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RESEARCH ARTICLE

Comparative study of food habits and seasonal variations in the food of adult House Sparrow *Passer domesticus indicus* in some rural and urban areas of Jammu Province.

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Abstract

Comparative study of food habits and seasonal variations in food of adult House Sparrow *Passer domesticus indicus* was done from 2009 to 2013 in some rural and urban areas of Jammu region. The analysis of stomach contents (usually including crop, proventriculus and ventriculus) was done from dead specimens of House Sparrow (47 specimens from rural areas and 20 specimens from urban areas) that were accidentally killed. The prey taxa were identified by means of analyzing various body-parts in the remains of the diets of adult House Sparrow using a dissecting microscope and reference books as followed by Asokan *et al.* (2009 b). The animal matter, plant matter, grit particles, kitchen refuse were separated and weighed with electronic weighing balance. Total food mass in 47 samples of House Sparrows from rural areas was 49.98 gm by weight which again comprised of plant matter (37.27 gm by weight; 74.57 %), insect matter (5.04 gm by weight; 10.08 %), vegetables and kitchen refuse (0.47 gm by weight; 0.94 %), Grit (4.12 gm by weight; 8.25 %) and unidentified matter (3.08 gm by weight; 6.16 %). Of the total insect matter, body parts of insects of order Coleoptera were most frequently found followed by Diptera, Homoptera and Arachnids including larvae, pupae and adult. Plant matter was found varying from 65% (May-July) to 88.40% (August-October). Animal matter was found varying from 5.30% (Nov-Jan) to 17.9% (May-July). Vegetable and kitchen refuse were found varying from 0.70% (Aug-Oct) to 1.10% (Nov-Jan). Grits were found varying from 3.40% (Aug-Oct) to 12.40% (May-July) (12.40%) followed by 9.80% in February-April. Total food mass in 20 samples of House Sparrows from urban areas was 17.68 gm by weight which again comprises of plant matter (11.61 gm by weight; 64.51%), insect matter (1.32 gm by weight; 7.38 %), vegetable and kitchen refuse (2.54 gm by weight; 14.60 %), Grit (1.34 gm by weight; 7.54 %) and unidentified matter (0.86 gm by weight; 5.93 %).

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Introduction:-

House Sparrow, commonly called as Chidi or Gouriya, is among the most common birds of India and has been earlier reported to be prevalent in good numbers in Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Rajasthan, Gujarat, Maharashtra, Orissa and Kerala (Clayton and Cotgreave, 1994). House Sparrow (*Passer domesticus*) is a member of the family Passeridae belonging to order Passeriformes. House Sparrows are usually seen near human habitations e.g. Agricultural land, villages and urban areas. It is primarily a seed eater but requires insects and their larvae in the breeding seasons (Lowther and Clink, 1992). In rural areas, sparrows are specialising on the seeds of cultivated grain crops such as oats, wheat, barley, corn, and maize. The other major food source is the seeds of annual herbs such as grasses (Graminae), rushes (Juncidae), goosefoot (Chenopodium), docks (Polygonaceae) and chickweed (*Stellaria spp.*) (Keil, 1972; Gavett and Wakely, 1986; Wilson *et al.*, 1999). Birds living in built up areas, supplement their diet of natural vegetable matter with a variety of household scraps, such as

bread and peanuts deliberately put out by humans (Summers-Smith, 1988). The present research work was selected to gather first hand information regarding the food and seasonal variations in case of adult House Sparrow as no work has been done in this regard from the Jammu.

Materials and methods:-

Study area:-

Geographically Jammu it is located between 32° 27' and 33° 30" North latitude and 74° 19' and 75° 20" East longitudes. Altitudinally, it extends from 275 m to 410 m above the mean sea level. Predominated native plant species in the study area are *Ficus bengalensis* (Bour), *Fiscus religiosa* (Peepal), *Dalbergia sissoo*, *Mangifera indica*, *Acacia modesta*, *Acacia arabica*, *Zizyphus spp*, *Gravillea robusta* (Pallavi), *Cannabis sativa* (Bhang), *Dedonia viscosa*, Ashoka, Silver Oak, Satpatra, Palm tree, Kanakchampa, Ranimehndi, Jeevapota etc. The samples were collected from rural and urban of Jammu Province. The urban area selected for present study included Janipur, Manda, Bag-e-Bahu and Channi.

