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Variable first prebasic primary molt in Rio Grande and Merriam's Wild Turkeys.— Gallinaceous birds typically retain the juvenal ninth (JIX) and tenth (JX) primary wing feathers during the first prebasic molt (Petrides 1945, terminology follows Humphrey and Parkes 1959). However, not all Wild Turkeys (*Meleagris gallopavo*) retain JIX and JX during this molt. Some retain only JX (reviewed by Lewis 1967), and in 21% of 125 Florida Wild Turkeys (*M. g. osceola*), all 10 juvenal primaries were molted (Williams and Austin 1970, 1988). Leopold (1943) suggested that Wild Turkeys were genetically predisposed to retain both JIX and JX, whereas domestic turkeys retained only JX. He further suggested that the frequency of this extended primary molt indicated the degree of cross-breeding between wild and domestic turkeys. Stable frequencies could be maintained if this molting characteristic had neutral selective value. Alternatively, Williams and Austin (1988) hypothesized that the first prebasic molt among wild birds varied in a genetically controlled manner along a north-south gradient related to climate. They predicted that more northerly populations would exhibit progressively higher frequencies of retention of both JIX and JX.

We examined patterns of first prebasic molt among winter-caught yearling (referred to as juveniles by some authors) Rio Grande (*M. g. intermedia*) and Merriam's (*M. g. merriami*) Wild Turkeys. Here we report our findings and discuss their relevance to the two stated hypotheses. Previous studies of first prebasic molt in Wild Turkeys primarily examined the Eastern (*M. g. silvestris*) and Florida subspecies.

Study area and methods.—Rio Grande Wild Turkeys were studied along the South Platte River in northeastern Colorado in 1986–1987 (Schmutz and Braun 1989). Merriam's Wild Turkeys were studied in southcentral Colorado west of Trinidad in 1986 and 1988–1989 (Hoffman 1990).

Turkeys were captured in January and February with drop-nets, cannon nets, and Clover single-gate deer traps. Captured birds were weighed to the nearest 500 g with spring scales. Numbers of juvenal primaries retained (identified by their greater wear and pointedness) were counted. Turkeys were classified as yearlings if JIX and/or JX were present, otherwise they were classified as adults. We assumed that molting of both JIX and JX by yearlings was rare or nonexistent, as it had never been reported outside of Florida. Primary length was measured from the rim of the follicle to the distal tip of the feather by placing a ruler behind the feather to be measured. The base of the ruler rested on the skin between the primaries and the feather was flattened against the ruler to remove its normal curvature. An index (GROW8) of the growth of the eighth basic primary (BPVIII) was computed as:

$$\text{GROW8} = (\text{LBPVII} - \text{LBPVIII})/\text{LBPVII} \times 100$$

where LBPVII and LBPVIII are the lengths of BPVII and BPVIII, respectively.

Wings were collected from males of both subspecies during the 1986–1988 spring hunting seasons. The four-week season began on the third Saturday in April. Age, number of juvenal primaries retained, and primary lengths were obtained when feather wear from courtship displays was minimal. Unless otherwise stated, all data and results pertain to yearlings.

Results.—Nineteen of 55 (35%) captured Rio Grande females and three of 17 (18%) captured Rio Grande males had molted JIX. Seven of 31 (23%) Rio Grande males shot during the spring hunting season had molted JIX. One of 27 (4%) female and none of 17 male Merriam's Wild Turkeys captured had molted JIX. Fifteen of 164 (9%) Merriam's males shot in spring had molted JIX. Overall, JIX was molted more frequently in yearling Rio Grande (28%) than in Merriam's Wild Turkeys (8%) (G-test, $P < 0.001$).

