Prevalence of Trypanosomiasis in Wild Rats in Banyuwangi District

Zhaza Afililla¹, Setiawan Koesdarto², Hani Plumeriastuti³, Muhammad Yunus², Lucia Tri Suwanti²

¹Veterinary Profession Program, ²Department of Veterinary Parasitology, ³Department of Veterinary Pathology
Faculty of Veterinary Medicine, Universitas Airlangga
Corresponding author: zafililla@fkh.unair.ac.id

ABSTRACT

The aim of this research was to investigate the number of prevalence of Trypanosomiasis of wild rats in Banyuwangi District. Sixty wild rats were trapped from 4 sub-districts, Banyuwangi, Srono, Songgon, and Tegaldlimo in human residence, markets and rice fields from March until June 2017. Blood were taken after anaesthetized using ether. The examination of parasite used blood smear in Giemsa staining. The result show that just 1 of 60 blood sample was appear Trypanosoma sp., it means the prevalence of Trypanosomiasis of wild rats in Banyuwangi was 1.67%.

Keywords: Banyuwangi, prevalence, trypanosomiasis, trypanosoma, wild rats

Received: 11-02-2022   Revised: 18-04-2022   Accepted: 26-06-2022

INTRODUCTION

Trypanosomiasis is a disease which has important role in human and veterinary medicine. This disease caused by Trypanosoma sp., known as protozoan parasite which has flagella in their body (Dobigny et al., 2010).

In Thailand, Trypanosomes which have quite similar morphological parameters with T. lewisi-like were found from an infant with fever, cough, also anorexia (Sarataphan et al., 2007). As mentioned by Shegokar et al., (2006) in India

T. evansi was found for the first time in human around 2004. These cases possibly the effect of rodents and wild rats’ existence in human dwelling. As the population of wild rats has getting bigger nowadays, it mostly lives in close area with human. In some case wild rats become the first competitor of humans for food, mostly about the pre-harvest damage. This condition is true according to Meerburg (2009), has mentioned in Malaysia, the precentage of crop losses has reached 5%. The magnificent number of crop losses happened in Indonesia, it reached 17%.

The huge number of crop losses in both country has shown that rodents existence could be some kind of threat to human, in this case is about food.

In Indonesia, Trypanosomiasis mostly found in livestock, which infecting cattle. Any report about wild rats Trypanosomiasis in Indonesia is almost none until now (Sim and Wiwanitkit, 2015).

Study on prevalence of Trypanosomiasis in wild rats caused by T. lewisi has been done in many countries since mid-20th century, first was conducted in New Zealand, USA, and more infection has been reported from African and Asian countries, South America also have reports in Chile and Brazil (Linardi and Botelho, 2002).

According to Suwanti and Mufasirin (2014), in their research about wild rats Trypanosomiasis through 2011 until 2014, 7 out of 89 wild rats were infected Trypanosoma sp. in Surabaya.

Wild rat has become serious
problems which related to public health and rodent-borne diseases. Wild rats also have been acknowledged as a vector of some diseases, mainly zoonotic diseases. Wild rats have known as a host of more than 60 zoonotic diseases that becomes the top threat to human health as mentioned by Blasdell et al. (2015) in Meerburg et al., (2009).

Many rodents borne diseases that have ever been recorded in the world according to Nurisa and Ristiyanto (2005). There are 14 diseases that caused by protozoa. One of these 14 rodent borne diseases is Trypanosomiasis, which mostly happened in the tropical area of the world and possibly transmitted to human.

Banyuwangi District is one area that also has potential to conducted Trypanosomiasis detection in wild rats. Because Banyuwangi District is known as one of the endemic area of Trypanosomiasis in accordance with the research of Sawitri et al., (2015), which had been taking the isolate of Trypanosomiasis from some areas in Indonesia to represent the endemic area, including Banyuwangi. It has been decades since Trypanosomiasis or Surra had entered to Banyuwangi District.

