

*Full Length Research Paper*

# **Nesting Ecology, Interspecific Interaction and Nesting Association of Indian Black Kite (*Milvus migrans*) Inhabiting the Arid Zone of Rajasthan**

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The nesting ecology, interspecific interaction and nesting association of the Black kite (*Milvus migrans*) were studied during the 2012-2014 breeding season in 400 km<sup>2</sup> area in and around Churu city of Rajasthan, India. Total 38 nest sites of the Black kite were located within the study area. Majority of the nest sites were located in the heart of urban and rural area and nearby feeding sites. Among 38 nests sites 24 (63.15%) were permanent in nature while 14 (36.84%) were temporary in nature. Among 24 nest sites, 5 (20.83%) were found in rural area and 19 (79.16%) in urban area. Among temporary 14 nest sites, 3 (21.42%) were found in rural area and 11 (78.57%) in urban area. The Black kite more frequent preferred nest on tallest available tree with highest relatively density, canopy cover and DBH at nest site. The average nest tree/object height was  $10.67 \pm \text{SD } 9.28$  m. above ground. The nesting tree/object was found to vary from 6.06 to 50.00 m. The nest position from ground was at an average of  $9.50 \pm \text{SD } 9.06$  m. The nest height varied in the range of 5.10 to 48.01 m. The average canopy cover was  $5.36 \pm \text{SD } 1.28$  m. Average data on DBH was also observed with an average of  $0.57 \pm \text{SD } 0.11$  m. The DBH noted to vary in the range of 0.43 to 0.73. Trees selected to nest showed no significant correlation between the nest height and canopy cover ( $t = 2.6712$ ,  $df = 70$ ,  $p < .01$ ), and total heights of the trees and the nest heights ( $t = .5537$ ,  $df = 70$ ,  $p > .01$ ), data showed significant correlation between total heights and nest heights. Nest placement on the sub branch of the tree was found with an average of  $2.71 \pm \text{SD } 0.38$  m. from the end of the trunk. The numbers of flight pathways at each nest site were also counted and it was found with an average of  $2.79 \pm \text{SD } 0.81$  and it varied in the range of 1 to 4. The Black kite nests singly, usually high in a tree or man-made objects such as Peepal, Neem, Khejari, Ardu, Firash, Sapheda, Power pylon, Flood light, Mobile tower and Masjid top. Often the tree and man-made objects is very close to human habitations. Nests are often used annually in spite of nest failures due to harassment by House crow, Sand storms and Human disturbance.

**Keywords:** Nesting ecology, Black kite, Arid zone, Rajasthan, India

## INTRODUCTION

Section of nest site is often considered as an important determinant of reproductive success in many bird species (Coulson 1968, McCrimmon 1980). Nests of birds have been compared to the mammalian uterus which provides warmth and protection to the developing embryo. Nest site selection is closely related to individual fitness since it influences the probability of successfully raising offspring (Martin 1988). The poor nest site selection leads to nest predation and hence affect the natural selection of the bird species (Ricklefs 1969, Nilsson 1984). Factors such as inclement weather and proximity to feeding places may also influence bird species of small body size. Larger species are better to tolerate weather oscillations and can make long distance trips in reach of food (Collias and Collias 1984). Nests made at the places not easily accessible to predators, such as cliffs, tall trees, man-made objects, thick vegetation in breeding success (Ames and Merserau 1964, Kelley 1993). Since selection pressure for nest sites is intense, the choice of less safe places is very common. In a given species, nest site quality varies in space and time at different scales due to different environmental factors affecting reproductive success (Wiens 1976).

Raptors are reported to settle in areas where food is abundant, which significantly influence the selection of nest sites, minimizing the risks of predation (Mearns and Newton 1988) and optimize the thermal environment (Mosher and White 1976). Nest site selection of raptors has been studied by Orth and Kennedy (2001) for Burrowing owl, Sara and Vittorio (2003) for Egyptian vultures and Stanevieius (2004) for Marsh harrier.

However, nesting requirements of the Black kite is poorly known except brief account given by Ali (1979) and Naorji (2007). Nesting ecology of the Black kite was studied to understand the factors affecting selection of nesting habitat and nest tree and its implications for managements of the species for conservation purpose. During present investigations, the nest size, height of the nest and the nest composition of the Black kite were studied in detail. Because of these parameters in birds differ as per their habitats.

