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Roosting Requirements and Habits of Rose-Ringed Parakeet (*Psittacula Krameri*: Borealis) In A Canal-Irrigated Plantation in Central Punjab, Pakistan

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Abstract
The rose-ringed parakeet (*Psiitacula krameri borealis)*, of the order 'Psittaciformes', has wide feeding niche, inhabiting sufficiently large roosts among diversified cultivations of Central Punjab, Pakistan. This paper reports on the roosting habits and requirements of the parakeet in a canal irrigated plantation of Central Punjab, Pakistan. Observations, extended for period of five months, among the selected sub-habitats comprised roosting habits *viz.* allo-feeding, allo-preening, parakeet exits and returns, and tussles with other birds. Of their significant findings 36.17±4.25, 30.83±3.88, 16.74±2.28, 18.02±1.87, 32.00±3.12 and 31.80±3.89 respectively. For all these roosts, population richness of rose-ringed parakeet was maximum at the University Campus, with large experimental crops throughout the year, with sufficient numbers of old and tall trees which served as their roosts. For roost requirements, tussles existed between the parakeets and other birds' in commensurate with suitable ecological conditions viz. temperature, relative humidity, predation, and short distance from their roosts, to increment benefits.

Keywords: Roost requirements, rose-ringed parakeet; habits, population, riverine tracts

1. Introduction
The rose-ringed parakeet (*Psittacula krameri borealis)* remains one of the primary vertebrate pests of the fruit orchards, cultivations and native wildlife. It seems to have settled as stable and sustainable populations in different ecological habitats [1]. Unquestionably, being one of the highly opportunistic birds, the parakeets obtain food from various existing resources in both open and stored grains, causing intensive damage and economic losses. They prefer well moisture habitats to establish their roosts among trees viz. *Cedrela toona, Eugenia cumini, Dalbergia sissoo, Ficus bengalensis, Salmalia malabarica* and *Terminalia arjuna*, which predominatly occur close to the food crops nearby the food crops, in canal and riverine irrigated habitats [2-4]. In its native range throughout the sub-continent, the rose-ringed parakeet occurs in at least three more sub-species viz. *P.k. neumann; P.k. parvirostris and P.k. scopoli* [5], and regarded as potentially major pest to variety of food resources, particularly in unprotected conditions [6]. It has been recorded that losses to both cultivated crops and fruit orchards in Pakistan due to persistent destruction for various sub-habitats, have caused serious economic losses to both farmers and stakeholders, with direct impacts on sustainable national economy. Of the predominantly inflicted food crops include wheat, maize, sugarcane, rice, fodders, sunflower, mango, guava, citrus, mulberry, pomegranate and dates [7-12]. The parakeets seem to be more food spoilers than consumers, and on some given day, can annihilate the standing crop with their tenacious activities, and resultantly, the crop straws appear scattered on the ground [13, 14].

Occurrence of the rose-ringed parakeets throughout Pakistan is characterized in the plains of Central Punjab, Lower Sindh and Indus plain, and some population remains scattered throughout the elevated mountains [15]. Depredations of the parakeets appear more intensive at about sunrise and yet again, at the late evening, before returning to their roosts. It remains significant that, the roosting sites remain more or less permanent for several years in the life of parakeets, as they maintain them for their varying diurnal periodicities, and also closer to the food crops for forging and feeding, without covering long distance [5, 16-18]. The parakeets are primarily the cavity nesting birds and have assumed the status as most destructive and

opportunistic vertebrate pets throughout various sub-habitats of the Asian sub-continent, exploiting the canal irrigated and riverine tracts in fairly large proportions [10, 19-23]. Similarly, in the plains of North Dakota, United States, ring-necked parakeets have been reported to cause considerable depredations and the resulting economic losses to variety of crops. Moreover, they compete with some other cavity nesting birds and over the years, have displaced them from their original habitats [24]. Present studies were, therefore, designed to assess the roosts and roost characteristics of the rose-ringed parakeet in a canal irrigated plantation from Tehsil (Samundari) of the District Faisalabad, Pakistan.