Banyuwangi District has tropic condition which is relatable to the occurrence of Trypanosomiasis, mostly happen in tropical area. Viewing the terms of territory and epidemiological conditions, it has the potential to also become home to a Trypanosomiasis that attack wild rats. Based on literacy, many researches have been done about the prevalence of parasites in wild rats around the world. Taiwan, United States of America, until Malaysia, they have been doing this research for quite long time (Shafiyyah et al., 2012).

Therefore, since there has not been many research with this topic in Indonesia, especially in Banyuwangi District and according to the background above, the author has considered this research about Trypanosoma sp. infection of wild rats which has zoonotic effect to human needs to be done in Banyuwangi District.

**METHODS**

**Samples**

This research was Cross-Sectional survey. This research used 60 bloods of wild rats as research samples. Sampling regardless of sex, age, weight, and size of rats. Blood sample of wild rats were taken from different four Sub-Districts in Banyuwangi District, named Songgon, Srono, Tegaldlimo and Banyuwangi Sub-District. Microscopical examination was conducted at Laboratory of Parasitology Faculty of Veterinary Medicine Universitas Airlangga from March to June 2017.

**Preparation of blood collecting**

Blood collecting process were done after the wild rat have anaesthetized. The blood collected through cardiac puncture using 3 ml tuberculin syringe. Then the blood transferred to EDTA tube quickly before clotting.

**Preparation of blood smear**

To make blood smear through some steps. First step, blood drop to the object glass using pipette, in the one side or nearly at the edge of the first object glass. Another object glass is put in front of the dropped blood until it is wide spread in the second object glass. Positioning the object glasses form a ± 45°. The second object glass is pulled in front until formed a thin layer of blood.

**Preparation of blood staining**

Blood smear were fixated in methanol absolute 96%, for 3 minutes. Staining started after fixation by using
Giemsa stain 10% for 30 minutes in staining jar. Blood smear films are washed by flowing water or sterile aquades and dried.

**Microscopic examination**
Microscopic observation of peripheral blood smear was used a microscope with 1000 magnification with oil emersion and then captured with OptiLab®.

**Data analysis**
Data was analyzed with descriptive method based on the formula of prevalence.

**RESULTS AND DISCUSSION**
In this research were used 60 wild rat blood samples to know the prevalence of Trypanosomiasis in wild rats in Banyuwangi District. Wild rats were taken from human residence, rice fields, garden, or traditional markets, representing four sub-districts in Banyuwangi, such as Banyuwangi, Srono, Songgon, and Tegaldlimo, from March to June 2017. One of 60 blood samples was positive, the number of prevalence was 1.67% as seen in the Table 1 and Figure 1 below.

To make a clearer view of Trypanosoma sp. as captured in Figure 1, the morphology of trypanosome that was found in wild rat’s blood was described in a sketch like in Figure 2 below.

Based on the research result, only 1 sample positive from 60 blood samples that had taken from wild rats. The overall prevalence is 1.67%. The result was shown by the representative four sub-districts in Banyuwangi. It is lower from Surabaya, which had 7.9% according to Suwanti and Mufasirin (2014). They detected 89 wild rats in Surabaya started from 2011 until 2014.

In this research, choose 4 sub-districts shown the prevalence of Trypanosomiasis in wild rats which was 1.67%. That one positive sample was found in human residence area in Kalipait Village, Tegaldlimo Subdistrict. While in the other sub-districts were not found.

The number of prevalence shown that in different area or region, the result will be out differently. It shows that the prevalence of Trypanosomiasis of wild rats is not only affected by the species or individual factors, but also external factors such as vector development, habitat conditions, include temperature and humidity.

Linardi and Botelho (2002) have mentioned in their research that rats showed higher prevalences of Trypanosomiasis infection in rainy season which commonly occur in October to March, than in dry season during April to September. Thus, the prevalence of this research showing low prevalence because the wild rats were 31 collected in March to June. The climate condition also affected the flea development, Xenopsilla cheopis which transmitted the disease to wild rats. The results of this survey according to Jittapalapong et al. (2009), established that habitats significantly affect the prevalence of Trypanosoma sp.

The prediction of Trypanosoma species was Trypanosoma lewisi. According to the morphology appearance in Desquesnes et al. (2002), T. lewisi has long thin posterior end with sub-terminal ovale kinetoplast, nucleus was located in the anterior part of the body with free flagellum. The trypanosome that was found has large body, it might be present in intermediate form with migration of the kinetoplas and granular body. This result depends on the incubation period.