The Black kite (*Milvus migrans*), Black ibis (*Pseudibis papillosa*) and House crow (*Corvus splendens*) are coexisting resident birds and usually nest solitarily (Ali and Ripley 1983, Soni et al. 2010). A close association of these species was observed in the study area. Interspecific interactions between two species could be expected for nest and food. While studying the nesting ecology of the Black kite, interspecific interactions were observed between said species. Avian breeding colonies represent temporally and spatially predictable food resources for predators. However, colonial breeding usually reduces predation impact through dilution effects and communal defense (Bertram 1978, Wittenberg and

Hunt 1985). In addition, protective nesting associations with birds of prey (Collias and Collias 1984) have been described as a mechanism for defending nests against predators (Cain and Hillgarth 1974). Despite the widespread occurrence of a protective nesting association in some groups of birds (Collias and Collias 1984). Nesting association of Black Kites with Crows was recorded in Vadodara (Godshe 2014). Few descriptions are available in the literature for raptor species (Parker et al. 1995, Sergio and Boto 1999). Study of the extent of niche overlap and interspecific interaction between the species was carried out in attempts to find importance and mechanism of interactions. Additionally, we noted that, nesting association in Black kite reduced nest predation, and breeding success was high.

## MATERIALS AND METHODS

The nesting ecology of the Black kite (*Milvus migrans*) was studied during the 2012-2014 in 400 km<sup>2</sup> area in and around Churu city of Rajasthan, India (Lat. 29° N, Long. 75° E and 286 msl). The annual rainfall in the area is 426 mm. Total 140 days of observation were made for five pairs during the breeding season. Month wise surveys were conducted from January 2012 to December 2014 to record the number of active nests (nest with eggs). The nests were constantly monitored 2 to 4 consecutive days in a week. A circular plot of 50 m diameter around the tree and man-made objects which the nest was located was defined as "Nest site." To study the vegetation of nest site, the tree species with more than 20 feet height within the area were recorded along with their density, relative density, height, height of nest from the ground and trunk diameter at breast height (DBH). Height of a tree was measured with the help of abney level and measuring tape. Canopy diameter was determined by visual estimation using measuring tape. To analyze the relationship between tree height and a canopy radius, and tree height and nest height, a correlation coefficient was calculated. Student's t-test was applied between the characteristics of single and multiple times selected trees and nests to assess the significance of multi use of the nests and analysis was carried out between the tree heights, nest heights, canopy cover, and DBH. It was assumed that the nearer the nest to the tree trunk benefited stronger support and exceeds hide. To examine the hypothesis, placement of the nests on a sub branch, distance of the nests from the tree trunk, number of nest supporting twigs, and flight pathways were recorded and compared between the multiple and singly used nests by applying student's t-test. To determine strong preference for the choice of a particular canopy side located on the edge of a bust road, canopy covers

**Table 1** Record of available and preferred nesting trees at different nesting sites. Nesting site in bold indicate permanent nesting site.

Name site	Location	Available tree /object	Preferred tree /objects for nesting												
			Neem	Khejari	Peepal	Ardu	Firash	Sapheda	Mobile tower	Flood light	Power pylon	Masjid Top			
<b>School Ground</b>	<b>Gajsar</b>	P,N,K,T,R		K											
<b>Hanuman Temple</b>	<b>Depalsar</b>	P,N,K,S,T			P										
School Wall	Gohgatia	K,T,R		K											
Kacha Johara	Hanutpura	P,N,K,S	N												
<b>Balika School</b>	<b>Ratan Nagar</b>	P,N	N												
Bhagutha Sidh	Ratan Nagar	P,N,F,K	N												
<b>Gaushala Johara</b>	<b>Ramgarh</b>	P,N,K,S,R			P										
<b>Deep Sagar</b>	<b>Thelasar</b>	N,P,K,T		K											
Indermani Park	Churu	N,P,T,Sh,FI,I	N												
<b>Shyam Cinema</b>	<b>Churu</b>	N,P,Mt	N												
<b>CJRM School</b>	<b>Churu</b>	N,P,K,R,Vb		K											
<b>Jharia Mori</b>	<b>Churu</b>	N,P,F			P										
<b>Churu Jail</b>	<b>Churu</b>	N,P,K,Sh,B		K											
Railway Colony	Churu	P,B,F			P										
<b>Near Bagla School</b>	<b>Churu</b>	N,P,Sh	N												
Poonia Colony	Churu	N,P,K,T,A,Sh						Sh							
<b>Pankha Circle</b>	<b>Churu</b>	N,P,K,FI									FI				
Graveyard	Churu	N,F,K,Vb,R,F,T,A					F								
RSEB Johara	Churu	P,B,K		K											
Police Line Area	Churu	N,P,F,T,A	N												
<b>Nai Sadak</b>	<b>Churu</b>	N,P,B,MT													MT
<b>Govt. College</b>	<b>Churu</b>	N,P,Sh,T	N												
<b>Nath Ji Ka Dhora</b>	<b>Churu</b>	N,P,B,Sh,R,Vb,T,K		K											
<b>Johari Sagar</b>	<b>Churu</b>	N,P	N												
<b>Sethani Johara</b>	<b>Churu</b>	N,K	N												
<b>College Ground</b>	<b>Churu</b>	N,P,Vb,K		K											
Kassai Mohilla	Churu	N,P,MT									MT				
<b>Shetalla Chowk</b>	<b>Churu</b>	N,P,Pp			P										
<b>Hanuman Gari Mandir</b>	<b>Churu</b>	N,P,K,Vb,T,S,B,I,Sh		K											
<b>Gaushala Agriculture Land</b>	<b>Churu</b>	N,P,K,R,Pp										Pp			

