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# Incubation behaviour and parental care of a nestling in the Black Monarch *Symposiarchus axillaris*

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**Summary.** The Black Monarch *Symposiarchus axillaris*, endemic to low montane forests in New Guinea, is socially monogamous and a territorial pair breeder. It builds a deep cup-shaped nest that is externally composed of moss. Watches at one nest with an egg confirmed that both male and female contribute equally in the later part of incubation. In the first 2 hours after hatching, both male and female contributed equally to brooding and feeding of the young, and in nest-defence. The combination of black skin and extensive long black down of the newly hatched Black Monarch appears to be unique amongst Australasian monarch flycatchers. The pattern of biparental care in the Black Monarch is compared with other Australian and New Guinea monarchs, particularly the Leaden Flycatcher *Myiagra rubecula*. Equal investment in provisioning of offspring by the male and the female may indicate a low benefit from extra-pair copulations.

## Introduction

The 97 species of monarch flycatchers (Monarchidae) range throughout southern Africa, Asia, Australasia and Oceania. The distinctive fantail-like Black Monarch *Symposiarchus axillaris* was recognised as the sole member of the subgenus *Penemonarcha* (Schodde & Mason 1999). Currently, 31 species of *Monarcha* monarchs ranging throughout Wallacea, New Guinea, the Bismarck Archipelago and Admiralty and Solomon Islands have been split into three genera—*Symposiachrus* (the pied monarchs; 19 species), *Monarcha* (the rufous monarchs; nine species) and *Carterornis* (the white-eared group; three species)—with the Black Monarch placed at the top of the *Symposiarchus* sequence (Filardi & Smith 2005; Gill & Donsker 2014).

The Black Monarch is a small 15–17-g insectivore (Diamond 1972) endemic to the montane forests of New Guinea and of Goodenough Island, in the D'Entrecasteaux Island Group. Unlike the other 30 species of core monarchs, it resembles a rhipidurid fantail by perching and foraging with the body held horizontal, wings drooped and tail elevated. It mainly inhabits hill and low montane forests from 1000 m to 2000 m above sea-level (asl) and ascends to higher elevations (up to 2300 m) than any other New Guinean monarch (Beehler *et al.* 1986; Coates 1990). Two subspecies are recognised, nominate *axillaris* of western New Guinea and subspecies *fallax* of eastern New Guinea mountains and Goodenough Island (Coates 1990; Coates *et al.* 2006). In the Arfak Mountains of Indonesian New Guinea, the Black Monarch coexists with the Black-winged Monarch *Monarcha*

*frater* from at least 1200 to 1500 m asl and with the Black Fantail *Rhipidura atra* from 1400 to at least 1800 m asl (RHD pers. obs.). One nest and egg of the Black Monarch subspecies *fallax* have been described (Harrison & Frith 1970), but breeding behaviour is little known and the nestling down is undescribed (Coates 1990; Coates *et al.* 2006). This paper describes the nest and egg of the nominate subspecies *axillaris* in the Arfak Mountains, documents incubation behaviour, hatching, feather development and parental care of the nestling, and compares these traits with other New Guinean and Australian monarchs.

## Study site and methods

From 1 to 16 November 2012, Carolyn Donaghey and I stayed at a hut in montane rainforest 1580 m asl above Kwau village, in the Arfak Mountains, Indonesian New Guinea (1°6'S, 133°55'E). Our focus was robins (Petroicidae), but the discovery of a Black Monarch nest enabled me to study this species' incubation and parental care behaviour. Low montane rainforest in the vicinity of the Monarch nest was characterised by a 20–25-m-high canopy layer dominated by oak *Castanopsis* and many tree species of the families Elaeocarpaceae and Lauraceae with occasional emergent figs *Ficus* spp., and a dense ground-layer of shrubs, ferns and herbs (Johns *et al.* 2007; RHD pers. obs.). During the first half of November 2012, there was little sunshine, and heavy rain fell most afternoons and evenings.

