

Sanitation And Temperature Factors Related To Existence Of Cockroach And Rats Vectors On Passenger Ship In Kendari City Port

Eka Dharma Putra Marhanto^{1*}, Anry Hariadhin Depu²

^{1,2}Mandala Waluya Kendari College of Health Sciences,
Southeast Sulawesi, Indonesia

**Corresponding Author :*

Eka Dharma Putra Marhanto

Jl. Jend. A. Nasution No. G-37 Tel. 3193176 (0401), Kendari, Indonesia

Email: eka.teknolink@gmail.com

Abstract

Objectives: Ship arrival and departure activities have an important influence on the transmission of various vectors which have the potential to infect the ship's crew and passengers. This study aims to determine the factors associated with the presence of vectors on passenger ships.

Methods: This type of research is observational. The population is a local passenger ship that anchors at 4 ports in Kendari City, with a population of 44 ships and a sample of 40 ships. with the sampling technique is systematic random sampling.

Results: The results of the study used the Chi Square test between sanitary conditions and the presence of cockroaches ($15.708 > 3.841$), there was a relationship between sanitary conditions and the presence of rats ($14.249 > 3.841$), there was a relationship between temperature and the presence of cockroaches ($9.724 > 3.841$), there was a relationship between temperature and the presence of rats ($7.901 > 3.841$).

Conclusion: There were relationship between sanitary conditions and temperature with the presence of cockroach and rat vectors on passenger ships mooring at the Port of Kendari City. Therefore it is necessary to increase the sanitary conditions and temperature in the room.

Key Words : Ship, Sanitation, Temperature, Cockroach, Rat Vector

INTRODUCTION

The development of sea transportation has caused the intensity of the use of ships, both people and goods, and ship departure schedules to increase. The frequency of ship departures and arrivals plays an important role in the transmission of various kinds of pest insects that can potentially infect the crew and passengers, both between regions and across countries (1). The condition of the port as the recipient and manager of goods from all over the world is one of the causes of the incidence of insect infestation on ships (2).

Then the presence and density of rats in the Kendari Harbor Perimeter area in 2016 was 21.66%, in 2017 it was 16.66% there was a decrease of 5%, but in 2018 it was 17.75% there was an increase in rat density by 1.09 %. One of the problems is the change in the environment and the wider breeding grounds for disease-transmitting vectors. Environmental changes lead to adaptation of disease-transmitting vectors to a wider area and changes in the concurrent transport of goods and people.

Vectors and disease-carrying animals can cause problems in human life, both directly and indirectly. In the field of transportation, such as ships, vectors and disease-carrying animals are really undesirable, because the means of transportation are required to be free of vectors and disease-carrying animals in accordance with the 1962 Marine Quarantine Law and article 52 IHR (International Health Regulation). As for areas in ports, based on article 16 of the IHR, the Port Health Office must try to keep the port area free from rat infestation and conduct rat proofing (rat inspection) of

buildings in the port area. In addition to suppressing the rat population,

Mice are rodents (rodentia) which are very disturbing to humans. Between rats and humans the relationship is parasitism. In the health sector, rats are a reservoir for several pathogens that cause disease in humans, as well as in livestock or pets. Various diseases spread by rats include bubonic plague, leptospirosis (a disease caused by the bacterium *Leptospira interrogans*), murine typhus (this disease is also called endemic typhus), scrub typhus (caused by *Orientia tsutsugamushi*, transmitted through the bite of mite larvae that live in rodents, salmonellosis (a group of bacteria that causes typhus and also causes food to become toxic), the disease can be spread to humans without intermediaries through saliva, urine and feces or through the bite of ectoparasites in the rat's body. Compared to ectoparasites, a type of parasite that lives on other hosts (animal hosts), flea ectoparasites have an important function in the field of health because they function as vectors of diseases, such as the bubonic plague. Plague as the main zoonotic disease in rats that can infect humans. The bubonic plague in Indonesia was transmitted to the port of Tanjung Perak in Surabaya in 1910. Its spread was demonstrated by rice ships carrying rats infected with the bubonic plague. In several regions of the country, this disease is often a case and it is necessary to be prepared for its transmission until it is still classified as a quarantine disease as written in the International Health Regulations (IHR). The spread of bubonic plague in Indonesian territory cannot be separated from the role of ports as entry gates for transportation, passenger and goods circulation, as well as the opportunity to