P=Peepal, N=Neem, K=Khejari, S=Sirash, T=Talee, I= Imali, F=Firash, Vb= VilayatiBabool, Sa= Sapheda, R= Rohida, A= Ardu, Mt= Mobile tower, Pp=Power pylon, MT= Masjid Top, FI=Flood light.

were divided into two categories viz. towards and away from the road.

Further, nesting trees located on the edge of the water wells were also taken into an account to study if any preference is made for the part of a canopy which is

leaning on the well side. The heights of man-made objects are measured and the height of nest is also measured. The man-made objects are located as a nest site. This study aspect would show the tendency of a safer nest site selection in relation to anthropogenic

**Table 2** Tree height, nest height, canopy cover, and diameter at breast height (DBH) of the nesting tree. Measurements were recorded in meter.

Nest Site	Preferred tree/object for nesting	Tree/object height	Nest height	Canopy cover	DBH
<b>School Ground</b>	Khejari	6.80	5.68	4.28	0.51
<b>Hanuman Temple</b>	Peepal	7.34	6.90	5.02	0.58
School Wall	Khejari	10.08	8.60	7.25	0.68
Kacha Johara	Neem	6.92	5.75	4.78	0.52
<b>Balika School</b>	Neem	7.05	6.10	4.60	0.54
Bhagutha Sidh	Neem	7.64	6.54	5.00	0.58
<b>Gasuhala Johara</b>	Peepal	7.74	6.80	4.98	0.63
<b>Deep Sagar</b>	Khejari	8.05	7.66	5.60	0.71
Indermani Park	Neem	7.67	6.49	5.02	0.60
<b>Shyam Cinema</b>	Neem	6.46	5.30	4.38	0.48
<b>CJRM School</b>	Khejari	7.49	6.51	5.10	0.53
<b>Jharia Mori</b>	Peepal	7.81	6.90	5.19	0.68
<b>Churu Jail</b>	Khejari	6.36	5.36	3.98	0.46
Railway Colony	Peepal	6.98	6.00	4.02	0.62
<b>Near Bagla School</b>	Neem	7.00	6.10	5.67	0.55
Poonia Colony	Sapheda	11.46	9.96	6.78	1.01
<b>Pankha Circle</b>	Flood light	30.00	29.42	-	-
Graveyard	Firash	7.48	6.46	6.08	0.49
RSEB Johara	Khejari	6.09	5.10	4.20	0.44
Police Line Area	Neem	7.78	6.72	5.55	0.59
<b>Nai Sadak</b>	Masjid Top	18.00	16.46	-	-
<b>Govt. College</b>	Neem	6.78	5.49	4.02	0.49
<b>Nath Ji ka Dhora</b>	Khejari	6.92	5.92	5.01	0.50
<b>Johari Sagar</b>	Neem	7.41	6.49	5.16	0.52
<b>Sethani Johara</b>	Neem	7.35	6.12	5.13	0.51
<b>College Ground</b>	Khejari	6.98	5.16	4.92	0.43
Kassai Mohalla	Mobile tower	50.00	48.01	-	-
<b>Shetalla Chowk</b>	Peepal	7.66	6.63	4.92	0.61
<b>Hanuman Garhi Mandir</b>	Khejari	6.06	5.12	3.43	0.43
<b>Gaushala Agriculture Land</b>	Power pylon	40.00	37.46	-	-
<b>MJD College</b>	Ardu	11.76	10.11	8.46	0.73
<b>Govt. School</b>	Sapheda	12.06	11.00	7.06	0.69
<b>Graveyard</b>	Neem	8.45	7.06	7.02	0.59
Shawa Road	Ardu	10.68	9.11	8.11	0.61
<b>RCP Colony</b>	Ardu	10.46	8.98	8.06	0.60
Talianan Mohalla	Neem	6.49	5.41	3.49	0.47
Bala Ji Johara	Peepal	7.10	6.06	5.09	0.68
Forest Area	Neem	7.13	6.10	5.06	0.52
		X= 10.67	x= 9.50	x = 5.36	x=0.57
		±SD 9.28	±SD 9.06	±SD 1.28	±SD 0.11