Growth of BPVIII was examined only in yearling females that retained JIX and JX, because those that molted JIX had already completed growth of BPVIII due to the sequential nature of primary replacement. We examined only females because of the small sample. Growth of BPVIII was apparently incomplete in Rio Grande birds ≤ 3.0 kg and for some Merriam's Wild Turkeys as judged by BPVIII's length relative to BPVII (Fig. 1, large index values meaning a large discrepancy in lengths of BPVII and BPVIII, and thus, a shorter than full-grown BPVIII). Growth of BPVIII was apparently complete in Rio Grande turkeys ≥ 3.2 kg as differences in proportional length between BPVII and BPVIII were approximately equal in all birds. We did not ascertain whether BPVIII was still growing. Rio Grande females >3.0 kg that had molted JIX were heavier (N = 18, $\bar{x}$ = 3.70 kg, SD = 0.18 kg, one-way ANOVA, $P < 0.001$) than those that had not (N = 29, $\bar{x}$ = 3.47 kg, SD = 0.21 kg, Fig. 2). Rio Grande adult females (N = 24, $\bar{x}$ = 4.06 kg, SD = 0.29 kg) were heavier (one-way ANOVA, $P < 0.001$) than yearling females that molted JIX. Year differences were not significant in either ANOVA ($P > 0.49$).

Discussion.—Leopold's (1943) hypothesis for variable first prebasic molt required past or present hybridization between wild and domestic turkeys. We have no reason to believe that the two populations we studied were not pure, wild-strain turkeys. Plumage characteristics were consistent with their subspecific status. The few domestic birds that occurred on each study area were visibly different from the wild birds and were not seen to interact with them. Additionally, Leopold's hypothesis fails to explain molting of both JIX and JX by yearling Florida Wild Turkeys (Williams and Austin 1970).

The frequency of JIX molt among subspecies was in agreement with Williams and Austin's (1988) hypothesis. Both Rio Grande and Merriam's turkeys molted JIX less frequently than

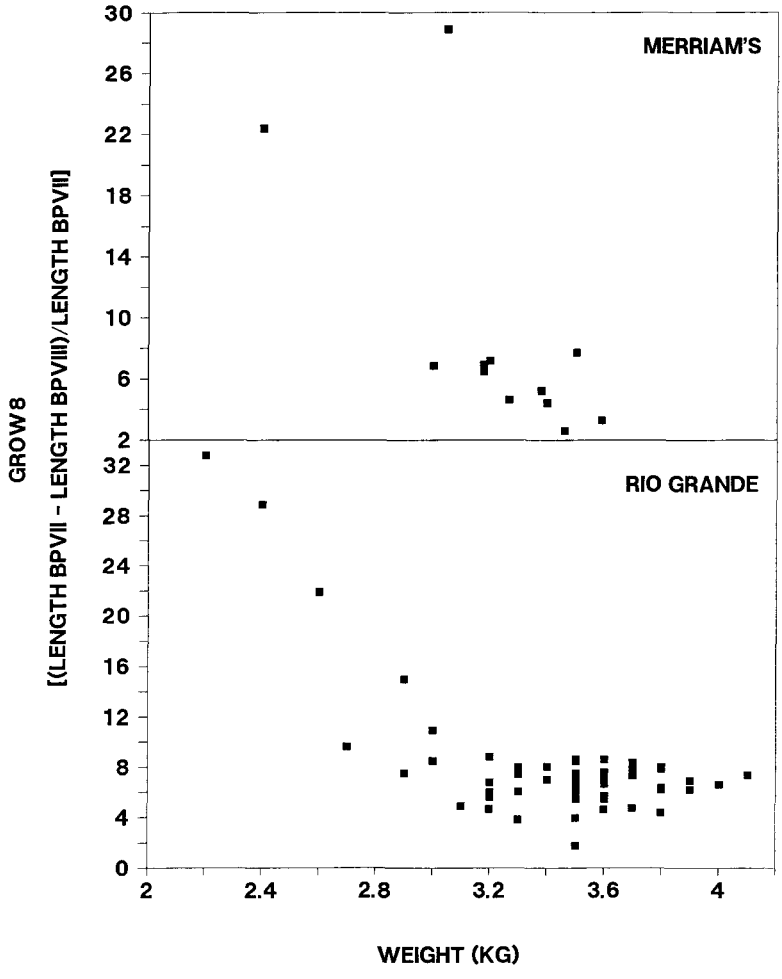

FIG. 1. Relative growth of the eighth basic primary (BPVIII) in female Merriam's and Rio Grande wild turkeys observed in mid-winter. Lower values of GROW8 are interpreted as more complete growth.

reported values for the more southerly Florida turkey (Williams and Austin 1988). The Rio Grande birds released in Colorado originated from Texas, Kansas, and Oklahoma, and occupy an area of milder climate than the native population of Merriam's turkeys within the state. Therefore, the higher frequency of JIX molt among Rio Grande as compared to Merriam's turkeys also supports the Williams and Austin (1988) hypothesis.