become an access for transmutation of disease transmission which results in public health due to quarantine diseases, new emerging diseases or infectious diseases. re-emerging disease. The emergence of the potential for disease transmission is the result of rapid developments in information technology and transportation, free trade, and rapid movement of people between regions and regions. new infectious diseases (New Emerging Disease), or old infectious diseases that reappear (Re-emerging Disease). The emergence of the potential for disease transmission is the result of rapid developments in information technology and transportation, free trade, and rapid movement of people between regions and regions. new infectious diseases (New Emerging Disease), or old infectious diseases that reappear (Re-emerging Disease). The emergence of the potential for disease transmission is the result of rapid developments in information technology and transportation, free trade, and rapid movement of people between regions and regions (3).

Cockroaches are very close in life to humans, like buildings that are warm, humid, and where there is lots of food. Cockroaches are insects that live in houses, buildings, offices, hospitals, hotels, restaurants, libraries, in trash cans, sewage canals, and generally cockroach life in groups has the ability to fly, avoiding light, therefore during the day cockroaches hide between -between or dark places and actively move at night. For humans, cockroaches are one of the dangerous insects, because several species of cockroaches are known to transmit diseases to humans (4).

Diseases caused by insect vectors are diseases caused by pathogens (infectious microorganisms) in humans and transmitted through insect vectors, including malaria, dengue hemorrhagic

fever, elephantiasis (filariasis), bone flu (chikungunya), viral brain inflammation , which is most common in the Asian region (Japanese encephalitis). These diseases are still a public health problem in tropical and sub-tropical regions.

Definition of Passenger Ship Sanitation

Sanitation is an effort to prevent disease by eliminating or controlling environmental risk factors which are a link in the chain of disease transmission (5). Meanwhile, according to government health regulations No.530/87 ship sanitation is all activities carried out on environmental factors on board to stop the chain of disease transmission in order to improve health levels. Ship sanitation is an inherent part of the health attitude towards sanitation. Referring to this basis, the determinants of ship sanitation attitudes can start from the concept of determinants of health attitudes expressed by Green and Blum that the degree of public health is one of them influenced by behavioral and environmental factors besides health and heredity services..The factors considered related to ship sanitation include external factors such as policies and supervision from the Marine and Fisheries Ministry (Port Health Office), while internal factors such as the leadership of the Master, the existence of Standard Operational Procedure (SOP) for ship sanitation and the behavior of the Ship's Crew. The purpose of inspecting ship sanitation is intended so that the ship is free from the threat of diseases that have the potential to cause outbreaks, prevent transmission of infectious diseases, and create a comfortable and safe atmosphere for passengers, crew members and the ship's captain (2).

Regarding the institution that has the authority to carry out supervision is the Port Health Office. According to Permenkes No.356/Menkes/IV/2008 that

the Port Health Office has the job of supervising the arrival and departure of quarantine diseases, and potential infectious disease outbreaks, quarantine, limited health services in the port working area, as well as controlling environmental health impacts. . There is another important function of the Port Health Office which is to carry out observations of quarantine diseases and potential national outbreaks of infectious diseases according to diseases related to international traffic, carry out health monitoring of passenger ships and carry out port environmental risk controls (4).

Ship sanitation is carried out for all types of ships, both passenger ships and cargo ships. Checking ship sanitation is intended to issue a sanitation certificate in order to obtain a Sailing Health Permit. The results of the inspection are declared high risk, a Sanitation Control Certificate or Ship Sanitation Control Certificate (SSCC) is issued, after sanitation measures are taken and if the risk factor is low, a Ship Sanitation Exemption Control Certificate (SSCEC) is issued, and the inspection is carried out within a certain period of time. once every six months (6).