pressure as well anti-predation mechanics.

Along with the study on nesting ecology of the Black kite, observations were also, carried out on other bird species nesting in the same area. Since the Black ibis (*Pseudibis papillosa*) was the main coexisting species some times. Nesting association of Black kites with Crows was recorded in Vadodara. It was also noted that the nests used by Vultures were reused by Black kites. Old nest is reused by many species like Cattle egret and Little Blue heron. Black kites often reuse their conspecific or heterospecific deserted nests. By preferring old nests, the kites could save energy required in exploring safer

nest sites and by shortening the period of nidification. The interspecific interactions for nests site between them recorded into following four categories.

Category I: Use of same nests site or nest tree by both the species in different seasons.

Category II: Reuse of deserted nest by other species (i.e., Black kite nest reused by ibis and vultures and vice versa)

Category III: Simultaneous uses of same nest tree without disturbing each other.

Category IV: Displacements of occupant species from its nest by invader species.

## RESULTS

Total 38 nest sites of the Black kite were located within the study area (Table 1). Majority of the nest sites were located in the heart of rural and urban area and nearby feeding sites. But in rainy season the Black kites prefers to nest in outskirts of rural and urban area. The Black kite preferred nest sites at the trees in the club number of tree species and some man-made objects. Relative density of Neem (*Azadirachta indica*), Peepal (*Ficus religiosa*), Firash (*Tamarix indica*), Ardu (*Alianthus exelsa*), Khejari (*Prosopis cineraria*) and Sapheda (*Eucalyptus alba*) were significantly higher than other trees in the habitat of the Black kites. Besides it mobile tower, power pylon, flood light and masjid top are involve in habitat of the Black kite. Out of 14 tree species available at nest site (Table 1); only six species of trees were utilized for nesting by the Black kite. Besides it mobile tower, power pylon, flood light, and masjid top were utilized for nesting by the Black kite. The Black kite was found to nest on Peepal, Neem, Firash, Ardu, Khejari and Sapheda (Table 1), besides power pylon, mobile tower, flood light, and top of masjid. Total 13 (34.21%) Neem, 9 (23.68%) Khejari, 6(15.78%) Peepal, 3(7.89%) Ardu, 1(2.63%) Firash, 2 (5.26%) Sapheda, 1 (2.63%) Mobile tower, 1 (2.63%) Flood light, 1 (2.63%) Power pylon and 1 (2.63%) Masjid top trees and man-made objects selected for nesting.

These selected trees and objects comprised 18.57% of available 70 Neem, 10.58% of available 85 Khejari, 11.11% of available 54 Peepal, 20% of available 5 Ardu, 13.33% of available 15 Firash, 40% of available 5 Sapheda, 25% of available 4 Mobile tower, 100% of available 1 Flood light, 50% of available 2 Power pylons and 100% of available 1 Masjid top, trees and man-made objects in the study area. Out of 13 Neem nesting trees, 3 (23.07%) were located in rural area while 10 (76.92%) was located in urban area, out of 9 Khejari nesting trees, 3 (33.33%) were located in rural area while 6 (66.66%) was located in urban area, out of 6 Peepal nesting trees 2 (33.33%) were located in rural area while 4 (66.66%) was located in urban area. There are 3(100%) Ardu, 1 (100%) Firash, 2(100%) Sapheda, 1(100%) Mobile tower, 1 (100%) Flood light, 1 (100%) Power pylon and 1 (100%) Masjid top nesting site are located only in urban area.

