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GEOGRAPHIC VARIATION IN *DICRODON GUTTULATUM* DUMERIL AND BIBRON (REPTILIA: TEIIDAE) IN NORTHWESTERN SOUTH AMERICA

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Abstract

Five of fifteen characters vary geographically among the littoral and montane populations of *Dicrodon guttulatum*. On the basis of character analysis *D. barbouri* Noble is referred to the synonomy of *D. Guttulatum* and *D. holmbergi* is reduced to a subspecies of *D. guttulatum*. *D. g. guttulatum* ranges in northwestern South America from the Ecuadorian Province of Manabi south to the Peruvian Department of Libertad, possibly to the Department of Lima. *D. g. holmbergi* is known only from the Department of Libertad.

Introduction

Dicrodon guttulatum is known from the arid and semi-arid coastal plains of Ecuador and Peru, the western foothills of the Andean cordillera, and Isla Santa Clara (Isla de los Muertos) in the Gulf of Guayaquil (Map I). The species apparently penetrates the Choco rainforest in northwestern Ecuador although its presence there is not confirmed. Its well-delimited north-south distribution permits the analyses of geographically variable characters traceable through contiguous Ecuadorian, and apparently non-contiguous Peruvian, populations.

Previously four monotypic species were consensually referred to *Dicrodon: heterolepis* Tschudi, *guttulatum* Duméril and Bibron, *barbouri* Noble, and *holmbergi Schmidt*. Monotypic *D. heterolepis* and polytypic *D. guttulatum* are recognized herein.

Garman (1892) described *Cnemidophorus lentiginosus* from southwestern Ecuador. Noble (1924), noting that the population near Sullana, Department of Piura, Perú, differed from adjacent populations, described as a new species *barbouri*. Barbour and Loveridge (1929) reduced *barbouri and lentiginosus* to subspecies. Burt and Burt (1931) first retained the specific distinctness but later (1933) referred *barbouri* to the synonomy of *lentiginosus*. Schmidt (1957) concluded that the populations of Chao Valley and Río Virú, Department of Libertad, Perú, merited specific distinction (*holmbergi*). He determined that *lentiginosus* was conspecific with *guttulatum* thereby necessitating the resurrection of *guttulatum*. Peters (1967) synonomyzed *Ameiva leucostigma* with *D. guttulatum*.

The seven general geographic terms used herein denote physiographic areas from which population samples were obtained. Specific localities are listed hereinafter.

Abbreviations refer to the following museums: American Museum of Natural History (AMNH); United States National Museum (USNM); Chicago Natural History Museum (CNHM); University of Illinois Museum of Natural History (UIMNH); Museum of Comparative Zoology (MCZ).

Specimens Examined

Northern Ecuador. Province of Manabí. 6Kms SE Manta, USNM 164248-50; Manta, CNHM 53835-53; 2Kms N San Clemente, USNM 164251. All *D. g. guttulatum*.

Peninsular Ecuador. Province of Guayas. Santa Elena, AMNH 21840-44, 21869-70, 21872-77, 21940-42; 1 Km N Playas, USNM 164233-35; 12 Kms N Playas, USNM 164236-38; Santa Rosa, MCZ 81495; Guayaquil, MCZ 81482; Salinas, MCZ 81484-94, UIMNH 16876; Rocks of Morro, MCZ 83137; between Buenos Aires and El Prado, MCZ 83129-31, 83141; El Morro, MCZ 83138; Buenos Aires, MCZ 83132-33; El Prado MCZ 83123-28; near Buenos Aires, MCZ 83122, 1 Km. SW Colonche, USNM 164245-47; 6 Kms. SW Colonche, USNM 164239-40, 164242-43. All *D. g. guttulatum*.

Isla Santa Clara. Province of Guayas. AMNH 28997-81, MCZ 81458-62, 81464-70, 81472-81, All *D. g. guttulatum*.

Southern Ecuador. Province of Loja. Catamayo, near La Toma, USNM 164223-29; Valley of Catamayo, USNM 164230-32; Valley of Casanga, El Empalme, USNM 164219-22. All *D. g. guttulatum*.