Definition of Temperature Factor

Temperature is an environmental factor that determines or regulates the life activities of insects. This impact is clearly seen in the physiological processes of insects, namely acting as a limiting factor for the ability of insects to survive. At a certain temperature the activity of insect life is high (very active), while at other temperatures the activity of insects is low (less active). Therefore there are zones or temperature areas that limit the activities of insect life. These zones (for the tropics) are:

- a. Upper fatal limit zone, at that temperature insects have died, that is at temperatures > 480C.

- b. Upper dormant zone, at this temperature the activity (external organs) of insects is not effective, that is, at a temperature of 380C - 450C.
- c. Upper effective zone, at this temperature insect activity is effective at 290C-380C.
- d. Optimum zone, at $\pm 280C$, insect activity is the highest.
- e. Lower effective zone, at this temperature insect activity (internal and external organs) is effective, namely at a temperature of 270C - 150C.
- f. Lower dormant zone, at this temperature there is no external activity, which is at 150C.
- g. Lower fatal zone, at this temperature insects have died ($\pm 400C$).

Definition of Cockroach Vector

Cockroaches are one type of insect that is always found around the environment where we live. Until now, more than 4,500 species of cockroaches have been identified. For humans, cockroaches are one of the dangerous insects, because several species of cockroaches are known to transmit diseases to humans such as tuberculosis, typhus, asthma, cholera, and hepatitis (7). *Periplaneta americana* or better known as the American cockroach has dark red characteristics with yellow stains on the dorsum and a body length of approximately 4 cm. The American cockroach has two pairs of wings, three pairs of legs, a pair of antennae and cerci (8).

Understanding Rat Vector

Mice are animals belonging to the order Rodentia, sub-order Myomorpha, family muridae. this family muridae is the dominant one of the order Rodentia because it has high reproductive power,

eats all kinds of food (omnivorous) and easily adapts to the environment created by humans. Mice are mammals belonging to the Muridae tribe. The best known rat species are mice (*Mus spp*) and brown rats (*Rattus norvegicus*) which are found in almost all countries and are important model organisms in biology.

Mice are pests that are difficult to control and carry parasites that can harm human health. But behind the losses, rats also play an important role in the ecosystem because they are the first consumers in the food chain. Rats play a role and function as seed dispersers for some food scraps. The shape of the rat's teeth that protrude in front of as many as two requires the rat to eat seeds so that the teeth can always be sharpened. Propagation and self-pollination are also regulated naturally with the help of pollinating animals or seed dispersers through intermediate hosts. The purpose of seed scattering is to reduce the risk of extinction.

Rats and mice are rodents (rodentia) which are detrimental to humans. The relationship between mice and humans is often parasitic. In the field of health, mice can be a reservoir for several pathogens that cause disease in humans, both animals, livestock and pets. Types of diseases carried by rats include bubonic plague, leptospirosis, murine typhus, scrub typhus, leishmaniasis, salmonellosis, Chagas disease and also several worm diseases such as schistosomiasis and angiostrongyliasis. The disease can be transmitted to humans directly by saliva, urine and feces or through the bites of ectoparasites in rats (fleas, fleas, ticks and mites).

METHODS

This type of research is observational research, in which researchers only make observations without providing treatment and intervention. This study aims to determine the factors associated with the presence of cockroach and rat vectors on passenger ships in the Kendari harbor area. Independent Variables are environmental sanitation and temperature. The population in this study were local passenger ships mooring at Kendari Archipelago Port, Kendari Boat Base Port, Kendari-Wawonii Port with a total of 44 ships (Recapitulation data for Kendari Port Health Office PHQC publications). The equipment used is Environmental Meter PCE-EM 882.

To see the presence of cockroaches on passenger ships, these cockroaches are seen for signs such as dirt, capsules and the presence of the cockroach itself. done by visually seeing the signs indicating the presence of cockroaches such as the presence of cockroach droppings (fecal) and capsules (ootheca). Besides the existence of the cockroach by looking at it (alive or dead).

