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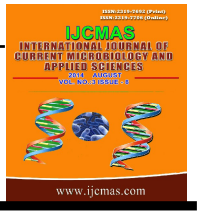

Original Research Article

Dietary Habits of the Barn Owl (*Tyto alba*) in an Agricultural Farmland of Faisalabad Pakistan

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Keywords

Barn Owl (Tyto alba), *Ficus bengalensis, Terminalia arjuna, Salmalia malabarica and Dalbergia sissoo*

A B S T R A C T

This paper portrays information on the dietary habits of the barn owl (*Tyto alba*) of an agricultural roost in Faisalabad, Pakistan. The barn owl inhabits the old and tall trees viz. *Ficus bengalensis*, *Terminalia arjuna*, *Salmalia malabarica* and *Dalbergia sissoo*, exhibited an enriched faunal diversity comprising small mammals, insects and small birds. Of a total 1772 small mammals analysed from the scats (±20.48 SE), *Suncus murinus* and *Gollunda elliotti* remained the highest as owl's dietary proportions (407) and (359), whereas, *Nesokia indica* was the least predated on food item, while for 873 insects identified (±11.70 SE), order *Coleoptera* remained the most frequently consumed food, and that of *Noctuidae* (33) was the minimally depredated insect order. For birds, of the 170 (±4.79 SE) samples detected among the pellets, *Passer domesticus* and *Psittacula krameri* were the most depredated ones, while the *Sturnus vulgaris* was the least consumed bird species. Due to owl's clear vision during the night, it preferred to consume a variety of rodents inhabiting the crops. It can, therefore, serve as a useful biological bird of prey. Evidently, to avert indiscriminate use of toxicants for managing the rodents in the economically important crops in Pakistan, a prolonged and regular use of the barn owl would ensure a substantial management of small mammals, for better growth of economically important crops and their management.

Introduction

The barn owl (*Tyto alba*) belongs to the order *Strigiformes* and family *Tytonidae* (Scopoli) inhabits all the continents, except that of Antarctica, among the grasslands, ruins in the agricultural fields, old and tall trees and pastures (Konig & Weick, 2008). It is mainly cosmopolitan and as such, occurs in fairly good proportions among the agricultural stations and feeding lots, preying on small mammals, insects, few small reptiles and birds (Sibley & Monroe, 1990; Taylor, 1994; Tores *et al*. 2005). Analysis of owl pellets has long been used for the detection of small mammals, birds and insects (Massoia, 1983; Torre *et al*. 2004). As an efficient and potential biological predator, its importance to feed on a wide variety of small mammals (as major vertebrate pests) is economically important along with the conservation status (Cayford, 1992).

In Pakistan, the barn owl inhabits a wide range of habitats viz. the Indus plain, ruins of canal rest houses along side irrigation canals, old and tall trees and relatively undisturbed abandoned buildings and farmsteads (Roberts, 1991). Food contents consumed by this owl have been analysed throughout the temperate region, but information in the neo-tropics has remained relatively limited (Platt *et al*. 2009). An important aspect of the barn owl is the presence of retinal rods in large numbers, enabling it to visualize clearly in the dark than in the sunlight, due to the breakdown of a photosensitive pigment, the rhodopsin to leash the daytime vision (Warrant, 2004; Orlowski *et al*. 2012).

Analysis of the barn owl pellets has provided with useful information regarding its dietary habits, that is, the frequency of consumption of prey items from its roosting site of a specific habitat (Martin, 2009; Teta *et al*. 2006).

The barn owl consumes its food in the manner to void the undigested parts through regurgitation in large pellets on the ground (Goodman *et al*. 1993). According to Paspali *et al*. (2013), significant seasonal variations in the diet of the barn owl (*Tyto alba*) were exhibited with a lower proportion of *Suncus murinus,* although formed a part of its diet regularly throughout the year. Seasonal and climatic changes have largely affected the dietary habits of the barn owl, and as reported by Hassan *et al*. (2007) during a study conducted in six districts of Central Punjab, Pakistan, comprised 2360 regurgitated barn owl pellets, it was evident that of the occurrence of small mammals, house shrew (*Suncus murinus*), remained a predominant prey species (78%) during winter, and (27%) in summer, while insects, unidentified materials and small birds were the remnants of other foods consumed by the barn owl. In another similar study on the feeding habits of the barn owl in South Australia reported that the owls intermittently predated on a variety of rodents in the plague hit habitats and as such, played a significant role in lowering their populations and decrease the incidence of the disease (Morton & Martin, 1979). Widespread occurrence of rodents in the oil palm plantations in Malaysia were largely controlled by the introduction of barn owls, whereas, their pellet analysis showed (75%) of the house rat, (15%) of insects and (7.7%) of the unidentified remnants (Puan *et al*. 2011). Significant variations were recorded in the dietary habits of the barn owl, ranging from small to large rodents, with a good proportion of insects among the cultivated crops in Madagascar (Rasoma and Goodman, 2007), while findings of Magrini & Facure (2008) point out to the occurrence of house rats, shrews, house mouse and cotton rats in varying proportions among the regurgitated barn owl pellets of the barn owl.