A nest with an egg was discovered by a Kwau villager, Hans Mandacau, on 6 November 2012. The next day, I assembled a hide and watched the nest, which was attended by a pair of Black Monarchs. Two 2-hour nest-watches were conducted from a hide 8 m from the nest, one at 1400–1600 h on 8 November and one at 1000–1200 h on 9 November to record incubation rhythm and behaviour. The egg hatched during a 2-hour nest-watch from 0800 h to 1000 h on 10 November, and parental care behaviour was documented for both the male and the female. The adults at the nest were observed through a telescope mounted on a tripod, and their visits, absences and behaviour were timed to the nearest second with a lap/split stopwatch. The sex of each adult was determined from the plumage: both sexes are black with white pectoral patches, but the male was glossy black and the female was sooty black and had a small grey ectoparasite below one eyelid. The egg was measured to the nearest 0.1 mm with callipers on 6 November. The egg and nestling were weighed to the nearest 0.1 g with an electronic pocket scale. The nest dimensions were measured with a tape measure.

## Observations

### *Nest, egg and clutch-size*

The Black Monarch nest was deep and cup-shaped, tapering to a narrower base, and externally composed of bright-green moss (Figure 1). It was supported by a small lateral fork and was built against the thin stem of a 2.4-m-high broad-leaved sapling in the understorey 1.9 m above the ground on a north-facing slope at an elevation of 1430 m asl. Its external measurements were 9.0 cm × 7.0 cm across and 10 cm deep, and internally it was 10 cm in diameter and 5.5 cm deep. Loose strands of green moss hung 10 cm below the base. The interior of the nest was lined with fine black rootlets. A nest found and photographed by Guy Dutson on 14 July 2012 above Mokwom village also in the Arfak Mountains (Figure 2b) was similar but was situated in a fork of the main stem of the nest-tree.