The trypanosome was only one single trypanosome in the figure. As mentioned by Desquesnes (2013), based on the development condition and the
Table 1. Number of Prevalence of Trypanosomiasis of Wild Rats in Banyuwangi District

| Result      | Number of Samples | Percentage (%) |
|-------------|-------------------|----------------|
| Positive    | 1                 | 1.67           |
| Negative    | 59                | 98.33          |
| Total of Sample | 60            | 100            |

Figure 1. Trypanosoma sp. that was found in wild rats blood with 1000x magnification used Giemsa staining.

Figure 2. The sketch of Trypanosoma sp. morphology that were found in wild rat’s blood.

host immunity. According to the result, which T. lewisi was predicted in Tegaldlimo Sub- district, it is potentially become the source infection in human. Because the positive sample was found in human residence area. Infection in human happened in several countries.

Studies have been done in several Asia countries about Human Trypansomiasis. In Thailand, Sarataphan et al. (2007) mentioned that T. lewisi-like were found from an infant, same thing also happened in India in 2004, according to Shegokar et al., (2006)

T. evansi was found for the first time in human. In 2010 also found T. lewisi infection in a 37-days old infant in India (Verma et al., 2011). Truc et al. (2013) also mentioned, that Trypanosomiasis in human has occurred at Malaysia in 1933, Sri Lanka
in 1999, and mentioned that most of the records were come from India.

Study about the infection of Trypanosomiasis of wild rats has not been done oftenly in Indonesia and it was the first time to be done in Banyuwangi District. This should become a warning that the infection of Trypanosomiasis in wild rats has a potential to infect human.

CONCLUSION

It could be concluded that the number of prevalence of Trypanosomiasis in Banyuwangi District was 1.67%. T. lewisi predicted as the species of Trypanosoma sp. that was found. Trypanosoma sp. might still potential to cause outbreak, especially in cattle because Banyuwangi District is known as the endemic area of Trypanosomiasis or Surra in cattle. It also possible to infect human since it was found in human residence area.

REFERENCES

Abenga, J.N. 2014. A Comparative Pathology of Trypanosoma brucei Infections. Global Advanced Research Journals. Benue State. 3: 390-399.

Akande, O.A. 2008. A Study on Wild Rat Behaviour and Control on A Pig Farm. Faculty of Veterinary Medicine and Animal Science. Sweden.

Alias, S.N., N. Sahimin, M.A. Edah and S.N. Mohd-Zaid. 2014. Epidemiology of Blood Parasitic Infections in the Urban Rat Population in Peninsular Malaysia. Tropical Biomedicine. 31(2): 230-240.

Bargul, J.L., J. Jung, F.A. McDimba, C.O. Omogo, V.O. Adung’a, T.Krüger, D.K. Masiga and M. Engstier. 2016. Species-Specific Adaptations of Trypanosome Morphology and Motility to the Mammalian Host. PLoS Pathog.

Begon, M. 2003. Health Effects on Human Population Effects on Rodents. Journal Wild Animal Science. 10: 13-19.

Birhanu, H., R. Fikru, M. Said, W. Kidane, T. Gebrehiwot, A. Hagos, T. Alemu, T. Dawit, D. Berkvens, B. M. Goddeiris and P. Büscher. 2015. Epidemiology of Trypanosoma evansi and Trypanosoma vivax in Domestic Animals from Selected Districts of Tigray and Afar Regions, Northern Ethiopia. BioMed Central. 8: 212.

Blasdell, K., F. Bordes, K. Chaisiri, Y. Chaval, J. Claude, J.F. Cosson, A. Latinne, J. Michaux, S. Morand, M. Pages and A. Tran. 2015. Progress on Research on Rodents and Rodent-borne Zoonoses in South-east Asia. Journal Compilation CSIRO. 42: 98-107.

Deschamps, J.Y., M. Desquesnes, L. Dorso, S. Ravel, G. Bossard, M. Charbonneau, A. Garand and F.A. Roux. 2016. Refractory Hypoglycaemia in A Dong Infected with Trypanosoma congolense. Parasite Journal. 23(1).

