Dhaka Univ. J. Biol. Sci. **26**(2): 175-187, 2017 (July)

GRASSLAND SPECIALIST BIRDS IN A MANAGED HABITAT OF NORTH-EAST BANGLADESH

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Key words: Grassland birds, Toxic grasses, Community ecology, Bird migration

Abstract

A seven-month spanned study from November, 2015 to May, 2016 was carried out to investigate the status and fluctuation of grassland dependent birds in a *Saccharum-Imperata* patch locating in the northeastern Bangladesh under ownership of a tea-garden; applying line transects with direct observation and diversity index. A total of 2586 individuals of 110 species was observed, grassland specialists constituted 829 (32%) individuals from 39 (35%) species. Only seven non-passerine specialists were observed against 32 passerine specialists whereas 19 being resident and 20 wintering species. Of the grassland specialists, 31% turned out as few, 33% fairly common, 21% common and 15% very common. Insectivores and seed-eaters were dominant feeding guilds over scavengers and omnivores at the site yielding nine categories. Specialists scored the highest value in Shannon's Index for November ($H'_{sp.nov} = 2.81$) followed by a steady decline throughout the study period. The largest winter congregation of Yellow-breasted Bunting and Common Rosefinch in Bangladesh was observed and sighting of Black-headed Bunting was the fourth national record. The site was found to be supporting breeding population of Golden-headed Cisticola so far only known to country's inventory. Despite once supporting about 10 extirpated avian species and still being diverse, adequate information on grasslands is still wanting in Bangladesh.

Introduction

Evolved in parallel with periodic and frequent disturbances, grassland - together with the dominating monocotyledonous Poaceae plants and the coevolved specialist fauna - stands as a complex, distinctive, diverse and globally spread biome[(1-2)]. Grasslands contribute nearly a quarter of the world's vegetation cover from the tropics to the temperate regions, attributed by both natural and anthropogenic tree-growth inhibiting factors and broad range of rainfall intensity, comprising an area of about 52.5 million sq km[(2)].

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Of the four major sub-continental grassland types, *Phragmites-Saccharum-Imperata* hygrophilous formation sways from the Panjab plains to the North-east India as well as through watersheds of the Ganges-Brahmaputra-Meghna delta in south[3]. This sub-tropical grass complex, due to their presence on river alluviums and floodplains and correlation with monsoon, is often referred as 'wet savanna'[3]. Bangladesh, as the existing literature suggest and geographically, betokens this formation, furthermore, having 285 species of wild grass[4-5].

Grasslands in Bangladesh encompass about 5 percent of total forested area and positioned atop in the worst affected habitats' list of the country[6]. Along with the bygone habitats, Bangladesh has also lost many habitat specialist species *i.e.*, dependent on and adapted to grasslands for completing full life cycle or part of it (can be breeding, nesting, feeding, migratory or wintering species)[7]. Of country's 31 extirpated species, 10 of both mammalian and avian species were directly associated with grasslands including all three species of Asian Rhinoceroses, Blackbuck, Blue Bull, Swamp Deer, two species of Florican and Francolin, three species of Parrotbill, one Patridge, White-winged Duck and globally extinct Pink-headed Duck[6,8].

At present, except those of the southern coastal belt and of the northern tributaries of the Jamuna River, grasslands from central regions are completely gone and habitats that reminisce the characteristic north-east Indian grass complex are extremely scattered either disturbed by random grazing practices or pocketed by human settlements, in peril and treated as the least concerned wildlife habitat [6,9]. Despite being pocketed and heavily altered, these habitats still harbor many rare and elusive fauna along with a handful of threatened species like Yellow-breasted Bunting, Bristled Grassbird, Fishing Cat, Indian Hare and Bengal Fox etc.[6, 10-11].

Therefore, to check the declining trend of grassland habitats and dependent specialists, perceiving grassland birds' ecology and biology has become pertinent. However, other than the annotation from Khan (1988), any further literary study on indigenous grassland birds are still lacking in Bangladesh[12].

In this study, objectives are to (1) investigate specialist birds in a grassland patch being under routinized management but similar to north-eastern 'wet-savanna' formation and (2) document their periodicity across the winter; thus to update the shortfall of information on grassland birds of Bangladesh and provide baseline for comparative studies with vegetation and management layouts.

