

THE NESTING BEHAVIOUR OF THE MUSOPHAGIDAE

by Myles Lamont

The Musophagidae are renowned for their poor nest making, with their feeble attempts at nest construction often being likened to those of the Columbiformes (Pigeons and Doves) (Payne, 1997; Isenberg, 1993; Schroeder, 1991; Fry et al. 1988; Maclean 1985; Rowan, 1983; Berry & Todd, 1982; Britton & Britton, 1976; Lamont, 2005; McLachlan & Liversidge, 1976; Stannard, 1971; Mackworth-Praed & Grant, 1957; van Someren, 1956; Courtenay-Latimer, 1942; Bannerman 1933; Friedman, 1930). Due to their poor nest building skills, most aviculturists do not encourage natural nest building besides which most aviaries lack suitable natural nest sites within their perimeters. This has in effect led to a gap in our knowledge of the natural nest building behaviour of this family of birds in captivity. There is also a lack of knowledge about this activity in the wild.

Here at the Hancock Wildlife Research Center in Canada, each breeding pair of turacos is provided with a nest platform measuring approximately 30cm x 20cm with a 7cm perimeter lip (12in x 8in with a 2¾in perimeter lip). This is similar to that used at other facilities (Bruslund Jensen, 2006; Lamont, 2006b; Paterson, 1993; Milne, 1991; Heston, 1987) and, incidentally, is very similar in size to natural nest sites found in the wild (Borghesio pers. comm. 2006; Rowan, 1983). In addition to a nest platform, hanging or wicker baskets are used successfully, however, occasionally a pair will decide to make its own nest.

Although a rather uncommon occurrence, natural nest construction has occurred at the Hancock Wildlife Research Center and has resulted in some interesting behavioural observations, most of which are described in more detail later in this article.

There follows a summary of numerous published and some unpublished records of nest observation of the Musophagidae compiled on a species by species basis, both from the wild (*in situ*) and in captivity (*ex situ*).

Nest observations

Species

Guinea or Green Turaco *Tauraco persa*

In the wild. Bannerman (1953) described the nest as roughly built and bulkier than a dove's nest. That of *T. p. zenkeri* was described by Chapin (1939) as being a frail structure of dry twigs, placed in a low forest tree and containing two eggs. Fry et al. (1988) described the nest as a shallow platform 20cm-30cm (8in-1ft) in diameter, made of sticks and

twigs interlaced together. It was said to be flimsy or compact but open, with light showing through and looking reminiscent of a large dove's nest. Nests were found 1.5m-3m (approx. 5ft-10ft) above the ground in a thick portion of an isolated bush, a tree, and in a tangle of leaves and twigs on the outer branches of a tree. Creepers are also used, but usually concealed from view. Twigs are normally snapped from a tree and brought to the nest one or two at a time. One nest took five days to complete. Payne (1997) described the nest as a roughly built platform of twigs interlaced with finer twigs and found in the thickest part of a bush or tree. He described it as bulkier than a dove's nest.

In captivity. A flimsy platform of twigs, similar to that of other species of turaco. A failed nesting attempt in thick ivy was also noted by Rutgers and Norris (1972). A female *T. persa* x *T. hartlaubi* hybrid attempted to nest in a clump of ivy, but did not complete the nest (Lamont, 2006a). The pair of *T. p. buffoni* kept by Horne (1991) nested in a hanging basket suspended in an elderberry bush.

Black-billed Turaco *Tauraco schuetti*

In the wild. Mackworth-Praed and Grant (1957) wrote of a stick nest like that of other turacos in a thick tree or creeper. Chapin (1939) mentioned that, "At Lukolela a female about to lay was collected on September 2nd, and a nest was found under construction in some dense second growth in early December, but it was never completed." Referring to *T. s. emini*, he wrote, "In the region of Medje we were shown nests on August 24th and September 28th, frail structures of twigs, about 12ft (3.6m) up, in tangled second growth." Fry et al. (1988) referred to a frail platform of twigs some 4m (approx. 13ft) above the ground in tangled growth in a tree. Payne (1997) described the nest as a frail platform of twigs some 3m-5m (approx. 10ft-16ft) above the ground in tangled secondary growth.

Schalow's Turaco *Tauraco schalowi*

In the wild. Mackworth-Praed and Grant (1957) described the nest as a flimsy structure of sticks, some 10ft-30ft (approx. 3m-9m) above the ground. Chapin (1939) made a brief mention of this species and described the nest as, "...like a dove's, 12ft (3.6m) up in an acacia." Payne (1997) wrote of a flimsy structure of sticks some 3m-10m (10ft-32ft) above the ground in the thickest part of a tree or bush.

In captivity. Boehm (1967) wrote of this species building a "...much more elaborate nest than has been observed in other turaco species we have bred. The nest is more "jay-like" in its construction. Not having experienced nesting preparations of all turaco species, I cannot say definitely that this is characteristic only of Schalow's." However, Roles (1973) wrote: "mating was never observed and no form of nest building was seen to take place, the

two dull white eggs being laid on April 13th 1972 on the totally unadorned nest platform.”

Fischer's Turaco *Tauraco fischeri*

In the wild. Britton and Britton (1976) wrote of a nest found 7.5m (approx. 24ft) above the ground. It was described as a loose platform of twigs with no lining or other nest material used. It was not taken as it could only be removed in pieces. Fry et al. (1988) referred to a loose platform of twigs placed 7.5m (approx. 24ft) above the ground in a *Syzygium* tree. Payne (1997) described the nest as a frail platform of twigs placed 3m-10m (approx. 10ft-32ft) above the ground in thick tree foliage.

In captivity. Milne (1991) described the nest as measuring 1ft x 1ft x 6in deep (approx. 30cm x 30cm x 15cm deep). Twigs and grasses were placed in the shallow box to help stimulate the pair to breed. Paterson (1993) wrote that the nest box measured 1ft x 1ft x 1ft (approx. 30cm x 30cm x 30cm). The base was made of wire mesh and the front lip was 4in (10cm) high; the roof had a 2in (5cm) overhang and slanted down towards the front. The box was lined with apple tree twigs of uniform length (approx. 6in (15cm)) and thickness. The twigs were then reorganised by the birds.

