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Taxonomic status of the Negros Bleeding-heart *Gallicolumba keayi* from Panay, Philippines, with notes on its behaviour*

E. CURIO

Following the discovery of a new population of the Negros bleeding-heart pigeon on Panay, a first, yet very incomplete, account of the species's behaviour is given and illustrated by photographs of a live male. A clutch in March contained two eggs. Neither the morphometrics nor the colouration of three adult birds, this male included, from the north-west Panay peninsula indicate that the Panay birds are any different from the earlier described Negros form. Errors in the earlier descriptions, based entirely on museum skins, are corrected. One female showed an anomalous central tail feather. Currently data on body mass and behaviour are known only for individuals from Panay. A new way of protectively closing the eyes, not noticed in birds before, is described; it is employed whilst picking up bulky insect prey and also when the head is tucked into the plumage while preening. The similarity of the two island forms of the species reflects the close faunal resemblance of the two Visayan islands that is further underscored by the recent publication of more than 60 new distributional records of birds from Panay previously known from Negros only .

Clarke (1900) described a new bleeding-heart *Gallicolumba keayi*, based on three specimens from Negros island, Philippines, obtained from Mr W. A. Keay, the owner of a sugar plantation. Clarke's description was enlivened by a colour plate prepared by J. G. Keulemans that got most details correct (see below). The Negros species was the last of the five Philippine endemic bleeding-hearts to be discovered (Dickinson *et al.* 1991). Unlike *G. luzonica* and *G. criniger* from the Luzon and the Mindanao regions, respectively, that have often been kept in bird collections, the Negros form had not been recorded in captivity, so that its appearance and behaviour remained virtually unknown. The same holds true for both the Sulu Bleeding-heart *G. menagei* (D. Allen, pers. comm. 1999) and the Mindoro Bleeding-heart *G. platenae*, though pictures of a captive *platenae* have been published recently (Brooks *et al.* 1995). Attention to the plight of all three critically endangered forms has been drawn by a full-colour poster painted by W. L. R. Oliver. Extensive deforestation taking place throughout the country (DENR 1997) is threatening all forest birds, and the risk of extinction is exacerbated for single-island endemics such as the three bleeding-hearts mentioned.

Following up hints received from both conservationists (Diesmos and Pedregosa 1995) and hunters in the Valderama (near Mt Baloy) and Malumpati areas (north-west Panay), the Philippine Endemic Species Conservation Project (PESCP) diligently searched for signs of the Negros Bleeding-heart on Panay from 1995 when its explorations started. As a result, project members discovered the bird in Lahang forest (Municipality of Libertad, Antique) in 1996 and, later the same year, also in nearby Sibaliw (Municipality of Buruanga, Aklan) (Klop *et al.* 1998), in both primary and secondary-growth forest at 450 m. Our search in good forest at 950 m near Mt Baloy (Hamtang above Nawili) did not meet with success. On Negros, the pigeon occurs at 'higher elevations', i.e. around 1,000 m. But this may not reflect a true preference as all forest below 800 m has been cleared. In the course of our banding operations, three bleeding-hearts were captured near the Research Station Sibaliw, thanks to the skills of our field assistant 'June' Benjamin Tacud. One of them was put into a well-planted rehabilitation cage (5 x 3 x 2.5 m) as per a Memorandum of Agreement with the Department of Environment and Natural Resources (DENR). The cage was lined with very soft fishing net, thus forestalling injury. The behavioural observations and photography were carried out on this bird, while an account of the external appearance is based on all three birds.

There is great interest in establishing the taxonomic status of the Panay bleeding-heart. If it proves not to differ from the Negros form, the risk of extinction of the species would be split. Behavioural data presented here, as well as blood samples, are available only from the Panay form, so comparison of the two populations has to rest entirely on morphological features. .

