DESCRIPTION OF RAT AND FLEA FAUNA AS VECTORS IN THE PES OBSERVATION AREA OF PASURUAN DISTRICT, EAST JAVA IN THE YEAR 2018-2022

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ABSTRACT. Bubonic plague is an infectious disease that can be transmitted by rodents and vectors. The main vector of bubonic plague is the flea Xenopsylla cheopis. Bubonic plague is a re-emerging disease, meaning that it can reappear at any time. The bubonic plague control program is to conduct regular surveillance activities both in the focus area and outside the focus area. The purpose of this study was to describe the density of rat and flea fauna in bubonic plague surveillance areas in Pasuruan Regency. These data were obtained from surveillance activities conducted by BBTKLPP Surabaya in Pasuruan Regency. The type of research is descriptive. The data to be studied is included in the retrospective cohort research method. The variables of this study were trap success, general density index of larvae, special index of larvae. Univariate analysis with data centering measures was used for data analysis. The results of the research from 2018 to 2022 conducted by BBTKLPP Surabaya in Pasuruan Regency were conducted in three locations, namely houses, gardens, and forests. The most common rat caught was in the home area with the species Rattus tanezumi. Meanwhile, the most common flea found during the sweeping was Xenopsylla cheopis. This condition has the potential to transmit bubonic plague and other diseases through rats and fleas through direct contact with humans. The density of rats and fleas found in the home environment or in contact with humans.

Keywords: Bubonic Plague, Rats, Flea

1 INTRODUCTION

According to the book Epidemiology of Infectious Disease (Masriadi, 2016), disease is a failure of an organism to adapt to pressure, resulting in a disruption of body function. According to the PES Control Technical Manual(P2P, 2014) (Rahmawati, 2013) , diseases can be transmitted through rodents and vectors, one of which is bubonic plague. Bubonic plague can be transmitted to humans through the bite of a pinjal caused by the bacterium Yersinia pestis. The rat mite as the main vector of bubonic plague is Xenopsylla cheopis. In the International Health Regulation (2005) bubonic plague as a re-emerging disease, which is a disease that can reappear at any time and can cause a Public Health Emergency of International Concern (PHIEC) or a public health emergency that is troubling the world (International Health Regulation,

2005) (Malikhatin, 2017) (Frith, J, 2012). According to the International Health Regulation (1969), every country should conduct regular inspections of rodents and their ectoparasites in every area, especially those that have been infected, to reduce the danger of spreading bubonic plague (Organization, 1983). According to the book Guidelines for Investigating and Handling Outbreaks of Infectious Diseases and Food Poisoning, bubonic plague in humans was once known as black death in World War II and resulted in very high mortality (Borchert, J. N et al., 2007) (Barbieri, R et al., 2021).

According to the book Technical Guidelines for PES Control(P2P, 2014), in 1400 bubonic plague occurred in most of mainland Europe with 25 million victims. In Indonesia, bubonic plague is listed in Law No. 4 of 1984 concerning infectious disease outbreaks. Bubonic plague first entered Indonesia in 1910 through the Port of Surabaya (Marbawati, 2019) (Walloe, L, 2008) . From 1910 to 1960, 245,375 people died from bubonic plague (Andrianaivoarimanana, V et al., 2013) (Poland, J. D et al., 2019).

The total number of cases was 17.6% in East Java, 51.5% in Central Java, and 30.9% in West Java. The entry of the disease into Indonesia was carried by rats and their lenders from Rangoon Port in Myanmar. The rats entered the ship carrying rice and docked at Tanjung Perak Port in Surabaya. An outbreak of bubonic plague occurred in 1987 in Pasuruan District, East Java. On November 3, 1986 there were 8 cases of death with fever symptoms and no known cause in Sulorowo Village, Pasuruan District, East Java. On February 13, 1987 cumulatively there were 20 deaths out of 24 patients with unexplained high fever, cough and shortness of breath suspected as bubonic plague with a Case Fatality Rate of 83.3%. In February to April 1987, active surveillance activities were carried out and 224 suspected cases of bubonic plague were found with 1 death. The last case of bubonic plague was reported from Pasuruan Regency in 2007 as many as 40 suspects and 1 person died. Based on data from the Indonesian Ministry of Health, Directorate General of P2P(Dirjen P2P), the last human case of bubonic plague was reported in 2007 in Pasuruan Regency until now there are no reports of human cases of bubonic plague, but surveillance of bubonic plague is still being carried out.