To see the presence of rats on passenger ships, Rats are carried out by visually looking for signs indicating the presence of rats such as: Gnawings (bite marks), Run Ways (paths) usually at the corner of the wall with the floor, black in color, Rub Marks (friction marks)) usually at the corner of the wall, in the form of loose hairs, Burrows (holes) usually in the ground or wooden/gypsum walls, Dropping (feces/dirt), Track Paths (palm marks) usually on cable pipes, in the form of a blackish layer of wax, Voice, Life & Death rats, Nests, Swing Marks (jump marks)

Data analysis was carried out in two stages, namely descriptive and

inferential analysis. This analysis was carried out using the help of statistical applications. Done with the aim of describing the data obtained according to time, place of person by displaying it in the frequency distribution table, accompanied by an explanation. Inferential analysis is an analysis of two variables which is carried out to test whether there is a relationship between the independent variable and the dependent variable using the chi square test

RESULTS

Table 1 shows that most of the ship sanitary conditions are in the bad category, namely 22 ships (55%). And a small portion of ship sanitation is in the good category, namely 18 ships (45%). Table 2 shows that of the 18 ships whose temperature conditions were effective, 12 ships (67%) found traces of cockroaches and six (6) ships (33%) found no traces of cockroaches. Meanwhile, out of the 22 ships whose ship sanitation was not good, three (3) ships (14%) had cockroaches and 19 ships (86%) had no cockroaches. Table 3 shows that most of the passenger ships were found to have no traces of the presence of cockroaches, namely as many as 25 ships (63%). And a small number of passenger ships were found to have traces of cockroaches, namely as many as 15 ships (38%).

Table 4 shows that most of the passenger ships were found to have no traces of rats, namely 22 ships (55%). And a small number of passenger ships were found to have traces of rats, namely as many as 18 ships (45%).

Table 1. Distribution of Sanitary Conditions for Passenger Ships at Harbor Kendari City

Sanitation	Amount	
	n	%
Well	18	45%
Not good	22	55%
Total	40	100%

Table 2. Distribution of Passenger Ship Temperature Conditions at Harbor Kendari City

Temperature	Amount	
	n	%
Effective	24	60%
Ineffective	16	40%
Total	40	100%

Table 3. Distribution of Cockroach Presence on Passenger Ships at the Port of Kendari City

Existence of Cockroaches	Amount	
	n	%
There is	15	38%
There isn't any	25	63%
Total	40	100%

Table 4. Distribution of Rat Presence on Passenger Ships at the Port of Kendari City

The presence of mice	Amount	
	n	%
There is	18	45%
There isn't any	22	55%
Total	40	100%

DISCUSSION

Cockroaches are vectors that are very close to humans, as well as sanitation. Cockroaches are one of the ship's insects, in addition to house and building insects.

According to research (9) who stated that the vector that was often found on board were cockroaches with the *Blatella germanica* species, namely the discovery of 431 of 28 traps placed on 21 ships.

According to (10) Disease transmission can occur through bacteria or disease germs found in garbage or food scraps, where the germs are carried by the feet or other body parts of the cockroach, then through the cockroach's body organs, then the disease germs contaminate the food. The vector that is most often found on board is the cockroach. Cockroaches are a problem in public health because cockroaches often breed and live around living things that have died. When viewed from their habits and place of life, it is very possible that cockroaches can transmit disease to humans. Disease germs that stick to their bodies brought from dirty places will be left behind or stick to the places they infest.

At night cockroaches actively search for food in kitchens, food warehouses, trash cans and drains. Cockroaches are able to carry the ootheca or clutch of eggs which they lay on their backs for several weeks. Cockroaches are able to fly, are able to adapt even though they are carried in goods on transportation equipment, cockroaches are able to walk from building to other buildings or from channel to other channels, parks, ditches in the ground to places of human life. Cockroaches like to eat human feces and like to step on dirt and garbage when looking for food. Cockroaches can secrete fluids from their mouths and other parts of their bodies, causing odors in the area or food they step on. These insects are nuisance animals because they usually live in dirty places and under certain conditions emit a liquid that smells bad. The results of this study indicate that out of 25 ships with good sanitary conditions, three ships (12%) found traces of cockroaches.

