TAXONOMY

THERE ARE TWO DISTINCT, NOT IMMEDIATELY RELATED SPECIES OF MIOMBO DOUBLE-COLLARED SUNBIRDS: *CINNYRIS MANOENSIS* AND *C. GERTRUDIS*

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INTRODUCTION

The last major taxonomic review of the species limits within the *Cinnyris afer/C. chalybeus* complex of African 'double-collared' sunbirds was that of Clancey & Irwin (1978). One of the more important decisions of that review was the recognition of the Miombo Double-collared Sunbird *C. manoensis* as specifically distinct from its otherwise purely South African counterpart, the Lesser Double-collared Sunbird *C. chalybeus.* This decision has subsequently found general acceptance within the standard literature (Fry & Keith 2000, Cheke *et al.* 2001, Hockey et al. 2005, del Hoyo *et al.* 2008). Clancey & Irwin (1978) also recognised two races of the new Miombo Double-collared Sunbird, namely *manoensis* and *pintoi* (the latter now becoming a synonym of *C. gertrudis*, see below). One uncertainty was that the type locality of *manoensis* (Missale, to the north of Lake Malawi in south-western Tanzania, within the Mano district at 09°15'S; 33°48'E) appeared to lie deep within the established range of what has now become *gertrudis*. Furthermore, it can now be shown that this is the only locality from which *manoensis* is recorded in Tanzania (despite many statements to the contrary in the literature) with all other Tanzanian records to date being referable to *gertrudis*, with the type locality of Songea (10°40'S; 35°38'E).

This situation remained perplexing until it became clear that it involved two quite readily distinguishable species that were not even each other's closest relatives. It became apparent that in Zambia their ranges overlapped and the two forms were separated ecologically, occupying different habitats and behaving as good biological species. Subsequently these differences were supported by molecular analysis. We would therefore like to suggest that *C. manoensis* becomes known as the Eastern Miombo Sunbird, and *C. gertrudis* the Western Miombo Sunbird. Both are endemic to the Zambezian or miombo biome, centred on the moister southern savannas.

A BRIEF NOMENCLATURAL REVIEW

Before proceeding, it is necessary to review the confusing taxonomic and nomenclatural changes that have occurred over time and in particular why the name *gertrudis* has priority over *pintoi.*

For a time, birds in this complex were known as *Nectarinia intermedia* (Bocage, 1878) but because this name had already been used for *C. asiaticus intermedius* (Hume, 1870) the replacement name of *pintoi* was proposed by Wolters (1965) with the type locality being Caconda, Huila, Angola. However, *gertrudis* had been described by Grote (1926), with the type locality of Songea in south-eastern Tanzania, as a race of *C. chalybeus* of South Africa. This name therefore takes priority over *pintoi*.

The original description of *gertrudis* was rather brief, mentioning a shorter bill of 17 mm. Separation from *chalybeus* was based largely on its apparent geographical isolation as it was not then known that the populations met and in fact overlapped. It was also emphasised that the classification of many related forms (including both *mediocris* and *afer*) had still to be decided. It is not clear

why there was no mention of *manoensis*, held in the same collection in Berlin and surely falling within the group of similar forms worthy of discussion. The reasons for this omission can only be surmised, but might it have been considered rather different even then?

What we now know as *manoensis* was once known as *C. chalybeus bractiatus* described by Vincent (1933) from Fort Chiquaqua, near present-day Harare. Macdonald (1958) pointed out that an earlier name, *manoensis*, took priority having been described by Reichenow (1907) with the type locality being Missale, Mano district, south-western Tanzania. Clancey & Irwin (1978) then treated *manoensis* as specifically distinct from its South African counterpart *chalybeus.* In the text that follows only the names *manoensis* and *gertrudis* are used, with the others being formally discarded.

UNRAVELLING THE SITUATION IN ZAMBIA

On 19 August 2001 PML was collecting data for the Zambian Important Bird Areas programme in the North Swaka National Forest (near Mkushi at 13°24'S; 29°36'E) when he found a sunbird nest in a small evergreen tree. It was an untidy ball of grass lodged in a terminal leaf cluster, about 2 m up and it contained two small chicks. The surrounding terrain was rocky with some scattered scrub. After a short wait, a male 'double-collared' sunbird arrived and fed the chicks. As only one such species was believed to occur there, it was concluded that it must be a Miombo Double-collared Sunbird of the race *gertrudis.* However, certain aspects seemed anomalous. Firstly, the nest of this sunbird in Zambia is typically a hanging pear-shaped structure made of *Usnea* lichen, secondly the bird itself appeared a little more bulky than usual, and thirdly it was some distance from any miombo woodland where the species is most generally found.