APPEARANCE AND MORPHOMETRICS

Colouration

The external appearance of all three birds matches the illustration by Keulemans (Clarke 1900), apart from the following important points (Plates I and II). The upper white breast is virtually embraced by a wide band of metallic-green feathers that taper off towards the midline. This shiny green band, together with the shiny bluish-green upper mantle merging into the lesser wing-coverts, encloses a band of white feathers that merges

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ventrally with the white of the breast. This white band extends towards the upper back and gives the impression of a second white wing-bar. Three study skins (Nos. 4 to 6 in Table 1) that I inspected (only photos of Nos. 4 & 5) revealed no indication of this conspicuous white band, obviously due to feather disarrangement during skin preparation. While such disarrangement of the lateral breast feathers made both the broad green lateral band and the white bar bordering it disappear on Keulemans' plate, the colour illustration of *G. keayi* in Hachisuka (1931-1932) captures almost correctly the position and size of the former band. Whether the vestigial length of the white bar in the latter illustration is genuine and, hence a potentially discriminating character, needs to be determined by study of live birds from Negros.

The blood red breast patch is narrow, usually no wider than 5 mm, and ca 26 mm long, but its shape may change due to the activities of the bird (Plates I and II). This name-giving trait has been seen correctly (Hachisuka 1931-1932), or has been painted far too wide (Clarke 1900). The narrow shape of this patch renders *G. keayi* distinct from all other bleeding-hearts.

The white wingbar is formed by the two to three most distal rows of lesser wing-coverts, the grey base of which, however, cannot be seen in life (contra Clarke 1900). The latest descriptions (Hachisuka 1931-1932, Delacour and Mayr 1946, duPont 1971) ascribe this wing-bar only to *G. keayi*; yet a close inspection of a skin of *G. platenae* (Museum für Naturkunde, Berlin) and of photos of one live bird (Brooks *et al*. 1995) reveal one upper prominent, or even a smaller second, white wing-bar in this species, too (colour poster of *G. keayi*, *G. platenae* by PESCP, 1997).

Clarke (1900) described the greater and median upper wing-coverts to be 'purplish chestnut' throughout, while other authors do not mention them (Delacour and Mayr 1946, duPont 1971), or reiterate his account verbatim (Hachisuka 1931-1932). Our first bird (No. 1, Table 2) shows only the greater and median coverts of the secondaries to be thus coloured, whereas the primary coverts are blackish (photos of spread wing). A close inspection of colour photos of both the holotype and co-type (courtesy of R. McGowan, Edinburgh) revealed no obvious difference from this pattern in the Panay bird. Hence, the original description needs an amendment in this regard as well.

The colour of the soft parts was assessed both verbally and with the use of colour charts (Küppers 1991) (Table 1). While we agree with the then verbal accounts of earlier authors (Clarke 1900, Hachisuka 1931-1932, Delacour and Mayr 1946, duPont 1971), all of them failed to notice the violet tinge of the red iris that we found in (at least) two of the three birds. Oliver's poster has the iris yellowish.

Morphometrics

Table 2 gives the measurements of our three Panay bleeding-hearts (I) and 10+ study skins from various collections, the holotype and one co-type (Nos. 4 & 5) included (II). In one case (Hachisuka 1931-1932), the number of skins examined is not given. Measurements were taken by the curators of the collections approached to forestall the loss of the material. One exception from this was No. 6. There is wide overlap of measurements between the two samples, and the overall values of the Negros birds (II) fall squarely in the range of the limited sample of Panay birds. There is one exception (No. 6) where two bill measurements exceed those for Panay.

The tail length is problematic. Whereas one source (Hachisuka 1931-1932) gives 100 mm as the lower end of the range for Negros, this is not reached by *any* other measurement (an anomaly [Table 2, footnote 2] excluded). Even allowing for shrinkage of tissue in skins (Svensson 1975, Jenni and Winkler 1989), this would not bridge the gap between the longest individual tails in Table 2 and the range mentioned by Hachisuka (1931-1932). Strangely, another discrepancy between data on specimen labels (Nos. 4 and 5), i.e. when collected in the fresh state and those from the skins now, runs counter to the expectation based on shrinkage and, thus, remains unexplained. In conclusion, the scanty data at hand give no hint as to a size difference between Negros and Panay bleeding-hearts.

One individual from Panay had an anomalous tail feather tip (No. 2, Table 2).

The total length and the body mass of the three Panay birds (Nos. 1 to 3) amounted to 243, 250 and 259 mm and to 175, 176 and 206 g, respectively. No comparison with the Negros birds is possible.