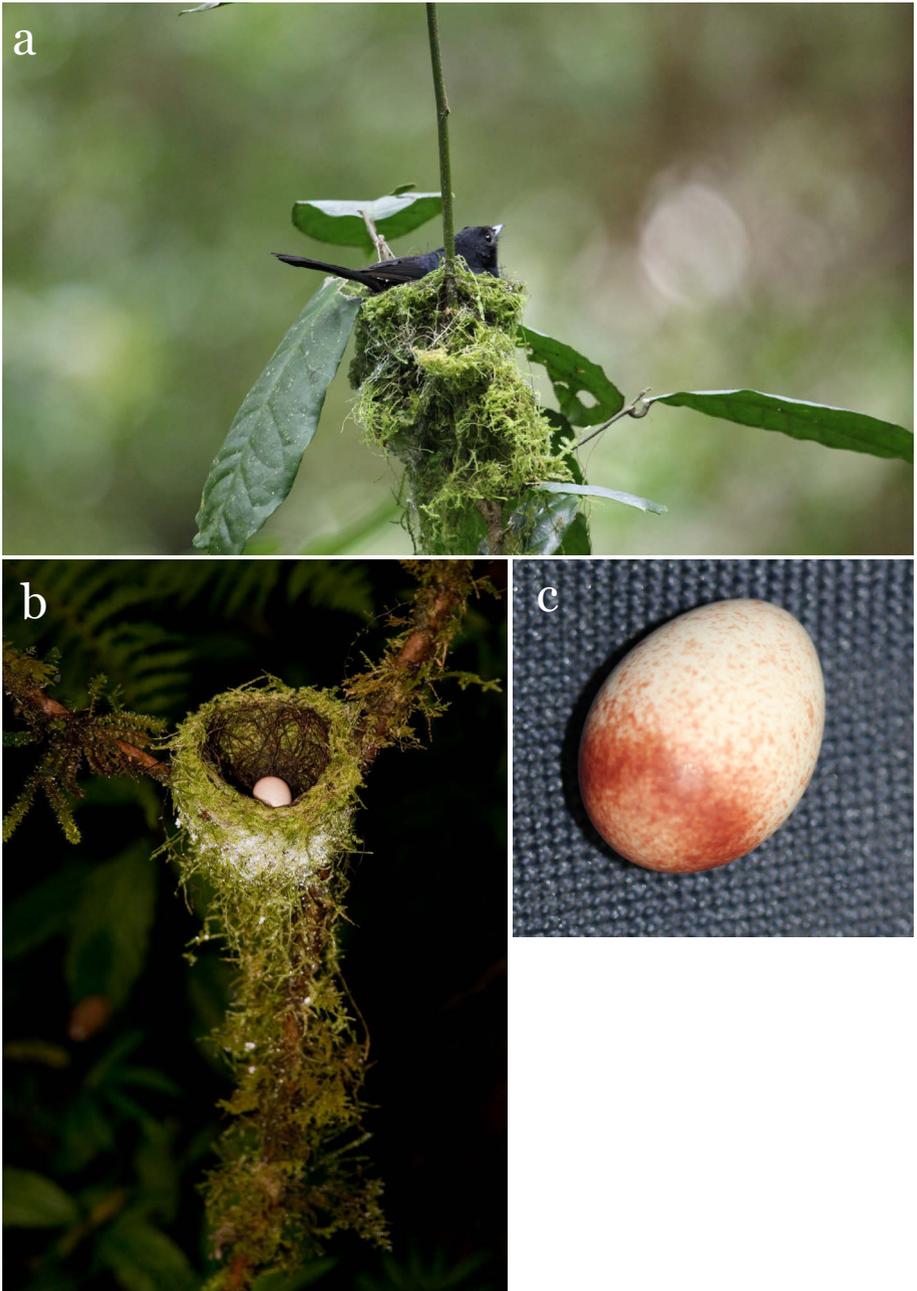


**Figure 1.** Black Monarch nest above Kwau Village, Arfak Mountains, Indonesian New Guinea. Photo: Richard H. Donaghey

The single egg measured 21.8 mm × 14.8 mm and 4 days before hatching weighed 2.8 g. It was pale pinkish white, sparsely spotted with light-brown and reddish-brown blotches on the smaller end and a zone or cap of dense reddish-brown coalescing blotches on the larger end (Figure 2c). The egg in the nest at Mokwom (Figure 2b) had a similar ground-colour but the pattern of spots and blotches was not noted.

#### *Incubation rhythm*

Both the female and the male took turns in incubating (Figures 2a and 4). During a 2-hour afternoon watch on 8 November, nest attentiveness was 102.82 minutes, thus incubation constancy was 85.7%. During a 2-hour morning watch on



**Figure 2.** Black Monarch nest and incubation, Arfak Mountains, Indonesian New Guinea: (a) female on nest, near Kwau village, photo: Carolyn Donaghey; (b) nest and egg above Mokwom village, photo: Guy Dutson; (c) Egg, near Kwau village, photo: Richard H. Donaghey



**Figure 3.** Nestling Black Monarch. Above: 3 hours after hatching, below: 5 days old. Photos: Richard H. Donaghey



**Figure 4.** Male Black Monarch on nest. Photo: Richard H. Donaghey

9 November, nest attentiveness was 89.6 minutes and incubation constancy was 74.6%. For six incubation sessions in the afternoon, the mean length was 19.28 minutes (range 11.98–25.67 min.), for six sessions in the morning it was 14.19 minutes (4.15–18.48 min.), and for all sessions combined it was 16.74 minutes (4.15–25.67 min.). Mean length of six incubation sessions by the male was 17.49 minutes (10.60–25.67 min.) and of six sessions by the female was 15.98 minutes (4.15–24.47 min.). Mean length of 12 absences was 3.97 minutes (0–24.02 min.). If the longest and shortest absences are omitted, the mean length of ten absences was 2.36 minutes (0.03–11.15 min.). On one occasion, the female arrived at the nest before the male departed.