Out of total 38 nest sites 8 (21.05%) nest sites were located in rural area and 30 (78.94%) in the urban area. Among 38 nest sites 24 (63.15%) nest sites were permanent in nature. While 14 (36.84%) were temporary in nature. Among permanent nest site, 24 nest sites, 5 (20.83%) were found in rural area and 19 (79.16%) in urban area. Among temporary nest site, 14 nest sites, 3 (21.42%) were found in rural area and 11(78.57%) in urban area. The ratio of temporary and permanent nesting was 38:62 in rural areas. The ratio of temporary

and permanent nesting was 37:63 in urban areas. Among 30 urban nesting sites, 11 (36.66%) were temporary in nature while 19(63.33%) were of permanent in nature. Nesting trees and man-made objects were also used for roosting by this Black kite. At one site the water tank man-made object was selected for nesting but resulted in nest failure because water tank process of under construction.

The Black kite more frequently preferred nest on tallest available tree with highest relative density, canopy cover and DBH at nest site (Table 2). The average nest tree and objects height was  $10.67 \pm \text{SD}9.8$  m above ground. The nesting tree and object height was found to vary from 6.06 to 50 m. The nest position from the ground was at an average of  $9.50 \pm \text{SD} 9.06$  m. The nest height varied in the range of 5.10 to 48.01 m. The average canopy cover was  $5.36 \pm \text{SD}1.28$  m. The canopy cover was in the range of 3.43 to 8.46. Average data on DBH was also observed with an average of  $0.57 \pm \text{SD} 0.11$  m. The DBH noted to vary in the range of 0.43 to 1.01 m.

A total of 38 nests of the Black kite were studied during the entire study period. Trees selected to nest showed no significant correlation between the nest height and canopy cover ( $t=2.6712$ ,  $df=70$ ,  $p<.01$ ) and significant correlation between total height and nest height ( $t=.5537$ ,  $df= 70$   $p>.01$ ). Characteristics such as tree height, canopy cover and nest height of the trees used for nesting once or many times were observed.

All observed nests of the Black kite were found to locate on the third sub branch of the trees (Table 3). Nest placement on the sub branch of the tree was found with an average of  $2.71 \pm \text{SD}0.38$  m from the end of the trunk. The numbers of flight pathways at each nest site were also counted and it was found with an average of  $2.79 \pm \text{SD} 0.81$  and it varied in the range of 1 to 4. Nest distance from the tree trunk was found with an average of  $3.68 \pm \text{SD} 0.42$  m and it varied in the range of 2.9 to 4.6. Number of nest supporting twigs was found with an average of  $3.73 \pm \text{SD} 0.75$  and it varied in the range of 3 to 5.

Table 4 depicts the description of surrounding area of nesting sites. It was observed that in rural area out of 8 nests, 5 nests were located in the heart of rural area in close proximity of human beings while 3 nests were located in outskirts of the rural area. In urban area out of 30 nests, 19 nests were located in the heart of Churu city and 11 nests were located in the outskirts of the city. Black kite is a solitary breeder but some time seen communal breeding's. Two nests are seen on the top of Masjid in the heart of Churu city. There is a single nest seen on the most of trees outskirts in Churu city but on the some places two nest are seen on the Khejari trees also out skirt of Churu city. Mostly, roosting trees were selected for nesting. Out of 38 nesting sites 13 (34.21%) were located near WWB and 14 (36.84%) were near the busy road. On national highway only 10 (26.31%) nest were

