IOP Conf. Series: Materials Science and Engineering **434** (2018) 012139 doi:10.1088/1757-899X/434/1/012139

Differentiating hybrid and juvenile of black-winged myna (Acridotheres melanopterus) by using morphometric data

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Abstract. The studies related to black-winged myna (*Acridotheres melanopterus*) are still very lack at the moment. The bird is an endemic species of Java and Bali which is currently critically endangered according to the International Union of Conservation for Nature (IUCN) since 2010. Hybridization of this species in captivity often occurs with other myna species. The morphological features between hybrid black-winged myna and pure juvenile white starlings are very similar. It is difficult to distinguish hybrid black-winged starling and pure juveniles without thorough observation. The study was conducted to determine the differences between hybrid black-winged myna and pure juvenile based on the morphometric characteristics using Principal Component Analysis (PCA). Samples were selected using the purposive sampling method at Cikananga Conservation Breeding Center located in Sukabumi, West Java in May 2017. The morphometric data were taken directly from eight hybrid birds and 14 pure juveniles. Data collection was done by measuring body length, body width, body circumference, wingspan and weight. The morphometric data were analyzed by PCA using the SPSS V.20 program. The analysis shows that length and width are the main distinguishing factors between hybrid birds and pure juveniles with values of 0.916 and 0.862 respectively.

1. Introduction

A research is needed related to the factors that leading the black-winged myna to extinction [1]. Uncontrolled hybridization can be one of the factors causing the black-winged myna on the brink of extinction [2, 3]. The high demand of the myna at the market is not in line with the population that is very low in nature. Black-winged myna currently hard to find in the wild with Critically Endangered status, therefore humans began to breed these birds to meet the market needs or as a conservation effort. The number of captive breeding is not accompanied by sufficient knowledge of the private breeders about the black-winged myna [1, 4, 5]. The fact that black-winged myna is having two other closely related species is little known by the breeder. The three species of black-winged myna are having similar morphological characteristic and so people are tending to know them as one species. This is resulted in the number of cross-breeds or hybridization either intentionally or unintentionally

among black-winged myna in captivity. This may increase the risk of extinction of the pure species from each black-winged myna which is currently Critically Endangered [6].

The black-winged myna has a medium body size with approximately 23cm in length as adults. The body is dominated by white feather and some black feather on the tail and wing [1, 7]. The bird is divided into three distinct species: the species of West Java and Madura (*Acridotheres melanopterus*), Balinese species (*Acridotheres tertius*), and East Java species (*Acridotheres tricolor*) [1, 7, 8]. These three species can be distinguished morphologically by the color of the dorsal feather and the wing cover. The feather on the back and wings of the *Acridotheres melanopterus* is white, *Acridotheres tertius* is blackish-gray, and *Acridotheres tricolor* is gray. The young black-winged mynas is having gray feathers on the head, neck, back and wing covers, and the characteristics occurs in the three species [4, 9].

The morphological characteristics of the young black-winged mynas from the three species are identic so it would be very difficult to determine its species in the young age [7, 9]. The hybrid of black-winged myna is also having identic morphological characteristic with the juvenile, making it hard to differentiate them. It is very important to make sure all the founders for conservation breeding program is pure to maintain their genetic variation and so the knowledge on how to differentiate the hybrid from the pure is crucial. The research aim is to produce new data on the morphometric characteristics of the hybrids and the pure juvenile. The results of this study have great potential to serve as the basics of knowledge for breeders in cultivating White Myna for either commercial purposes or most importantly for the future Jalak Putih conservation effort. The result will be very useful for the breeders to differentiate the species. It will prevent the breeders to breed the birds by mating it with another species of black-winged myna (*Acridotheres tertius* & *Acridotheres tricolor*).

2. Method

2.1. Study area

Cikananga Conservation Breeding Center (CCBC) is part of Cikananga Foundation that focused on conservation of animals and nature. It is a wildlife center located in the southern Sukabumi, West Java, Indonesia. The goal of CCBC is to breed Indonesia's endemic species, threatened from extinction to preserve their integrity (through managed breeding) and release them back into their habitats in their geographic range. Currently, CCBC houses and successfully breeds the black-winged myna (*Acridotheres melanopterus*), the rufous-fronted laughingthrush (*Garrulax rufifrons*), the java green magpie (*Cissa thalassina*), the sumatran laughingthrush (*Garrulax bicolor*) and the java warty pig (*Sus verrucosus*). The research will be focused on black-winged myna. The location of CCBC can be seen on the image below (figure 1).

