A NEW FORM OF *ANABACERTHIA VARIEGATICEPS* (*FURNARIIDAE*) FROM WESTERN MÉXICO

KEVIN WINKER[1,2]

ABSTRACT.—*A. v. schaldachi* is described as a new subspecies from Guerrero, Mexico.

While comparing recently obtained specimens of *Anabacerthia variegaticeps* from México with specimens in the U.S. National Museum (USNM), it was immediately clear that a geographic sorting of the USNM holdings of this species had not been performed for many decades (if ever). Upon sorting, it became evident that a series of six birds from Guerrero showed distinct plumage differences from all of the other specimens present. Although *A. variegaticeps* has been considered by some authors as a subspecies of the allopatric South American *A. striaticollis* (e.g., Peters 1951), most recent authors (e.g., Wetmore 1972, A.O.U. 1983) recognize *A. variegaticeps* as a distinct species - a conclusion with which I concur. *A. variegaticeps* occupies humid evergreen montane forest and ranges in Middle America from southern México (Guerrero, Veracruz) southward through Guatemala and Honduras, apparently skipping Nicaragua and resuming its distribution in Costa Rica, occurring thence southeastward into Chiriquí, western Panamá.

Although *A. "v." temporalis* of Colombia and Ecuador is currently considered a subspecies of *variegaticeps* (Meyer de Schauensee 1970), its placement there seems unwarranted and requires reconsideration (see Peters 1951:128, Ridgely and Tudor 1994:143, and specimens). Middle American *A. variegaticeps* have generally been considered monotypic; Bangs' (1906:108) subspecies *A. v. idoneus* from Boquete, Chiriquí, Panamá was considered inseparable from the nominate form by both Ridgway (1911:209) and Wetmore (1972:88). Examination of numerous specimens from Panamá confirms these authors' treatment of Bangs' *A. v. idoneus*.

A. variegaticeps shows no sexual plumage dimorphism; it is monochromatic. Plumage variation in this species, as in most of the Furnariidae, is rather conservative. Nevertheless, it should not be surprising to find subtle but distinct differences in an allopatric population. So far as has been determined, the Guerrero population of this species is both the westernmost and most isolated in México (Miller et al. 1957, Binford 1989, Howell and Webb 1995). From my own observations in southern Veracruz, the species appears to be sedentary in southern México.

This situation provided an opportunity to determine the utility of spectrophotometric technology for diagnosing subtle plumage differences. One of the complaints of subspecific determination has been the rather idiosyncratic, subjective nature of diagnoses. Objective descriptions in which differences are either very obvious or reproducible through character quantification would thus seem to be more popular. However, judging from the number of new subspecies lying annotated but undescribed in museum trays, this more rigorous process has deterred many from describing their discoveries. Reflectance spectrophotometry offers a potentially powerful tool for objectively characterizing plumage differences suggested to exist by the human eye.

METHODS

Light reflectance measurements of specimens in the U.S. National Museum of Natural History were made using a 9.4 mm aperture on a Milton Roy "Color Mate Colorimeter" reflectance spectrophotometer. Reflectance characteristics were recorded as coordinates on three different opponent-color axes, light-to-dark (L), red-to-green (a), and yellow-to-blue (b) (see Hunter and Harold 1987 for a detailed description). These coordi-

nates represent axes of extremes that cannot occur simultaneously on a homogeneous surface (something cannot be light and dark, or red and green, or yellow and blue). A surface measured by this instrument yields a single value for each of these three characters: a lightness value (amount of light reflected, L, scored 0-100), a value for redness-greenness (a, with reddish plumage receiving positive values, greenish negative), and a value for yellowness-blueness (b, with yellowish plumage receiving positive values, blueish negative). Each of these values is measured against base values of zero for each character, established using a white ceramic tile standard.

For each specimen in the USNM collection, reflectance characteristics were measured from four body regions: lower throat, abdomen, crown, and back. Three sequential measures were made for each of these body regions, with the specimen being removed from the device and repositioned for each repeated measure. Each value L, a, and b for each specimen in the analyses represents the average of these three sequential measurements.

