

Short Communications

Courtship Display and Mating of the Superb Bird of Paradise

Lophorina superba

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The Superb Bird of Paradise *Lophorina superba* inhabits rainforest and forest edge between approximately 1000 and 2250 m above mean sea level (amsl) throughout mainland New Guinea. The adult male is velvet black with metallic-like oil-green iridescent plumage on the crown, an erectile iridescent breast shield, and with a very long erectile and spreadable cape of modified velvet black nape feathers. Peculiar horn-like naral tufts of erectile rather stiff black feathers adorn the base of the upper mandible, above the nostrils, as does a similar tuft of feathers beneath the lower mandible. The female is cryptically coloured in browns and greys with distinct blackish ventral barring, like many other female paradisaeids (see Gilliard 1969; Cooper & Forshaw 1977). First year male plumage is like that of the female, the black and iridescent plumage of adult males being acquired gradually over several years (Gilliard 1969). Male Superb Birds of Paradise are said to be territorial, defending an area as small as 1.5 ha within which they forage for insects and fruits (Beehler & Pruett-Jones 1983) and vocally attract and display to females. Males are presumed to be polygynous, probably promiscuous, displaying solitarily from arboreal perches (Frith 1985). Wild displays are undescribed (Gilliard 1969; Peckover & Filewood 1976; Cooper & Forshaw 1977).

On 26 and 27 October 1985 we made observations in primary montane rainforest on the Mt. Mengam ridge at approximately 1500 m amsl in the Adelbert Range of Papua New Guinea. We were on the spine of a ridge, some 8 to 12 m wide, that fell gently toward the north-east. Two metres from us was the uphill end, and base, of a fallen dead tree trunk half a metre in diameter and ten metres long, lying on a 40° slope to the west-north-west and supported between half and one metre above ground by adjacent trees. Above the fallen tree a large open break in the otherwise constant forest canopy provided good illumination. Near the lower end of the fallen trunk was a small area of dense regenerating sapling growth about 5 m tall. We used 8 x 30 binoculars and the naked eye throughout 10 h 55 min of observation, never further than 12 m from the birds. We presume because of their behaviour that all female-plumaged wild birds observed were females. We observed the displays of captive birds at the Baiyer River Sanctuary, Western Highlands, Papua New Guinea during

December 1977 and November 1985 and we compared these with those of the wild birds and descriptions by other authors.

Initial display activity (IDA)

This was observed seven times and consists of a sleeked pose, held for about five seconds, before movement of cape, breast and naral tuft plumage. The male slightly crouches with breast shield sleeked tightly back against himself, cape held back and down against the back, wings and tail held normally, head and bill pointed upwards with eyes fixed on the female, and naral tufts projecting conspicuously forward and bifurcate (Fig. 1). This pose is followed by a repeated, sudden, upward and outward extension of the breast shield, with head and bill still pointing at the female and naral tufts unaltered. Interspersed with this breast shield flashing is a cape-flicking action in which the cape is flicked well forwards above and over the head but not spread as in HID (see below), with an exaggerated downward movement of the head that shows the iridescent crown to the female (Fig. 2). Breast shield flashing and cape-flicking increase in tempo as the IDA progresses. It appeared that breast-shield flashing and cape-flicking always alternated during this rapid performance. During IDA wings and tail appear to be held in normal position.



FIGURE 1 Wild adult Superb Bird of Paradise in Initial Display Activity sleeked posture.



FIGURE 2 Wild adult male Superb Bird of Paradise in cape-flicking and crown presentation posture of Initial Display Activity directed at the female.

If the female moved during IDA the male took a few short steps to turn and face her at all times but after so doing reverted to a brief sleeked, slightly crouched, posture (as above) before recommencing IDA.