Material and Methods

Comprising an area of 17.59 hectares, the site (24º12′11″ N, 91º51′55″ E) falls under ownership and management of the Kurma Tea Estate located in the north-eastern administrative district of Moulvibazar of Sylhet division. The tea garden is 33 km away from Moulvibazar district and 10 km from the Adampur Reserve Forest northwardly

whereas the Indian States of Tripura and Assam are respectively 3 km on the south and 35 km on the east. Likewise bordering Tripura and Assam, climate of the region is of tropical savanna climate being marked with considerable precipitation due to the south-west monsoon[13-14].

Typical of the north-eastern part of Bangladesh, Ravenna grass *Saccharum ravennae* is the most dominant and the tallest species forming a typical elephant grass set up with dense congregation within the area[5]. Cogon grass *Imperata cylindrica* forms the second sheet layer; as a majority where Ravenna grass is sparse or absent. A GIS-based habitat map was developed to characterize the survey site based on spread and dominance of the grass species (Fig. 1). We divided the study area into six micro-habitats, these include (1) bush-associated area with predominance of *Clerodendrum infortunatum* and *Lantana sp.* (BA), (2) dense tall grass formation with characteristic heavy growth of Ravenna grass (DT), (3) sparse grass along road with sparse Ravenna grass, Cogon grass and other less-dominating grasses (SG), (4) sparse short grass with spread of Cogon grass (SS), (5) grasses along the creek attributed with Ravenna grass, and sedges and their integral association within creek emergence (AC) and (6) crop-associated area with presence of lentils and only creeping grasses (CA). Nomenclature and identification were followed after Ahmed *et al.* (2008 a,b), Siddiqui *et al.* (2008a)[5,15-16]. The dimension of the area, distances, mapping, habitat data attributes were estimated with ArcGIS 10.3.1 and Google Earth Pro. Ground truthing was carried out by Global Positioning System (GPS) navigator Garmin GPSMAP 62S.

A total of six transect lines (T1-T6, each 100 m) was arrayed out randomly over the study site. Distances between lines were kept 100 m as far as a minimum measure in order to keep data independent. Line straddling over different micro-habitats was considered for the micro-habitat over which its most part fell. A maximum width of 20 m on either side of line was set as delimiting belt for each transect[17]. Surveys were conducted for a period of seven months, once in each month from November, 2015 to May, 2016. On average 15 minutes was spent on each transect line in the early morning (0730-0930 hrs) to record observations. Even ratio of count sequence among transects was assured with care. Birds were counted based on direct observation as well as by calls. Species flying overhead were recorded only when those were identifiable. For further confirmation, high-resolution photographs were used as well. Three different sets of categories were assigned to the observed birds: passerines and non-passerines, migrants and residents, grassland generalists and grassland specialists. Siddiqui *et al.* (2008b), Grimmet *et al.* (2011) and IUCN Bangladesh (2015a) were consulted for nomenclature and dependency categorization of generalists and specialists[6,18-19].

Khan (2015) was followed to estimate the relative abundance as very common (VC) 80-100%, common (C) 50 - 79%, fairly common (FC) 20 - 49% and few (F) 10 - 19% which was calculated based on total sighting per survey attempt[20].

