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A STUDY ON MORPHOMETRIC, HAEMATOLOGICAL, AND FEEDING ANALYSIS OF BAYA WEAVER (*PLOCEUS PHILIPPINUS*) FROM PAKISTAN

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ABSTRACT

Baya weaver is found in floodplains of Pakistan and is famous for building retort shaped hanging nests. For this study, 24 samples of baya weaver (twelve from both sexes) were collected from the wild habitat to analyze morphometry, haematology, and gut contents. Morphometric parameters e.g., body weight was measured with the help of a weight balance while body weight, body length, tail length, wingspan, wing length, longest primary feather, tarsus, central toe length, head length with and without bill, bill length, and chest circumference were measured with measuring tape. Feeding analysis was carried out through a study of complete gastrointestinal tracts (GITs). For that purpose, birds were anaesthetized with a combination of ketamine HCL (10 mg/kg) and diazepam (0.2 mg/kg). GITs were removed through dissection and kept in 10% formalin and analyzed in an ornithological lab with the help of dissecting microscopes. About 5 µL blood was taken from the wing vein and stored in the EDTA tube for haematological analysis. The body length (male 18.43±0.58cm, 15.93±0.26cm) and chest circumference (male 12.53±0.05 cm, female 12.00±0.22 cm) of both sexes were significantly different between male and female baya weavers. Both sexes mostly feed on wheat and rice. However, pin red grass (*Saccharum munja*), beetles, moths, sunflower seeds, and plant materials were also recorded in the study. Haematological parameters were recorded for the first time for baya weaver in this study. This study concludes that male baya weaver has a longer body length and chest circumference as compared to female baya weaver. The preferred food of male baya weaver was beetles, while female's preferred food was rice.

Keywords: Baya weaver, Haematology, Feeding, Morphometric parameters

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INTRODUCTION

Baya weaver (*Ploceus philippinus*) is a prominent member of the family Ploceidae, order Passeriformes. It is widely distributed in floodplains of Eastern Pakistan, Vietnam, Southern Nepal, Sri Lanka, Western Indonesia, tropical Africa, and Madagascar (Oschadleus 2018). This bird is also found in India, Bhutan, Bangladesh, Myanmar, Thailand, Laos, Java, and Bali (Craig 2010). They live in colonial areas near wetlands, cultivated areas, grassland, and mangroves (Craig 2010; Leighton 2015).

The 15 cm baya weaver looks like a sparrow (Oschadleus 2018) that has a grey, massive, shot and conical finch-like beak (Asokan *et al.* 2008). The forehead is white, and the outer edges of the wings show white patches. Legs are short, as they are in many other passerines with a long tail (Oschadleus 2018). The breeding male has a blackish bill, a brown-yellow crown, a dark brown mask, a yellow breast and a buff belly (Fig. 1). Non-breeding males and females are dull in colour and look like house sparrows (Fig. 2) (Craig 2010). Males have advertising calls, which help them distinguish themselves from other potentially harmful species (Robson 2020).

Baya Weaver feeds on seeds including rice, millet, wheat, maize, grass, and sunflowers. However, rice made up the vast majority of the feed. It also feeds on insects as well, including grasshoppers, butterflies, flies, caterpillars, termites, spiders, beetle, small snails, and frogs. Baya Weaver rests in nearby areas of its feeding grounds during the mid-day period (Craig 2010).

Morphometry is important to study geographical variation within species, sexual differences, classification, and growth of birds (Töpfer 2018). Some factors such as sex, age, and species of birds cause variation in morphometry. Moreover, changes in size of bird are associated with habitat. For example, wing length is associated with the type of habitat (Telleria and Carlionell 1999). Morphometry is also important in antipredator tactics (Alatalo *et al.* 1984), sexual selection (Hedenström and Møller 1992), and for migration strategies (Marchetti *et al.* 1995).

Haematology is a branch of medicine that deals with the causes, prognosis, treatment, and prevention of blood-related diseases. It is one of the useful tools in diagnosing and treating specific diseases (Newman 2020). Building the standard reference haematological values are of prime interest. As no study has been recorded regarding the haematological parameters in baya weaver. Therefore, the present study was designed to record some morphometric and haematological parameters and gut contents of baya weaver sampled from four districts, including Okara, Bahawalnagar, Sahiwal, and Kasur in Punjab, Pakistan.

Figure 1. Male baya weaver

Figure 2. Female baya weaver

MATERIALS AND METHODS

Sampling Area: Samples were collected from four districts, including Okara, Bahawalnagar, Sahiwal, and Kasur in Punjab, Pakistan. Twenty-four samples of baya weaver (12 per sex) were collected from cultivable fields with the help of local hunters and mesh-types nets from December 2020 to March 2021. The sampling area was semi-dry, with a temperature range of between 15 and 26°C.

