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Phylogeographic Relationships of the Black Kite *Milvus migrans*

Jessica Scheider, Michael Wink, Michael Stubbe, Sabine Hille and Wolfgang Wiltschko

ABSTRACT

We have started to develop genetic markers to define the phylogeography of different populations of the Black Kite. First results obtained from sequences of the mitochondrial cytochrome b gene (cyt-b, lengths 1143 BP) indicate that the Black and Red Kites (*Milvus migrans* and *Milvus milvus*) and populations of *Milvus migrans* are closely related. However, some phylogeographic patterns are apparent. Additionally, migration routes have been reconstructed from recoveries of ringed birds indicating that the subspecies show different migratory behaviour.

INTRODUCTION

The breeding range of the subspecies of the Black Kite *Milvus migrans* covers Europe, Africa, Asia and Australia. These birds of prey live throughout nearly all habitats, from desert to forest and near rivers. Five to seven geographically defined subspecies have been distinguished morphologically, but their taxonomy needs a thorough revision as some descriptions are contradictory.

In general the head of the Black Kite is whitish, the body dark brown; a marked greyish patch near the carpal joint of wing in flight is visible. The following descriptions of the different subspecies is based on Brown (1982), Ortlieb (1998), del Hoyo (1994), Glutz von Blotzheim (1971), Vaurie (1965), Étchécopar (1978), and Cramp (1980):

***M. m. migrans* (BODDAERT 1783):**

Its breeding area covers Europe, Western Asia and the north-western coast of Africa. It migrates to Africa and south-west Asia (Iran, Pakistan). Morphology: Dull brown above, with whitish head, body dark brown above and below, black bill, yellowish legs.

***M.m.lineatus* (JE GRAY 1831):**

The tallest subspecies breeds in Asia north from Ural to Kamtschatka, south from Iran to Indochina; partly migratory. Morphology: the carpal joint of the wing is the biggest of all the subspecies, more or less uniformly dark brown, less rufous, black bill.

***M.m.parasitus* (DAUDIN 1800):**

The distribution area of the so-called Yellow-billed Kite is from West-Africa to Kenya down to South-Africa. Morphology: smaller than *M. m. migrans*, adults with yellow bill and legs.

***M. m. aegyptius* (GMELIN 1788):**

This subspecies is doubtful and could belong to *M. m. parasitus*. Breeding SW Arabia and coastal East Africa south to Kenya. Morphology: smaller than nominate *migrans* but paler and more rufous throughout, the tail with darker bars, the bill blackish in immature, yellow in adult.

M. m. govinda SYKES 1832:

Breeds on the Indian continent, Eastern Pakistan to Malay Peninsula. Morphology: smaller than *M. m. migrans*, other characters intermediate between *migrans* and *lineatus*.

M. m. affinis GOULD 1838:

Australian continent. Morphology: tail more rufous and deeper tailed than nominate *migrans*.

M. m. formosanus KURODA 1920 :

This subspecies is distributed in Taiwan and Hainan, but has been described from only seven individuals. It is often lumped together with *M. m. lineatus*.

MATERIAL AND METHODS

Migration

The migration routes of the subspecies of the Black Kite *Milvus migrans* were reconstructed from data obtained from local ringing programmes. The data were analysed with ArcView GIS 3.2 to reconstruct the migration routes.

DNA studies

Blood, tissue or feather samples of the Black Kite as well as samples of the Red Kite and some other Accipitriformes (as outgroups) were obtained from Germany (*Milvus migrans migrans, Milvus milvus*), Mongolia (*ssp. lineatus*), South Africa and Kenya (*ssp. parasitus*) and Australia (*ssp. affinis*). The samples were stored in EDTA buffer, Queens Buffer or absolute ethanol (Wink 1998; 2000). The cytochrome gene was amplified by PCR (primers: L14764, mt-A and mt-C) and sequenced directly (on a capillary sequencer: ABI 3100). Sequences of 1000 and more base pairs were aligned in WinEdt5.2 and analysed with the software packages PAUP*4.0b10 (Swofford, 2002) and MEGA2 (Kumar *et al.* 2001) (see Wink 2000; Wink & Sauer-Gürth 2000; Wink *et al.* 2002; Broders *et al.* 2003 for further details).