Desquesnes, M. and M.L. Dia. 2003. Mechanical Transmission of Trypanosoma congolense in Cattle by the African Tabanid Atylotus agrestis. Experimental Parasitology Journal. 2003(105): 226-231.

Desquesnes, M., P. Holzmuller, D.H. Lai, A. Dargantes, Z.R. Lun and S. Jittapalapong. 2013. Trypanosoma evansi and Surra: A Review and Perspective on Origin, History, Distribution, Taxonomy, Morphology, Hosts, and Pathogenic Effects. BioMed Research International. 2013: 1-22.
evansi and Surra: A Review and Perspective on Transmission, Epidemiology, and Control, Impact, and Zoonotic Aspects. BioMed Research International. 2013: 1-20.

Desquesnes, M., Yangtara, S., Kunphukhieo, P., Jittapalapong, S. and Herder, S. 2016. Zoonotic Trypanosomes in South East Asia: Attempts to Control Trypanosoma lewisi Using Human and Animal Trypanocidal Drugs. Experimental Parasitology Journal 165(2016): 35-42.

Dobigny, G., P. Poirier, K. Hima, O. Cabaret, P. Gauthier, C. Tatard, J.M. Costa and S. Bretagne. 2010. Molecular Survey of Rodent-Borne Trypanosoma in Niger with Special Emphasis on T. lewisi Imported by Invasive Black Rats. Acta Tropica Journal. 2011(117): 183-188.

Franco, J.R., P.P. Simarro, A. Diarra and J.G. Jannin. 2014. Epidemiology of Human African Trypanosomiasis. Journal Clinical Epidemiology. 2014(6): 257-275.

Himsworth, C.G., Jardine, C.M., Parsons, K.L., Feng, A.Y.T. and Patrick D.M. 2014. The Characteristics of Wild Rat (Rattus spp.) Populations from an Inner-City Neighborhood with a Focus on Factors Critical to the Understanding of Rat-Associated Zoonoses.

Huchon, D., O. Malsen, M.J.J.B. Sibbald, K. Ament, M. Stanhope, F. Catzeflis, W.W. de Jong and E.J.P. Douzery. 2002. Rodent Phylogeny and a Timescale for the Evolution of Glires: Evidence from an Extensive Taxon Sampling Using Three Nuclear Genes. Molecular Biology and Evolution. 19(7): 1053-1065.

Jackson, A.P., S. Goyard, D. Xia, B.J. Foth, M. Sanders, J.M. Wastling, P. Minoprio and M. Berriman. 2015. Global Gene Expression Profiling Through the Complete Life Cycle of Trypanosoma vivax. PLOA Negl Trop Dis.

Jittapalapong, S., V. Herbreteau, J.P. Hugof, P. Arreseisrom, A. Karmchanabanthoeng, W. Rerkamnuaychoke and S. Morand. 2009. Relationship of Parasites and Pathogens Diversity to Rodents in Thailand. Kasetrat Journal of Natural Science. 43: 106-117.

Keita, M., B. Bouteille, B. Enanga, J.M. Vallat and M. Dumas. 1997. Trypanosoma brucei brucei: A Long-Term Model of Human African Trypanosomiasis in Mice, Meningo-Encephalitis, Astrocytosis, and Neurological Disorders. Experimental Parasitology Journal. 1997(85): 183-192.

Kennedy, P.G.E. 2012. Clinical Features, Diagnosis, and Treatment of Human Trypanosomiasis (Sleeping Sickness). University of Glasgow.

Kuepfer, I., E.P. Hhary, M. Allan, A. Edielu, C. Burri and J.A. Blum. 2011. Clinical Presentation of T. b. rhodesiense Sleeping Sickness in Second Stage Patients from Tanzania and Uganda. Journal PLoS Neglected Tropical Disease. 5(3): 1-9

Langousis, G. and K.L. Hill. 2014. Motility and More: The Flagellum of Trypanosoma brucei. Microbiology Nature Reviews. 12(2014): 505-518.