2. Materials and Methods

Roosting requirement and roosting habits of rose- ringed parakeet (*P. krameri)* were studied for a period of 20 weeks (January 2013 to May 2013) in canal irrigated farmlands of Tehsil Samundari, where sufficiently large crops exist. Occurrence of such crops largely remains experimental throughout the year, and therefore, no possibility occurs here for the limitation of food to variety of birds. Moreover, the region of Central Punjab (Pakistan) is mainly regarded as the main focus of agricultural activities. Various crops viz. wheat, maize, sugarcane, rice, fodders besides fruit orchards like citrus, mango, guava, dates and mulberry occur in good proportions. Different trees of variable heights also act not only as shelter for birds', but also offer suitable roosts (elevated branches) and nests (hollows), maintained by them for long durations. For the present study, surveys were conducted to ascertain the roosts and roosting habits of the rose-ringed parakeet within the large agricultural landscape of a river habitat. The parakeet roosts was fairly large and was located less than kilometer away from the well grown croplands. Mostly, the roadside were metallic with trees viz. *Salmalia malabarica, Terminalia arjuna, Cedrela toona, Dalbergia sissoo* and *Ficus bengalensis* were also abundant. Behvioural displays of the parakeets viz. exits and returns (morning and evening), allo-feeding, allo-preening and intra and inter-specific tussles proved beneficial to determine the relative population abundance of the bird, and the interactions of short distance roosts from the crops. Observations were made consecutively in the present studies and were statistically applied with Pearson's correlation matrix design, for the evaluations of environment data and roosting behavior [25].

3. Results and Discussion

Observations on the roosting requirements and habits of the rose-ringed parakeet, conducted in a canal irrigated agricultural farmland comprising the population of rose-ringed parakeet, for its roosting habits. In all, studies were conducted for 20 weeks (January through May) to assess different behavioral patterns in Tehsil Samundari, Faisalabad. It remained evident that, of the correlation matrix recorded for the parakeet roosting habits (allo-feeding, allo-preening, exits, returns, intra specific and inter specific tussles), depicted a negative correlation for the allo-feeding, allo-preening and exits and returns and that, with the three temperature ranges (morning, evening and their average) and that of the relative humidity. Of these, only the intra-specific competition indicated a positive correlation with the temperature ranges, while, none was recorded for the inter-specific competition (Table 1). For the four weeks (each of January and February), slightly lowered interactions among the temperature ranges and humidity remained evident, whereas, somewhat upward trend was recorded in g March. Nonetheless, there was a strong interaction between morning temperature and humidity during May, and higher interactions took place in the evening and for various temperature ranges throughout (Fig. 1).

Interactions between mean number of birds and temperature regarding the allo-feeding and allo-preening incidences clearly depicted that, there were non-significant correlative values between the marauding birds and existing temperature (Fig. II). For the exits and returns of rose-ringed parakeets, minute upper trends were exhibited with the marginal impact of temperature (Fig. III). Finally, the parakeets showed fair degree of inter-specific interactions with other cavity nesting bird species, and a decline was recorded among the members of same species (Fig. IV). Incidences of allo-feeding and allo-preening for relative humidity did not implicate positive relationship, while somewhat decline in trend occurred for parakeets' exits and returns from the roosts; overall, it was evident that, slight positive interaction (R^2=66%) was recorded for the incorporating the morning and evening intra-specific parakeet competition, whereas, complete negative interaction ($R^{2=}$ 37%) occurred for the inter-specific competition (Figs. V, VI).

Present studies on the roosting habits of rose-ringed parakeets indicated that, apart from intra-specific behavior, all other behavioural aspects suggested negative correlative values, including the varying temperatures. The temperature impacts were marginal, but past April, a steady increase in it with the decreased relative humidity, triggered important effects during the morning hours for the different behavioural activities of the rose-ringed parakeet. The microclimate of potential roost-sites, particularly among winter birds, possibly remains significant ecological factor regarding optimal roost site. Nonetheless, little is known for the ambient temperature inside the roosts and tree hollows used as cavities. At cold temperatures, the occurrence of tree cavities provides sufficient insulation to winter birds for their survival values, and opportunity given for breeding [26]. Present study suggests that, although some impacts of temperature (in the morning durations) were optimal for the roost activities of the parakeets', but studies by [27] have reported that increase of temperature had effects on the incubation and nesting behavior of long-tailed tits (*Aegithalos caudatus glaucogularis*) in England. However, in our studies, the effects of temperature could not be truly ascertained, apart from the fact that, morning temperatures during dry summer conditions, significantly affected the behavioral patterns of rose-ringed parakeet. Nonetheless, it remains pertinent that variable temperature ranges seem to be predominant regarding the multifarious bird behavioural performance in varying ecological conditions. Ecologically suitable temperature fosters the growth performance and breeding for birds', without significant costs; but larger variations cause costly changes to them, like loss of foraging, roosting and nesting abilities [28-33]. While the roost composition in the rose-ringed parakeet remains pivotal in its life history, as supported by sufficiently large number of old and tall trees and to some extent by abandoned and relatively undisturbed structures among various habitats [34, 35].