The samples were also collected from different rural stations. The samples were collected from Ramban (33.2500°N latitude, 75.2500°E longitude located 150 km from Jammu), Ramnagar (32.82°N latitude and 75.32°E longitude located 22 km from Udhampur city), Billawar (32.6200°N latitude and 75.6200°E longitude 120 km from Jammu), Chenani (33.0219°N latitude and 75.1700°E longitude located about 92 km from Jammu).

Material and methodology:-

The analysis of stomach contents (usually including crop, proventriculus and ventriculus) of dead specimens killed was done in different seasons. The specimens were preserved in Formaldehyde and taken to laboratory where the gut analysis was done. Gut analysis of adults (**Fig. A-G**) was later done to study the food content during the study period. For analysis of gizzard contents, each gizzard was sliced in half with a razor blade, and the contents were flushed into a petridish where they were examined and sorted under a zoom with simple and compound microscope for proper identification. The animal matter, plant matter, grit particles, kitchen refuse were separated and weighed with electronic weighing balance. Unidentified matter was also separated.

Much of the insect matter present in the gut content consisted of fragments of insect cuticle and other debris that was difficult to attribute to particular taxa, however wherever possible, the prey remains were identified to order level.

The prey taxa were identified by means of analyzing various body-parts in the remains of the diets using a dissecting microscope and reference books as followed by Asokan *et al.* (2009 b):

- a) Coleoptera (mandibles, elytra and leg fragments);
- b) Hemiptera (H-shaped tergal plates, mouthparts and leg fragments);
- c) Hymenoptera (mouthparts, leg fragments and wing fragments);
- d) Orthoptera (raptorial leg fragments and mandibles);
- e) Diptera (antennae, eyes and wings);
- f) Odonata (wings, leg fragments and head capsules);
- g) Lepidoptera (wing scales and proboscis), crabs (pedipalps and shell fragments);

The relative abundance of the different insect orders was scored according to the numbers of body parts counted.

To study the variations in the food and feeding methods, the study period was divided into two stages namely breeding period and non breeding period.

Results:-

A total of 67 dead specimens were collected and studied thoroughly. In the rural areas, the gut analysis of 47 specimens (23 females and 24 males) was done from 2009 to 2013 in different seasons. Total food mass in 47 samples of House Sparrows was 49.98 gm by weight which again comprised of plant matter (37.27 gm by weight; 74.57 %), insect matter (5.04 gm by weight; 10.08 %), vegetables and kitchen refuse (0.47 gm by weight; 0.94 %), grit (4.12 gm by weight; 8.25 %) and unidentified matter (3.08 gm by weight; 6.16 %). The plant matter further consisted of cereals seeds (24.72 gm by weight; 66.32 %), non-cereal seeds (8.09 gm by weight; 21.71 %) and plant fragments (4.46 gm by weight; 11.96 %). Among cereals seeds, wheat seeds were found most dominant (8.76 gm by weight; 35.44 % of cereals seeds) followed by rice seeds (6.97 gm by weight; 28.20 %) then by maize seeds (5.93 gm by weight; 23.99 %) and barley seeds (3.05 gm by weight; 12.34%). Non-cereal seeds constituted 21.71 % (8.09

gm) of total plant matter. Among non-cereals seeds, grass and weed seeds were found most dominant (6.84 gm by weight; 84.51 %) followed by *Berberis aristata* seeds (0.50 gm by weight; 6.14 %), *Pyrus pashia* seeds (0.42 gm by weight; 5.20 %), *Ficus palmate* seeds (0.19 gm by weight; 2.40 %) and *Morus alba* seeds (0.15 gm by weight; 1.80 %). Plant fragments constituted (4.46 gm by weight; 11.96 % of total plant matter). Among plant fragments, leaf fragments were found most dominant (1.51 gm by weight; 33.86 %) followed by grass fragments (1.45 gm by weight; 32.51 %), flower parts (0.88 gm by weight; 19.73 %), and anthers (0.63 gm by weight; 14.13 %) (**Table 1**).

Of the total insect matter, body parts of insects of order Coleoptera were most frequently found followed by Diptera, Homoptera and Arachnids including larvae, pupae and adult.