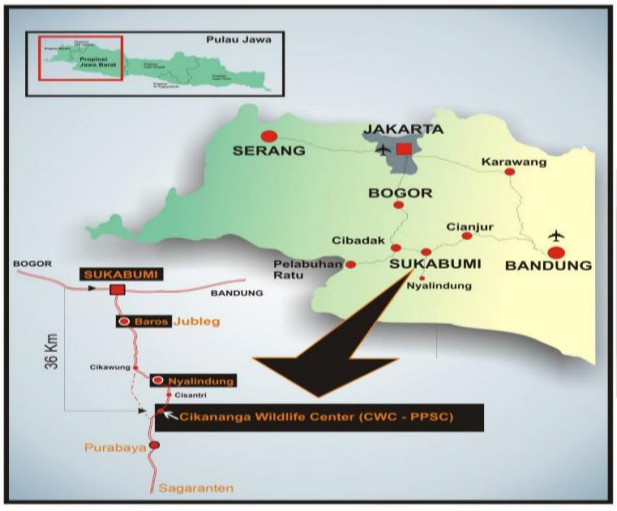

Figure 1. Cikananga conservation breeding center location map.

2.2. Procedure

The identification of BWS morphometric characteristics was done with the bird in hand. Purposive sampling has been used as the method to choose the sample. The hybrid birds are should be at least 2 years old and the juveniles are less than 2 years old. The data collection was done at Cikananga Conservation Breeding Center (CCBC) located at Sukabumi City, West Java, Indonesia. The weight measurement process was done using 250g dynamometer or spring scale and a cloth bag for the bird. A measuring tape was needed to measure the wingspan, length, width and circumference of the body. All the data collection should be done in the morning to minimize the bird's stress level because of the increasing temperature from the sun.

The first process is to catch the bird and put it into the prepared bag, weight it with the hanging scale. The bird identity is needs to be noted before the work. Take out the bird from the bag and hold the bird carefully (should be done by experienced person). Measure the length of the body (from the beak to the tail). Take a full body picture from the right and left side, also from above and below the body (spread the wing if possible). Gradually, take the photos of the back, rump, right shoulder, left shoulder and chest. Count the abnormal feather if it is observed while the examination. The data taken will be written on the sheet prepared before. The image below (figure 2) shows the definition of each morphometric factors measured.

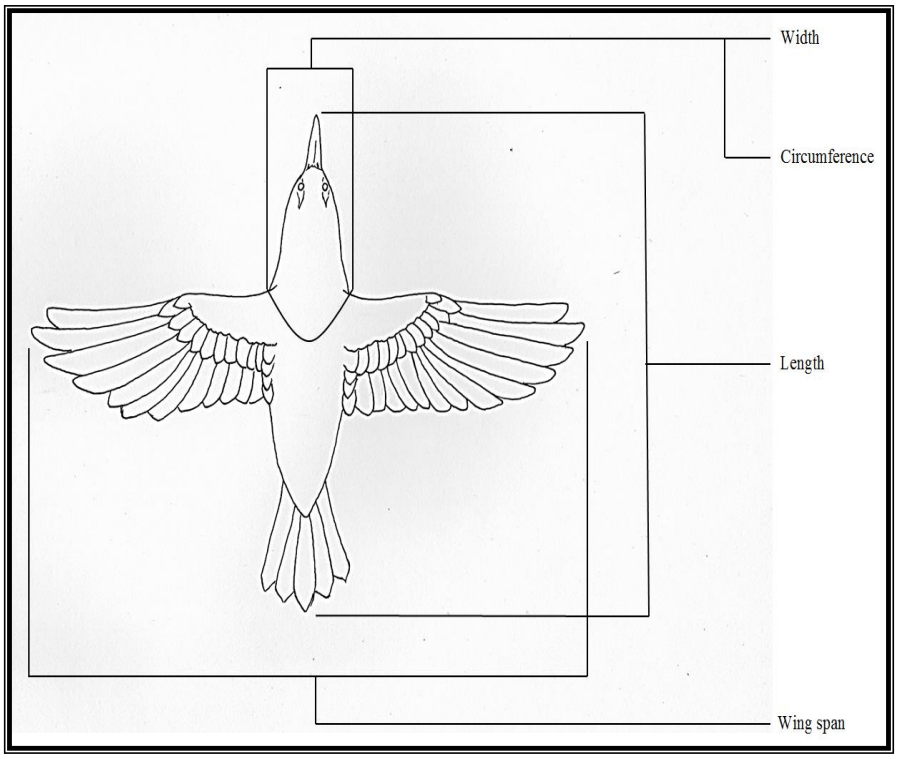

Figure 2. Black-winged myna measurement detail.

2.3. Data analysis

The collected data was analyzed by SPSS V.20 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 from each component. 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 show the conclusion.

