HAYATI Journal of Biosciences 24 (2017) 195–200

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Contents lists available at ScienceDirect

HAYATI Journal of Biosciences

journal homepage: http://www.journals.elsevier.com/hayati-journal-of-biosciences

Original Research Article

Molt in Birds Inhabiting a Human-Dominated Habitat

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ARTICLE INFO

Article history:
Received 31 August 2015
Received in revised form
28 August 2016
Accepted 1 November 2017
Available online 11 December 2017

KEYWORDS:
birds,
molt,
molt-breeding overlap

ABSTRACT

Molt is one of the biological processes in the life of birds that requires high energy. Therefore, it usually occurs when food is abundant. However, molt and breeding overlap have been recorded in the tropics. There are very few studies on bird molting patterns in Indonesia. This study aimed at describing molt in birds that inhabit a human-dominated habitat in Bogor Agricultural University Campus in Bogor, West Java. Molt of primary feathers of adult birds were checked during bird monitoring using mist nets from August 2010 to December 2013. Occurrence of brood patch as indicator of breeding stage was also recorded. Molt data were obtained from 230 adult birds from 29 species. Molts occurred from February to December, with most birds having active molts in July and October. Breeding occurred in March, April, July, and October, with the peak of breeding occurring in March. Molt and breeding overlap were identified only in three species, i.e. Eurasian Tree Sparrow (*Passer montanus*), Horsfield's Babbler (*Malacocincla sepiarium*), and Scarlet-headed Flowerpecker (*Dicaeum trochileum*). This study suggests that resources in the study site are available for conservation of bird community in human-dominated habitat. However, further research is needed to assess food availability and bird breeding success.

1. Introduction

Birds need to change their feathers once in a while. There are times in the life cycle of birds that its plumages get worn and need replacement. Young birds also changed their plumage when they grew up. This process is known as molting. Molt is simply the replacement of feather. It is also one of the most fundamental processes of any bird's life cycle. Feathers are not permanent structures and need to be replaced. Therefore, molting involves detachment of old feathers and growth of new feathers. This process makes birds need high energy during molting. Previous studies (Murphy & King 1982) stated that birds cope with the situation by adjusting their food consumed or using their endogenous reserve or alteration in the timing of activities that require high energy such as breeding. Therefore, most birds usually do not coincide their timing of molt with their timing of breeding; although there are records of molt and breeding overlaps in the tropical birds such as reported by Miller (1961).

The reasons behind the high occurrence of molt breeding overlap may lie in the combined effect of reduced seasonality of tropical environments, competition, and the increased risk of nest predation in these areas (Cody 1966; Ricklefs 1969). In temperate species, timing of breeding and molt is generally constrained by food availability and periods of thermal stress such that both activities must occur during the summer months. In contrast, the reduced seasonality in tropical climates permits a longer breeding season (Ricklefs 1969). Despite this, competition for food (Karr & Brawn 1990; Poulin *et al.* 1992; Recher 1990), low reproductive success (through high levels of nest predation) (Scheuerlein & Gwinner 2002; Weidinger 2002), and extended parental care (Russell *et al.* 2004; Schaefer *et al.* 2004) may all combine to make the length of time required for the successful production of each offspring much greater than for temperate areas. It has therefore been argued that molt may be just as time constrained in tropical areas as temperate areas.

There are very few studies on bird molt in Indonesia (Novarino 2008). Regarding energy requirement for molting and breeding birds, loss of natural habitats because of conversion to other land uses—which is highly increasing—might influence the pattern of molt and breeding. Human-modified habitats might increase food

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Peer review under responsibility of Institut Pertanian Bogor.

https://doi.org/10.1016/j.hjb.2017.11.004

availability for some bird species through the planting of fruit-bearing trees or flowering trees and on the other hand might reduce some resources for other bird species. Reduced food in disturbed habitat might affect molting in birds (Freed & Cann 2012).

Lack of molt studies in Indonesia might be due to limitation in equipment and skill in capturing birds for research. In 2010, Indonesian Bird Banding Scheme (IBBS) was established by The Indonesian Institute of Sciences (LIPI), and one of its goals is to promote bird banding as one of the standard methods for bird monitoring in Indonesia. To achieve the goal, trainings have been conducted for interested individuals and groups. This study is a part of a regular bird monitoring program and training using mist nets by a group of bird banding enthusiasts in Bogor Agricultural University, the Cikabayan Bird Banding Club, in which the authors are members.