Livingstone's Turaco *Tauraco livingstonii*

In the wild. The compact but transparent nest is a well woven mass of large twigs with fine ones, usually in the top of a small tree and well concealed (Mackworth-Praed & Grant, 1957). Payne (1997) described it as a well woven platform of sticks and twigs some 3m-10m (approx. 10ft-32ft) above the ground in the thickest part of a bush or tree.

In captivity. Garsee (1992) noted: “I had an open platform with 6in (approx. 15cm) sides constructed and painted black. It was hung approximately 6ft 6in (2m) high on the side of the aviary. I first placed twigs in it for nesting, but they were not to their liking and were all thrown out. They were replaced with natural wood fibre packing material and they seemed to like this.”

Knysna Turaco *Tauraco corythaix*

In the wild. Nests can be found at various heights from 3m-9m (approx. 10ft-30ft) above the ground, usually in a tangle of leafy twigs in the outer branches of a tree; often among creepers and also in the crown of a tree fern. Nests measure 20cm-30cm (8in-1ft) across and are usually fairly flimsy platforms of interlaced twigs with a shallow depression in the centre. Both sexes seem to partake in nest construction, with one bird bringing twigs to the nest site while the other works them into the nest (Rowan, 1988). Stannard (1971) wrote: “Today I stood stock-still under the bougainvillea and by craning my neck, could see through the tangle of branches and

watch the birds come in, stand or sit on the nest and place their sticks right inside the tangled mass of creeper.” McLachlan and Liversidge (1976) described the nest as a shallow platform of sticks placed in a tree or in thick creepers.

Courtenay-Latimer (1942) described how he found a pair, “...building in a Boerboon tree *Schotia brachypetala* approximately 12ft (3.6m) from the ground. The nest was completed November 1st and measured roughly 1ft (30cm) in diameter, whilst the hollow or depression measured 4in-5in (10cm-12.5cm) across. The foundation was built of fairly heavy sticks with finer twigs towards the top and resembled a large dove’s nest in appearance.” Maclean (1985) noted that the nest is a shallow platform of sticks, like a large dove’s nest, in a leafy tree or dense creeper. According to Payne (1997), the nest is “...a shallow platform of sticks, much like that of a large dove, 2m-9m (approx. 6ft 6in-29ft 6in) above the ground in a leafy tree or among dense creepers.”

In captivity. One nest was made in the top of a hawthorn tree where a female took over a discarded nest of a Grey-winged Blackbird *Turdus boulboul* and reared three young from two clutches. Further nests were made in a basket in a pine tree (Everitt, 1965a). Payne (1963) wrote: “..at the highest point in the shelter I put up a contraption made of thin saplings and the last-year runners from the Russian vine made to resemble an open nest, and into this saucer-like shape I put a handful of straw and rootlets.” At Cologne Zoo: “The eggs were laid in a wooden bowl, about 4ft 6in (approx. 1.4m) above the floor of the inside cage. Little twigs which had been placed on the floor for them had been used as nesting material” (Hick, 1964). Two young were reared in a nest that the parents built of pine needles and green grass shoots in a shallow wooden tomato box in South Africa. (Barnicoat, 1987).

Bannerman’s Turaco *Tauraco bannermani*

In the wild. Payne wrote: “Nest a flimsy platform of twigs, well hidden in thickest part of an isolated tree or bush among a tangle of creepers, or in the thick foliage on outer branches at 1.5m-10m (approx. 5ft-32ft) above ground in open forest or along forest edge.”

Red-crested Turaco *Tauraco erythrolophus*

In the wild. The nest is assumed to be similar to that of other *Tauraco* spp.

Yellow-billed Turaco *Tauraco macrorhynchus*

In the wild. Bannerman (1933) considered a nest found by Bates (1909) and described as belonging to *T. p. zenkeri*, to actually be that of *T. macrorhynchus*. He went on to describe it as “placed in the thick top of

a low tree...and built of tiny dry twigs laid loosely together, so that it fell to pieces when taken in hand.” Fry et al. (1988) described the nest as a flimsy platform of dry twigs, hidden in the thick foliage of a tree or creeper 7.5m-10m (approx. 25ft-32ft) above the ground. There was also mention of a nest that was apparently located on the ground. Payne (1997) wrote: “Nest a flimsy platform of dry twigs, well hidden in tree foliage, 7m-10m (approx. 23ft-32ft) above the ground, reports of ground nesting on Bioko require confirmation.”

White-cheeked Turaco *Tauraco leucotis*

In the wild. The nest is a rather thick platform of dry twigs, very loosely put together, with a slight hollow at the top (Mackworth-Praed & Grant, 1957). Payne (1997) also described it as a rather thick platform of dry twigs, loosely constructed with a slight depression at the top, built some 7m-10m (approx. 23ft-32ft) above the ground.

In captivity. Thomson (1991) stated that the birds did not make substantial nests, rather more a gathering of flexible twigs placed randomly together in a thick part of a tree or bush. Foxall and Burton (1975) noted that a 9ft (approx. 2.7m) high section of a felled Lawson Cypress *Chamaecyparis lawsoniana* was erected in a well-lit shelter. A nesting platform was placed in the cypress and furnished with some small twigs, but this arrangement was apparently ignored. The cypress twigs were still green, but dry and brittle and it was these that the birds used to make their own nest, 7ft (approx. 2.1m) above the ground in the cypress itself. When completed the nest was quite substantial and measured approximately 8in-9in (20cm-23cm) in diameter and 4in (10cm) thick at the centre. A pair in the Boehm aviaries nested successfully 10ft (approx. 3m) up in a White Pine *Pinus strobes*. The nest of twigs, which was quite fragile, fitted into a crutch in the branches and owing to its insecure appearance, was supported by a wire-netting basket. The nest was prepared by the female alone (Everitt, 1965a).

Rutgers and Norris (1972) noted that a pair of *T. l. donaldsoni* had nested approximately 9ft (2.7m) above the ground in a poplar tree *Populus* sp. and laid three successive clutches of two eggs in the nest.

Prince Ruspoli's Turaco *Tauraco ruspoli*

In the wild. The nest is assumed to be similar to that of other *Tauraco* spp.