**Table 3** Characteristics of the nest location and number of flight pathways.

Nest Site	Preferred tree/object for nesting	Nest placement on the sub branch of the tree	Number of nests supporting twigs	Nest distance from the tree trunk (m)	Flight pathways approaching the nest
<b>School Ground</b>	Khejari	2.3	3	3.8	3
<b>Hanuman Temple</b>	Peepal	2.4	5	4.2	2
School Wall	Khejari	2.4	4	3.8	3
Kacha Johara	Neem	2.7	4	3.6	4
<b>Balika School</b>	Neem	2.8	3	3.8	4
Bhagutha Sidh	Neem	2.8	4	3.9	3
<b>Gaushala Johara</b>	Peepal	2.9	5	4.0	2
<b>Deep Sagar</b>	Khejari	2.9	4	3.1	3
Indermani Park	Neem	2.6	3	2.9	3
<b>Shyam Cinema</b>	Neem	2.9	4	3.6	4
<b>CJRM School</b>	Khejari	2.4	5	3.7	2
<b>Jharia Mori</b>	Peepal	3.2	3	3.8	3
<b>Churu Jail</b>	Khejari	3.0	3	2.9	3
Railway Colony	Peepal	3.3	4	4.1	4
<b>Near Bagla School</b>	Neem	2.9	3	3.4	4
Poonia Colony	Sapheda	2.3	4	4.2	2
<b>Pankha Circle</b>	Flood light	-	-	-	-
Graveyard	Firash	3.1	5	2.9	3
RSEB Johara	Khejari	3.0	3	3.8	3
Police Line Area	Neem	2.9	4	3.6	2
<b>Nai Sadak</b>	Masjid Top	-	-	-	-
<b>Govt. College</b>	Neem	2.6	3	4.1	4
<b>Nath Ji Ka Dhora</b>	Khejari	2.9	3	4.0	3
<b>Johari Sagar</b>	Neem	2.8	4	3.8	2
<b>Sethani Johara</b>	Neem	3.4	5	3.8	2
<b>College Ground</b>	Khejari	1.7	3	3.3	1
Kassai Mohalla	Mobile tower	-	-	-	-
<b>Shetalla Chowk</b>	Peepal	3.4	4	4.2	4
<b>Hanuman Garhi Mandir</b>	Khejari	2.6	3	3.9	3
<b>Gaushala Agriculture Land</b>	Power pylon	-	-	-	-
<b>MJD College</b>	Ardu	2.7	3	3.1	2
<b>Govt. School</b>	Sapheda	2.8	3	3.6	3
<b>Graveyard</b>	Neem	2.6	4	3.4	4
Shawa Road	Ardu	2.2	3	3.1	3
<b>RCP Colony</b>	Ardu	2.4	4	3.3	2
Talianan Mohalla	Neem	1.9	3	4.1	2
Bala Ji Johara Forest Area	Peepal	3.1	5	4.6	3
	Neem	2.6	4	3.9	2
		X= 2.71	X= 3.73	X= 3.68	X= 2.79
		±SD 0.38	±SD 0.75	±SD 0.42	±SD 0.81

detected, while in the outskirts area the number was 9 (23.68%). In graveyard area only 2 (5.26%) nests were observed whereas in AFH total 11 (28.94%) nest were observed. Industrial area was the least choice as only 1 (2.63%) nest was found there out of 38 nests, 13 (34.21%) sites were protected by boundary wall and these sites were safe from predators. In our study it was observed that out of total 38 nesting sites, 24 (63.15%) were located near human habitation. A nest of White vulture was also found 25 ft. away from the nest of the

Black kite at Peepal tree. Surprisingly, the House crow and Black ibis also built a nest nearest the nest of the Black kite.

## DISCUSSION

Identification of the habitat features, that influence reproduction and survival, are essential for the management and long term viability of bird populations

