

MOLTS, PLUMAGES AND AGE GROUPS IN  
*PIRANGA BIDENTATA* IN MEXICO

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*Piranga bidentata*, the Flame-colored or Swainson Tanager, is a species occurring in Mexico and Central America as far south as western Panama. The three recognized races occurring in Mexico are *P. b. bidentata* (highlands of western and central Mexico), *P. b. sanguinolenta* (mountains of eastern and southern Mexico to El Salvador), and *P. b. flammea* (Tres Marias Islands), (Miller, Friedmann, *et al.*, 1957: 305-306; Blake, 1953: 534-535).

Among the numerous references to this tanager there has appeared no thorough description of the molt and plumage sequences, nor of the sub-adult plumage. The juvenal plumage has not been described. Ridgway (1902), limited in his treatment of this highly variable species by a lack of adequate material, based some adult descriptions on as few as two or three specimens. We have examined a total of 201 specimens collected in Mexico, of which 130 were *P. b. sanguinolenta*. This provides sufficient material for more thorough descriptions of the juvenal, sub-adult and adult plumages of the eastern race, and for comparisons with the other Mexican subspecies.

Measurements of 186 of the 201 specimens examined are summarized in Table 1. These data provide comparisons between the three races studied and the sex and age groups discussed in this paper. Of special interest are the significant differences obtained in the bill and tarsal measurements for the races *bidentata* and *flammea*, as these subspecies are not readily separated on the basis of coloration alone. All measurements given are in millimeters; wing length is on the chord; bill width is at the nostrils. Not included in this table are measurements of four Cuernavaca, Morelos specimens, and birds in juvenal plumage or post-juvenal molt. Specimens in post-nuptial molt have been grouped with adults.

The problem of determination of age groups and plumages arose as a result of field studies and collections at the Rancho del Cielo cloud forest locality (Martin, 1958) in Tamaulipas, Mexico by Byron E. Harrell, Joyce LeFebvre and Eugene LeFebvre. Another problem became evident as specimens were received on loan; there exists a confusion in specific identity between sub-adult males, females and juvenile *Piranga bidentata* and the Mexican races of the Hepatic Tanager, *Piranga flava*. Eight specimens of *P. flava* from several collections had been misidentified and were sent to us as subspecies

of *P. bidentata*. To clarify the distinction between the two species, a brief discussion of their plumage differences is presented.

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#### DESCRIPTION OF THE MOLTS AND PLUMAGES

##### *Piranga bidentata sanguinolenta*

(130 specimens: 100 males, 29 females, 1 juvenile)

Color designations in the following descriptions follow Palmer (1955) in most terms used.

##### *Juvenal plumage* (sex unknown)

The juvenal plumage may be described briefly as streaked on the head, back and undersides. It is predominantly blackish-brown above and pale yellow below. Because this plumage has not been described before, we are treating it in greater detail. This account is based on one specimen, a fledgling, collected June 24, 1953, at the Rancho del Cielo.

Bill in preserved specimen light fuscous becoming pale yellow in rictal region; forehead, crown, and nape orange-yellow to buffy-yellow; shaft streaks blackish-brown giving the head a boldly streaked appearance; mantle similar except broader shaft areas and buff color accentuated; shaft streaks of rump reduced; chin and throat buff-yellow, lighter than pileum and containing some blackish-brown shaft streaks; these streaks expand near tip of each feather; breast and belly pale yellow becoming deeper yellow on crissum, breast feathers with few blackish-brown tips; sides and flanks lighter yellow with darkened blackish-brown shaft area; wings blackish-brown; primaries, greater and median primary coverts lack spots; outermost primary edged with white, others faintly edged with green; secondaries and median secondary coverts tipped with buff-yellow spot; shaft streak extends along rachis through spot to tip of feather; greater secondary coverts with straw buff-yellow spot confined to outer vane distally on each feather; spotting of secondaries and coverts more deeply colored in fresh feathers, fades to pale white or

grayish-white in older feathers; tail blackish-brown, feathers only ½-inch emerged and largely hidden by upper and lower tail coverts.

*Post-juvenal molt* (6 males, 1 female)

The juvenal plumage is lost by the post-juvenal molt which replaces the entire body plumage, lesser, median, and greater secondary coverts and the tail coverts. There is no indication in the specimens before us that the primary coverts are molted. The rectrices and most of the remiges are not molted; however, one specimen indicates that the tertiaries are replaced. These feathers resemble closely the juvenal tertiaries. Thus it is easy to overlook this replacement.