In addition, wing chord and tail length of specimens were measured to the nearest 0.1 mm using vernier calipers following Baldwin et al. (1931). Specimens in the American Museum of Natural History (AMNH) were also measured, photographed, and visually examined (reflectance data were not collected on these birds).

RESULTS

Data were collected to determine whether differences perceived by the eye were real. The null hypothesis being tested is that there is no difference in these color characteristics between Guerrero and non-Guerrero birds. Although all measured reflectance characteristics showed at least some overlap between the two groups, the red-green axis (a) showed highly significant differences between the two groups on throat and abdomen (Table 1). The null hypothesis that there is no difference can therefore be rejected: There are significant differences in color between Guerrero and non-Guerrero birds. There was also a tendency for the crowns of Guerrero birds to reflect more light (L; Table 1).

Despite the existence of significant differences in the means of some reflectance values between Guerrero and non-Guerrero birds, the fact that all characters showed some overlap between the groups prohibits an uncomplicated demonstration of the visual separability of the Guerrero specimens. Statistical methods exist, however, to examine the success rate with which diagnoses can be made when employing multiple variables. Using discriminant analysis, each variable is examined in relation to all of the others and multiplied by a constant to generate an equation (or function), which, when solved for each individual, maximizes the ability to distinguish between the members of two groups.

To determine whether separation of Guerrero and non-Guerrero birds was possible using the measured reflectance characteristics, a discriminant analysis was performed in which all untransformed reflectance variables were directly loaded. The resulting 12-variable discriminant function successfully classified 95.31% of the 64 individuals for which no variables were missing. All of the Guerrero birds were successfully classified, but three of the birds from other populations were mis-classified. This result suggests that the perceived differences are real, and, again, that we may reject the null hypothesis. If there was no difference between Guerrero and non-Guerrero birds, we would expect the discriminant analysis to yield a classification that was only about 50% successful. But these results also show that the measurements taken do not allow perfect separation. Examination of the mis-classified three individuals, from Panamá (USNM 456,682), Veracruz (USNM 154,661), and Chiapas (USNM 154,663), showed that all three are visually separable from the Guerrero birds: They are a richer brown on the venter and/or have yellower throats, they average a richer brown above, the crowns are mottled and/or darker, and, perhaps most importantly, more throat scalloping is apparent. Some means of objectively

scoring the degree of throat scalloping would probably enable absolute separation. Alternatively, morphometric data might increase diagnosability.

Measurements of wing chord and tail showed significant levels of sexual size dimorphism (not shown), and some geographic variation in size seems to occur (also not shown). To use morphometrics effectively in this case, analyses were separated by sex. When discriminant analyses were performed separately on each sex by directly loading all untransformed variables (mensural and reflectance), females (N = 23) were 100% separable into Guerrero and non-Guerrero categories. Males (N = 36) showed a classification success of 97.2%, with the same bird from Panamá noted above being mis-classified. Again, upon visual examination this individual is easily separated from Guerrero birds.

Considering the results of the discriminant analyses when the sexes were separated, the measured variables enabled a 98.4% success rate in categorizing individuals into either Guerrero or non-Guerrero populations. Although this might be considered a high level of successful classification, visual examination of USNM and AMNH specimens suggests that the Guerrero population is 100% separable from non-Guerrero populations. Importantly, neither time of year nor decade of collection seemed associated with the differences observed; there were many birds from the quarter and/or decade of the Guerrero collection (see below) in the non-Guerrero sample. According to the "75-percent rule," a population may be recognized as a subspecies if 75% of its individuals differ from a previously recognized subspecies (Mayr 1969:190).

Given its distinctiveness, the Guerrero population may be recognized as

Anabacerthia variegaticeps schaldachi, subsp. nov.

HOLOTYPE. – USNM No. 185,845; an adult female taken by E. W. Nelson and E. A. Goldman on 21 May 1903 at Omilteme, Guerrero, Mexico. (This locality is in the mountains near Chilpancingo [Goldman 1951:152]).

PARATYPES. – USNM 186,563, an adult female taken on 22 May 1903; USNM 185,844, an adult male taken on 21 May 1903; USNM 186,564, an adult male taken on 23 May 1903; and USNM 186,561 and USNM 186,562, adult males taken on 22 May 1903. All were taken by Nelson and Goldman at Omilteme, Guerrero, Mexico.