**Table 4** Nesting site and description of surrounding area.

Location	Nest site	Nesting tree/object area
<b>Gajsar</b>	<b>School Ground</b>	Near waste water body, near busy road, and out skrit area, large municipal garbage dumping station.
<b>Depalsar</b>	<b>Hanuman Temple</b>	Surrounded by houses, Railway station.
Goghatia	School Wall	Surrounded by houses and surrounded by wall.
Hanutpura	Kacha Johara	Near waste water body and agriculture farm house with sand dunes.
<b>Ratan Nagar</b>	<b>Balika School</b>	Near human Inhabitation and surrounded by houses and surrounded by wall.
Ratan Nagar	Bhagutha Sidh	Near state highway and outskirts of village.
<b>Ramgarh</b>	<b>Gaushala Johara</b>	Near waste water body and busy road, surrounded by farm houses.
<b>Thelasar</b>	<b>Deep Sagar</b>	Near highway.
Churu	Indermani Park	Park protected by wall and near market area, near human inhabitation.
<b>Churu</b>	<b>Shyam Cinema</b>	Near busy road, near market and complex and busy crowded area.
<b>Churu</b>	<b>CJRM School</b>	Near highway and out skrit area of city.
<b>Churu</b>	<b>Jaharia Mori</b>	Near temporary municipal garbage dumping, busy road and surrounded by house and market and permanent nesting area of Black kite.
<b>Churu</b>	<b>Churu Jail</b>	Near human Inhabitation and surrounded by wall.
Churu	Railway Colony	Near railway station and surrounded by houses.
<b>Churu</b>	<b>Near Bagla School</b>	Near busy road and surrounded by houses.
Churu	Poonia Colony	Near highway and surrounded by houses.
<b>Churu</b>	<b>Pankha Circle</b>	Near busy road and highway and permanent nesting on flood light.
Churu	Graveyard	Surrounded by houses and a small water body.
Churu	RSEB Johara	Near water body and out skrit.
Churu	Police Line Area	Surrounded by thick wall and houses.
<b>Churu</b>	<b>Nai Sadak</b>	This area surrounded by Muslim community so many slaughter houses in this area near busy road, market area and a small and temporary water body with garbage area.
<b>Churu</b>	<b>Govt. College</b>	Near busy railway station and surrounded by market shops houses.
<b>Churu</b>	<b>Nath Ji Ka Dhora</b>	In out skrit of city, near busy road and agriculture farm houses.
<b>Churu</b>	<b>Johari Sagar</b>	Near waste water body.
<b>Churu</b>	<b>Sethani Johara</b>	Near water body and crowding area.
<b>Churu</b>	<b>College Ground</b>	Near waste water body and bus stand.
Churu	Kassai Mohalla	Near slaughter houses and surrounded by houses.
<b>Churu</b>	<b>Shetalla Chowk</b>	Near busy road.
<b>Churu</b>	<b>Hanuman Garhi Mandir</b>	Out skrit of Churu city, and waste water body with large municipal garbage dumping station.
<b>Churu</b>	<b>Gaushala Agriculture Land</b>	Out skrit of Churu, sand dunes.
<b>Taranagar</b>	<b>MJD College</b>	Near high way and sand dunes.
<b>Taranagar</b>	<b>Govt. School</b>	Surrounded by mocked and houses near busy road.
<b>Taranagar</b>	<b>Graveyard</b>	Out skrit of city and near busy road.
Taranagar	Shawa Road	Near busy road surrounded by market.
<b>Taranagar</b>	<b>RCP Colony</b>	Near busy road and high way, this area protected by thick wall, this area permanent nesting site for Black kite at Ardu trees.
Taranagar	Talianan Mohalla	Surrounded by houses.
Taranagar	Bala Ji Johara	Near waste water body.
Taranagar	Forest Area	Near busy road.

(Davis et al. 2006). As successful nesting is important for later, selection of nesting tree also should be equally important. The Black kite prefers Neem, Peepal, Khejari, Firash, Ardu and Sapheda trees for nesting. The reason may be the availability of these trees in large numbers which have suitable height and canopy preferred by these raptors. The Black kites made their nests on the Mobile tower, Flood light, Power pylon and Masjid top beside the trees. The Black kite made their nests on man-made objects because of so much height, less human disturbance and for safety.

The selection of nesting tree in birds is also based on the previously performed successful breeding (Klopfer 1963). Considering the characteristics of the Peepal, Neem, Khejari, Firash, Ardu and Sapheda, their larger canopy covers provide number of crotches to support the nest at proper location. In breeding months viz. November to March trees usually used by Black kites for nesting with full of leaves and may be a factor in nesting. The dense cover of the canopy provides sustained protection by minimizing the direct heat loss in the open sky (Morse 1980). As per Burger and Hahn (1989), a dense canopy cover reduces the thermal stress to vulnerable young and provides hide from the potential air predators. Moreover, a well-covered nest does not require wing shading provided by parents to their chicks, which considerably reduces energy loss to the parents (Lack 1968).

We have observed Black kite make nest on power pylon, masjid top, floodlight and mobile tower. Nesting recorded on a disused chimney (Dharmakumarsinhji 1955, Bhuiyan and Khan 1981), and an overhead water tank (Bhuiyan and Khan 1981). Baker (1935) once observed power pylons are frequently used for nesting by Black kite.

As noted for Hadada ibis and Black ibis (Soni et al. 2010), Black kite also prefer nesting on the upper third of the tree. A positive correlation between tree height, canopy and nest height makes nesting successful. The height and higher nest elevation provides easy access to escape when there is a danger by the ground predator (Burger 1978a). Although non-significant differences between DBH of permanent resting tree and temporary trees has supported the theory of safer site selection based on an experience of no collapsing of the nest during occupancy; but least related to the size of the tree at its base. A choice of the nest height in birds seems to be determined with the consideration of climatic pressure such as wind speed, temperature, sudden and heavy rain pour, and potential predation including human disturbance (Dhinsa et al. 1989).

The significant variation in the supporting twigs of the nest shows the sturdier the nest happened to be selected repeatedly. The nest placement on the sub-branch and its distance from the trunk has significance of minimizing

exposer, easy flight pathways and escape. Beside the characteristics of the tree and nest vicinity, consideration of the foraging sites in imminent horizon is also equally important. The Black kite tends to build nest near the feeding sites. Similarly, Kushlan (1976) reported that the American White ibis (*Eudocimus albus*) select the nesting colony site depending on the availability of the foraging habitat. Olga and Jose (1989) also observed that the Egyptian vulture (*Neophron percnopterus*) builds nests at the site where the food availability is abundant.