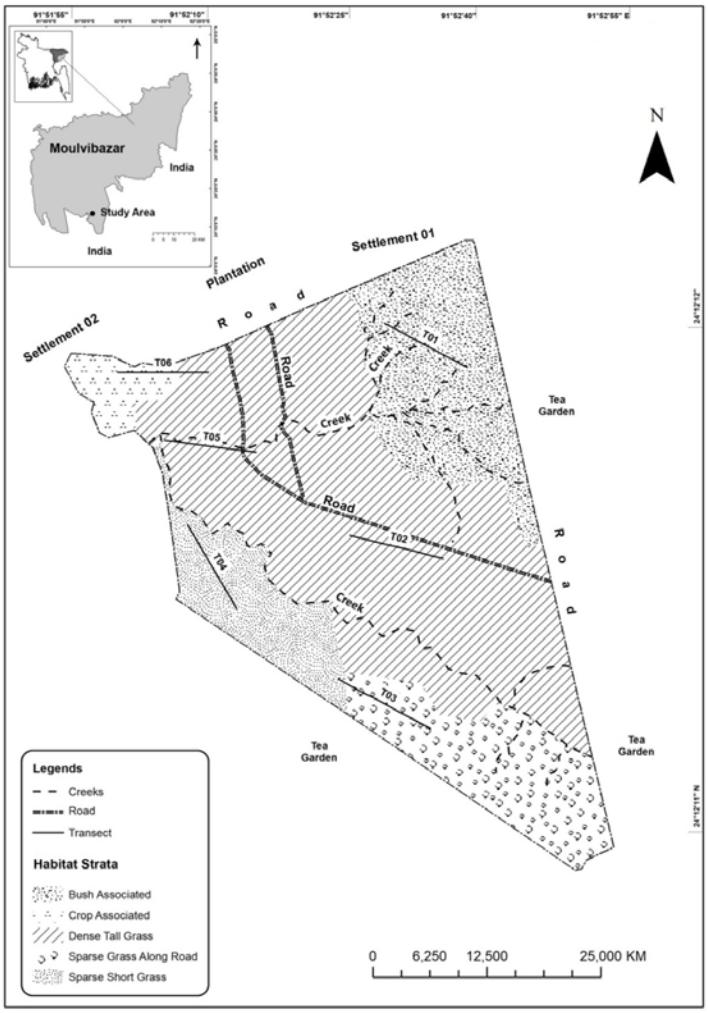


Fig. 1. Map of the study area, micro-habitat stratification and layout of transect lines.

Diversity of avian community against months was probed with Shannon's diversity index (H′) for total, generalist and specialist species[21]. Normality of data was checked using Q-Q plots, Shapiro-Wilk Test and barplots[21]. All statistical analyses were carried out with R 3.3.0 utilizing add-in packages *i.e.,* MASS and biodiversityR.

Results and Discussion

Through seven-month long bird survey, a total of 110 species of birds was skimmed out, of which 39 were categorized as grassland specialists; the rest 71 being generalists (Table 1). Passerine/non-passerine association for generalist species were narrow ($Generalist_{nP}$ = 38 species, $generalist_{P}$ = 33) whereas only seven non-passerine specialist

Table 1. Grassland specialist species observed in the study with their feeding guild, residency, local and threat status ([np]Species, non passerine species; [p]Species, passerine species; M_w, winter migrants; R, residents; LC, least concern; VU, vulnerable; DD, data deficient; VC, very common; C, common; FC, fairly common; F, few).

Family	Species	Feeding guilds	Residency status	Local status	Threat status
Picidae	[np]EURASIAN WRYNECK Jynx *torquilla*	Insectivore	M_w	FC	LC
Upupidae	[np]COMMON HOOPOE *Upupa epops*	Insectivore	R	FC	LC
Coraciidae	[np]INDIAN ROLLER *Coracias benghalensis*	Insectivore	R	C	LC
Turnicidae	[np]BARRED BUTTONQUAIL *Turnix suscitator*	Insectivore	R	F	LC
Accipitridae	[np]BLACK-WINGED KITE *Elanus caeruleus*	Raptor	R	FC	LC
	[np]WESTERN MARSH HARRIER *Circus aeruginosus*	Raptor	M_w	F	LC
	[np]PIED HARRIER *C. melanoleucos*	Raptor	M_w	F	LC
Emberizidae	[p]BLACK-HEADED BUNTING *Emberiza melanocephala*	Granivore	M_w	F	LC
	[p]YELLOW-BREASTED BUNTING *E. aureola*	Granivore	M_w	VC	VU
	[p]LITTLE BUNTING *E. pusilla*	Granivore	M_w	F	LC
	[p]CHESTNUT-EARED BUNTING *E. fucata*	Granivore	Mw	F	LC
Fringillidae	[p]COMMON ROSEFINCH *Carpodacus erythrinus*	Granivore	M_w	FC	LC
Estrildidae	[p]TRICOLOURED MUNIA *Lonchura malacca*	Granivore	R	FC	LC
	[p]CHESTNUT MUNIA *L. atricapilla*	Granivore	R	FC	LC
	[p]SCALY-BREASTED MUNIA *L. punctulata*	Granivore	R	VC	LC
	[p]WHITE-RUMPED MUNIA *L. striata*	Granivore	R	F	LC
	[p]INDIAN SILVERBILL *Euodice malabarica*	Granivore	R	FC	LC
	[p]RED AVADAVAT *Amandava amandava*	Granivore	R	C	LC
Ploceidae	[p]BAYA WEAVER *Ploceus philippinus*	Granivore	R	C	LC

(Contd.)

