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FIRST RECORDED POLYGYNOUS MATING IN THE RED KITE (*MILVUS MILVUS*)

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KEY WORDS: *Red Kite*, Milvus milvus; *bigamy*; *polygyny*; *Doñana, Spain.*

Diurnal birds of prey are predominantly monogamous (Newton 1979). Alternative mating systems like polygyny, polyandry, or cooperative breeding are rare, but have been recorded in at least 16 species of raptors (Newton 1979, Faaborg and Bednarz 1990, Heredia and Donázar 1990, Tella 1993, Tella et al. 1996). Nonmonogamous relationships are easily overlooked when working with unmarked individuals and are almost certainly more widespread than published records show (Newton 1979). Polygyny in birds of prey has only been regularly observed in harriers (*Circus* spp.) although it has been occasionally recorded in another nine species (Newton 1979, Hiraldo et al. 1991, Tella et al. 1996) and seems to be associated with relatively productive habitats with an abundant food supply.

The Red Kite (*Milvus milvus*) is considered a monogamous raptor and to our knowledge no instances of polygyny have been reported previously (Glutz von Blotzheim et al. 1971, Newton 1979, Cramp and Simmons 1980). According to Glutz von Blotzheim et al. (1971) and Cramp and Simmons (1980), both adults build nests. Incubation is mainly done by females although males may incubate for short periods during the day. Males bring prey to females and defend nest sites during incubation and the first two weeks after hatching while females brood and feed the young. Later, both members of pairs defend nest sites and bring food to nests, where the young feed themselves. On average, young fledge 55 d after hatching and are fed by both parents for another 26 d in the vicinity of the nest (Bustamante 1993). The entire hunting territory is not defended, but Red Kites defend areas surrounding nest sites at least until the young become independent (Bustamante and Hiraldo 1993).

In 1996 and 1997, we recorded the presence of a po-

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lygynous trio of Red Kites in the area around the "Palacio de Doñana," Doñana Biological Reserve, southwest Spain (37°N, 6°30'W; Valverde 1958, Rogers and Myers 1980). The male could be identified by a white PVC band on the left leg with the code "2AU" that could be read with a telescope from approximately 200 m. This bird was banded as a nestling by L. García on 6 May 1977 in a pine forest named "Pinar de San Agustín," <1000 m from the "Palacio de Doñana." The bird was retrapped and observed several times during its life close to this pine forest and was documented breeding in this area at least since 1984 (B. Heredia, L. García, G. Vilchez, F. Hiraldo, M. Pineda and R. Lafitte pers. comm.). One female (F1) associated with this male was not banded and could only be identified due to her proximity to one of the nests. The other female (F2) using the territory had a metal band on the right leg, but we could not read this band. Due to the absence of differences in coloration or molting between the individuals, they could only be identified when they were perched in plain sight.

OBSERVATIONS IN 1996

Observations in March 1996 indicated that there was a polygynous trio in the area around the "Palacio de Doñana." On 8 March 1996, from 0757–1200 H, we were simultaneously observing what we thought were two different pairs of breeding Red Kites. One pair was observed building a nest in a stone pine (*Pinus pinea*) inside a small pine forest named "Pinar de San Agustín." One kite was banded with a white PVC band on the left leg that was read with the telescope as "2AU." The other kite (F1) was not banded. During observations, both kites were observed bringing material to the nest. On one occasion, they copulated indicating they were pair-bonded and we deduced "2AU" was the male and F1 the female. A second nest being observed was in a tall eucalyptus tree (*Eucalyptus globulus*) approximately 50 m east of the "Palacio de Doñana" and 800 m east of the first nest. Most of the time only one kite (F2) was observed in the area, flying and perching on the nest tree. This kite was banded with a metal band on the right leg. At 0934 H, a second kite, banded with white PVC band on the left leg, was seen perched 100 m from the nest. At 0959 and 1002 H, the kites copulated twice in another eucalyptus close to the nest tree. The copulation positions indicated that F2 was a female but we were not able to read the PVC band code of the male with a telescope. At 1005 H, the male with the white PVC band flew away. On 20 March 1996, F2 was observed copulating with the male with a white PVC band and both kites brought sticks to the nest in the eucalyptus tree. On 22 March 1996 at 1026 H, the nest was observed while F2 incubated. The male with the white PVC band flew to the nest and copulated with F2. On this occasion, the PVC band of the male was identified as "2AU." At 1234 H on the same day, a blind was set close to the nest occupied by F1 in the pine forest. At 1353 H, the male "2AU" entered the nest in the stone pine with prey and began incubating. The male "2AU" was still incubating at 1415 H when observations were stopped.