The owl was also considered as a key factor in reducing the incidence of hantavirus, largely transmitted by the rodents to humans and livestock. Feeding habits of barn owls influenced by sufficiently large population fluctuations of the common and water voles appeared to be more specialist in selection of food items, and also indicating a highly complex correlation among common and water voles with forest rodents, predicting its predilection to consume small mammals in abundance than other preys while establishing a permanent roost in the woodlands (Bernard *et al*. 2010).

For the present studies, it was hypothesized that using the barn owl populations closer to the agricultural roost would largely inhibit frequency of occurrence of small mammals as non-random prey species among

significant agricultural crops, and to enhance the numbers of barn owl to reduce the prevalent and depredatory impacts of small mammals, for better crop quality and production.

Materials and Methods

Study area

Observations on determining the food habits of the garn owl (*Tyto alba*) were conducted for a period of four months (October, 2011 through January, 2012) in an agricultural farmland of Faisalabad, Pakistan with latitude 31°25 north and longitude 73°04, of Central Punjab. Mainly this region is characterized by fairly dry and humid hot summers (42±5°C; May through August), fall season (September through November), and exceptionally cold winters (2±5°C; December through February). Main crops of this region comprise wheat, maize, rice, fodders, sugarcane, sorghum and millet, while popular fruit orchards are citrus, dates, guava, mango and mulberry. The entire region is canal irrigated and three irrigation canals viz. Jhang branch, Gogera branch and Rakh branch, along with well developed water tributaries irrigate various agricultural croplands.

The roost

For present studies, an agricultural roost was selected to assess the barn owl feeding patterns on nearby crops. This roost largely comprised four tree species viz. *Salmalia malabarica, Ficus bengalensis, Dalbergia sissoo and Terminalia arjuna*. In all, eight (n=8) trees of the four species existed, which served as the roost of the barn owl. Alongside, a fairly large animal shed of the Faculty of Animal Husbandry was also present to house several cattle for dairy purposes.

Sampling of pellets

The barn owl pellets were surveyed and collated from the underneath the four trees in variable numbers throughout the studies (October through January). Collection was done on daily basis in the evening (5:00 to 8:00) visitations assessing them as solid. The cut off pellets were not included in the samples. They were carefully numerically numbered with the date and name of the tree, placed in polyethylene bags and brought to the department laboratory for further analyses the next morning. Each pellet before being dissected was electronically weighed, and length was measured using standard vernier calipers. Pellets were cut loose with sharp forceps and contents were checked for small mammals, birds and insects. The dissected barn owl pellets were critically examined and materials identified were designated as small mammals, birds and insects, as predominant prey items. All the identified food items were compared and contrasted with available reference materials (scats) for various rodent species, mainly on the basis of their dentition and skull patterns (Torre *et al*. 2004). Analysis was accomplished symmetrically after the pellets were collated for the four months.

Statistical analysis

A quantified record was maintained for all the pellets using statistical designs two analysis of variance (ANOVA) to ascertain the monthly variations of barn owl pellets in the study sites and their predilection for specific food items, as determined from their pellet analysis. Species richness estimation regarding the relative population abundance of prey items was calculated by curvilinear models (Clarke & Bunck, 1991; Torre, 2001) to explain the results meaningfully.