Family	Species	Feeding guilds	Residency status	Local status	Threat status
Muscicapidae	[P]JERDON'S BUSH CHAT *Saxicola jerdoni*	Insectivore	M_W	FC	DD
	[P]PIED BUSH CHAT *S. caprata*	Insectivore	R	C	LC
	[P]COMMON STONECHAT *S. torquatus*	Insectivore	M_W	VC	LC
	[P]BLUETHROAT *Luscinia svecica*	Insectivore	M_W	FC	LC
	[P]SIBERIAN RUBYTHROAT *Calliope calliope*	Insectivore	M_W	FC	LC
Timaliidae	[P]STRIATED BABBLER *Turdoides earlei*	Omnivore	R	C	LC
	[P]YELLOW-EYED BABBLER *Chrysomma sinense*	Insectivore	M_W	VC	VU
Phylloscopidae	[P]DUSKY WARBLER *Phylloscopus fuscatus*	Insectivore	M_W	F	LC
Acrocephalidae	[P]THICK-BILLED WARBLER *Iduna aedon*	Insectivore	M_W	F	LC
	[P]CLAMOROUS REED WARBLER *Acrocephalus stentoreus*	Insectivore	M_W	FC	LC
Locustellidae	[P]STRIATED GRASSBIRD *Megalurus palustris*	Insectivore	M_W	FC	LC
Cisticolidae	[P]PLAIN PRINIA *Prinia inornata*	Insectivore	R	VC	LC
	[P]GREY-BREASTED PRINIA *P. hodgsonii*	Insectivore	R	C	LC
	[P]GRACEFUL PRINIA *P. gracilis*	Insectivore	R	F	LC
Cisticolidae	[P]GOLDEN-HEADED CISTICOLA *Cisticola exilis*	Insectivore	R	C	LC
	[P]ORIENTAL SKYLARK *Alauda gulgula*	Insectivore	R	F	LC
Alaudidae	[P]GREATER SHORT-TOED LARK *Calandrella brachydachtyla*	Insectivore	M_W	F	LC
	[P]BENGAL BUSH LARK *Mirafra assamica*	Insectivore	R	C	LC
Motacillidae	[P]PADDYFIELD PIPIT *Anthus rufulus*	Insectivore	M_W	VC	LC
	[P]YELLOW WAGTAIL *Motacilla flava*	Insectivore	M_W	FC	LC

species were observed against 32 passerine specialists. Of the 39 specialist species, 6 (15%) were very common, 8 (21%) common, 13 (33%) fairly common and 12 (31%) were few (Table 1).

Change in species richness across micro-habitats over months was found as inflated for December (Table 2). In December, considering microhabitats, dense tall grass (S_{sDT} = 27, n_{sDT} = 123), along the creek (S_{sAC} = 13, n_{sAC} = 26) and sparse grass along road (S_{sSG} = 10, n_{sSG} = 65) exhibited the most diverse congregation of specialist species. However, the generalists exhibited a spike in index in comparison to a steep decline of specialists onset of March to May which was preceded by slash-and-burn treatment on the habitat (Table 2).

Table 2. Month-wise trend of changes in grassland specialist species (S_G, generalist species; S_S, specialist species; n_G, number of generalist individuals; n_S, number of specialist individuals; AC, along the creek; BA, bush associated; DT, dense tall grass; SG, sparse grass along road; SS, sparse short grass; CA, crop associated).