We then examined variation in extent of the first prebasic molt within a subspecific population. The extent of this molt was a function of body weight, which was likely correlated with hatch date. In this Rio Grande population, hatching occurred over an eight-week period

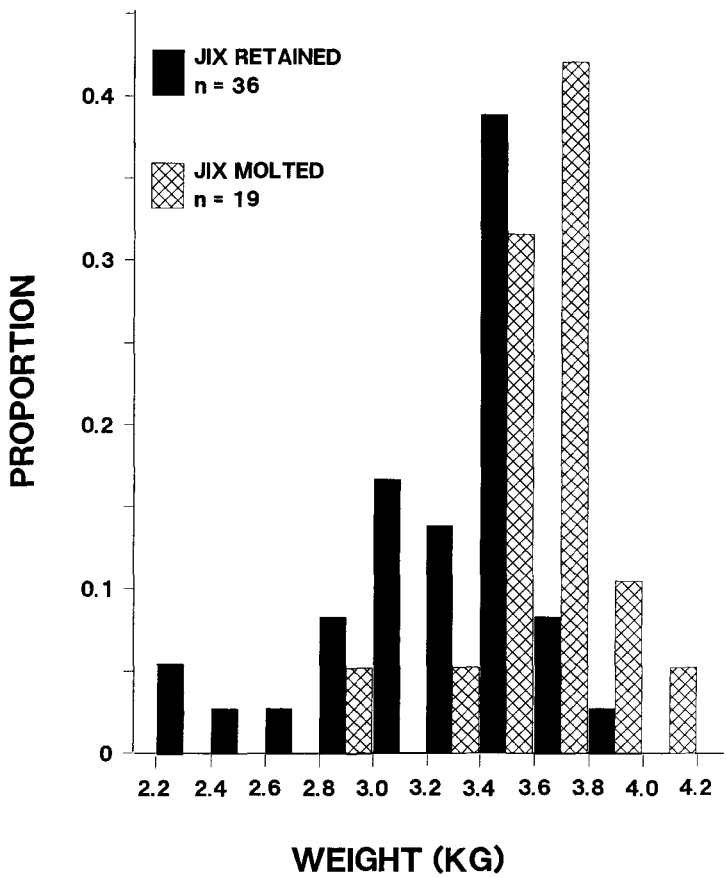

FIG. 2. Winter body weights (kg) of two molt classes of female Rio Grande Wild Turkeys.

(Schmutz and Braun 1989). This variation in hatching dates would result in a maximum age difference in days of about 25% among yearlings caught in early February. Yearlings that had molted JIX were heaviest and probably represented young from early nesting attempts the previous spring, assuming that body mass is closely associated with age. Yearlings that retained both JIX and JX, but apparently completed growth of BPVIII, were of moderate weight. Those that retained both JIX and JX and exhibited incomplete growth of BPVIII were lightest and probably represented young from late nesting attempts.

Merriam's turkeys also showed variation in extent of the first prebasic molt, but with a lower frequency of JIX molt. Yearlings in this population were younger than Rio Grande yearlings due to a month's difference in average hatch date (Schmutz and Braun 1989, Hoffman 1990), and had probably not progressed as far in the first prebasic molt.