Hartlaub's Turaco *Tauraco hartlaubi*

In the wild. A very pigeon-like flat, transparent tray of sticks, placed among dense creepers in a bush or tree and usually within 15ft (4.5m) of the ground (Mackworth-Praed & Grant, 1957). The nest had previously been

described by van Someren (1956) as being comparatively low down and characteristically near thick foliage and fine twiggy branches. It was said to be loosely constructed of twigs, interlaced to form a shallow platform, like a pigeon's nest. He noted that it is often so transparent that the eggs can be seen from below. Finer twigs are sometimes used to line the nest, which is usually on a horizontal branch.

Nests have been found in dense tangles of bush. They were quite thick and approximately 20cm (8in) across and were cup-shaped (Borghesio pers. comm. 2006). Fry et al. (1988) described the nest as, "... a shallow platform of loosely interlaced twigs, sometimes lined with finer twigs; eggs showing through. Always built amongst fine, twiggy branches with thick foliage, high in e.g. *Rhus* or thorny *Chaetacme* tree. Nest added to during nestling period." According to Payne (1997) the nest is a platform of loose sticks and twigs, sometimes lined with finer twigs. It is usually 3m-8m (approx. 10ft-26ft) above the ground among thick tree foliage.

In captivity. Risdon (1954) wrote: "...we fixed up a bunch of twigs in a corner of the flight. The middle of this was flattened out and a shallow dish-shaped piece of wire netting was fixed to form a platform. On this some coarse hay was shaped to form a foundation for a nest." Rutgers and Norris (1972) described the nest as a platform of twigs, usually built among creepers enveloping bushes or low trees and seldom more than 15ft (4.5m) from the ground.

White-crested Turaco *Tauraco leucolophus*

In the wild. The nest is a saucer-like platform of dry twigs (Mackworth-Praed & Grant, 1957). It is built of small, dry sticks and twigs interwoven into a saucer-like shape some 15cm (6in) in diameter, according to Fry et al. (1988). One nest was located in some forked branches 7m (approx. 22ft) high in an acacia-like savannah tree, while another was found 3m (approx. 10ft) above the ground in a small tree (Fry et al. 1988). Payne (1997) described the nest as a flimsy saucer-shaped platform of interlaced twigs and sticks 3m-7m (approx. 10ft-22ft) above the ground, often in an acacia.

In captivity. Brown (1971) witnessed an unusual nesting attempt, in which the pair nested on the floor and only sat at night. Unsurprisingly, nothing came of the eggs.

Purple-crested Turaco *Tauraco porphyreolophus*¹

In the wild. Rowan (1983) described the nest as a flimsy, unlined platform of intertwining twigs, through which the eggs can often be seen from below. Favoured sites are among matted creepers and in dense parasitic growth. Maclean (1985) described the nest as a platform of sticks in a tree or creeper, up to about 4m (13ft) above the ground, often in an

isolated thicket or at the edge of a forest. According to Fry et al. (1988) the nest is a flimsy platform of interwoven twigs 3m-9m (approx. 10ft-30ft) up in a tree, well concealed in a matted creeper or in parasitic growth. Both sexes are involved in its construction. The nesting tree is usually isolated on an open savannah or is part of a dense thicket. Payne (1997) described it as a flimsy, unlined platform of twigs 3m-9m (approx. 10ft-30ft) above the ground, well concealed in a tree among matted creepers or in dense parasitic growth.

In captivity. Jarvis and Currie (1974) described how a cut pine tree was fixed upright in the enclosed section of the aviary and a wire mesh platform 90cm (almost 3ft) in diameter was placed in it 1m (approx. 3ft 3in) from the earth floor. The platform was covered with pine needles which the birds later rearranged. An empty orange box with an open top, prepared with a layer of fresh hay, to which the birds added a few small sticks, was also used successfully by this species (Raison, 1992).

Rwenzori Turaco *Ruwenzorornis johnstoni*¹

In the wild. Fry et al. (1988) described the nest as being a small platform of sticks built 1m-3m (approx. 4ft-10ft) above the ground in a clump of bamboo. Payne (1997) also described it as being a small platform of sticks, often in a clump of bamboo, but gave the height as being some 3m-5m (approx. 10ft-16ft) above the ground.

Violet Turaco *Musophaga violacea*

In the wild. The nest was described by Mackworth-Praed and Grant (1957) as a slight structure of twigs in a bush 10ft-12ft (approx. 3m-3.6m) from the ground. Fry et al. (1988) described it as being a fragile pigeon-like nest of twigs and sticks in a leafy tree some 6m (20ft) up.

In captivity. Nests are usually made on a typical nest platform of the type described earlier or in a basket. They have also been made by placing sticks in the corner of a square frame designed for ibis and spoonbills to nest on. This species has also built its nest in a *Berberis* sp. (Gomis pers. comm. 2006). Nests consisting of fragile stick platforms, so transparent and flimsy that the eggs could be seen through the bottom, 6.7m (approx. 22ft) above the ground, were noted by Bent (1988); who further noted that the pair were seen carrying twigs broken from a *Ficus* sp. and taking them

¹I have followed *The Clements Checklist of the Birds of the World, Sixth Edition* (2007) and listed the Purple-crested Turaco in the genus *Tauraco* and the Ruwenzori Turaco in the genus *Ruwenzorornis*. Some other recent publications have placed both of them in the genus *Gallirex* and they may also be found listed in the genus *Musophaga* or with the Ruwenzori Turaco listed in the genus *Tauraco* with the Purple-crested species. - Ed.

into artificial rock planters full of vegetation, which were approximately 6m (20ft) off the ground.

Ross's Turaco *Musophaga rossae*

In the wild. Mackworth-Praed and Grant (1957) described the nest as a pigeon-like platform of sticks and Maclean (1985) described it as a platform of sticks and twigs in a tree. Fry et al. (1988) gave a more detailed account, describing it as a pigeon-like platform of sticks up to 60cm (almost 2ft) long, lined with twigs (375 in one nest) and 20cm-21cm (approx. 8in -8¼in) in diameter. It is built by the male and female 2m-16m (approx. 6ft-62ft) above the ground, in a clump of thick foliage, mistletoe or creepers, usually in an isolated tree. It takes the birds five to 16 days, working mainly in the morning.

