Moult in Scalyfeathered Finches *Sporopipes squamifrons* in southeast Botswana

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Methods and results

Between July 1996 and November 2000 I mistnetted and ringed birds in *Acacia* bush at Ruretse some 20 km NE of Gaborone. Various seed-eaters including Scalyfeathered Finches *Sporopipes squamifrons* were attracted by millet or sorghum seed provided in a tray and by pools of water where they drank regularly. The wing length of most birds was measured to the nearest 0.5 mm, using the flattened maximum chord method, and most birds were weighed to the nearest 0.5 g, using a 50 g Pesola balance, and they were examined for moult. Primary moult was scored in the standard way (Ginn & Melville 1983).

In the study period 283 Scalyfeathered Finches were ringed and biometrics were recorded for most of these. Catches were higher in the dry late winter months. Fewer birds were caught in April and May (Table 1), partly because of much reduced ringing effort in these months (and in December) but also because there was much seed and water available elsewhere in the latter part of the wet season and early in the dry season.

The mean wing length of Scalyfeathered Finches (n = 266) was 56.9 mm (±1.61) with a range of 51–60 mm. Mean weight (n = 224) was 11.5 g (±0.89, range 8.5–14.9 g).

Most Scalyfeathered Finches were unfortunately aged only as full grown so timing of adult and post-juvenile moult cannot be adequately assessed. Moult of the primary feathers was recorded in every month except March and April (and May when no birds were caught). Strangely, few were caught in the last stages of primary moult. Data from 25 retrapped birds suggested that moult in Scalyfeathered Finches is rather slow. It took four to seven days for the moult score to increase by one, giving duration of primary moult as *c.* 200–350 days, assuming that moult progresses in a linear fashion. In some birds, primary feathers were a mix of completely new feathers and old unmoulted feathers, typical of suspended or interrupted moult. Suspended moult might explain the incidences where moult was extremely slow. For example, in one bird the moult score only

Table 1. Numbers of Scalyfeathered Finches ringed in each month with numbers and percentages in moult and categories of moult scores.

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
No. ringed		24	15	16	3	0	33	43	38	45	26	29	11
In moult:	**no.**	11	12	2	0		19	21	30	19	16	21	10
	%	46%	80%	12.5%	0%		58%	49%	79%	42%	61.5%	72%	91%
Moult score:	**1–10**	4	5	1			2	5	4	7	1	3	3
	11–20	3	4	1			7	7	9	3	7	10	3
	21–30	2	3				4	5	9	5	3	2	3
	31–40	2	0				2	1	5	3	5	4	1
	41–49	0	0					3	3	1	0	2	0

increased by four over 45 days.

Whilst moult usually proceeded in the normal way, starting from the innermost primary and continuing outward in sequence (sequential moult), a proportion of birds showed irregular or eccentric moult (Table 2; see Jeni & Winkler 1994). Of 111 birds caught up to April 1999 some 21.6% showed irregular moult. In typical irregular moult, feathers were dropped in two places on the wing. Others were more irregular, perhaps even 'chaotic' (Herremans 2001), with old feathers occurring in three places on the wing. Irregular moult occurred in birds caught between June and February. Although few birds with such moult were accurately aged, the bird with ring AF53050 caught on 8 February 2000 was known to be at least eight months old as it had been first ringed on 18 June 1999.

In those few birds where moult of the secondary flight feathers was noted, it proceeded either in the normal sequence (the outermost feather being dropped first and moult continuing inwards towards the tertial feathers) or in an irregular way. At least eight birds (of 10) moulted their secondary flight feathers in this atypical fashion.

Other seed-eaters mostly showed sequential moult but five adult Greenwinged Pytilias *Pytilia melba* caught in the summer of 1996/97 and seven caught in April 1998 showed

Table 2. Scalyfeathered Finches showing irregular moult or interrupted moult.

