Endemic species: Morphometric differences between male and female of black-winged myna (*Acridotheres melanopterus*)

R E Vernia¹, R Lestari¹, A Abinawanto¹, N Winarni², A Sedayu³ and A Bowolaksono¹,*

¹ Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, 16424 Depok, West Java, Indonesia  
² Research Center for Climate Change, Universitas Indonesia, Depok, West Java, Indonesia  
³ Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta, Jalan Rawamangun Muka No. 1, 13220 East Jakarta, Indonesia

*alaksono@sci.ui.ac.id

Abstract. Black-winged myna (*Acridotheres melanopterus*) is an endemic species from Indonesia, which has no difference between male and female based on their morphological characteristic. It can be a problem for the breeders to identify the sex when they have to pair the bird. The aim of this research is to identify the differences between male and female black-winged myna based on morphometric characteristic. There are weight, length, width, circumference, and the spread of the wings. The data is processed using principal component analysis (PCA) on the SPSS 20 program. The samples are 71 black-winged myna with minimum two years of age from breeding facilities in Java and Bali islands. Based on the research, morphometric characteristic that distinguishes male and female bird mostly is their wingspan and their weight. Morphometric characteristics of the female myna are smaller than the male. This result is essential for breeders to minimize the risk of pairing the same sex bird.

1. Introduction

Black-winged myna (*Acridotheres melanopterus*) is a bird species endemic to Indonesia, it can be found only in Java and Bali islands [1]. The Indonesian government has designated black-winged myna as protected animal, this bird is included in the list of protected rare bird by Indonesian government through Law Number 5, 1990 related to Conservation of Biological Resource and Ecosystem, as well as Government Regulation Number 7, 1999 related to Utilization of Wild Plant and Animal. Animal trading in Indonesia (including birds) has been going on for a long time and there are even animal markets that specifically only sell various types of birds, included black-winged myna. Many rare birds are still traded in the animal market [2]. The status of this bird is critically endangered according to the International Union of Conservation for Nature (IUCN) since 2010 until now. Black-winged myna can still be legally traded as long as they are coming from legal breeding facility [3].

Morphologically, the male and female black-winged myna are totally the same [4]. DNA sexing method can be used to determine the sex of the bird, but it is expensive and not many people familiar about it. If the breeder does not know about the sex of the bird, the pairing process becomes more challenging. When the same sex bird is being paired, the risk for them to fight is higher. It can ruin the
pairing process or even make the birds wounded from the fight [5]. Sex of black-winged myna is also known to be essential when the age is reaching productive phase. The breeding facility is required to make sure that conservation program through breeding is being carried out effectively and efficiently. It is important because the breeding center is necessary to breed birds in the right way in releasing healthy and standardized black-winged myna. In the previous study, black-winged myna has been differ by morphological characteristic with its relative [6]. It is also known that PCA methods or morphometric data can be used to distinguish hybrid black-winged myna and its pure juvenile [7], but has not been tested to differ the mature, as it is male or female. Determination of bird sex by morphometric method has already been done by several different species, such as *Buteo jamaicensis calurus* (Red-tailed Hawks) and *Pygoscelis papua ellsworthi* (Gentoo Penguins) [8,9].

Research into morphometric characteristic of black-winged myna is important as a basis for distinguishing the sex without DNA sexing method. According to IUCN, this research is conducted to avoid black-winged myna from extinction. The study aims to understand differences between male and female black-winged myna (*Acridotheres melanopterus*) in terms of morphometric characteristics. The information about black-winged myna’s morphometric characteristics being the result of this research can be used as reference to distinguish the sex of the bird and prevent unsuccessful breeding at captivity.

2. Materials and methods

2.1. Location

The research was carried out at some captive breeding facilities scattered in Java and Bali, Indonesia. It was conducted from July to August 2018. One captive is located in West Java Province, three in Central Java Province and one in Bali. The captive breeding facility in West Java Province is located at Sukabumi City. The captive breeding facilities in Central Java Province as located at Klaten City, and one in island of Bali, which is located at Tabanan Area. All of these captive breeding facilities are the breeding of black-winged myna. Some of them are breeding bird for the legal trade and fulfilling the animal market demand, and some of them are made for the conservation effort of the bird. The research will be carried out from July to August 2018.

2.2. Procedure

![Figure 1. Black-winged myna morphometric observation.](image)
The morphometric identification of black-winged myna will be carried out with the birds in hand. The birds are adults with a minimum age of 2 years. The morphometric observations that will be carried out are measuring body length (cm), body width (cm), body circumference (cm), wingspan (cm) and body weight (g) of each black-winged myna (Figure 1). Photographs of specific sections from the black-winged myna will be taken to help the identification of the morphology. These specific parts are the head, upper body, chest, wing cover, right and left side of the body and tail are performed as visual data, which will then be analyzed to determine the morphological characteristics of black-winged myna.