In captivity. Rutgers and Norris (1972) described the nest as a flimsy platform of twigs fairly high above the ground. Some interesting observations of nesting at Disney's Animal Kingdom were provided by Congdon (2000). The nest was approximately 30ft-35ft (9m-10m) off the ground in a clump of bamboo *Bambusa* sp. It consisted largely of sticks approximately ⅛in (2mm) in diameter and of various lengths. They were not observed to be picked up off the ground, but were broken from three branches. They also appeared to come from another tree, possibly a Chinese Elm *Ulmus parvifolia*. There was also a large amount of leafy foliage. Both the male and female took part in the nest building. Approximately a month after the above observations were made, the nest was inspected again and did not have so much leafy material but consisted mainly of twigs and sticks. Plasse (pers. comm. 2006) noted that the birds apparently succeeded in building the nest so that several stalks of bamboo were pulled together by the twigs, leaves and rootlets that had been accumulated to make the nest platform.

Royston (1974) noted that her birds made their nests partly of bunches of long grass fixed high up in secluded places in bushes and trees in the aviaries, the birds adding a few sticks and using the same nest for a second brood. Steel (1973) wrote: "I hurriedly spent a whole afternoon erecting a large log at the far end of the flight, up against a south-facing wall, hoping that this might be a suitable home for them but not, they took no notice of it whatsoever, but preferred to carry stupid pieces of stick to some dangerously insecure branches in the greenhouse. I endeavoured to help them by putting some flat, dry laurel branches and leaves horizontally, but for all their industrious stick carrying, everything fell to the ground again. I then wove in a piece of wire netting upon which I thought they could lay their sticks more securely." Eventually, a modified shopping basket with a concave bottom, placed 6ft (1.8m) above the ground, was utilised as a nest

site.

Ellis (1975) mentioned a letter from Syd Downey in Kenya, in which Mr Downey wrote: "... the pair of Ross's Turacos had nested again and hatched two chicks, but for some reason neither survived." They appeared to have been sat on too heavily and, Mr Downey, wondered, if the nest which he arranged for them, was too cup-shaped. He added, he knew that in the wild the nest is a bare, flat platform. Milne (1990) described how this species successfully used a bowl-shaped, thick wicker basket, 1ft 2in (35.5cm) in diameter and 7in (17.5cm) deep.

Grey Go-away Bird *Corythaixoides concolor*

In the wild. Mackworth-Praed and Grant (1957) stated that this species makes a stick nest like that of a pigeon, usually in dense creepers or high on an acacia. Rowan (1983) provided further information, stating that the nest is always built in a tree, most commonly a thorny species, and is usually placed high in the crown. There may be a scant attempt at concealment, as the chosen tree often has little or no foliage. The height of the nest can vary from 1.5m-20m (approx. 5ft-65ft), but is most commonly 3m-10m (approx. 10ft-32ft) above the ground. It is a platform of interlaced twigs resembling a dove's nest in its simple and often flimsy construction. It is usually 18cm-24cm (approx. 7in-9½in) across and about 3cm (1¼in) thick. McLachlan and Liversidge (1976) described it as the usual dove-like structure, often so thin that the eggs can be seen from below. It is up to about 25ft (7.6m) from the ground, according to them, in a thorn tree or sometimes a soft-foliage tree.

Maclean (1985) called it a scanty platform of sticks and twigs in a fork or crown of a tree (usually thorny) or in a clump of mistletoe or matted creeper 1.5m-20m (approx. 5ft-65ft) above the ground. A flimsy pigeon-like nest measuring 18cm-24cm (approx. 7in-9½in) in diameter, with the eggs visible from below, was how Fry et al. (1988) described it. Both sexes partake in nest construction, building it 3m-20m (approx. 10ft-65ft) up in a tree, usually an acacia. They may also build in a non-thorny species of tree and in clumps of mistletoe and dense matted creepers.

In captivity. A pair at Busch Bird Park laid three eggs on a ledge of a steel support beam (Young, 1975). Further notes by the same author indicated that a flimsy nest of bamboo twigs was constructed in a clump of bamboo, against the wire side of the enclosure approximately 20ft (6m) above ground level and 8ft (approx. 2.4m) above the top of a waterfall. Roles (1970) noted that a female at Jersey Zoo carried hawthorn twigs to a wire nesting platform on a conifer branch, about 7ft (2.1m) above the ground. The female and her mate built the nest entirely of hawthorn twigs; oak and various other twigs lying in the aviary were left untouched.

Bare-faced Go-away Bird *Corythaixoides personatus*

In the wild. A round, loosely made stick nest in the fork of a tree, generally an acacia (Mackworth-Praed & Grant, 1957). "A shallow platform of loosely interwoven sticks, sometimes lined with rootlets and dry grass, in a fork or near the top of a tree, usually an acacia" (Fry et al. 1988).

In captivity. A wire platform designed for Threskiornithidae (Ibis and Spoonbills) has been used, with sticks and twigs being placed in the middle of the wire square, to make a poorly built nest (Gomis pers. comm. 2006).

White-bellied Go-away Bird *Corythaixoides leucogaster*

In the wild. A bare platform of sticks, which is usually almost transparent, some 10ft-20ft (approx. 3m-6m) from the ground (Mackworth-Praed & Grant, 1957). The nest is usually placed in the crown of a tall acacia tree. Friedman (1930) described the nest as a mere lattice of sticks, 10m (approx. 32ft) above the ground, near the end of a horizontal bough of a large thorn tree. Built of twigs and thorns, it resembles a large dove's nest and is so loosely constructed that an observer can look up through it and see if it contains eggs or young. Fry et al. (1988) described the nest as an untidy, thin and flat structure built of twigs, 3m-12m (approx. 10ft-32ft) above the ground in an *Acacia xanthrophloea* or other thorn tree.

In captivity. Isenberg (1993) found that the nest made by his birds was worse than the most loosely built dove's nest and as a result the eggs kept dropping out, until an artificial nest was woven for them using fruit tree twigs. At Houston Zoo a second nest platform (smaller than the first) contained a handwoven framework of dried vines over straw. This was fixed to the shelter wall a short distance below the older nest which contained only straw (Todd et al. 1985).