2. Materials and Methods

Data were collected in Bogor Agricultural University Darmaga Campus from August 2010 to December 2013. The area is located in the District of Bogor, West Java Province, Indonesia (6^{o}33'29.9"S—106^{o}43'25.4"E). The 267 ha area is consisted of several habitat types, including buildings, parks, lakes, arboretum, garden, man-made forest, and agricultural land. The area is known to have relatively high bird diversity, with no less than 85 species recorded in the area (HIMAKOVA 2012). Situated in the tropics, the area has a mean temperature of 26°C and high relative humidity (70%—90%) as well as high annual rainfall (3000—5000 mm per year).

Molt data were collected by capturing birds using mist nets. Six to eight mist nets were set up for 2 days every 1—3 months from August 2010 to December 2013 in 10 sampling sites, which comprise different habitat types (home garden, mixed tree plantation, and bushes) (Figure 1). Each site did not receive similar mist netting effort because of logistic problems; the most frequented were Cikabayan site (mixed agricultural farm and planted woodlot). Mist nets were opened from 6.00 to 17.00 hours. To prevent risk of injury for birds, nets were closed during rain and very hot weather. Nets were checked every hour, and sometimes, when predators were suspected or depending on weather condition, nets were checked every 30 minutes. Any bird caught in the mist net would soon be released, put into bird bag, and brought to the banding station to be identified, aged, sexed, banded using IBBS numbered ring, measured, and checked for primary feather molt. The numbered ring was not applied to swift and swiflets because no rings for the species are available from IBBS. Occurrence (the presence and/or the absence) of brood patch, an indication of breeding activity, was also noted. Birds captured were categorized as adults, immature, or juveniles by plumage and bare parts coloration. Age classification and sex determination followed Lowe (1989), MacKinnon *et al.* (2010), and Robson (2000).

Each primary feather molt was scored 0, 1, 2, 3, or 5, following guidelines from the study by Ginn and Melville (1983). Total molt score is calculated from left wing only; therefore, it ranged between 0 and 50. A bird with a total molt score of 0 is categorized as having no molting activity, whereas a bird with a total molt score of 50 is categorized as having new feathers (has finished molting).