The feathers of the breast are the first to be replaced. This replacement begins on the central portion of the ventral tract and proceeds both anteriorly and posteriorly. The sides and flanks are completed first. The feathers of the chin and throat are partially replaced while streakings still are present on the upper breast. Gradually the chin and throat are fully replaced and only a small somewhat oval area remains on each side of the upper breast which retains some spotted juvenal feathers. About this time, most of the feathers of the interscapulars, scapulars and rump are molted and the feathers of the capital tract are beginning to be replaced.

During the time when the breast molt is still confined to the central part of the ventral tract, replacement of the lesser secondary coverts and interscapulars begins; the replacement progresses anteriorly and posteriorly. By the time the molt on the underparts has replaced the feathers of the breast, sides and flanks, most or three-fourths of the back and rump has also been replaced.

The head is the last major region of the body to molt. This replacement begins when the underparts and back are at least three fourths through the molt. The replacement of one specimen begins evenly on the forehead, crown, and nape and proceeds from the mid-line laterally. The forehead and crown are completed at the same time that replacement of the breast is completed. The auriculars and nape are replaced last.

The time of molt occurs from late May (Chiapas) until the end of August (Veracruz).

MALE PLUMAGES

*Sub-adult plumage* (27 males)

Specimens: Nuevo Leon, April 28–June 7; Tamaulipas, March 3–June 13; Veracruz, April 12–August 31; Chiapas, March 7–June 19; Guerrero, March 21–April 14.

The post-juvenal molt results in a yellow-green to orange-yellow sub-adult plumage that, in the males, differs strikingly from the later plumages. This plumage is retained through the following breeding season; the changes in coloration found in the breeding season are due to fading and wear of feather edges and tips.

Sub-adults are essentially yellow-green to orange-yellow dorsally except for wings, tail, and broad blackish stripes on scapulars and interscapulars; ventrally bright yellow; sides and flanks more olivaceous; orange and melanin on head and under-

parts highly variable; often birds with greater amount of orange also have increased melanin in the orange areas; thus, colors darker and less brilliant. The more deeply orange-tinged specimens also show varying amounts of orange or orange-red mixed with melanin on upper back; some have brownish-orange on rump and upper tail coverts. The most intensely colored specimens have greenish edgings of wing and tail replaced by dull orange-red. Remiges and rectrices retained from juvenal plumage; outermost rectrices show small white tips on inner vane.

#### *Post-nuptial molt* (1 male, 3 females)

The description of this molt is based on three females in at least a first post-nuptial molt and on one male in a second post-nuptial molt. Insofar as we could determine, the progression of the molt is the same in the two age groups, differing only in the colors of the feathers. This molt sequence is essentially the same as that followed in the post-juvenal molt with the exception that the molt is complete.

Replacement of the remiges and rectrices occurs at the time when the underparts and interscapular area are already partially molted. The order of replacement on the wings starts with the lesser secondary coverts (which are the first coverts to be replaced in the post-juvenal molt) and then involves the greater secondary coverts and tertiaries in succession. It is interesting to note that as a result of the order of replacement on the wing, the median coverts which form the whitish wing bar are retained until after the lesser and greater secondary coverts are replaced. The progression of the wing and tail molt cannot be followed in greater detail because we lack adequate material.

The four specimens exhibiting this molt were all collected during October (4-27) in Chiapas.

#### *Adult male plumage* (66 males)

Specimens: Nuevo Leon, March 19-June 22; Tamaulipas, March 1-July 29; Veracruz, March 29-July 7; Hidalgo, April 11 and 12; San Luis Potosi, April 21; Puebla, May 17; Chiapas, February 27-October 28; Guerrero, February 10-December 25.

The first post-nuptial molt results in a mainly orange-scarlet adult plumage.

Body orange-scarlet with varying amounts of green, greenish-yellow or yellow-orange on back and rump; top of head and auriculars intensified by presence of melanin. Compared to sub-adults, ventrally similar but flanks olive-brown; wings, tail and shaft streaks of back blacker; white spots on inner vane of three outermost rectrices larger, outermost spot about one inch in length.

Ten specimens differ from the other birds in this plumage in that the scarlet is intensified over the entire bird with, in most specimens, an almost complete loss of green and yellow, and with little evidence of orange present. In these birds even the wing bars and tertial spots

are entirely or partially edged with pinkish-scarlet, and the flanks are dusky-scarlet. We are inclined to believe that this intensification of color indicates an older age class.

