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Cover Page Footnote

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A PRELIMINARY STUDY ON THE SMALL POPULATION PARADIGM AND NESTING BIOLOGY OF ROSE-RINGED PARAKEETS (*PSITTACULA KRAMERI*) IN GUJAR KHAN, PAKISTAN

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ABSTRACT

Rose-ringed parakeet (*P. krameri*) is commonly found native psittacid in Pakistan. It is most popular companion bird in Pakistan. It is an unprotected species as per The Punjab Wildlife Act, 1974. The objectives of the present study were to study its population paradigm and basic nesting biology in the Gujar Khan, Punjab, Pakistan. Previously, no studies were carried out to assess its live and vacant nest cavities, nesting site, nest height, cavity position on substrate, and potential roosts in the area. Moreover, this study also assesses the potential threats and factors in this area and conservation of the parakeet. Results show that in the study area (36.77%) active and (63.22%) inactive nests were found. A total of 10 tree species were utilized to make nests. It was found *Ficus bengalensis*, *Syzygium cumini*, *Morus alba*, *Melia azedarach* and *Broussonetia papyrifera* as the most used tree species for nesting due to more frequencies and old ages. Parakeets make nest at 3-11 m height. The preferred nest height (42.48%) was in the range of 7-9 m, while (5.88%) least at 3-5 m height. For safety reasons they made more nests (45.09%) on the tree trunk followed by terminal (31.37%) and at fork (23.52%). Due to smaller thriving population we found only (mean=7±4) parakeets during roost counting. Severe cutting of trees, destruction of its habitat and poaching for selling in the bird market are the main causes of its population decline. Government must change its status from unprotected to protected species and should ban its dealing for pet.

Keywords: Conservation, nesting biology, population paradigm and rose-ringed parakeet.

INTRODUCTION

Rose-ringed parakeet is one of the four types of parakeet species present in Pakistan, which are Alexandrine parakeet (*Psittacula eupatria*), Plum headed parakeet (*P. cyanocephala*), Rose-ringed parakeet (*P. krameri*) and Slaty headed parakeet (*P. himalayana*). Out of three others Rose-ringed parakeet is most widely distributed in Pakistan and invasive or introduced in some other parts of the world (Forshaw, 1989; Juniper and Parr, 1998). It is most popular companion cage bird throughout the Pakistan. In Pakistan it is

distributed from forests to public parks and urban to agriculture areas (Paton et al., 1982; Strubble and Mathysen, 2009).

Ring-necked or Rose-ringed parakeet is medium sized (40 cm), aggressive, cavity nesting bird belongs to order Psittaciformes. Vernacularly it is called "Katha Tota". The weight range of this charismatic species is 110-182 g (Butler, 2003). They have dark green plumage, adult males have prominent black collar and ring on the neck of male, while female lacks the rose-ring (Roberts, 1991; Waseem et al., 2015) instead have an bright green ring. They become ready

for breeding at the age of three years (Shwartz et al., 2009). Immature are hard to discriminate without morphometric analysis. Tail is longer and almost half of the body length of the bird and may be up to 25 cm in length.

Rose-ringed parakeet (*P. krameri*) is native to Indian subcontinent. They have wide behaviour, tolerance and feeding niche, so they are able to colonize different parts of the world (Forshaw, 1989; Khan and Husnain, 1990; Khan, 2002). Due to their escape from cages they are able to establish their feral populations in alien regions. Jackson et al., presented their work in (2015) and stated that majority of invasive parakeets (*P. k. borealis*, a subspecies) are Indian or Pakistani origin.

Rose-ringed parakeet is considered as a pest throughout its expanding range due to its competitiveness with humans for food (Khan and Husnain, 1990; Khan, et al., 2013; Waseem et al., 2015). Owe to their opportunistic feeding habits they invade crops and destroy horticultural gardens and orchards. In Pakistan (Bashir, 1979) stated that they can destroy crops and orchards thus cause the property and economic losses that was equal to the US\$15 million in 1979. Khan (2002) mentioned that Rose-ring parakeets primarily feed on citrus fruits, guava, mango, almonds, nuts, acorns as well as buds and flowers as per their obtainability.

No previous studies were carried out in Gujjar Khan to find the status of the Rose-ringed parakeets. The specific goals of the present study were to analyse the basic nesting biology of Rose-ringed parakeet by studying nests condition, nest site selection, nest cavity height and position in the area to identify the potential roosts of the Rose-ringed parakeet in Tehsil Gujjar Khan. It was also a focus of study to describe the declining factors of the species in the region and to estimate the impact of predation on Rose-ringed parakeet which can help to predict the models for the conservation of the species.

