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Population, Distribution, Sub-species, Feeding and Breeding Biology of Black Kite: A Review

Chishty Nadim[1*], Pandey Vijay Shankar[2] and Choudhary Narayan Lal[3]

[1,3]Wildlife, Limnology and Toxicology Research Laboratory, Department of Zoology, Government Meera Girl's College (Mohanlal Sukhadia University) Udaipur, Rajasthan, India
[2] DCF, Mount Abu, Sirohi district, Rajasthan, India

**Corresponding Author*

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Abstract: The black kite is a medium-sized raptor and widely distributed on all continents except Nearctic and Neo-tropic zone. It plays a crucial role in the ecosystem and maintains prey populations, especially for rodents. They preferred a wide variety of habitats, including open areas, grasslands, scattered vegetation, agricultural land and also adapted towards cities and towns. Black kite diets are extremely diverse; they typically consume grasshoppers, birds, rodents, bats and dead animal carcasses. A diet of black kite varies geographically and depends on the availability and abundance of prey population. The breeding season for black kites begins in March and lasts until April and also vary and depending on the subspecies. Black kites usually construct nest upon large trees, mobile tower and electric pylons. They generally utilise plant matter as nesting material, but sometime they also utilise clothes, paper and plastic. Population of black kite is declining due to poisoning by pesticides, lack of roosting and nesting sites, lack of prey availability and electrocutions. Environmental conditions such as extreme temperature, wind velocity and rainfall influence the daily activity and breeding biology of black kites. Habitat fragmentation, anthropogenic interference, deforestation, pesticide pollution and electrocutions cause negative impacts on raptor survival, including the black kite.

Keywords: Black kite, Nesting, Prey, Environmental conditions, Raptor, Breeding biology, *Milvus migrans*

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Introduction

The black kite is a medium-sized raptor that belongs to the family Accipitridae and order Accipitriiformes. The populations of Accipitridae family birds are declining in various countries, but black kites are the most abundant species on earth (Ferguson-Lees and Christie, 2001). Black kite (*Milvus migrans*) is a common and widespread raptor that can be found in Eurasia, Africa, Asia and Australia (Ferguson-Lees and Christie, 2001; Birdlife International, 2021). It is an opportunistic predator and scavenger that can live in a variety of habitats, including human dominated landscapes and diets very diverse and influenced by geographical areas (Sergio *et al.,* 2003; Cortes-Avizanda *et al.,* 2011; Tanferna *et al.,* 2013; Panuccio *et al.,* 2013). Kites are robust predators

with curved beaks, large wings, pointed and sharp talons on their feet. Kites assist in the control and equilibrium of prey populations by killing agricultural pests such as grasshoppers, rodents and small-sized herbivores like rabbits and also feed upon sick animals (Bowland *et al.,* 1993). It plays a significant role in maintaining biological balances in the ecosystem. Kites are excellent bio-indicators of ecosystem health because they prey on other animals for food and sometimes act as natural scavengers (Machange *et al.,* 2005). They usually live in colonies and communally roost during the evening time. When there is plenty of food and during migration, large aggregations of black kites can be seen (Cramp and Simmons, 1980). According to Blanco (1997), the presence of kites as city scavengers is critical because they clean up decomposing carcasses, preventing disease and infection transmission in the ecosystem and also play an important predatory role in the urban ecosystem (Malhotra, 2007). Crows and kites have essentially similar feeding habits, resulting in interspecific clepto-parasitism observed at a dumping area (Sharma and Soni, 2017). Human disturbance, habitat fragmentation, isolation, habitat alteration and expansion of urbanisation cause adverse impacts on bird populations and abundance (Blair, 1996; Sauvajot *et al.,* 1998; Fernández-Juricic and Tellera, 2000; Fernández-Juricic, 2000). Random demographic dynamics and individual migration between adjacent habitats also cause changes among avian populations (Karr, 1982; DeSante and Geupel, 1987; Greenberg, 1981; Karr and Freemark, 1983). In the present review, we discuss the population, distribution, subspecies, food and feeding behaviour, nesting and breeding behaviour and threats to the survival of black kites.