Ring	Date	Secondaries						Primaries									
		6	5	4	3	2	1	1	2	3	4	5	6	7	8	9	10
Black/Yellow, R	18/7/1996							0	0	4	3	0	0	0	0	0	0
Purple L	18/7/1996							5	5	0	0	5	5	0	0	0	0
Black/green, L	27/6/1996							1	0	5	5	0	0	0	0	0	0
Light blue, L	5/8/1996	5	5	0	0	0	5	5	4	1	5	5	5	4	0	0	0
Light blue, R	29/1/1997							5	5	0	0	5	0	0	0	0	0
W19248	29/1/1997	0	5	5	0	0	4	5	0	0	0	0	0	0	0	0	0
AE44104	3/2/1997	0	5	5	5	0	0	5	5	1	0	0	0	0	0	0	0
AE44111	3/2/1997	5	5	0	5	0	5	3	0	0	0	0	0	0	0	0	0
Dark blue, L & R	3/2/1997	5	5	5	3	5	0	0	0	0	0	4	0	0	0	0	0
AE44120	3/2/1997	5	0	0	0	0	0	0	0	5	5	4	0	0	0	0	0
AE44121	3/2/1997							0	2	5	0	1	0	5	0	0	0
AE44125	3/2/1997							5	0	5	5	0	0	0	0	0	0
AE44983	2/11/1997	0	0	0	5	1	1	5	5	5	5	5	5	1	0	0	3
Red R	12/1/1998							3	3	5	5	5	5	5	5	0	0
Black/yellow, L	12/1/1998							0	0	0	0	1	5	5	0	0	0
AE81618	03/9/1998							0	5	5	0	0	0	0	0	0	0
AE81963	28/10/1998							4	0	0	5	5	0	0	0	0	0
AE81964	28/10/1998							5	0	0	5	5	2	0	0	0	0
Pink L	1/11/1998							5	5	3	0	5	3	0	0	0	0
Pink R	1/11/1998							5	5	0	2	5	5	5	5	5	5
Pink, L & R	1/11/1998							0	0	0	5	5	5	0	0	0	0
Yellow/dark blue, R	22/11/1998	5	5	5	5	5	5	0	5	0	0	5	0	0	0	0	0
AF34259	22/11/1998							0	5	0	5	5	0	0	5	0	0
AE34277	10/2/1999	5	5	0	5	5	5	3	0	0	0	0	0	0	0	0	0
AF34018	21/2/1999	5	0	3	0	5	5	5	5	5	5	5	5	5	5	5	5
AF53050	8/2/2000							5	0	0	5	0	0	0	2	0	0
AF63235	19/1/2000							5	5	5	3	5	0	0	0	0	0

L = left, R = right wings

irregular moult (Table 3) and some showed suspended moult. Two caught subsequently also showed irregular moult. Irregular moult was recorded occasionally in Blackthroated Canaries *Serinus atrogularis* caught in February and March.

Discussion

The exact duration of moult in Scalyfeathered Finches was uncertain, but was apparently at least 200 days or more, much longer than in most passerines. It is the rate that feathers are shed rather than the growth rate of individual feathers that influences the duration of moult (Newton 1967). Ideally for all birds caught, details should have been taken of whether each bird had old feathers, new feathers or was in active moult. Underhill & Zucchini (1998) provided a model of avian moult but this depends on the moult score in each bird increasing linearly with time. Not all passerines undergo a linear moult. For example, Rothery *et al.* (2001) found that in the European Starling *Sturnus vulgaris*, moult score showed a non-linear increase, with a lower rate of increase in the later stages of moult. It is not known whether this is the case for Scalyfeathered Finches. The lack of a defined moulting season in the Scalyfeathered Finch may indicate year round breeding.