MATERIAL AND METHODS

Study Sites

We carried out preliminary surveys and selected four sites of Tehsil Gujjar Khan, District Rawalpindi, Pakistan for the status of Rose-ringed parakeet and its remaining population studies. The study Site--I: Daultala (33.1918° N, 73.1423° E) is a suburban union council of Tehsil Gujjar Khan (33.2616° N, 73.3058° E), District Rawalpindi with the total population of 21,957 in 2017, characterized by scarce vegetation with intensive agricultural practices. Almost all people live in cemented houses, having access to the city via paved roads. The area is being cleared for growing human settlements. Study Site- II: Sukho (33.2529° N, 73.1792° E) is an agricultural area with relatively less human population (11,060) and little vegetation or undisturbed area.

Study Site- III: Nata Gujarmall (33.1721° N, 73.1571° E) has least human population (2,693) and vast agricultural landscapes. There are also some dams at this site but this study site has also some totally undisturbed area. Study Site--IV: is Ahdi (33.1418° N, 73.1261° E) (6,179) is an agricultural and more disturbed site as it contains an oil field named as "Ahdi Oil Field" operated by Pakistan Petroleum Limited (PPL). Oil exploration was started in 1956 and the production was started in 1980 (Pakistan Petroleum Limited, 2020). Since then this area has been cleared extensively for the oil production purposes. Study area was completely surveyed with respect to potential sites for the Rose-ring parakeet, and aforementioned parameters.

Important vegetation of the area include Amaltas (*Cassia fistula*), Eucalyptus (*Eucalyptus camaldulensis*), Pomegranate (*Punica granatum*), Sukh-chain (*Pongamia pinnata*), Sacred fig (*Ficus religiosa*), Bottle brush (*Callistemon rigidus*), Guava (*Psidium*

guavaja), Dhrek (*Melia azedarach*), Beri (*Ziziphus jujuba*), Keekar (*Acacia nilotica*), Phulai (*A. modesta*), Cypress spp., Java plum (*Syzygium cumini*), Neem (*Azadirachta indica*), Sheesham (*Dalbergia sissoo*), Giant milkweed (*Calotropis gigantea*), Java plum (*Syzygium cumini*), Indian Lilac (*Azadirachta indica*), Mango tree (*Mangifera indica*) (Bilal et al., 2020),

Field Methodology

Present study was carried out from August 2019 to July 2020 at the four sites of Tehsil Gujar Khan. Data on all the parameters were collected by two observers and 1-3 numbers of volunteers at all the sites. Rose-ringed parakeets were detected for short duration by naked eye (Ali, 2002) without disconcerting them. Data on the nest site characteristics of Rose-ringed parakeet was collected during their breeding season i.e. February to May (Krishnaprasadan et al., 1988).

Data on the nest site and nest site characteristics were collected weekly in the morning and evening time; using line transects surveys (Bibby et al., 2000). This technique is frequently employed to count Psittaciformes and their nests (Gnam and Burchsted, 1991). Line transect surveys can estimate the distribution of the subject and populations between habitats more accurately. Only tree species that had a parakeet nest were recorded. Nest cavity heights were measured by employing stick method and measuring tape (Hairiah et al., 2001; Bilal et al., 2020).

As Psittaciformes roost together in flocks, so we employed roost counting method for the estimation of Rose-ringed parakeet population size in the study area (Chapman et al., 1989; Forshaw, 1989; Gnam and Burchsted, 1991; Mabb, 1997; Juniper and Parr, 1998; Pithon and Dytham, 1999; Keiji, 2001; Renton, 2002). This method of census is frequently used to estimate the numbers of roosting birds at a specific roosting area (Casagrande and

Beissinger, 1997; Whitman et al., 1997), can conclude the numbers of parakeets within a given roosting area (Reynolds et al., 1980; Marsden, 1999).

For the field observations Russian Tecno Shehfeld Military Binoculars (20X50) was also used (Bilal et al., 2020). All the observations were recorded on the data sheets for further analyses. Photographs were also taken with the help of Nikon d5300 (18-55 mm) DSLR Camera. Only the utilized vegetation by Rose-ringed parakeet was recorded at all the study area.

RESULTS AND DISCUSSION

It was found that it is communal bird and lives in colonies both in breeding and non-breeding season. However, the parakeet finds out cavities in small groups of 2 to 5 birds from December to May and from August to October. The obtained results are discussed below.