Haematological Analysis: About 5 microliters blood was taken from wing vein in an EDTA tube. Then it was carried to the lab for further analysis. The complete blood profile was analyzed in the laboratory on an automatic haematological analyzer (XP100 Sysmex, Kobe, Japan) as described by Aslam *et al.* (2021) and Waheed *et al.* (2021).

Morphometry: After capturing, the birds were anaesthetized with 10 mg/kg of ketamine HCL and diazepam (2 mg/kg). Body weight was recorded in grams using a weight balance (0.005g). The other morphometric parameters (body length, tail length, wingspan, wing length, longest primary feather, tarsus, central toe length, head length with and without bill, bill length, and chest circumference) were recorded in cm by using a measuring tape as described by Waheed *et al.* (2021).

Feed Analysis: The anesthetized birds were dissected to get gastrointestinal tracts (GITs) for feeding preference analysis. Each GIT was stored in 10% formalin for the further analysis. Each stomach was dissected and washed thoroughly to get food contents. Food contents were identified using a dissecting microscope (2-4X, IRMECO) with the aid of descriptions and diagrams available for seed identification (Martin *et al.* 1961).

Statistical Analysis: The data analysis was done using descriptive statistics and t-test (with a 0.05 confidence level) for comparing different parameters of male and female baya weaver with the help of GraphPad Prism (version 9).

RESULTS

Morphometric Analysis: A significant difference was recorded in body length and chest circumference between male and female baya weaver. Male baya weaver had a significantly longer body length and chest circumference. No significant difference was recorded in the rest of the studied parameters (Table 1, Fig. 1).

Haematological Analysis: This study was the first attempt to build standard reference values of haematological parameters for male baya weaver that can used in future studies as reference (Table 2).

Gut contents: The weight of food material and empty gut was non-significant while the total weight of gut was significantly different between both sexes of baya weaver (Table 3).

Table 1. Comparison of biometrics of male and female baya weaver.

Characters	Sex (n= 10 each)	SE	Mean	SD	Range	P-value
Body Weight (g)	Male	1.55	49.27	2.68	46.8 – 53	0.1573^{NS}
	Female	0.45	45.83	0.78	44.9 – 46.8	
Body Length (cm)	Male	0.33	18.43	0.58	17.8 – 19.2	0.0051^{**}
	Female	0.15	15.93	0.26	15.7 – 16.3	
Tail Length (cm)	Male	0.12	4.60	0.22	4.4– 4.9	0.6291^{NS}
	Female	0.09	4.50	0.16	4.3 – 4.7	
Wingspan (cm)	Male	0.55	34.77	0.95	33.7– 36	0.8255^{NS}
	Female	0.43	34.57	0.74	33.9– 35.6	
Wing Length (cm)	Male	0.17	15.77	0.29	15.4-16.1	0.0863^{NS}
	Female	0.19	16.47	0.33	16.1 – 16.9	
Longest Primary Feather (cm)	Male	0.24	10.70	0.41	10.2-11.2	0.2910^{NS}
	Female	0.46	11.47	0.79	10.4 – 11.7	
Tarsus (cm)	Male	0.14	2.87	0.25	2.6-3.2	0.2028^{NS}
	Female	0.07	2.57	0.12	2.4– 2.7	
Central Toe Length (cm)	Male	0.07	2.43	0.12	2.3-2.6	0.1447^{NS}
	Female	0.05	2.23	0.09	2.1 – 2.3	
Head Length without Bill (cm)	Male	0.29	2.93	0.50	2.4-3.6	0.1700^{NS}
	Female	0.05	2.33	0.09	2.2 – 2.4	
Head Length with Bill (cm)	Male	0.48	4.50	0.33	3.6-5.6	0.1814^{NS}
	Female	0.10	3.53	0.08	3.3-3.7	
Bill Length (cm)	Male	0.19	1.57	0.33	1.2-2.0	0.2018^{NS}
	Female	0.05	1.20	0.08	1.1–1.3	
Chest Circumference (cm)	Male	0.03	12.53	0.05	12.5-12.6	0.0270^{*}
	Female	0.12	12.00	0.22	11.8– 12.3	

NS = Non-significant (P>0.05); SD = Standard deviation; SE = Standard error; **= Highly significant difference (P<0.01); *= Significant difference (P<0.01)