4. Conclusion

Present studies conclusively suggest that, the rose-ringed parakeet maintains its status as serious vertebrate pest among the cultivations and also the stored grain products. Majority of its roosts and behavioural habits indicated little correlation with the fluctuations of temperature and relative humidity,

although during summer, morning temperature exerted some positive impacts on its breeding and roosting behavior; but largely less effects were correlated with the ecological changes on the parakeet life history.

Table 1: Correlation between different parameters with environmental data

Roost habits	Temp (morning)	Temp (evening)	Temp (average)	Relative Humidity
Allo-feeding	-0.411	-0.419	-0.418	0.021
	0.072	0.066	0.067	0.931
Allo-preening	-0.069	-0.093	-0.081	-0.058
	0.773	0.696	0.733	0.808
Exit	0.083	0.004	0.045	-0.05
	0.728	0.988	0.852	0.835
Return	0.303	0.245	0.277	-0.343
	0.194	0.298	0.237	0.138
Intra-specific	-0.477*	-0.461*	-0.473*	0.258
	0.034	0.041	0.035	0.273
Inter-specific	0.255	0.211	0.235	-0.194
	0.279	0.371	0.318	0.413
Total	0.109	0.017	0.064	-0.165
	0.648	0.945	0.788	0.486

Upper values indicated Pearson's correlation coefficient; Lower values indicated level of significance at 5% probability. * = Significant (P<0.05); ** = highly significant (P<0.01)

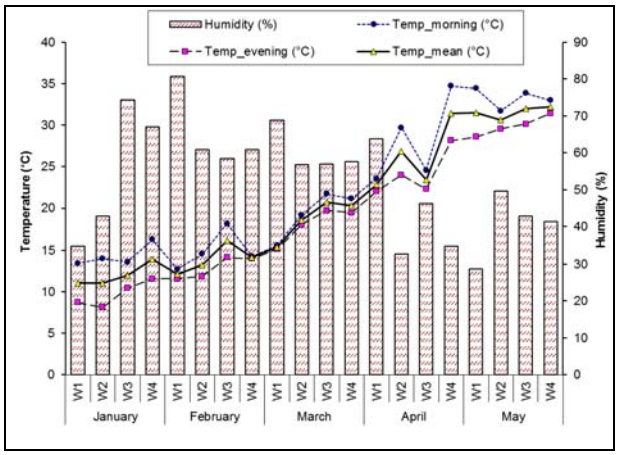

Fig 1: Impacts of various environmental factors impacting the rose-ringed parakeet in present study.

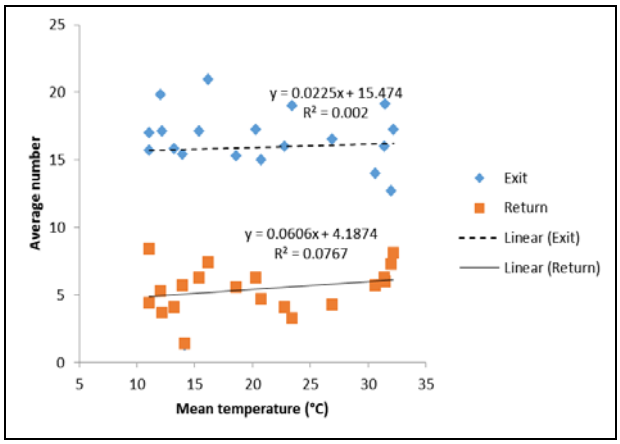

Fig 3: Mean exits and returns of the rose-ringed parakeet from their roosting sites in the study sites.

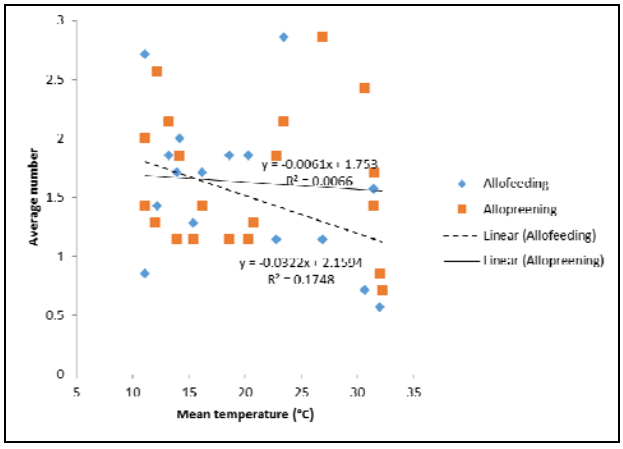

Fig 2: Various parakeet behaviour correlations as influenced by the average roost temperature.

