study by Priyotomo (2015)^[8] and Sulasmi & Sri Hastuti (2017)^[12] that the density of mice was caused by poor or poorly maintained sanitation and the presence of food sources. This is also supported by the results of research conducted by Mutaqin *et.al* (2016)^[7] the number of mice caught in the house, due to the condition of buildings that are not *rat proofing*, trash cans in the kitchen that are not closed, and the habit of keeping garden produce in the kitchen. So that conclusions can be drawn from the results of previous studies and studies that the existence of food sources more influences the density of rat populations compared to the influence of the season, it is also mentioned in the study conducted by Joharina *et.al* (2016)^[3].

3.7.2 Analisis of mouse species

The type of rat species in this study was based on the results of identification of rats caught in the Tanjung Perak Port of Surabaya by looking at the identification key. Identification key types of rats can be known based on the morphological characteristics of body length, tail length, ear length, body color, tail color, body weight, hind limb length, and number of mammae (Ristiyanto *et.al*, 2014)^[10]. Based on the identification results, it can be seen that there are 2 types of rat species, namely *Rattus*

norvegicus and *Rattus tanezumi*, but almost all types are *Rattus tanezumi* or house mice, as well as identification results from 3 trapping locations of mouse species *Rattus tanezumi* almost all found at Gapura Surya Nusantara location. This is because the location of Gapura Surya Nusantara has many food sources, dark places (ceilings) that are used as nests, especially in the location of the kitchen, dirty places (unkempt stall tables).

Type *Rattustanezumi* and *Rattus norvegicus* a rat domestic ie perform life activities (searching for food, shelter, nesting and breeding) depended on the aktivitas man and liked the place is dark and dirty as well as a feed source (kitchen, wardrobes, and store the results harvest or animal feed) Yuliadi *et.al* (2016)^[14]. This is in line with the research conducted by Joharina *et.al* (2016)^[3] the dominant mouse species found in Semarang Port, namely the type of *Rattus tanezumi* with 70 rats.

3.7.3 Analysis of rat sex.

The sex of mice is one of the characteristics for the determination or determination of the type of mouse in female mice that have mammary organs (mammary glands). The number of nipples in each mouse is different, it can determine the type of mice both around the settlements and silvatik habitat (far from the human environment) (Yuliadi *et.al*, 2016)^[14]. The results of identification of rat sex in Tanjung Perak Port, Surabaya, were mostly male. This is consistent with research conducted Annashr (2017)^[1] in the village Jomblang, Semarang namely rat sex more males are caught as much as 63% but is different in contrast to research Sulasmi & Sri Hastuti (2017)^[12] The number of female mice more many caught than males because female mice are individual food seekers for their children so that they often come out of the nest. The existence of differences from the results of the above research can be influenced by social behavior factors of rats, in poor feed conditions and increased rat population there is a social competition which forces low-ranking male rats out of the population because in one group there is only one male strong among males the others are usually the dominant male is characterized by the large body size (Yuliadi *etal*,2016)^[14].

3.7.4 Analysis of fleas index.

The fleas index is used to determine the average investment density of fleas on the body of a mouse. The index category offleas specifically *Xenopsylla cheopis* according to the Indonesian Ministry of Health (2007)^[4] namely the high fleas index (> 1%) and the low fleas index (<1%). The calculation results of the fleas index *Xenopsylla cheopis* at Tanjung Perak Port in Surabaya amounted to 2.64%, while the location of the index trap at the Gapura Surya Nusantara (GSN) location was 3.5% and included in the category of high fleas index and fleas index results in the study the value is higher compared to the results of measurements carried out by the CTF during 2018, namely the low fleas index category.

The difference in results can occur because it is likely that when the rat sweeping process is less painstaking and thorough in combing, especially in rat body curves that are repeated repeatedly not only one sweep, considering the fleas suck the blood of mice so that fleas stick to the skin of the mouse can be anticipated by sorting out mouse hair using tweezers so that the fleas attached to the skin of the mouse can be taken and get a valid result. In addition, the high fleas index results can also be affected because the density factor of mice given that mice are hosts of fleas in this study. The location of Gapura Surya Nusantara (GSN) also has a high rat density value and according to some research results *Xenopsylla cheopis* is a rodent parasite especially from the genus *rattusrattus* and found in mouse species *tanezumi*. This is in accordance with the research, namely the type of rat *Rattus tanezumi* was most caught in the Port of Tanjung Perak Surabaya. This is in line with the research conducted by Widjaja (2016)^[13] stating that the density of fleas is determined by the presence of the host.