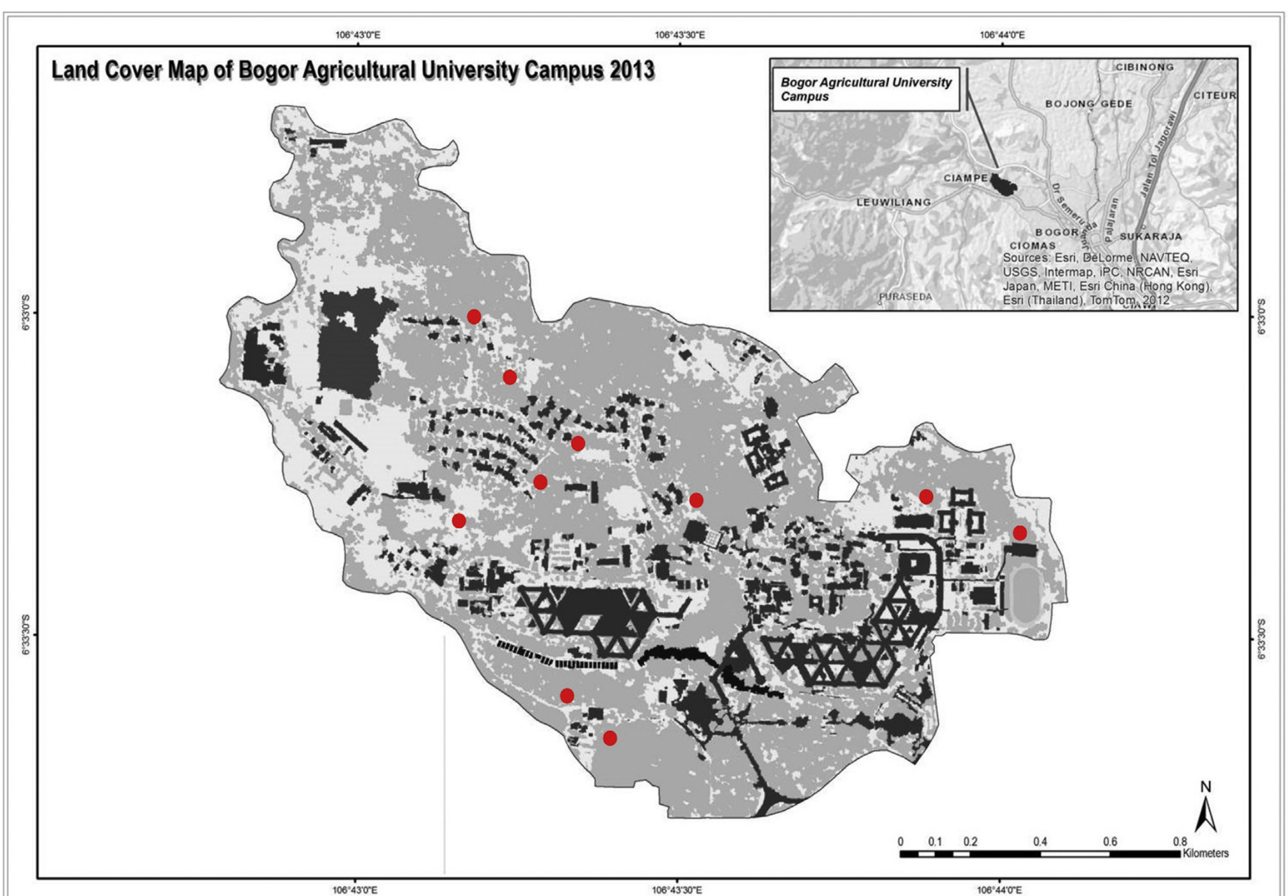

Figure 1. Location of sample sites (red dot).

Therefore, a bird with active molt had a total molt score between 1 and 49. Molt analysis was done only by using data from adult birds. There were several cases when the measurements were not done for all birds. The reasons for this were as follows: (1) the bird escaped during process or (2) the bird was released to reduce the stress of the bird, especially when it was badly entangled in the net. Analysis of molt pattern was only done for birds with at least 10 individuals. Data from 2010 to 2013 were lumped to analyze the timing of molt.

3. Results

A total of 497 individuals from 33 species were captured during the study, including 33 retraps (captured more than once). There was a variation in the number of captured birds based on age classes (Figure 2), with Eurasian Tree Sparrow (*Passer montanus*) being the largest number followed by Sooty-headed Bulbul (*Pycnonotus aurigaster*), Scarlet-headed Flowerpecker (*Dicaeum trochileum*), and Scaly-breasted Munia (*Lonchura punctulata*). Two hundred thirty individuals of 29 species were categorized as adult. Looking at the molt scores of those adult birds, it showed that molt occurred from February to December, with most birds having active molt in July and November. Breeding, as indicated by the occurrence of brood patch, occurred in March, April, July, and October, with the peak of breeding occurred in March (Figure 3).

Eight species had more than 10 individuals caught, and it showed that there are differences in the timing of molt among species (Table). However, the data are fragmented because species captured were not consistent every month. For example, the highest number of captures was Eurasian Tree Sparrow (*Passer montanus*), but data were only available for March, April, and October, where many of the birds showed active molt. New feathers were found in March and October. Scatter plots of molt score of five sampled species showed that most birds presumably started molting between March and June (Figures 4–8), although the length of molt period varied.

Birds that showed brood patch and molting at the same time are Eurasian Tree Sparrow (*Passer montanus*) (n = 10), Horsfield's Babbler (*Malacocincla sepiarium*) (n = 1), and Scarlet-headed Flowerpecker (*Dicaeum trochileum*) (n = 1). Molt and breeding overlap in Eurasian Tree Sparrow occurred in March and October, whereas in Horsfield's Babbler, it occurred in March, and in Scarlet-headed Flowerpecker, it occurred in July.

4. Discussion

Molting may vary according to resource availability and species characteristics. In Borneo, Fogden (1972) found that molting occurred soon after breeding season, and birds finished molting in November, the period when food abundance (insects) was decreased. Larger