#### FEMALE PLUMAGES

Plumage differences between adult females and sub-adult males are not readily apparent. Dickey and van Rossem (1938: 553) likewise reported this for El Salvador specimens. When only specimens bearing data on gonads are used, the females show a plumage difference only in the presence of fewer or no orange feathers on the chin, throat and head. When all specimens marked female are considered, some females show even more orange on the forehead and crown than do some first year males. Specimens marked "female" showing this orange may be males.

It is of interest to note that in *P. bidentata* the first year males closely resemble the females while in *P. flava* this condition does not prevail; instead, the males become brighter greenish-yellow below following the post-juvenal molt and the females become dull yellowish-green.

#### *Post-juvenal molt* (1 specimen)

We examined only one specimen (Chiapas, May 26) which still retains part of the juvenal plumage. In this individual the colors are more intense than for the juvenal plumage described above.

#### *Sub-adult plumage* (7 females)

Specimens: Nuevo Leon, June 7-23; Tamaulipas, April 15-July 28; Chiapas, May 26.

Sub-adult females are practically indistinguishable from sub-adult males, and, unless representing extremes, individuals cannot be sexed by coloration. A series of sub-adult females compared to males will show more pronounced streaking on the pileum. Some sub-adult males can be separated because of the increased red in the plumage.

The plumage of seven sub-adults examined has yellow-green to olive-green on the pileum; some show orange on the forehead; forehead, crown and nape distinctly streaked with black; back streaked with black with broad central shaft areas fringed with olive-green or greenish-yellow. As the season progresses, the back, especially, fades and wears, losing most of the greenish-yellow and olive coloring, becoming rather gray-green. Underparts generally bright yellow, orange-yellow on chin, throat and upper breast; sides and flanks dark olive; wings and tail black or brownish-black, feathers edged with yellow-green except outermost primary and rectrix which are whitish-gray; tail tipping pale and limited in extent as in sub-adult males.

*Adult plumage* (18 females)

Specimens: Nuevo Leon, March 26–June 22; Tamaulipas, March 4–July 20; Veracruz, April 3–July 2; Chiapas, May 24–October 27.

Generally the adult females can be differentiated from the sub-adult females by a very slight lessening of streaking on the head, and by the large ( $\frac{3}{4}$ -1 in.) tail spots found on the outermost rectrices.

The fresh adult plumage in two October birds shows a general addition of orange, deepest on head, chin, and throat; head streaks nearly obscured by brighter fringes; throat, breast and belly orange-yellow to olivaceous-yellow, the darker color on sides and flanks; backs remain streaked but black less extensive, largely masked by green edges of neighboring feathers; later in season wear or overlying brighter fringes results in increase of black on back and in streaking of head; white spots on the outermost rectrices as in adult males.

In another specimen taken in October and in fresh plumage the colors are more intense than those described above. Four adult females collected in the spring also exhibit brighter colors:

Pileum yellow, touched with dusky, unstreaked; back streaked, black shaft streaks fringed with bright yellow-green; rump and upper tail coverts bright green or green-olive; throat, breast and belly bright yellow.

## GEOGRAPHIC COMPARISON WITH OTHER MEXICAN RACES

The juvenal plumage and the post-juvenal molt (based on three molting specimens examined) in *P. b. bidentata* are similar to those in the race *sanguinolenta*. No specimens of *P. b. flammea* in these categories were available. Therefore, the following discussions will briefly compare the plumages found in other populations in Mexico.

Specimens from Sonora, Sinaloa, Jalisco, Nayarit, and Michoacan agree in their subspecific relationships based on coloration, and the males are easily separated from all males of the eastern race. Adult males in fresh plumage (October-February) have bright yellow-scarlet to scarlet heads, throats, and breasts. The underparts are orange or yellow-orange; the back is streaked and the wings and tail are dull black resembling those of the eastern race. By the breeding season (specimens: March-August) this plumage is faded and less brilliant dorsally, although the underparts remain much the same. The adult male differs then, from adult male *sanguinolenta* principally in lacking the intense red on the head, back and undersides, thus appearing more orange. There is less green on the back, wings and tail; the green of the back is replaced by gray-orange. *P. bidentata* has less melanin on the body, although this difference is less marked than the difference in greens and reds.

These differences in the amounts of red, green, and melanin in the plumage hold true for the sub-adult plumages as well. Four sub-

adult *bidentata* (April 25–May 1) examined are yellow-green above and bright yellow below. Compared to *sanguinolenta*, the ventral parts are more yellow and the pileum and back have more yellow and less green and melanin.