Population, Distribution and Sub-species of Black Kite:

According to Bird Life International (2016), the global population of black kite is estimated between 1,470,000 to 1,980,000 young individuals, with the European population accounting for 11 per cent of the total population, with an estimated 81,200–109,000 breeding pairs (Bird Life International, 2016). *Milvus migrans migrans* is bred and lives in the North African region (Cramp and Simmons, 1983). Seasonal changes in bird's habitat utilisation patterns and food availability are frequently influenced by seasonal precipitation and food abundance (Fogden, 1972). Wet and dry weather cycles create significant seasonality for the majority of birds (Kushlan, 1978). Except in the Nearctic and a Neo-tropic zone, the black kite is a potentially wider spread raptor on the earth's planet (Ferguson-Lees and Christie, 2001). It can be found in the Palearctic, Indo-Malayan, Afro-Malagasy and Australian regions (Panuccio *et al.,* 2013; Nunes *et al.,* 2015). It is a common migrant and breeds from the Mediterranean coast to Morocco's southern High Atlas (Thévenot *et al.,* 2003). They are found on the coast of the Sahara in the northern region of Algeria (Isenmann and Moali, 2000). The breeding ecology and success of the black kite have been extensively studied in Europe and Asia (Desai and Malhotra, 1979; Koga *et al.,* 1989; Viuela and Veiga, 1992; Sergio and Boto, 1999). Black kites prefer a wide variety of habitats, including open areas, grassy or herbaceous vegetations and dispersed tree areas such as savannah grassland and agricultural fields (Kemp *et al.,* 2020). The species of black kites are distributed in Europe, Asia, Africa and Australia and other places. The temperate populations of black kites are migratory, whereas the tropical populations are resident. *Milvus migrans* is a common and widespread raptor in Algeria. This species has been identified as a declining and vulnerable species in Europe (Sergio and Boto, 1999). Its numbers are declining in Portugal, Eastern Europe and Russia (Vinuela and Sunyer, 1994; Bijisma, 1997). The black kite (*Milvus migrans*) is found in the Indian subcontinent regions and a resident raptor, can be found in urban areas (Ali and Reply, 1968; Mahabal and Bastawade, 1987). Due to the higher population density in urban areas, they have been considered the least concerned (Bird Life International, 2009).

Milvus migrans govinda (Black Kite) is a locally frequent diurnal broad scavenging species. It is a migratory breeder in the Palearctic region (Bijlsma, 1997) and resident species in the Indian subcontinent with limited mobility (Mahabal and Bastawade, 1987). This species is common in Indian subcontinent and has been categorised as least concern (Bird Life International, 2009). *Milvus migrans* or black kites are also found in Africa, Asia and Europe, where they migrate annually (Agostini and Logozzo, 1997; Bird Life Australia, 2019). They are also found throughout the mainland of Australia (Bird Life Australia, 2019).

Vaurie (1965), Glutz von Blotzheim (1971), Étchécopar (1978), Cramp (1980), del Hoyo (1994) and Ortlieb (1998) provided following descriptions of several sub-species of black kites in world:

Milvus migrans migrans (Boddaert, 1783): Its breeding ranges are in Europe, Western Asia and Africa's north-western coast. It migrates from Africa to the Middle East as well as south-west Asia, especially in Iran and Pakistan. The appearance of this species is a whitish head with dull brown on top, a dark brown lower part of the body, a black bill, and yellowish legs.

Milvus migrans lineatus (Gray, J.E., 1831): *Milvus migrans lineatus* species is biggest subspecies of black kite and usually breeds in Asia, north of the Ural and south of Iran and Indochina. The body appearance of this sub-species is largest with a dark brown, less rufous bill and a more or less uniformly dark brown carpal joint.

Milvus migrans parasitus (Daudin, 1800): *Milvus migrans parasitus* is commonly known as the yellow billed kite and its distribution ranges from West Africa to Kenya and South Africa to the Cape down. Body size of *Milvus migrant sparasitus* is smaller as compared to *Milvus migrans migrans* and adults having yellow bill and legs.

Milvus migrans aegyptius (Gmelin, 1788): This sub-species is uncertain and it may be *Milvus migrans parasitus*. Its breeding and distribution ranges are south west Arabia and costal east Africa to Kenya. Body size is smaller than *Milvus migrans migrans,* body having darker stripes on the tail and a blackish bill in immature and adult birds having a yellow bill.

Milvus migrans govinda (Sykes, 1982): *Milvus migrans govinda* is breed in the Indian subcontinent region and ranges from the Malay Peninsula to the eastern part of Pakistan. *Milvus migrans govinda* is smaller in size as compared to *Milvus migrans migrans* and other characteristic features are that they are intermediate in size as compared to *Milvus migrans migrans* and *Milvus migrans lineatus*.