Sanitation is closely related to vector density, especially cockroaches on board. In accordance with research (11), which states that the factors associated with the density of cockroaches on board are ship sanitation and length of berthing. The sanitary conditions of ships that have a high level of risk of health problems were found to have cockroaches in the high or dense category. The results of the ship sanitation assessment showed that 40% of motorized ships had a high level of risk of health problems and of these 40%, 91.67% found cockroaches in the high or dense category, while 8.33% had a high level of risk of health problems. the presence of cockroaches in the low category.

Sanitation is an act of monitoring various factors in the human physical environment that have an influence on human physical development, health and survival which affects the degree of human health by making efforts to prevent the emergence of disease, so that survival can be guaranteed. All components on board are risk factors for the spread of disease-causing vectors, both quarantine diseases and potentially infectious diseases, so it is necessary to carry out sanitation checks. Meanwhile, from 15 ships whose ship sanitation was not good, there were 12 ships (80%) that had cockroaches. This was because based on the observations of researchers related to sanitation, it showed that 76.67% of motor boats are not equipped with trash cans that meet the requirements in several parts of the ship, especially in the kitchen because the kitchen is very closely related to food which is the habitat of cockroaches. This condition is in accordance with research which explains that environmental sanitation such as improper waste handling can invite the emergence of cockroaches. In addition, poor lighting conditions and air exchange can become breeding grounds for vectors and other nuisance

animals that can transmit disease to ship occupants. The existence of these cockroaches can be caused by (12) the contents and physical environment or the rooms on the ship such as; bathrooms or toilets, bedrooms for crew members, food storage warehouses, clean water reservoirs or water reservoirs (holds), kitchens, trash and pantry. In this section generally disease vectors such as cockroaches can breed. If it is declared that the ship is free from vectors, a Ship Sanitation Control Exemption Certificate (SSCEC) document can be issued.

The results of data analysis using the Chi Square test obtained values X^2 count $>$ X^2 table ($15.708 > 3.841$), and the Phi coefficient (Φ) is 0.680, which means that there is a strong relationship between sanitary conditions and the presence of cockroaches on passenger ships mooring at the Port of Kendari City. This research is in line with (13) what states that there is a strong relationship between sanitary conditions and the presence of cockroaches on board.

Sanitation is a cockroach control strategy that can be done by cleaning leftover food on the floor or shelves, immediately washing cutlery after use, cleaning routinely places where cockroaches hide such as trash cans, under refrigerators, stoves, household furniture, and places where cockroaches are hiding, other hidden. Entrances and places where cockroaches live must be closed, by repairing leaking pipes, cleaning drains, sinks and sinks. Cockroach living areas can also be destroyed by cleaning wardrobes or cloth storage areas, not hanging or immediately washing dirty clothes and other dirty equipment. Vessel sanitation assessment needs to be carried out, bearing in mind that ships carry disease vectors,

In general, cockroaches can live and their population increases in moist

environmental conditions, available food, and close to water. A similar study conducted at European Ports reported that *B. germanica* cockroaches were the most abundant type of cockroach on ferries and cargo ships (9).

Relationship of sanitation with the presence of rats

Mice are capable of transmitting disease to humans by carrying disease seeds, fleas, fleas, bacteria and parasites. This animal from the Murides tribe is known as a source of several zoonotic diseases. Several types of diseases that are transmitted by rats include Pes/Plaque, Leptospirosis, Scub Typhus, Murine Thypus, Rat Bite Fever, Salmonellosis, Lymphatic Chorionmeningitis, Hantavirus Pulmonary Syndrome and Lassa Fever. These diseases are transmitted by rats in a variety of ways, starting from rat bites, rat urine, rat droppings, or those that are transmitted indirectly through other animals that contract the disease from rats or contaminated food/drink, water, or objects.

The results of this study indicate that out of 25 ships with good sanitary conditions, five ships (20%) found traces of rats. There were signs of the presence of rats on these five ships because, at the time of the measurement, these five ships had been docked at the port for more than three days due to engine repairs. This is in line with research which states that the residence time of a ship in port is closely related to the presence of vectors on board because in the buffer zone there are several potential rat breeding sites (14). Meanwhile, out of 13 ships with poor sanitary conditions, 13 ships (87%) had rats and two ships (13%) had no rats.