Two juvenal plumaged male *bidentata* (June 6–July 31) lack the degree of streaking which is prominent on the heads of two immature

TABLE 1  
MEASUREMENTS OF MEXICAN RACES OF *Piranga bidentata*

MALES:								
	WINGS		CULMEN		BILL WIDTH		TARSUS	
	<i>sub-adult</i>	<i>adult</i>	<i>sub-adult</i>	<i>adult</i>	<i>sub-adult</i>	<i>adult</i>	<i>sub-adult</i>	<i>adult</i>
<i>sanguinolenta</i>								
$\bar{x}$	93.3	96.7	16.7	16.6	9.3	9.4	21.3	21.0
$s_x$	2.2	2.2	0.6	0.7	0.8	0.4	0.2	0.7
$SE_x$	0.4	0.3	0.1	0.3	0.2	0.4	0.1	0.1
Range	87–97	91–102	15.1–17.6	15.6–17.7	8.6–9.7	8.7–10.6	20–23	19–22
Sample	27	67	27	66	27	67	27	66
<i>bidentata</i>								
$\bar{x}$	95.5	97.5	15.9	16.4	9.1	9.3	22.0	21.7
$s_x$	1.1	3.3	0.3	0.7	0.2	0.1	0.0	0.5
$SE_x$	0.6	0.7	0.1	0.1	0.1	0.02	0.0	0.1
Range	94–97	86–104	15.6–16.3	15.1–17.7	8.9–9.2	8.7–9.8	.....	21–23
Sample	4	24	4	24	4	24	4	24
<i>flammea</i>								
$\bar{x}$	92.0	98.3	17.4	17.5	9.6	9.5	21.5	22.5
$s_x$	...	0.7	...	0.5	...	0.1	...	0.7
$SE_x$	...	0.2	...	0.1	...	0.02	...	0.2
Range	.....	97–101	.....	16.9–18.5	.....	9.3–10.1	.....	21–24
Sample	2	15	2	15	2	15	2	15
FEMALES:								
<i>sanguinolenta</i>								
$\bar{x}$	94.1	94.2	16.3	16.6	9.3	9.1	20.1	20.4
$s_x$	2.4	2.6	0.8	0.7	0.2	0.5	0.7	0.4
$SE_x$	1.0	0.6	0.3	0.2	0.1	0.1	0.3	0.1
Range	91–97	91–100	15.3–17.3	15.2–17.8	8.9–9.8	8.0–9.7	19–21	19–22
Sample	7	21	7	20	7	21	7	20
<i>bidentata</i>								
$\bar{x}$	93.6		16.8		9.3		20.5	
$s_x$	2.1		0.4		0.1		1.0	
$SE_x$	0.7		0.1		0.04		0.3	
Range	88–97		16.0–17.7		8.2–9.8		19–22	
Sample	11		11		11		11	
<i>flammea</i>								
$\bar{x}$	92.0		17.8		9.7		21.8	
$s_x$	2.3		0.6		0.1		1.0	
$SE_x$	0.8		0.2		0.5		0.3	
Range	88–95		17.0–18.4		9.4–10.5		20–23	
Sample	8		8		8		8	

specimens of *sanguinolenta* from Tamaulipas and Veracruz. The underparts likewise are less heavily spotted compared to juveniles of *sanguinolenta*.

Males of *flammea* (Tres Marias Is., March 7–October 24) resemble *bidentata* in coloration, except for the degree of spotting on the undersides of the lateral rectrices. Ridgway (1902) described the race *flammea* as being distinctly larger in size than *bidentata*, but this obtained only in his total length measurement. We did not measure total length but found the two races differed significantly (5% level) in massiveness of bill; this difference is apparent in bill measurements summarized in Table 1.

As in *P. b. bidentata* the sub-adults of *flammea* may be described briefly as yellow-green above with bright yellow underparts. Two males (May 2-11) and eight females (date and age unknown) are indistinguishable from each other, although one of the males does have more orange on the head and throat than do any of the other specimens. The two males are badly worn and fading is evident.

Comparison of female *bidentata* with *flammea* shows great similarity in plumage coloration; no consistent difference is evident except in size (Ridgway, 1902 and Table 1). Both differ from *sanguinolenta* in that the underparts are bright yellow, lacking the dusky or orangish colors which are found on the breasts and flanks of *sanguinolenta*. The head and back of *sanguinolenta* have more melanin and again show more green (less gray) than do the two western races.

The juvenal female in *sanguinolenta* (this specimen is partially molted) is somewhat darker on the flanks and has slight orange tinges on the breast. The head is more heavily streaked than in the western subspecies.