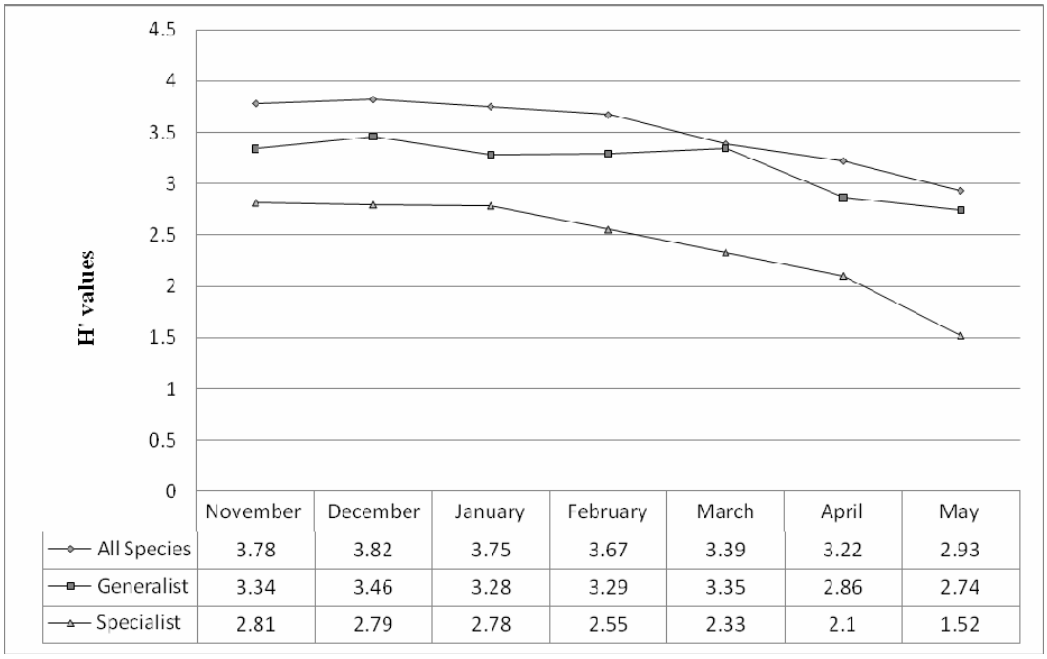
		November	December	January	February	March	April	May
AC	S_G	8	11	15	12	6	4	13
	n_G	35	29	32	35	20	26	18
	S_S	4	13	4	8	4	0	6
	n_S	12	26	18	6	6	8	0
BA	S_G	11	23	19	21	11	8	23
	n_G	83	71	67	53	38	35	25
	S_S	3	7	5	7	4	2	4
	n_S	11	18	21	11	7	10	7
CA	S_G	11	27	25	25	19	12	27
	n_G	91	69	73	80	73	53	46
	S_S	3	9	3	7	2	1	3
	n_S	7	19	23	9	3	11	2
DT	S_G	4	15	14	12	7	9	16
	n_G	47	32	29	43	17	16	28
	S_S	4	27	13	10	11	1	15
	n_S	49	123	77	22	27	13	3
SG	S_G	10	16	14	11	7	10	14
	n_G	39	51	41	31	16	34	26
	S_S	1	10	9	10	2	2	12
	n_S	33	65	37	20	5	1	5
SS	S_G	8	14	13	8	14	9	18
	n_G	58	35	23	40	44	25	40
	S_S	2	9	9	8	1	1	8
	n_S	17	37	17	21	2	9	1

In terms of migratory trend, 33 migrant species were observed ($generalist_{summer.nP}$ = 1, $generalist_{summer.P}$ = 1, $generalist_{winter.nP}$ = 3, $generalist_{winter.P}$ = 8, $specialist_{winter.nP}$ = 3, $specialist_{winter.P}$ = 17); with no summer migrant grassland specialists. A total of 19 resident

grassland specialists were found in the study area ($Specialist_{resident.nP}$ = 4, $Specialist_{resident.P}$ = 15) (Table 1).

Birds sighted from the study area were represented by 2586 individuals (n_{all} = 2586). Of total bird densities, specialist species comprised 32% (n_s = 829); 68% contributed by the generalists (n_g = 1757).