Lun, Z.R., Y.Z. Wen, P. Uzureau, L. Lecordier, H. Lai, Y.G. Lan, M. Desquesnes, G.Q. Geng, T.B. Yang, W.L. Zhou, J.G. Jannin, P.P. Simarro, P. Truc, P. Vincendeau and E. Pays. 2015. Resistance to Normal Human Serum Reveals Trypanosoma lewisi as An Underestimated Human Pathogen.
Journal Molecular & Biochem Parasitology. 199(2015): 58-61.

Meerburg, B.G., G.R. Singleton and A. Kijlstra. 2009. Rodent-borne Diseases and Their Risk for Public Health. Critical Reviews in Microbiology. 35(3): 221-270.

Mostert, M.E. 2009. Molecular and Morphological Assessment of Invasive, Inland Rattus (Rodentia: Muridae) Congenerics in South Africa and Their Reservoir Host Potential with Respect to Helicobacter and Bartonella [Dissertation]. Faculty of Natural and Agricultural Sciences. University of Pretoria.

Murakami, O. 1992. Tikus Sawah. Laporan Akhir Kerjasama Indonesia-Jepang Bidang Perlindungan Tanaman Pangan. Direktorat Bina Perlindungan Tanaman. Jakarta. 97.

Musser, G.G. and Carleton, M.D. 2005. Family Muridae. In: Mammal Species of the World. The John Hopkins University Press. Baltimore. 894-1531.

Nantulya, V.M. 1990. Trypanosomiasis in Domestic Animals: the Problems of Diagnosis. Reviews Science Technology Office International Epizootic. 9(2): 357-367.

Nguyen V.V.C., Le Buu Chau, M. Desquesnes, S. Herder, P.H.L. Nguyen, J.I. Campbell, V.C. Nguyen, B. Yimming, P. Chalermwong, S. Jittapalapong, J.R. Franco, T.T. Ngo, M.A. Rabaa, J. Carrique-Mas, P.T.T. Tam, T.V.T. Nga, A. Berto, T.H. Ngo, V.M.H. Nguyen, C.T. Nguyen, K.C. Nguyen, B. Wills, T.H. Tran, G.E. Thwaites, S. Yacoub and S. Baker. 2016. A Clinical and Epidemiological Investigation of the First Reported Human Infection with the Zoonotic Parasite Trypanosoma evansi in Southeast Asia. 1-7

Nurisa, I. and Ristiyanto. 2005. Penyakit Bersumber Rodensia (Tikus dan Mencit) di Indonesia. Jurnal Ekologi Kesehatan. 4(3): 308-319.

Office of the International Epizootic (OIE). 2013. Trypanosoma evansi Infection (Including Surra). 1-2.

Osorio, A.L.A.R., C.R. Madruga, M. Desquesnes, C.O. Soares, L.R.R. Ribeiro and S.C.G. Da Costa. 2008. Trypanosoma (Duttonella) vivax: Its Biology, Epidemiology, Pathogenesis, and Introduction in the World - A Review. Memorias Inst Oswaldo Cruz. 103(1): 1-13.

Peacock, L., S. Cook, V. Ferris, M. Bailey and W. Gibson. 2012. The Life Cycle of Trypanosoma (Nannomonas) congolense in the Tsetse Fly. 2012(5): 1-13.

Pemerintah Daerah Kabupaten Banyuwangi. 2014. Banyuwangi dalam Angka.

Pollitt, L.C., P. MacGregor, K. Matthews and S. Reece. 2011. Malaria and Trypanosome Transmission: Different Parasite Same Rules. 27(5): 197-203.

Pumhom, P., D. Pognon, S. Yangtara, N. Thaprathorn, C. Milocco, B. Douangboupha, S. Herder, Y. Chaval, S. Morand, S. Jittapalapong and M. Desquesnes. 2013. Molecular Prevalence of Trypanosoma spp. in Wild Rodents of Southeast Asia: Influence of Human Settlement Habitat. Epidemiology Infection. 142(2014): 1221-1230.

Rayat, C.S and Vasishta R.K. 2014. Wild Rats as Reservoir of Trypanosoma lewisi in Northwest India. Austin Journal Pathology & Laboratory Medicine. 1(2): 1-3.