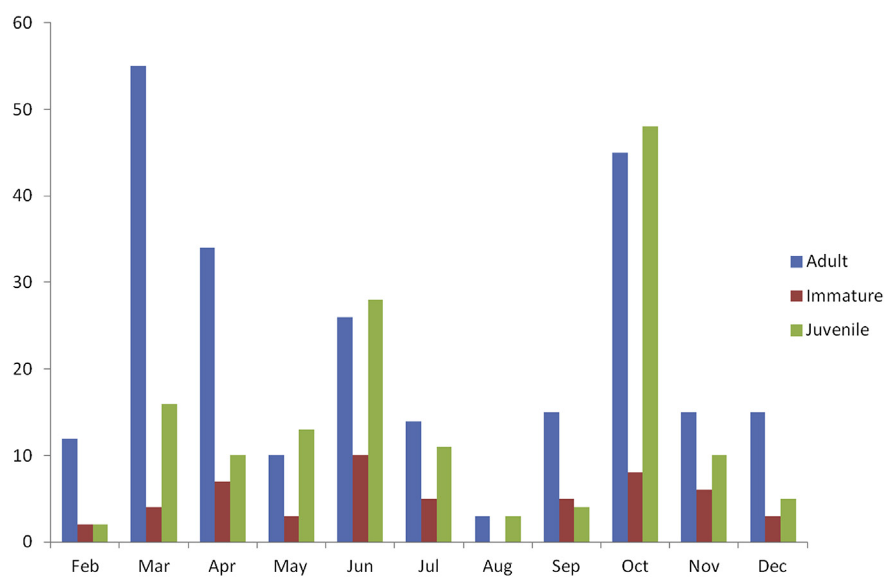

Figure 2. Variation in the number of birds captured based on age classes.

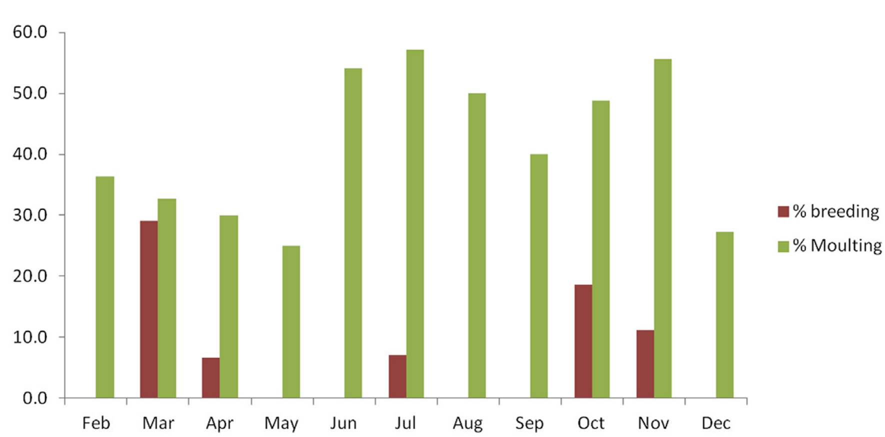

Figure 3. Variation in the number of molting and breeding birds.

Table. Number of individuals with active molt (*n* per species ≥10 individuals; – indicated that no birds were captured)

Month	*Collocalia linchi* (*n* = 15)	*Dicaeum trochileum* (*n* = 15)	*Hirundo tahitica* (*n* = 15)	*Orthotomus sepium* (*n* = 17)	*Orthotomus sutorius* (*n* = 10)	*Passer montanus* (*n* = 48)	*Pellorneum capistratum* (*n* = 14)	*Pycnontotus aurigaster* (*n* = 36)
January	–	–	–	–	–	–	–	–
February	–	0	–	2	0	–	–	1
March	0	–	1	0	0	10	2	1
April	–	1	–	0	2	0	1	3
May	–	–	–	–	–	1	0	2
June	2	1	0	2	2	–	1	3
July	0	2	–	1	–	–	–	2
August	–	–	–	–	–	–	–	–
September	–	0	–	2	0	–	0	–
October	2	1	0	1	–	12	2	1
November	0	0	–	1	0	–	–	6
December	0	0	–	1	–	–	–	1