Milvus migrans affinis (Gould, 1838): They are distributed throughout the Australian continent. The tail is rufous and longer than *Milvus migrans migrans*.

Milvus migrans formosanus (Kuroda, 1920): This subspecies occurs in Taiwan and Hainan, although only seven individuals have been recorded. It is frequently confused with *Milvus migrans lineatus*.

The Black Kite (*Milvus migrans*) is a widely distributed raptor which can be found in Eurasia, Africa and Australia (Ferguson-Lees and Christie, 2001; Bird Life International 2021). *Milvus migrans migrans* and *Milvus migrans lineatus* sub-species are found in the western and eastern parts of the Palaearctic region (Dickinson and Remsen, 2013; Clements *et al.,* 2019; Orta *et al.,* 2020; Gill *et al.,* 2021). *Milvus migrans govinda* sub-species inhabit the Indian subcontinent, *Milvus migrans affinis* inhabits Australia and surrounding areas, *Milvus migrans formosanus* inhabits the eastern part of China, Hainan, and Taiwan, and *Milvus migrans parasitus and Milvus migrans aegyptius* sub-species inhabit Africa. The ranges of *Milvus migrans migrans* and *Milvus migrans lineatus* overlap with each other. They cover a large area, mainly Eastern Europe, western Siberia and Kazakhstan (Dementiev *et al.,* 1951; Stepanyan, 1990; Ferguson- Lee and Christie, 2001; Karyakin, 2017; Skyrpan and Literak, 2019; Panter *et al.,* 2020). *Milvus migrans lineatus* is also distributed

in the Iberian Peninsula (Skyrpan *et al.,* 2021). Birds in the intergradation zone exhibit a variety of intermediate characters, indicating that these two sub-species, *Milvus migrans migrans* and *Milvus migrans lineatus* of black kite cross easily (Karyakin, 2017). During the migration, *Milvus migrans migrans* and *Milvus migrans lineatus* assemble with *Milvus migrans govinda* in Pakistan and Afghanistan. All these three Eurasian sub species are collectively sustained in these regions (Karyakin, 2017).

The Palaearctic *Milvus migrans migrans* and *Milvus migrans lineatus* are winter migratory birds, migrating from Europe to Sub-Saharan Africa and the Middle East region. Migration route of *Milvus migrans migrans* is noted by Sergio *et al.* (2014), Ovciarikova *et al.* (2020) and Skyrpan *et al.* (2021) but migration of *Milvus migrans lineatus* is unclear. According to phenotypic studies of kites, *Milvus migrans lineatus* is winter migratory in India, China and Indo-China regions (Hoyo *et al.,* 1994). Other studies also reported that *Milvus migrans lineatus* is resident in eastern part of Mongolia and winter migratory in Myanmar and India (Choudhari, 2005; Davaasuren, 2019). *Milvus migrans govinda* is breeding resident of Indian subcontinent but during winter season they are also sharing habitat with eastern Palaearctic migratory black kite (NIBR, 2011; Bird Life International, 2021). A nearly moderately active population of *Milvus migrans lineatus* occupies in Japan with seasonal migrations restricted to the Japanese Archipelago areas (Hirano and Ueda, 2011). *Milvus migrans affinis* is a seasonal migratory bird of the Australian continent (Marchant and Higgins, 1993). *Milvus migrans parasitus* migrates from South Africa to Uganda and *Milvus migrans aegyptius* migrates from the south to the east African coast (Clark and Davies, 2018; Ehlers Smith *et al.,* 2021). According to Telemetry data, immature *Milvus migrans migrans* do not return to their native places after the winter season and may remain outside of native places, remaining at migratory places up to maturity and moving around wintering breeding areas and roosting places (Literak *et al.,* 2020; Ovciarikova *et al.,* 2020). In the Siberia region, juvenile of black kite aggregations have been reported during the summer season (Popov, 2007; Bakhtin, 2013). *Milvus migrans migrans* sexually mature and start breeding after 3-5 years of age (Forero *et al.,* 2002).

