Postnuptial and Postjuvenal Molts of Red-winged Blackbirds in Cass County, North Dakota

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Red-winged Blackbirds (*Agelaius phoeniceus*) form roosting and feeding aggregations (flocks) in late summer and autumn. Recent investigations of the flocks have centered on behavior and management (Martin 1977, Weatherhead and Bider 1979, Stone and Danner 1980). Postnuptial (prebasic) and postjuvenal (first prebasic) molts of Red-wings coincide with flocking and, at their peak, have a marked effect on the birds' behavior (Allen 1914, Smith and Bird 1969, Meanley and Bond 1970).

Quantitative information on the phenology of Red-wing molt is sparse. Dunson (1965) and Payne (1969) studied the timimg of molt in two nonmigratory, southern populations. Meanley and Bond (1970) estimated the duration of Red-wing molt in the Patuxent, Maryland area.

We studied the molt (molt refers to the entire process of losing feathers and replacing them) progress of five age-sex classes in a migratory population of Red-winged Blackbirds in southwestern Cass County, North Dakota (46°08′N, 97°04′W). Our objectives were: (1) to assess differences in the phenology of molt by age and sex, and (2) to determine the seasonal relations of nesting, molt, and migration.

Southwestern Cass County is on the edge of the Drift Prairie physiographic region (Klausing 1968). Numerous wetlands, scattered throughout this agricultural area, provide daytime resting sites and night roosts for blackbirds (Icteridae) and Starlings (*Sturnus vulgaris*, Sturnidae). The principal roost in our study area is located in the U.S. Fish and Wildlife Service Waterfowl Production Area at Alice, which includes a cattail (*Typhus* spp.) marsh. Paul Lago (MS) estimated that at peak density in 1972 (mid-October) there were 292,000 birds roosting in the marsh. Density varies from week to week during each season and probably from year to year. We collected 3,795 Red-wings from the study area by shooting from June through October 1980. They were sexed, aged by plumage characteristics and presence or absence of the bursa of Fabricius (Wright and Wright 1944, Payne 1969), and assessed for stage of molt.

Plumages of Red-wings have been described by Dwight (1900), Selander and Giller (1960), and Meanley and Bond (1970). All remiges are normally replaced during the postnuptial and postjuvenal molts. Primaries are replaced in sequence from 1 (innermost) through 9; the outer secondaries (1–6) are normally molted from outermost (1) to innermost (6).

The birds were divided into five age-sex classes. Standard banding terminology is followed for age designations. After hatching-year (AHY) females breed during their first full breeding season. Their age cannot be easily determined after their hatching year (HY). Second-year (SY) males have lived for 1 yr and generally do not breed. They can be reliably distinguished from the breeding after-second-year (ASY) males, which have lived at least 2 yr, by plumage characteristics until molt is 60% complete (first week of August). Hatching year males and females are young-of-the-year birds.

Each primary and secondary feather of the right wing was assigned a numerical value using a five-point scoring system similar to that of Evans (1966), Newton (1966), and Sealy (1979). A 0 was assigned an old feather, 1 a missing or small pin feather, 2 a feather up to ⅓ grown, 3 up to ⅔ grown, 4 up to ¾ grown, and 5 a nearly complete or complete feather. Our emphasis is on the phenology of primary molt, which is considered a good indicator of overall molt progress (Evans 1966, Newton 1966). The secondaries molted irregularly in some individuals and thus were not ideal for statistical analysis.

The functional relationship of the increase in primary scores (dependent variable, Y) with time (independent variable, X) is assumed to be linear ($Y = a + bX$). The increase in primary scores with time (slope, b) and Y-intercept (a) were determined by means of regression analysis (Evans 1966, Newton 1966, Payne 1969). Regression values were used to estimate the beginning and end of molt for four age-sex classes: AHY males (SY and ASY males combined), AHY females, and HY males and females. Potential bias in the regression estimates due to nonlinearity (Evans 1966, Newton 1966) was reduced by only including data collected while 95% of the birds were molting. This occurred from 29 July through 23 September for AHY birds and from 26 August through 7 October for HY birds. Duncan's multiple range test was used to determine whether or not the means of the primary scores were significantly different.