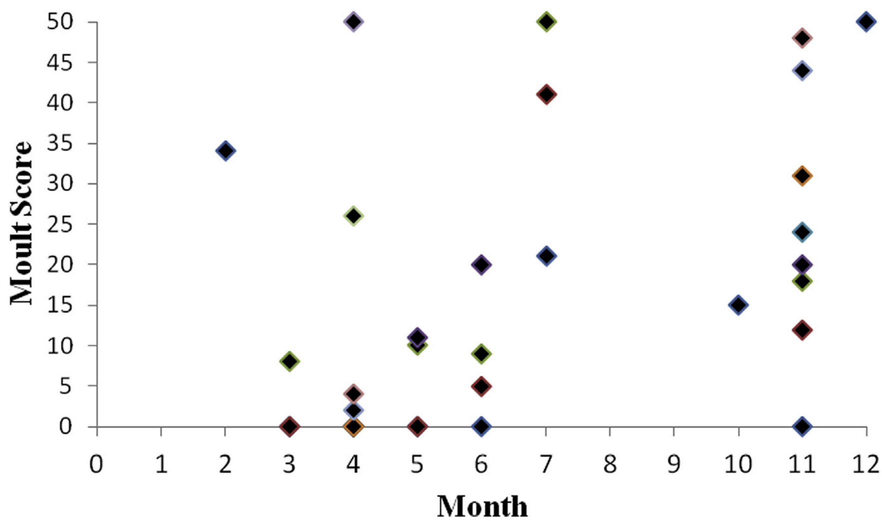

Figure 4. Scatter plot of molt score of Sooty-headed Bulbul (*Pycnonotus aurigaster*).

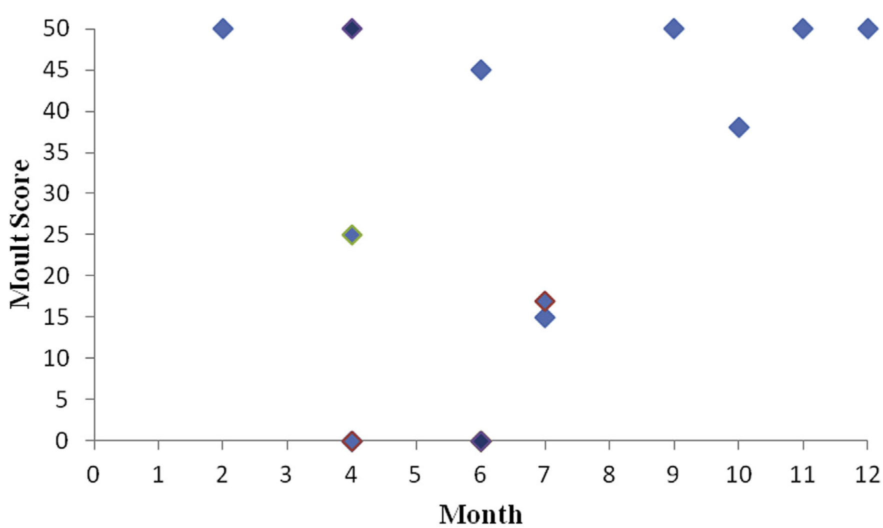

Figure 5. Scatter plot of molt score of Scarlet-headed Flowerpecker (*Dicaeum trochileum*).

birds also tend to have a longer period to complete their molting session (Ginn & Melville 1983). Novarino (2008) found that in Sipisang, West Sumatra, most birds undergone molting almost all year round with the peak occurring from July to September. This peak coincided with the end of breeding season. He suggested that this relates to nutrition requirement and food availability.

Compared with other species in this study, Sooty-headed Bulbul is a relatively large bird. This species feed on fruits and insects (MacKinnon *et al.* 2010). Sooty-headed Bulbulis is a successful and adaptable species found in open country with scattered bushes and trees. Therefore, food might not be the limiting factor for molting of this species in the study site. This also applies to Eurasian Tree

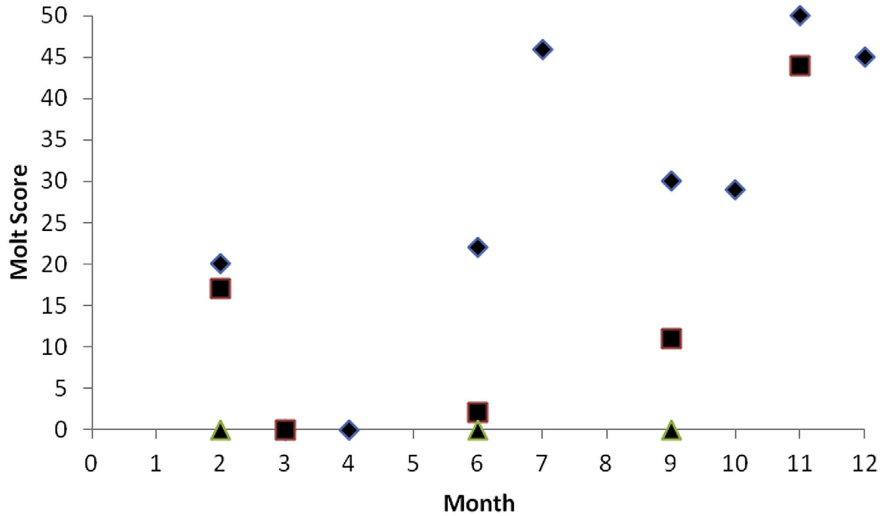

Figure 6. Scatter plot of molt score of Javan Tailorbird (*Orthotomus sepium*).

