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pick out even at a distance against the light. Although associating with the 15-strong Crowned Sandgrouse group and adapting its general rhythm, the Pin-tailed Sandgrouse reacted slowly to the other sandgrouse, often lagging slightly behind them when they moved, or wandering off a few metres when feeding **(Plate 2)**. In contrast, it merged well with the group in flight.

REFERENCES

GOODMAN, S.M. AND P.L. MEININGER. 1989. (Eds). *The Birds of Egypt*. OUP. Oxford. UK.
MADGE, S AND P. MCGOWAN. 2002. *Pheasants, Partridges and Grouse.* A&C Black. London
SHIRIHAI, H. (1996). *The birds of Israel*. Academic Press, London.

Second clutches by Common Kestrels *Falco tinnunculus* breeding on buildings in Israel

MOTTI CHARTER, AMOS BOUSKILA AND YOSSI LESHEM

Motti Charter and Yossi Leshem, George S. Wise Faculty of Life Sciences, Department of Zoology, Tel Aviv University, IL-69978 Tel Aviv, Israel. E-mail: charterm@post.tau.ac.il; Amos Bouskila, Department of Life Sciences, Ben-Gurion University of the Negev, Beer-Sheva, 84105, Israel

DOUBLE BROODS have been recorded for rodent-hunting raptors, such as American Kestrels *Falco sparverius* (Toland 1985), White-Tailed Kite *Elanus leucurus* and Harris' Hawks *Parabuteo unicinctus* (Newton 1979). The reproductive success of Common Kestrel (*F. tinnunculus*; hereafter Kestrel) has been studied throughout most of its range (*eg* Korpimäki 1984, Village 1990, Kostrzewa & Kostrzewa 1997) but laying second clutches after rearing a first brood successfully has been observed in the field only in Spain (Sánchez 1990, Fargallo *et al* 1996) and South Africa (van Heerden *et al* 1994). Fargallo *et al* (1996) reported that three out of 11 Kestrel pairs began possible second clutches. Kestrels in captivity, under designated photoperiods, have produced second clutches (Meijer 1989, Meijer *et al* 1992). We report three instances of Kestrels laying second clutches that were started before or after first broods were raised during the 2004 breeding season in three locations in Israel.

Methods and results

During the 2004 breeding season, three out of 40 breeding Kestrel pairs (being monitored as part of a yearly survey in Israel of breeders in buildings) started potential second clutches after the first had fledged. None of the three pairs were ringed or otherwise marked, but we adjudged that the same pairs had laid two clutches from our field observations, the timing of laying between clutches, and the same nests being used continuously. Pair A nested in Rishon L'Zion, pair B in Tel Aviv and pair C in the Kibbutz Merom Golan. All three pairs nested in flowerpots on building window sills. Pairs A and B nested in densely populated urban areas and pair C in a village.

Table 1 summarises the following paragraphs. Pair A started its first clutch on the 11th floor of a 15-storey building on 13 March 2004, laid five eggs, two nestlings hatching and fledging. The 2nd clutch – comprising four eggs – was laid in the same flowerpot starting on 19 May. This date was only five days after the first brood had flown the nest, but. They kept returning to the flowerpot to sleep at night while the adult female incubated the second clutch, which the male would incubate when the female went off to feed. After three weeks' incubation, the female abandoned the clutch, at which time the first brood stopped sleeping there.

Pair B nested in two different flowerpots on separate buildings, 35m apart. The first nest was started on 23 March on the top floor of an 8-storey building; from 5 eggs, 3 nestlings hatched

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and later fledged. The second nest was on the 10th floor of an adjacent 15-storey building. It was begun on 15 May 2004, 7 days before the first brood's nestlings began to fledge (22 May). Both male and female visited both nests. The female stopped hunting about a week before beginning to lay in the second nest, staying in close proximity to the first nest, but starting to visit the second flowerpot. The male supplied all the food for the first brood and his mate. On 21 May 2004, the female began incubating the second clutch, but continued to feed the first brood in the first nest when the male brought prey. After fledging, the young would visit the second nest frequently, but when the young approached too closely, the female would chase them away. As for the first clutch, the male incubated the eggs when the female left the second nest to eat the prey he had supplied to the first nest. The female continued to incubate the eggs for 30 days round the clock; she then continued for 7 nights before abandoning the eggs. The clutch was found to be infertile.

