

A case of bigamy in the redbreasted swallow *Hirundo semirufa*

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The first known case of bigamy in the redbreasted swallow *Hirundo semirufa* is described and tested against theories on polygynous breeding in birds. Although three birds fed the nestlings only four of the eight fledged indicating that bigamy is not more productive than a monogamous breeding system.

Die eerste bekende geval van bigamie in die rooiborsswael *Hirundo semirufa* word beskryf en die voorkoms hiervan word vergelyk met teorieë oor poligamie by voëls. Poligamie is skynbaar nie 'n meer produktiewe broei-strategie as monogamie nie aangesien slegs vier van die agt kuikens die nes verlaat het.

Although monogamy is the most common mating system among passerine birds (Lack 1968) it has received little research attention. The study of polygyny, on the other hand, has led to the formulation of several theories most of which explain how differences in territory quality can give rise to polygyny in territorial passerines (Verner & Willson 1966; Orians 1969). Emlen & Oring (1977) put forward a model which states that bigamy can occur when differences in territory quality are large enough so that a female can have higher fitness if she shares resources on a high-quality territory of a mated male, than if she mates monogamously, in a low-quality territory. The correlation between mate quality and territory quality was assumed to be high (Orians 1969) but Weatherhead & Robertson (1977) suggested that if the correlation was not high, the female would rather base her choice on the quality of the mate than on that of the territory.

In the Hirundinidae only the tree swallow *Tachycineta bicolor* was regularly found breeding bigamously under experimental conditions (Quinney 1983). The European swallow *Hirundo rustica* did so irregularly under natural conditions (Bonte 1956; Richardson 1956; Löhrl 1962; Brombach 1977) and the sand martin *Riparia riparia* also showed signs of bigamous behaviour (Beccher & Mornestam 1979). In all the above cases the bigamous males attended two separate nests. On the whole, polygyny is of irregular occurrence in European passerines (Møller 1986) and it has apparently not been recorded in tropical and sub-tropical Hirundinidae.

During an intensive breeding biological study on the redbreasted swallow a single case of bigamy was observed and monitored. Towards the end of October 1986 a group of three redbreasted swallows started building a nest in a 1,2 m high concrete culvert some 25 km west of Bloemfontein, South Africa (29°16'S / 26°00'E). All three of the birds participated in carrying mud as well as collecting soft material for the nest pad. When an observation hole was made into the

nest on 1 December 1986 the nest contained eight eggs [single females lay up to five eggs per clutch (pers. obs.)]. The nest was checked daily or at least every second day thereafter. On 8 December 1986 at 09h00 seven of the eggs had hatched, the eighth was busy hatching and the nest also contained three more fresh eggs. The chicks were all marked with permanent marker type pens, weighed and the wing lengths measured each time the nest was visited. When the chicks were six days old they all showed signs of starvation and dehydration. Between day 7 and day 10 the four smallest chicks died and only four chicks remained which developed normally and fledged on 1 January 1987. The three eggs laid at the time of hatching all failed to hatch although they were all fertile as indicated by a degree of development of the embryos.

On 9 December 1986 all three adult birds were trapped during the night on the nest, measured and ringed. Sexes are easily distinguished as only females have a featherless broodpatch. Males have longer tail streamers than females (Table 1). The bigamous male, however, did not have any obvious extraordinary features that would make a female choose to mate bigamously (Table 1). It would seem more likely that one of the females selected to join an already mated pair. Only one of the females (the 'primary' female) incubated throughout but all three adults fed the chicks. There was never any aggression between the birds. The extra three eggs that were laid in the nest when the chicks hatched would seem to indicate that one of the females, probably the non-incubating one, could spend enough time in building up reserves to lay a second clutch less than two weeks after the first was completed. Although all three of the adults fed the young they could only raise four chicks to fledging as is often done by monogamous pairs (unpl. data). Why then did the one female choose to be the 'secondary' female? The 'secondary' female was somewhat, although not significantly, smaller than the 'primary' female and other females measured in the area (Table 1). This probably indicated that this female was a first year breeding bird and thus inexperienced in choosing a partner or that no other partner was available. The latter seems highly likely as there were adequate nesting sites available but no other swallows breeding in the vicinity. Quinney (1983) concluded that the combination of limited nest sites available for the tree swallows and the abundant food supply led to the observed high incidence of polygyny. The 'secondary' redbreasted swallow female did not get maximum benefit from mating with an already mated male as her genetic material only had a 50% chance of survival to fledging. She did, however, lay seven eggs although the last three never hatched. The 'territory', or rather foraging area, was probably no better than that of other pairs, as it showed similar monthly insect biomass, (in mg) and it can therefore be ignored as a possible factor (bigamous foraging area: $\bar{x} = 10,9 \pm 1,27$; $n = 3$; other foraging areas: $\bar{x} = 10,5 \pm 2,64$; $n = 6$; $t = 0,26$; $df = 7$; n.s.).

The above would seem to indicate that this case of bigamy in the redbreasted swallow was probably the

Table 1 Measurements of a bigamous *Hirundo semirufa* male and two females in relation to other individuals in the area

| Measurement | N | Mean | SD | Range | ♂ | Primary | Secondary |
|-----------------------|-----|-------|-------|-------------|-------|---------|-----------|
| | | | | | | ♀ | ♀ |
| Wing length (mm) | ♂ 6 | 131,4 | 2,87 | 127,0–135,0 | 131,0 | | |
| | ♀ 8 | 130,3 | 3,55 | 124,0–135,0 | | 134,0 | 128,0 |
| Longest rectrix (mm) | ♂ 6 | 131,9 | 19,81 | 99,5–157,0 | 140,9 | | |
| | ♀ 8 | 120,4 | 7,10 | 109,0–130,0 | | 116,1 | 110,4 |
| Shortest rectrix (mm) | ♂ 6 | 50,2 | 4,00 | 42,2– 53,2 | 49,1 | | |
| | ♀ 8 | 52,5 | 3,67 | 46,7– 58,0 | | 52,3 | 47,3 |
| Tarsus (mm) | ♂ 6 | 16,2 | 0,67 | 15,0– 16,9 | 15,9 | | |
| | ♀ 8 | 16,5 | 0,94 | 14,8– 17,6 | | 15,9 | 15,3 |
| Culmen (mm) | ♂ 6 | 8,6 | 0,50 | 8,0– 9,2 | 8,5 | | |
| | ♀ 8 | 8,1 | 0,35 | 7,4– 8,4 | | 8,3 | 8,0 |
| Body mass (g) | ♂ 6 | 30,1 | 2,58 | 25,7– 32,6 | 32,5 | | |
| | ♀ 8 | 29,5 | 1,65 | 27,5– 32,8 | | 31,0 | 29,2 |

result of an inexperienced female mating with an already mated male and had little to do with the quality of the male or his 'territory'. It seems that monogamy would probably have been a more productive strategy and that bigamy in the redbreasted swallow was only caused by extraordinary circumstances. Bigamy in natural situations in normally monogamous birds thus seems to be the result of factors which are probably very different from those usually associated with polygyny.

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