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Feed Preference, Adaptation, and Role of The Eurasian Tree Sparrows (*Passer montanus* L.) in Urban and Rural Environments

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ABSTRACT

The Eurasian tree sparrow (*Passer montanus* L.) known as both pest and predators; in the urban area, it is considered a pest because of its droppings, feathers, and nests around the house. Meanwhile, in rural areas, it is considered both pests and predators because their diets are small insects and small grains like a grain in the rice field. This study aimed to determine the daily consumption rate of sparrows on grain; their preferred food; identify the adaptability; and the role of sparrows in urban and rural areas. Feeding ability test using the no-choice baiting method. Food preference test using the choice baiting method. The adaptability and role of sparrow data are obtained through location determination and direct observation in the field. The results show that the consumption rate of individual sparrow is ten percent of body weight. The most preferred food for sparrow is yellow mealworm, followed by millet, cricket, foxtail millet, rice grain, and corn. The Eurasian tree sparrow is not considered a pest on rice fields. The presence of the sparrow in urban areas is less than in rural areas. Both in urban and rural areas, more sparrows were seen or found in the morning than in the afternoon. Sparrows can adapt well in rural and urban areas because the environment provides open area and house building. In urban areas, sparrow is considered urban pests; meanwhile in rural areas they potentially considered a pest on barley and millet, and predators on small insects.

Keywords: Consumption, mealworms, open areas, pests, predators

Preferensi Pakan, Paya Adaptasi, dan Peran Burung Gereja (*Passer montanus* L.) di Lingkungan Perkotaan dan Perdesaan

ABSTRAK

Burung gereja (*Passer montanus* L.) dikenal sebagai hama sekaligus predator. Di daerah perkotaan, burung gereja dianggap sebagai hama karena kotoran, bulu, dan sarangnya di sekitar rumah. Sedangkan di perdesaan, burung ini dianggap sebagai hama sekaligus predator karena makanannya adalah serangga kecil dan biji-bijian kecil seperti bulir padi di sawah. Penelitian ini bertujuan untuk mengetahui tingkat konsumsi harian burung gereja terhadap biji-bijian; makanan kesukaannya; serta mengidentifikasi kemampuan beradaptasi dan peran burung gereja baik di perkotaan maupun di perdesaan. Uji kemampuan makan mengguna-kan metode pemberian umpan tanpa pilihan. Uji preferensi pakan menggunakan metode pemberian umpan dengan pilihan. Data adaptasi dan peran burung gereja diperoleh melalui penentuan lokasi, observasi langsung di lapangan, dan wawancara. Hasil menunjukkan bahwa tingkat konsumsi harian burung gereja pada umpan gabah adalah sepuluh persen dari bobot tubuh. Makanan yang paling disukai oleh burung gereja adalah ulat hongkong, diikuti oleh milet, jangkrik, jewawut, beras, dan jagung. Burung gereja tidak dianggap sebagai hama di pertanaman padi. Kehadiran burung gereja di perkotaan lebih sedikit daripada di perdesaan. Di perkotaan dan di perdesaan, burung gereja lebih banyak terlihat pada pagi hari daripada sore hari. Burung gereja dapat beradaptasi dengan baik di perkotaan dan di perdesaan karena lingkungan tersebut menyediakan area terbuka dan bangunan rumah. Di perkotaan, burung gereja dianggap sebagai hama perkotaan sedangkan di perdesaan berpotensi sebagai hama pada jelai dan jewawut dan sebagai predator karena makan serangga kecil.