Food and Feeding Behaviour of Black Kite:

Black kites are predators and sometimes act as scavengers. During the foraging, they spend most of time soaring and gliding. They can be easily identified by forked tail and tilted wings during the flight. They are opportunist predators and usually feed upon birds, rodents and bats (Narayanan, 1989; Mikula *et al.,* 2016; Meheretu and Leirs, 2019). They have ability to find and look for prey in smoke and fires due to acute vision power (Hollands, 1984). Thousands of kites flying and foraging around dumping yards of cities and towns and they usually feed upon organs and corpse of butchered animals (Naoroji, 2006; Malhotra, 2007). The black kites were seen feasting at a garbage dump in Rome. The kites arrive early morning and left shortly after dusk (Giacomo and Guerrieri, 2008). Cameroon (2003) and Mahmoodul Hassan *et al.* (2007) observed that surrounding habitat and environmental factors also influence the foraging and feeding habitats of black kites. The presence of body parts of mice, rabbits and feathers of pigeons around the nests of black kites, indicates they usually feed upon a variety of prey species and diverse diet. The availability of vegetarian food items like "baddas", breads and sweets also reveals that these birds can meet their nutritional demands in the absence of insects, rodents and other prey (Sharma and Soni, 2017). Black kites have been known to steal food from children's hands (Whistler, 1949; Ali and Ripley 1978; Sharma and Soni, 2017). Furthermore, diet and food consumption influence ecological aspects such as egg-laying, clutch size and breeding of birds, especially raptors (Korimako, 1987). Mice are the most common prey in the black kite diet (Slotow *et al.,* 1988; Tarboton, 1977, 1978). The diet of raptors particularly black kites can vary according

to geographical areas and habitat around nests. In the Italian pre-alp regions, the black kite population diet was predominated by birds and fishes (Sergio and Boto, 1999).

Breeding and Nesting Behavior of Black Kite:

High temperatures, wind velocity and rain fall caused adverse impacts on activities such as foraging, egg viability and breeding success in black kite populations in European regions (Hiraldo *et al.,* 1990; Viuela, 2000; Sergio, 2003). The Indian population of black kites is well-adapted for urban habitat and can be found in highly crowded areas. In India, the breeding season for black kites begins in winter and the young birds flee before the monsoon arrives. The nest is a ragged platform made of twigs and scraps that is hung from a tree. In subsequent years, nesting locations may be reused. Several studies have been conducted on the breeding ecology of black kites around the world, mainly in Europe (Fiuynski and Wendland, 1967; Meybure, 1969; Desai and Malhotra, 1979; Fiuynski *et al.,* 1981) and in Japan, both in a hilly location (Haneda and Koizumi, 1965) and near a fishing-port (Koga *et al.,* 1989). Generally courtship starts in early March and egg laying in the first week of April (Koga and Shiraihi, 1994). Sergio and Boto (1999) reported that the egg laying period of black kites was 14 to 16 days in the Tarf mountain area, but in the Italian Pre-Alps, the egg laying period was more than 25 days. The mean clutch size of black kites was 3 eggs per active nest (Boumaaza *et al.,* 2016) and the 15 nests contained at least one egg. This mean clutch size in this current study (Boumaaza *et al.,* 2016) was similar to previous studies (Fiuynski and Wendland, 1967; Meybure, 1969; Desai and Malhotra, 1979; Fiuynski *et al.,* 1981; Koga *et al.,* 1989; Vinuela and Sunyer, 1994; Bijisma, 1997; Sergio and Boto, 1999). The average clutch size of black kite was 2.26 in France (Thiollay, 1967), 2.98 in Slovakia (Danko, 1989), 2.18 in Japan (Konga *et al.,* 1989) and 2.98 in Algeria (Messabhiaa *et al.,* 2019). The egg laying in Ras El Ma ravine starts early in April (Sergio and Boto, 1999) and the egg laying date is 27 days longer than in previous studies in the Ras El Ma ravine region of Guelma, northeast Algeria (Boumaaza *et al.,* 2016). In southern Australia, the breeding season of black kites ranges from July to November (Debus, 2012; Bird Life Australia, 2019). They have been known to successfully reproduce outside of their recognised breeding region, such as near Melbourne (Mc Donald, 2003). A black kite nest with two nestlings was observed near Martindale on October 13, 2015. Later, an adult and a fledgling were seen together. They were the only successful breeding observations in the Hunter region (Alexander, 2016).

