



Original Research

**Gross Studies on Wing Flight Feathers of Small Indian Kite
(*Milvus Migrans Govinda*)**

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Abstract

The study was conducted on the wings of six adult kites (*Milvus migrans govinda*) irrespective of sex. Male and female birds have the same plumage but female birds are longer than male. The samples were collected from the cadavers presented to the Bodakdev (Wildlife Care Center) and Namonam Parivar, Ahmedabad. The present study showed that primary feathers were 10 in number and attached to the manus (carpometacarpus and digits), which were appeared as finger due to their structure. The number of secondary feathers varied according to the length of wing which were 12 to 15 and attached to the ulna. The numbers of allula were 2 to 3, which attached with first digit. The observations of present study concluded the type of flight (soaring and gliding) and type of bird (bird of prey).

Key words: Alula, Bird of Prey, Manus, Primary Feathers, Secondary Feathers, Small Indian Kite

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Introduction

The small Indian kite (*Milvus migrans govinda*) is a race of the Black kite (*Milvus migrans*) belongs to family Accipitridae, is one of the most common medium sized diurnal raptors of India, formerly known as Pariah kite. In Latin genus *Milvus* means 'kite' while species *migrans* means 'migrating or wandering' and race *govinda* meaning 'cow finder' comes from Hindu mythology as this race is common in Indian subcontinent (Godshe, 2014). In raptors flight is the primary mode of locomotion, feeding and breeding. The present study has been planned to study the gross structure of the flight feathers of wing. Flight feathers of wing are primary and secondary. Feathers are epidermal growths that form the distinctive outer covering; they are considered the most complex integumentary structures. Feathers serve many functions. They keep the bird warm, attract other birds of the same species, and aid in flight. Feathers are also valuable in aiding



the identification of species in forensic studies, particularly in bird strikes to aircraft. The available literature revealed that the work on the gross anatomy of flight feathers.

Materials and Methods

The present study was carried out on six adult kites irrespective of sex. There were no difference in colour and shape of plumage of male and female birds except their size (females longer than males). The classification, nomenclature and numbering of feathers has been adopted as per the description given by Trail (2001). The gross photography of wing feathers with various views, showing characteristics features were recorded.

Results and Discussion

Wings of *Milvus migrans govinda* had three types of flight feathers, which is also known as remiges, consist of the primaries, secondaries and alula (Fig. 1). Primary and secondary feathers play main role in flight, alula a small cluster of stiff feathers which not directly participated in flight. The present observation is in agreement with the observation of Trail (2001), Pennycuick (2008) and Hardey *et al.* (2009) in different diurnal raptors and Wang, Bin (2017) in seagull.

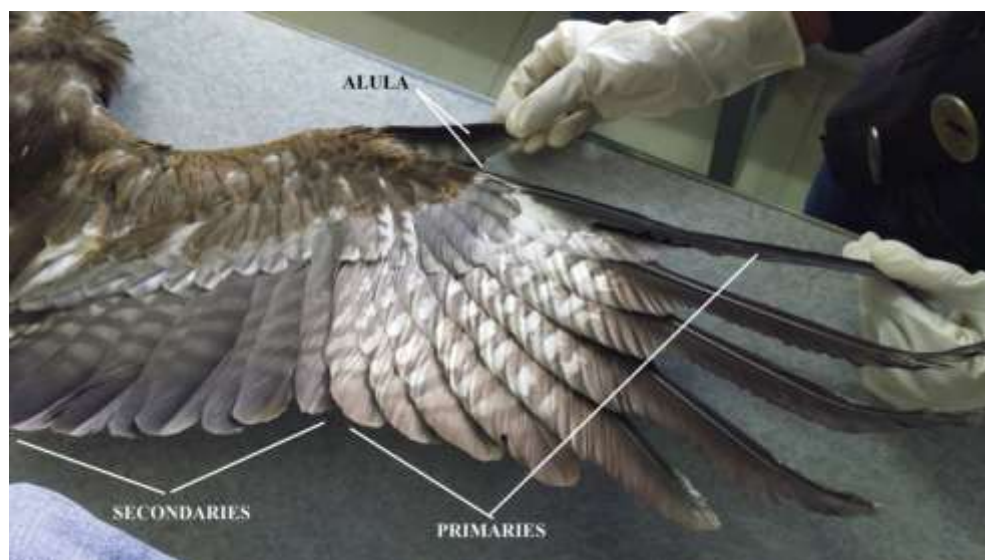


Fig. 1: Ventral view of wing showing all three types of flight feathers i.e. primaries, secondaries and alula

Primary Feathers

These were outer and largest of the flight feathers. These were long, stiff and asymmetrically shaped as has been described by Trail (2001) in different diurnal raptors. In *Milvus migrans govinda* primary feathers were 10 in number, which attached to the manus (carpometacarpus and digits) and appeared as finger due to their structure (Fig. 2). According to Baumel J.J. (1993) the manus serves as an anchor for the primaries.