Northern Perú. Department of Piura. Chongolappi, AMNH 28585-87; Talara, AMNH 28969, 31953, CNHM 41676 (30 specimens); Valley of Parinas, AMNH 6663, CNHM 41573; Negritos beach, CNHM 5729; El Alto, FMNH 41575, 41578-79; Quebrada Parinas near Negritos, CNHM 8380; Valley of Parinas, approximately 6 miles N Talara, CNHM 8381; plains back of Talara, CNHM 37366-68; Negritos CNHM 8455-57; Punta Mar, CNHM 9820-29; Quebrada de Mogollón, Sierra de Amatope, CNHM 41574; between Negritos and Verdún Alto, CNHM 41577; Mallares in Chira Valley, CNHM 41581; La Brea, CNHM 41582. All *D. g. guttulatum*. *Sullana*. Department of Piura. Sullana, AMNH 28506-14. *D. g. guttulatum*.

Pacasmayo. Department of Libertad. Valley of Río Virú, CNHM 8179, USNM 127824-25; Pacasmayo, AMNH 20742-44. D. g. holmbergi

Matucana. Department of Lima. Matucana, CNHM 41580. *D g guttulalum?*

Character Variation

Five of the 14 characters analyzed vary geographically: number of rows of longitudinal (1) and transverse (2) dorsal scales and enlarged antebrachial scales (3); maximum and mean snout-vent (s-v) length (4); and nature of the supra-orbital semicircles (5). Geographically non-variable characters are: number of femoral pores (1) and digital lamellae (2); nature of the frontoparietal (3); anterior nasal (4), and prefrontal scales (5); ratios of head length (6) and tibia length (7) to s-v length; maximum s-v length (8); dorsal body color (9).

The Isla Santa Clara and Pacasmayo populations diverge from all others in the number of rows of longitudinal dorsal scales. Geographic variation among the remaining populations is insignificant. An abrupt mean increase, notably absent among the Ecuadorian, occurs among the Peruvian populations.

TABLE 1. Geographic Variation in the Number of Rows of Longitudinal Dorsal Scales.

Population	Range	$\bar{x}$	σ	N
Northern Ecuador	86-115	95	7	23
Peninsular Ecuador	85-109	96	5	58
Isla Santa Clara	91-109	104	4	31
Southern Ecuador	84-101	93	5	14
Northern Peru	77-110	92	7	59
Sullana	90-106	96	5	9
Pacasmayo	91-117	104	7	7

Geographic variation in the number of rows of transverseverse dorsal scales is strikingly similar to that of the aforementioned character except for the Isla Santa Clara population. The Pacasmayo population is somewhat differentiated from the northern populatins. An irregular mean increase, absent in the Ecuadorian, obtains among the Peruvian populations.

TABLE 2. Geographic Variation in the Number of Rows of Transverse Dorsal Scales.

Population	Range	$\bar{x}$	σ	N
Northern Ecuador	202-266	238	14	23
Peninsular Ecuador	206-254	234	28	54
Isla Santa Clara	214-268	240	12	31
Southern Ecuador	220-248	234	10	14
Northern Peru	176-260	224	20	59
Sullana	226-268	242	14	9
Pacasmayo	226-280	258	18	7

Sexually mature individuals of both sexes from Isla Santa Clara are larger and therefore have a greater mean s-v length than individuals from mainland populations although closely approached in means by the Pacasmayo populations. The means of other populations are closely approximated.

TABLE 3. Geographic Variation in Snout-Vent Length.