A few days later PML discussed these observations with JFRC-R who confirmed that all but one of the *gertrudis* nests he had found in Zambia had been hanging structures made from *Usnea* lichen and within miombo. Intriguingly, the nest which had not conformed as expected, had matched that found by PML and had also been found in an area of rocks and scrub. At this point it became clear that we were dealing with two different species. This was later confirmed through fieldwork at a third locality, the Mutinondo Wilderness Area at 12°27'S; 31°I8'E. Here we found the two species of double-collared sunbirds alongside one another but in different habitats, with the typical *gertrudis* only within the miombo and the unidentified form where rocks and scrub predominated. Other differences that separated the two were voice, body size and structure and eggs.

At this juncture it was considered that the unidentified sunbird might have possibly been the Greater Double-collared *C. afer* partly due to its larger size and choice of habitat and also because all records had come from the chain of montane country running south-westwards along the top of the Muchinga Escarpment directly from the Eastern Highlands of Zambia, close to the Malawian border, where this species was known to occur.

Also in Zambia, but back in late August 1964, MPSI spent a week visiting the Mundwiji Plain (Mwinilunga district, North-western Province, 11°45'S; 25°45'E). Here he found that Miombo Double-collared Sunbirds were especially common, particularly along the ecotone between the miombo woodland and the strips of gallery forest. However, he could not reconcile these birds with those he knew so well in Zimbabwe and their vocalisations were equally unfamiliar. Even more surprisingly, in the course of a visit to the Natural History Museum of Zimbabwe in Bulawayo in 2001 he pulled out a tray of Zambian double-collared sunbirds and glanced at five study skins that he and Jali Makawa had collected way back in April 1960 at the Kundalila Falls along the Muchinga Escarpment (13°09'S; 30°42'E).

Four of these were small-bodied and the other obviously larger. After a more detailed examination it became suddenly clear that the larger bird was a *manoensis* and the others *gertrudis,* which at that point were regarded as races of one another. Further work was to follow and it soon became abundantly clear (supported by the earlier literature) that the two forms were sympatric. The habitat here also comprised well-developed miombo woodland with an accompanying rocky ecotone in the more open situations along the edge of the escarpment.

At around the same time, PML and JFRC-R had been working at the National Museum of Zambia in Livingstone. Here they were quickly able to rule out the presence of *C. afer* and independently came to the conclusion that *manoensis* and *gertrudis* overlapped. When examined more critically, the two were also obviously different across a range of characters that had been long overlooked by others. In the literature anomalous birds had been referred to as 'intermediates', whereas in reality the two forms were co-existing alongside each other. At about the same time we were also informed by Raurie Bowie (*in litt.*) that a molecular assessment revealed that these two sunbirds were not even each other's immediate relatives.

EARLIER EVIDENCE FOR A GEOGRAPHICAL OVERLAP

Rather surprisingly, there was already evidence to support the idea of a geographical overlap and sympatry but this had been widely misinterpreted as being racial. Macdonald (1958) explained that the two forms were readily distinguishable and at the same time he drew attention to what he termed 'distributional inconsistencies'. He pointed out that two specimens from Danger Hill (11°32'S; 31°36'E) represented both *manoensis* and *gertrudis*, while another two from Lavushi Manda (12°22'S; 30°52'E) had the characters of *manoensis* and a further two birds from Metenje in the Serenje district (12°50'S; 31°10'E) shared the characters of *gertrudis*. He went on to claim that it was necessary to clarify the situation in Zimbabwe where, once again, another two study skins from the Kana river represented the two taxa. Shortly after this paper was published MPSI checked the specimens and found that the one attributed to *gertrudis* was in fact a poorly prepared *manoensis* which had lost most of its upper tail coverts. It is appropriate to point out here that the material from Danger Hill, Lavushi Manda and the Kana river had been on loan from the Natural History Museum of Zimbabwe, although not acknowledged by Macdonald. It should also be noted that it has not been possible to locate the two specimens from Metenje referred to by Macdonald, which might be expected to be in the Natural History Museum collection in Tring, UK as they were obtained during C.R.S. Pitman's 'Faunal Survey' (Pitman, 1934). However, we do not question their identification.