Kata Kunci: Area terbuka, hama, konsumsi, predator, ulat

INTRODUCTION

Rice is the most important food crop in the world after wheat and corn (Purnomo & Purnamawati 2007). In an effort to increase rice productivity, there are several obstacles, one of which is plant pest organisms. The pests that attack rice crops are pests,

diseases, and weeds (Widiarta & Suharto 2009). One of the pests that attack rice plants is the *bondol* bird group. Indonesia has a high diversity of bird species number 3rd in the world, including the diversity of species of *bondol* bird groups (Family Ploceidae). Birds have an important role in nature, namely groups of insectivorous birds (insectivores), fruit eaters (frugivores), seed eaters (granivores) and animal eaters (carnivores) (Arief *et al*., 2016). Birds that act as pests in rice cultivation are groups of *bondol*, *emprit*, or sparrows, *peking bondol* bird, black *bondol* bird, hajj *bondol* bird, *manyar* bird, and sparrows (BBPOPT 2019).

The Eurasian tree sparrow (*Passer montanus* L.) is a member of the *bondol* bird group from the European continent, spreading widely to Africa, Asia, Australia, America, and Indonesia. In Indonesia, this bird is found in Java, Sumatra, Kalimantan, Sulawesi, Bali, and Papua. Sparrows have a wide distribution and high adaptability to various types of habitats, can associate with humans, and live in groups to look for food (Swastikaningrum *et al*., 2012).

Sparrows are easily found in settlements, rice fields, poultry cages, yards, roofs of houses, or warehouses with grass, trees, and agricultural land (LIPI 2006). Sparrows make nests on the roofs of houses like tall buildings (Prianto 2018).

Sparrows are seen actively foraging on the ground in open fields which produce small grains and small insects (Kamal *et al.,* 2016). Sparrows are potential pests and predators. Pest is a living creature whose presence is not desired at a place and time because it causes disturbances in comfort, aesthetics, and health. Problems regarding residential pests that arise depend on the level of danger, loss or disturbance, population, and the level of human tolerance for their presence in the residential environment (Sigit & Hadi 2006). Predators are animals that prey on other animals or insects for their survival. During his life need a lot of prey (Nurindah & Indrayani 2008).

Sparrows in urban areas cause problems due to droppings, nests, and feathers that enter the house, while in rural areas these birds feed on small insects and small seeds such as grass seeds and grain, especially in areas where rice is planted. According to Anugrah *et al.* (2017), sparrows are seed-eating birds and small insects. Sparrow attacks in rice fields begin when rice seeds are planted, still young, and ready to be harvested (Dewi *et al.,* 2017). Rice production will decrease because many grains are lost, rice stalks are damaged, stems are broken, the remaining seeds fall, and the stems of rice plants dry up (BBPOPT 2019).

The aims of the study to determine the level of individual sparrows' consumption of rice grain feed, the feed preferred by sparrows, and to identify the adaptability and role of sparrows that have the potential as pests and predators in urban and rural environments.

MATERIALS AND METHODS

Place and Time of Research

This research was conducted at the Vertebrate Pest Laboratory, Department of Plant Protection, Faculty of Agriculture, Institut Pertanian Bogor (IPB) University to test the feeding ability and feed preferences of sparrows, as well as for observing the adaptability and role of sparrows in urban (Bogor City, 106° 48' East and 6° 26' South) and rural (Bogor District, 106° 23' East and 6° 18' South) environments. The research was conducted from September 2019 to January 2020.

Research Methods

Sparrow Feeding Ability and Preference

Cage Preparation

The cage is made of wood and wire to cover the entire surface of the cage. The cage measures 100 cm (length) x 100 cm (width) x 100 cm (height). After the test cage is suitable for use, a glass, a container to store food, and newspapers are placed coating the bottom of the cage.

Preparation of Test Animal Feed

The feeds used were rice grain, corn, millet, foxtail millet, yellow mealworm, and crickets obtained from a bird feed shop at Babeh Kampus, Bogor Market; the Useful Animal Unit of the Field Laboratory of the Faculty of Animal Husbandry, IPB University; and the bird kiosk of Fadilah Dramaga, Bogor. Each of the feed weighed at 20% of the body weight of the sparrow.

