Effect Of Climate And Sanitation Of Rats Population And Index Flea As Indicator Detection *Yersinia pestis* In Port Surabaya

Moch Agus Wahyudi[1] , Ririh Yudhastuti[2] , Hari Basuki Notobroto[3]

Environmental Health Department, Public Health Faculty, Airlangga University, Surabaya, Indonesia[1, 2]
Biostatistics Departement, Public Health Faculty, Airlangga University, Surabaya, Indonesia[3]
Email : ochadiraku2@yahoo.co.id[1]

Abstract

Background: International Health Regulations (IHR) classifies plague as the disease is likely to recur, and has the potential to cause epidemics and extraordinary events. **Objectives:** analyze the influence of climate and level of sanitation to the population of rats and fleas index as an indicator of yersinia pestis in the port of Surabaya. **Methods:** analytic observational research with cross sectional design through testing time series and regresion linier. Population in this study are data on the number of mice caught and the number of fleas were found and observed in the laboratory of the Port Health Office of Surabaya. **Results:** results of linear regression analysis with p=0,001 for the influence of humidity on the population of rats, p=0,036 for the influence of solar radiation on the rat population, the value of p=0,033 for the influence of rainfall on the level of sanitation, and p=0,037 for influence the level of sanitation of the rat population, so the hypothesis is accepted. **Conclusions and suggestions:** There is the influence of humidity and solar radiation on the population of rats and fleas index, rainfall factors affect the level of sanitation, sanitation factors influence the rat population. Necessary to control vectors by using DUSTLON besides adding a mousetrap

Keywords : Climate, Sanitation, Rat, Flea

INTRODUCTION

Plague is a disease zoonosa (sourced animals), especially in mice or rodent. An infectious disease that is still contained in the list of international quarantine disease was plague. International Health Regulations (IHR) classifies Plague as the disease is likely to recur, and has the potential to cause epidemics and extraordinary events (Stephen Person, 2010). The Plague transmission cycle involving rodents as the host animal, fleas (Siphonaptera) living ectoparasites in mice as vectors, and support of environmental factors that are conducive to disease development.

According to Sub.Dit.Zoonosis (2014), is currently The Plague still exist in Indonesia in both humans (serological) and in animals silvatik spread plague focus area in District Selo and Cepogo Boyolali, Central Java; Cangkringan Sleman, Yogyakarta; as well as the District Tosari, Puspo, Pasrepan and District Speech Pasuruan, East Java.

Difficulties in combating The plague caused by rats as a host of spread is very wide, commensal, and easily adapt to new environments, Yersinia pestis bacteria can survive for months post-infective (David Orme, 2013).

First, that The Plague including zoonotic disease is highly contagious. Second, the transmission cycle involving the The plague of rats and fleas as host and vekto. Third, the development of fleas, rats dissemination and transmission of disease naturally require the support of ecological factors. Not all variables statistically significant effect on the ecological fleas or rodents population density in an area, so it is necessary to do research on ecological risk factors and effects.

If the ecological risk factors and their effect on the epidemiology plague has been known, the natural phenomena that started as early as possible the incidence of The plague recognizable, then this will strongly support early warning systems, to anticipate the outbreak, vector control The Plague.

Because the plague included rare cases, so in this study flea *Xenopsylla cheopis* index (CPI ≥ 1) is used as an indicator of the case and the CPI <1 as the control with regard to general index fleas (IUP). The use of *Xenopsylla cheopis* index as an indicator of the results of research case because Turner et al (1974) note, that *Xenopsylla cheopis* known as the main vector in addition to the plague fleas Stivalius cognatus. Based on the above problems, this study is to analyze the relationship between knowledge, attitude, and availability of PPE to use PPE to farmers in the district Ngantru sprayers, Tulungagung.

RESEARCH METHODS

This research was observational analytic with cross-sectional design, the researchers conducted measurements or research at one time. The research was carried out in the port area of tanjung perak Surabaya, Surabaya port health office, BBTKL Surabaya, as well as the BMKG (Meteorology and Geophysics) Surabaya.

