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WHITE TAILED JUNGLE RAT MORPHOLOGICAL DIVERSITY STUDY (*Maxomys sp.*) OF NORTH SULAWESI ACCORDING FROM THE TAIL MORPHOLOGICAL CHARACTERISTICS

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Abstract

Tail characteristics of the White-Tailed Jungle Rat (*Maxomys sp.*) of North Sulawesi have been examined by us to reveal the population diversity. Usually, examining population diversity or species uses numerous morphological features as markers for variation. However, in this study, we are only using one morphological feature, which is the characteristic of the tail from the samples. Several experts have used tail characteristics as the sole identifier for species identifications. On another account, diversity studies using various white-tailed jungle rats are also being performed, and the result of the said study can be compared with the result of the study in which only a single feature is the tail characteristics of the white-tailed jungle rat. The characteristics of white-tailed jungle rats that were examined include total length, the total length of the white section and the present/lack of fine hairs on the tip. The number of samples is 35. The samples are obtained from the jungles of North Sulawesi, which are The District of Minahasa, North Minahasa, South Minahasa, and Southeast Minahasa. The results of morphological observation of the white-tailed jungle rat were analyzed using mutual cluster analysis, statistics program, SPSS IBM, 26. The analysis results from a dendrogram showed two main clusters: the first with the numbers 9, 19 and 12 and the second with the remaining sample numbers. On the second cluster, there are two more formed sub-cluster. The results of this study are nearly identical to the study results that use various morphological diversities. This study recommends that the tail characteristics of a white-tailed rat can represent the diversity of white-tailed rats.

Keywords: *Tail morphological characteristics, white tailed rat, North Sulawesi*

INTRODUCTION

White-tailed rat (*Maxomys sp.*) is one of the rat species present in Indonesia that is only available in North Sulawesi, which makes this animal an endemic species of Sulawesi. The species of said rat has different morphological traits from the sheer size and fur coloration but has the same main character, which is the tip of the white-tailed coloration. The natural enemy of this particular rat are snakes, eagles, and owls. However, the white-tailed rats' main threat is hunting for consumption and trade (Saroyo *et al.*, 2013). White-tailed rats in the jungle naturally have an essential role in the ecosystem. The reproduction cycle of

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this rat is moderately quick because it can breed nine pups in an average pregnancy period. (Wahyuni, 2005). However, even though the breeding of rats is relatively fast, if the white-tailed rats are constantly being hunted for consumption, then some or even the whole species can go extinct, interrupting the ecosystem's stability. On the other hand, the need for white-tailed rat meat for the people of Minahasa from day to day never drought; because of that, the effort for genetic resource conservation attempt (plasma nutfah) will be more directed and succeed if the characteristic and population diversity have been known for sure. Morphological diversity study for the population for the kind of white-tailed rats up until now is still limited, so there are urgencies for researchers and study deeply to obtain complete information, so it can be used in an attempt to assemble the captivity programs in a manner in *situ* or *ex-situ.*

Reviewed from the perspective of the Minahasan tribe, habits that like to consume jungle rat meat will cause the need for meat to increase constantly, even though the availability of white rat meat is obtained via hunting in the jungle. Because of that, the only way to conduct ex-situ captivity is for the needs to stay available and the resources still preserved.

White-tailed rat diversity study and analysis of rats' meat have been done. Morphological diversity and genetics have been checked, and from the genetic perspective, white-tailed jungle rats are diverse, for example, microsatellite-based (Kawahe et al., 2019) and RAPD (Mege et al., 2020). From the morphological perspective, generally is also examined by Achmadi A. S. (2010; 2013). From various examinations, it is revealed the fact that several variants or species define white-tailed jungle rats (*Maxomys sp.*) in North Sulawesi.