3.7.5. Analysis of rat fleas species of rat

fleas obtained from the results of sweeping rats, both types of mice caught in the Tanjung Perak Port of Surabaya all have the same type, *Xenopsylla cheopis*. The type of mice most infested by fleas is *Rattus tanezumi*, where almost all of them are caught in the location of Gapura Surya Nusantara (GSN) where the conditions are inside the house. This is supported by research conducted by Annashr (2017)^[1] stating that fleas like mammals that live in nests, holes and caves and mice that are most infested by fleas are *Rattus tanezumi*. Dry air conditions have an unfavorable effect on the survival of fleas. Every 10 increase in temperature⁰C, the life span of fleas decreases 1/2 or 2/3 times the normal life (Ristiyanto, 2014)^[10]. So that the type of rat *Rattus tanezumi* needs to be aware of because this type of mouse is preferred or where the fleas of *Xenopsylla cheopis* are remembered considering the type of fleas *Xenopsylla cheopis* acts as a vector of bubonic plague.

3.7.6. Density analysis of rats with fleas index

Analysis of density of rats with fleas index based on the calculation of rat density and fleas index can be seen that there is a relationship between the density of mice with fleas index in the working area of class 1 Tanjung Perak Surabaya KKP because both show high density results (> 7%) and high fleas index (> 1%). This happens because rats and fleas have a very close relationship considering rats are hosts of fleas, in this study rats *Rattus tanezumi* were mostly caught, especially in the location of Gapura Surya Nusantara (GSN) because the trapping lay in the house and the installation location was at places where there are food sources and according to the results of identification of these types of mice, fleas are found *Xenopsylla cheopis*. The above research is in line with the research conducted by Priyotomo (2015)^[8] in the Cilacap Sea Port area in that study the success rate of was 13% and the fleas index *Xenopsylla cheopis* was 1.4%.

In its implementation the CTF did not calculate the density of mice because the CTF referred to SOPs which only calculated the index of fleas, but according to important researchers the density of mice was calculated to control rat populations considering rats as fleas and regulated in Minister of Health Regulation No. 34 of 2013 concerning the implementation of actions remove mice and insects from ports, airports and land border crossing posts. The operators are business entities engaged in environmental sanitation. Whereas in Class 1 KKP Tanjung Perak Port there is a Field of Environmental Risk Control (PRL) which handles the control of mice and fleas in the Tanjung Perak Port area of Surabaya.

4. Conclusions and Suggestions

Overall rat density in the Tanjung Perak Port of Surabaya is included in the high density category (> 7%), which is a value trap success of 15.45%. Whereas the rat based on 3 research sites had different results, the highest density of mice from 3 locations in the location of Gapura Surya Nusantara (GSN), namely trap success was 66.6% and included in the high density category (> 7%). The species of mouse species that were caught were almost entirely *Rattus Tanezumi*. Most of the rats' sex are male sex. The index of special fleas *Xenopsylla cheopis* in the Tanjung Perak Port of Surabaya is included in the high category (> 1%), which is 2.64%, while the location of the highest fleas index trapping is based on 3 locations, namely in Gapura Surya Nusantara (GSN) which is 3, 5% and included in the high category (> 1%). The types of rat fleas that are obtained all have the same type, namely fleas *Xenopsylla cheopis*. So that this study can be concluded that there is a relationship between the density of mice with index fleas in the working area of class 1 KKP Tanjung Perak Surabaya.

Suggestions for agencies provide direction and insight to warehouse owners and place managers that are used as mice mapping to improve environmental sanitation efforts, such as neater arrangement of goods, especially in warehouses whose contents are preferred by rats and making efforts rat proffing so that holes are not used as nests. Make efforts to eradicate mice, especially in places that are suspected to be the place for mice to suppress rat density.

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