On two occasions, as a female hopped down a sapling towards him just before HID, the male backed to the far edge of the log, assumed a sleeked posture but with breast shield fully erect, and opened his mouth to expose the bright yellowish interior. On the first of these occasions he then closed his mouth, produced a loud 'click' sound with the wings, opened and shut his mouth once more, clicked the wings again and then hopped back to the centre of the log to face the female hopping towards him. On the second occasion he opened his mouth twice and produced a simultaneous loud 'click' at least once with the wings.

High intensity display (HID)

This display was observed four times. The breast shield is thrust forward and expanded fully, the narial tufts erected and bifurcate, and the cape flicked forwards and spread laterally to form a complete semi-circle over the head and down either side to at least the upper edge of the breast shield, if not behind it and below (see below). Below the outer lower edge of the breast shield black feathers extend inwards and round to meet the body feathers, forming a complete circle of black broken only by the iridescent triangular breast shield (see Fig. 3). It was difficult to see whether these lower feathers were cape feathers extending down below the breast shield to meet the body feathers or,

more likely, consisted of drooped wings or erected lower body contour feathers or both. Just below the central part of the cape, above eyes and bill, two very conspicuous blue-green iridescent 'eye spots' appear, possibly by an adjustment of crown or crown and narial feathering, which are extremely striking when suitably lit. The closed bill is not discernable and the eyes can only just be seen below the lower edge of each of the 'eye spots'. The mouth remained closed. In this remarkable posture the male proceeds in short sharp steps to dance round the female.

Observations of wild birds

Displays Between 0800 and 1000 h on 26 October an adult male was calling in a gully to the south-east and he moved about the local area from tree to tree and to points high and low in the forest. Still calling, he moved over the ridge and into a gully to the north-west into dense saplings below the far end of a fallen dead log (we subsequently watched the log area until 1145 h and from 0705 to 1410 h on 27 October). Thirty seconds later he gave one series of calls and flew off to the north-east out of sight. He called intermittently down the ridge and then back into the south-east gully. At 1130 h calling became more frequent, and closer. At 1135 h the male again flew from the south-east gully over us at only 2 m above ground and again into saplings near the lower end of the fallen log (this route hereafter called the flight path) to give a series of loud calls before flying down onto the lower end of the fallen tree trunk (hereafter the display area).

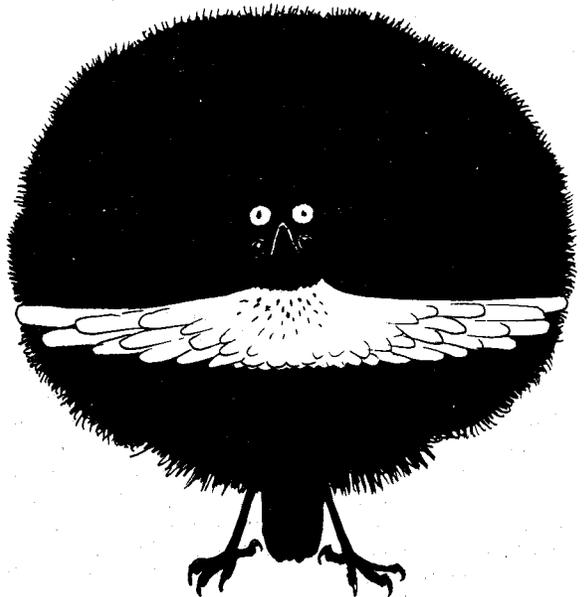


FIGURE 3 Wild adult male Superb Bird of Paradise in High Intensity Display posture. Note 'eye spots' above the eyes.