The subjects in this study was data on the number of mice caught and the number of fleas were found and observed in the laboratory of the Port Health Office of Surabaya and the rat population caught trap at the time of observation and identification of species of fleas were found on the body of the rat as a sample for mapping the number of fleas *Xenopsylla*

*cheopis* and non *Xenopsylla cheopis* fleas in the area of the Port of Surabaya.

The independent variables such as temperature, humidity, precipitation, solar radiation, and sanitation. the dependent variable is population density of rats and fleas. The data were analyzed using time series and linear regression (α = 0.05) to determine the effect of temperature, humidity, precipitation, solar radiation, and sanitation. The independent variables and dependent variables are said to exist the effect if the level of significance (p) <0.05.

RESULTS

The monthly data include average climate temperature data, humidity, rainfall and sunshine duration for 5 years starting from January 2011 to December 2015. Data were obtained from the Meteorology, Climatology and Geophysics Karangploso Malang.

Monthly climate in the Port of Surabaya for the average temperature ranged between 27.5 0C to 310C, with a daily average temperature was 27.8 0C. For the average humidity ranged between 62% to 81%, with a daily average humidity of 73%. For maximum rainfall reached 510 milliliters, with average daily rainfall of 182 milliliters and for the average solar radiation ranged between 3.84 hours to 8 hours, with solar radiation daily average of 6.16 hours.

The average temperature monthly for 5 years (January 2011 to December 2015) are measured in degrees Celsius by using Thermometer, the data obtained from the Meteorology, Climatology and Geophysics Karangploso Malang for Regional Port Surabaya in figure 1 below this:
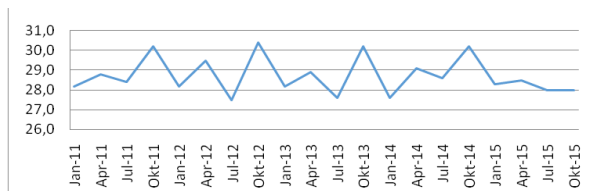
Figure 1. The average temperature of Surabaya in 2011- December 2015

Rainfall is the amount of rainwater that falls on the ground for a certain period measured in height above the horizontal surface if there is no removal by the process of evaporation flux and impregnation, by using a graduated rain called Umbrometer, and units used are millimeters (BMKG, 2013).

An average of rainfall per month for 5 years (2011 through 2015) were obtained from BMKG for Surabaya Port area in Figure 2 as follows:
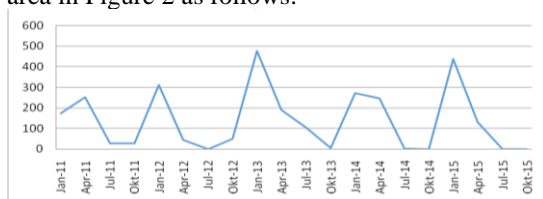

Figure 2.An Average of Rainfall in Surabaya in 2011- December 2015

Sunshine duration is its duration the sun shining through the earth's surface in a period of one day, measured in hours.

The period of one day is more properly called the period of long days the sun is above the horizon for 8 hours starting from 08.00 till 16.00. While tools to measure the duration of solar radiation at the BMKG is the type Campbell Stokes (BMKG, 2013).

An average of Sunshine duration per month for 5 years (January 2011 to December 2015) were obtained from BMKG for Surabaya Port area in Figure 3 as follows:
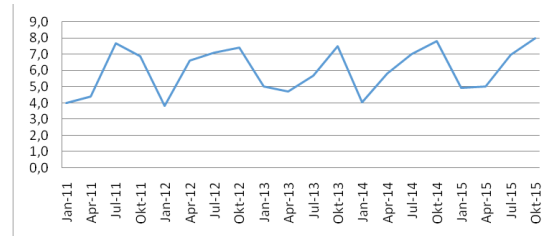