Western Grey Plantain-eater *Crinifer piscator*

In the wild. The nest was described by Fry et al. (1988) as a substantial platform of dry, thin sticks, that was some 30cm (approx. 11¾in) in diameter and 12cm (4¾in) deep. It was some 4m-10m (approx. 13ft-32ft) above the ground in a leafy tree. *Khaya senegalensis* and *Acacia albida* have been used.

Eastern Grey Plantain-eater *Crinifer zonurus*

In the wild. Mackworth-Praed and Grant (1957) described it as a large nest of loose sticks and Fry et al. (1988) described it as a substantial nest made of sticks, built near the top of a tree.

Great Blue Turaco *Corythaeola cristata*

In the wild. The nest, generally built high in a tree, was described by Mackworth-Praed and Grant (1957) as a loose platform of small sticks, appearing ridiculously small for the bird. This was contradicted by Chapin

(1963), who noted that the nest of *Corythaeola* is the largest built by any turaco and is composed mainly of dry sticks, some of which may be nearly 1m (3ft 9in) in length. The nest is said to often be in the forked branches of a tree, some 20m (approx. 65ft) or more above the ground. Sites chosen though can vary in height from 10m-16m (approx. 32ft-52ft) and may be hidden in a clump of semi-parasitic mistletoe or in a creeper covered tree (Candy, 1984).

Fry et al. (1988) provided the most complete description of the nest, describing it as a well constructed to flimsy and insecure platform of dry sticks, measuring 31cm x 51cm (approx. 1ft x 1ft 8in) with a shallow rim. The base is made of sticks up to 61cm (2ft) long, with smaller twigs used to line the nest. It is constructed by both sexes usually over a period of a week, some 8m-25m (approx. 26ft-82ft) above the ground in a tall tree covered with creepers or in dense foliage and often in a clump of mistletoe. Old nests may be re-used. Payne (1977) described the nest as usually being a platform of dry sticks with a shallow rim, built by both sexes at 8m-25m (approx. 26ft-82ft) in a tall leafy tree. The nest is often over water.

In captivity. It is relatively rare, hence there is a lack of information on its captive breeding behaviour. It has been known to use nesting baskets and has used a natural nest site, using leaf material in a clump of *Cissus antarctica* (B. Macordes pers. comm. 2006).

The second part of the above article - Further notes on the White-cheeked Turaco T. l. leucotis - will be published in the next issue of the magazine. The author, Myles Lamont, Avian Manager, Hancock Wildlife Research Center, 19313 Zero Avenue, Surrey, British Columbia V3S 9R9, Canada, would like to hear from those aware of other reports of turaco nesting behaviour, either published or unpublished. E-mail:myles@hancockwildlife.org

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BATES'S FIREFINCH

Writing about additions to the London Zoo collection, Arthur Prestwich (A.A.P.), *Avicultural Magazine* Vol.53, No.5, p.191 (September-October 1947), listed among the "more interesting arrivals," Bates's Firefinch *Lagonosticta rubicata virata*, a bird new to the collection, from "Kulikoro, French Sudan." Described by Bates in 1932, it is, of course, now accorded full species status and known as the Mali or Kulikoro Firefinch *L. virata*. It was first bred in the UK by Ian Hinze, who described the breeding in the *Avicultural Magazine* Vol. 107, No.1, pp.27-34 (2001). Ian was subsequently awarded the society's medal for the first UK breeding of this West African firefinch.

BREEDING THE RUFOUS-COLLARED SPARROW

Zonotrichia capensis

by Jim Jerrard

According Clements (2007) the Rufous-collared Sparrow *Zonotrichia capensis* has 28 subspecies, whereas Howard & Moore (1980) listed 25. Not surprisingly perhaps, it has a wide geographical distribution, being found from the highlands of southern Mexico southwards to Cape Horn. The four other members of the genus, the White-crowned Sparrow *Z. leucophrys*, White-throated Sparrow *Z. albicollis*, Golden-crowned Sparrow *Z. atricapilla* and Harris's Sparrow *Z. querula*, breed in North America.

The sexes of the Rufous-collared Sparrow look alike, so I was pleased to purchase a proven pair at the Stafford Show in spring 2006. During the summer of that year I had no luck with the pair, only clear eggs were laid - nine in all. So in September I caged the pair for the winter and fed the pair seed only until the following February. I then began to feed some livefood to the pair and, by March, the female was ripping up the paper covering the floor of the cage and the male was starting to sing.

On March 14th I put the two into a flight measuring 9ft x 3ft x 6ft (approx. 2.7m x 0.9m x 1.8m) and supplied them with dry grass, dog hair and sisal. On April 5th the female began to build in an open nest box, about 5ft (1.5m) above the ground. The first egg was laid on April 10th and was followed by a further two. The female began to incubate on April 12th and 10 days later two chicks hatched. The other egg was clear. The chicks were ringed (banded) at seven days old by my friend Sean Fitzpatrick and left the nest on May 3rd, aged 11 days old.

On May 6th, the female laid again and, on May 8th, was once more incubating a clutch of three eggs. As the male was continuing to feed the two young from the first nest, I left them with their parents. Unfortunately, they harassed the female while she was sitting and perhaps as a result of this, the eggs became addled and were abandoned on May 15th.

I removed the two young on May 17th. The female cleaned and relined the nest and laid again on May 24th - a further clutch of three eggs. All three hatched on June 6th and when the chicks were seven days old they were ringed by Sean Fitzpatrick. When they were 23 days old I removed them from their parents.

Following their removal, the female went to nest yet again, this time choosing a slightly higher nest site. There was a clutch of four eggs, which should have hatched on July 24th, but when tested on the 26th, proved to

be clear. Fortunately, I was able to use this to my advantage, as in the next flight a pair of buntings *Emberiza* sp.¹ were nesting and, that same day, I noticed some eggshells on the floor, one of which had a chick stuck to it. On inspecting the nest, I found it contained a chick and an egg. I left things as they were and went to get some livefood, however, on my return I found the remaining chick on the floor. It was cold, but by holding it in my cupped hands and using my warm breath, I managed to revive it.

I immediately transferred it and the remaining egg to the nest of the pair of Rufous-collared Sparrows, while doing so removing their clear eggs. When I checked the nest again less than half an hour later, I was delighted to discover that the buntings' egg had hatched and the nest now contained two chicks. The foster parents made quite a commotion, but all went well and both chicks were reared successfully. They were ringed at seven days old and left the nest at nine days.