The population of SY males began molt earlier and were more synchronized than the ASY males and AHY females (Table 1). By the last week of July, SY males had significantly higher primary scores ($n = 34$, $\bar{x} = 12.6$, SE = 1.25, $P < 0.05$) than the ASY males ($n = 61$, $\bar{x} = 8.2$, SE = 0.61) or AHY females ($n = 133$, $\bar{x} = 8.6$, SE = 0.51); the difference was equivalent to one remige. The interval between the first AHY Red-wing observed molting and the first with completed flight feather replacement was 77 days (Table 1). The average molt start and completion dates calculated by linear regression analyses approximate the observed molt schedules for each AHY age-sex class (Tables 1, 2).

Samples of HY birds were difficult to obtain until

TABLE 1. Molt schedules of four age-sex classes of Red-winged Blackbirds in Cass County, North Dakota.

Age	Sex	*n*[a]	Date molting first observed	Date last bird observed not molting	Date first bird observed with completed molt
SY	M	78	8 July	24 July	23 September[b]
ASY	M	1,648	15 July	13 August	23 September[b]
AHY	F	713	16 July	21 August	23 September
HY	M+F	457	15 July	26 August	2 October

[a] The number collected from the onset of molt through the date the first bird in each age-sex had completed molt.
[b] Second-year and after-second-year males could not be distinguished reliably after the first week of August.

they achieved independence and began feeding in the uplands (early August). Postjuvenal molt had begun in 60% of the birds at that time (Fig. 1). No statistical differences were found between HY males and females; therefore, the sexes were combined in further analyses. The onset of postjuvenal molt was asynchronous, spanning a period of 6 weeks (Table 1). The interval between the first HY bird collected while molting and the first with completed flight feather replacement was 79 days. As a population, HY birds began molt in mid-July and completed molt in mid-October (Table 2).

Red-winged Blackbird males are polygynous, generally do not breed until their third summer, and have a reduced parental role compared to the females (Bent 1958, Orians 1961). Red-wings do not molt until they have completed nesting activities (Wright and Wright 1944, Payne 1969), a trend documented for many north-temperate passerines (Niles 1972, Verbeek 1973, Middleton 1977, Mewaldt and King 1978), including other icterids (Selander 1958, Sealy 1979).

We found that, as a population, the relative timing of molt among the AHY age-sex classes was related to the degree of participation each group had in the nesting activities. Second-year males (generally nonbreeding) began to molt first. Breeding males tend to leave their territories before the females have completed nesting and also begin molt earlier than the females.

Dunson (1965) and Payne (1969) reported that breeding male and female Red-wings begin to molt concurrently. We found that individual ASY males and AHY females began to molt at approximately the same time. For the period 29 July through 18 August, however, a larger percentage of the males were molting than females (Fig. 1). The percentage of nonmolting AHY females remained essentially the same from 22 July through 18 August. This 10–15% may represent (1) renesting birds (Dolbeer 1976), (2) later nesting SY females (Crawford 1977), and (3) those birds that double brooded (Case and Hewitt 1963, Dolbeer 1978).

The relative timing of molt of sexes in other species also appears to depend upon whether the female, male, or both sexes raise the young until they are independent. Male Great-tailed Grackles (*Quiscalus mexicanus*), which do not care for the young, molt 2 weeks before the females (Selander 1958). By comparison, male Northern Orioles (*Icterus galbula*) feed the brood several days longer than do the females and begin molt slightly later (Sealy 1979). Evans (1966) reported that both sexes of the Lesser Redpoll (*Carduelis flammea carbaret*) care for the young and begin to molt simultaneously.

Wright and Wright (1944) collected 11 SY males in Wisconsin and found no differences in the timing of molt among SY and ASY males. Other studies suggest that in species in which the SY males do not breed, the onset of their molt is earlier than in the breeding males: Great-tailed Grackles (Selander 1958), Steller's Jay (*Cyanocitta stelleri*) (Pitelka 1958), and Northern Orioles (Sealy 1979). In our population, the phenology of molt among SY males differs from that of the ASY males. The difference suggests that the males may remain as two distinct groups after the nesting season and perhaps until after migration.

TABLE 2. The phenology of molt of Red-winged Blackbirds in Cass County, North Dakota, as determined by regression analysis.

Sex	Age	*n*	Rate of molt	Mean start date	Mean completion date	Duration of molt (days)
Male	AHY[a]	1,034	0.58	13 July	29 September	78 ± 1
Female	AHY	661	0.69	22 July	25 September	65 ± 1
Both sexes	HY	443	0.47	12 July	15 October	96 ± 1

[a] Second-year and after-second-year males could not be distinguished reliably after the first week of August and were combined for the regression analysis.