Live and Vacant Nests

Nest is the structure for breeding, survival of new-borns and their protection (Collias and Collias, 1964; Collias, 1964) Holes and crevices in the trees are created by some ecological, local factors (aging of trees), insects or birds. The secondary nest diggers use or modify those previous crevices and holes in the trees or nest holes of other birds for breeding purposes. If competition is present then they can also exclude other birds from their nests for their own breeding (Stubble and Mathysen, 2007).

Live nests were characterized by the continuous traffic of Rose-ringed parakeets for maintenance, guarding, hatching and nourishing. The status of all the nests was observed regarding activity of parakeets and its condition relative to other nests. During the whole study period at all the study sites we found a total of 57

(36.77%) live and 98 (63.22%) vacant or abandoned or inactive nests. the presence

of such a big number of nests shows the previous population size. These 98 vacant nests were used by the parakeets for the propagation of population. That population has gone to the 57 live nests, which we found during our surveys. The status of vacant nests was also confirmed by interviewing few inhabitants of the area.

Nest Site Selection

Nest site selection is an important factor in the reproductive success of the avian species and preferences but vary from species to species. It is the main driving force behind the population distribution and abundance. It is crucial for the fitness, as nest site selection can influence the traits of the birds (Aitken and Martin, 2007). Parakeets dug cavity in hollow and old trees. Furthermore, similar studies by Khan et al., (2004) proves the tree type and age of tree determines the cavity nests of Rose-ringed parakeet in Central Punjab. The proximity to the activity area, disturbances, and concealment are kept in mind during the nest site selection by birds.

In Rose-ringed parakeets the nest site selection starts in December through May. Female is responsible for broadening of dome shaped cavity opening. For making a nest comfortable parakeets use some downy feather, dry grasses and leaves as a bedding material. These observations were in correspondence with the previous one by (Sarwar et al., 1989), they found that in Punjab same nesting behaviour is prevalent in Rose-ringed parakeet and they select suitable site for nesting with regard to water body and nesting materials. In their native range (Indian Subcontinent) Rose-ringed parakeets mainly reproduce in hole on trees but some other studies described their nest in cracks and crevices of the buildings and poles (Ali and Riply, 1969; Sarwar et al., 1989; Roberts, 1991). Previous studies also show that Rose-ringed parakeet prefers to breed near human settlements

(Sarwar et al., 1989) but we could not find nests near human dwellings. All the area within these sites was searched extensively for the nests and relevant data.

At Site-I, both live and vacated nest cavities were found to be made on *Syzygium cumini* (20.0%), *Ficus religiosa* and *Morus alba* (14.29%), *Mangifera indica* and *Eucalyptus camaldulensis* (11.43%), *Broussonetia papyrifera* (8.57%), *Melia azedarach*, *Ficus bengalensis* and *Dalbergia sissoo* (5.71%) and *Albizia lebbek* (2.86%).

At Site-II we found nest cavities of Rose-ring parakeet on the *Melia azedarach* (18.75%), *Albizia lebbek* (16.67%), *Morus alba* and *Dalbergia sissoo* (12.50%), *Ficus bengalensis* (10.42%), *Syzygium cumini* and *Ficus religiosa* (8.33%), *Mangifera indica* (6.25%), *Broussonetia papyrifera* (4.17%), *Eucalyptus camaldulensis* (2.08%).

Site-III was characterized by having more number of nests cavities on trees than other three sites. At this site we found 8 trees as a nesting site for Rose-ring parakeet. *Broussonetia papyrifera* (22.58%), *Melia azedarach* (12.90%), *Morus alba*, *Syzygium cumini* and *Ficus religiosa* (12.90%), *Albizia lebbek* (9.68%), *Dalbergia sissoo* (3.23%) and *Ficus bengalensis* (1.90%), were the tree species for the excavating of nest site at this site. *Mangifera indica* and *Eucalyptus camaldulensis* were the two tree species not utilized by Rose-ring parakeet for nest sites.

At Site-IV we observed following tree species as a good site for cavity nesting: *Broussonetia papyrifera* (14.63%), *Morus alba*, *Syzygium cumini*, *Eucalyptus camaldulensis* and *Mangifera indica* (12.20%), *Melia azedarach* and *Ficus bengalensis* (9.76%), *Albizia lebbek* (7.32%), *Dalbergia sissoo* and *Ficus religiosa* (4.58%).