It was the first time I have bred the Rufous-collared Sparrow, and I found the species very easy to cater for. The nests were very deep and the eggs were stony-grey, heavily blotched and streaked rusty red at the large end. In the past, when I kept this species, the eggs that were laid were similar in coloration to those of the Blackbird *Turdus merula* (i.e. usually bluish-green or greenish-blue speckled and mottled light reddish-brown). My Rufous-collared Sparrows are very lively birds but are shy and would leave the nest and hide when I entered the flight, as did the young. The latter had brown backs, grey underparts heavily streaked with brown and lacked the rufous collar and well defined head markings. The five Rufous-collared Sparrow chicks and the two bunting chicks the pair fostered were all reared on buffalo worms, small crickets and, after the first week, waxworm larvae. The young of both species were ringed with I.O.A. rings size D.

¹ *The identity of Jim Jerrard's buntings has been the subject of a number of letters between the two of us. He is convinced that his birds are Somali Golden-breasted Buntings E. poliopleura, but I am not so sure and think it more likely that they are the more wide-ranging Golden-breasted Bunting E. flaviventris. A colour photo of the buntings can be seen in the Avicultural Magazine Vol.III, No.4, p.162 (2005). If they prove to be the Somali Golden-breasted Bunting, he will be the first person in the UK to have bred this species.- Ed.*

Jim Jerrard, who lives in south Yorkshire, here in the UK, would like to hear from anybody who breeds foreign buntings. He can be contacted via the Hon.Editor.

PARENTAL BEHAVIOUR BY TWO PAIRS OF GUAM MICRONESIAN KINGFISHERS

Halcyon cinnamomina cinnamomina

by Jennifer J. Elston, Christy Sky, Glorieli Quinones,
Jennifer Carney, Chelle Plasse and Tammie Bettinger

Introduction and background

Historically, the Guam Micronesian Kingfisher *Halcyon c. cinnamomina* - hereafter referred to as the Micronesian Kingfisher - existed throughout the forested regions of Guam¹ (Fry et al. 1992). The population of this subspecies was decimated following the unintentional introduction of the Brown Tree Snake *Boiga irregularis* to the island and by 1986 the Micronesian Kingfisher was extinct in the wild (Savidge, 1987; Wiles et al. 2003). Today, the Micronesian Kingfisher survives only in captivity as part of a captive propagation programme. The birds are spread among 11 institutions in the USA and one on Guam (Bahner, 2006). The goal of the propagation programme is to increase the population through captive breeding for release in the future on Guam or other appropriate sites (U.S. Fish and Wildlife Service, 2004).

Despite the accomplishments of the programme in keeping this subspecies alive, breeding the birds in captivity has presented challenges, including that of the failure of the parents to rear their offspring (Bahner et al. 1997), resulting in the majority of offspring being hand-reared (Bahner, 2006). The hand-rearing protocol has been instrumental in increasing the population of Micronesian Kingfishers, because chicks that may otherwise have perished through parental inexperience or neglect, have survived by being hand-reared. In addition, when their eggs are removed from the nest, the females lay a further clutch (Oehler, 1990), so maximum egg production can be encouraged during the breeding season. As a result of the extensive need to hand-rear the chicks, little is known about the parental behaviour of the Micronesian Kingfisher. A larger more stable population of these birds needs to be established in captivity before reintroduction attempts occur, and information regarding parent-rearing behaviour is necessary so that avian managers can feel confident that these birds are sufficiently able to care for their offspring. Parent-rearing experience gained in captivity may better prepare the birds for reproductive success in the wild (Wallace, 1994).

During the 2005 and 2006 breeding seasons, we had the opportunity to study parental activity by two pairs of Micronesian Kingfishers housed at Disney's Animal Kingdom, Lake Buena Vista, Florida, USA. Our

objectives were to record the frequency and duration of parental visits to the nest log during incubation and nestling periods and to establish a preliminary database documenting parent-rearing behaviour by the Micronesian Kingfisher.

Materials and methods

Subjects and housing

Two pairs of Micronesian Kingfishers were housed in separate off-display, outdoor aviaries. Both pairs had visual access to other birds in the facility, but did not have visual access to other Micronesian Kingfishers. Other birds in the facility, including additional Micronesian Kingfishers, were audible. The aviaries measured 6m x 6m x 2m (approx. 20ft x 20ft x 6ft 6in) and 6m x 3m x 2m (approx. 20ft x 9ft 9in x 6ft 6in) and each contained two or three decayed queen palm logs that could be used for nesting.

One pair of Micronesian Kingfishers (a mature pair) consisted of a seven year-old parent-reared male and a six-year old hand-reared female. The pair had resided together for two years. Neither bird had prior experience of parent-rearing a chick, but had previously incubated and hatched an egg in 2004. The 2004 chick was removed from the log three days after hatching and hand-reared, after it was determined that the chick was not gaining weight. The second pair of Micronesian Kingfishers (a novice pair) was hatched and hand-reared at Disney's Animal Kingdom in 2004. At the time of the study, the two birds were approximately two years old. The pair had been housed together since fledging and had no prior experience of breeding.

During reproductive periods food was provided ad-lib at least four times a day. The diet consisted of pinkie mice, anoles, crickets, large mealworms, superworms and waxworms (Crissey and Toddes, 1997). Vitamin E (Roche, Nutley, New Jersey, USA) and chitin (Fisher Scientific, Pittsburgh, Pennsylvania, USA) supplements, manufactured in powdered forms, were also offered to the birds daily in 2cm ($\frac{3}{4}$ in) plastic capsules that were inserted in the pinkie mice or anoles (one capsule per bird each day). Vitamin E was provided to enhance fertility and chitin was supplied in order to replicate the insect exoskeletons in the natural diet. Supplementation ceased when offspring were present in the nest log to avoid the risk of a chick choking if an adult attempted to feed a capsule to it and resumed after the chicks fledged. Because the aviaries are outside a variety of natural foods, including insects, anoles, frogs and toads, were also available.