Figure 3. The average length of an average Sunshine duration of Surabaya in 2011- December 2015

The environmental sanitation is health status of an environment that includes housing, sewerage, water supply, and so on (Notoadmojo, 2003). The health status of an environment in the criteria for becoming eligible and ineligible can be seen in Figure 4 below:
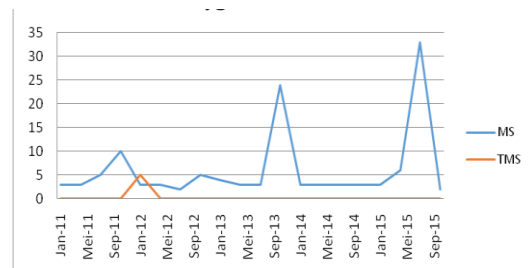
Figure 4. Sanitation average of Surabaya in 2011- December 2015

Rat population is the number of rats caught each month during the installation period for 5 days in a row
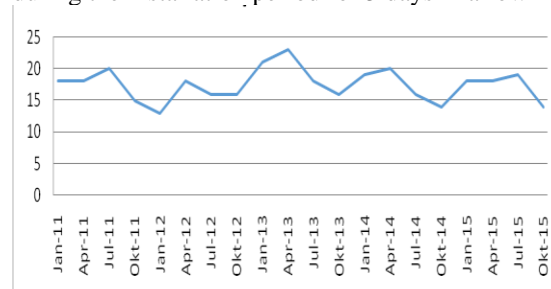
Figure 5. Rat population of Surabaya in 2011-December 2015

Flea index is the ratio between the number of rat fleas are caught with the number of rats caught during the installation period for 5 consecutive days.
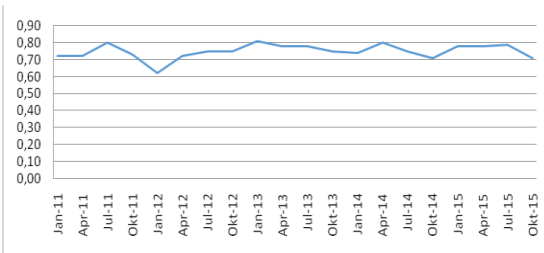
Figure 6. Flea index of Surabaya in 2011- December 2015

Time Series Analysis (trend) is an analytical method that is intended to make an estimate or forecasting the future (Martisunu, 2013).

Generally equation of linear and time series analysis using excel for trend forecasting in the port of Surabaya flea index formula is obtained: y = -0,004x + 0,76, and statistical data obtained as follows: where y is the variable that is sought after trend and x is a variable calculated time calculation unit in the initial trend.

Climatic Effects of Rat Population

Effect of temperature on the population of mice using linear regression data obtained as follows: by using the Linear Regression for the temperature of the rat population in the Port of Surabaya obtained t = -0.932 and p = 0.355 (p> 0.05).

Effect of humidity on the population of mice using linear regression data obtained as follows: using a linear regression on humidity of the rat population in the Port of Surabaya obtained t = 3.584 and p = 0.001 (p <0.05).

The effect of rainfall on the population of mice using linear regression data obtained as follows: by using the Linear Regression on precipitation of the rat population in the Port of Surabaya obtained t = -0.714 and p = 0.478 (p> 0.05).

The effect Sunshine duration on the population of mice using linear regression data obtained as follows: by using the Linear Regression on solar radiation on the rat population in the Port of Surabaya obtained t = -2.150 and p = 0.036 (p <0.05).

Climate Effect on flea Index

Effect of temperature on the index of fleas by using linear regression data obtained as follows: by using the Linear Regression on the temperature on the index of fleas in the port of Surabaya obtained t = -1.251 and p = 0.216 (p> 0.05).

Effect of humidity on the index of fleas by using linear regression data obtained as follows: by using the Linear Regression on humidity on the index of fleas in the port of Surabaya obtained t = 3.173 and p = 0.02 (p <0.05).