Results and Discussion

Studies on dietary habits of the barn owl (*Tyto alba*) were conducted for a period of four months (October, 2011 through January, 2012) in an agricultural roosts of Faisalabad, Pakistan. In all, (1603) small mammals, (197) birds and (1071) insects (± 152.0 SE) were recorded to occur among the (528) collated barn owl pellets from four (n=4) trees viz. *Terminalia arjuna*, *Ficus bengalensis*, *Terminalia arjuna* and *Dalbergia sissoo* (Table 1). Considering the species-wise distribution of small mammals among the collated barn owl pellets, it was apparent that, *Suncus murinus* happened to be the most frequently consumed small mammal (407), while the *Nesokia indica* remained to be the least (20) depredated rodent among the pellets (Table 2). Regarding the occurrence of various birds' heads in the pellets of the barn owl, it was evident that, house sparrow (*Passer domesticus*) and rose-ringed parakeet (*Psittacula krameri*) were relatively high (70) and (56), while traces of other birds were not significant (Table 3), while of the insect orders, *Coleoptera* was most predominant, followed almost comparably by the *Diptera* and *Homoptera* (109) and (121), respectively (Table 4). To know about the frequency of occurrence of small mammals, birds and insects with respect to existing trees for the garn owl pellets, *Dalbergia sissoo* had maximum numbers (809), followed by *Terminalia arjuna* (666), *Salmalia malabarica* (604) and *Ficus bengalensis* (595). Incidence of small mammals remained fairly high for all four trees, overwhelmingly on *D. sissoo* (454), while on *S. malabarica*, *T. arjuna* and *F. bengalensis*, were comparable (Fig 1), while of the monthly distribution of various preys for four species, showed a maximum of small mammals being depredated during the study period, and the least were the birds, again re-emphasizing on the predilection of the barn owl for various rodents (Fig 2). A comparison for the species of small mammals indicated that, *Suncus murinus, Gollunda ellioti* and *Mus musculus* were the most frequently depredated ones, and that of *Nesokia indica* was the least. Of the birds, *Passer domesticus* and *Sturnus vulgaris* ranged between maximum and minimum, while for the insects, order *Coleoptera* was invariably highest and that of *noctuid* was lowest (Fig 3).

Present studies were conducted in an established agricultural roost of the barn owl (*Tyto alba*), comprising *Dalbergia sissoo, Salmalia malabarica, Ficus bengalensis* and *Terminalia arjuna*. Of the overall collated barn owl pellets from the roost, overall richness of frequency of percentage for small mammals, insects and birds was (60.0%) for varied small mammals, (32.70) for insect fauna and for small birds (7.37), which indicated the predominance for small mammals, and these findings also corresponded to (Ali, 1998; Castaneda *et al*. 2004), who also reported more or less similar results. Significantly, the size of the barn owl pellets was also variable, but sufficiently large to include the scats of variable small mammals, insects and small sized birds. Pellet analysis also indicated a relatively high richness of the dietary habits in each sample for the barn owl, therefore, rendering it to be the cosmopolitan bird of prey (Taylor, 1994; Travaini *et al*. 1997; Charter *et al*. 2007).

Regarding the rodent composition in its diet, *Suncus murius* was found to be most comprehensively depredated food item, while *Gollunda elliotti* was the next consumed food item. Of the others, the frequency of occurrence widely varied and *Nesokia indica* was the least preferred small mammal.

Table.1 Month wise Distribution of Small Mammals, Birds and Insects in the Owls Pallets Collected from Different Trees

SPECIES	Oct-2011	Nov-2011	Dec-2011	Jan-2012	Total	±SE	P-Value
Small Mammals	572	477	326	228	1603	152.50	0.3712
Birds	88	70	21	18	197		
Insects	401	309	127	37	874		
Total	1061	856	474	283	2674		

Table.2 Distribution of Small Mammals in the Owls Pellets Collected from Different Trees

Small mammals	Oct-2011	Nov-2011	Dec-2011	Jan-2012	Total	± SE	P-Value
Mus musculus	132	77	50	53	312	20.480	0.2457
Suncus murinus	161	128	71	47	407		
Gollunda ellioti	112	119	68	60	359		
Rattus rattus	53	98	79	39	269		
Mus booduga	54	23	20	14	270		
Bandicota bengalensis	48	10	10	4	72		
Rattus norvegicus	10	3	16	7	36		
Nesokia indica	12	0	8	0	20		
Tatera indica	0	19	4	4	27		
Total	582	477	326	228	1772		