Macdonald believed the two forms intergraded and the same mistake was made by Clancey & Irwin (1978) who continued to refer to such birds as 'intergrades.' This was duly quoted by Dowsett *et al.* (2008), also oblivious to the reality that such birds were either one form or the other. The same is true in the literature from Malawi in which statements referring to 'intergrades' without clear evidence date to Benson (1953) and these have simply been repeated by later authors. In the Natural History Museum collection in Tring there are 13 Malawian specimens of *manoensis* and 8 of *gertrudis*, all of which are readily distinguishable and none suggesting 'intergrades.'

THE WIDER PERSPECTIVE WITHIN ZAMBIA

These two species are now known to overlap over a distance of at least 600 km along the Muchinga Escarpment (Figure 1). Here they exist in a state of parapatry where the two habitats (miombo woodland and the more rocky terrain) form a mosaic along the

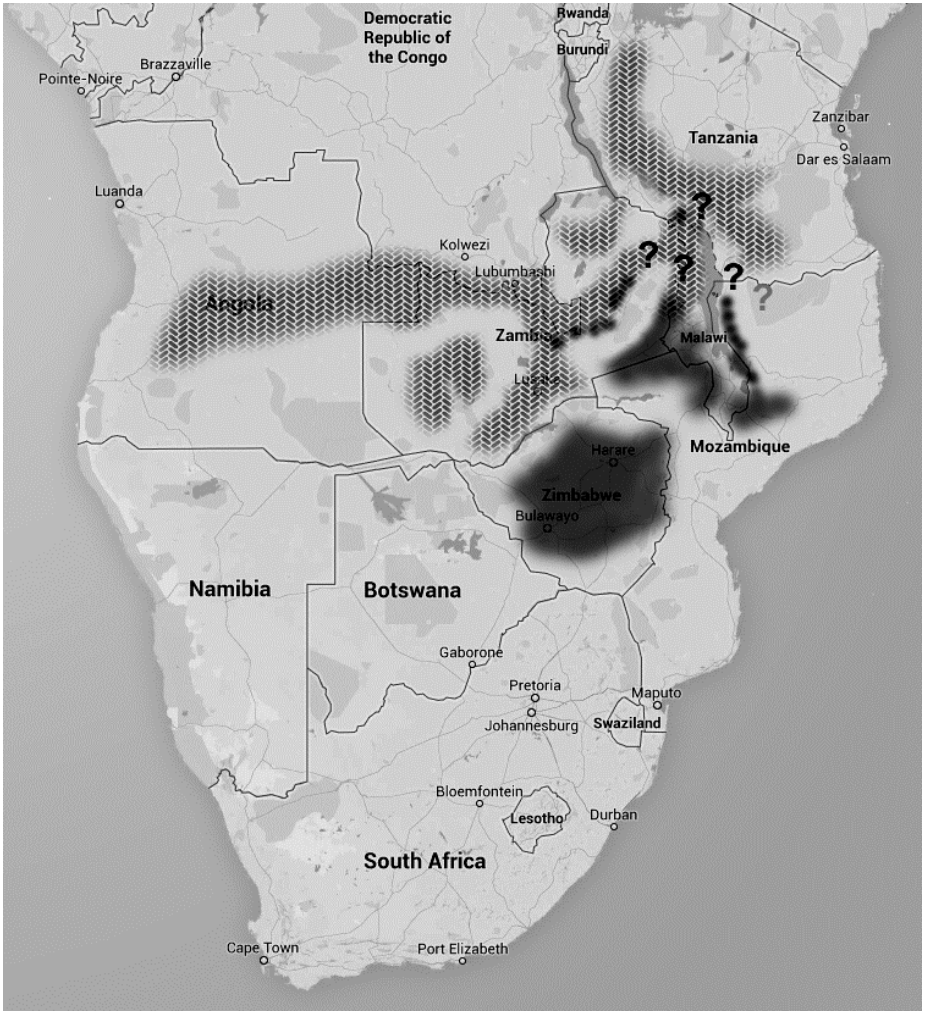

Fig. 1. The approximate distributions of the Western Miombo Sunbird *Cinnyris gertrudis* (patterned shading) and Eastern Miombo Sunbird *C. manoensis* (dark shading). Note the region of overlap along the Muchinga Escarpment to the west of the Luangwa valley in Zambia and the most significant areas of uncertainty indicated by question marks in northern Zambia and Malawi, southern Tanzania and northern Mozambique.

escarpment providing conditions that must be optimal for both. But while this is easily understood, there remains a great deal of uncertainty elsewhere. For instance, Dowsett *et al.* (2008) state simply that *manoensis* replaces *gertrudis* on the Eastern Province plateau, but no precise limits are set. It might reasonably be suggested, that *manoensis* ranges further north at higher levels to encircle the upper reaches of the Luangwa valley system to form a geographical continuum with the known range along the

Muchingas. It should be noted that *gertrudis* is known from Lundazi, adjacent to the Malawian border (12°17'S; 33°10'E) at around the same latitude where *manoensis* is said to occur in Malawi. The disposition of each species in this area still needs to be resolved more clearly.