BEHAVIOUR

One adult male (No. 1, Table 2) was observed in the spacious rehabilitation cage. In view of the possible importance for future conservation breeding of this rare species and, as it was the first account of its kind for any bleeding-heart form (D. Goodwin *in litt.* 2000, A. Anzenberger *in litt.* 2000, A. Münst *in litt.* 2000), notes on its behaviour are reported below.

Table 1. Colour of soft parts and breast patch in three Negros Bleeding-hearts (Nos. 1 to 3) of Table 2 from Panay as assessed with the aid of Küppers' colour atlas (1991) and as judged by three observers qualitatively throughout

No	Iris	Beak	Legs	Breast patch
1	S20Y30/M90 violet red	dark slaty grey	S20Y50/M90 coral red	S00Y70/M99 blood red
2	S 10Y80/M80 carmine red	Black	S20Y40/M90 coral red	S00Y90/M90 blood red
3	S00Y10/M70 violet red	slaty grey	S00Y20/M99 coral red	S00Y70/M99 blood red

Table 2. Measurements (in mm, accuracy 0.1 mm, where possible) of three live individuals of *G. keayi* from Sibaliw, Municipality of Buruanga, Antique Province, Panay (I); of museum skins from Negros (II)

	No	Date	Sex/ age	Wing[1]	Tail	Tarsus	Bill to feathers	Bill to nostrils	Bill width /nostrils	Culmen at base	Remarks
I	1	8 Feb 99	♂ ad.	149	72	37.6	19.2	11.1	3.8	5.9	Sex determined from behaviour (text)
	2	11 Nov 99	♀ ad.	144	90[2]	34.1	17.9	9.3	3.9	5.6	Skin at station Sibaliw. Ovary 11x7, even-sized follicles
	3	20 Mar 00	♂ ad	156	93	37.5	17.6	9.8	3.5	6.3	Nail of left inner toe missing. *Sex judged by size
II	4	1899	-	158; 157	73[3]	36	16.6	9.8	-	-	Nat. Museums of Scotland NMSZ 1900.116.31, Holotype[4]
	5	1899	-	147; 147	63[3]	34	18.0	9.5	-	-	NMSZ 1900.116.32, Co-type[4]
	6	30 Dec 59	♀ ad.	149; 146	81	32	16.5	10.0	5.0	ca. 7.5	Peabody Museum, Yale, No. 54310. Photograph with author.
	7	10 May 50	♀	146	80	32.0	13.9	8.8	-	-	Field Museum of Natural History FMNH 417944
	8	10 May 50	♀	145	75	28.3	13.7	8.1	-	-	FMNH 417945
	9	7 May 50	♀ iuv.	139	69	29.7	-	-	-	-	FNMH 209780
	10	12 Apr 50	♂ ad.	151	77.0	34.8	16.7	ca. 10.4	-	-	FMNH 209779
	11	3 May 50	♂ iuv.	138.3	72.1	31.8	ca. 20	10.9	-	-	FMNH 209778
	12	6 May 49	♀	142.2	93.8	34.2	17.7	7.6	-	-	Delaware Museum of Natural History, DMNH 13637
	x	-	-	159	100-104	37	18-22	-	-	-	Av. of unknown number of skins of either sex[5]
Arithmetic mean of individual or group measurements (skins only):				147.3[6]	78.6	33	17.0	9.4	(5.0)	(7.5)	Where range is given, average taken

1 Svensson's11 'flattened wing' method where feathers are not straightened on ruler. Two entries denote right and left wing.

2 Vane of one of the two central rectrices ends in torsion of a 15 mm long tip (not contained in tail length above) of 2 mm width. The other central rectrix ends normally.

3 Given on labels as 101 and 96 mm, respectively, while all other measurements are 'within 1 mm or so of those written on the specimen labels' (McGowan in litt. 1999)