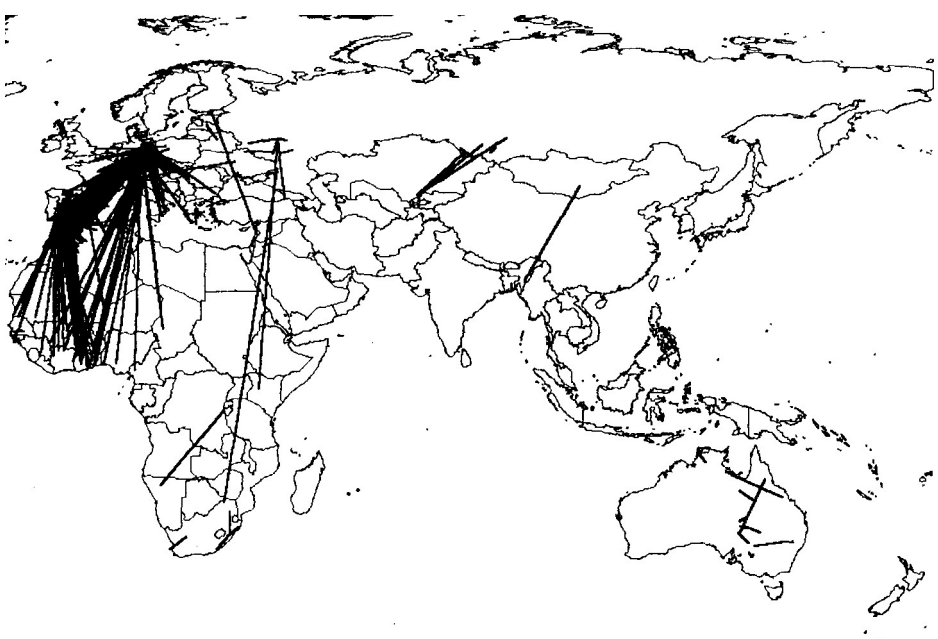
RESULTS AND DISCUSSION

As can be seen from Figure 1, the nominate subspecies *migrans* migrates from its breeding area in Europe mainly to western Africa (Guinea – Nigeria). Some recoveries – mainly originating from northern and eastern Europe – indicate a possible alternative S-E-Route via the Bosphorus. One interesting recovery is a bird ringed in Finland and shot in Jordan. Two others ringed in western Russia were recovered in Kenya and South Africa. Some of the wintering areas of *migrans* overlap with the breeding range of the *M. m. parasitus*.

The wintering range of *M. m. lineatus* is not known. Recoveries from birds ringed during autumn migration were made only during breeding time in the NE: In southern Russia; own observations in Kazakhstan indicate intense southward migration of this subspecies. One interesting recovery comes from a bird ringed in southern Mongolia and recovered in Eastern India (Manipur/Assam). This is the only evidence indicating that *M. m. lineatus* flies east of the Himalayas and additionally spends the winter in the eastern breeding area of the subspecies *M. m. govinda*.

Milvus migrans parasitus is a non-migrating subspecies which stays in its breeding area and does not leave the African continent. The few recoveries do not give a hint of a migrating or wintering pattern. The same phenomenon applies to *M. m. affinis*, the Australian subspecies. Recoveries show irregular movements within the Australian continent.

Figure 1: Migration routes of the subspecies reconstructed from recoveries of ringed Black Kites *Milvus migrans*