Preparation of Test Animals

The test animal used was a sparrow. The bird was obtained from a bird trader at the bird kiosk Fadilah Dramaga, Bogor and then adapted first in a maintenance cage at the Vertebrate Pest Laboratory for three consecutive days. The body weight of birds is weighed, recorded, and reduced by the weight of the plastic before being put into the cage.

Feeding Ability Testing

The feed used for testing is rice grain. The feed given is weighed every day and replaced with a new one. At the end of the observation, the birds were weighed and continued with feeding preference testing.

Feed Preference Testing

The test is carried out by the choice test method. The feed used in the test was rice grain, corn, millet, foxtail millet, yellow mealworm, and crickets. The placement of food is separated in a different container for each feed. The food given is weighed every day and replaced with a new one.

Observed Variables

The observed variable was bird consumption of feed in each treatment by calculating the difference between the initial weight of the feed and the final weight of the feed. The difference in weight was carried out on the feed in the treatment cage and outside the cage to calculate the addition or shrinkage that occurred.

Feed Conversion

The data obtained from the sparrow test was first converted to 10 g of the body weight of the bird, with the following formula:

$$\text{Average body weight of bird (g)} = \frac{[\text{Initial weight (g)} + \text{Final weight (g)}]}{2}$$

$$\text{Feed conversion} = [\text{Feed consumption (g)} / \text{Average body weight of bird (g)}] \times 10$$

Feed conversion is carried out by multiplying a constant value (10). Ten gram is the average body weight of sparrow, so that the consumption does not vary for different bird weights.

$$\text{Consumption (\%)} = [\text{One feed consumed (g)} / \text{Total feed consumed (g)}] \times 100\%$$

Data Analysis

The research data were tabulated using Microsoft Office Excel 2007, then processed using the Statistical Analysis System (SAS) for Windows 9.0 program. Followed by the F test, if the results obtained are significantly different, then it is continued with the Honestly Significant Difference Test (Tukey's Test) at the level of =5% and =1%.

Adaptability and Role of Sparrows in Urban and Rural Environments

Location Determination

The location determination was carried out by purposive sampling, namely in the urban environment, four locations representing the City of Bogor (A – D) were selected, while in the rural environment two locations representing the Bogor Regency (E – F) were selected with the following categories:

A. (Taman Kencana) is a city with a large house type (area > 100 m^2), a lot of tree vegetation (> 5 trees), and much grass (area > 40 m^2)
B. (Villa Indah) is a city with a large house type (area >100 m^2), little tree vegetation (3-5 trees), and little grass (10-40 m^2)
C. (Bojong Neros) is a city with a small house type (area < 100 m^2), tree vegetation is present (1-2 trees), and the grass is present (area < 10 m^2)
D. (Empang) is a city with a small house type (area < 100 m^2), tree vegetation is present (1-2 trees), and the grass is absent (0 m^2)
E. (Situ Gede) is a village with a houses that is close (< 7 m distance) from the rice field area
F. (Cikarawang) is a village with houses that are far (> 300 m away) from the rice field area

Observations were made at six locations and 18 observation points (three points per location). Observations of adaptability were carried out in the morning (06.00 – 09.00), while observations of the role of sparrows were carried out in the morning (06.00 – 09.00) and in the afternoon (15.00 – 18.00).

Direct Observation

Direct observation was carried out using the concentration count method. Concentration count is an observation method carried out at certain places to observe the behavior of sparrows and calculate the population or number of these birds.

1. **Habitat.** Habitat can be identified by observing directly at the interview locations and looking for locations that have the potential as nesting, shelter, and roasting sparrows.
2. **Population.** The population is obtained by counting the number of birds at observation points, counting the number of times the birds perch in the area of the house, grass, trees, and rice fields.
3. **Feed.** The observed feeds were the type of feed, the method of obtaining the feed, the time of foraging for the feed, the location where the feed was obtained, and counting the number of times the birds ate at that location.
4. **Problems or damage caused.** The problem or damage caused is known by observing directly at the research site and based on the results of interviews
5. **Temperature and relative humidity.** Temperature and relative humidity at the study site were obtained by measuring uses a thermohygrometer

Interview

Respondents were 18 people, 12 people in urban areas and six people in rural areas. The respondents are house owners, household assistants, bird traders, security guards, farmers, and officers in pest control. The interview method is a free interview that is directly and uses a questionnaire.