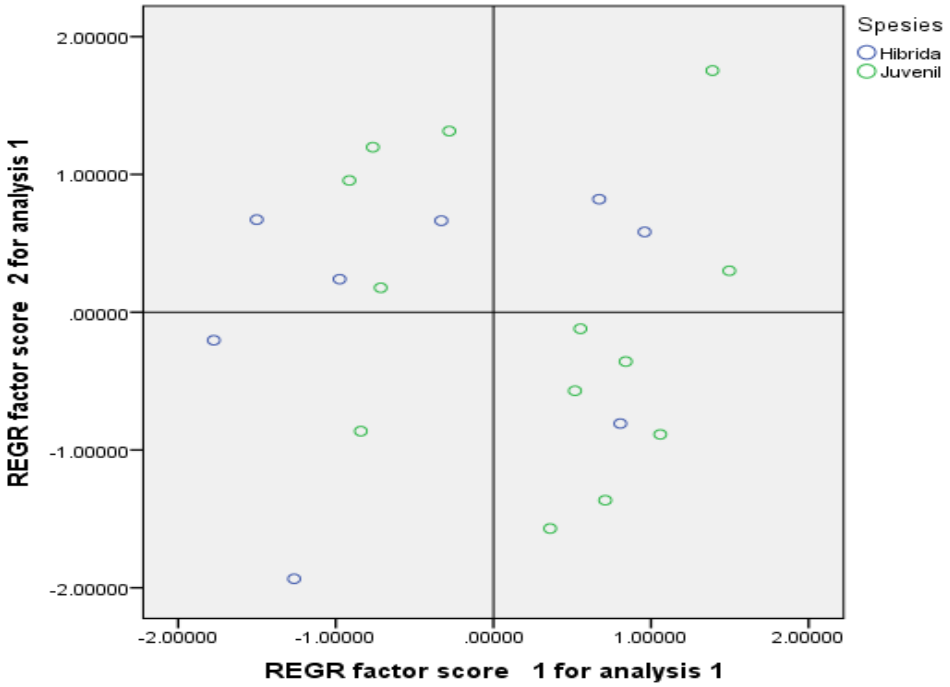

Figure 3. Scatter dot graph of hybrid and pure juvenile of black-winged myna morphometric data.

3. Results and discussion

3.1. Result

It is hard to differentiate the hybrid from the pure juvenile of black-winged myna. Their similar morphological characteristic is the main problem causing the difficulties. From the data collected, there are two components that appear after the PCA. There are only the components with eigenvalue higher than 1 will be determined as the important component. The table below (Table 1) is showing the result of PCA analysis of the data collected.

Table 1. Principal component analysis result.

Factors	Component 1	Component 2
Weight	0.410	0.792
Length		0.916
Width	0.862	
Circumference	0.705	0.456
Wingspan	0.715	
Eigenvalue	1.919	1.764
Variance %	38.383	35.276
Cumulative %	38.383	73.659

The value of each factor is showing how much it is affecting the component. In the component 1, "width" is the factor with highest value which means the "width" is the factor that affecting the component the most. In the component 2, "length" is the factor with highest value. The blank space in the table means that the score is below 0.4 and didn't affecting the component in many ways. The variance from both component is more than 30%, it is a little bit small but 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. Morphologically, the juveniles and the hybrid show no different signs or characteristics. From morphometric data, the average of the data can be analyzing to determine most distinctive factor. The data distribution is also important to see if the data scattered or agglomerated. The graph (figure 3) is based on the regression score from each factor.

From the graph above (figure 3), it can be seen that the distribution of the hybrid and pure black-winged myna is evenly distributed in all parts. This means that the morphometric factors between them is not apparent. Regardless of their similar morphological characteristics, the study shows that both morphometric and morphology are also indistinguishable between the hybrid and pure juvenile of black-winged myna. Therefore, the age of the bird becomes very important to identify the black-winged myna. The bird must be at least two years old to be sure whether the anomalies characteristics that existed at the juvenile phase are gone or not. If the anomaly characteristics are still remains until the bird is mature, it is very likely that the individual is hybrid. The anomalies characteristics are the present of black or gray feather on the back, wing coverts, rump, flank, breast or head. The image below (figure 4) is showing how similar the hybrid and pure juvenile of black-winged myna can be. The morphological characteristic of pure juvenile is having some black or gray feathers on their back and wings. It will be gone when the bird is mature, it is around two years old. For the hybrid, the black or grey feathers on the back and wings will not gone and remain the rest of it life. The (A) is the hybrid with some black feathers on the back, the wing is clean. The (B) is a pure juvenile with some black feathers on the wing coverts and grey feathers on the back.