Sarataphan, N., M. Vongpakorn, B. Nuansrichay, N. Autarkool, T. Keowkarnkiah, P. Rodtian, R.W. Stich and S. Jittapalapong. 2007. Diagnosis of a Trypanosoma lewisi-
like (Hepertosoma) Infection in A Sick Infant from Thailand. Journal of Medical Microbiology. 56(2007): 1118-1121.

Sawitri, D.H., A.H. Wardhana, H. Wibowo, M. Sadikin, F. Ekawasti. 2015. Molecular Identification Technique of Trypanosoma evansi by Multiplex Polymerase Chain Reaction. Indonesian Journal of Animal and Veterinary Sciences. 20(4): 297-307.

Schwarz, E. 1960. Classification, Origin, and Distribution of Commensal Rats. US Armed Forces Institute of Pathology. Washington DC. USA. 411-416.

Sharp, P.E. and LaRegina, M.C. 1998. The Laboratory Rat. CRC Press. Washington University School of Medicine. 109.

Shegokar, V.R., R.M. Powar, P.P. Joshi, A. Bhargava, V.S. Dani, R. Katti, V.R. Zare, V.D. Khanande, J. Jannin and P. Truc. 2006. Short Report: Human Trypanosomiasis Caused by Trypanosoma evansi in A Village in India: Preliminary Serologic Survey of The Local Population. American Journal Tropical Medicine and Hygiene. 75(5): 869-870.

Sim, S.T., V. Wiwanitkit. 2015. Emerging Human Trypanosomiasis in Southeast Asia: A Coming New Threat. Journal of Nature and Science. 1(1): 1-2.

Siti Shafiyah, C.O., I. Jamaiah, M. Rohela, Y.L. Lau and F. Siti Aminah. 2012. Prevalence of Intestinal and Blood Parasites among Wild Rats in Kuala Lumpur, Malaysia. Tropical Biomedicine. 29(4): 544-550.

Suwanti, L.T. and Mufasirin. 2014. Proceeding International Seminar and Workshop Biting Flies as Vector Trypanosomiasis and the Role of One Health in Animal Health. Yogyakarta: Indonesia.

Tamarit, A., M.T. Tejedor-Junco, M. Gonzales, J. Alberola and C. Gutierrez. 2011. Morphological and Biometrical Features of Trypanosoma evansi isolates from an outbreak mainland Spain. Veterinary Parasitology. 177(2011) 152-156.

Tang, H.J., Y.G. Lan, Y.Z. Wen, X.C. Zhang, M. Desquesnes, T.B. Yang, G. Hide and Z.R. Lun. 2012. Detection of Trypanosoma lewisi from Wild Rats in Southern China and Its Genetic Diversity Based on the ITS1 and ITS2 Sequences. Journal Infection, Genetics and Evolution. 12(2012): 1046-1051.

Tranggono, M. 1988. A High Prevalence of Malignant Catarrhal Fever in Banyuwangi, East Java. Australian Centre for International Agricultural Research. 52.

Trindade, S., F.R. Ferreira, T. Carvalho, S. Dias, T.K. Smith and L.M. Figueiredo. 2016. Trypanosoma brucei Parasites Occupy and Functionally Adapt to the Adipose Tissue in Mice. Cell Host and Microbe. 19: 837-848.

Truc, P., P. Buscher, G. Cuny, M.I. Gonzatti, J. Jannin, P. Joshi, P. Juyal, Z.R. Lun, R. Mattioli, E. Pays, P.P. Simarro, M. Maria, G. Teixeira, L. Touratier, P. Vincendeau and M. Desquesnes. 2013. Human Infection by Animal Trypansomes. PLOS Neglected Tropical Diseases.
Lejon, S. Deborggraeve, U.V.S. Rana, J. Puliyl. 2011. Case Report: Trypanosoma lewisi or T. lewisi-like infection in a 37- Day- Old India Infant. American Journal of Tropical Medicine and Hygiene. 85(2): 221-224.

World Organization Health. 2012. African Trypanosomiasis (Sleeping Sickness). 259.