The male went directly into IDA for 15 to 20 sec, directed upwards at a female perched nearby. She then flew onto the log 30 to 50 cm lower than the male and he performed HID for 35 sec. On this occasion she approached him in a submissive crouched posture with slightly drooped wings. The male remained stationary in the HID posture until the approaching female reached him and then proceeded to dance around her, moving in quick, short, side steps, as she exaggerated her submissive pose. He danced past her in semi-circles, twice down the log and back up. During the dance their bills almost touched and she side-stepped in order to rotate her body so that she always faced him. On his final return the male lowered his plumage and mounted for less than 5 sec; the female then flew up into the saplings. He reverted to IDA for 15 to 20 sec before also flying into the saplings. He was later heard calling intermittently down slope towards the north-east, then progressively toward the south-east gully until calling repeatedly there. During these displays the male was sunlit, enhancing the iridescent breast shield and crown plumage. During the two subsequent displays on 27th the male was not sunlit, the female did not assume the submissive pose and copulation did not ensue.

On the 27th from 0705 to 0811 h frequent calls were given in the SE gully, getting closer and more frequent. At 0812 h the male traversed the flight path to land on the display area. He performed IDA for 5 to 10 sec before flying up into saplings. He gave one series of calls and then again worked his way back into the SE gully, calling intermittently. Between 0814 and 1200 h he called from various points in the SE gully, getting closer and more intense towards midday.

At 1205 h the male traversed the flight path low and landed on the display area to give two single calls. A female joined him, 30 cm below on the display area and he formed stationary HID to her. She flushed into the saplings as a result of our movements. The male reverted briefly into IDA sleeked posture before flying up into the saplings. Birds were not visible from 1206 to 1304 h whilst the male gave several series of calls low down in vegetation around the display area, possibly attempting to attract the female(s) back. At 1307 h he again traversed the flight path to land in saplings above the display area, gave a single call, flew down onto it and performed IDA for about 120 sec. He then backed himself away from an approaching female and went into a 8 sec stationary HID as she landed on the display area just 30 to 50 cm below him. She flew back up into the saplings and he reverted to IDA at 1310 h. He continued directing IDA at the female for 9 min whilst visually following her through the saplings above him. At 1319 h he again backed a few steps (see above) as the female returned to the display area 30 cm below him and performed HID around her for 90 sec during which he performed a complex dance. As the female approached him, he was in stationary IDA pose but

as she got closer he backed off a few steps until she halted. He then danced a full anti-clockwise circle around her and back clockwise twice; to then dance in a semi-circle down the log and back to his original starting point, producing a loud clicking sound throughout. The female did not assume a submissive pose and for the next 20 sec he continued HID whilst stationary, almost frozen, until she turned, hopped down the log and flew to above the display area. The male again reverted to IDA, for 4 min, before flying up towards the female. Both birds then moved out of sight. The male gave two single calls, and then called intermittently whilst making his way to the SE gully, and remained there until observations terminated at 1410 h.

Calls A series of up to 12 loud repeated screeches were given by the adult male both high in the forest canopy and in understorey vegetation, but sometimes only a single note was given.

Just before displays the calls became more frequent and intense. After copulation the male was relatively quiet but when copulation did not follow HID his calls appeared louder and more intense. On the 27th the HID did not terminate in copulation and the male then gave a series of calls 20 times between 1326 and 1410 h, presumably in an attempt to attract the female back to the display area. On the 27th we heard two single screeches as the male landed on the display area and later heard the same just after he left. All other call notes heard were in series of two or more, and were very similar to those of male Victoria's Riflebird *Ptiloris victoriae* (pers. obs.).

On 27th we noted the male clicking during display; twice just before HID and continuous clicking throughout one of the four observed HID.

Observations of captive birds

Displays On 9 December 1977, CBF observed a displaying adult male housed alone in a 2.4 m high aviary with other bird of paradise species in aviaries to either side of it at Baiyer River Sanctuary. At 0810 h the male danced-stepped along a 1.6 m high horizontal perch with cape and breast shield expanded and head slightly down. With vigorous wing flicking he moved back and forth along the perch no more than 20 cm in each direction in a crouched pose producing loud rhythmic wing-clicking sounds. At 0815 h this male performed a similar display, commenced this time by the bird widely mouth-gaping. At 0818 h the male displayed on the same perch, but with slightly different posturing. He crouched and, thus, brought his breast shield down low close to the perch, with cape well raised, but not over his head. The shield and cape, in fact, formed a high 'ruff' about his head (see Fig. 4). Initially the mouth was opened wide and, once display commenced, the loud clicking was produced now and then. During this display the nasal tufts at the base of upper and lower