Table.3 Distribution of Birds in the Owls Pellets Collected from Different Trees

Birds	Oct-2011	Nov-2011	Dec-2011	Jan-2012	Total	± SE	P-Value
Psittacula krameri	29	16	7	4	56	4.7929	0.026
Cyanocitta cristatta	8	16	7	0	31		
Sturnus vulgaris	9	0	0	4	13		
Passer domesticus	28	30	7	5	70		
Corvus splednens	14	8	0	5	27		
Total	88	70	21	18	197		

Table.4 Occurrence of Insects in the Owls Pellets Collected from Different Trees

Insects	Oct-2011	Nov-2011	Dec-2011	Jan-2012	Total	±SE	P-Value
Noctuidae	16	8	5	4	33	11.766	0.0062
Diptera	40	50	15	4	109		
Homeptera	64	43	7	7	121		
Isoptera	36	22	12	4	74		
Diplura	30	19	5	3	57		
Coleoptera	19	27	14	4	64		
Coleoptera	108	122	66	5	301		
Hymenoptera	47	14	3	5	69		
Protura	41	4	0	0	45		
Total	401	309	127	36	873		

Table.5 Tree species distribution of the preys in the barn owl pellets as recorded in the study sites of the roost

	Oct-2011	Nov-2011	Dec-2011	Jan-2012	Total	± SE	P-Value
Dalbergia sissoo							
Small Mammals	170	133	83	68	454	38.447	0,1937
Birds	50	29	8	9	96		
Insects	126	80	38	15	259		
Total	346	242	129	92	809		
Salmalia malabarica							
Small Mammals	126	123	75	61	385	37.782	0.5171
Birds	16	10	5	5	36		
Insects	84	65	27	7	183		
Total	226	198	107	73	604		
Terminalia arjuna							
Small Mammals	155	106	79	56	396	41.959	0.4097
Birds	13	12	6	4	35		
Insects	89	114	27	5	235		
Total	257	232	112	65	666		
Ficus bengalensis							
Small Mammals	121	115	89	43	368	37.479	0.4646
Birds	9	19	2	0	30		
Insects	102	50	35	10	197		
Total	232	184	126	53	595		

Nevertheless, the percentage composition of small mammals was largest which showed its affinity for them throughout the present studies, lasting from fall through winter, relatively cold and dry weather, which had no impacts from rainfall, as there are incidences of the rain to affect the barn owl populations, and during the rainy season, resource availability (vegetation cover) certainly increases to affect the barn owl populations (Leirs *et al*. 1997; Monadjem, 1998; Makundi *et al*. 1999). Perhaps, the species richness for barn owl (rodents) would be considerably higher during the summer and spring seasons, with more availability of food to them, than in the fall and winter seasons. As majority of the rodents have proved to be destructive to important cash crops in Pakistan, causing substantial economic losses, efficiency of barn owls among the woodlands might trigger the reverse trend to control their populations through an efficient control, an augmented global trend for management of pests using non chemical methods to protect the already dwindled agricultural systems, as well manifested in oil-palm plantations in Malaysia using the barn owl populations against rodent pests (Wood & Chung, 2003).

Of the insects present in the barn owl pellets, it was evident that, order *Coleoptera* was predomint, while frequency of occurrence for various insect orders did not exist in the same magnitude. Insects can also be regarded as an alternative diet of the owl due to the diminishing of their preferential foods, the rodents, in any habitat (Cerpa & Yanez, 1981; Pavez, 2004), and finally the incidence of avian fauna was found in small proportions in the barn owl pellets, with house sparrow and rose-ringed parakeets in relative abundance, whereas,

some traces were also found for other birds. Impacts of rodent pests have been unparalleled on sustainable agro-ecosystems in Pakistan, causing considerable depredations to stored grains, poultry farms, grain markets and household situations throughout Pakistan (Hassan, 1989; Khan *et al*. 1992; Ahmad *et al*. 1995; Lathiya, 2008). The requirements of the modern day agriculture in wake of alarming increase in population, demand better crop quality and yield. Cropping systems throughout Pakistan are plagued with various vertebrate pests, mainly the rodents, disrupting the stability and sustainability of the rich diversity of food crops. It, therefore, augments that, propagation of the barn owl in the cultivations would be beneficial to do away with the rodent menace largely, inhibit the damage and economic losses, without putting any serious implications of the sustainability of agro-ecosystems of Pakistan.

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