Primaries are numbered from the innermost to outwards (P1-P10) (Fig. 2). Outer primaries were narrow and stiff than the inner primaries, which were broader and less stiff. This variation in shape of feathers may be because of their function.

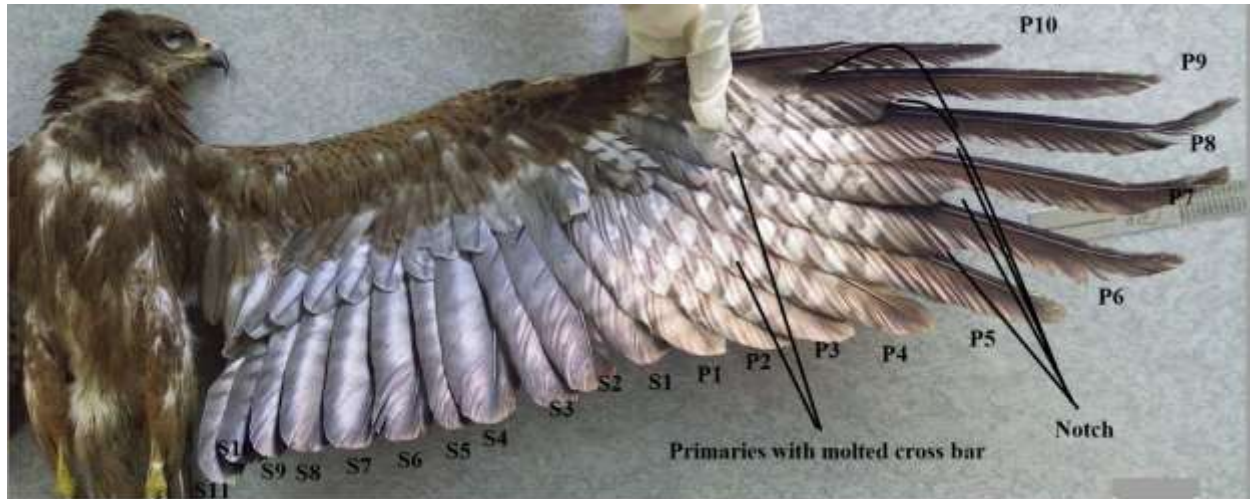


Fig. 2: Ventral view of wing showing all numbering of primaries (inward to outward) and secondaries (outward to inward). Show notch in primaries at posterior vane.

The present observation is in agreement with the observation of Alvarez *et al.* (2001), Trail (2001), Pennycuick (2008) and Hardey *et al.* (2009) in different diurnal raptors. Pennycuick (2008) stated that this reflects the function of the feathers: the outer primaries meet the air first, and must provide wind resistance and maneuverability.

In gross study primaries were lighter in colour than secondaries on dorsal aspect (Fig. 3) ventrally primaries have dark cross bars and were mottled at the base (Fig. 2). Present observation is in agreement with the observation of Alvarez *et al.* (2001), Trail (2001), Pennycuick (2008) and Hardey *et al.* (2009) in different diurnal raptors. The last five primaries showed emargination at anterior border of feathers and notch at posterior border of feathers. Wang, Bin (2017) in seagull stated that the outer primaries of most birds of prey have characteristic notches in the upper part of the two feather webs, known as emarginations on the outer or leading edge, and notches on the inner web. These notch and emargination were more prominent in 6th, 7th and 8th number of primaries (Fig.3). According to study longest primaries were 7th and 8th (Fig.2). Trail (2001) observed that the small outermost primary (P10) has no emargination in its narrow, stiff anterior vane. As you move inward, the posterior notches become less obvious, and the anterior vanes develop wider bases which gradually increase in length. Together, these changes reduce the relative length of the narrow tips. Author also described about type of bird in the basis of flight, author stated that in large soaring birds, the outer primaries have elongated narrow tips formed by a “notch” in the posterior vane and emargination in the anterior vane. This produces the characteristic “fingers” visible at the end of the wings

of a soaring bird. The elongated tips provide slots that increase lift as air is forced through the narrow gaps. So the observation of present study showed type of flight (soaring) as Trail (2001), Pennycuick (2008) and Hardey *et al.* (2009) in different diurnal raptors.



