

Further Evidence for Additional Pre-nuptial Moul in Melodious Warblers (*Hippolais polyglotta*)

By Gabriel Gargallo

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New data suggest that after the complete pre-nuptial moult most Melodious Warblers *Hippolais polyglotta* undergo an additional partial moult. It is stated that it usually includes the replacement of some flight feathers, mainly tertials, and innermost greater coverts. The incidence of this additional moult seems to be related to the timing of the complete pre-nuptial moult.

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Address: GCA, Museu de Zoologia, Apt. 593 08080, Barcelona (Spain).

1. Introduction

Both adult and first year Melodious Warblers (*Hippolais polyglotta*) undergo a complete pre-nuptial moult in West Africa (Cramp 1992, Jenni & Winkler 1994). Birds moult soon after arrival in the winter quarters. Moult proceeds rapidly and is completed from October, usually by November (Aidley & Wilkinson 1987, Bensch *et al.* 1991, Cramp 1992). Moreover, present knowledge suggests that some adults undertake an additional partial moult in late winter (Cramp 1992, Svensson 1992). This moult being confined to body feathers (no tertials included; Cramp 1992).

The present paper brings forward new evidence suggesting that the additional pre-nuptial moult in Melodious Warblers is more widespread than previously reported and that it usually includes the replacement of some tertials and innermost greater coverts.

2. Methods

Melodious Warblers were studied in several localities from Catalonia and the Balearic Islands in the springs of 1991–1993, and during the course of a ringing campaign in Kerbacha (35°05'N–02°19'W), Saidia, Oujda, Morocco in the period 16th April–15th May 1994. In total 136 birds were inspected for moult; only flight feathers (remiges and rectrices) and major wing coverts (all except median and marginal coverts) were checked. The innermost tenth greater covert was not considered. In 122 birds the moult of remiges was studied in both wings; in the others 14 only the left wing was inspected. The pattern of the winter moult was deduced from the degree of wear of the different feathers. For each bird third primary length (Berthold & Friedrich 1979), fat score (Kaiser 1993) and body mass were recorded. Primaries were numbered descendantly, secondaries (including tertials) and greater coverts ascendantly. Rectrices were numbered centrifugally.

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3. Results

No signs of suppressed complete pre-nuptial moult were found among these birds checked. However, 120 (88.2%) out of 136 birds (only the left side considered) had some feathers distinctively fresher than the rest and therefore replaced subsequently to the complete moult. The two innermost tertials and the innermost greater covert were the most frequently moulted feathers (Figure 1). Secondaries and rectrices were rarely replaced. Moult of primaries was exceptional (Figure 1 & Table 1). Primary coverts, carpal covert and the alula feathers were never moulted (Table 1). Among those birds moulting some flight feathers (n=108), moult was symmetric in 61 cases (56.5%); in 68 (63%) considering only the remiges.