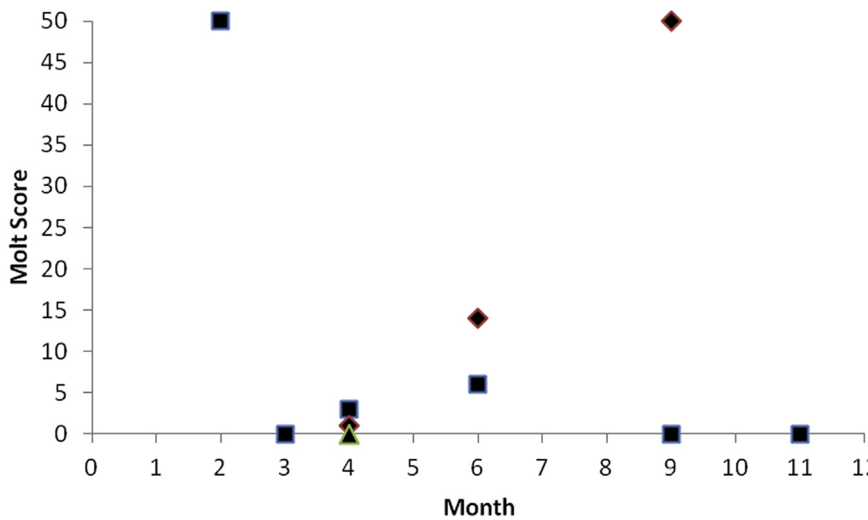

Figure 7. Scatter plot of molt score of Common Tailorbird (*Orthotomus sutorius*).

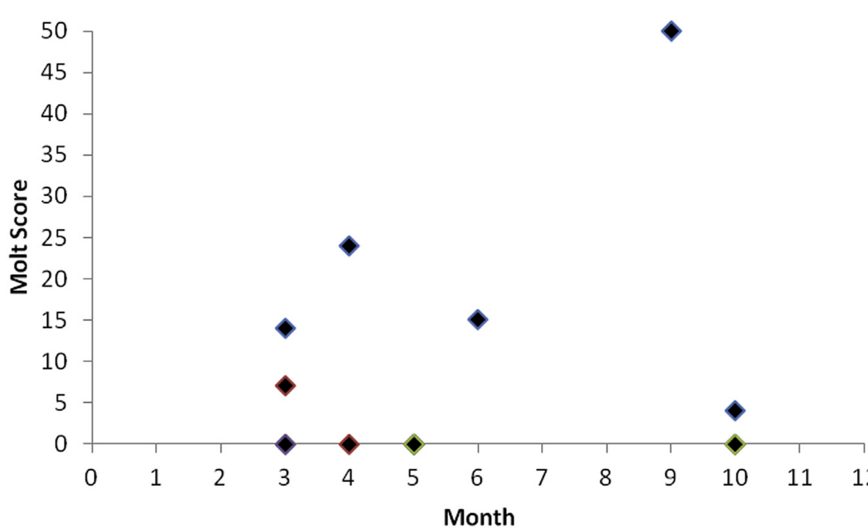

Figure 8. Scatterplot of molt score of Black-capped Babbler (*Pellorneum capistratum*).

Sparrow, in which breeding and molting occurred. Eurasian Tree Sparrow could consume a varied type of food, from grains to food scraps, and they are locally abundant in town, villages, and rural development (Strange 2001).

Although the data in this study are still limited, it suggest that variation in habitat types provides resources for bird community in the study site. However, further research is needed to assess food availability and bird breeding success. Planting of fruit-bearing trees in the housing area and experimental farm provided food for this species, so it can fulfill energy requirement for molt.

Conflict of Interest Statement

There is no conflict of interest.

Acknowledgements

The authors thank other members of Cikabayan Bird Banding Club who have voluntarily helped in collecting data. They also thank Dr Dewi M. Prawiradilaga from the Indonesian Institute of Science (LIPI) who has been always supportive with our bird banding activities, including lending us the equipment and bands. They also thank their trainers from Australia Bird and Bat Banding Scheme, especially Mr Alan Leishman, who also supported them with some equipment.

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