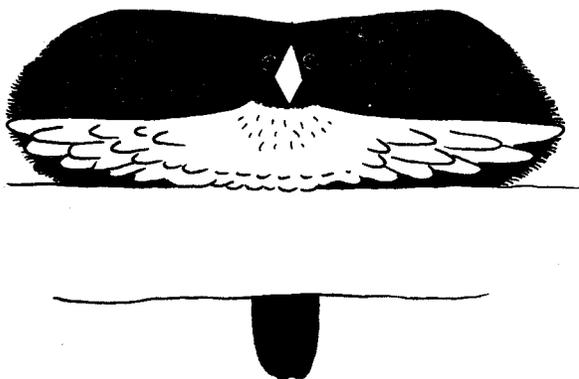


FIGURE 4 Captive male Superb Bird of Paradise in crouched High Intensity Display, with gaping mouth and no 'eye spots' above the eyes.

mandibles were erected to project conspicuously forward. Both of the above display types were preceded by the sleeked pose of the IDA (see above) but differed from those of the wild male in that the captive crouched down. Similar displays, accompanied by loud clicking, were also seen on the 7 to 11 December inclusive.

Other behaviours Two captive pairs of birds, one true pair (the female had laid an egg) and another consisting of a mature and immature male (some black plumage), were observed intermittently in separate aviaries at the Baiyer River Sanctuary, between 20 and 27 November 1985 inclusive.

On 19 occasions the male of the captive confirmed pair closely approached the female and presented his crown to her, by lowering his bill (Fig. 2), and she usually preened it. On two occasions the mature male similarly solicited the immature male who preened in response. Once, both male and female simultaneously presented their crowns to each other and whilst the female held her pose the male tried to lift her wing as if to preen underneath it and then suddenly mounted her. The female avoided copulation by dropping down to hang upside down beneath the perch directly below the male, briefly, before righting herself back onto the perch, when the male again presented his crown to her.

The male allopreening solicitation posture is identical to the cape flicking pose of the IDA but is performed slowly in a more relaxed manner with dropped wings and, if ignored by the female, may be held for up to 20 sec and the female gently bill-prodded now and then to encourage her to preen the male. Both birds commonly preened themselves before and after this mutual activity.

Calls We noted single and multiple calls given by both fully adult and immature plumaged males, but only noted

the female giving a single screech note. Three other calls were heard. A male scolded us when he came to feed close to us, and would not stop calling until we moved away. On three occasions when male approached female, he gave a soft mew-like sound, 'pe-er, pe-er, pe-er', and she gave this call once whilst the male fed. The male also produced an occasional quite nasal snort.

Discussion

Our observations of a wild-displaying adult male Superb Bird of Paradise are generally in accord with observations of captives by others and ourselves. The adult male is described as a dispersed territorial, solitarily, arboreal displaying, polygynous (possibly resource control polygyny) bird by Beehler & Pruett-Jones (1983) who note that male territories are non-overlapping and abutting, and of between 1.19 and 1.71 ha ($\bar{x} = 1.5$ ha, $n = 3$); and that females probably nest within the territory of the male of their choice. Particularly noteworthy is the finding that the Superb Bird of Paradise and the only other two birds of paradise proved to be territorial to date, the Buff-tailed Sicklebill *Epimachus albertisi* and the Brown Sicklebill *E. meyeri*, are predominantly arthropod-eaters as opposed to predominantly frugivorous (Beehler & Pruett-Jones 1983). The small territory size is consistent with our experience, on Mt. Mengam, of the male moving about a limited area of forest and calling very predominantly at two particular points within it — the display area and the south-east gully.