Pair C nested in a flower pot on a window sill of a single-storey house in Ramt HaGolan, laying 6 eggs, all of which hatched and later fledged on 25 May. On 26 July, the same nest held three nestlings, estimated to be around 23 days old. Their hatching date probably was 3 July and the laying date 6 June, some 12 twelve days after the first brood had fledged.

Discussion

From direct observation, we know Pair B comprised the same two adults involved with both nesting attempts. We believe that the second nesting attempts by pairs A and C were likewise by the unchanged pairs that had raised the first broods, because Kestrel fledglings stay close to the nest after fledging and the parents feed them in that vicinity. Sometimes the fledged brood use their nest to sleep in. All three pairs laid their second clutches within 12 days of fledging their first brood. Indeed, one pair started before the brood fledged. It is unlikely that Kestrel parents would allow another pair to use their nest so soon after the first brood fledged. Furthermore, the female ceases hunting and remains near the intended nest before starting to lay, an unlikely event if the intended nest was already was occupied by a another pair with nestlings.

For Kestrels, the dates of the breeding season and initiation of laying become later as latitude increases (**Fig 1**). Replacement clutches are less frequent and clutch size is larger at higher latitudes (Newton 1979). Fargallo *et al* (1996) suggested that prey abundance and latitudinal trends allowed Kestrel pairs to lay second clutches in Spain. It seems no coincidence that our study, like most reported cases of Kestrel double clutches (Sánchez 1990, Fargallo *et al* 1996), involves Mediterranean populations.

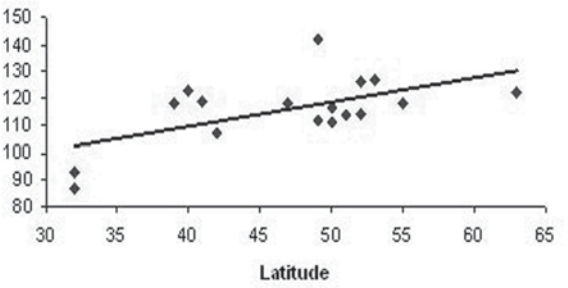


Figure 1. Relationship between laying date (1= 1 January) and latitude for Common Kestrel *Falco tinnunculus*. Data Taken from 16 different studies*. Pearson's r=0.60, n= 17, P=< 0.05

*Cavé 1968; Bonin & Strenna 1986; Korpimäki 1984; Village 1986; Village 1990; Aparicio 1994; Pikula *et al* 1984; Plesník & Dusík 1994; Gil-Delgado *et al* 1995; Kostrzewa & Kostrzewa 1997; Korpimäki & Wiehn 1998; Avilés & Sánchez 2000; van Zyl 1999; Salvati 2002, Charter 2005.

The adults faced the conflicting requirements of continuing to feed the first-brood fledglings and of incubating the second clutch in different ways. The female from Pair A allowed her first-brood fledglings to visit the nest during second-clutch incubation, but the female from Pair B frequently chased away her first-brood fledglings.

Further studies in similar latitudes and other locations (preferably including marked individuals) would be needed to determine the frequency of Kestrel double brooding and the conditions that permit it.

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Table 1. Second clutches recorded during the 2004 breeding season in Israel

1st clutch	Laying Date	Clutch Size	Brood Size	No Fledged
Pair A	11 March	5	2	2
Pair B	23 March	5	3	3
Pair C	31 March*	6	6	6
Mean	17 March	5.33	3.67	3.67
2nd clutch				
Pair A	19 May	4	0	0
Pair B	15 May	3	0	0
Pair C	06 June	NK	NK	3
Mean	17 May	3.50	0.00	1.00

*Approximate laying date determined by subtracting the average incubation of 28 days (Cramp & Simmons 1980) from the hatching date (determined from nestling age). NK=Not Known

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REFERENCES

APARICIO, J.M. 1994. The seasonal decline in clutch size: an experiment with supplementary food in the Kestrel, *Falco tinnunculus*. *Oikos* **71**: 451–458

AVILÉS, J.M, AND J.M. SANCHEZ. 2000. Breeding biology of the Eurasian Kestrel in the steppes of southwestern Spain. *J. Raptor Res*. **34 (1)**: 45–48.