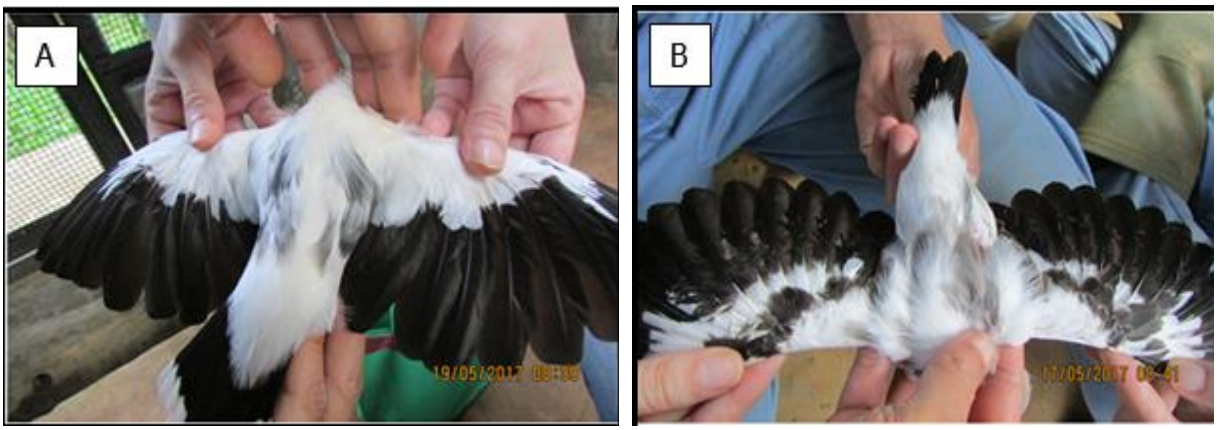

Figure 4. (A) Hybrid and (B) pure juvenile of black-winged myna.

3.2. Discussion

Hybridization is well known playing an important part in evolution process [3]. Natural hybridization has played an important role in the evolution of many plant and animal taxa [10, 11]. Nevertheless, some research recently shows that hybridization can also be one of the factors that leads a species to extinction [12, 3]. Hybridization has contributed to the extinction of many species through direct and indirect means. Determining whether hybridization is natural or anthropogenic is crucial for conservation, but is often difficult to achieve [7, 3, 13]. Seeing how hybridization can affect the conservation effort, well knowledge is required to manage it carefully.

The result from the research shows how difficult it is to distinguish the hybrid from the pure juvenile of black-winged myna. They don't have any significant distinctive characteristics for the differentiation process. Checking it genetically maybe one of the ways to make sure of it [14, 15], but remembering the cost and also time required it is not very efficient. Morphological identification is the simplest way to identify the hybrid from the pure [16, 17], but the identification cannot be applied to the juveniles. It is to prevent identification error because the juveniles are still experiencing morphological changing phase. Doing the observation to the mature black-winged myna is still effective and efficient to at least identifying the hybrid by the morphological characteristic anomalies. The bird should be at least two years old to be considered as mature physically and sexually. They will not be experiencing any other morphological changing except the molting phase. The three species differences that are not so far in terms of morphology make it difficult to identify at a glance. Identification to distinguish three black-winged myna species will be more difficult if done when the birds are in juvenile phase [1, 7]. The physical characteristics of the young black-winged myna of the

three species are similar and it would be very difficult to determine the species in that phase. So making sure to have the record of the bird is a must to ensure the age.

The other thing that may affect the result of morphological observation is the molting phase of the bird. When the bird is in their molting phase, the pattern of their feathers can be somehow different. If the observant is not being careful, there might be a lot of mistakes on the result. Making sure that the bird is mature enough and not in their molting phase is an important thing to do to ensure a good observation [18, 19]. In the future, research that combining genetic and morphology is urgently needed. The cases with black-winged myna are a good example how closely related animals are hard to distinguish especially when the hybridization is occurring. Hopefully, the result from the research can be a basis for everyone who wants to differentiate the hybrid and pure juvenile of black-winged myna.

4. Conclusion

Uncontrolled hybridization between the three black-winged myna species can be one of the factors that lead it to extinction. By differentiating the hybrid from the pure species, the breeders can prevent further hybridization. By using the morphometric data and analyzing it with PCA, the differences between the hybrid and the pure is becoming clearer. The method can be use as one of the ways to determine the hybrid individuals of black-winged myna.

Acknowledgement

I thank Mr. Ono as the manager of Cikananga, Mrs. Renata as the representative of Bali Bird Park, Mr. Gede as the owner of Kicau Burung Captive Breeding Facility, and all the keeper from the breeding facilities that are already helping me to conduct the research at their captive breeding facilities.

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