DIAGNOSIS. – Discussed in part above. In addition, *A. v. schaldachi* can be distinguished from other members of the species by the paler, grayer ventral plumage (less rufescent), by the greatly diminished (almost absent) throat scalloping, and by the grayer crown. Also, the back averages slightly less rufescent.

DESCRIPTION OF HOLOTYPE. – (Capitalized color names and numbers from Smithe 1975, 1981). The throat is Pale Horn (92), blending on the upper breast into the predominant ventral color, which is between Cinnamon (123A) and Tawny Olive (223D), or between Buff (24) and Clay Color (26); this color becomes grayer on the lower venter. The crown is closest to Dark Brownish Olive (129), with some Yellow Ochre (123C) feathers on the forecrown going back in narrow, bilateral lines to meet the eyerings above the eyes; these eyerings are also Yellow Ochre (123C). The lores are Dark Brownish Olive (129) or Hair Brown (119A), bordered above by the narrow preorbital stripe of Yellow Ochre (123C), and meeting the eyerings. A broader Yellow Ochre (123C) postorbital streak extends from the upper eyering along each side to the rear quarters of the head. The auriculars are a mottled combination of Pale Horn (92) and grayish Dark Brownish Olive (129). The malar region is similar, but with a little Yellow Ochre (123C) present as well. The crown colors end abruptly at the upper back; the greater dorsum is closest to a dark Verona Brown (223B). The closed wing is like the greater dorsum, but slightly more rufescent. The tail is difficult to match, but may be called a reddish Mars Brown (223A), or near Munsell 5YR 3/3 or 3/4.

TABLE 1

LIGHT REFLECTANCE VALUES (L, A, AND B) FROM FOUR BODY REGIONS ON SPECIMENS FROM GUERRERO AND NON-GUERRERO POPULATIONS

Character		Guerrero (6) Mean	SD	Min. - Max.	non-Guerrero (58) Mean	SD	Min. - Max.	t[1]	P
Throat	L	52.18	1.76	(49.26 - 54.76)	50.50	3.81	(39.05 - 60.38)	-1.05	0.298
	a	16.98	1.97	(14.05 - 19.25)	22.35	2.61	(16.81 - 26.93)	4.82	<0.0005
	b	83.11	1.35	(81.42 - 85.26)	81.67	2.46	(75.93 - 87.94)	-1.38	0.172
Abdomen	L	42.17	3.17	(38.12 - 47.01)	43.57	2.74	(37.96 - 52.83)	1.15	0.255
	a	22.63	0.74	(21.46 - 23.78)	24.74	2.31	(18.06 - 29.27)	4.69	<0.0005
	b	75.79	0.76	(74.73 - 76.80)	75.91	2.25	(71.55 - 81.64)	0.26	0.799
Crown	L	27.53	0.77	(26.69 - 29.09)	26.63	2.15	(23.32 - 33.91)	-2.02	0.064
	a	10.59	0.76	(9.68 - 12.00)	10.60	1.25	(8.22 - 14.15)	0.02	0.987
	b	73.35	1.30	(71.58 - 74.95)	72.49	2.60	(66.86 - 78.03)	-0.78	0.436
Dorsum	L	27.78	0.57	(26.76 - 28.55)	27.33	1.19	(25.07 - 30.06)	-0.90	0.370
	a	19.06	0.99	(17.23 - 20.07)	18.56	1.86	(12.41 - 21.62)	-0.64	0.523
	b	68.62	0.77	(67.12 - 69.40)	68.27	2.92	(61.75 - 74.14)	-0.68	0.506

[1] t-value and associated P-value from a two-sample t-test. In cases where the two population variances were not equal, the t-test was performed using separate variance estimates (Norusis 1986:B-122).

VARIATION. – Presented in Results.