Effect of rainfall on the index of fleas by using linear regression data obtained as follows: by using the Linear Regression on rainfall on the index of fleas in the port of Surabaya obtained t = -1.499 and p = 0.140 (p> 0.05).

Effect of solar radiation on the index of fleas by using linear regression data obtained as follows: by using the Linear Regression on solar radiation on the index of fleas in the port of Surabaya obtained t = -2.580 and p = 0.013 (p <0.05).

Effect of Rainfall on Sanitation

Effect of rainfall to sanitation using linear regression data obtained as follows: by using the Linear Regression on rainfall to sanitation in the port of Surabaya obtained t = 2.185 and p = 0.033 (p <0.05).

Effect of Sanitation on Rat Population

Effect of sanitation to populations of mice using linear regression data obtained as follows: by using the Linear Regression on the level of sanitation of the rat population in the Port of Surabaya obtained t = 2.131 and p = 0.037 (p <0.05).

Measurement of Climate, Sanitation, Rat Population and flea Index

Table 1. Climate (average of temperature, humidity, rainfall, and solar radiation) in May 2016 Port of Surabaya

Month	May 2016			
	Temperature	Humudity	Rainfall	Duration
May	30	76	70,7	6,9

The measurement results of sanitation, conducted in May 2016 obtained the following data: Eligible: 0 and ineligible: 8

The measurement results of rat population and flea index, conducted in May 2016 obtained the following data:
Rat population: 22 and flea index: 2.5
By calculating rat caught 22 fleas caught the number 55 and the identification of species of flea everything is Xenopsylla cheopis.

Inoculation

To process all the fleas caught Inoculation crushed by means inserted into a tool called Grinder tissue for 20 minutes . Then inoculated on white mice for 2-3 days . Of the inoculation process *Yersinia pestis* negative results obtained from the Port of Surabaya

DISCUSSION

Results of Linear Regression analysis between average humidity of the rat population in the Port of Surabaya showed their strong influence with a positive linear line , meaning that the higher average humidity effect by increasing the rat population in the Port of Surabaya.

In conclusion, according to the results shown by Wahyuni Arumsari et al . Research Wahyuni Arumsari et al (2012) on analysis of Environmental Factors Abiotic affecting presence of leptospirosis in rats in the village Sambiroto , District Tembalang , Semarang , which examined variable environmental factors abiotic , suggest that environmental factors abiotic (pH of water , soil pH , humidity , and light intensity) affect the existence of rats.

Linear Regression analysis results between solar radiation on average against the rat population in the Port of Surabaya showed their strong effect with negative linear line , meaning that the higher solar radiation on average significantly associated with lower rat population in the Port of Surabaya .

According to Tamara Ben Ari in Plugue and climate : Scale Matter in 2011 that the orientation of the wind and sun exposure affect the environment and habitat mice.

With the solar radiation that will affect the longer the mice to mobilize lifestyle , which means that the solar radiation will cause the shortening of the time of night , while the rats are included nocturne animals or animal activity at night . When solar radiation is longer mobolitas this causes mice to be reduced and the effect on the number of rats caught.

Results of Linear Regression analysis between average rainfall to the level of sanitation qualified in the Port of Surabaya showed their strong influence with negative linear line . For the average rainfall of the level of sanitation that are not eligible in the port of Surabaya showed their strong influence with a positive linear line . This means that the higher the average rainfall , the level of sanitation increasingly ineligible . Conversely the lower the rainfall , the level of sanitation will be eligible. In conclusion, according to the results shown by Mustazahid Agfadi Wirayoga . Research Mustazahid Agfadi Wirayoga (2013) about the relationship incidence of Dengue Hemorrhagic Fever with the climate in Semarang City Year 2006-2011 , said that the heavy rainfall and flooding could worsen the sanitary system.