The sparrows were found to show a lot of variations in food during different seasons. Plant matter was found varying from 65% (May-July) to 88.40% (August-October). Animal matter was found varying from 5.30% (Nov-Jan) to 17.9% (May-July). Vegetable and kitchen refuse were found varying from 0.70% (Aug-Oct) to 1.10% (Nov-Jan). Grit content varied from 3.40% (Aug-Oct) to 12.40% (May-July) (12.40%) followed by 9.80% in February-April (**Fig. 1**).

However, in urban areas the analysis of 20 specimens (11 females and 8 males) was also during the study period. The various types of food items found in the samples collected from stomach of are shown in **Table 2**. Total food mass in 20 samples of House Sparrows was 17.68 gm by weight which again comprised of plant matter (11.61 gm by weight; 64.51%), insect matter (1.32 gm by weight; 7.38 %), vegetable and kitchen refuse (2.54 gm by weight; 14.60 %), grit (1.34 gm by weight; 7.54 %) and unidentified matter (0.86 gm by weight; 5.93 %). The plant matter further consisted of cereals seeds (7.20 gm by weight; 62.02% of total plant matter), grass and weed seeds (2.17 gm by weight; 18.69 % of total matter) and plant fragments (2.25 gm by weight; 19.38 % of total plant matter). Among cereal seeds, wheat seeds were found most dominant (2.87 gm by weight; 39.89 % of cereals seeds) followed by rice seed (2.80 gm by weight; 38.85 %), barley (1.08 gm by weight; 15.05 %) and maize seed (0.45 gm by weight; 6.25 %). Among non-cereal seeds, only grass and weed seeds were found. Among plant fragments, grass fragments were found most dominant (1.25 gm by weight; 55.57 %) followed by leaf fragments (0.49 gm by weight; 21.79 %), flower parts (0.28 gm by weight; 12.52 %) and anthers (0.22 gm by weight; 9.90 %).

Of the total animal matter, body parts of insects of order Coleoptera were most frequently found followed by Homoptera, Diptera and Arachnids including larvae, pupae and adult were also observed along with other insect parts.

Table 1:- Weight and percent composition of various food items in the diet of House Sparrow during different seasons of the year from 2009-2013 (N=47 dead sparrows) in rural areas.

F o o d i t e m				W e i g h t (g m)				P e r c e n t a g e			
1	P l a n t m a t t e r			3 7 . 2 7				7 4 . 5 7			
		Cereals seeds			2 4 . 7 2			6 6 . 3 0			
			W h e a t		8 . 7 6				3 5 . 4 4		
			M a i z e		5 . 9 3				2 3 . 9 9		
			B a r l e y		3 . 0 5				1 2 . 3 4		
			R i c e		6 . 9 7				2 8 . 2 0		
		N o n - c e r e a l s e e d s			8 . 0 9			2 1 . 7 1			
			M o r u s a l b a		0 . 1 5				1 . 8 0		
			F i c u s p a l m a t a		0 . 1 9				2 . 4 0		
			Grass and weed seeds		6 . 8 4				8 4 . 5 1		
			P y r u s p a s h i a		0 . 4 2				5 . 2 0		
			B e r b e r i s a r t i s t a		0 . 5 0				6 . 1 4		
		P l a n t f r a g m e n t s			4 . 4 6			1 1 . 9 6			
			A n t h e r s		0 . 6 3				1 4 . 1 3		
			Flower parts		0 . 8 8				1 9 . 7 3		
			Grass fragments		1 . 4 5				3 2 . 5 1		
		Leaf fragments		1 . 5 1				3 3 . 8 6			
2	Insect matter (Insects and arachnids including larvae, pupae and adult)			5 . 0 4				1 0 . 0 8			
3	V e g e t a b l e a n d k i t c h e n r e f u g e			0 . 4 7				0 . 9 4			
4	G s r i t			4 . 1 2				8 . 2 5			
5	U n i d e n t i f i e d m a t t e r			3 . 0 8				6 . 1 6			
T o t a l				4 9 . 9 8				1 0 0			