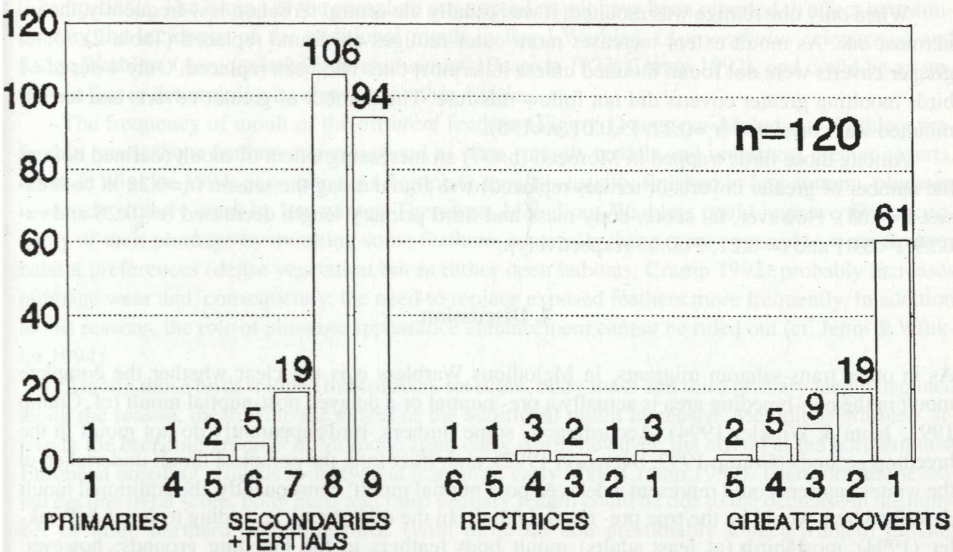


Figure 1: Frequency of moult of the different flight feathers and greater coverts during the additional pre-nuptial moult among those birds which moulted some.

Table 1: Frequency of moult, median values and minimum-maximum number of feathers replaced in the different feather tracts (n=136, left wing/tail). (PP= primaries, SS= secondaries, TT= tertials, RR= rectrices, GC= greater coverts, PC= primary coverts, CC= carpal covert, AL= alula).

	PP	SS	TT	RR	GC	PC	CC	AL
F	1 0.7%	5 3.7%	117 86.0%	7 5.1%	61 44.9%	0	0	0
Median	0	0	2	0	0			
min.-max.	0-1	0-3	0-3	0-4	0-4			

Table 2: Frequency of replacement of the different tertials and secondaries according to the overall number of remiges replaced.

Secondaries		Tertials		8	9	n	No. of remiges replaced
4	5	6	7				
0	0	0	0	0	0	0	6
1	1	1	0	1	1	1	5
0	0	2	2	2	2	2	4
0	1	2	16	18	17	18	3
0	0	0	1	64	63	64	2
0	0	0	0	21	11	32	1

When only one remige was moulted, it was usually the central tertial or, less frequently, the innermost one. As moult extent increases more outer remiges are found replaced (Table 2). Outer greater coverts were not found moulted unless innermost ones had been replaced. Only 4 out of 61 birds moulting greater coverts did not follow this rule. The number of greater coverts and tertials moulted was correlated ($r_s=0.27$, $P<0.01$, $n=136$).

Among those birds trapped in Morocco ($n=97$) an increasing extent of moult (defined both as the number of greater coverts or tertials replaced) was found along the season ($r_s=0.23$ in both cases, $P<0.05$). However, fat score, body mass and third primary length decreased ($r=-0.28$ and $r=-0.29$, $P<0.01$ and $r=-0.21$, $P<0.05$ respectively).

4. Discussion

As in other trans-saharan migrants, in Melodious Warblers it is not clear whether the complete moult in the non-breeding area is actually a pre-nuptial or a delayed post-nuptial moult (cf. Cramp 1992, Jenni & Winkler 1994). According to some authors, birds apparently do not moult in the breeding grounds (Cramp 1992, Svensson 1992), and, therefore, the complete moult undertaken in the winter quarters could represent a delayed post-nuptial moult; consequently, the additional moult described here would be the true pre-nuptial moult. In the other hand, according to Jenni & Winkler (1994), most birds (at least adults) moult body feathers in the breeding grounds; however, remains unknown whether these feathers are renewed again in winter or their replacement forms part of a suspended post-nuptial moult process completed in the winter quarters. Therefore, since present knowledge on this subject is very vague, as a matter of convention, the complete winter moult have been treated as a pre-nuptial moult here.

According to present data most Melodious Warblers undertake an additional pre-nuptial moult in late winter. This high incidence indicates that it is undertaken both by adult and first winter birds. Present knowledge suggests that, among those species moulting completely in winter, only some also undertake an additional partial pre-nuptial moult (e.g. House Martin (*Delichon urbica*), Sand Martin (*Riparia riparia*), Savi's Warbler (*Locustella luscinioides*), and some Acrocephalus Warblers (*Acrocephalus* sp.), Jenni & Winkler 1994). In these species the replacement of flight feathers is reported to be rare (Jenni & Winkler 1994). Apparently Melodious Warblers are peculiar in this fact. However, further study in both these species and in others in which this additional moult has not been previously reported (e.g. Olivaceous Warbler (*Hippolais pallida*) and Bonelli's Warbler (*Phylloscopus bonelli*), *pers. obs.* and see below) will show it is more common than previously thought.