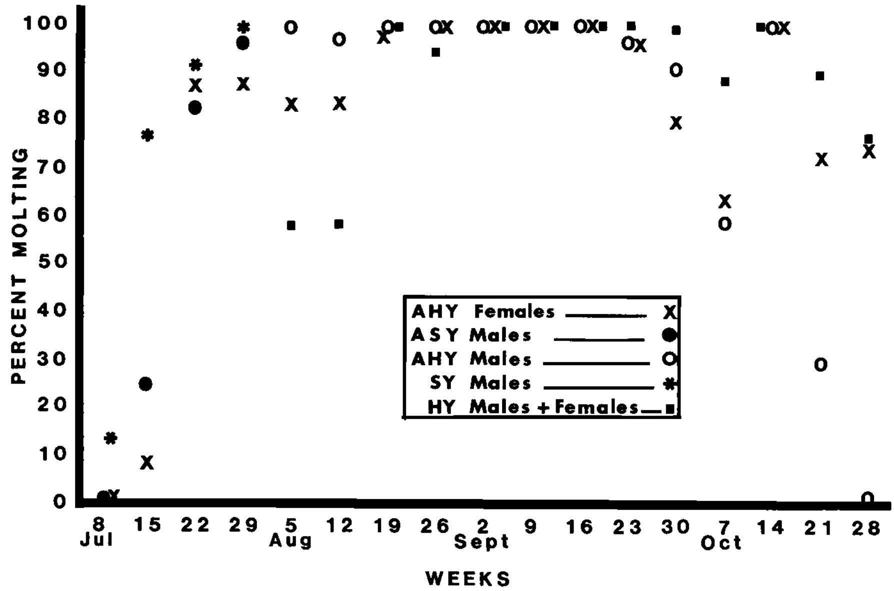

Fig. 1. The percentage of Red-winged Blackbirds molting from July through October 1980 in southwestern Cass County, North Dakota.

The onset of postjuvenal molt, in the Alice population, spanned a period that was 2 weeks longer than the period indicated by Dunson (1965) and Payne (1969). This suggests that the nesting season was more synchronized in their populations. Variability in the start of postjuvenal molt probably reflects differences in level of maturity (Selander 1958, Dunson 1965).

According to Dolbeer (1978), Red-wings normally remain within 200 km of their breeding area until molt is complete. On the other hand, Dolbeer's analysis of banding returns indicates that birds nesting north of our study area, in western Canada, may migrate during August and September. Molt would not be complete during the earlier part of this period. Meanley and Bond (1970) suggested that Red-wings replace their flight feathers within 8 weeks and primaries 8 and 9 must be at least ⅔ grown (score of 41) before they will migrate. In Payne's (1969) nonmigratory population in California, individual molt duration, as determined by regression analysis, was 9 weeks. Dolnik and Gavrilov (1980) suggest that birds may molt faster at more northerly latitudes.

We assume, therefore, that individual Red-wings in southwestern Cass County complete molt in at least 9 weeks. Thus, the first AHY males should have completed molt by 9 September, the first HY birds by 15 September, and the first AHY females by 16 September. We did not collect AHY Red-wings with a complete winter plumage, however, until the week of 23 September nor HY birds with a complete winter plumage until 1 week later (Table 1). For any 1-week interval in September and October, the actual percentage of Red-wings with a complete winter plumage was much lower than would be predicted from starting dates (Fig. 1). For example, because 87% of the AHY females were molting during the week of 29 July (Fig. 1), we would expect that 9 weeks later (week of 23 September) approximately 87% of the AHY females would have completed molt. Our data indicate that only 9% of the AHY females had completed molt by the week of 23 September. We obtained similar results for HY birds and AHY males (the percentage of SY and ASY molting males must be combined through the week of 29 July). This suggests that many Red-wings leave southwestern Cass County upon completion of molt or just before the completion of molt and that birds less advanced in molt arrive from the north during the same period. Red-wing numbers increased in our study area through September, but we have no evidence, other than molt-progress analysis, to indicate that birds migrate from the area at this time. On the basis of the molt-progress analysis, however, we believe that most of the local Red-wings have migrated by late September and that birds in southwestern Cass County during October are transients.