Data Analysis

The research data were tabulated using Microsoft Office Excel 2007, then processed with the Statistical Package for the Social Science (SPSS) for Windows 26. Followed by the F test to determine the effect of the response variable on the explanatory variable. If the results obtained are significantly different, then proceed with the Honest Significant

Difference Test (Tukey's Test) at the level of 5% and 1% to determine the effect of location on the sparrow population, T-test to determine the effect of each explanatory variable individually, and Multiple Regression Analysis to determine the regression equation model.

Table 1. Results of testing the ability of individual sparrow to eat on rice grain

	Initial body weight	Final body weight	Average body weight	Average consumption	Feed conversion
	---------- gram ----------				
Average	18.63	16.80	17.71	3.20	1.79
Std. Dev.	1.54	2.27	1.68	0.82	0.40

RESULTS AND DISCUSSION

Sparrow Eating Ability

Testing the ability to eat individual sparrows on rice grain was carried out for seven consecutive days of observation using 15 replications. The test results can be seen in Table 1.

The average weight of the sparrow has decreased due to stress. Environmental conditions cause stress at the test site that are not in accordance with the original environment, namely in the open. The average feed consumption of the sparrows was 1.79 g/10 g of body weight and the average body weight of the sparrows was 17.71 g. The percentage of consumption in individual sparrow testing of the rice grain is 10.12% or 1/10 of its body weight. Ziyadah (2011) stated that the *bondol* bird (*Lonchura* sp.) with a body weight of 10.40 – 11.81 g has a consumption percentage on individual testing of grain that is 20.99 – 25.61% or 1/5 to 1/4 of its body weight. The percentage of consumption of the sparrow (10.12%) is lower than the *bondol* bird (25.61%) because of its larger body weight. Although the daily consumption of the sparrows (3.20 g) was higher than that of the *bondol* bird (2.18 – 3.02 g), sparrows are not considered as a pest in rice cultivation because the group of sparrows in rice fields is smaller than that of the *bondol* bird.

Sundari, (2018) stated that the bird species which causes a lot of losses are *bondol* birds (*Lonchura* sp.). *Bondol* birds, when attacking rice crops, can reach thousands of heads and consume rice grains that are ready for harvest in a short time. *Bondol* bird's attacks can cause rice crop failure because the percentage of losses caused by these birds can reach 50%. Budillah, (2019) stated that the percentage of damage caused by bird attacks ranges from 10 – 50%. Some of the reasons that cause high *bondol* bird attacks are cropping patterns that are not simultaneous and added with the absence of control of the *bondol* bird population.

Sparrow Feed Preferences

Testing individual sparrows' feed preferences for six feeds was carried out for seven consecutive days of observation using 15 replications. The test results can be seen in Table 2.

Table 2. Consumption of sparrow to feed on preference test

Feed	Average consumption	
	(g/10 g of body weight)[a]	(%)
Yellow mealworm	2.5407 ^{aA}	44.28
Millet	1.5873 ^{bB}	27.67
Crickets	0.6967 ^{cC}	12.15
Foxtail millet	0.5793 ^{cdC}	10.10
Rice grain	0.3067 ^{cdC}	5.32
Corn	0.0280 ^{dC}	0.48

[a] Numbers in the column, followed by the same letter, are not significantly different according to the Tukey Test at α=5% (lowercase) and 1% (capital letter).

The most preferred feed by sparrows in a row are yellow mealworm, millet, crickets, foxtail millet, rice grain, and corn. Yellow mealworm are larvae of the beetle *Tenebrio molitor* (L.), Order Coleoptera, and Family Tenebrionidae. Yellow mealworm is the main feed preferred by sparrows and the average consumption is significantly different from the other five feeds, namely millet, crickets, foxtail millet, rice grain, and corn. The use of this mealworm as a feed source because of its high nutritional content, especially in protein and fat with levels of 48 – 56.58% and 25 – 40% (Listiani, 2008).