Mature pair

In July 2005 the mature female produced her third clutch of the season, consisting of two eggs. The eggs from the previous two clutches had been

*Christy Sky*

Female Guam Micronesian Kingfisher chick aged 27 days in nest log.

removed from the nest log for the chicks to be hand-reared. In the case of the third clutch, one egg was removed so that the chick could be hand-reared and the second egg was left with the parents to incubate. Daily video recordings were made at the nest log from the day the chick hatched until it fledged. The chick was weighed when the opportunity arose up until day nine, when its size and behaviour made it difficult to remove it from the nest log.

In early summer 2006 a bullet camera was inserted inside the cavity the pair had excavated in the nest log. In June 2006 the mature female produced her third clutch of two eggs inside the nest log. Similar to the 2005 breeding season, the eggs from the previous two clutches were removed from the nest log for the chicks to be hand-reared. With this clutch, however, one egg was removed for the chick to be hand-reared and the other egg was left in the nest log for the pair to incubate. All parental activity inside the nest cavity during the day was recorded. The chick was weighed when the opportunity arose up until the time it was removed from the log to be hand-reared. Because the chick was removed from the log, data were recorded only for the incubation and early brooding periods.

Novice pair

In July 2006 the novice female produced her fourth clutch of the season, which consisted of two eggs. The eggs of the previous three clutches had been removed from the nest log for the chicks to be hand-reared. With the fourth clutch, one egg was left in the nest log for the pair to incubate and the other egg was removed for the chick to be hand-reared. Video

recordings were made at the nest log from the day the chick hatched until it fledged. It was weighed when the opportunity arose until day 10, when its size and behaviour made it difficult to remove it from the nest log.

In August 2006 the novice female produced her fifth clutch. It consisted of a single egg and the pair was given the opportunity to incubate it. Daily video recordings were made of all parental interaction at the nest log. The egg was hatched successfully and the chick was weighed when the opportunity arose, up until the time that it was removed from the nest to be hand-reared.

Data collection

All video recordings were made using VCRs between approximately 06.30-20.30hrs. Tapes were scored for all behaviours (behavioural sampling: Martin & Bateson, 1993) exhibited by the birds while at the nest log (see Table 1), as well as the number of visits to the log, the time of the visits, length of the visits and the sex of the bird. During the 2006 incubation and nestling periods the daily temperature and relative humidity were recorded by HOBO data loggers (Onset Computer Corporation, Bourne, Massachusetts, USA) that were positioned on the outside of each pair's nest log. After fledging the young birds were sexed based on feather coloration (i.e. males have a cinnamon coloured breast; females have a white coloured breast) and feather/tissue analysis (Avian Biotech International, Tallahassee, Florida, USA). Egg and chick data for both pairs during the 2005 and 2006 breeding seasons are presented in Table 2.

During incubation periods a total of 269.5 hours of video was recorded for the mature pair (June 2006) and a total of 239.3 hours of video for the novice pair (August 2006). During nestling periods a total of 274.8 hours of video was recorded for the mature pair (July 2005) and a total of 337.6 hours of video was recorded for the novice pair (July 2006). Food provision was not scored for the mature pair, because the position of the camera made it difficult to observe whether a bird had food in its beak when it arrive at the nest log.

Results

Incubation and early brooding periods

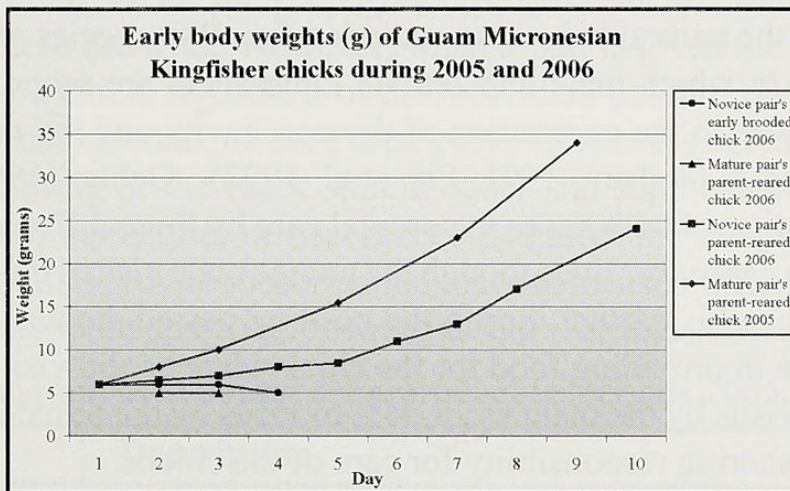
Mature pair - July 2006 and novice pair - August 2006

There was some variation between the two pairs in the percentage of time birds spent in the nest log per day during the incubation period (see Table 3). Birds spent time in the nest cavity throughout the day and on average fewer than 15 minutes elapsed without a bird being present in the nest log. Both pairs hatched their chicks after an incubation period of 25 days. The bullet camera in the mature pair's nest log made it possible to determine that the chick began hatching in the morning at 09.07hrs and

36.2 minutes later the majority of the chick's body was freed from the shell.

Staff determined that each pair's chick was not gaining weight after hatching (see graph below). As a result, the mature pair's chick was removed from the nest log on day three and the novice pair's chick was removed for hand-rearing on day four. During the first few days after the chicks hatched and before they were removed from the nest logs, the mature pair and the novice pair spent a large amount of time in their nest logs (85.46% and 72.13% of time per day, respectively). In addition, both pairs made visits to their chick during this time (the mature pair 4.37 visits per hour; the novice pair 2.83 visits per hour), however, food provision was observed only twice in the case of the mature pair and three times in the case of the novice pair. Both chicks were females. The average daily temperature was 26.6°C (79.9°F) and the average relative humidity was 81.3% during the incubation and early brooding periods.

Fig. 1. Both parent-reared chicks fledged from the nest log and both early brooded chicks were removed from the nest log for hand-rearing at three and four days old.



Nestling period

Mature pair - July 2005 and novice pair - July 2006

The mature pair's chick hatched after an incubation period of 23 days and the novice pair's chick after an incubation period of 24 days. Keepers provided a small amount of supplementary food (chopped pinkie mice) once a day for the first two days after hatching for the mature pair's chick and for the first eight days after hatching for the novice pair's chick. Both chicks gained weight steadily during the first few days after hatching (see graph).