According to the PES Control Technical Manual(P2P, 2014), the objectives of the bubonic plague control program are to free the bubonic plague area in Indonesia, reduce the morbidity rate of bubonic plague, prevent the transmission of bubonic plague from the focal area to other areas, and monitor areas that have contracted bubonic plague so that they are not infected again. This bubonic plague control program can be carried out by conducting continuous surveillance activities for bubonic plague both in the focus area and outside the focus area. These surveillance activities include rodent surveys, human surveys, and rodent population surveys. This study will provide information on the number of rodent and flea populations and their types in the bubonic plague observation area of Pasuruan Regency, East Java from 2018 to 2022.

2 RESEARCH METHODS

The type and source of data in this study used secondary data. The data was obtained from the Surabaya Environmental Health and Disease Control Engineering Center in Pasuruan Regency, East Java. This type of research uses descriptive research which can be seen from the time side of the data to be studied including retrospective cohort research methods. The variables of this study were rat density, flea density, trap success, general density index of flea, special index of flea. Data analysis used univariate analysis or descriptive analysis with data centering measures.

3 RESULTS

The results of research on the results of surveillance activities carried out by the Surabaya Environmental Health and Disease Control Engineering Center (BBTKLPP) in Pasuruan Regency obtained the number of rats and flea caught, as well as the trap success of rats and the density index of flea in surveillance activities in 2018 to 2022. The number of rats and lice obtained is about the number of rats and lice and their types. The results were analyzed from secondary data of the Surabaya Environmental Health and Disease Control Engineering Center.

1. Description of Rat Fauna in the Pes Observation Area of Pasuruan Regency
   a. Number and type of rats

Table 1. Number and Type of Rats In The Year 2018-2022

Year	Trap Location	Rattus tanezumi (tail)	Rattus exulans (tail)	Hylomys suilus (tail)	Suncus murinus (tail)	Other Spesies (tail)	Total (tail)
2018	House	3431	9	0	150	5	**3595**
	Garden	237	842	33	226	243	**1581**
	Forest	8	276	23	2	76	**385**
2019	House	1141	2	0	42	0	**1185**
	Garden	42	236	4	86	80	**554**
	Forest	69	745	110	22	257	**1203**
2020	House	1702	0	0	43	0	**1745**
	Garden	85	364	30	137	91	**707**
	Forest	0	100	0	0	0	**100**
2021	House	1006	0	0	10	0	**1016**
	Garden	103	293	10	100	52	**558**
	Forest	1	35	35	0	202	**273**
2022	House	1409	2	0	22	0	**1433**
	Garden	95	474	19	126	147	**861**
	Forest	13	167	3	2	132	**317**

Total	9342	3545	267	968	1285	15513

Source : BBTKLPP Surabaya

Based on the table above, the results of surveillance activities carried out by BBTKLPP Surabaya in Pasuruan Regency, the number of rats found for 5 years was 15513. The most rats found were in 2018 with the rat species Rattus tanezumi. The most rats found from the three trap locations were at the trap location in the house area.

b. Trap Success

The results obtained from the trap success of rats for five years from 2018 to 2022 conducted by BBTKLPP Surabaya in Pasuruan Regency are as follows.

Table 2. Trap Success During 5 Years

Year	*Trap Success*
2018	3,6 %
2019	2,7 %
2020	2,7 %
2021	3,1 %
2022	2,7 %

Based on the table, it shows that the calculation of trap success for five years by BBTKLPP Surabaya in Pasuruan Regency was the highest in 2018.