The results of the researchers' observations also revealed that the conditions of the rooms on the ship did not

meet the health requirements. The room that has the most risk factors for inviting rats is the kitchen that does not meet the requirements. Most of the ships studied had galleys, food rafting rooms, holds, and liquid waste that did not meet ship sanitation requirements which could potentially pose a risk to the presence of rats. This is in line with research (15) at the port of Banjarmasin which shows that kitchen sanitation has a very large indication of the presence of vectors with 5 out of 9 ships found and the results of the chi square test show that there is a relationship between kitchen sanitation and the presence of vectors and rodents (16).

The results of data analysis using the Chi Square test, obtained values X^2 count $> X^2$ table ($14,249 > 3,841$), and the Phi coefficient (Φ) is 0.649, meaning that there is a strong relationship between sanitary conditions and the presence of rats on passenger ships mooring at the Port of Kendari City. This research is (17) in line with research conducted by which states that there is a relationship between ship sanitation variables and the presence of rats on board by using the Chi square test showing a p value of 0.000 which is less than α : 0.05, it is stated that there is a relationship between ship sanitation and the presence of rats. There were 26 ships that had ship sanitation that met the requirements and there were no signs of the presence of rats or the presence of rats, while on ships that had ship sanitation that did not meet the requirements and there were no signs of the presence of rats or the presence of rats, there were 3 ships. There were 8 ships that had signs of the presence of rats and the presence of rats in the non-eligible category.

According to research which stated from the results of the fisher exact test obtained $\rho = 0.023$ ($\rho < \alpha$) which means that there is a significant relationship

between ship sanitation and signs of the presence of rats and the presence of rats on ships flagged by the Republic of Indonesia. This is shown by the presence of rats on ships with sanitation that do not meet the requirements of 43% and signs of the presence of rats on ships that meet the sanitation requirements of 4%, it can be seen that with sanitary conditions on ships that do not meet the requirements, the signs of the presence of rats are more tall. This study has the same results as previous research conducted by (18), this study has the results of a relationship between ship sanitation and the presence of rats on board the number of ships that meet the requirements is 25 ships with a proportion of 78% while ships with sanitation requirements do not meet the requirements 7 ships with 22% and signs of rats found are dirt, road marks, and signs of rat presence.

Supervision by the Port Health Office should be increased so that ship company owners pay more attention to and be responsible for their ships as a means of transporting goods and passengers that are free from risk factors for disease transmission. 2008.

The relationship between temperature and the existence of the cockroach vector

Sea transportation is still an alternative choice besides land and air transportation because it has several advantages, including greater carrying capacity and lower costs. As technology develops, ships as a means of sea transportation serve not only domestic but also foreign trips. This causes an increase in the frequency and number of trips between countries which causes an increase in the spread of diseases, especially quarantine diseases such as the plague, yellow fever and cholera. The

spread of these diseases can be done by maintaining the sanitary hygienic conditions of the ship so that the presence of vectors and disease-transmitting animals can be eliminated.

The results of this study indicate that of the 18 ships whose temperature conditions were effective there were 12 ships (67%) found traces of the presence of cockroaches. From the measurement results, cockroaches are most often found in the passenger's kitchen with a temperature range of 25°C-30°C. Likewise with other rooms, the density of cockroaches was also found in the dry food storage room and also the crew's kitchen room with a temperature range ranging from 25°C-30°C. In line with (19) which shows that cockroaches are also very often found at temperatures ranging from 23°C-30°C. Based on Republic of Indonesia Decree of the Minister of Health 1405 of 2002, it shows that some temperatures in the ship's room still do not meet the specified requirements. The source of air flow through the exhauster in several rooms did not function properly so that the room temperature values measured at the time of the study did not meet the requirements.