*Guernavaca specimens* (4 specimens)

Four specimens from Cuernavaca, Morelos are sufficiently different in plumage coloration to merit separate description; however, no attempt is made at this time to separate these birds from the western race because an adequate number of specimens is lacking to substantiate such a change. Of these, one sub-adult male (February 16), when compared to other sub-adult *P. b. bidentata*, has darker orange to orange-yellow feathers on the head with an increase in melanin. The change in color from the nape to the back is abrupt, forming a definite crescentic line at this point (accentuated somewhat by the method of preparation). This character is also true for one sub-adult female specimen (February 16). The back is much darker than it is in the other representatives of this race showing wider black central areas in each feather, the edges of these feathers are light yellow-green on the anterior region of the back becoming whitish to whitish-gray on the posterior feathers. The tail feathers are brown apparently because of fading; the white area on the rectrices is only one-half to three-fourths inches long. The wings are similar to those for the rest of the race.



Two adult specimens (February 10 and 11) from Cuernavaca differ slightly from the other adult *P. b. bidentata* examined. The range of colors of the head, throat, breast, belly and rump falls within those described. The forehead has a few bright scarlet feathers in one specimen. The line of demarcation between the nape and the back is prominent as noted for the sub-adults. The back feathers have edges of orange-olive and greenish-orange; but there is a light grayish appearance when compared with other specimens of *bidentata*.

#### COMPARISON OF *Piranga bidentata* WITH *P. flava*

*Piranga flava* specimens: Michoacan, 2 juveniles, May 17, 4 post-juvinal molt, July 1-31; Guerrero, 4 post-juvinal molt, June 21-Sept. 1; Morelos, 1 juvenal male, April 26, 1 post-juvinal molt, June 10, 1 adult female, August 13; Chiapas, 1 adult male, August 29; Veracruz, 1 post-juvinal molt, August 7; Arizona (Santa Rita Mts.) adult female and male, June 25; (Huachuca Mts.) adult female and male, July 24 and July 1; New Mexico, adult male, May 7.

Since the identity of some age and sex groups between the Flame-colored Tanager, *Piranga bidentata*, and the Hepatic Tanager, *P. flava*, has been confused, a review of the plumage differences between the two species is desirable. Adult males are seldom confused; the orange-red *P. bidentata*, with its white wing bars, tail spots, and dusky-streaked back, is easily distinguished from the less intensely colored *P. flava*. Zimmer (1929) has discussed the molts and plumages of *P. flava* in greater detail. The following comparison of the juvenile stages is based on an examination of the one *bidentata* fledgling, previously described, with thirteen juvenile *flava* from Mexico, three fledglings in juvenal plumage, and ten birds in post-juvinal molt. (The points of difference from *P. bidentata* apply to both Mexican races of *P. flava*: *P. f. hepatica* and *P. f. dextra*.)

The dark centers on the feathers of the top of the head and back in the juvenal plumage of both species give the bird a streaked dorsal appearance. The general dorsal coloration of *P. flava* is darker and is an olivaceous-brown fading to grayish-brown. The dorsal aspect contrasts with the *pale yellow head streaked with black* and the yellowish to rich buff back of *bidentata*. The underparts of *flava* are pale yellow *boldly streaked with black or brownish-black*, while in *bidentata* the breast and belly are very pale yellow to whitish and have light streaks largely confined to the breast. The tertiaries in *bidentata* have large white spots which are not present in *flava*. The edges of the outer vane of the primaries and secondaries are brighter in *flava* than in *bidentata*. The tail in *flava* is brown *edged with bright orange-yellow-green, and the complete lack of white spots* easily distinguishes this species from *bidentata*.

An adult female and a sub-adult male *P. flava* collected in August

have a green aspect to the dorsal appearance. The back is plain and unstreaked, and lacks the bright yellow-green or orangish edging commonly found in *bidentata*, as well as the white tail spots and wing bars of that species. Ventrally, the immature males and all females of *bidentata* are brighter yellow and less olivaceous than are birds of similar age groups in *P. flava*.

#### SUMMARY

The molt and plumage sequence of the three Mexican races of *Piranga bidentata* was determined from 201 specimens. Differences between the sub-adult and adult plumages in each subspecies and among the subspecies are described, and the juvenal plumage of *P. b. sanguinolenta* is described for the first time. Measurements of the Mexican races are presented. In addition, plumage differences between *P. bidentata* and *P. flava* are pointed out.

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