In *Hippolais* Warblers (*Hippolais* sp.) the incidence of such additional moult seems to be related to the timing of the complete pre-nuptial moult. It is absent in Icterine Warbler (*Hippolais icterina*) and Olive-tree Warbler (*Hippolais olivetorum*) which undergo the complete pre-nuptial moult about three month later than Melodious Warbler, and in Upcher's Warbler (*Hippolais languida*) which finish the complete pre-nuptial moult from January (Cramp 1992, Jenni & Winkler 1994). In Olivaceous Warblers, at least in subspecies *opaca*, some birds moult some flight feathers, usually the central tertial, and greater coverts after the complete pre-nuptial moult (*pers. obs.*); moult, however, is less frequent than in Melodious Warbler (additional moult was found in 7 out of 15 birds checked). Present knowledge suggests that in this species the complete pre-nuptial moult takes place later than in Melodious Warbler. In West Africa there are records of completed moult from late autumn but usually by January; in East Africa there are records of birds in active complete moult until March (Williamson 1968, Aidley & Wilkinson 1987, Bensch *et al.* 1991, Cramp 1992). As in Melodious Warblers, in Booted Warblers (*Hippolais caligata*) the complete pre-nuptial moult starts immediately upon arrival in the winter quarters (Gaston 1976). Afterwards, probably after subsequent migration further south, some birds apparently undertake an additional body moult

(Cramp 1992). The timing of the complete pre-nuptial moult have been reported to affect in a similar way the incidence of the additional moult in Reed Warblers (*Acrocephalus scirpaceus*) and Sedge Warblers (*Acrocephalus schoenobaenus*) (Pearson 1973, Cramp 1992), and could be an important factor determining its absence in other species.

The frequency of moult of the different feathers (Figure 1) suggests Melodious Warblers preferably moult those feathers more exposed to wear (mainly tertials and innermost greater coverts, Jenni & Winkler 1994, *pers. obs.*). As complete moult is usually finished in late autumn, plumage is already slightly worn by late winter. Therefore, Melodious Warblers could improve the functionality of their plumage by moulting some feathers, especially those more exposed to wear. Species habitat preferences (dense vegetation but in rather open habitats, Cramp 1992) probably increases plumage wear and, consequently, the need to replace exposed feathers more frequently. In addition to this reason, the role of plumage appearance enhancement cannot be ruled out (cf. Jenni & Winkler 1994).

Among those birds trapped in Morocco, fat score, body mass and third primary length declined along the season, meanwhile the extent of the additional moult increased. Melodious Warblers arrive in the breeding grounds in Morocco from early April, however, the arrival at the northernmost European breeding grounds is delayed at least until early May (Cramp 1992). Therefore, the seasonal decline in fat score, body mass and third primary length could be due to the decrease in the number of more northern migrating birds (with more fat and presumably longer winged) passing through the ringing site. The parallel increase in the extent of the additional moult would suggest that birds from more northern breeding grounds could undertake a less extensive additional pre-nuptial moult. However, the impossibility of separating sex and age classes and in consequence their related differences in migratory behaviour, prevent a more enlightened analysis.

5. Zusammenfassung

Neue Untersuchungsergebnisse zeigen, daß *Hippolais polyglotta* nach der Winter-Vollmauser vor der Brutperiode noch eine Teilmauser durchläuft, bei der auch regelmäßig einige Armschwingen und Flügeldecken vermausert werden. Verschiedene Aspekte dieser Mauser werden diskutiert.

6. References

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Autor(en)/Author(s): Gargallo Gabriel

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