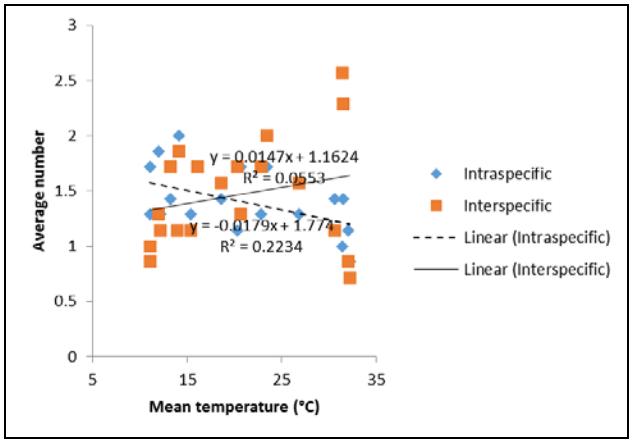

Fig 4: Linear correlations between intra-specific and inter-specific sepsis tussles in the study sites.

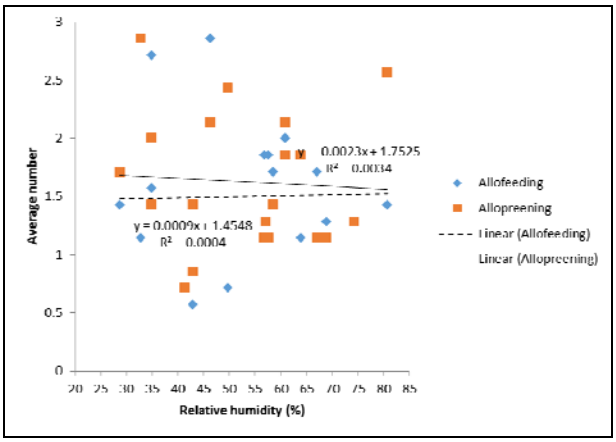

Fig 5: Interaction (linear) as recorded between allo-feeding and allo-preening of the rose-ringed parakeet

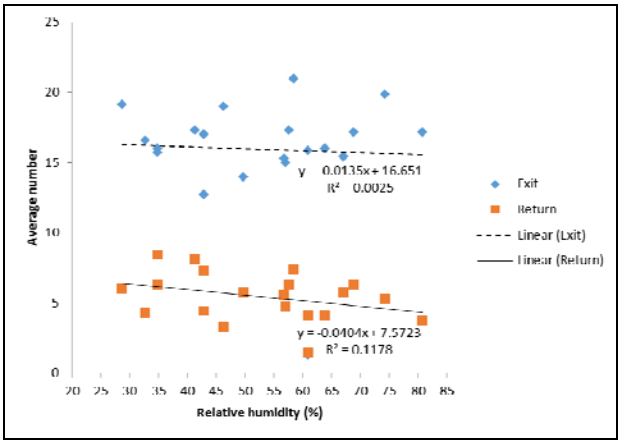

Fig 6: Parakeet exits and returns (negative correlations) in their roosting sites.

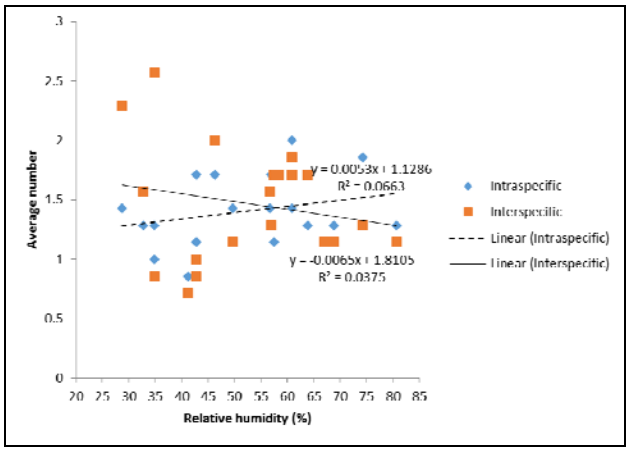

Fig 7: Cumulative intra-specific and inter-specific indices as collated in parakeet roosts.

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