Study on contour feathers growth of White-rumped Shama during fledgling phase

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Abstract. White-rumped Shama (\textit{Copsychus malabaricus}) has become a favorite pet among Indonesian bird keepers lately. A champion bird with beautiful chirps and colours would be valued high. There are very limited scientific information on its species, and this study results will enrich the biological data. The purpose of this study was to trace and record white-rumped shama contour feathers growth including feather types and changes of size during fledgling phase. There were 8 mixed sex chicks (a crossbreed of Medan x North Bengkulu) aged 30 days with similar body weight and size used in this study. Daily individual observation on parameters were conducted from day-1 of nurturing until chick’s individual first moulting day. Observation results showed that contour feathers on white-rumped shama chicks body which easily to observed were retrices and remiges. Then, based on anatomical feather during fledgling phase on chick’s part of forehead, nape, chest, back, wing and tail we recorded 3 types of feathers which were filoplumae, plumulae and plumae. Average of retrices length and width in tail were 69.62 mm and 11.10 mm per chick, and average of remiges primarie length and width in wing were 63.32 mm and 9.74 mm per chick, respectively. Researchers found that as similar as to other species of aves, the size of White-rumped Shama retrices is longer and wider than remiges.

1. Introduction
Similar to other countries in 5 continents lately, Covid-19 pandemic situation in Indonesia obviously pay a negative impact on economic situation, their basic daily life style and needs. However, it assume does not affect the Indonesian bird lover. Obviously they still willingly pay an extra expenses to fulfill their pet needs for commercial feeds, expensive supplements and a newly cage system. For local bird lovers in Bengkulu city, we found that they still conduct some regulars competition for birds singing contest including for white-rumped shama (\textit{Copsychus malabaricus}) class during this unstable economic situation. Based on those facts, we believe that there will be a slightly potential advantegeous for some part of the community such as for bird breeders, feed producers and bird lovers. And for scientific reason, it will give chance to conduct some researches to enrich world fauna’s biological information.
Most recent studies revealed that keeping white-rumped shama as a pet is popular among Indonesian especially for bird lovers in Bengkulu city [1-3]. In the year of 2019, researchers of Universitas Bengkulu, [1,2], found that in 9 districts of Bengkulu city totally 642 birds kept in **ex situ** habitat consisted of 434 males and 208 females with sex ratio approximately of 2:1. Population density was 4.23 birds/km² (2.86 male birds/km² and 1.37 female birds/km²). Population distribution by a **Variance-Mean Ratio** formula was 4.8 or VMR>1. Furthermore, there was 79 fanciers consisted of 78 male fanciers (98.7%) and 1 female fancier (1.27%). Eleven fanciers (13.9%) were categorized as captive breeders and 68 fanciers (86.1%) were categorized as birds lovers.

Among bird lovers, it is well known that the mortality rate for bird chicks quite high when reared separately from their parents [4,5]. The most important reason is because those chicks still fully depending on their parents. White-rumped shama chicks still feed directly in a form of pulp-like from parent beak. Separation treatment can influence chicks feed consumption and this situation which can lead to stress and death.

The objective of this study was to trace and record white-rumped shama contour feathers growth including feather types and changes of size during fledgling phase.

2. Method

This study conducted for almost 6 months in the year of 2020. Began by a preparation to collect an adequate number of same age white-rumped shama chicks, similar species and same performances chicks (body weight and health condition). There were total 8 mixed sex chicks, 30 days of age identified as North Bengkulu–Medan crossbreed individuals, average of body weight was 25.13±1.95 g per chick with ranged between 21.77 to 27.66 g. The number of sample was limited to 8 individuals based on its expensive price (up to IDR 2 millions per chick), limited number of similar age and subspecies available when study conducted and as a support to conservation program by using a breeding farm individuals only. Most recent studies reported that prior its moulting phase, it is difficult to confirm its sex [4]. Therefore mixed sex chicks were used in this study.