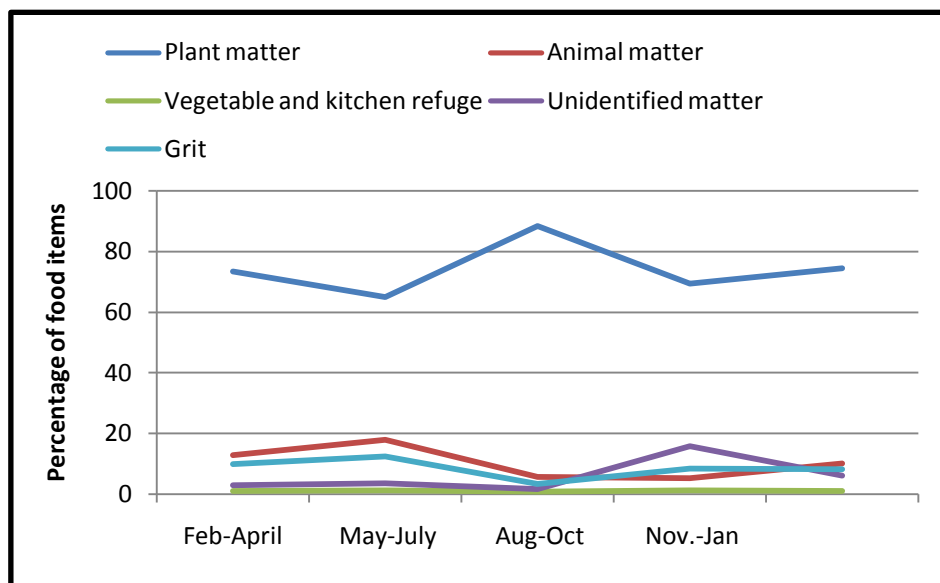
Fig 1:- Seasonal variations in diet of House Sparrow diet in rural areas (N=47 specimen)**Fig.A:-** A accidentally killed specimen of male House Sparrow**Fig.B:-** Dissected specimen of adult male of House Sparrow**Fig.C:-** Dissected alimentary canal of adult male of House Sparrow



Fig.D:- Stomach of adult male of House Sparrow



Fig.E:- Plant matter, insect matter, egg shell and grit particles from stomach of adult male of House Sparrow



Fig.F:- Slide showing body parts of insect (leg) in stomach content



Fig. G:- Slide showing body parts of insect (antenna) in stomach content

Discussions:-

In the present study, diet of adult House Sparrows in rural areas was found to be comprised of 74.57 % plant matter, 10.08 % insect matter, 0.94 % vegetables and kitchen refuse, 8.25 % grit and 6.16 % unidentified matter (N=47 samples) (**Table 1**). Plant matter was found maximum during August-October (88.40%) while insect matter was found maximum during May-July (17.90%) and February-April (12.80%). This may be because the breeding period of House Sparrow starts from March onwards and it takes more insect matter during breeding period. The non-breeding period diet is dominated by vegetable and plant matters. Vegetable and kitchen refuse were found maximum during November-January (1.11%). Grits were found maximum during May-July (12.40%) followed by 9.80% in February-April (**Fig. 1**). The grit particles aid in digestion of insect matter. Hence grit particles are found more during breeding seasons. In urban areas, the diet was found to be comprised of 64.51 % plant matter, 7.38 % insect matter, 14.60 % vegetables and kitchen refuse, 7.54 % grit and 5.93% unidentified matter (N=20 samples) (**Table 2**). Hammer (1948) analysed gut of 2657 sparrows collected from various parts of Denmark from 1941 to 1944 and found that grains, principally oats, barley, and wheat (and, to a lesser extent, rye), were again the most common food items and were taken throughout the year. In the present study, grains of cereal seeds like wheat,

maize, barley and rice were found to be dominant. Weed seeds were again most prominent in the fall and early winter diet (September–December). In present study, cereal seeds, grass and weed seeds were found dominant during May-July and Aug-October both in rural and urban areas. Hammer (1948) reported that insect items primarily beetles; caterpillars (Lepidoptera); larvae, pupae, and newly emerged adult flies (Diptera) and aphids (Homoptera) were most prominent during the breeding season (April–August). She also reported that there were no differences in the diet based on either sex or age of the sparrows. Moreover, she noticed that there were dietary differences among the sites from which the specimens were collected, including the presence of such items as molluscs and crustaceans at locations where sparrows could feed on beaches (e.g. Vorso Island). In present study, body parts of insects of order Coleoptera were most frequently found followed by Diptera, Homoptera and Arachnids including larvae, pupae and adult in rural areas whereas in urban areas, body parts of the insects of the order Coleoptera were dominant followed by order Homoptera. Larval, pupal and adult forms of order Diptera and Arachnida were also recorded in the diet of House Sparrow in urban areas.