#### *Hatching of the egg and parental care*

During a 2-hour nest-watch from 0800 h to 1000 h on 10 November, I observed behaviour of the adults associated with hatching, and quantified post-hatching biparental care in brooding and feeding of the nestling (Front cover). When I entered the hide at 0745 h, the male was sitting on the nest. He flew off at 0802 h, and at 0810 h the female flew in, paused on a leaf petiole above the nest for 1.92 minutes, then settled on the nest at 0812 h. At 0814 h, she raised herself from the nest and jabbed her bill into the nest. When she lifted her head, tiny (< 1mm) eggshell fragments could be seen on her bill. She flew off with half an eggshell, and after 27 seconds returned to the nest. She was at the nest for 17 seconds, then flew off with the other half eggshell. After an absence of 34 seconds, she flew in (with no food in her bill), perched for 35 seconds on the stem of the sapling that supported the nest, and then brooded the nestling for

20.08 minutes. She flew off the nest at 0836 h, and after 8 seconds the male (with no food in his bill) flew onto a perch above the nest, gave two short buzzy calls, peered into the nest, gave two more short buzzes and brooded the nestling for 23.68 minutes. Thus the male discovered the nestling 22 minutes after hatching occurred. The nest was unattended for 17 seconds, then at 0900 h the female flew in, perched on the leaf petiole above the nest with a small food item in her bill, and delivered the first prey item to the nestling 46 minutes after it had hatched. The female brooded the nestling for 3.15 minutes, then after 13 seconds the male perched on the sapling stem above the nest, fed the nestling 49 minutes after it had hatched, then brooded the nestling for 7.65 minutes. During the next 49 minutes, the adults brought food to the nest six times and the nestling was fed five times (three times by the female, twice by the male). Once, the male perched at the nest with a small fly in his bill for 32 seconds, then ate the fly before brooding the nestling. Four food items delivered to the nestling were two 1-cm-long insects with green translucent wings like a grasshopper (Orthoptera) or lacewing (Neuroptera), and two brown flies (Diptera). For five brooding sessions by the female, the mean length was 8.64 minutes (range 4.45–20.08 min.) and for four sessions by the male it was 12.07 minutes (1.9–23.68 min.); the mean was 10.16 minutes for brooding sessions by both male and female combined.

#### *Nestling growth and development*

Three hours after hatching, the nestling weighed 2.4 g, which is 15% of the median weight of an adult (15–17 g; Diamond 1972). On hatching, the altricial young had black skin densely covered with fine wispy black down 2–4 mm long on all of the feather-tracts of the head, upperparts and underparts, and the eyes were closed (Figure 3, above). Five days after hatching, the nestling was 4.5 cm long and weighed 8.5 g, the eyes were closed, the primary and secondary feathers had erupted 2 mm from the sheaths, the greater wing-coverts had erupted, black down covered the body, and the gape was pale yellow (Figure 3, below).

#### *Nest-defence and anti-predator behaviour*

At 1138 h on 9 November, the day before the egg hatched, I heard raspy monarch calls nearby, and the incubating Black Monarch flew off the nest and joined its mate flying at and around a Cinnamon-browed Melidectes *Melidectes ochromelas* (Meliphagidae) in the understorey 7 m from the nest. Both Monarchs uttered buzz and possibly whistle vocalisations, and chased the honeyeater away from their nest. Thus both male and female Black Monarch co-operated in nest-defence to repel a potential nest-predator.

## **Discussion**

#### *Breeding season*

Breeding of the Black Monarch in the late dry and wet season is indicated by the following observations: fledged young at Mt Kaindi in mid October (Coates

1990); a description of a nest and egg collected on 5 January 1941 in far south-eastern New Guinea (when the 'male was shot at the nest', and thus suggestive of incubation: Harrison & Frith 1970, p. 175); a nest and egg on 14 July 2012 in the Arfak Mountains (Figure 2b); and my observations in November.