Morphological-based examination of white-tailed jungle rats has been performed. However, the effort requires a relatively long time, a relatively expensive cost, and a more complex method of analysis, which seems less practical. An alternative solution to examine the diversity of white-tailed jungle rats is through a more compact definer based on the tail's morphological characteristics. The white-tailed jungle rats' morphological characteristic only consists of a few features, such as total tail length, shear plane on the base of the tail, length of white coloration on the tail, and the present/lack of fine white hair on the tip of the tail. Said morphological characteristics are the parametric characteristics, and there is also a non-parametric characteristic which is the shape of the shear spanding plane on the base of the tail. The present/lack of a fine whitetail on the tip of the tail, because of the compactness of the distinction used, then the procedure of analyzing diversity will be cheaper, more effective and more efficient.

RESEARCH METHODS

The methods used for this research are observation of captured jungle rats, morphological characteristics of white-tailed jungle rats including total tail length, shear plane on the base of the tail, length of white coloration on the tail, the present/lack of fine white hair on the tip of the tail. The observed observation/measurement data will be analyzed to find the grouping of the result observation objects.

The sample of white-tailed rats is 35 samples, and samples are obtained from the jungles in the area of North Sulawesi, which is The District of Minahasa, North Minahasa, South Minahasa, and Southeast

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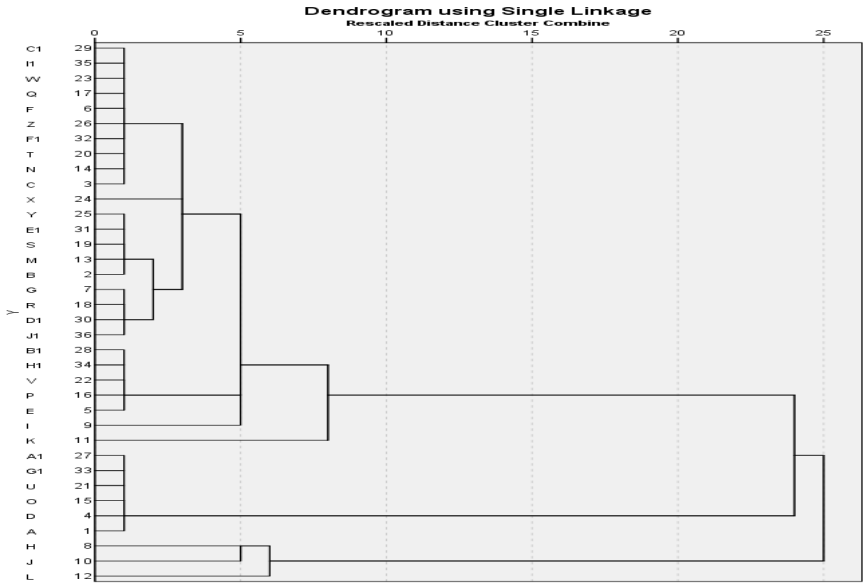
Minahasa. The results of morphological observation of the white-tailed jungle rat were analyzed using mutual cluster analysis, statistics program, SPSS IBM, 26.

RESULTS AND DISCUSSION

The dendogram which is the result of cluster analysis (Picture 1), represents that is formed clusters from the member of the samples.



Picture 1. Morphological dendrogram of white tailed jungle rats. The number 1 to 35 are the sample sizes.

The result of the analysis of the two main clusters is the cluster with the sample numbers 9, 10 and 12, and the remaining cluster samples are the second cluster. The second cluster is divided again into two sub-categories with the sample numbers 27, 33, 21, 15, 4 and q, and the next sub-cluster with the remaining sample numbers. Further exploration obtained the fact that the classification of sample members is caused by the presence/lack of hair on the tip of the tail, and the other group was marked with fine hair present on the tip of the tail, like in Picture 2.