West of the Muchingas *gertrudis* ranges widely and is common in some areas, but as is clear from the map in Dowsett *et al.* (2008) and here (Figure 1) it appears to be absent from the larger river basins such as the Chambeshi, Kafue and upper Zambezi, where there is much more open country and thinner miombo formations. These are perhaps ecologically unsuitable and there may be increased interspecific competition from other sunbird species. It is also seemingly absent at times from richer miombo formations (PML, personal observations), though the precise factors that affect its distribution at this level are still unclear.

THE SITUATION ELSEWHERE

It follows that the parapatry identified in Zambia may be replicated elsewhere to the east, but due to the confusion of the past, very few data are available from an enormous area of Tanzania and northern Mozambique. In Malawi, Dowsett-Lemaire & Dowsett (2006) were reasonably specific, giving the range of *manoensis* as north to Ntchisi at *c*. 13°22'S; 34°01'E, after which it becomes replaced by *gertrudis*. But there is in fact a *gertrudis* specimen in the Natural History Museum in Tring collected from Ntchisi itself, so they may overlap here. The extent to which either species may be associated with a particular habitat and the areas of overlap throughout this region is yet to be determined.

In northern Mozambique, where most material dates back as far as Vincent (1935), specimens from localities south of *c*. 15°22'S are *manoensis*, although it is known to occur at least as far north as Unango on the eastern side of Lake Malawi (*c*. 13°S). A specimen from here (also in Tring) was obtained by C.W. Benson's collector Jali Makawa (Benson 1946).

Further north, in Tanzania, *gertrudis* has been recorded from the Matengo Highlands to the north-east of Lake Malawi at *c*. 10°50'S (Sassi & Zimmer 1941) and it becomes more widespread within the Songea district. Otherwise, there are many thousands of square kilometres from which no information is available but a situation comparable to that along the Muchingas seems rather unlikely to be repeated in most areas.

VARIATION WITHIN THE TWO SPECIES

In the course of examining the abundant material in this study, it is clear that *manoensis* is monotypic with no observable geographical variation, despite the significant distributional barrier formed by the Middle Zambezi valley.

The same may be said of the population of *gertrudis* ranging continuously eastwards from Angola through Zambia and into northern Malawi. Material from Tanzania in Tring (consisting of 6 males and two females from Iringa, one male from Dabaga (Lynes 1934), and one male from Mt Kiboriani) suggests that birds from this region are all consistently darker-bellied and more sooty with slightly larger legs and feet. In the males, the red breast-band is appreciably broader. Further work might reveal that these birds could be racially distinguishable.

We have also seen a colour image of a recently collected male from near the Tatanda Mission on the eastern aspect of Lake Tanganyika, 26 km from the Zambian border at 8°31'S; 31°30'E at 1800 m (provided by D.A. Turner). It appears to be more olive-bellied and may indicate yet further variation where the species ranges further north towards Lake Victoria.

HOW CAN THE TWO SPECIES BE DISTINGUISHED?

Measurements and appearance

Until now, the two forms have been separated by the colour of the uppertail coverts which are a metallic blue or violet in male *manoensis* and largely greyish, narrowly tipped with glossy green or more occasionally violet in *gertrudis*. There is also a difference in size with *manoensis* being a medium-sized bird of around 14.5-16.5 cm while *gertrudis* is considerably more diminutive at 10.5-12.5 cm. *Gertrudis* also weighs less than *manoensis* (Table 1).

Table 1. Comparative weights for *manoensis* and *gertrudis*.