Population	Range	$\bar{x}$	σ	N	Sex
Northern Ecuador	87-118 57-128	101 83	11 20	6 16	
Peninsular Ecuador	46-149 51-132	116 89	46 23	17 26	
Isla Santa Clara	57-163 85-148	126 124	30 14	17 14	
Southern Ecuador	84-129 65-132	112 107	20 23	3 11	
Northern Peru	106-145 44-121	112 69	30 21	13 44	
Sullana	110-115 50-118	112 90	2 29	3 6	
Pacasmayo	123-125 76-136	124 106	1 23	1 5	

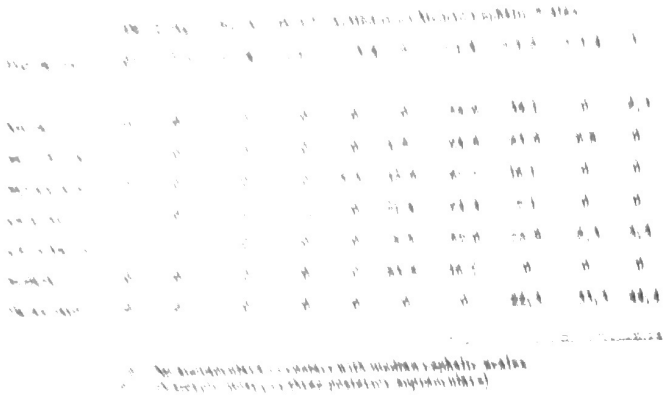
Schmidt (1957) accorded specific significance to the number of rows and relative size of the enlarged antebrachial Scales. In the paratypic series of *holmbergi* (CNHM 8179, USNM 127824-25, AMNH 20742-44) three rows (not four as cited by Schmidt, *op. cit.*) are present, the inferior rows being subequal in size to the superior. More than 75% of the individuals from Sullana and Pacasmayo possess three rows (Table 4) strongly differentiating them from the northern populations. Among any other population the character is present in a maximum of 46%.

TABLE 4. Geographic Variation in the Number of Rows of Enlarged Antebrachial Scales.

Population	% with 3 Rows	% with 2 Rows	N
Northern Ecuador	0.0	100	23
Peninsular Ecuador	3.4	96.6	59
Isla Santa Clara	35.5	64.5	31
Southern Ecuador	35.8	64.2	14
Northern Peru	3.4	96.6	60
Sullana	77.7	22.3	9
Pacasmayo	85.7	14.3	7

Schmidt (1957) stated that the primary diagnostic criterion of *holmbergi* is the separation of the three posterior supraocular scales from the median head scales by an intervening ring of circumsupraocular scales. Such separation obtains in four paratypes (CNHM 8179, USNM 127824-25, AMNH 20742-44). Thus, only 66% of the population sample is distinguishable. A significantly greater percentage of the Pacasmayo population sample has at least 2¾ posterior supraoculars separated from the median cephalic scutes (Table 5). Among the northern populations the percentage of individuals exhibiting separation is significantly less than the 75% level usually considered the minimum for subspecific recognition (Simpson, 1961).

TABLE 4. Geographic variation in the separation of the posterior supraoculars from the median cephalic scales.



DISCUSSION

Schmidt (1957) differentiated *holmbergi* on the basis of two characters, neither of which is unique to the populations. Although a high percentage of individuals from Pacasmayo possess three rows of enlarged antebrachials, it is equally high in the Sullana and in other populations. The percentage of individuals among the Pacasmayo population with three posterior supraoculars separated from the median cephalic scutes is insufficient for taxonomic recognition. More than 75% of the population sample has at least 2/4 posterior supraoculars separated from the median head scales. Similar separation occurs at low frequencies in other populations. Thus, the Pacasmayo population is divergent from all other populations of *guttulatum* in one and recognizably differentiated in two characters (one shared with the Sullana population).

The holotype and paratypic series was collected in the Chao Valley (Schmidt, 1957). The specimens from Pacasmayo (AMNH 20742-44) and valley of Río Virú (CNHM 8179) are also designated as paratypes although they are not included in the original specific description. The three localities are separated by east-west directed valleys and arid expanses from which *D. guttulatum* has not been reported. The geographic isolation of the Peruvian populations may account for the greater mean divergence in geographically variable characters not observed in Ecuadorian populations. The Ecuadorian populations are apparently sufficiently contiguous to maintain greater character homogeneity.