ETYMOLOGY. – I am pleased to name this form after my friend and colleague William J. Schaldach, Jr., whose studies of Mexican birds have spanned more than 35 years. Many of those years were spent in explorations with Allan Phillips, and the two were good friends. Although an erstwhile mammalogist, ultimately it is Schaldach's avian studies in México—effectively encouraged by Phillips—that will probably receive most attention. Allan and Willie were regular correspondents, and years ago on a rainy day at Willie's home in Catemaco, Veracruz, he showed me a recent letter from Allan. I was puzzled by the letter beginning with "Dear E. A.," and being signed "E. W.," but Willie explained: They had referred to each other as "E. W." (for Phillips) and "E. A." (for Schaldach) for many years, having long recognized the similarities between themselves and a pair of greatly esteemed predecessors, E. W. Nelson and E. A. Goldman, the inveterate explorers of Mexican biology and the collectors of the type series of this new taxon. Both pairs of biological explorers shared an age difference between individuals of about 10 years, and in each pair the older was predominantly an ornithologist while the younger was primarily a mammalogist. It is in honor of the younger member of this more recent team that this new form is named.

DISCUSSION

We seem to have reached a stage in ornithology where easily recognizable subspecific differences have been described and agreed upon, while subtle differences remain undescribed or contested. The result is that we have numerous subspecies recognized in groups that tend to show substantial levels of plumage variation (e.g., many oscines), but relatively few subspecies in groups that tend to show plumage conservatism

(e.g., many suboscines). Eventually, we will probably gain a better understanding of the covariation of phenotype and genotype among broad groups of birds with similar biogeographic and evolutionary history. However, until then we must struggle along, placing taxonomic bookmarks where we observe phenotypic disjunctions of possible evolutionary significance.

Despite its having produced the bulk of our present taxonomy, the historic method of giving brief verbal descriptions of one's observations has become a less popular method of delineating differences among avian populations and species. Although this is understandable in some ways (quantifiable, reproducible results will always be favored in science), the measurement of plumage variation is something we have not yet learned to perform with comprehensive exactitude. The utility of measurement of the length of body parts has long been recognized in studying geographic variation and species limits (e.g., Ridgway 1911, Baldwin et al. 1931), but plumage variation is a more difficult thing to measure. In providing reproducible, quantified values for plumage "color," reflectance spectrophotometry would seem to represent a boon to students of geographic variation. Nevertheless, the capabilities of the method still fall short of what the human eye can perform quickly and accurately.

The results of this study have shown me that the human eye is still a far superior instrument for recognizing similarities and differences among specimens than the very detailed, reproducible results obtained from measuring light reflectance from important areas on these same specimens. Nevertheless, we must continue to make progress in the use of mensural data to delineate differences among populations and, in suboscines especially, species. In the parlance of recent scientific fashion, taxonomic designations are hypotheses subject to future testing. The coin by which subtly different taxa will be accepted will be quantifiable differences and diagnoses.

Genetic studies can play an important role in determining the uniqueness of populations, but we do not yet have adequate genetic samples of most species to make the broad comparisons necessary. In neotropical passerines it is becoming clear that underlying genetic differentiation often greatly exceeds observed phenotypic differentiation (e.g., Capparella 1988, Escalante 1991, Hackett 1993). Given this situation, progress in neotropical avian systematics will be most effectively advanced through widespread general collecting of skin, skeleton, and tissue specimens. Phillips (e.g., 1986) long emphasized the need for increased efforts to collect new material. The scientific and conservation benefits of new collections have also been recently emphasized by Remsen (1995), Winker et al. (1996), and Winker (1996).

Even though Bangs' (1906) subspecies *idoneus* does not appear valid based on plumage, members of this allopatric population of Costa Rica and Panamá tend to have more throat scalloping than the northern forms, and genetic differences are probable. Considering the sedentary nature of *Anabacerthia variegaticeps* and the existence of several allopatric populations in Middle America, it seems likely that other distinct subspecies remain to be discovered. Given the species' plumage conservatism, however, determination of the distinctiveness of other populations will be facilitated by genetic and perhaps vocal studies. More detailed study of this interesting bird is warranted. In addition to our poor understanding of its geographic variation, it seems that the nest of the species has never been described (Wetmore 1972, Howell and Webb 1995).

MATERIAL EXAMINED

MEXICO: Guerrero (6); Veracruz (7); Oaxaca (1); Chiapas (3); unknown ("Mexique" and "Mexico;" 3); GUATEMALA (5); HONDURAS (15); COSTA RICA (28); PANAMA (46).