For the observation process, the tools and materials are had to be prepared before making it. Next step, the bird identity is written. After that, the birds are being captured and put it in a cloth bags that have been prepared, weighing it on a hanging scale. Next, the bird is removed from the cloth bags and someone need to hold it carefully (must be done by experienced people). With the bird in hand, morphometric measurements are being performed on all parts needed. The data from the observation should be recorded on the observation sheet. After the morphometric measurement is done, the photos for morphology analysis should be taken immediately.

2.3. Data analysis
SPSS V.20 analyzed the collected data with Principal Component Analysis (PCA) method. The method was used to define which factor is the most distinctive between all the factors recorded. PCA can reduce the number of the factors into fewer component based on the correlation between the factors, it can show which factor is the most distinctive between the variable. The first step is to see how many components are created from the factors reduction. The SPSS will analyze the data and produce a scree plot to shows the components based on the eigenvalue of each factors. In the end, a scatter dot graph was made based on the component data. Analyzing the result of the SPSS analysis will lead the research to the conclusion.

3. Results and discussion
3.1. Results
This research is using 71 adult black-winged mynas as the sample. From more than a hundred bird, these 71 bird each are two years old or older. The bird should be at least two years old to ensure that the bird is already pass the juvenile phase. Based on the PCA analysis, there are two components that being extracted from the data. These two components are having Eigenvalue score greater than one. It can be seen on the screen plot graph (Figure 2).

![Figure 2. Scree plot of PCA analysis.](image-url)
From the two component, we can see that there is one factor that is the most distinctive. The factor with the score below 0.4 is considered to not having a big impact. The wingspan is the factor with biggest score in the component one, the weight is the biggest factor in component two. Based on this, weight and wingspan can be considered as the most distinctive characteristics that differ the male and the female. The detail of the PCA extraction result can be seen on Table 1.

| Factors       | Component 1 | Component 2 |
|---------------|-------------|--------------|
| Weight        | 0.027       | 0.774        |
| Length        | 0.738       | 0.197        |
| Width         | 0.615       | 0.328        |
| Circumference | 0.111       | 0.636        |
| Wingspan      | 0.872       | -0.216       |
| Eigenvalue    | 1.800       | 1.093        |
| Variance %    | 33.920      | 23.933       |
| Cumulative %  | 33.920      | 57.853       |

The variance from both component is quite small, but it is still good because the cumulative becomes higher and good enough to represent the group. Each component is consisting all of the factors but with different level of distinctive rate. The value of each factor is showing how much it is affecting the component. In the component 1, wingspan is the factor with highest value which means it is the factor that affecting the component the most. In the component 2, weight is the factor with highest value. A scatter dot graph is made from the analysis to show the differences of the male and female black-winged myna based on the morphometric factors (Figure 3).

Based on the scatter dot graph on figure 4, the male birds are tending to be scattered on the right and the top side of the graph. For the female, they are scattered more to the left and bellow of the graph line. It is showing than most of the male black-winged mynas are bigger especially in term of wingspan and the weight than the female. The graph is quite clear because the group of female and male is separated clearly based on their morphometric characteristics data.

![Figure 3](image-url)
3.2. Discussion
Black-winged myna is an endemic species from Indonesia that threatened by human since the 1990. The fame of the bird is raising because of the sound, it is capable to sing a lot of different pattern of songs that captivated human interest [10]. Some conservation efforts are performed to help the species from the extinction. Building a captive population to help the wild population is one of the effort. But it is a bit complicated when the breeders doing the pairing process. It is because morphologically, the male and female black-winged myna are not having any differences. Morphometric method by PCA is one of reliable method, which can be easily used for breeders. Morphometric analysis also has minimum error when it is used for characterizing same bird species, because male and female mynas have similar features such as wings colour, chest, back, sides of the body, and head shape [6,11].

DNA sexing is one of another method that can be used to identify the sex of black-winged myna. The problem is occurring when not all the breeders are understood about genetics or cannot afford the fee to perform the DNA sexing. When the breeders did not know about the sex of the bird, the successful rate of the pairing process is low. There is higher risk for the birds to fight instead of pairing because they are maybe having a same sex. Bird identified using pooled DNA is also not recommended to be used as sex identification method because it will not reflect each of individual samples [12].

Based on the result of the research, morphometric characteristics can be used to at least minimizing failure rate of the pairing process. The female is slightly smaller than the male, especially the wingspan and the weight. This information is an important data that can be used to differentiating the male and female of black-winged myna. Practically, the breeders can perform morphometric observation for an additional information that help the pairing process.

4. Conclusions
The breeders especially form a private captive breeding facility is needed a simple way to help them differ the male and female of black-winged myna. The result of this research is showing that morphometric characteristics can be used to differentiating between the male and female of the black-winged myna. Even that the different is not big, it is still can be used as an additional information. Furthermore, more deep and comprehensive research is needed to discover more ways to help the conservation effort of the black-winged myna.

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