### *Nest and egg*

The nest of the Black Monarch is similar to that of other New Guinean and Australian rainforest understorey monarchs, the Spot-winged *Symposiarchus guttula*, Spectacled *S. trivirgatus*, Hooded *S. manadensis*, Rufous *Monarcha rubiensis*, Black-faced *M. melanopsis* and Black-winged Monarchs (Coates 1990; Coates *et al.* 2006; Higgins *et al.* 2006). The nest of the Spot-winged Monarch is decorated with pieces of animal silk (Coates 1990), and that of the Black Monarch above Mokwom also appeared to be decorated with silk (G. Dutton pers. obs.; Figure 2b). The placement of the Black Monarch nest in an upright fork of a sapling in open rainforest understorey is similar to that of these monarchs but differs from the *Arses* monarchs (which suspend basket nests) and the canopy-nesting White-eared Monarch *Carterornis leucotis* and *Myiagra* woodland species of Australia (Coates 1990; Coates *et al.* 2006; Higgins *et al.* 2006).

The ground-colour of the eggs of Australian and New Guinean *Symposiarchus*, *Monarcha* and *Arses* monarchs is white, pinkish white or creamy white (Coates 1990). The pale pinkish-white ground-colour, reddish-brown spots, and size of the Black Monarch egg are most similar to eggs of the Spot-winged, Black-faced and Frilled Monarchs *Arses telescopthalmus* (Coates 1990) whereas eggs of the Spectacled, Hooded and Black-winged Monarchs are white to creamy white with reddish-brown spots (Harrison & Frith 1970; Coates 1990).

### *Hatching, and discovery of the nestling by the male*

My observations of hatching were fortuitous. Both the male and the female Black Monarch alternated incubation sessions and visited the nest an estimated total of 30–40 times a day during the incubation period. The male discovered the nestling 22 minutes after hatching, and the female and male first fed the nestling 46 and 49 minutes, respectively, after hatching. In this instance, the female assisted hatching and removed the eggshell. There are few observations published on discovery of the nestling(s) by the male, the notable exception being Central American passerine species in which only the female incubates (Skutch 1953). At 23 nests of 18 species in nine families, eight males first brought food within 1 hour after the first egg hatched, nine in 1–6 hours, five in 6 hours–1.5 days, and one between the sixth and tenth day after hatching (Skutch 1976). Although these birds are unrelated to monarchs, they show that promptness in male discovery of nestlings depends on the frequencies of nest-guarding, escorting the female to and from the nest, feeding the female and bringing food to the nest during incubation. Harper (1985) followed habituated pairs of European Robins *Erithacus rubecula* (Muscicapidae) away from the nest soon after hatching, and found that most males responded to females carrying food or eggshell by first feeding the young within 2 minutes but other males took much longer to respond.