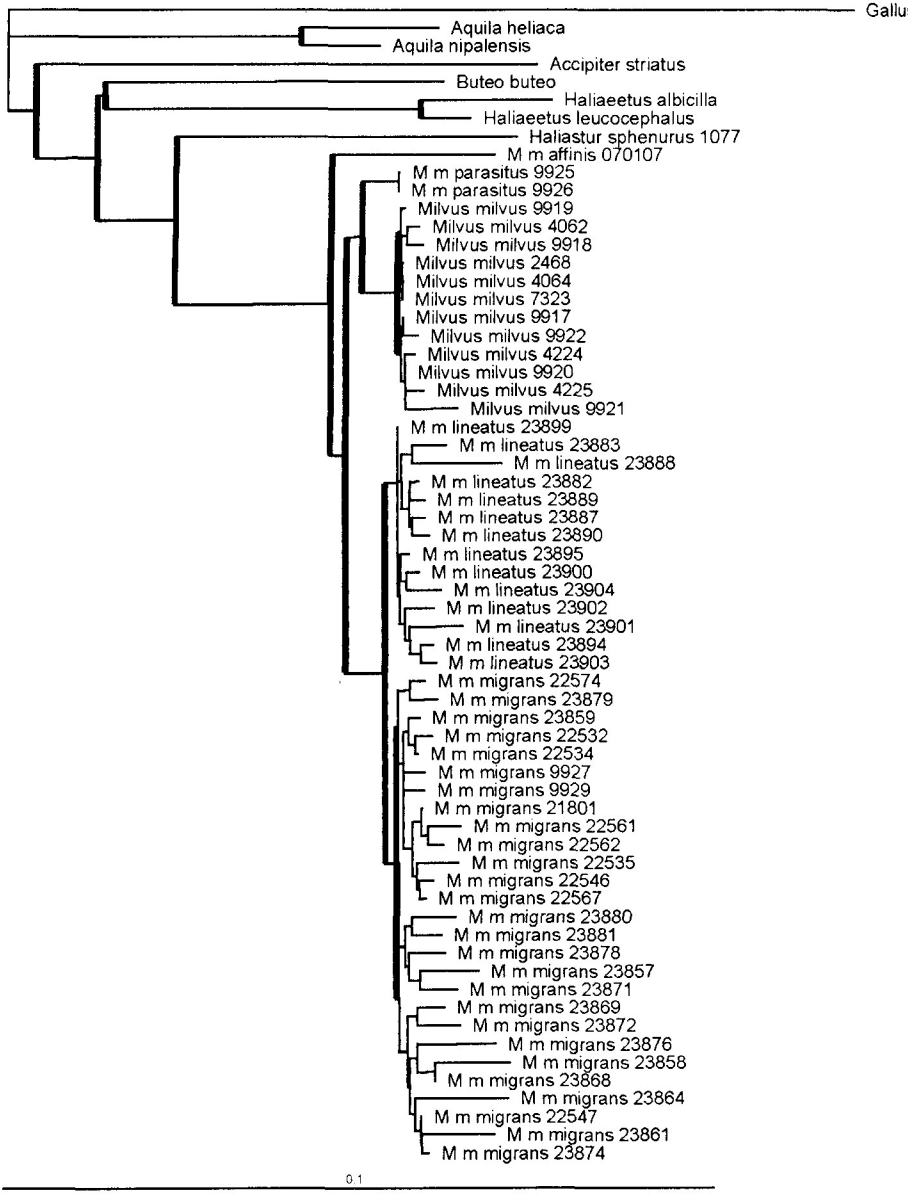
Preliminary analysis of the nucleotide data from cytochrome b clearly indicates that both kite species as well as the subspecies of the Black Kite fall into distinct clades. The Red Kites and most subspecies of the Black Kite are clearly distinguishable from each other. There is some evidence for a limited hybridisation between both species (data not shown).

M. m. lineatus forms a distinct phylogenetic group within the Black Kite group; Both subspecies are also clearly distinguishable from each other on account of morphological characters.

M. m. affinis clusters to the base of the kites. This surprising finding needs to be corroborated employing more individuals; the present result came from a single bird and could be an artefact due to degraded DNA.

Milvus m. parasitus seems to be phylogenetically closer to *Milvus milvus*, as was already found by Wink *et al* (2000).

Figure 2. A molecular phylogeny of the kites based on cytochrome b sequences. Maximum parsimony tree (phylogram); conditions: heuristic search, branch swapping TBR. Branches printed in bold indicate bootstrap values above 75%.