In summary, we found that age-sex differences in Red-wing molt phenology exist between SY males, ASY males, AHY females, and HY birds. Variation in the start of molt between and within each of the AHY classes is probably related to the duration of nesting activities. We speculate that many of the resident Red-wings roosting in our study area complete molt and migrate before the northern birds.

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Literature Cited

Allen, A. A. 1914. The Red-winged Blackbird: a study in the ecology of a cat-tail marsh. Abstract, Proc. Linnaean Soc. New York 24–25: 43–128.

Bent, A. C. 1958. Life histories of North American blackbirds, orioles tanagers, and allies. U.S. Natl. Mus. Bull. 211: 123–149.

Case, N. A., & O. H. Hewitt. 1963. Nesting and productivity of the Red-winged Blackbird in relation to habitat. Living Bird 2: 7–20.

Crawford, R. D. 1977. Breeding biology of year-old and older female Red-winged and Yellow-headed blackbirds. Wilson Bull. 89: 73–80.

Dolbeer, R. A. 1976. Reproductive rate and temporal spacing of nesting of Red-winged Blackbirds in upland habitat. Auk 93: 343–355.

———. 1978. Movement and migration patterns of Red-winged Blackbirds: a continental overview. Bird-Banding 49: 17–34.

Dolnik, V. R., & V. M. Gavrilov. 1980. Photoperiod control of the molt cycle in the Chaffinch (*Fringilla coelebs*). Auk 97: 50–62.

Dunson, W. A. 1965. Physiological aspects of the onset of molt in the Red-winged Blackbird. Condor 67: 265–269.

Dwight, J. 1900. The sequence of plumages and moults of the passerine birds of New York. Ann. New York Acad. Sci. 13: 73–360.

Evans, P. R. 1966. Autumn movements, moult and measurements of the Lesser Redpoll, *Carduelis flammea carbaret*. Ibis 108: 183–216.

Klausing, R. L. 1968. Geology and ground water resources of Cass County, North Dakota. North Dakota Water Comm. Bull. No. 47.

Martin, M. L. 1977. Flocking and roosting activities of the Red-winged Blackbird in southern Quebec. Unpublished M.S. thesis. Montreal, Quebec, McGill Univ.

Meanley, B., & G. M. Bond. 1970. Molts and plumages of the Red-winged Blackbird with particular reference to fall migration. Bird-Banding 41: 22–27.

Mewaldt, L. R., & J. R. King. 1978. Latitudinal variation of postnuptial molt in White-crowned Sparrows of the Pacific Coast. Auk 95: 168–174.

Middleton, A. L. A. 1977. The molt of the American Goldfinch. Condor 79: 440–444.

Newton, I. 1966. The molt of the Bullfinch *Pyrrhula pyrrhula*. Ibis 108: 41–67.

Niles, D. M. 1972. Molt cycles of Purple Martins (*Progne subis*). Condor 74: 61–71.

Orians, G. H. 1961. The ecology of blackbird (*Agelaius*) social systems. Ecol. Monogr. 31: 285–312.

Payne, R. B. 1969. Breeding seasons and reproductive physiology of Tricolored Blackbirds and Red-winged Blackbirds. Univ. California Publ. Zool. 90.

Pitelka, F. A. 1958. Timing of molt in Steller's Jays of the Queen Charlotte Islands, British Columbia. Condor 60: 38–49.

Sealy, S. G. 1979. Prebasic molt of the Northern Oriole. Can. J. Zool. 57: 1473–1478.

Selander, R. K. 1958. Age determination and molt in the Boat-tailed Grackle. Condor 60: 355–376.

———, & D. R. Giller. 1960. First-year plumages of the Brown-headed Cowbird and Red-winged Blackbird. Condor 62: 202–214.

Smith, L. B., & R. D. Bird. 1969. Autumn flocking habits of the Red-winged Blackbird in southern Manitoba. Can. Field-Natur. 83: 40–47.

Stone, C. P., & C. R. Danner. 1980. Autumn flocking of Red-winged Blackbirds in relation to agricultural variables. Amer. Midl. Natur. 103: 196–199.

Verbeek, N. A. M. 1973. Pterytosis and timing of molt of the Water Pipit. Condor 75: 287–292.

Weatherhead, P. J., & J. R. Bider. 1979. Management options for blackbird problems in agriculture. Phytoprotection. 60: 145–155.

Wright, P. L., & M. H. Wright. 1944. The reproductive cycle of the male Red-winged Blackbird. Condor. 46: 46–59.

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