Based on the results of temperature measurements it was also known that the room for storing meat and fish was a room where cockroaches were not found at all. This room has a very low temperature, which ranges from -5°C to -10°C while in the vegetable storage room cockroaches are still often found in the low density category because the temperature in this room ranges from 10°C to 20°C. From these data it can be seen that cockroach behavior is affected by temperature. The study (20) stated that the death of *P. australasiae* cockroaches showed that a maximum of 50% of cockroach deaths were at 30°C, while there were only 10% of cockroach deaths at 21°C, 24°C and

27°C. The optimum temperature for cockroaches to live and breed is in the temperature range of 25°C-30°C, but cockroaches that are still nymphs are still able to survive in temperature conditions of 17.1°C.

Meanwhile, of the 22 ships with effective ship temperatures, there were three (3) ships (14%) that found cockroaches. The presence of food is also a factor in the presence of cockroaches in a room (21). This is evidenced by the data that cockroaches are more often found in the passenger's kitchen, which is a place for food processing, where of course there is a lot of food in the room. In addition, sanitation is also a factor in the presence of cockroaches (11). At the time of measurement cockroaches were more often found in places where food waste was piled up and also food baskets that were not arranged neatly. The existence of cockroaches indirectly has the potential to transmit disease through food to passengers and ship crew (21). Several pathogenic bacteria are found on the surface of cockroach bodies, namely *Klebsiella*, *Pseudomonas*, *E. Coli*, *Staphylococcus*, *Enterobacter*, *Streptococcus*, *Bacillus* and others, so that when cockroaches infest food or food ingredients it allows some of these bacteria to stick to food and can infect several diseases. in humans.

The results of data analysis using the Chi Square test, obtained values X^2 count $> X^2$ table ($9,724 > 3,841$), and the Phi coefficient (Φ) of 0.545 means that there is a moderate relationship between temperature and the presence of cockroaches on passenger ships that dock at the Port of Kendari City. This research is in line with research conducted by (13), which states that based on the results of statistical tests using the Spearman correlation coefficient test, it is obtained p value = 0.004 which is smaller than the

value $\alpha = 0.05$. So this shows that H_0 is rejected, which means there is a relationship between temperature and cockroach density in the kitchen and food storage room on passenger ships mooring at Semayang port, Balikpapan.

The results of this study indicate that of the 18 ships whose temperature conditions were effective, 13 ships (72%) found traces of rats. This illustrates that temperature conditions participate in increasing the rat population in ships. This was supported by the results of interviews between researchers and Port Health Office officers who stated that in every implementation of rat eradication or ship fumigation, rats were found in food storage warehouses.

Meanwhile, of the 22 ships whose ship temperature was not effective, five ships (23%) were found to have rats. This is due to the unfavorable behavior of the crew members, where there are still many crew members who do not care about environmental sanitation and lack of concern for the cleanliness of the ship's crew, especially places that can be a source of food and rat breeding grounds.

In addition to being caused by physical factors on board the ship, namely the room/compartment of the ship, the existence of disease vectors on board is also inseparable from the actions of the crew, as well as every ship that docks, rat shields are not installed on the ship's ropes, lighting in the room/compartment of the ship is often no flame. This can cause the breeding of vectors in the room or compartment of the ship which is a risk factor for the source and transmission of disease. Ship owner companies provide knowledge through counseling about the dangers of rats on ships, how to control them and personal hygiene in order to increase the awareness of ship crew. The captain of the ship should make sanctions

for the crew if they violate environmental sanitation.

The results of data analysis using the Chi Square test, obtained values X^2 count $> X^2$ table ($7,901 > 3.841$), and the Phi coefficient (Φ) of 0.495 means that there is a significant relationship between temperature and the presence of rats on passenger ships mooring at the Port of Kendari City. This research is in line with research conducted by (13), which stated that temperature is a contributing factor for signs of the presence of rats on board.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the factors related to the presence of cockroach and rat vectors on board ships at the port of Kendari City, that there is a relationship between sanitary conditions and the presence of cockroach vectors on passenger ships at the port of Kendari City. Likewise, there is a relationship between sanitary conditions and the presence of rat vectors on passenger ships at the Kendari city port. While temperature has a relationship with the presence of the cockroach vector on passenger ships at the port of Kendari city and there is a relationship between temperature and the presence of rat vectors on passenger ships at the port of Kendari city.

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