The next feed that mainly consumed was millet, which was significantly different from the

other five feeds, namely yellow mealworm, crickets, foxtail millet, rice grain, and corn. The most widely used millet as bird feed is white millet (*Pennisetum glaucum*). White millet contains 11.3% protein, 4.28% fat, 11.25% crude protein, 4.83% crude fiber, and total energy of 4397 calories/gram (Ningsih, 2015). Millet is a type of small cereal that was once the staple food of the people of East and Southeast Asia before growing other cereal crops. In Africa, Russia, and other developed countries, millet has been widely used as food for humans. One of the pests on millet plants is birds (Prabowo, 2010).

The third most consumed feed was crickets and the results of the analysis showed that crickets were not significantly different from foxtail millet and rice grain, and it was significantly different from yellow mealworm, millet, and corn. Crickets are insects that belong to the Order Orthoptera, Family Gryllidae. Protein content ranges from 56.02 – 61.58%, so crickets can be used as an alternative protein source food (Napitupulu, 2003). The benefits obtained if crickets are used as bird feed are that they can improve the quality of the sound of birds chirping, increase color brilliance, and increase stamina (Siswoyo *et al.*, 2008).

Foxtail millet is a food that sparrows less favor and the results of the analysis show that foxtail millet is not significantly different from crickets, rice, and corn and is significantly different from yellow mealworm and millet. Nurmala, (2003) stated that foxtail millet is an alternative cereal food crop as a source of energy and protein for millions of people in Asia and Africa. In India, foxtail millet is the second staple food after sorghum, it is also fermented into alcoholic beverages. In the United States, foxtail millet is used as bird feed and other animal feed mixes. A bird is one of the pests that attack foxtail millet (Nurmala, 2003).

Rice grain is a feed that is less favored by sparrows, and the results of the analysis showed in Table 2, that rice grain are consumed at a low rate, although it is not significantly different from crickets, foxtail millet, and corn. Rice grain is significantly different from yellow mealworm and millet. Corn is the least preferred food for sparrows and the results of the analysis show that corn is not significantly different from foxtail millet and rice grain, and significantly different from yellow mealworm, millet, and crickets. The sparrow is a bird that can potentially be a pest on millet and foxtail millet crops. The percentage of sparrow consumption of millet and foxtail millet as cereal crops is higher than that of rice grain and corn. Sparrows can be grouped into grain eater (granivores) and insect eater (insectivores).

The Adaptability of Sparrows in Urban and Rural Environments

Observation of the adaptability of sparrows was carried out six times in each location. In this observation, temperature and relative humidity were also observed, but the results showed that the average temperature and relative humidity were almost the same in each observation location with a slight standard deviation. In rural environments, the temperature is lower, but relative humidity is higher compared to the urban environments. Rural environment is relatively more relaxed and wetter compared to the urban environment. Temperature and relative humidity have no effect on the population of sparrows. The results of observations on temperature and relative humidity can be seen in Table 3.

Table 3. Temperature and relative humidity in the urban and rural area

Observation	Urban		Rural	
	Temp. (°C)	RH (%)	Temp. (°C)	RH (%)
1	27.2	63.4	24.1	77.2
2	27.3	68.7	25.6	67.1
3	26.4	70.9	27.4	77.1
4	26.2	70.5	26.0	71.7
5	26.5	70.5	25.7	78.6
6	25.0	77.0	27.1	74.6
Average	26.43	70.17	25.98	74.38
Std. Dev.	0.83	4.37	1.19	4.32

Observations of sparrow populations were carried out in urban and rural areas. The sparrow population in an urban and rural environment can be seen in Table 4. Based on these observations, the average sparrow in urban areas (A, B, C, and D) compared to rural areas (E and F) is 4 : 7.