The Guelma black kite constructs nests on cliffs, trees and also utilises old nests. The majority of the Guelma black kite nests are constructed on trees, especially on sweet chestnut, downy oak, common lime and Scotch pine (Sergio and Boto, 1999; Boumazza *et al.,* 2016). Several factors determine the choice of nest tree, the most crucial of which were the height and species of tree (Bakhtin, 2015). Usually nests constructed on tall trees and height ranges from 7-32 meters, they usually depends upon local floral composition (Kumar *et al.,* 2014; Bakhtin, 2015; Pryor, 2020). Selection of plant species for nest construction usually depends upon indigenous flora; the Oak (*Quercus* spp.) is commonly used in Italy (Zocchi *et al.,* 2004), Poplar (*Populus* spp.) in western Siberia (Bakhtin, 2015) and *Eucalyptus* spp., *Azadiracta indica* and *Syzygium cumini* and sometimes nests construct upon mobile tower and electrical pylon (Kumar *et al.,* 2014). Black kites generally utilise twigs and branches of trees in nest construction; sometimes anthropogenic derived materials such as paper, cloth and plastics are also used (Mazumdar *et al.,* 2016). Large scale changes in ecosystem such as human development, vanishing of natural habitat and deforestation may become limiting factor for nesting site of black kite (Boeker, 1971; Scott, 1985; Hunt *et al.,* 1999).

Threat and Conservation Problems of Black Kite Survival:

The black kite is the most common and widely

spread raptor. The population has declined due to poisoning by toxicants and pesticides, shooting and water contamination. Local declines may also be caused by urbanisation and agricultural advancements (Ferguson-Lees and Christie, 2001). Many factors, including pollution and pesticides are responsible for low breeding success. There is no indication that nestling survival is linked to the types of food they eat (Slotow *et al.,* 1988). Raptors are important in ecosystems because they can regulate and determine patterns of community structure in their prey (Menge *et al.,* 1994). Population status and estimation of raptors are unique challenges that are very difficult to meet due to high dispersal in wide areas and low nest density (Fuller and Mosher, 1981). Excessive and rapid urbanization, deforestation and habitat fragmentation are major threats and are responsible for limiting prey populations, distribution and abundance. Due to anthropogenic disturbance and activities, many raptors left the nest and nesting sites (Boeker, 1971; Scott, 1985; Hunt *et al.,* 1999). Development of roads and highways also contributes to biodiversity loss, including birds (Pimm and Gilpin, 1989; Kruess and Tscharntke, 1994). Most of studies have been conducted on the effect of roads and highway development on bird populations and estimated traffic-related mortality, especially for owls (Bourquin, 1983; Hernandez, 1988). They may be disrupted in their roosting due to big roads, motor traffic disturbance and very little vegetation or habitat loss as a result of roadways. Due to dramatic changes in their landscape, many cities in the ancient world (London, Cape Verde, Istanbul) have seen historical reductions in the population of *Milvus* kites (Grossman *et al.,* 1964; Parry and Putman, 1979; Ferguson-Lees and Christie, 2001). At the moment, cutting down old and large trees may be a limiting factor for black kite nesting success. Pesticides and insecticides used in excess on agricultural land pollute the food chain. The consumption of poisoned carcasses by black kites and other raptors is caused by dead rodents and mice exposed to pesticides and rodenticides. The black kite's growth and survival are also limited by urbanisation, pollution and a lack of food and nesting sites. Further genetic variations, breeding success and population surveys as well as a long-term study may be useful in determining the population and breeding success of black kites.

Conclusion

The black kite is a medium-sized raptor. They play an important role in the ecosystem by maintaining prey populations, particularly rodents. The breeding season for black kites begins in March and lasts until April, depending on the subspecies. Kites are robust predators with curved beak, large wings, pointed and sharp talons on their feet. During the foraging time, they spend most of time in soaring and gliding. Presence of body parts of mouse, rabbits and feathers of pigeons around nests of black kites indicates that they usually feed upon variety of prey species. Black kites have been known to steal food from children's hands. In India, the breeding season for black kites begins in the winter and the young birds flee before the monsoons arrive. Black kite nests are identified by placing a small flag on the ground near the nest. The Guelma black kite construct nests on cliffs, trees and also utilized old nests. They have been known to successfully reproduce outside of their recognized breeding region, such as near Melbourne. Black kite nests construct on tall trees and selection of plant species for nest construction is usually depends upon indigenous flora. Large scale changes in ecosystem such as human development, vanishing of natural habitat and deforestation may become limiting factor for nesting site of black kite. Population status and estimation of raptors is very difficult due to spread in large and wide areas and low nest density. Raptors are important in ecosystems because they can regulate patterns of community structure in their prey. Urbanisation, deforestation and habitat fragmentation are major threats and responsible for limiting prey population, distribution and abundance.

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