Our assumption that body weight correlates with age among yearling Wild Turkeys is supported by Healy and Nenno's (1980) data on hand-reared Eastern Wild Turkeys, although their birds were younger. Mean female weights were strongly related to age for young 0–

189 days ($R^2 = 0.98$, $P < 0.001$) and 100–189 days ($R^2 = 0.94$, $P < 0.001$) of age. Given that heavier birds represent older birds, we have assumed that either onset or rate of the first prebasic molt is age-related. We believe that the onset of this molt is age-related in Wild Turkeys for several reasons: (1) the variable molt patterns seen in February among variable aged yearling turkeys suggested that convergence of the first prebasic molt, observed in Chaffinches (*Fringilla coelebs*) of different hatch dates (Dolnik and Gavrilov 1980), did not occur, (2) lengths of BPVII and BPVIII were strongly related to age in hand-reared Wild Turkeys (McGuire 1970, Healy and Nenno 1980), and (3) evidence for a relationship between age and molt onset has been observed in White-crowned Sparrows (*Zonotrichia leucophrys,* Morton et al. 1969, King and Mewaldt 1987). We know of no similar data within Galliformes.

Hens with BPIX and JX might be first-year adults that nested late, and, therefore, started molting later and either had not completed or prematurely terminated their prebasic molt by time of capture. Weight differences between hens classified as adults and those classified as yearlings with BPIX and JX argues against this hypothesis. Furthermore, this hypothesis does not account for variable molt among males.

The relative frequency of JIX molt among subspecies in this study supports the Williams and Austin (1988) hypothesis as an ultimate explanation of variation in the first prebasic molt of Wild Turkeys. However, our correlation of body weight, and probably hatch date (both partially influenced by enviromental factors), with the extent of first prebasic molt suggests that within a population the number of juvenal primaries molted may be subject to proximate environmental circumstances.

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Natal pterylosis of phoebes.—Detailed accounts of natal pterylosis currently are available for only a small percentage of the species of passerine birds of the world. The perception that natal down patterns have only limited value as taxonomic characters (Collins and Kemp 1976) and provide little information about concealing coloration or thermoregulatory ability has not engendered much support for further studies. As a result, the necessary specimens most often only are collected coincidental to other field studies (Marra 1990). As a result, the species coverage is spotty and is plagued by small sample sizes (Collins 1990). We present here data on three *Sayornis* flycatchers. This constitutes one of the few comparative analyses among all species of a single genus (see also Minsky and Collins 1983).

The genus *Sayornis* consists of three widespread and commonly occurring species of tyrant flycatchers: Eastern Phoebe (*Sayornis phoebe*), Black Phoebe (*S. nigricans*), and Say's Phoebe (*S. saya*). The breeding biology of all three species has been described by numerous authors (Bent 1942, Schroeder 1985 and references therein). All three species build shallow open-cup nests placed on a supporting structure, usually in a covered place, and in Eastern and Black phoebes, near water. Although many aspects of the breeding biology of phoebes is known in detail, the natal pterylosis has been described only for the Eastern Phoebe (Wetherbee 1957). As part of a continuing survey of natal pterylosis in passerine birds, we present here similar observations on both Black and Say's phoebes and review the pattern of natal pterylosis in the genus.

Wetherbee (1957:358–359; Table 4) reported information on the Eastern Phoebe based on 17 specimens collected in Maine, Massachusetts, Wisconsin and Michigan. Included were one late stage embryo, 10 newly hatched chicks (Stage A, Wetherbee 1957:356), five older chicks (Stage B) and one late-teleoptile stage chick with the sheaths of the pin feathers ruptured (Stage D).

Three Black Phoebe specimens were available for this study. A newly hatched chick (Stage A) and two early pin feather stage chicks (Stage C) were collected from nests on Rainbow Creek, San Diego County, California, on 17 May and 24 May 1983, respectively. An additional nearly fledged chick (late Stage D) was used for study of feather tract arrangement, but since down had probably been lost through abrasion, it was not included in the neossoptile counts for the species. Say's Phoebe was represented by two chicks (Stage B) collected from a single nest near China Lake, Inyo County, California, on 8 May 1974.

All specimens were examined under a binocular dissecting microscope and the number and distribution of natal downs (neossoptiles) in each species were recorded (Table 1). The terminology for neossoptile tracts and regions within tracts follows that of Wetherbee (1957).