The largest congregation of avian individuals over the seven-month period was December (n_{Dec} = 576) followed by months *viz.* November (n_{Nov} = 482) > January (n_{Jan} = 466) > February (n_{Feb} = 371) > March (n_{Mar} = 359) > April (n_{Apr} = 249) > May (n_{May} = 196). Despite this finding, during November, H′ index for specialist species was the highest. As aforementioned, though inflation in species richness was observed in December – in particular for the microhabitat of dense tall grass, along the creek and sparse grass along road, specialists yielded the highest value in November ($H'_{sp.nov}$ = 2.81) for the study area. Diversity index started lowering as the summer commenced regardless generalists or specialists ($H'_{all.apr}$ = 3.22, $H'_{all.may}$ = 2.93). Comparison of H′ indices for total species diversity, generalist and specialist diversity was shown in Fig. 2.



	November	December	January	February	March	April	May
All Species	3.78	3.82	3.75	3.67	3.39	3.22	2.93
Generalist	3.34	3.46	3.28	3.29	3.35	2.86	2.74
Specialist	2.81	2.79	2.78	2.55	2.33	2.1	1.52

Fig. 2. Shannon's index across months considering all species, generalists and specialists.

Of the generalists, three species of sturnids, two species each from doves and bulbuls appeared to be the most abundant species for all micro-habitats (Fig. 3). In case of specialists, passerines ranked among the most dominated ones in terms of counts of individuals; being led by Scaly-breasted Munia and Yellow-eyed Babbler (Fig. 4).

Species detected during the study period were categorized into nine feeding guilds. All guilds were sighted from each micro-habitat; however, with sharp changes in abundance over the months (Fig. 5). Birds dependent on insects were the most common and the most profuse across the micro-habitats. Seed-eaters followed after the insectivores. Omnivores and scavengers were respectively positioned third and fourth of the feeding guilds. Guild of nectarivore and molluscivore birds ranked as the lowest of nine categories. Considering the specialists, species from four different feeding guilds were observed *i.e.,* insectivore, granivore, raptor and omnivore whereas the first two being the dominant guilds (Table 1).

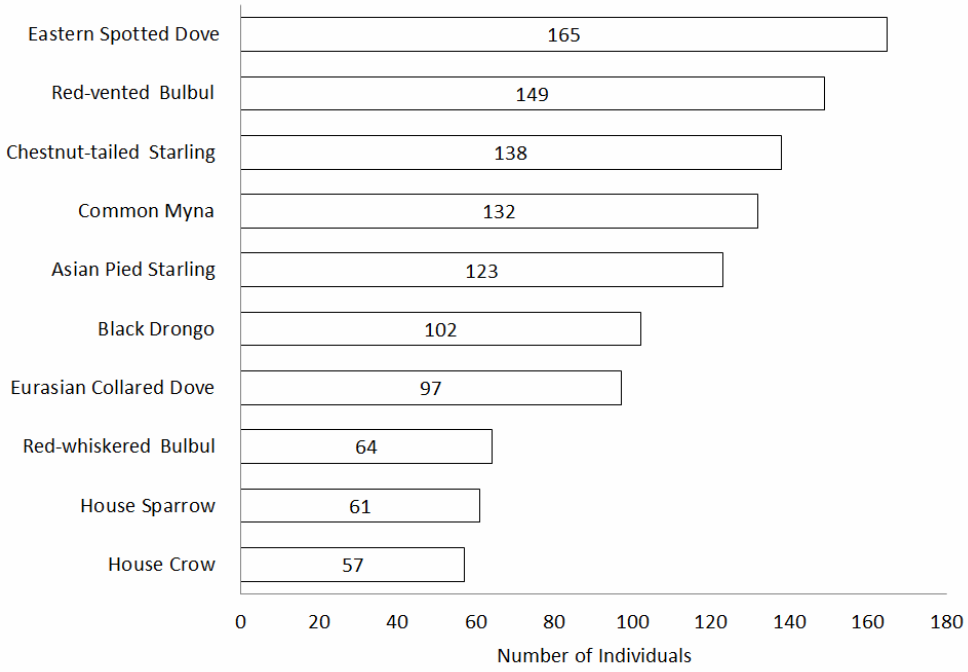


Fig. 3. Grassland generalists (leading ten) in the study area.