4 Colour prints, courtesy of Mr R. McGowan, NMS, with author.

5 From Hachisuka7; bill to feathers 'culmen from base' (p. 221).

6 Where both wings where measured, average taken.

Feeding

Already on its second day in an acclimatization cage (60 x 50 x 40 cm), shielded off with white cloth that covered the only look-through wall, the bird took seeds from the ground. A bit later it took them from the filled bowl, on top of which freshly killed insects were placed. Insects were also placed on the ground. The seed mixture consisted of 40% oily seeds (sunflower seeds, dehusked cardy *Cynara cardunculus*) and 60% mealy seeds (silver millet, durrha, wheat; no rye!) (Nicolai pers. comm. 1998). Corvimin, a top quality multi-vitamin and mineral powder, was added to the diet twice a week. A weight control in October 1999, i.e. after eight months, revealed no weight loss. The food in the aviary, which became the bird's standard home after five days, was enriched with both more and larger insects and berries. Small berries of Durum-on and Magdong-od (2.5-3 mm and 3-4 mm in diameter, respectively) were taken (Plate I, 4), while slightly larger ones (Lawi-Lawi Tabaw) were rejected. The bird ate unripe berries (yellowish, orange or red) only after having eaten all the ripe ones, which it selected by sight alone. However, rejection was partly based on picking up the individual berries. The berries of Magdong-od were recognised as being ripe visually, even though these were purplish-red. Captive Luzon Bleeding-hearts are not keen on fruits of any kind (J. Nicolai, pers. comm.). Given this rather strict preference for tiny fruits, it came as a surprise when we found a relatively large seed without any traces of pulp (Plate I, 6) in the gizzard of a female that had accidentally died (Table 2, No. 2; skin in station Sibaliw). The seed had many times the size of the smallest rejected berries. It belonged to a palm (*Borassus* or *Borassodendron*) that has not yet been recorded from the Philippines, with representatives occurring on Borneo as the nearest place (H.-J. Tillich *in litt*.) Furthermore, mastication in the gizzard opened up the nutritious contents without the help of grit that is commonly taken up by ground doves. The captive male took up small pieces of grit, though.

The appetite for insects in the aviary was so great that up to eight dead dragonflies Odonata (Plate I, 5 and 7) were eaten less than 20 min after they were thrown on the ground of the cage. Similar-sized grasshoppers were taken as well. The bird seized the insect with (both?) eyes closed at the moment of impact (Plate I, 5), which never happened with berries, then threw the prey on the ground, without mandibulating it. After picking it up thus several times, it swallowed it. Dismembered wings and heads were eaten after the rest. Insects were clearly preferred over the seeds available all the time. Searching for food was facilitated by tossing leaves aside with the bill.

The protective eye closure when picking up an insect is remarkable. Not only did it occur when there was no prey movement but the motor pattern and context of eye closure is apparently undescribed for birds. When sleeping, a bird typically closes its eyes by raising the lower lid. The foraging bird under scrutiny half-closed its eyes by lowering the upper lid (Plate I, 5) or completely closed them by partly raising the lower lid simultaneously (photo). At the moment of impact the eyes were thus protected. While holding the insect securely, the eyes were kept wide open.

The bird drank water by sucking as is typical for doves. Once it drank from a water-filled dry leaf in preference to the full bowl a few steps away.

Preening

The movements used in preening were the same as employed by many birds. Surprisingly, again the eyes were closed by lowering the upper lid before the bill was tucked into the ruffled feathers (Plate II, 8), i.e. in the same way as when picking up a larger insect (see above). But, in contrast, to the latter protective mannerism, the eye was reopened, while the head was raised, by pulling down the *lower* lid. (The movement of the upper lid could not be perceived.) The only interpretation possible is that, after the upper lid had closed the eye as documented, it gave way to the lower lid, which then reopened the eye during the raising of the head.

Sun-bathing

Like many other pigeon species, the bird walked into a sun spot on the floor, squatted down and tilted over the completely unfolded wing while rolling the body over the opposite side so that the wing's outer surface touched the ground. Thereby the inner surface and the flanks became exposed to the sun on the very side that was hit by the sun before. Seconds later, the wing was partly folded and returned to the basking position, or the bird stood up and walked back into the shade.

Roosting

In the forest, three birds were found sleeping on a young tree in the late evening of 24 April 1998, two of which sat side by side (Plate II, 9). The third one, higher up, flew off when disturbed. Later on, two were seen roosting together 3 m up in a young *Palaquium luzoniense* tree (23 March 1998). Roosting in a group may have been due to earlier breeding in March (see below), because bleeding-hearts normally stay by themselves during the day (ca. 12 observations); only once were two birds seen together (12 February). In the aviary, the lone bird roosted both under the roof at one end and in the open. It seemed to prefer rather thin twigs providing a stronger and safer hold for the feet, even if there was no rain shelter (see also II, 9).