Suspended moult was frequent in Scalyfeathered Finches and Herremans (1995) also found such moult to be frequent in Green-winged Pytilias in the dry season in SE Botswana. Suspended moult was also noted in Lark-like Buntings *Emberiza impetuani* in August and September (late dry season) and in a few Blackcheeked and Violeteared Waxbill *Uraeginthus granatinus* in April and May (this study). Reasons for such a moult pattern are varied. Some migrants may show arrested moult, beginning to moult in breeding quarters and continuing when they arrive in their non-breeding quarters, e.g. Tawny Pipit *Anthus campestris* (*A. novaeseelandiae* in Craig 1983). Other birds may show arrested moult if food resources are scarce. Apparent suspended or interrupted moult could conceivably be mistaken for a slow rate of shedding feathers. In some species feathers are shed rapidly, with two or more growing at the same time. In others feathers are shed more slowly and only one primary feather may be growing at any one time.

Eccentric moult (Jeni & Winkler 1994) appears to be rare in passerines but Herremans (1994, 1995) found such moult in some juvenile Blackcheeked Waxbills *Estrilda*

Table 3. Irregular and suspended moult in Green-winged Pytilia (Melba Finch) *Pytilia melba*.

Ring number of *Pytilia*		Date	Primary flight feathers									
			1	2	3	4	5	6	7	8	9	10
AE44182	Adult female	24/01/1997	5	5	5	0	5	4	1	0	0	0
W18201	Adult male	24/01/1997	0	0	0	0	0	0	5	0	0	0
AE44191	Adult female	24/01/1997	0	0	0	5	5	5	5	0	0	0
AE44016	Adult female	03/02/1997	4	0	0	0	5	5	5	4	0	0
AE44024	Adult male	03/02/1997	5	0	4	0	0	5	0	0	0	0
AF17056	Adult male, right	13/04/1998	5	5	5	5	5	0	0	0	5	0
AF17056	Adult male, left	13/04/1998	5	5	5	5	5	0	0	0	0	5
AE44415	Adult male	13/04/1998	0	0	0	5	0	0	0	0	0	0
AF17055	Adult male	13/04/1998	0	5	0	5	0	0	0	0	0	0
AE81391	Imm. female	18/04/1998	0	0	0	5	0	0	0	0	0	0
AF17094	Adult female	18/04/1998	0	0	0	5	5	5	0	0	0	0
AF17092	Adult male	18/04/1998	5	5	5	5	4	0	5	0	0	0
AF71368	Adult female	01/03/1999	0	0	0	0	0	5	5	0	0	0
AE44576	Adult female	09/01/1999	5	5	5	5	2	5	2	0	0	0

erythronotos in southeast Botswana. In such eccentric moult the longest primary feathers were replaced in descendant sequence but the innermost two to four feathers were retained. Waxbills (Estrildae) undergo a complete moult in the dry season in southern Africa (Craig 1983). Herremans (1995) noted that adult waxbills underwent a relatively fast complete moult in the usual sequence in the first part of the dry season whereas juveniles underwent a partial post-juvenile moult early or late in the dry season.

Eccentric moult in Blackcheeked Waxbills was not noted at Ruretse, but was common in Scalyfeathered Finches. These birds live in very dry habitats where rain and food resources are unpredictable and patchy and young birds also undergo a complete moult. It is of interest that Doublebarred Finches *Taeniopygia bichenovii* in arid areas of northern Australia similarly show eccentric moult which can occur at any time of the year (Pete Collins per. comm.). Not all Scalyfeathered Finches at Ruretse were aged but many of the birds showing eccentric or more irregular moult were immature birds. From Herremans' work (1994, 1995) it seems likely that those Scalyfeathered Finches showing irregular moult and apparently moulting through much of the year were young birds undergoing partial moults. However, in Greenwinged Pytilias it was adults rather than immature birds that showed irregular moult (Table 3). Other seed-eating passerine species at Ruretse generally showed normal moult patterns and had a more defined moult season.

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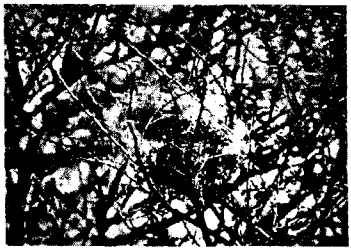

Scalyfeathered Finch and nest of Scalyfeathered Finch.