The survey presented about 15% of country's total bird species[20]. In general, habitat adapters or generalists were largely dominated (68%) over the area. Of the generalists, Black-naped Oriole *Oriolus chinensis* and Indian Cuckoo *Cuculus micropterus* were the summer migrants. Greater Spotted Eagle (Vulnerable nationally and globally) was the only generalist found as threatened globally and nationally with another species Crested Serpent Eagle *Clanga clanga* as Data Deficient (DD) for the country[6]. It is to be mentioned that Eastern Spotted Dove *Spilopelia chinensis* was the most abundant generalist species; another two seed-eater - Eurasian Collared Dove *Streptopelia decaocto* and House Sparrow *Passer domesticus* also being on the top-ten most abundant generalists' list.

Likewise, insectivores and seed-eaters, regardless generalists or specialists, were the most dominating in the queue of feeding guilds rather than scavengers and omnivores. Together with these observations, presence of 39 specialists - 32% in the total composition, up to half in comparison with Khan (1988) - was pertaining to the specialization of the study site's potentiality to harbor habitat specific fauna[12].

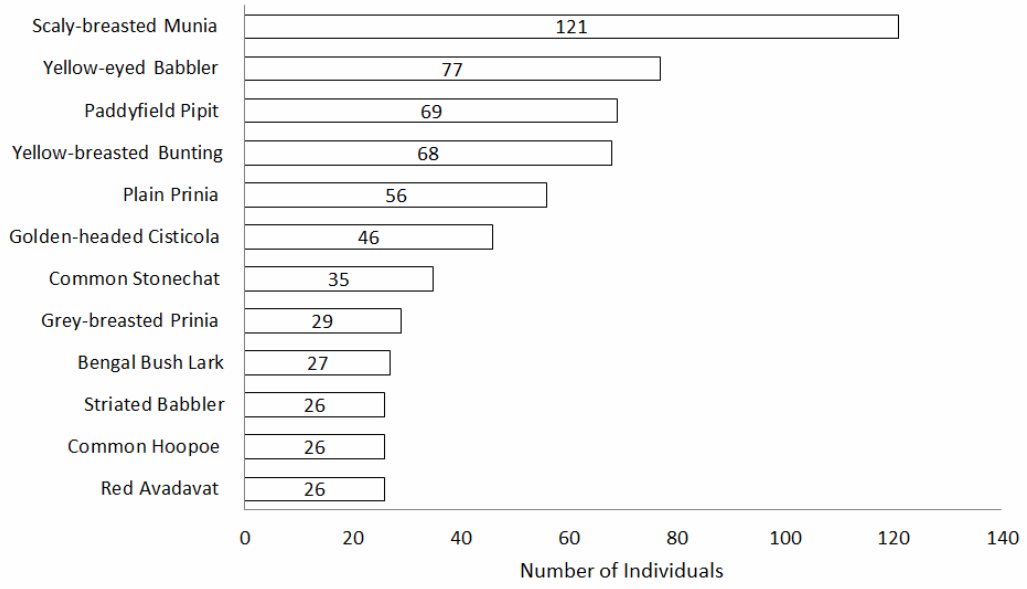


Fig. 4. Grassland specialists (leading ten) in the study area.

Of the resident grassland birds of Bangladesh, all five estrildid finches of Bangladesh were observed; with Scaly-breasted Munia holding the highest density. Other than Scaly-breasted Munia, six other resident species were positioned in the most abundant list of specialists (Fig. 5) which encompassed Golden-headed Cisticola and Red Avadavat both. Of fringillid finches, Common Rosefinch, along with, a resident ploceid (Baya Weaver) and four species of rare winter migrant emberizid specialists were sighted *i.e.,* Black-headed Bunting, Little Bunting, Chestnut-eared Bunting and Yellow-breasted Bunting[6,18-19]. With the latter as Vulnerable (VU) for Bangladesh and Endangered (EN) globally, another nationally VU species (Yellow-eyed Babbler) was also found. During the peak winter *i.e.,* the surveys from November to January yielded 13 and 68 individuals of Common Rosefinch and Yellow-breasted Bunting correspondingly - being the largest congregation in term of single survey attempt[6,10]. Black-headed Bunting (two individuals) was observed from transect at dense tall grass on the month of December, it made the finding as fourth country record for Bangladesh[10,22]. The study also revealed Golden-headed Cisticola and Jerdon's Bushchat. These grassland diminutives are with scattered information in Bangladesh. The latter is still a Data Deficient whereas the patch