Vocalizations

These were recorded with a Sony TC-D5M recorder and a dynamic microphone. The male sang most commonly from September and October 1999 through to March 2000, between near dawn (ca. 05h10) and near dusk (17h00), usually from the top of the shelter (Plate II, 10). In addition to the loud songs there were two monosyllabic *hu* calls and one unrecorded bisyllabic *huhu* call of a distinctly different sound quality but inserted into bouts of song. The songs consisted of trills of rapidly repeated syllables with possibly up to three harmonics, with their major energy at around 0.5 kHz (Fig. 1). In spite of varying from 28 to 78 syllables, these trills always had a duration of about 2.4 s. Between trills the bird remained still or walked back and forth, sometimes flying down and up again. Trills were even sung in the acclimatization cage when the bird was suffering from a leg injury in October. On two occasions trills were preceded by two very different soft *hu* calls (Fig. 1 c., Fig. 2). All the *hu* and *huhu* call versions were of low volume while the loud trills were long-distance signals, easily audible in the field. The high repetition rate of ca 3.5 trills per min, and the context, suggest trills to be territorial advertisement. A wild male gave c. 11 songs/min, both before and after being flushed by humans (17 March 01, 11h25). According to hunters' reports, the Negros Bleeding-heart utters a soft *coo* and a high-pitched *uu-oom*. These calls allow them to distinguish the species from other doves (Emerald Dove *Chalcophaps indica*, White-eared Brown Dove *Phapitreron leucotis*) (Diesmos and Pedregosa 1995). Though these calls might fit into the above account of the Panay bird, I find it strange that the major diagnostic vocalization should not be the much louder song trill (which has, however, not been reported for the Negros population).

Visual displays

Typically the lifting-wings display (Plate II, 11 and 13, Fig. 3) with maximally and rapidly raised wings is given at a rate of about one third of the song rate 1 or 2 s after a song. The body feathers are puffed out, giving the bird a much-enlarged appearance. At the end, during the slower down-stroke of the wings, portions of the wing-coverts including the white bar are selectively raised above the wing surface as to be visible from the front (Plate II, 13). The display accompanied a song only once and was given on the song post. An identical display is used by the Luzon Bleeding-heart male when courting the female, or when luring her to a place for nest-building (Münst and Wolters 1999). The lifting-wings display also occurs during courtship in the New Guinean Golden-heart Dove *Gallicolumba rufigula* (Coates 1985), though with the wings raised merely halfway up (J. Nicolai, pers. comm., photos), as is also typical of *G. rubescens* (Gifford 1925). The display has apparently arisen before the Philippine radiation of the endemic bleeding-hearts and is, hence, expected to be common to all of them.

Second, there is an extremely rapid double wing-beat, during which the wings are beaten twice at such a high speed that the double stroke can be only heard but not seen. The stroke does not lift the body at all. Like the lifting-wings display, the double wing-beat occurs also during song bouts but more rarely. Only once it occurred in a bout of preening. Being close-range signals, these displays function surely in a different way than the songs. Produced in the absence of a conspecific they must be regarded as vacuum activities.

Tameness

During the day, flight distances were noticed at 3, 10, 13 m and 10–15 m when birds took wing and settled again after a short flight. This level of tameness may lead to the species being easily overlooked as compared

to all other pigeons of the area. The species's rarity may therefore be more apparent than real.

REPRODUCTION

On 8 March 1999 Henry Urbina of PESCP found the only known nest of the species in primary forest near the Bulanao trail (Plate II, 12). The two eggs fell victim to a predator within a day of its discovery, thus precluding further observation. The nest was placed amidst the leaves of a birdnest fern *Asplenium* supported by fallen logs, and was clearly visible from above. The time of the year matches both joint roosting of groups (see above) and previous records both for *G. platenae* and *G. luzonica*, with nestlings found in May (Dickinson *et al.* 1991).

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E. Curio, Conservation Biology Unit, Faculty of Biology, Ruhr-Universität Bochum, 44780 Bochum, Germany; email: eberhard.curio@ruhr-uni-bochum.de