### *Breeding system and parental care*

As far as is known, Australasian monarchs are territorial pair breeders (Bell 1982; Coates 1990; Cockburn 2003; Coates *et al.* 2006; Higgins *et al.* 2006) or inferred to be pair breeders (Cockburn 2006). To my knowledge, extra-pair paternity has not been documented by DNA testing for any species of monarch. Male Madagascar Paradise Flycatchers *Terpsiphone mutata* (which have exaggeratedly long tails) intrude into neighbouring territories during the laying period, thus providing circumstantial evidence of potential extra-pair copulations (Møller 1987; Mizuta 2000). Information on incubation behaviour and parental care in monarchs of Australia and New Guinea is meagre and rarely quantified (Coates 1990; Coates *et al.* 2006; Higgins *et al.* 2006) except for the Leaden Flycatcher *Myiagra rubecula* (Trémont & Ford 2000). Both the male and the female share incubation in the Black-faced Monarch (Marchant 1986), Frilled Monarch (Coates 1990), Frill-necked Monarch *Arses lorealis* (Frith & Frith 1993), Leaden Flycatcher, Satin Flycatcher *Myiagra cyanoleuca*, Shining Flycatcher *M. alecto* and Restless Flycatcher *M. inquieta* (Debus & Lollback 2005; Higgins *et al.* 2006). The female Spectacled Monarch incubates, but further study is required to quantify the extent of male incubation (Higgins *et al.* 2006). Biparental care of nestlings is typical of monarchs (Coates 1990; Coates *et al.* 2006; Higgins *et al.* 2006). Both male and female Leaden Flycatchers contribute more or less equally to all aspects of parental care (Trémont & Ford 2000). Female Leaden Flycatchers engage more in intraspecific nest-defence whereas males more often repel intruding known nest-predators. Trémont & Ford (2000) suggested that in the Leaden Flycatcher almost equal biparental investment in rearing offspring to independence is necessary because a low nest success (23%) means that the benefits of male parental care are greater than the benefits of extra-pair copulations. In the low montane forests of the Arfak Mountains, almost nothing is known about nest success and nest-predators. In the present study, the male Black Monarch contributed almost equally to incubation, brooding and feeding the nestling, and in repelling potential nest-predators, suggesting that he is important for reproductive success. Ketterson & Nolan (1994) suggested that male parental care, particularly in sharing incubation and feeding offspring, might limit opportunities for extra-pair copulations. Møller & Cuervo (2000) analysed paternity and paternal care from many bird studies and found that there was a strong negative relationship between extra-pair paternity and the energy-demanding provisioning of offspring but little evidence that male incubation restricts extra-pair activity. They concluded that certainty of paternity selected for male parental care, especially provisioning of offspring. This suggests that extra-pair copulations might not be frequent in the Black Monarch and Leaden Flycatcher given the equal parental care by male and female in these species.

### *Nestling growth and development*

The combination of black skin and the extensive fine long black down covering the body of the newly hatched Black Monarch appears to be unique amongst Australasian monarchs. Black-faced Monarch nestlings have sparse brownish-grey down on the crown, with the skin on the crown blue-grey and on the body salmon-pink; Black-winged Monarch nestlings have thick pale-greyish down on

the crown; and a newly hatched Spectacled Monarch had sparse dark-brownish-grey down on the crown and skin grey-black grading to dark pink on the wings and underparts (Higgins *et al.* 2006). Newly hatched Spot-winged Monarch nestlings, when viewed in the nest from above, have black skin, becoming dark pink on the throat, and frizzy/fuzzy black down on the crown (B. Coates pers. obs.).

## Acknowledgements

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## New editors for Wallacean, New Guinean and Melanesian birds

Guy Dutson has recently stepped down as the inaugural subject editor for birds of Wallacea, New Guinea and Melanesia. We thank Guy for his work in helping expand the geographic scope of *Australian Field Ornithology*—two articles on New Guinea endemics appear in this issue. To replace Guy, we shall now have two experienced editors for this diverse geography. Frank Rheindt, an Assistant Professor at the Department of Biological Sciences, National University of Singapore, will take on the Wallacean component. Few are more experienced and publish as regularly on the birds of that region as Frank. Frank will also continue his role on the *AFO* editorial board. To take on the New Guinean and Melanesian component, we are delighted that Clifford Frith has joined the *AFO* editorial team. Cliff and his wife Dawn are the authorities on that region's iconic bird families—the birds-of-paradise and bowerbirds—and Cliff has both extensive ecological experience in the region and in publishing.

## Apology: BirdLife Northern NSW contribution to *Australian Field Ornithology*

BirdLife Australia and the *Australian Field Ornithology* Editorial Board sincerely apologise to BirdLife Northern NSW for the lack of recognition of their significant contribution to the Christmas Island Supplement of *AFO* in 2014.

We sincerely thank BirdLife Northern NSW for their contribution to the publication of the birds of Christmas Island Supplement and to the previous Supplement on the birds of Diamantina National Park. Both are significant contributions to the Australian ornithological literature and BirdLife Northern NSW has played a critical role in their publication.

*James Fitzsimons*  
Editorial Board (Chair)