is so far holding only known breeding population of the cisticola[6,10,23]. With presence of diverse and countrywide rare seed-eaters and species relying on long elephant grass, raptors specific to grassland were also found *i.e.,* two species of migratory harriers - Pied Harrier and Western Marsh Harrier and a resident grassland kite of Bangladesh - Black-winged Kite.

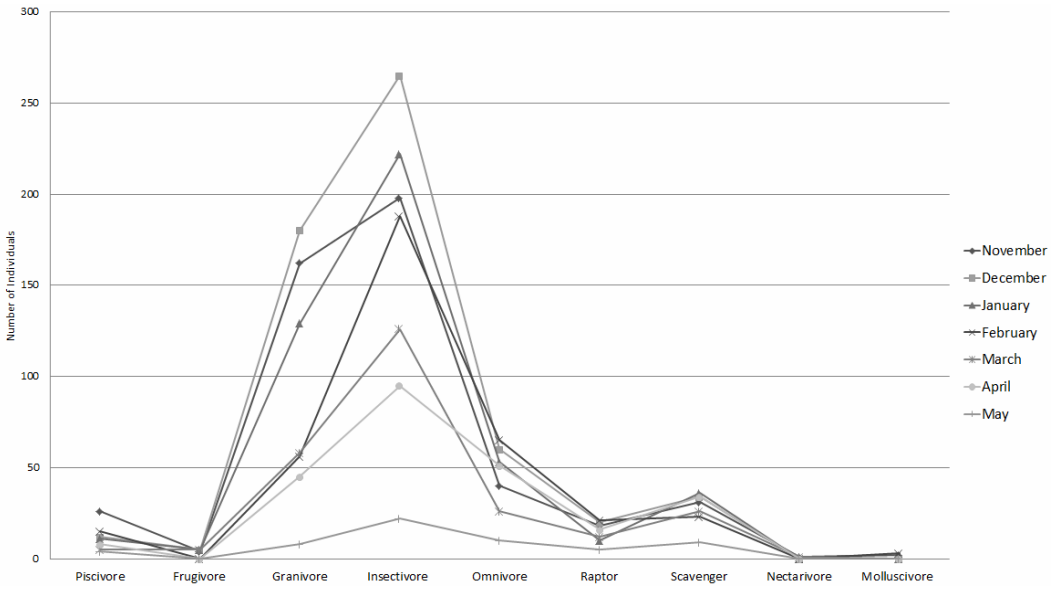


Fig. 5. Different feeding guilds and their variation in abundance over the months.

Native *Saccharum* contributes largely to the total grasslands (0.8 million hectares) of Bangladesh[6]. Moreover, cultivation of sugarcane *S. officinarum* encompasses about 0.16 million hectares throughout the north and north-west districts[5,24]. Ravenna grass is mainly concentrated towards the northeast region having strong presence in almost all of country's 174 tea-gardens, *S. spontaneum* occupies the central region as well as the vast sand bars on the Ganges and the Jamuna[5,25]. Materials for making huts and cottage industries are extracted on yearly basis from the latter two[4,5].

Though enigmatic grassland specialists have gone from Bangladesh, existing grasslands and the *Saccharum* spreads are still of importance for many species, yielding records in regular intervals[11]. Thus, stretches a depiction of exigencies to undertake conservation effort for such habitats; particularly in form of eco-birding for the north-eastern tea-gardens.

Acknowledgements

The authors are thankful to workers and land managers of the Kurma Tea Estate for kindly providing information regarding management practices and for their kind

permission to work on the site. Gratitude is to the Noazesh Knowledge Centre of the WildTeam for supporting with valuable literary works. The Bangladesh Bird Club created sphere of the project under the Munir Ahmed Khan Bird Conservation Fund.

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(Manuscript received on 1 May, 2017; revised on 13 July, 2017)