Thus, distance from foraging habitat is crucial to birds avoid exposure of chicks for long duration to predation. Though measured majority of nests found in the arid zone of Rajasthan, found nearer to either garbage dumps of near mutton shops and slaughter house where plenty of food is available. Food and water are the basic requirements for any individuals. In the case of Black kites, their nests are nearer to water bodies and garbage dumping station too. Same results reported by Godshe (2014) in Vadodara city.

Many species are reported to occupy previously used nesting area (Catchpole 1972, Greenwood and Harvey 1976, Newton 1982). Breeding site fidelity was more often observed in successful individuals than the unsuccessful one (Darley et al. 1977, Beletskey and Orians 1991). It is probably because of familiarity to an area which may permit to take advantages of favourable foraging, predator avoidance and nesting site that enhance reproductive success (Hinde 1956, Greenwood and Harvey 1982). Similarly nesting nearby the roost site is also advantageous for the same. This seems quite possible factor affecting nest site selection by the Black kite as the entire nest sites were also used as roost sites throughout the year. Black kite preferred to nest nearby the roost sites that may be due to familiar environment and their location mainly near the foraging sites and hence facilitate easy settlement of breeding pairs. Similar pattern of nest site selection was observed in Bonelli's eagle in which breeding colony formation was initiated by displaying males at roost site during day time (Ontiveros 1999). Availability of food is another factor affecting nest site selection. In some localities, roost sites and nest sites of the White ibis were often shifted from one site to the other depending on food availability (Kushlan 1976).

Reuse of old deserted nests and takeover active nests were recorded in many bird species as a consequence of scarcity of nest sites or nest materials (Dusi 1968, Burger 1978a, 1978b). Nesting association of the Black kite with crows may be due to shortage of nesting sites. An association with a predatory species is related to protection from potential predators. Such an association is also reported in White ibis (Donazar et al. 1996). Similar observation was recorded at Ahmedabad. Stealing of nest material was also recorded occasionally



by Black kites as is also reviewed by Welty and Baptista (1988). Old nest is reused by many species like Cattle egret and Little Blue heron (Dusi 1968).

Likewise, Black kites often reuse their conspecific or heterospecific deserted nests. By preferring old nests, the Black kite could save energy required in search of safer nest site and by shortening the period nidification. Frequent flights are required to gather nest material from nearby area to build a nest. Thus, Black kites have to invest much time and energy to build a new nest. Therefore, reuse of nest involves apparent benefit of time and energy saving by not building a new nest. It is further supported by the fact that early pre-laying period found significantly shorter when a pair reused old nest. If the same pair recuses the site, then it could minimize the cost of territory establishment too (Soniet al. 2010).

The nesting trees selected for nesting near the water resources were comparatively bigger in size due to their good growth. The good canopy of these trees provided suitable nesting sites as far as thermal heat regulation is concerned. Urbanization is uprooting the nesting trees of the birds, so also with the Black kite. Thus the Black kite preferred to nest on the tree along with the roads in spite of their exposure to wind and noise of traffic. It can be concluded that the Black kite whether built nest near the water resources, road sites, mid-on city, garden sites, agriculture fields, garbage dumping site, graveyard area, slaughter houses, they were near the feeding grounds. Various authors such as Donald (1918), Baker (1928), Ali and Ripley (1968) have also pointed out that the Black kites build the nests near or in the village or city which is in the easy reach of food.

Nesting of the Black kite was reported Desai and Malhotra (1979), and Kumar et al. (2014). Baker (1935) once observed three active nests on one tree, and very occasionally two on a single tree. We have observed two active nest of Black kite on khejari and Masjid top in Churu city. Often nests of Black kite in loose colonies, but sometimes solitarily. According to Lack (1968), birds were food solitarily use the nest solitarily. Though the Black kites a flock feeder, it was found to be sometimes solitary breeder by nature. Beside all above mentioned evidences, it shows that such as a divert behaviour has been apparently set forth an adaptation following the availability of food. Hence flexibility has been developed to avoid any potential competition for the breeding as well on the restricted foraging ground. This could be compared with the mixed colonial Egrets and Herons, which also maintain a certain distance among their nests depending upon their body size for the comfort and to avoid competition (Burger 1978a).

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