Morrison-Scott (1936) describes the HID posture of a captive adult male with mouth wide open as it moves along a perch by short steps, which Seth-Smith (1936) illustrated, but mentions nothing like IDA. Morrison-Scott notes the bird making a 'cawing noise' throughout the display, flicking its wings every now and again thus 'producing a clicking noise' whilst the tail 'at the same time (is) depressed and elevated'. He was impressed by two green 'irides with black pupils' either side of the head or beak and the real eyes being concealed during display. He examined museum specimens to discover what plumage creates the 'pupils', having satisfied himself that the 'irides' are formed by iridescent crown feathers, probably held in a concave disc either side of the head. He refers, however, to the 'pseudo-eyes' as being both 'on each side of the head, on top' and 'one on either side of the beak'. We were unable to confirm if they are formed by movement of iridescent crown feathers only or if the nasal tufts are also involved. There is need for detailed analysis of head feather positions during HID. We did not witness cawing or tail movements during display.

Crandall (1932) describes a very similar HID, specifically noting crouching but no bill gaping or wing flicking. Manson-Bahr (1935, p. 67) briefly describes HID preceded by no vocalisations, noting that the bird crouches before raising its plumes, that the 'eyes' appear as 'two iridescent

points, like some shining emeralds' and that with widely gaping beak a 'slight hissing sound' is produced as the bird sways from side to side.

Stonor (1940, pp. 27-28) records HID preceded by increasingly loud screeching and dancing back and forth along a perch, the HID with slight swaying movements 'usually with mouth wide open' and occasional screeches. Stonor notes a 'sharp click — "Tick-tick" ' produced by sudden flicking of the 'wing feathers' of the displaying and gaping bird, and 'two tiny patches of shining green feathers between the eyes' that the bird 'raises'.

Timmis (1968, 1970) in describing his captive adult male's HID towards a female writes 'he crouched low on his perch partially spreading his wings and expanding his breast plate to its fullest extent'. This bird danced 'very vaguely' and 'at regular intervals gave a series of harsh screams with the mouth wide open, showing the bright yellowish lining'. These notes appear to be those given by Coates (1977).

Thus, it is clear that male Superb Bird of Paradise courtship displays typically include certain elements. In the IDA the bird crouches and raises the head with bill uppermost and conspicuously sleeks the plumage before incorporating display plumes into a HID. During HID a bird may or may not often call and/or gape the mandibles wide to expose mouth colouration. It may raise and/or depress the tail, partially spread its wings and may take short steps along a perch or across a large log, sometimes dancing around a female, and may sway from side to side. Two characteristic aspects of all HID described are the presentation of two striking eye-like iridescent spots above or between the real eyes and the production of sharp loud clicks produced by wing feather movements. Call notes and stepping dance are reminiscent of the Parotias *Parotia* spp; and the sleeked IDA pose may be seen as analogous to the pre-display bob of the Parotias (Frith & Frith 1981) but is also near identical to an IDA pose of a captive Magnificent Riflebird *Ptiloris magnificus* we observed on 9 December 1977 at Baiyer River Sanctuary. Bill gaping, calls, vertical tail movements, side-to-side swaying and wing-induced sounds are similar to typical display components of Riflebirds *Ptiloris* spp (Crandall 1937; Everitt 1962; Gilliard 1969; Cooper & Forshaw 1977; pers. obs.), whilst wing flicking and narial tuft raising are noted for some Parotias *Parotia* spp (Frith & Frith 1981) and Stephanie's Astrapia *Astrapia stephaniae* (Healey 1978). Healey (1978) found Stephanie's Astrapia to be a communal (lek) displaying species that, together with the Ribbon-tailed Astrapia *A. mayeri*, displays by flying back and forth between upper canopy perches (Gilliard 1969; pers. obs.).