Kalmbach (1940) reported on the stomach contents of 4848 adult sparrows found that vegetable material (Cereal grains and grain-based animal feeds) comprised almost 97% of the annual diet with the percentage of items in this category falling below 60% only in the month of October, weed and grass seeds were prominent in the autumn and early winter (September–December), peaking in October with 41% of the identified items and animal food, mostly beetles (Coleoptera), occurred in the diet primarily during the breeding season (March–August), peaking in May at about 10%. In present study, insect matter (mostly insects and arachnids) was also found maximum during May-July (17.90 %) and February-April (12.80 %) in rural areas which coincided with the breeding seasons of House Sparrow. Ion (1992) analysed and examined stomach contents of 394 sparrows collected in all seasons of the year at three rural agricultural locations in Romania and reported that the diet consisted of 72% vegetable items (wheat, sunflower, maize, Panicum, and weed seeds), 28% insect material (beetles, flies, and lepidopteran larvae). Insect material was prominent during the spring (39% of items) and summer (68%). Sanchez-Aguado (1986) (seen by Anderson, 2006) reported that weed seeds and cereals comprised 95.4 % and 97.1 % by mass of the diet of adult sparrows in winter and spring, respectively, with wheat (82.2 % in winter and 95.7 % in spring) being the single most important item. Insects, primarily Coleopterans in winter and Homoptera, Coleoptera and Diptera in spring made up the remainder of the diet. In present study, frequency of Coleopterans was found maximum during February-April and May-July while Homopterans were found maximum during August-October and November-January. Saini and Dhindsa (1991) reported that cereal grains made up 83.6 % by mass of the diet of 96 adult sparrows collected throughout the year at farms of Punjab Agricultural University. Wheat (38.8 %) and pearl millet (29.9 %) were the predominant cereals, and rice (7.7 %) and maize (7.2 %) made up the remainder. Weed seeds comprised 6.2 % of the diet, whereas insects and other insect material made up only 6.1 %. Rana and Idris (1987) analysed the stomach contents of 510 sparrows collected throughout the year in an arid region near Jodhpur. Cereal grains (particularly wheat, pearl millet, and barley) were again prominent in the diet, with insects and leguminous seeds being most numerous in the period from July to November. In present study, differences were observed in diet of House Sparrow in rural and urban areas. In rural areas, seeds of plants like *Morus alba*, *Ficus carica*, *Berberis aristata*, *Pyrus pashia* were found which were not found in diet of House Sparrow in urban areas. The cereal seeds were found more (49.46 %) in diet of House Sparrow in rural areas than diet of House Sparrow in urban areas (41.10 %). This may be because of lack of availability of cereals grains in the urban areas. The insect matter was also found less in diet of House Sparrow inhabiting urban areas (7.38 %) than diet of House Sparrow in rural areas (10.08 %). This may be because of lack of vegetation and insects in urban areas. Vegetable and kitchen refuse were found more in diet of House Sparrow living in urban areas (14.60 %) than the diet of House Sparrow (0.94 %) inhabiting rural areas.

Anderson (2006) reported that grit is a prominent component in the diets of both adult and nestling sparrows. In present study, grit constituted 8.25 % of mass of gut content of House Sparrow in rural areas (N=47) and in House Sparrow residing in urban areas; grit comprised 7.54 % of mass of gut contents. Saini and Dhindsa (1991) in India reported that grit made up an average of 21% of the mass of the gut contents and was high in every month except February (4%), when the sparrows were feeding heavily on the milk stage of wheat. In the present study, the grit content was found maximum during May-July (12.40 %) in urban areas and during March-April (9.80 %) in rural areas which also corresponded to the breeding seasons of House Sparrow, during which the insect proportion in the diet was found to be increased in order to meet the increasing energy demands during the breeding season. Moreover, increased grit content helped in the mechanical breakdown of the food in the ventriculus. This viewpoint is in consonance with that of Keil (1972), Gionfriddo and Best (1995) and Anderson (2006). In present study, egg shell was also found in the gut content of House Sparrow (**Fig. E**). The probable reason for the presence of egg shell

in the gut contents might be that it serves as an important dietary source of Calcium (Ca). Similar findings were put forth by Anderson (2006). However, Pinowska (1975) reported that the amount of grit in the stomachs of female sparrows at various stages of the breeding cycle in Poland tended to parallel the proportion of insects in the stomachs.

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