Fig. 3: Dorsal view of wing showing emargination at anterior vane of primaries.

Secondary Feather

The secondaries are the inner flight feathers, were attached to the ulna by rounded projections, known as quill knobs (Fig. 4). Secondary feathers remain close together like first five primaries they cannot be individually separated like the primaries. Secondaries were shorter and broader than primaries, with blunter ends (Fig. 2). The secondary feathers were variable in number according to length of the wing, in *Milvus migrans govinda*. The numbers of secondary feathers were 11 to 14. The observations of present study are in close agreement with the observation of Alvarez *et al.* (2001), Trail (2001), Pennycuick (2008) and Hardey *et al.* (2009) in different diurnal raptors. However, the present observation is lower than those reported by Hardey *et al.* (2009) in the golden eagle and the osprey where numbers of the secondary feathers were 17 and 20-21, respectively. The variations in the numbers of primary feathers and secondary feathers may be due the difference in the size of wings and the flight habit.

Secondaries were numbered from the outer to inner. Author Trail (2001) stated that each primary and secondary feather has its own number. Primaries were numbered from the innermost outwards. Secondaries are numbered from the outermost inwards. This numbering reflects the molt pattern, which begins with the inner primary and outer secondary. The inner primaries and secondaries overlap broadly to provide a smooth lifting surface.

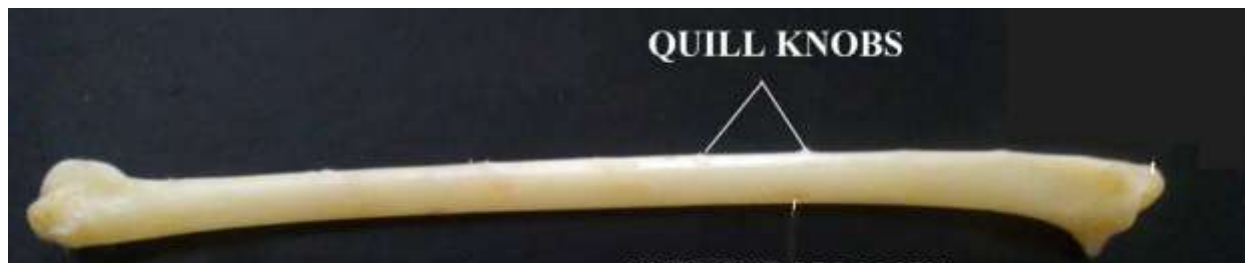


Fig. 4: Ulna of *Milvus migrans govinda* showing quill knobs for attachment of secondaries.

Alula

The numbers of alula were 2 to 3, which attach with first digit (Fig. 1). This observation is in close agreement with the observation of Alvarez *et al.* (2001), Trail (2001), Pennycuick (2008) and Hardey *et al.* (2009) in different diurnal raptors. Sang-im Lee *et al.* (2015) described that the alula or bastard wing is a small projection on the anterior edge of the wing of modern birds. The word is Latin and means "winglet". The alula is the freely moving first digit, a bird's "thumb", and typically bears three to five small flight feathers, with the exact number depending on the species. Zhang and Zhou (2000) stated that the alula is a small structure located at the joint between the hand-wing and arm-wing of birds and is known to be used in slow flight with high angles of attack such as landing. They gave evidence that the alula functions as a vortex generator that increases the lift force and enhances manoeuvrability in flights at high angles of attack. According to Tobalske *et al.* (2003) the functions of alula in the same way as the slats on the wing of an aircraft, allowing the wing to achieve a higher than normal angle of attack.

Conclusion

Present study conclude that the, type of flight is soaring and gliding as accordance with the observation of Saville (1956) and Norberg (2002) in different birds and type of bird is bird of prey as accordance with the observation of Trail (2001), Pennycuick (2008) and Hardey *et al.* (2009) in different diurnal raptors.

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