Due to the more frequency and abundance of *Ficus bengalensis*, *Syzygium cumini*, *Morus alba*, *Melia azedarach*

and *Broussonetia papyrifera* in the planes of Gujar Khan, Rose-ringed parakeet commonly acquire them for roosting and nesting. The results of present study show that Rose-ringed parakeets prefer aforementioned tree species. It is partly in contrary to earlier studies by (Orlan, 1969) who found that preferred tree species for digging nests are *Acacia nilotica* and *Dalbergia sissoo*.



Figure 1: Adult male Rose-ringed parakeet on *Dalbergia sissoo* tree at Study Site-I. Photo courtesy: Ali Hasnain Mosvi.

Trees along the croplands are used as a shade during the sowing and harvesting season and as wood fuel. In some parts of the Punjab like Gujar Khan the *A. nilotica*, *A. modesta* and *Delbergia sissoo* are common trees alongside the cropland patches. Rose-ringed parakeets are biased to make the nests in the cavities of *Albizia lebbek*, *A. nilotica*, *Dalbergia sissoo*, *Ficus religiosa*, *Syzygium cumini* (Khan et al., 2004). Also previous studies by Shafi et al., (1986) stated no or a few nests on the *Eucalyptus camaldulensis*, *Melia azedarach* tree species.

Nest Height

The data on height of the cavity from the ground showed that parakeets excavate cavities from 3-11 meters in height. It was found that its preferred nest height 42.48 % nests were in the range of 7-9 m height followed by (28.75 %) nests were built on the height of 5-7 m,

followed by 9-11 meters (22.87 %) and very few cavities (n= 9) were found at 3-5 meters (5.88 %) from ground.

In the study area there is less tree cover due to intensive agriculture system and cutting of trees. In 2002 and 2003, Butler testified that tree cover affects the nest site and height selection as it provides protection from wind, precipitation, temperature and helps in camouflage. Additionally, Butler stated that parakeet excavate nests on of 8.1-19.5 m mean height (Butler, 2002). In India it is 9.1-27.1 m in height (Yap and Sodhi, 2004). The observed nest height of Rose-ringed parakeet from the ground is averaged from 3.5 m (Juniper and Parr., 1998; Stubble and Mathysen, 2007). Preference of different height of nest selection is to ensure the protection of eggs and nestlings (Waseem et al., 2015). It means they chose some best nest site characteristics to breed in.

Cavities Position

Rose-ringed Parakeet is a cavity nesting bird and function of these cavities is to assist in breeding (Whistler, 1986; Roberts, 1991). Cavity position ensures the safety and wellbeing of the nest. During the data collection of cavity position at nesting substrate we found that Rose-ringed parakeets excavate cavities at the terminal position (n=48) of trees a total of 31.37% times. While at the junction of two branches or fork have (n=36) frequency and percentage of 23.52%. Tree trunk was found to contain relatively more numbers of cavities. We found tree trunk with (n=69) which are total of 45.09% nest cavities.

At Site- I we found more terminal nest cavities (40.0%) probably due to more disturbances and noise as compared to other three sites.

Table 1: Showing the tree species and nests of Rose-ringed parakeets at all four sites

No.	Tree species	Study Site- I				Study Site- II				Study Site- III				Study Site- IV			
		Live Nests	Vacated Nests	total nest	%	Live nests	Vacated nests	Total	%	Live Nest	Vacated nests	Total	%	Live nests	Vacated nests	Total	%
1	<i>Dalbergia sissoo</i>	0	2	2	5.41	1	5	6	12.50	0	1	1	2.94	1	1	2	4.88
2	<i>Mangifera indica</i>	1	3	4	10.81	0	3	3	6.25	0	0	0	0.00	3	2	5	12.20
3	<i>Albizia lebbeck</i>	0	1	1	2.70	2	6	8	16.67	1	2	3	8.82	1	3	4	9.76
4	<i>Ficus religiosa</i>	1	4	5	13.51	1	3	4	8.33	1	3	4	11.76	0	2	2	4.88
5	<i>Syzygium cumini</i>	2	5	7	18.92	2	2	4	8.33	3	1	4	11.76	3	2	5	12.20
6	<i>Ficus bengalensis</i>	0	2	2	5.41	2	3	5	10.42	2	2	4	11.76	3	1	4	9.76
7	<i>Morus alba</i>	1	4	5	13.51	3	3	6	12.50	1	3	4	11.76	1	4	5	12.20
8	<i>Melia azedarach</i>	1	3	4	10.81	5	4	9	18.75	5	2	7	20.59	3	2	5	12.20
9	<i>Broussonetia papyrifera</i>	0	3	3	8.11	1	1	2	4.17	3	4	7	20.59	4	3	7	17.07
10	<i>Eucalyptus camaldulensis</i>	1	3	4	10.81	1	0	1	2.08	0	0	0	0.00	0	2	2	4.88
Total		7	30	37	100	18	30	48	100	16	18	34	100	19	22	41	100

Table 2: Showing different height cohorts and cumulative frequencies of those height cohorts at all four sites.