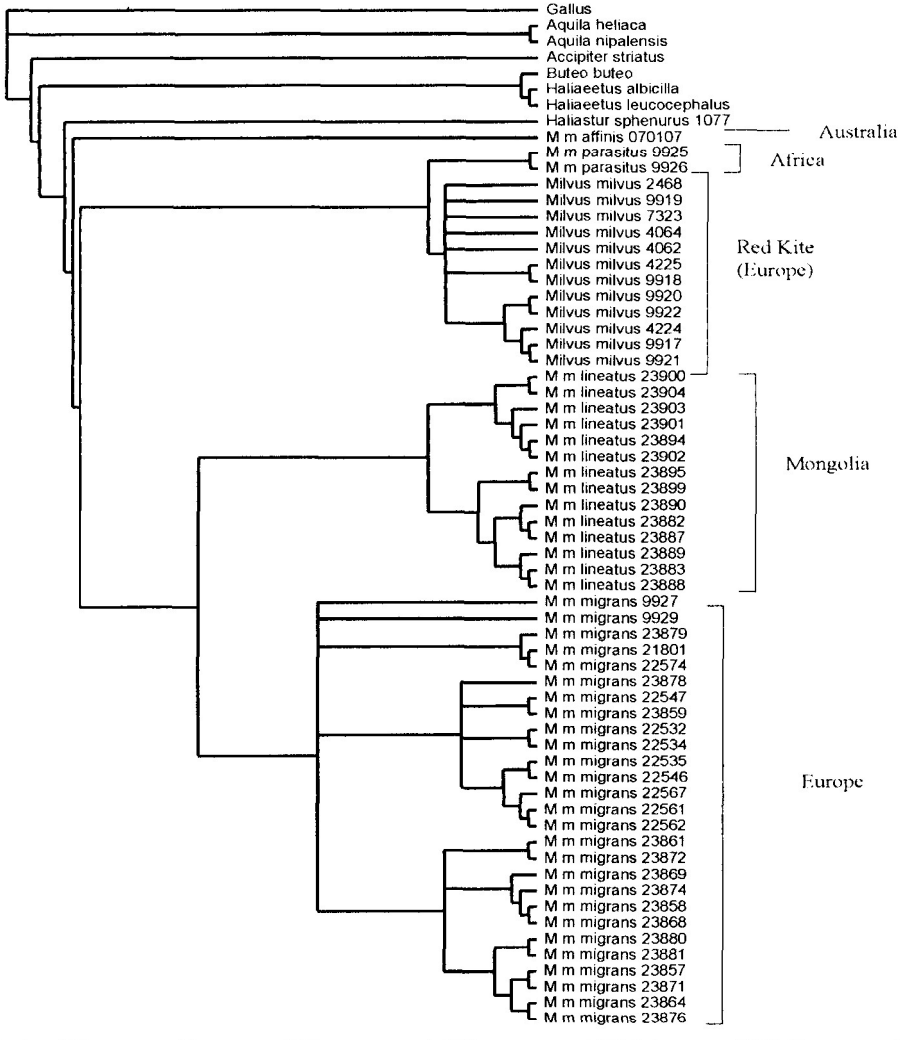


CONCLUSIONS

The Black Kite and Red Kite are phylogenetically closely related, although the former is one of the most successful and widespread birds, whereas the latter is an European endemic and one of the most endangered species of Europe.

We intend to describe and analyse the phylogenetic, phylogeographic and morphological framework of the kites (genus *Milvus*) in detail. However, to be able to establish the complete phylogenetic patterns of all subspecies of the Black Kite, more material - recoveries and samples - from Asia, Africa, Australia and India is needed.

Figure 3: Representation of the kite phylogeny as a 50% consensus cladogram



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Jessica Scheider
Zoologisches Institut
Johann Wolfgang Goethe-Universität
Frankfurt
Siesmayerstr. 70, D-60323 Frankfurt
Email: J.Scheider@zoology.uni-frankfurt.de

Prof. Dr. M. Wink
Institut für Pharmazie und Molekulare
Biotechnologie, Universität Heidelberg
INF 364, 69120 Heidelberg
Germany
Email: wink@uni-hd.de

Prof. Dr. Michael Stubbe
Martin-Luther-Universität
Institut für Zoologie
Domplatz 4, D-06099 Halle

Dr. Sabine Hille
Konrad Lorenz-Institut für
Vergleichende Verhaltensforschung
Österreichische Akademie der
Wissenschaften
Savoyenstraße 1 A, A-1160 Wien

Prof. Dr. Wolfgang Wiltschko
Zoologisches Institut
Johann Wolfgang Goethe-Universität Frankfurt
Siesmayerstr. 70, D-60323 Frankfurt
Email: Wiltschko@zoology.uni-frankfurt.de