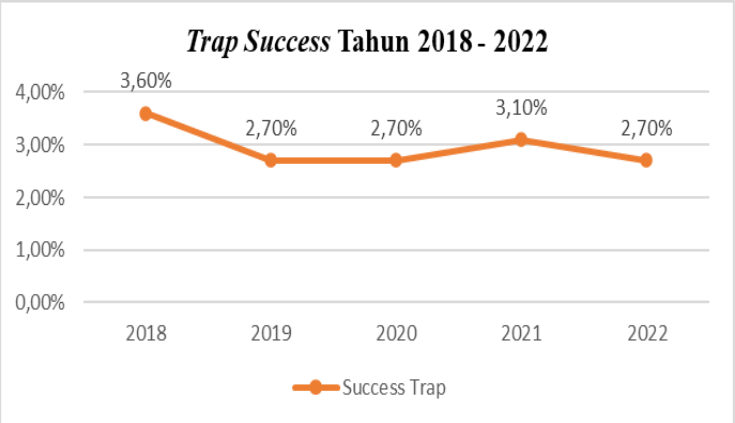

Fig. 1. Trap Success 2018 - 2022

Based on the figure, it shows that trap success for five years carried out by BBTKLPP Surabaya in Pasuruan Regency is still increasing and decreasing.

2. Description of Flea Fauna in the Pes Observation Area of Pasuruan Regency

The results of research on the results of surveillance activities carried out by BBTKLPP Surabaya in Pasuruan Regency for 5 years from 2018 to 2022 obtained the types of pests and capture locations as detailed in the table and figure below.

a. Number and type of flea

The results of hair sweeping conducted by BBTKLPP Surabaya in Pasuruan Regency on rats caught in the bubonic plague observation area in Pasuruan Regency from 2018 to 2022 are as follows.

Table 3. Number and Type of Flea In The Year 2018-2022

Year	Trap Location	*St. cognatus (tail)*	*X. cheopis (tail)*	Total (tail)
2018	House	676	3076	**3752**
	Garden	248	636	**884**
	Forest	69	157	**226**
2019	House	285	1034	**1319**
	Garden	38	175	**213**
	Forest	210	469	**679**
2020	House	213	1134	**1347**
	Garden	83	293	**376**
	Forest	11	51	**62**
2021	House	83	708	**791**
	Garden	36	213	**249**
	Forest	135	69	**204**
2022	House	150	709	**859**
	Garden	87	210	**297**
	Forest	13	45	**58**
Total		2337	8979	11316

Source : BBTKLPP Surabaya

Based on the table above, the results of surveillance activities carried out by BBTKLPP Surabaya in Pasuruan Regency, the number of flea found for 5 years was 11316. The most flea found was in 2018 with the species X. cheopis. The most flea found from the three rat trap locations was in the rat trap location in the house area.

b. General density index of flea

The results of the general density index of flea that have been calculated by BBTKLPP Surabaya in Pasuruan Regency are as follows.

Fig. 2. Table 4. General Density Index of Flea 2018 - 2022

Year	General Density Index
2018	0,83
2019	0,75
2020	0,67
2021	0,61
2022	0,63

Source : BBTKLPP Surabaya

Based on the table shows that the results of the general density index of flea for five years from 2018 to 2022 were the highest in 2018 at 0.83. Based on the table, the fluctuation of the general density index of flea for five years can be seen as follows.

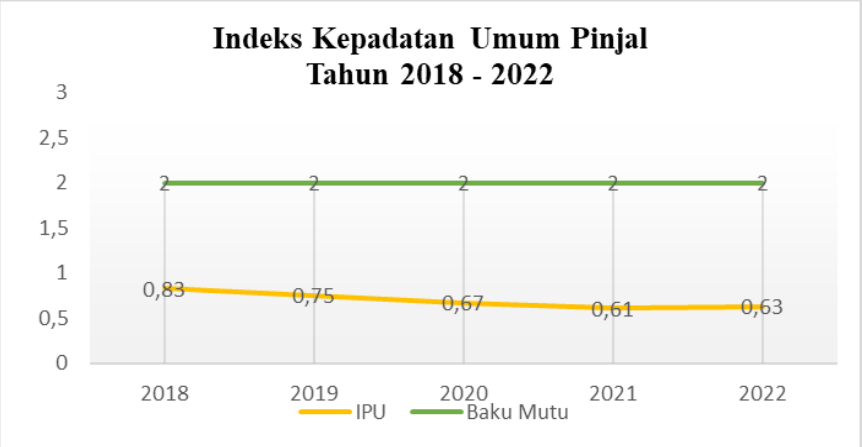

Fig. 3. General Density Index of Flea 2018 - 2022

Based on the figure shows that the general density index of flea for five years from 2018 to 2022 is still increasing and decreasing although with relatively low results from the quality standard.

c. Special density index of flea

The results of the specific density index of flea that have been calculated by BBTKLPP Surabaya in Pasuruan Regency are as follows.