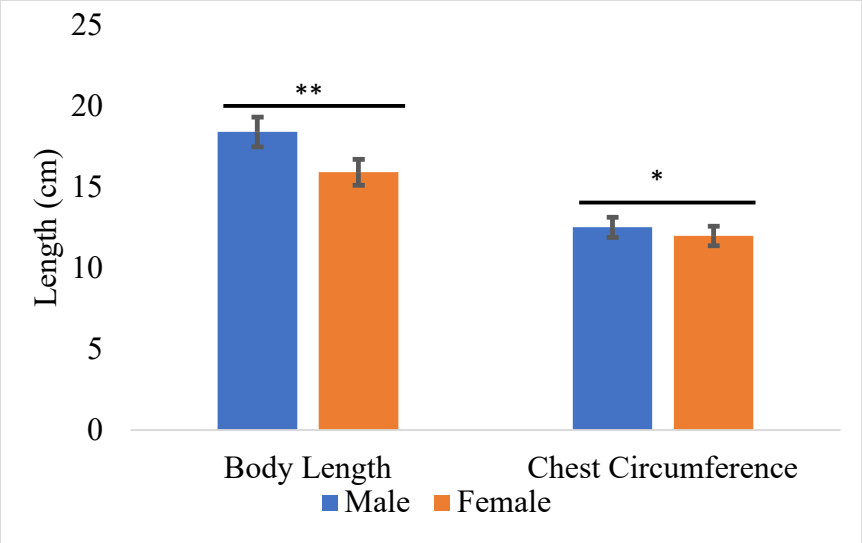

Figure 3. Comparison of body length and chest circumference between male and female baya weaver (* = p <0 .05; ** = p < 0.01)

Table 2. Some Haematological parameters of male baya weaver collected from Punjab, Pakistan.

Variable	SE	Mean ± SD
HGB (g/dl)	3.75	22.33±6.50
WBC (x10^3/µL)	73.55	379.17± 127.39
RBC (x10^6/ µL)	0.97	5.48±1.68
HCT (%)	8.66	71.17±15.00
MCV (FL)	16.96	138.70±29.37
MCH (pg)	6.64	47.47±11.50
MCHC (g/dl)	6.63	35.43±11.48
PLT (x10^3/ µL)	4.21	15.80±7.30
RDW	6.80	75.77±11.77
MPV (fl)	2.28	10.43±3.95
Neutrophils	2.60	84.67±4.50
Lymphocytes	3.31	11.67±5.73
Monocytes	0.47	2.00±0.82
Eosinophils	0.27	1.67±0.47

SD = Standard deviation; SE = Standard error; HGB = hemoglobin; WBC = White Blood Cells; RBC = Red blood cell; HCT = hematocrit; MCV = Mean Corpuscular Volume; MCH = Mean Corpuscular Hemoglobin; MCHC = Mean Corpuscular Hemoglobin Concentration; PLT = Platelets; RDW= Red Cell distribution Width; MPV= Mean Platelet Volume

Table 3. Comparison of gut contents in male and female baya weaver.

Characters	Gender	*N*	Mean	SD	SE	*P*-value
Total weight of gut (g)	Male	12	2.297	0.12	0.07	0.0327*
	Female	12	2.03	0.02	0.01	
Weight of food material (g)	Male	12	0.97	0.23	0.13	0.3230 NS
	Female	12	0.66	0.30	0.18	
Weight of empty gut (g)	Male	12	1.327	0.15	0.09	0.8805NS
	Female	12	1.367	0.32	0.18	

NS = Non-significant (P>0.05); SD = Standard deviation; SE = Standard error; *= Significant difference (P<0.05)

Significant differences were noted in the gut contents of male and female baya weavers, as the gut contents of the male consisted mainly of beetles, while no beetles were reported in the gut contents of the female. In the female baya weaver, rice made up the majority of the gut contents. Wheat, pin red grass, and some unidentified

material were also reported from the gut contents of both sexes. Moths and plant material were present only in the gut contents of the male, while sunflower seeds were reported from the female's gut contents (Table 4).

Table 4: Comparison of gut content between male and female baya weaver.