The Sullana series consists of the paratypes of *D. barbouri* Noble (AMNH 28506-14). The population sample approaches that of Pacasmayo in one character (Table 4) and tends toward the northern populations in others. Noble (1924) diagnosed *barbouri* as having a more pallid dorsum than adjacent populations. Pale individuals occur sporadically among other populations in the more arid areas. *D. barbouri* is thus consubspecific with the nominate race. The Sullana and the Pacasmayo populations are separated by approximately 300 kilometers from which *guttulatum* has not been reported.

Although separated from the southern Ecuadorian population by physiographic barriers the northern Peruvian population tends strongly toward the Ecuadorian rather than the southern Peruvian populations. Parker (1938) remarked that the Catamayo Valley appears to form a route by which many reptiles of the desert coastal plain reach the arid montane regions, thereby reducing the effects of geographic isolation.

A female specimen (CNHM 41580) bearing the locality "Matucana, Department of Lima", agrees in all salient characters with the nominate race. If the datum is not erroneous, the individual represents a southern range extension of more than 500 kilometers (Fig. 1).

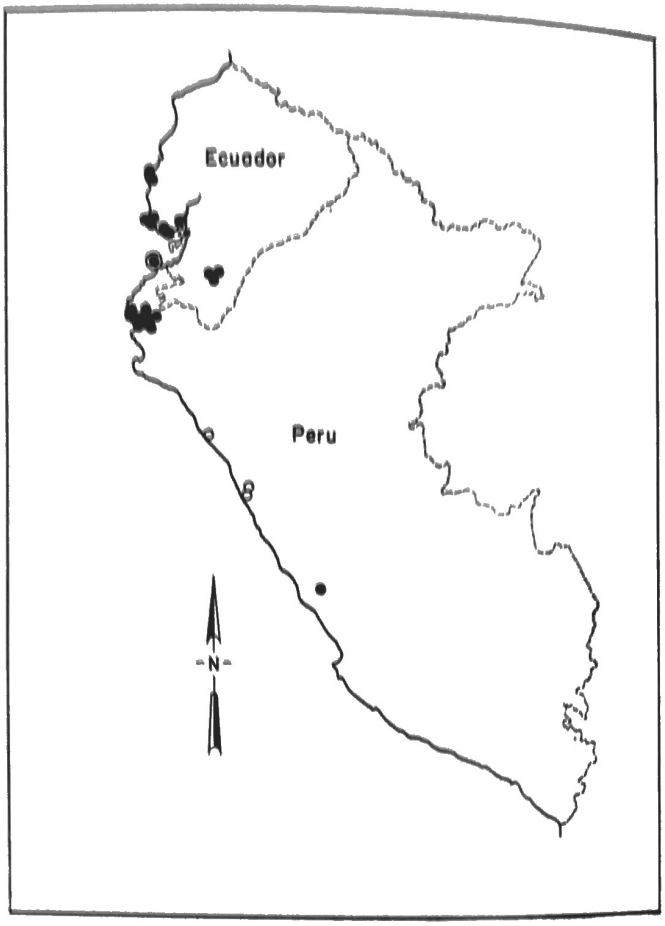


FIGURE 1. Localities of *Dicrodon guttulatum* Duméril and Bibron. Black circles, *D. g. guttulatum;* white circles, *D. g. holmbergi;* black circle within white, Isla Santa Clara.

Isla Santa Clara supports a dense population of *guttulatum*. This population has diverged from the mainland population in two characters. The differentiation is not at a level of taxonomic recognition. Character convergence with the Pacasmayo population is noteworthy.

In the Ecuadorian littoral *guttulatum* is locally abundant in the sparsely-vegetated area from the Peninsula of Santa Elena north to the Province of Manabí. It has not been reported from the Chocó rainforest (northern Manabí and the Province of Esmeraldas) although sight records are available (personal communication, Gustavo Orcés-V.). *Guttulatum* is ecologically adaptable to more humid areas, having been collected along the periphery