Fig. 4. Table 5. Special Density Index of Flea 2018 - 2022

Year	Special Density Index of Flea
2018	0,66

2019	0,57
2020	0,55
2021	0,49
2022	0,49

Source : BBTKLPP Surabaya

Based on the table shows that the results of the general density index of flea for five years from 2018 to 2022 were the highest in 2018 at 0.66. Based on the table, the fluctuation of the special density index of flea for five years can be seen as follows.

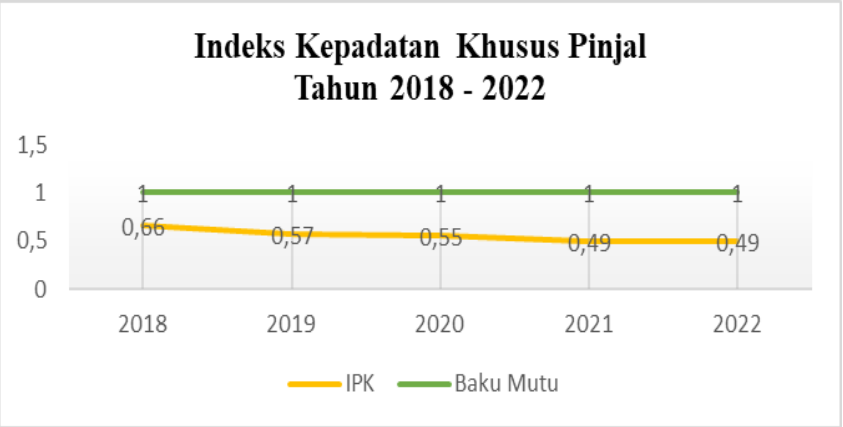

Fig. 5. Special Density Index of Flea 2018 - 2022

Based on the figure shows that the general density index of flea for five years from 2018 to 2022 is still increasing and decreasing although with relatively low results from the quality standard.

4 DISCUSSION

4.1 Description of Rat Fauna in the Pes Observation Area of Pasuruan Regency

Based on the results of surveillance activities conducted by BBTKLPP Surabaya in Pauruan Regency for five (5) years from 2018 to 2022, it was found that most of the rats caught were indoor rats with the species Rattus tanezumi. The calculation results for five years are 2018 of 3.60%, 2019 of 2.70%, 2020 of 2.70%, 2021 of 3.10%, and 2022 of 2.70%. The results of these calculations can state that trap success is still experiencing ups and downs and still exceeds the quality standards.

This journal is in line with the research of Rery Afianto, et al in Tandang Village, Tembalang Subdistrict, Semarang City, The results of the capture of rats can be seen

that the most caught rat species is Rattus tanezumi. The original habitat of Rattus tanezumi is in the home area because the rat is a domestic rat whose life such as foraging, sheltering, nesting, and breeding at home. Rats can also move from one place to another if they lack food. Considering that house rats are domestic rats, so that the contact with humans is relatively high, it is necessary to be aware that in addition to being a pest of settlements, it also causes losses or consequences for human health (Isnani, 2018) (Dean, K. R et al., 2018). The presence of rats as both pests and disease vectors is strongly influenced by the surrounding environmental conditions (RI, 2016).

According to research by Ari Kusumajaya, et al in Banyumas Regency (Kusumajaya, 2020), the results of rats identified in the capture of rats in the Leptospirosis case area in Darmakradenan Village, Ajibarang District, Banyumas Regency amounted to 30 rats with the species of Rattus tanezumi and Mus musculus. The species of Rattus tanezumi identified based on the location inside the house were 14 rats and at the location outside the house were 12 rats so that the total number of Rattus tanezumi species was 26 out of 30 rats caught. The results of the capture suggest that the type of Rattus tanezumi or rats whose habitat in the home area is more common so that disease transmission will be faster (Monecke, S et el., 2009)

According to the research conducted by Syamsuar Manyullei, et al. at Soekarno Hatta Sea Port (Manyullei, et al. 2019), the results of rat trap installation conducted for four (4) days obtained two types of rats, namely Rattus tanezumi and Rattus norvegicus. The results of the trap installation showed that the most common type of rat found was Rattus tanezumi at 75%. These are rats that live in the habitat of houses, yards, warehouses and gutters.