Type of Food	Weight of gut content (%)		P-value
	Male	Female	
Wheat	12	12	$>0.99^{NS}$
Beetles	34	0	0.0007^{**}
Rice	10	35	0.008^{**}
Moth	6	0	0.03^{*}
Plant material	12	0	0.03^{*}
Pin Red Grass	0	4	0.21^{NS}
Sunflower	0	25	0.009^{**}
Unidentified material	26	24	0.73^{NS}

NS = Non-significant (P>0.05); *= Significant difference (P<0.05); **= Highly significant difference (P<0.01)

DISCUSSION

A common method for identifying and differentiating between the sexes of the same species of bird is morphology. Moreover, it also provides detailed information about the size, age, and status of the birds (Leisler 1972). Measuring tail length, wingspan, and wing length is very important for monitoring migratory patterns and flight of birds, as these measurements are also used in describing the characteristics of flight of birds and birds' energetics (Pilastro *et al.* 1995). Morphometry has also been widely used in the study of various bird characteristics, such as geological separation of the same species and sex differences (Töpfer 2018). A few morphometric parameters such as body length, wingspan, chest circumference, length of longest primary feather, head size, and central toe length were recorded for the first time for baya weaver in this study. However, the remaining morphometric characters were similar to those described by Roberts (1992) and Ali and Ripley (1983).

Baya weaver feeds on wheat, pin red grass, beetles, rice, and sunflower seeds according to this study. They forage on seeds in the form of groups, feeding on plants and harvested fields, sometimes destroying the ripen fields (Sengupta 1974). They like to roost in reed beds near water sources. This species is reliant on both wild grasses such as Guinea grass and crops such as rice for both food and shelter (Kumar and Sharma 2017; Mir *et al.* 1981). Besides insects such as butterflies (Ambedkar 1972), they also prefer to feed on small frogs (George 1973), geckos (Varu 2002), and mollusks. This feed is mostly used to supplement their diet, especially when raising their young (Mukherjee and Saha 1974). Most of their seasonal travels are dictated by the availability of food in the area. A significant difference in insect food material and plant food material between male and female baya weaver was observed in this study and these findings are proved in other studies (Craig 2010; Roberts 1992).

Haematological studies provide information about different aspects of an individual animal, like nutritional and physiological status and pathologies (Cafarchia et al. 2006). This also provides information about the status of immunology (L'Vov et al. 2008), parasitic infection (Plutzer and Tomor 2009), and exposure to toxic substances. These values can be meaningfully interpreted as reference values (Stein et al. 1998). To detect such influences, baseline data on healthy birds must be established for each sex. Any abnormality and disorder in an animal can be easily diagnosed by blood studies (Olafedehan et al. 2010). There is a best relation between blood chemistry and normal body functions, reported by Isaac *et al.* (2013). Any abnormality in the body functions of animals can be examined by laboratory tests of blood cells (Etim et al. 2014). Several toxic chemicals can be detected by blood tests that have lethal effects on the body (Aderemi 2004). Haematology allows the detection of any type of infection in the blood and their effects on related tissues and organs in the bodies of migratory waterfowl because they have to face different situations in different habitats (Vergne et al. 2012).

Different haematological parameters indicate different physiological conditions of birds, e.g., the number of WBCs increases in leukaemia or becomes doubled under stressful conditions. However, a massive increase in the number of WBCs indicates that the bird is definitely suffering from a disease, while in the case of severe acute disease or bone marrow disease, the number of WBCs decreases. Eosinophils increase in parasitic or allergic conditions, while monocytes increase in chronic disease conditions. A low percentage of hematocrit is an indication of anemia, while a higher percentage of hematocrit indicates polycythemia (Sakas 2002).

Some haematological parameters like WBCs, RBCs, HGB, HCT, MCV, MCH, and MCHC were

recorded for the first time for baya weaver from Pakistan. In general, it is considered that the total number of WBCs in Passeriformes is lower as compared to larger bird species (Heatley and Russell 2020). In the present study, total WBCs were $379.17\pm127.39\times10^3/mm^3$ with a neutrophil to lymphocyte ratio of 1:7 while majority of Passeriformes have a low heterophil (functionally equivalent to neutrophil) to lymphocyte ratio (H:L= 2:7) (Li *et al.* 2014). Monocytes and eosinophils were 2% and 1.67%, respectively, similar to most of the Passeriformes as they have less than 10% monocytes and eosinophils (Scanes 2015). PLT, RDW, MPV, neutrophils, lymphocytes, monocytes, and eosinophils were all measured for the first time in this study. This haematological study could be used as a standard reference in future studies.

Conclusion: The present study concluded that the there was no significant difference in the morphometric parameters of male and female baya weaver except for body weight and chest circumference. The major portion of diet consists of beetles in male and rice in female.

Acknowledgments: Not Applicable.

Authors' Contrıbutıon: WZ, MW, and MSK conceived and designed the study. TK, RT and AZ collected the samples. NA, MA and MSS analyzed the data. MWA, AW, and AU interpreted the data and prepared the manuscript. MSK and MW critically revised the manuscript. All the authors approved the final version of manuscript.

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