Height Cohorts (m)	Study Site- I				Study Site- II				Study Site- III				Study Site- IV			
	Live nests	Vavated nests	Cumulative frequency	%	Live nests	Vavated nests	Cumulative frequency	%	Live nests	Vavated nests	Cumulative frequency	%	Live nests	Vavated nests	Cumulative frequency	%
3-5	0	1	1	2.8571 42857	1	1	2	4.3478 26087	0	2	2	6.4516 12903	1	3	4	9.75609 7561
5-7	1	17	19	51.428 57143	4	5	11	19.565 21739	4	5	11	29.032 25806	3	5	12	19.5121 9512
7-9	5	7	31	34.285 71429	4	16	31	43.478 26087	7	11	29	58.064 51613	9	6	27	36.5853 6585
9-11	1	3	35	11.428 57143	7	8	46	32.608 69565	2	0	31	6.4516 12903	6	8	41	34.1463 4146
Total	7	28		100	16	30		100	13	18		100	19	22		100

Table 3: Showing data of cavities positions and total found nests at terminal, fork and trunk of trees at all sites in the study area

Cavity Position	Study Site- I			Study Site- II			Study Site- III			Study Site- IV		
	Live nests	Vacated nests	Total %	Live nests	Vacated nests	Total %	Live nests	Vacated nests	Total %	Live nests	Vacated nests	Total %
Terminal nests	3	11	40.00	5	7	26.09	3	5	25.81	6	8	34.15
At fork	1	8	25.71	3	7	21.74	1	2	9.68	5	9	34.15
At tree trunk	3	9	34.29	8	16	52.17	9	11	64.52	8	5	31.71
Total	7	28	100.00	16	30	100.00	13	18	100.00	19	22	100.00

This may be the adaptation due to the poaching as the terminals sites of trees present at study sites are difficult to access as compared to the fork and tree trunk nesting sites. At Site- II and Site- III we observe more number of nest cavities at tree trunk, 52.17% and 64.52%, respectively. At Site- IV we found comparable number of terminal and forked nests, while at trunk nests were less prevalent 31.71%.

Roost Counts

Roost count method is employed when population size of parakeets and parrots is small (Casagrande and Beissinger, 1997) and have many advantages over Point count and Line transects method. The counting of pre- and post-breeding measure of roosts can provide us an insight in the population size (Matuzak and Brightsmith, 2007). The Information Centre hypothesis for

communal roost proposes that birds congregate at night to exchange information about some nearby feeding place (Ward and Zahvi, 1973). Time (pre and post breeding season and time of the year), congregation, distribution of vital resources and dispersal time is a crucial factor in the counting of birds for further population inferences (Bradbury and Vehrencamp, 1976; Tossas et al., 2012). The efforts without considering these factors are useless.

Population size estimation using roosts counts was carried out through whole study. The first author appealed to locate the roosting sites to the personal contacts via WhatsApp. No large communal roost can be located during the whole study period. Instead we can only identify small/ or may be called temporary communal roost at (33° 11' 33.7632" N x 73° 8' 41.3808" E). In addition, previously known roost sites were also actively

searched for Rose-ringed parakeets. Dawn and Dusk roost count began 45 minutes before the sunrise and sunset, respectively.

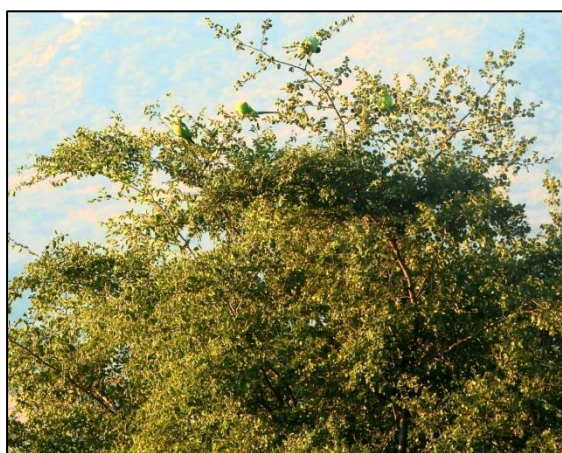


Figure 2: Roost temporary roost of parakeets at Indian jujube (*Ziziphus jujuba*) commonly known as Beri.