According to the book Medical and Veterinary Entomology (Durden and Mullen, 2018), monitoring rodent populations is one of the steps in control before human cases occur. Although rats and shrews are pests of some crops and vectors of disease, they play an important ecological role as food chains and seed dispersers throughout the forest. Therefore, it is necessary to monitor the diversity of rats and shrews (Prasetio and Setiati, 2015).

4.2 Description of Flea Fauna in the Pes Observation Area of Pasuruan Regency

Based on the results of research from surveillance activities conducted by BBTKLPP Surabaya in Pasuruan Regency for five (5) years from 2018 to 2022, the generalized flea index fluctuation in 2018 was 0.83, in 2019 was 0.75, in 2020 was 0.67, in 2021 was 0.61, in 2022 was 0.63. The highest generalized flea index in 2018 then decreased. The generalized flea index increased in 2022 by 0.2. Fluctuations of the specific flea index over five (5) years from 2018 amounted to 0.66, in 2019 amounted to 0.57, in 2020 amounted to 0.55, in 2021 amounted to 0.49, and in 2022 amounted to 0.49. The highest specific flea index in 2018 then still experienced an increase and decrease.

However, the results for the five years are still relatively low from the quality standard.This journal is in line with Sugeng Riyanto's research in Nongkojajar, Pasuruan Regency (Riyanto, 2019), where the results of the Xenopsylla cheopis type of flea were always higher than the Stivalius cognatus type. This illustrates that the number of Xenopsylla cheopis from year to year is more dominant, which means that if there is a type of disease that is easily transmitted by the bite of this type of flea, the risk of disease transmission becomes higher.

According to Wahyu Hilal, et al in Surorowo Hamlet, Kayubebek Village, Tutur Subdistrict, Pasuruan Regency (Hilal N, . and ., 2019), getting the results of the spread of rat lice species in residential areas is quite high with a total general lice index of 1.33 with the number of lice species Xenopsylla cheopis as much as 80.95% and Stivalius cognatus as much as 19.05% of the rat species Rattus tanezumi and Rattus exulans, then an area is said to be alert to the transmission of bubonic plague if the special lice index (X. cheopis) >1.

Xenopsylla cheopis is a common flea species found in the tropics (Ramadhani, Santoso and Raharjo, 2012). Xenopsylla cheopis is also a flea that is very easy to move from one host to another, both similar and different species (Sari *et al.*, 2020). Xenopsylla cheopis moths are more commonly found in residential areas compared to Stivalius cognatus moths because Stivalius cognatus moths are more dominant in outdoor areas. The hosts of S. cognatus are peridomestic rats and silvatic rats (Bland, D. M et al., 2021).

According to Durden and Hinkle in the book Rickettsioes (Pramestuti Nova, 2022), Neglected Vector-Borne Diseases, environmental factors are very important in determining the density of flea in different habitats or geographical areas. Environmental conditions that have a high density of rats will increase the population of flea (Dennis, D. T., & Staples, J. E, 2009).

5 CONCLUSION AND RECOMMENDATION

Surveillance activities carried out by BBTKLPP Surabaya in Pasuruan Regency in three locations, namely in the house, garden and forest areas. Two types of rats were caught during five years, namely Rattus tanezumi and Rattus exulans, and two types of cecurut, namely Hylomys suilus and Suncus murinus. The most common rat caught from 2018 to 2022 was Rattus tanezumi. The most trap success results were in 2018. The high number of mice caught was obtained from the location of the trap installation in the home area. The presence of rats in the home area is relatively more and will be more easily in direct contact with humans. This condition can potentially lead to the transmission of bubonic plague and other diseases transmitted through rats.

The flea found from the results of rat sweeping conducted by BBTKLPP Surabaya in Pasuruan Regency for five years obtained two species, namely Xenopsylla cheopis and Stivalius cognatus. The most common type of flea found from 2018 to 2022 is the Xenopsylla cheopis species with the most species in Rattus tanezumi mice. The presence of pinjal found in Rattus tanezumi mice in the home area is relatively more and will be more easily in direct contact with humans. This condition can potentially

lead to the transmission of bubonic plague and other diseases transmitted through pinjal in rats such as murine thypus, tularemia, and listeriosis.

The results of this study can be used as information to continue similar research with other variables such as the density of rats and flea that contain bacteria.

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