BONIN, B. AND L. STRENNA. 1986. Sur la biologie du faucon créderelle *Falco tinnunculus* en Auxois. *Alauda* **54**:241–262.

CAVÉ, A.J. 1968. The breeding of the Kestrel (Falco tinnunculus) in the reclaimed area Oostelijk Flevoland. *Neth. J. Zool*. **18**:313–407.

CHARTER, M. 2005. Aspects of the breeding biology of Common Kestrels (*Falco tinnunculus*) in Israel. MSc Theses, Tel Aviv University.

CRAMP, S. AND K.E.L. SIMMONS. 1980. (Eds). *The birds of the Western Palearctic.* Vol 2. OUP. Oxford. UK.

FARGALLO, J.A., G. BLANCO, AND E. SOTO-LARGO. 1996. Possible second clutches in a Mediterranean mountain population of the Eurasian Kestrel (*Falco tinnunculus*). *J. Raptor Res*. **30 (2)**: 70–73.

GIL-DELGADO, J.A., J. VERDEJO AND E. BARBA. 1995. Nestling diet and fledgling production of Eurasian Kestrels (*Falco tinnunculus*) in eastern Spain. *J. Raptor Res*. **29 (4)**: 240–244.

KORPIMÄKI, E. AND J. WIEHN. 1998. Clutch size of Kestrels: seasonal decline and experimental evidence for food limitation under fluctuating food conditions. *Oikos* **83**:259–272.

KORPIMÄKI, E. 1984. Population dynamics of birds of prey in relation to fluctuations in small mammal populations in western Finland. *Ann. Zool. Fennici* **21**: 287–293.

KOSTRZEWA, A. AND R. KOSTRZEWA. 1997. Breeding success of the Kestrel *Falco tinnunculus* in Germany: results 1985–1994. *J. für. Orn*. **138**: 73–82.

MEIJER T., S. DAAN AND C. DIJKSTRA. 1992. Egg-laying and Photerefractoriness in the Eurasian Kestrels *Falco tinnunculus*. *Orn. Scand*. **23**: 405–410.

MEIJER T. 1989. Photoperiodic control of reproduction and moult in the Kestrel, *Falco tinnunculus*. *J. Biol. Rhythms* **4**: 351–364.

NEWTON, I. 1979. *Population Ecology of Raptors*. Buteo Books. Vermilion. South Dakota. USA.

PIKULA, J., M. BEKLOVÁ AND V. KUBIK. 1984. The nidobiology of *Falco tinnunculus*. *Acta Sc. Nat. Brno* **18 (4)**: 1–55.

PLESNÍK, J. AND M. DUSÍK. 1994. Reproductive output of the Kestrel *Falco tinnunculus* in relation to small mammals dynamics in intensively cultivated farmlands. **In**: Meyburg, B.U. and R.D. Chancellor. (Eds). *Raptor Conservation Today*. 61–65.

SALVATI, L. 2002. Spring weather and breeding success of the Eurasian Kestrel (*Falco tinnunculus*) in urban Rome, Italy. *J. Raptor Res*. **36 (1)**: 81–84.

SÁNCHEZ. J.M. 1990. Noticiario Ornitológico. *Ardeola* **37**: 335.

TOLAND, B.R. 1985. Double brooding by American Kestrels in central Missouri. *Condor* **87**: 434–436.

VAN HEERDEN, P., A. ELLMANN AND B. VAN ZYL. 1994. Multiple breeding by Rock Kestrels in the Tygerberg Residential Area. *Birding in SA* **6**: 119–122

VAN ZYL, A.J. 1999. Breeding biology of the Common Kestrel in southern Africa (32°S) compared to studies in Europe (53°N). *Ostrich* **70**:127–132.

VILLAGE, A. 1990. *The Kestrel*. T&AD Poyser Ltd. London. UK.

VILLAGE, A. 1986. Breeding performance of Kestrels at Eskdalemuir, south Scotland. *J. Zoo. Lond*. **208**: 367–378.