a b

Picture 2. White fine hair on the tip of the tail, a. has fine hair, and b. bare

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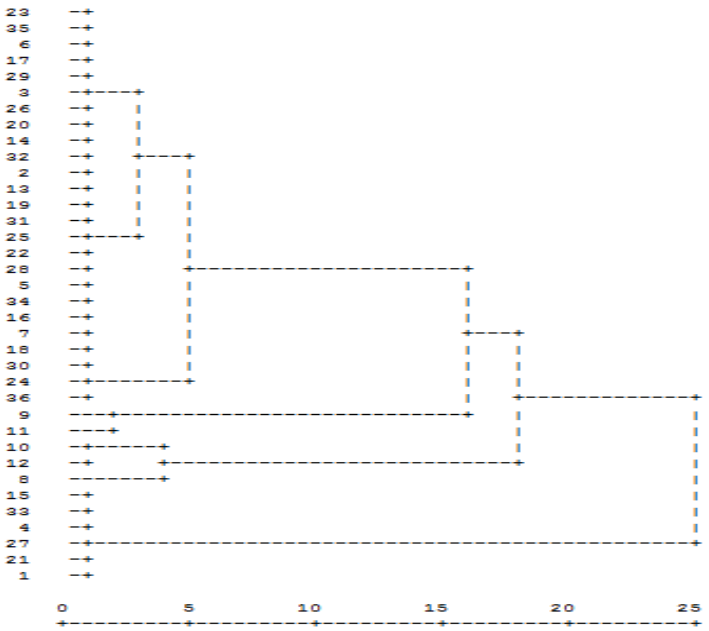
This result is also strengthened by the characteristic comparison data between the length of the white parts of the tail of each sample (Picture 3). Suppose the result of this analysis is compared with the dendrogram that uses ten morphological features (Picture 4). In that case, the classification of sample members is nearly identical, mainly because of the tail traits, because in picture 4, sample numbers 1,4,15,21,27 and 33 were defined by the lack of fine white hair at the tip of the tail. The result of this study shows that only using a single morphological feature of the white-tailed jungle rats can ease the identification of diversity. With that said, it is recommended that identifying white-tailed jungle rats can be eased by using only the tail's morphological characteristics.

Picture 3. Comparison of white coloration on the tail



Picture 4. The dendrogram of analysis result using 10 morphological traits.

(Sourcer: Decky D. W. Kamagi, Penelitian PNBP, Unima 2019, not published)

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Discussion

White-tailed jungle rats (*Maxomys sp.*), spiked white-tailed rats, live in tropical rainforests and can be found in Indonesia, especially in Sulawesi. The genome Maxomys is initially classified as a subgenus of Rattus. However, Musser *et al.* (1979) this rat is classified in its genome and inserted in the family of Muridae and sub-family Murinae like Rattus. The result of this study recommends that the classification of the Maxomys genome in Sulawesi must be reevaluated because there is a significant difference between the two variants that is supposedly a new or less known as a new subspecies.

About the linkage with the structure of white-tailed jungle rats' tail tips, now it is more apparent that the samples were collected from the two groups, which are the one with fine hair on the tip of the tail and the one with none. The presence/lack of hair on the tip of the tail of the samples is backed by another characteristic, such as total tail length and the length of the tail parts with white coloration. Two contrasts in the morphological characteristics were observed: the group with a long tail but shorter white coloration on the tip of the tail. The two groups are classified with various regional names regarding contrasting morphological characteristics. The sample group with more significant weight but with shorter tails and the tip of the tail without fine white hair is named tungkara/tangkara, and the sample group with lesser weight but with longer tails and fine white hair is named turean/putian. Suppose the two groups are coming from two different variants or species. In that case, the white-tailed jungle rats in Sulawesi species are not only Maxomys Helwandiim; further study has been needed to clarify the facts.

Now the genome Maxomys is still not stable, and because of that, several studies have been performed to clarify the taxonomical status of this genome (Ruedas & Kirsch, 1997; Corbet & Hill, 1992; Musser & Carleton, 2005). The results of this study will clarify the taxonomical status of white-tailed jungle rats in Sulawesi, especially regarding the characteristic morphometric study, even though there is a need for further study regarding geography, ecology, altitude, and the support of molecular examination.

CONCLUSION

Two big groups have been suspected to be from two different variants of white-tailed jungle rats or different species. The present/lack of fine white hair on the tip of the tail mainly causes the classification of sample members. So, this research makes it easier to identify the types of rats.

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