Linear Regression analysis results between the level of sanitation that does not qualify toward the rat population in the Port of Surabaya showed their strong influence with a positive linear line . This means that the sanitation is not eligible high, then the rat population will be higher. Instead sanitation does not meet the condition is low, then the rat population has declined. This conclusion is in line with research Rizka Auliya (2014) concerning the relationship between the strata Clean and Healthy Lifestyle order household and sanitary home with leptospirosis cases , said that the disease leptospirosis develop well when found popolasi rats in large quantities and with poor sanitation .

On trends / forecasting index of fleas in the harbor area of Surabaya showed -0,004x + y = 0.76 which indicates future flea index value will decrease . On forecasting index of fleas in the harbor area of Surabaya shows that fleas index value of not more than 0.76 value of the data is expected in the port area of Surabaya in coming years is no longer a risk areas Pes events .

In May 2016 the results of the process of inoculation flea Xenopsylla cheopis were 55 coming from the Port of Surabaya also showed negative Yersinia pestis . This means that the Port of Surabaya remained free of the bacterium Yersinia pestis , does not mean that early awareness of the bubonic plague ignored , but instead have to watch out for special flea index exceeds 1.

CONCLUSION
1. Factors humidity and solar radiation effect on the population of rats and fleas index , while the factors temperature and precipitation does not affect the population of rats and fleas index in the Port of Surabaya
2. Factors Rainfall effect of sanitation in the area of the Port of Surabaya
3. Sanitation factors affect the rat population in the area of the Port of Surabaya

4. Trend / forecasting index of fleas in the Region Port Surabaya in the future will be decreased with increasing public awareness about environmental health harbor that prevention is more important than cure
5. For a special flea index calculations at the port of Surabaya, in May 2016 performed at the Laboratory of Port Healt Office shows that the region in May 2016 including the risk of disease occurrence Pes
6. From the results of inoculation in May 2016 in the Port of Surabaya shows that the region is free of the bacteria *Yersinia pestis*

SUGGESTION

1. There needs to be further research on other factors that affect the value fluctuation of the population of rats and fleas index gained every month , in order to estimate when moments flea index has increased or decreased in order to do proper control management measure.
2. The need to improve human resources to the officers and Disease Vector Control Sourced through education and training regularly to update the expertise and skills in the field of vector control and disease animal sourced either in the Port Health Office Class 1 Surabaya
3. Extension activities should be carried out regularly to the public Port of Surabaya the importance of maintaining a healthy environment.
4. It should be carried out vector control vermin and rats by adding using DUSTLON in addition to using a mouse trap , to reduce the number of fleas index .
5. Activities in the Laboratory of Vector Port Health Office is not limited to identification of fleas , but until the inoculation to ascertain whether it contains bacteria *Yersinia pestis* flea or not.Always establish cross-sector cooperation related to Disease Control Pes , particularly Laboratory Pes BBTKL Nongkojajar Surabaya in Pasuruan

REFERENCES

1. *David Orme, 2013. Plague. Ransom Publishing. 1 Oktober 2013 – 64 halaman.*

2. *Dinas Kesehatan Kabupaten Pasuruan, 2005. POA Pengamatan Penyakit Zoonosis di Kabupaten Pasuruan Tahun 2005. Dinas Kesehatan Kabupaten Pasuruan, Pasuruan.*

3. *Hamida E, 2015. Faktor Risiko Kejadian Leptospirosis Pada Peternak Sapi Di Dataran Tinggi Kecamatan Ngrayun Ponorogo, tesis, FKM Universitas Airlangga.*

4. *Hasanah Nadlifatul, 2008. Survei Fauna Tikus Beserta Pinjal Dan Kutu Di Kelurahan Kuningan Hadap Sari RT 01 RW 04 Kecamatan Semarang Utara Kota Semarang. Jurnal FKM Universitas Diponegoro.*

5. *Kemenkes RI, 2008. Peraturan Kesehatan Internasional / International Health Regulations 2005 (IHR 2005), Jakarta.*

6. *Kemenkes RI, 2011. Peraturan Menteri Kesehatan tentang Organisasi dan Tata Kerja Kantor Kesehatan Pelabuhan.*