The mature pair entered the nest log on day one of the chick hatching, however, only the female was observed entering the nest log after the first day and neither bird was observed entering the nest log after day four.

The novice pair entered the nest log on day one of the chick hatching and continued to enter the nest log until day nine. Both pairs made chick visits throughout the day. On average these occurred more than once per hour and lasted fewer than 10 seconds (see Table 3). The mature male and female made an equal number of chick visits during fledging (0.82 visits per hour), however, the novice female made approximately twice as many chick visits as the novice male (1.03 vs 0.44 visits per hour, respectively). When food provision occurred, parents presented whole items of food to the chicks. Both pairs began drilling new holes in their nest logs before the chicks had fledged. The mature pair's chick fledged at 31 days and was a male. Seventeen days after fledging it weighed 60.0g. The novice pair's chick was a female. It fledged at 33 days and weighed 65.2g on the day of fledging. The average daily temperature was 28°C (82.4°F) and the average relative humidity was 69.1% during the 2006 nestling period.

Discussion and conclusions

Incubation of the eggs and care of the chicks was undertaken by both sexes, which signifies the importance of the participation of both parents in the incubation of the eggs and the survival of the chicks. This finding is similar to the natural behaviour recorded for other species of kingfishers in the wild, in which male and female kingfishers are monogamous and both participate in the excavation of the nest cavity and the rearing of the chicks (Davis & Graham, 1991; Fry et al. 1992). Oehler (1990) reported the participation of both sexes in parental care by three different species of kingfisher in captivity. Even though the novice male visited the nest log less frequently than his partner during the nestling period, he was comparable to the female in providing food for the chick when he did visit the nest log (35.37% of visits by the male vs 28.94% of visits by the female), indicating that he was sharing responsibility for care of the chicks.

During the incubation phase, birds spent on average fewer than 15 minutes between visits. Because predation pressure was absent and external disturbance (e.g. weather and humans, etc.) were minimal, the relatively continuous time spent in the nest cavity may reflect the importance of maintaining the proper temperature for the successful incubation of the eggs. During the nestling phase, both pairs visited the nest log slightly more than once per hour on average. Because chick visits occurred throughout the day, it is important that food sources are readily available so that parents can provide for their chicks.

Despite some variation between pairs regarding the percentage of time spent inside the nest cavity during the incubation periods in 2006 (mature pair's third clutch and novice pair's fifth clutch), both pairs successfully

hatched their chicks, indicating that the amount of time each pair spent inside their nest log was sufficient for successful hatching to occur. However, even though both pairs successfully incubated and hatched their eggs and were observed visiting their nest logs and brooding their chicks, the decision was taken to remove the hatchlings for hand-rearing because of the lack of weight gain during the first few days after hatching. In both instances in which the parents successfully reared their chicks, far less time was spent inside their nest logs after the chick hatched than during the occasions when it was necessary to remove the chicks for hand-rearing. It appears that in both of the latter cases the parents failed to switch their roles from incubation/brooding to more actively caring for the hatchlings (i.e. food provision). In the case of the Micronesian Kingfisher, there are probably many factors that contribute to the ultimate success or failure of a clutch, and successful incubation and/or fledging of offspring by a pair during one attempt does not always mean that the pair will be consistently successful in future reproductive attempts.

This study provides evidence that hand-reared birds can successfully incubate and hatch their own eggs and parent-rear their own offspring, which is encouraging for the propagation programme and future plans for reintroduction to the wild. However, when a pair is given the opportunity to parent-rear a chick, regardless of the individual parents' own parent- or hand-rearing background, or even their previous success at rearing chicks, careful monitoring of the chick should occur and supplementary feeding by keepers may sometimes be necessary. Although the sample size of the study was small, it provides information that can be used when giving pairs the opportunity to incubate their own eggs and rear their own offspring.

Table 1. Ethogram used during the reproductive periods 2005 and 2006.

Behaviour	Description
Entered nest log	Bird moved its entire body through the entrance hole and into the nest log.
Chick visit	Bird landed at nest log entrance hole and placed its head inside the hole; maybe accompanied by shaking of the body; occurred when offspring was present inside log.
Food provision	Visit made to the chick by a parent with an item of food visible in its bill and the food was deposited inside the nest log.
Drilling ¹	Bird flew at nest log and struck it one or more times with its bill.

¹ Adapted from Bahner et al. 1997.

Table 2. Egg and chick data 2005 and 2006.

Pair	Year	No. of clutches	No. of eggs ⁽ⁱ⁾	No. hatched	No. fledged ⁽ⁱⁱ⁾	Success rate ⁽ⁱⁱⁱ⁾
Mature pair	2005	7	12 (1)	4	4 (1)	33.33%
Mature pair	2006	5	8 (1)	4	2 (0)	25.00%
Novice pair	2006	5	9 (2)	7	6 (1)	66.67%

- (i) Number in parentheses indicates number of eggs incubated by parents.
(ii) Number in parentheses indicates number of parent-reared offspring.
(iii) Number fledged/number of eggs.

Table 3. Parental activity during incubation and nestling periods 2005 and 2006.

Activity	Mature pair	Novice pair
Incubation periods 2006		
Average percent of time spent inside nest log per day	62.34	45.48
Average length of time spent inside nest log per visit	16.76mins	12.53mins
Average length of time between nest log visits	9.75mins	13.97mins
Nestling periods 2005 and 2006		
Average percent of time spent inside nest log per day ¹	28.06	24.59
Average number of chick visits per hour	1.79	1.50
Average length of chick visits	5.85secs	3.97secs
Percent of chick visits that food was provided		30.58

¹ Refers to the four days after the mature pair’s chick hatched and the nine days after the novice pair’s chick hatched.

Acknowledgements

We wish to thank the Aviary Team and Animal Research and Technology Team at Disney’s Animal Kingdom for their cooperation during this study. Special thanks are extended to Cheryl Tybor for video recording and care of the birds, Jennifer Gaudio and Ginger Stanley for project support and Sue DuBois for assistance with video equipment. Christy Sky took the photograph.



Lamont, Myles. 2008. "The Nesting Behaviour Of The Musophagidae." *The Avicultural magazine* 114(1), 2–22.

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