Displaying and calling wild male Superb Birds of Paradise use larger moderately sloping outer branches of the lower part of the canopy trees (Rand & Gilliard 1967), high

and middle limbs in forest trees (Gilliard 1969), high in the crowns, though not at the very tops, of leafy trees (Diamond 1972), and within or below the canopy (Peckover & Filewood 1976). Each male has a specific tree or small group of trees where he calls and receives females (Pratt, in Beehler & Pruett-Jones 1983). From the regularity and location of calls given by the Mt. Mengam male, he probably had at least two such sites within his territory, one of which consisted of the fallen log no more than a metre above ground, much lower than previously reported. Very direct low flights to the log display area by this male indicates habitual use of it. We assume that the male observed was the same individual throughout because male Superb Birds of Paradise are territorial.

Our records of both sexes allopreening, more frequently the female preening the crown of the male in response to his soliciting pose, are of a behaviour previously seen in captive birds by Crandall (1932) who pointed out it was then, as now, unrecorded in other family members. More surprisingly, Timmis (1968, 1970) observed his captive male feeding the female animal food on several occasions before and during her nesting activities. These latter behaviours are typical of pair bonding monogamous birds and are unexpected in a polygynous species in which the female alone attends the nest as is the case in this species (Majnep & Bulmer 1977; Beehler & Pruett-Jones 1983).

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A Sexual Difference in the Contact Calls of Silvereyes

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Silvereyes *Zosterops lateralis* are known to flock during the non-breeding season (Marples 1944; Kikkawa 1961; Lane 1972). The mechanisms involved in the formation and maintenance of flocks are probably to be found in vocal communication as in flocks of other passerines (e.g. Red-cheeked Cordon Bleu *Uraeginthus bengalus*, Evans & Patterson 1971; Willow Tit *Parus montanus*, Ekman 1979; Strong-billed Honeyeater *Meliphreptus validirostris*, Pizzey 1980). Silvereyes maintain vocal contact whilst feeding and flying and loud calls are particularly common if an individual is separated from the flock. This paper examines the structure and use of these calls and reports on a sexual difference in them.

We have investigated vocal communication among members of winter flocks around Brisbane at Kobbie, Kangaroo Point and Everton Hills, and on Heron Island, where the Capricorn race (*Z. l. chlorocephala*) is resident. Brisbane birds were also studied in captivity. Calls were recorded using a Sony TC-D5 Pro cassette recorder with a Dan Gibson Electronic Parabolic Microphone. Sonograms were made using a Kay Elemetric Sonagraph with FL-1 and narrow band selectors.

On Heron Island, calls were recorded in winter between 13 and 23 June 1985, and 4 and 14 July 1987. Recordings were made of birds on release after trapping or netting them at feeding stations and retaining them in cages for 30 min or longer. Their sexes were known from earlier records of singing (males) and pair relations determined in the

breeding season. Ages ranged from less than one through to nine years.

Sonographic analysis showed three groups of calls that could be recognised in the field by a trained ear. Reliability was tested with tape recordings of 55 calls analysed by sonagraph in June 1985 and likewise confirmed over the next two years. The sexes were not known to the observer when the calls were tested on release.

Twelve Silvereyes caught at Everton Hills on 2 April 1985 were colour banded and transferred to an aviary at the University of Queensland. Before release into the aviary, and on subsequent occasions during the next six months, calls were recorded from these birds both within the aviary and in isolation in a separate room.

Another 12 Silvereyes caught at Kangaroo Point on 14 and 15 June 1986 were colour banded and placed in cages where they were recorded and monitored by ear for a total of 14 h at various times of the day for 12 days. Those birds that gave the 'variable' call were isolated from the others to ensure that other birds using this call were detected. The caged birds were sexed on 26 June 1986 by gonadal examination.

On a banding trip to Kobbie on 13 August 1986, the sex of captured Silvereyes was predicted on the basis of the plumage colour of the flank. Males had a distinct chestnut coloured flank, whereas females were more of an indistinct