The nest tended by F2 could be checked from an observation tower nearby. F2 laid one egg that failed to hatch for unknown reasons. We did not check the nest used by F1 until 8 May 1996. We found it contained two young that hatched on 20 and 21 April based on the length of their 7th primary feathers (Bustamante 1990) Both young fledged.

OBSERVATIONS IN 1997

We made opportunistic observations of the polygynous trio from 9 February–9 March. The male "2AU" was seen copulating with both an unbanded female on three occasions (9, 10, and 11 February) and a female with a metal band on the right leg on three occasions (13 February, 9 and 13 March). We suspect they were the same females, F1 and F2, from 1996. F1 was seen copulating and perched close to the male "2AU" in the same pine forest as in 1996 and F2 was seen bringing nest material to a nest in a poplar (*Populus alba*) 100 m north of the 1996 F2 nest. Only on one instance was the male seen bringing nest material to the pine forest nest. The F1 nest was located in a stone pine 50 m west from the 1996 nest The distance between F1 and F2 nests was approximately 750 m.

Both nests were observed on a regular basis from 24 April–26 June, during which time the young of both nests grew from a few days old to fledging. Observations were carried out from a blind and were restricted to days that were mostly without clouds and low wind speeds to minimize the effects of weather conditions on the hunting success and feeding frequency of the kites. During this period, F1 nest was observed for a total of 33.4 hr on 11 different days ($\bar{x}$ = 3.0 ± 2.0 hr, ±SD). F2 nest was observed for a total of 41.9 hr on 11 different days ($\bar{x}$ = 3.8 ± 1.6 hr, ±SD).

The F1 nest contained two young that were banded on 30 April. We estimated that the young had hatched on 7 and 12 April. A total of 10 prey was observed delivered to the nest during 33.4 hr of observation; five were brought by the male "2AU," two by the female F1. In three instances, it was not possible to identify the individual bringing the prey. F2 nest contained one young that was banded on 17 May. We estimated hatching date to have been 24 April. We recorded eight prey delivered to the nest during 41.9 hr of observation and all were brought by the female F2. The male "2AU" was never seen at F2 nest. We approached both nests on several occasions. F1 nest was defended by two adults (kites hovering above the nest) while F2 nest was defended by only one kite.

DISCUSSION

Observations in 1996 clearly showed that the same male "2AU" copulated with two females that used differ-

ent nests, helped both females with nest building and helped one of them (F1) with incubation. Both females laid eggs and only one bred successfully. We cannot completely exclude from the 1996 observations that copulations with F2 were extra-pair copulations by "2AU" and that F2 may have had an undetected partner. Observations in 1997 were detailed enough to show that "2AU" was the only male seen with both females during nest building, incubation and brood rearing. The male "2AU" copulated seemingly equally with both females and helped both during nest building. During brood rearing, the male's attention was directed exclusively to the F1 female and F2 raised its single nestling alone.

Polygyny had not been previously documented in Red Kites, but as individuals tend to be very similar in coloration this behavior could be very easily overlooked unless kites are marked. This polygynous trio was similar to polygynous bondings observed in Northern Harriers (*Circus cyaneus*) (Simmons et al. 1986) in that there was a hierarchy between females. In the case of the Red Kites, the second female to lay eggs received no attention from the male once its young hatched. Nearest-neighbor distance between Red Kite nests ($\bar{x}$ = 893.1 m, range = 690–2250, N = 21, Bustamante and Hiraldo 1990) was much shorter than elsewhere in Europe (4–5 km, Davies and Davis 1973, Valet 1975), probably indicating that there was abundant food for breeding Red Kites in Doñana. The Doñana area includes a highly productive marsh. The short distance between nesting territories in Doñana may have been a proximate cause facilitating this polygynous mating.