After ensuring the relaxation of parakeets at evening time we collected roost count data from a location that provided a full view of roosting site. We used this roost count technique after assuring that (1) that all parrots are at the roost; and (2) the count is accurate. Two observers collected data on the weekly basis. As the roost flock was very small, it was possible to count birds individually. We followed (Bibby et al., 2000) method of roost counting. We found mean = 7 ± 4 parakeets in the roost. We found that parakeets use the dense tall trees as roosts. Present study confirmed the observations of (Sarwar et al., 1989) that parakeets produce loud calls when arriving and leaving the roost sites at dusk and dawn, respectively.

Predation and Poaching

The parakeets are more vulnerable to the predation due to the one entrance cavity nest, egg incubating female in the nest, noisy chicks in the nest that make them conspicuous to attack. A study conducted by (Sanz and Rodriguez-Ferrao, 2006) showed that 37% of nests were lost during nestling period. Duncan and

Blackburn, (2007) studied the different pressures (e.g., hunting and poaching) that causes the decline in prey populations. Due to the one entrance cavity, the attacked predator causes the damage of eggs and chicks, sometimes the incubating female too. (Hossain et al., 1993) Raptors, owls, crows, snakes and rodents especially squirrels are the predator in the Indian Subcontinent (Hossain et al., 1993; Dhanda and Dhindsa, 1998).

In their studies Bjurlin and Cypher, (2005) and Shwartz et al., (2013) stated that the charismatic species can yield positive attitudes of people towards their conservation. There is lack of ecological knowledge in the residents of the study area. The perceptions and awareness also vary in socio-economic classes. We should educate people to save this species.

Conservation

The trees and the remaining forest patches are being cleared in this area for different causes, such as making houses, for fuel, forest clearing and cutting for agriculture. As the parakeets prefer old and tall trees to build a nest (Khan et al., 2004), the cutting of trees has reduced the preferred nesting sites. This is causing the sudden decline in the parakeet population in the study area. The remaining tree species are not sustaining the population of parakeets.

Rose-ringed parakeet is not a protected specie in Province Punjab. The Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974 had put it in Fourth Schedule, "*Schedule of Wild Birds and Animals Which are not Protected*". We must amended this act to declare it as a "Protected Specie" in order to conserve it. This will also protect its habitat which is in severe destruction. In our country bird keepers only keep wild parakeets for breeding purposes as they only can breed in captive settings.

Poaching and hunting of this wild bird must be banned. Cutting of its

preferred trees and stealing of eggs and nestlings is also a major cause of its decline, statistics shows that more than 50% of the eggs and nestlings are lost due to poaching. We made some market visits and found that wild and captive parakeets were being sold in the markets of study area. Though the bird dealers were reluctant to sell parakeets in an open showcase as the Punjab Wildlife Department is chalking tickets upon selling this charismatic bird.

CONCLUSION

The present study was conducted from August 2019 to July 2020. To find the data on nesting biology viz; number of live and vacant nests, nest site selection and nest height from the ground were the main objectives of the study. The present study was conducted from August 2019 to July 2020. The data on nesting biology viz., number of live and vacant nests, nest site selection, nest height from the ground, position of cavity at the site, by Rose-ringed parakeet were studied. Extensive surveys were conducted and we found total (36.77%) live and (63.22%) vacant nest cavities. We found older tree species *Syzygium cumini*, *Melia azedarach*, *Broussonetia papyrifera* the most preferred nesting substrates.

The most preferred height (42.48 %) for nesting site was 7-9 m. We found tree trunk with the highest (45.09 %) number of nest cavities. During the whole study period we could locate only one small roost of parakeets at the Site- I despite of calling for volunteering in the study area for locating roost. This means that the main population is not thriving due to heavy poaching pressure and lack of awareness in the common people. The keeping of parakeets as pet must be banned so the population again replenish in this area.

Some further studies for the estimation of breeding biology of the parakeet is required that should involve

the nesting, behavior, feeding and breeding biology of Rose-ringed parakeet in this region. Future extended studies should also note its inter- and intraspecific behavior as with cavity dwelling birds. The present study was designed to address the local declining of rose-ringed parakeet. The future focus of this study should include whole of the Gujar Khan.

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