Sparrows are more commonly found in rural areas than in urban areas. The interview results showed that the sparrow population in urban areas is less than in rural areas. In urban areas, sparrows can be found with 12 birds per encounter, while in rural areas, sparrows can be found with 20 birds per encounter. Populations of sparrows are primarily found in rural areas because in rural areas there are still many green open lands that can produce feed in the form of seeds and small insects. Open environmental conditions support the fulfillment of feed needs for sparrows compared to urban areas.

The observation locations in urban areas are Taman Kencana (A), Villa Indah Bogor (B), Bojong Neros (C), and Empang (D). The analysis showed that location A was significantly different from the other

three locations, namely B, C, and D. Locations B, C, and D were not significantly different among them. Many sparrows were found in location A, because they quickly adapt to urban environments with large, clean types of houses, and lots of tree and grass vegetation.

Table 4 Population of the sparrow in urban (A-D) and rural (E-F) area

Location	Observation						Average [a]
	1	2	3	4	5	6	
A	32	30	21	12	19	7	20.17 ^{aA}
B	12	8	8	6	7	5	7.67 ^{bB}
C	9	9	10	9	12	3	8.67 ^{bB}
D	5	9	16	10	6	11	9.5 ^{bB}
Average	14.5	14	13.75	9.25	11	6.5	**11.5**
Std Dev	12.01	10.68	5.91	2.5	5.94	3.42	5.83
E	32	33	40	29	27	11	28.67 ^{aA}
F	6	8	13	12	10	14	10.5 ^{bB}
Average	19	20.5	26.5	20.5	18.5	12.5	**19.58**
Std Dev	18.38	17.68	19.09	12.02	12.02	2.12	12.85

[a] Numbers in the average column, followed by the same letter, are not significantly different according to the Tukey Test at α=5% (lowercase) and 1% (capital letter).

Situ Gede (E) and Cikarawang (F) observation locations in rural areas. The analysis show that location E is significantly different from location F. Sparrows are often found in location E, because they are easy to adapt in rural areas with houses close to rice fields. In rural areas, sparrows can be found perching on houses, trees, and rice fields.

The results of the multiple regression analysis of the adaptability of the sparrow in urban and rural environments can be seen in Table 5

Table 5. Results of multiple regression analysis of the adaptability of the sparrow in urban and rural area

Model in Urban	Unstandardized B	Pr > F
(Constan)	– 7.135	0.000
House	1.524	0.000
Tree	– 0.584	0.000
Grass	0.594	0.000
Model in Rural	Unstandardized B	Pr > F
(Constant)	–12.390	0.000
House	1.427	0.000
Tree	0.040	0.000
Rice field	0.944	0.000

In **urban** area, based on the F test (simultaneous), the analysis in an urban environment, obtained significance value is 0.000 < 0.05, meaning that houses, trees, and grass simultaneously or jointly affect the sparrow population in an urban environment. Based on the T-test (partial) the significance value can be seen based on each independent variable. The house variable has a significance value of 0.000 < 0.05, the tree variable is 0.000 < 0.05 and the grass variable is 0.000 < 0.05, so houses, trees, and grass partially affect the sparrow population. The effect of simultaneous R as seen from R^2 square is 0.848 or 84.4%, meaning that houses, trees, and grass strongly influence the population by 84.4% and the remaining 15.6% is influenced by other variables not examined in this study.

The regression equation model obtained in an urban environment is $Y = – 7.135 + 1.524\ X_1 – 0.584\ X_2 + 0.594\ X_3$. The equation can be interpreted that the constanta value – 7.135. The constanta value is negative, meaning that if the house, tree, and grass variables are considered non-existent or equal to zero, the sparrow population variable will decrease. The coefficient of X_1 is the house with a value of 1.524 and the coefficient of X_3 is the grass with a value of 0.594. The variable coefficient is positive, meaning that the effect of the house and the grass variables on the sparrow population is positive or strong. If the house and tree variables increase, the sparrow population will increase in the neighborhood. The coefficient of X_2 is the tree with a value of – 0.584. The variable coefficient is negative, meaning that the effect of the tree variable on the sparrow population is negative or less strong. If the tree variable increases, the sparrow population decreases, because the sparrow can be found in an open environment with tree vegetation that is not dense, few in number, and not shady.