Four main hypotheses have been proposed to explain how polygyny may be advantageous. The "polygyny threshold" hypothesis (Verner and Wilson 1966, Orians 1969) suggests that a female should choose to mate polygynously in a high-quality territory when her fitness would be equal or greater than if she mated monogamously in a lower-quality territory. The "sexy son" hypothesis (Weatherhead and Robertson 1979) suggests that the female choice of polygyny could be based on the quality of the male rather than his territory. A third possibility is that if suitable breeding sites are limited and monopolized by a few males, females may be forced to mate polygynously rather than forgo breeding (Orians 1961). A skewed sex ratio (shortage of males) could be equivalent to limited breeding sites. Finally, the "deception" hypothesis (Alatalo et al. 1981) suggests that the male may be able to conceal its mated status to the females holding two separate territories.

It is difficult to believe that the male was able to deceive the second female and hide its mated status considering the polygynous trio was stable for two years and that the two nests were very close. In 1996 and 1997, we surveyed 32 nesting territories inside the Doñana Biological Reserve (10 000 ha) that had been occupied by Red Kites at least once since 1981. For the period 1981–97, the average number of nests in which Red Kites layed eggs was 16 (maximum 19 nests). Red Kites layed eggs in 13 nests in 1996 and in 14 nests in 1997 (F. Hiraldo unpubl. data). Nesting sites did not seem to be limited in any of the two years. We do not know if there could be an unbalanced sex ratio or a lack of bachelor males. The territory of the male "2AU" could be of a higher quality than other territories in the area. The fact that F2 was able to raise a young in 1997 without the help of the male suggests that food was abundant in the proximity of the nest. The F2 nest was very close to a group of inhabited houses, the "Palacio de Doñana," that constitutes a predictable source of food for the kites. Also, we cannot exclude the possibility that the male "2AU" was of higher quality than other males. Male "2AU" was 19 years old in 1997, the oldest known-age Red Kite in our marked population (F. Hiraldo unpubl. data). The longevity of "2AU" may suggest this bird carried "good genes" and he may have been a high-quality male.

RESUMEN.—Se describen las observaciones de un trío poligínico de milanos reales (*Milvus milvus*) en la Reserva Biológica de Doñana, durante dos años consecutivos: 1996 y 1997. Un macho marcado, de edad conocida, se apareó con dos hembras, posiblemente las mismas ambos años, que utilizaron para poner nidos distintos. En 1996 la primera hembra crió dos pollos y la segunda fracasó. En 1997 la primera hembra en realizar la puesta crió dos pollos y la segunda uno. Se comprobó este año que el macho cebaba y defendía exclusivamente el nido de la primera hembra y que la segunda fue capaz de criar con éxito su pollo sin la ayuda del macho.

[Traducción de Autores]

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MITES IN GREATER SPOTTED EAGLE NESTS

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KEY WORDS: *Spotted Eagle*; Aquila clanga; *mites*; *Acari*; *Mesostigmata*; *Biebrza National Park*; *Poland.*

The Greater Spotted Eagle (*Aquila clanga*) is among the rarest predatory birds in the world, nesting from the eastern areas of Poland, through Belarus and Russia to the Pacific coast (Meyburg 1994). In Poland, it is legally protected and classified in the Red Data Book as Endangered (Król 1992). It nests in impenetrable boggy woods and, in Poland, only about 12 pairs remain in Biebrza National Park (Maciorowski et al. 1996). Greater Spotted Eagles build their nests only in birches (*Betula* spp.), black beech (*Alnus glutinosa*) and, less frequently, in oaks (*Querqus* spp.) and willows (*Salix* spp.). While the mite fauna in the nests of several predatory birds has been studied in Europe (Nordberg 1936, Philips 1981, Wiśniewski and Hirschmann 1985, 1990, Mizera 1990, Mašan 1993), the acarofauna of Greater Spotted Eagle nests has never been described. In this paper, we identify mites of the order *Mesostigmata* which inhabit the nests of Greater Spotted Eagles in Poland. These mites are small (adult length 0.4–1.6 mm), free-living arachnids which have phoretic or other relationships with birds.

METHODS

Samples were obtained at two Greater Spotted Eagle nests in Biebrza National Park in northeastern Poland.