| Table 1. Nutrition contains by gold coin bird feed seaweed [6]. |
|------------------|------------------|
| **Nutrition**    | **Volume (%)**   |
| Crude protein    | 19               |
| Crude fatty      | 3                |
| Crude fiber      | 9                |
| Ash              | 9                |
| Water content    | 12               |

| Table 2. Nutrition Contains in Fresh Weaver Ant Eggs (100 gr). |
|------------------|------------------|
| **Component**    | **Total**        |
| Calori (kcal)    | 493              |
| Water Content (%)| 19               |
| Crude Protein (g)| 24.1             |
| Crude Fat (g)    | 42.2             |
| Carbohidrat (g)  | 4.3              |
| Crude Fiber (g)  | 4.6              |
| Ash (%)          | 2.8              |
| Calcium (mg)     | 40               |
| Phosfor (mg)     | 230              |
| Ferum (mg)       | 10.4             |
| Vit A, (IU)      | 710              |
| Vit B1 (mg)      | 0.22             |
| Vit B2 (mg)      | 1.13             |
| Niacin (mg)      | 5.7              |
There were 8 individual cages sized 200 cm of length, 25 cm of width and 175 cm of height equipped by individual feed container, water container and a 25 cm of special bar. Chicks fed a daily ad libitum with a combination of commercial feed (voer) and weaver ant eggs or red ant eggs (*Oecophylla smaragdina*). Drinking water was also ad libitum. Commercial Voer gold coin bird feed seaweed nutrition contains produced by Gold Coin Indonesia company can be seen in table 1. Furthermore, nutrition contains in 100 g of fresh weaver ant eggs or red ant eggs are in table 2 [7].

Parameter in this study was contour feather. A daily individual observation on parameter conducted from day-1 of nurturing until chick’s individual first molting day. Data of contour feathers such as types and sizes were collected and analyzed descriptively.

### 3. Results and discussion

This study result is believed as the first scientific report on Indonesia white-rumped shama contour feathers, especially for domesticated white-rumped shama chicks. As it is common for most researchers who believe that there are some differences on some parameters among domesticated birds *ex situ* and wild bird *in situ* specifically on its morphometric sizes and other biological performances such as molting age [4]. Therefore, this study results will enrich the fundamental data of this species. In general, a recent study [8] stated that feathers of aves can be varied in the term of structure and function. Observation results showed that contour feathers on white-rumped shama chicks body which easily to observed were retrices and remiges. Contour feather can be defined as the vaned feathers possessing barbules that chiefly cover the body of a bird and give it a streamlined form [9].

| Contour Feathers | Chick number | Average (mm) | SD |
|------------------|--------------|--------------|----|
| Retrices         | 1            | 65.83        | 69.62 |
| Length (mm)      | 2            | 70.76        | 6.15 |
| Width (mm)       | 3            | 71.63        |      |
|                  | 4            | 68.55        |      |
|                  | 5            | 81.54        |      |
|                  | 6            | 62.08        |      |
|                  | 7            | 66.98        |      |
|                  | 8            | 65.95        |      |

All data showed in table 3 was measured on the day of each individual white-rumped shama chick molting phase. Moulting of all chicks in this study reached varies between 58 to 100 days of biological age and the average of its first molting age was 80.75 days of biological age. This result was also reported in a previous study [4]. Until recent day, it is well known that for white-rumped shama which lives *in situ* reached their first molting in age of 9 month. This study result was younger and this data can demonstrate a fact about the differences between domesticated chick and wild one regarding their biological performance.

Average of retrices length and width in tail were 69.62±6.15 mm per chick and 11.10±1.02 mm per chick (table 3). Then the average of remiges primarie length and width in wing were 63.32±1.13 mm per chick and 9.73±0.19 mm per chick, respectively. The size of white-rumped Shama chick retrices is longer and wider than remiges. Specifically for local Bengkulu city bird lovers, white-rumped shama classified not only as a chirping bird but also well known for its beautiful color [1,3,4]. Its retrices is longer than the body length, and there are 2 black colored retrices on the top surface of tail which is longer than other retrices length. White colored retrices can be found in lower position and they have unequal length.