In rural area, based on the F test (simultaneous) the analysis in a rural environment obtained a significance value of 0.000 < 0.05, meaning that houses, trees, and rice fields simultaneously or jointly affect the sparrow population in the rural environment. Based on the T-test (partial) the significance value can be seen based on each independent variable. The house variable has a significance value of 0.000 < 0.05, the tree variable 0.000 > 0.05 and the rice field variable 0.000 < 0.05, so houses, trees and rice fields partially affect the sparrow population. The simultaneous R effect seen from R^2 square is 0.938 or 93.8%, meaning that houses, trees, and rice fields strongly influence the population by 93.8% and the remaining 6.2% is influenced by other variables not examined in this study.

The regression equation model obtained in rural areas is $Y = – 12.390 + 1.427 X_1 + 0.040 X_2 + 0.944 X_3$. The equation can be interpreted that the constanta value – 12.390, the constanta value is negative, meaning that if the house, tree, and rice field are considered non-existent or equal to zero, the sparrow population variable will decrease. The coefficient X_1 is the house with the value of 1.427, the coefficient X_2 is the tree with the value of 0.040, and the coefficient X_3 is the rice field with the value of 0.944. The variable coefficient is positive, meaning that the effect of the variable houses, trees, and rice field on the sparrow population is positive or strong. If the variables of houses, trees, and rice field increase, the sparrow population will increase in the environment.

Based on the analysis obtained variables that affect the population of sparrows in urban and rural environments. The variables that influence the urban area are houses, trees, and grass. Meanwhile, the variables that influence the rural areas are houses, trees, and rice fields. The existence of house is nesting place, resting, and sheltering sparrows, especially in the natural holes of the building. Trees is a place to perch, while grass and the rice fields is a place for sparrows to find food. Sparrows can adapt well to urban and rural environments because of the environment or open areas (trees, grass, and rice fields) and there are houses. In an urban environment there are houses, tree vegetation is not dense, few in number, not shady, and there is grass around the house. In a rural environment there are houses, tree vegetation is not dense, few in number, not shady, and there are rice fields around the house.

The Role of the Sparrow in Urban and Rural Area

Observations on the role of sparrows were carried out in six locations, four locations in urban areas and two locations in rural areas. Observations were made six times in the morning and three times in the morning and evening. Sparrows in urban environments are often found in the grass. Grass, especially on the surface of the soil, is a place for sparrows to find food, to get small insects, grass seeds, and other grass parts. The results of the observations can be seen in Table 6.

Table 6. Number of sparrows perching and feeding on grass in urban and rural areas

Location	Observation					
	1		2		3	
	M	A	M	A	M [a]	A [b]
	(heads)					
A	36	30	39	25	34	27
B	26	23	30	21	24	19
C	24	19	26	20	28	19
D	18	14	21	11	15	13
Average	26	21.5	29	19.25	25.25	19.5
Std. Dev.	7.49	6.76	7.62	5.91	7.97	5.74
E	45	34	44	33	45	35
F	19	22	15	14	21	18
Average	32	28	29.5	23.5	33	26.5
Std. Dev.	18.38	8.49	20.51	13.44	16.97	12.02

The number in the column indicates the number of birds perched in the morning (M) [a] and in the afternoon (A) [b]

Both in urban and rural areas, more sparrows were seen or found in the morning than in the afternoon, because the sparrow more needs for food in the morning after so many hours of fasting. Sparrows are more commonly found in urban areas than in rural areas. In urban areas, public perceptions or responses about sparrows are generally from not disturbing to disturbing. Some consider it unobtrusive because the presence of sparrows adds to the fun and tranquility. Most of the respondents thought and explained that sparrow was disturbing because this bird left dirt (feces), nests, and fallen feathers, and entered the house. Some respondents also thought that the bird could transmit the bird flu virus. To solve this problem, respondents cleaned up bird droppings, nests, and feathers.