	Locality	**Sex (sample size)**	**Weight (g) Range and mean**
manoensis	Mutinondo, Zambia	Male (1)	10.2
manoensis	Zimbabwe	Male (15)	8.4-12.8 (9.8)
		Female (8)	7.4-9.3 (8.4)
gertrudis	Zambia	Male (14)	6.6-8.8 (7.7)
		Female (3)	6.6-7.7 (7.2)

An additional feature that quickly became apparent was the differing body proportions in the two forms. When viewed in life, or especially as study skins, *manoensis* is very clearly longer-bodied, whereas *gertrudis* has a notably foreshortened body or trunk (see centre ii & iii). This would have become even more obvious if it had been possible to compare post-cranial skeletal material but none is available. This fundamental difference in shape and form suggests that they are not closely related to each other. This difference is exaggerated further by the shorter tail of *gertrudis* though it is interesting to note that the wing lengths of the two forms differ only very slightly (Table 2).

Table 2. Comparative measurements for *manoensis* and *gertrudis*. Data are shown as ranges with the mean in brackets. Material for *manoensis* is from Zambia, Malawi, northern Mozambique and Zimbabwe. That for *gertrudis* is a combined series from Angola, the southern Democratic Republic of the Congo, Zambia, Malawi and Tanzania.

		Sex (sample size)	**Wing (mm)**	**Tail (mm)**	**Culmen from base (mm)**
manoensis	North of Zambezi	Male (27)	59-65 (62.2)	40-45 (43.3)	22.0-24.0 (23.16)
		Female (7)	55-60 (57.4)	37-40 (38.0)	22.0-24.0 (22.80)
manoensis	South of Zambezi	Male (58)	60-66 (62.2)	42-48 (44.3)	22.5-25.0 (23.49)
		Female (44)	55-60 (57.2)	37-42 (39.1)	21.5-23.0 (21.95)
gertrudis		Male (50)	56-63 (60.3)	36-43 (38.5)	18.0-21.0 (19.68)
		Female (15)	53-60 (55.6)	32-39 (34.7)	16.5-20.5 (19.03)

The bill of *gertrudis* is shorter (17-21 mm) and more gracile than that of *manoensis* (22-24 mm) which is heavier, more robust and broader around the gape. The legs and feet also differ clearly. The tarsus of *gertrudis* measures 15-16 mm, against 17-18.5 mm in *manoensis* and the legs and feet of *manoensis* are proportionately heavier.

There are distinct plumage differences in the males: *gertrudis* is uniformly a more brilliant green whereas *manoensis* is slightly bluer-green and non-metallic feather bases

tend to become more exposed. The red breast-band of *manoensis* averages 10-13.5 mm deep against 7-11.5 mm in *gertrudis*. The yellow pectoral tufts tend to extend only to the base of the red breast-band in *manoensis* whereas in *gertrudis* they are longer and more profuse, extending well beyond the breast-band and the bend of the wing (Figures 2-4, centre ii & iii). The females are also separable; *manoensis* is a greyish bird overall, whereas *gertrudis* appears much less so with the head, body and wings having a more blackish wash, which is particularly obvious beside the strikingly white underwing coverts.

Voice

The calls of the two species are known reasonably well in certain parts of their range but not at all in others. In Zambia, at least, the differences between the two are striking. The song of *gertrudis* is a rambling squibble similar to and typical of so many sunbirds (and *Cinnyris* spp. in particular). However, what sets it apart is a very characteristic drawn out and descending trill at the end of the song phrase. This is a very consistent and distinctive feature of the song noted throughout its range (R. Stjernstedt personal communication, and author's personal observations). This descending trill is never given by *manoensis* which has a slower and less rambling song, incorporating strident whistled notes, some of which are glissandi. However, such whistles are given within the phrases rather than at the end of them and they are of a pure quality rather than trilled. Furthermore, the vocalisations of *manoensis* usually seem louder and more far-carrying then those of *gertrudis*. What is not yet known is whether or not such differences are consistent throughout their respective ranges. This would be a very valuable area for future research.

Nest and eggs

As already mentioned, *manoensis* tends to build a nest that forms an untidy ball or oval of grass often combined with other plant material and bound with spider web (Hockey *et al.* 2005). It is usually attached by the roof or back wall to a branch or lodged within a cluster of leaves. In contrast, *gertrudis* (without exception in Zambia) builds a hanging, pear-shaped structure, made almost exclusively from *Usnea* lichen. In discussing the eggs of the two forms, JFRC-R always stressed the uniformity of those of *gertrudis*, referring to them as 'almost always plain chocolate brown'. The only eggs in his collection that did not conform to this pattern were later proved to be those of *manoensis* from a zone of overlap that had not been identified at the time they were collected. These eggs, as is typical for *manoensis*, were not plain but delicately marked (see centre iii).

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