### Table 3. Size of contour feathers of white-rumped shama chicks on first molting phase.

| Contour Feathers | Chick number | Average (mm) | SD |
|------------------|--------------|--------------|----|
| Retrices         | 1            | 65.83        | 69.62 |
| Length (mm)      | 2            | 70.76        | 6.15 |
| Width (mm)       | 3            | 71.63        |      |
|                  | 4            | 68.55        |      |
|                  | 5            | 81.54        |      |
|                  | 6            | 62.08        |      |
|                  | 7            | 66.98        |      |
|                  | 8            | 65.95        |      |

| Remiges          | 9.88         | 9.92         | 9.74 |
|------------------|--------------|--------------|----|
| Length (mm)      | 63.73        | 64.09        | 63.32 |
| Width (mm)       | 63.86        | 64.81        | 1.13 |
|                  | 61.77        | 61.97        |      |
|                  | 62.99        | 64.03        |      |
|                  | 62.08        | 64.03        |      |
|                  | 9.6          | 9.57         |      |
|                  | 9.45         | 9.63         |      |
|                  | 11.10        | 10.43        |      |
|                  | 1.02         | 10.35        |      |
|                  | 1.13         | 10.17        |      |
|                  | 0.19         | 6.15         |      |

All datas showed on the table 3 was measured on the day of each individual white-rumped shama chick molting phase. Moulting of all chicks in this study reached varies between 58 to 100 days of biological age and the average of its first molting age was 80.75 days of biological age. This result was also reported in a previous study [4]. Until recent day, it is well known that for white-rumped shama which lives *in situ* reached their first molting in age of 9 month. This study result was younger and this data can demonstrate a fact about the differences between domesticated chick and wild one regarding their biological performance.
Gill [8] said that contour feathers form most of the surface of the bird, streamlining it for flight and often waterproofing it. The basal portion may be downy and thus act as insulation. The major contour feathers of the wing or remiges and tail or rectrices and their coverts function in flight. Contour feathers grow in tracts or pterylae separated by bare areas or named as apteria and develop from follicles in the skin.

Then in this study, based on anatomical feather during pledgling phase on chick’s part of forehead, nape, chest, back, wing and tail, we recorded 3 types of feathers which were filoplumae, plumulae and plumae. The typical contour feather consists of a tapered central shaft, the rachis, with paired branches (barbs) on each side [8]. Moreover, researchers stated that an unbranched basal section of the rachis is called the calamus, part of which lies beneath the skin [8,9]. The barbs have branches called barbules. The barbules on the distal side of each barb have hooks or known as hamuli that engage the barbules of the next barb. The barbs at the base of the vane are often plumaceous, lacking in hamuli and remaining free of each other.

Scientific reference regarding domesticated white-rumped shama chick biological information is meagre and might be not available. A researcher reported that pterylae feathers which can be found on wing and tail part can be longer than other pterylae feathers found on other part of chick body. The diameter size difference among pterylae feathers itself causing a size variation [10].

All species in aves class each contour feather on the body (but rarely on the wings) is provided with a complex branch, the after-shaft, or after-feather, that arises at the base of the vane [8,9]. Both studies reported that after-shaft has the appearance of a second, smaller feather, growing from the base of the first. Furthermore, it is also reported that down feathers have loose-webbed barbs, all rising from the tip of a very short shaft. Their function is insulation, and they may be found in both pterylae and apteria in adult birds. They also constitute the first feather coat of most young birds. Filoplumes are hair-like feathers with a few soft barbs near the tip. They are associated with contour feathers and may be sensory or decorative in function.

Researchers also assumed that nutrition, sex, genetic and environment can affect the contour feather differences. It is stated that size and morphology of wing feathers of bird can be affected by sex and age [11]. Also nutrition contains in this study contribute on contour feathers growth. Both on table 1 and table 2 showed us about crude protein in commercial voer and fresh weaver ant eggs which are 19% and 24.1%, respectively. According to a report Daryatmo and Widiarso (2016), fresh Oecophylla smaragdina or kroto contains crude protein as high as 47.8%. Based on this data, these feed can be classified as a feed contains high protein. This highly protein will improve the length and width of retrices and remiges [12].

4. Conclusion
Observation results showed that contour feathers on white-rumped shama chicks body which easily to observed were retrices and remiges. Then, based on anatomical feather during pledgling phase on chick’s part of forehead, nape, chest, back, wing and tail recorded 3 types of feathers which were filoplumae, plumulae and plumae. As similar as to other species of aves, the size of white-rumped Shama retrices is longer and wider than remiges.

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