Sparrows in urban areas play an important role as residential pests because they are disturbing and cause economic losses, including damage aesthetics, and cause health problems. The losses caused by sparrows are still low when compared to other residential pests (rats and insects). Most of the respondents did not want the presence of sparrows in their settlements. Problems regarding residential pests that arise depend on the level of danger, loss, disturbance, population, and the level of human tolerance for their presence in the residential environment.

Sparrows in rural areas are often found in rice fields. Rice fields as a place for sparrows to find food, especially in rice cultivation, namely rice grains or small insects in the fields. The sparrows that perch in the rice fields are not seen eating the rice grains in the rice fields. Sparrows tend to fly and perch in these areas to rest, roost, and look for other food sources such as small insects in rice fields. Sparrows eat small insects, i.e. ants, grasshoppers, crickets, caterpillars, bugs, beetle, and others; therefore sparrows

considered are not pests on rice crops. The interview results showed that in addition sparrow eating small grains such as grass seeds, rice, millet, barley, and other parts of grass. Sparrows also consumed small insects such as ants, grasshoppers, crickets, caterpillars, and ladybugs. According to BBPOPT, (2019), sparrows and other birds, namely groups of *bondol*, *emprit*, or sparrows, peking *bondol* birds, black *bondol* birds, hajj *bondol* birds, *manyar* birds, in groups or flocks to rice planting areas that are almost harvested. Then these birds eat the rice seeds, until the rice seeds run out in a short time.

Community perceptions or responses about sparrows in rural areas are generally disturbing. Most of the respondents are farmers who think that sparrows are not liked because of their droppings and eat paddy grains in the fields and paddy grain that is being dried in the sun. Sparrows are in the rice fields from planting to harvesting. The damage caused by tree sparrows is not as significant as the damage caused by other birds, such as groups of *emprit* or sparrows, Peking *bondol*, black *bondol*, hajj *bondol*, *manyar* birds, and sparrows. Farmers remain alert to the presence of this sparrow, because usually sparrows attack rice fields along with other groups of birds simultaneously, namely in the morning and afternoon or evening. To overcome this problem, nets, scarecrows, and sounds are installed to protect rice crops and to repel these birds. Some of the respondents were worried about their droppings and nests. The perception of people in rural areas regarding sparrows as pests in rice cultivation is dubious. Based on the interviews, most of the respondents did not know in detail about sparrows. Respondents could not be sure whether it was true that the sparrows that perched on the rice fields eat the rice grains. Sparrows that perch on rice fields are usually together with other groups of *bondol* birds.

CONCLUSION

Feed consumption of the sparrow was 1.79 g/10 g of body weight and the average body weight of the sparrow was 17.71 g. The consumption of of sparrow to grain is 1/10 of its body weight. The types of feed most favored by sparrows in a row are yellow mealworm, millet, crickets, foxtail millet, rice grain, and corn. Sparrows are not pests on rice crops. The presence of the sparrow in urban areas (12 birds/encounter) is less than in rural areas (20 birds/encounter). Both in urban and rural areas, more sparrows were seen or found in the morning than in the afternoon.

Sparrows can adapt well in urban and rural area because of the environment or open areas (trees, grass, and rice fields) and there are houses. The role of the sparrow in urban areas is a residential pest and in rural areas it has the potential as a pest on millet and foxtail millet crops. Sparrows are predators because they eat small insects (ants, grasshoppers, crickets, caterpillars, bugs, beetles, and others). It is necessary to calculate losses due to the presence of sparrows in urban environments. Moreover, research on the level of damage caused by sparrows to millet and foxtail millet commodities.

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