ACKNOWLEDGMENTS

Examination of specimens in the American Museum of Natural History was made possible in part with support from the Frank M. Chapman Memorial Fund. I thank George Barrowclough and Mary LeCroy for making my visit to AMNH so pleasant.

LITERATURE CITED

A.O.U. 1983. Check-list of North American birds. 6th ed. American Ornithologists' Union, Lawrence, KS.

BALDWIN, S. P., H. C. OBERHOLSER, and L. G. WORLEY. 1931. Measurements of birds. Sci. Publ. Cleveland Mus. Nat. Hist. 2:1-165.

BANGS, O. 1906. Notes on birds from Costa Rica and Chiriqui, with descriptions of new forms and new records for Costa Rica. Proc. Biol. Soc. Washington 19:101-112.

BINFORD, L. 1989. A distributional survey of the birds of the Mexican state of Oaxaca. Ornithol. Monogr. 43.

CAPPARELLA, A. P. 1988. Genetic variation in neotropical birds: Implications for the speciation process. Acta Congr. Int. Ornithol. 19:1658-1664.

ESCALANTE P., B. P. 1991. Genetic differentiation in yellowthroats (Parulinae: *Geothlypis*). Acta Congr. Int. Ornithol. 20:333-341.

GOLDMAN, E. A. 1951. Biological investigations in Mexico. Smithsonian Misc. Coll. 115.

HACKETT, S. J. 1993. Phylogenetics and biogeographic relationships in the neotropical genus Gymnopithys (*Formicariidae*). Wilson Bull. 105:301-315.

HOWELL, S. N. G., and S. Webb. 1995. A guide to the birds of Mexico and northern Central America. Oxford University Press, Oxford, England.

HUNTER, R. S., and R. W. Harold. 1987. The measurement of appearance. Second edition. John Wiley & Sons, New York, NY.

MAYR, E. 1969. Principles of systematic zoology. McGraw-Hill Book Company, New York, NY.

MILLER, A. H., H. FRIEDMANN, L. GRISCOM, and R. T. MOORE. 1957. Distributional check-list of the birds of Mexico. Pacific Coast Avifauna 33.

MEYER DE SCHAUENSEE, R. 1970. A guide to the birds of South America. Livingston Publishing Company, Wynnewood, PA.

NORUSIS, M. J. 1986. SPSS/PC+. SPSS, Inc., Chicago, IL.

PETERS, J. L. 1951. Check-list of birds of the world. Vol. VII. Museum of Comparative Zoology, Cambridge, MA.

PHILLIPS, A. R. 1986. Known birds of North and Middle America, Part I. Published by the author, Denver, CO.

REMSEN, J. V., Jr. 1995. The importance of continued collecting of bird specimens to ornithology and bird conservation. Bird Conserv. Int. 5:177-212.

RIDGELY, R. S., and G. TUDOR. 1994. The birds of South America, Volume II: The suboscine passerines. University Texas Press, Austin, TX.

RIDGWAY, R. 1911. The birds of North and Middle America. Part V. Bull. U.S. National Mus. 50(5):1-859.

SMITHE, F. B. 1975. Naturalist's color guide, Part I. Amer. Mus. Nat. Hist., New York, NY.

_____. 1981. Naturalist's color guide, Part III. Amer. Mus. Nat. Hist., New York, NY.

WETMORE, A. 1972. The birds of the Republic of Panamá. Part 3. Passeriformes: Dendrocolaptidae (Woodcreepers) to Oxyruncidae (Sharpbills). Smithsonian Inst. Press. Washington, DC.

WINKER, K. 1996. The crumbling infrastructure of biodiversity: The avian example. Conserv. Biol. 10:703-707.

WINKER, K., M. J. Braun, and G. R. Graves. 1996. Voucher specimens and quality control in avian molecular studies. Ibis 138:345-346.

[1] Division of Birds National Museum of Natural History MSC MRC 534, Smithsonian Institution Washington, DC. 20560 (301-238-3027; fax: 301-238-3059; winker@onyx.si.edu)

[2] University of Alaska Museum, 907 Yukon Drive, Fairbanks, AK 99775-6960