7. *Kemenkes RI, 2014. Petunjuk Teknis Pengendalian Pes, Jakarta.*

8. *Kuntoro H, 2011. Dasar Filosofis Metodologi Penelitian, Surabaya, Pustaka Melati.*

9. *Lynne Elliot. 2006. Mediecal Medicine and The Plague. Crabtree Publishing Company.*

10. *Maibang Whinda Gemaria, 2014. Kepadatan Tikus Dan Ektoparasit Yang Tertangkap Di Pasar Jatingaleh Dan Pasar Kedung Mundu Semarang 2014. Jurnal FKM Universitas Diponegoro.*

11. *Martini, 2010. Populasi Dan Indeks Pinjal Pada Tikus Yang Tertangkap Di Pasar Tradisional Kecamatan Semarang Selatan. Jurnal FKM Universitas Diponegoro.*

12. *Maulana Y, Diah Ika Rahma, Jarohman Raharjo, Anggun Paramita D, 2012. Identifikasi Ektoparasit Pada Tikus Dan Cecurut Di Daerah Fokus Pes Desa Suroteleng Kecamatan Selo Kabupaten Boyolali, ejournal litbang Depkes. BALABA.*

13. *Mayasari Arni Dyan, 2013. Hubungan Antara Sanitasi Rumah Warga Dengan Jumlah Tikus Dan Kepadatan Pinjal Di Desa Selo Kecamatan Selo Boyolali. Jurnal Universitas Muhammadiyah Surakarta.*

14. *Mills JN,Kenneth L. Gage, and Ali S. Khan, 2010. Potential Influence of Climate Change on Vektor-Borne and Zoonotic Diseases: A Review and Proposed Research Plan, Environmental Health Perspectives.*

15. *Napitupulu Dormani Peronika, 2015. Kepadatan Tikus Dan Keragaman Ektoparsit Yang Tertangkap Di Pelabuhan Tanjung Emas Semarang. Jurnal FKM Universitas Diponegoro.*

16. *Purnomo Windhu, Taufan Bramantoro, 2013. 36 Langkah Praktis Sukses Menulis Karya Tulis Ilmiah. PT. Revka Petra Media Surabaya.*

17. *Priyotomo Yudhi Cahyo, 2015. Studi Kepadatan Tikus Dan Ektoparasit Di Daerah Perimeter Dan Buffer Pelabuhan Laut Cilacap. Jurnal FKM Universitas Diponegoro.*

18. *Riha R, 2014, Hubungan Faktor Iklim Dengan Indeks Pinjal Sebagai Indikator Wilayah Berisiko Kejadian Pes Di Dusun Surorowo Pasuruan, tesis, FKM Uneversitas Airlangga.*

19. *Sofyan, HRA., 2012. Pedoman Pengendalian Tikus di Rumah Sakit. Direktorat Jenderal PP dan PL Dep.Kes.RI Jakarta.*

20. *Sub Direktorat Zoonosis, 2014. Pedoman Penanggulangan Penyakit Pes di Indonesia. Departemen Kesehatan RI., Direktorat Jenderal Pemberantasan Penyakit dan Penyehatan Lingkungan, Kementerian Kesehatan RI, Jakarta.*

21. *Stephen Person, 2010. Bubonic Plague: The Black Dead. Bearport Publishing, New York.*

22. *Supriyanto H, 2006, Analisis Eko Epidemiologi Penyakit Pes di desa Kayukebek kecamatan Tutur Kabupaten Pasuruan Jawa Timur, tesis, Universitas Gajah Mada Yogyakarta.*

23. *Undang-Undang RI No. 4 Tahun 1984, Tentang Wabah Penyakit Menular.*

24. *Wendy Orent, 2013. Plague: The Mysterious Past and Terrifying Future of The Worlds Most Dangerous Disease. Free Press New York, London, Toronto, Sydney.*

25. *Yudhastuti R, 2011, Pengendalian Vektor dan Rodent, Surabaya, Pustaka Melati.*