

AMERICAN MUSEUM
Novitates

PUBLISHED BY
THE AMERICAN MUSEUM
OF NATURAL HISTORY

CENTRAL PARK WEST AT 79TH STREET
NEW YORK, N.Y. 10024 U.S.A.

NUMBER 2671 FEBRUARY 6, 1979

CHARLES J. COLE, CLARENCE J. MCCOY
AND FEDERICO ACHAVAL

Karyotype of a South American Teiid Lizard,
Cnemidophorus lacertoides

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N.Y. 10024

Number 2671, pp. 1-5, fig. 1, table 1

February 6, 1979

Karyotype of a South American Teiid Lizard, *Cnemidophorus lacertoides*

CHARLES J. COLE,¹ CLARENCE J. McCOY,² and FEDERICO ACHAVAL³

ABSTRACT

Two males typical of *Cnemidophorus lacertoides* from Abra de Perdomo, Uruguay, had a diploid number of 50 chromosomes, including 26 macrochromosomes (all telocentric or essentially so, excepting one pair of submetacentrics) and 24 microchromosomes. A dotlike satellite occurred on the end of the largest chromosome opposite the centromere (telocentric).

A variant form of *C. lacertoides* occurring in an isolated population at Cabo Polonio, Uruguay, is

reported also. This form has the dorsal color pattern reduced, but its karyotype and scutellation are similar to those of the typically patterned form.

Among all other teiids whose chromosomes have been investigated, the karyotype of *Cnemidophorus lacertoides* is most similar to that of some *Ameiva* and *Kentropyx striatus*. The full significance of these observations to South American teiid systematics cannot be assessed, however, until additional comparative investigations are completed.

INTRODUCTION

Cnemidophorus karyotypes have been investigated extensively because some parthenogenetic species are triploids (Pennock, 1965), and chromosomal data can be invaluable in elucidating their evolutionary relationships (Lowe and Wright, 1966; see Cole, 1975 for a review). Consequently, among speciose genera of lizards (including more than 30 species and thus more than one percent of the world's known saurian fauna), *Cnemidophorus* may be the best known karyotypically.

Lowe et al. (1970) reported observations on karyotypes of 29 species of *Cnemidophorus* and used chromosomal data along with other char-

acteristics in recognizing five species groups. While that paper was in press, Fritts (1969) reported karyotypes for another species and proposed another reasonable species group. Karyotypes of additional species were described and discussed by Robinson (1973) and Bickham, McKinney, and Mathews ("1976" [1977]). Furthermore, karyotypes of some species have been reported more than once, but it is beyond the scope of this paper to present a full bibliography of *Cnemidophorus* karyotypes.

To date, karyotypes have been reported for nearly all the North American and all the Central American species of *Cnemidophorus*. In

¹Associate Curator, Department of Herpetology, The American Museum of Natural History.

²Curator, Section of Amphibians and Reptiles, Carnegie Museum of Natural History.

³Curator, Museo Nacional de Historia Natural de Montevideo, Uruguay; Asistente, Departamento de Zoología Vertebrados, Facultad de Humanidades y Ciencias, Universidad de La Republica.

contrast, less than half the South American species have been karyotyped, even though their chromosomes are of special interest because some South American populations of *Cnemidophorus lemniscatus* (Linnaeus, 1758) are parthenogenetic (Vanzolini, 1970; Hoogmoed, 1973; Peccinini-Seale and Frota-Pessoa, 1974). Therefore, upon obtaining living examples of both the typically patterned and a variant form of the rare and little known *Cnemidophorus lacertoides* Duméril and Bibron, 1839, we took the opportunity to determine their karyotypes.

ACKNOWLEDGMENTS

We are grateful to Ms. Carol R. Townsend, who made the chromosome preparations, and the O'Neil Fund, Carnegie Museum of Natural History, for supporting field work in Uruguay. Specimens examined are in the collections of the American Museum of Natural History, New York (AMNH), Carnegie Museum of Natural History, Pittsburgh (CM), Museo Nacional de Historia Natural, Montevideo (MNHN), and Departamento de Zoología Vertebrados, Facultad de Humanidades y Ciencias, Universidad de La Republica, Montevideo (ZVC-R).

METHODS

Chromosomes of 25 cells were examined. Preparations were of whole blood cultures incubated at 36 degrees centigrade for 72 hours in Chromosome Medium 1A (with phytohemagglutinin) of Grand Island Biological Company. Terminology regarding general aspects of *Cnemidophorus* karyotypes, particularly the various sets of chromosomes, follows Lowe and Wright (1966). Terminology regarding centromere position follows Cole (1970).

SPECIMENS EXAMINED KARYOTYPICALLY: Three specimens of *Cnemidophorus lacertoides* were available for karyotyping: URUGUAY: *Depto. Maldonado*: Abra de Perdomo (AMNH 115938, 115939; two males); and *Depto. Rocha*: Cabo Polonio (AMNH 116321; one female).

OBSERVATIONS AND DISCUSSION

The typical *Cnemidophorus lacertoides* (fig. 1A) has a diploid number of 50 chromosomes

(fig. 1C). None of the chromosomes is clearly referable to Set I, 26 are of Set II, and 24 are of Set III (microchromosomes). Thus, using the abbreviations of Lowe and Wright (1966), this is a 0+26+24 karyotype ($2n=50$). Excepting the third largest pair, which is submetacentric, all the macrochromosomes (Set II) are telocentric or essentially so. The largest pair is distinctly larger than the second largest pair and bears a tiny, dotlike, terminal satellite on the end opposite the centromere. Frequently one or two of the larger microchromosomes appear metacentric and occasionally a few others appear bi-armed also, but usually their shapes cannot be clearly resolved. No heteromorphic pairs were apparent among either the macrochromosomes or microchromosomes.

An unreported form of *C. lacertoides* (fig. 1B) occurs at Cabo Polonio, Depto. Rocha, Uruguay. This population is isolated by a zone of unsuitable habitat consisting of a ring of moving sand, marshes, and other non-rocky biotopes. Nineteen specimens examined from Cabo Polonio all show some degree of reduction of dorsal color pattern, but the sample does not differ from adjacent Uruguayan populations in scutellation (table 1).

Reduced expression of the color pattern at Cabo Polonio is due neither to sexual dimorphism nor to ontogenetic variation, but it does show individual variation. An individual with

TABLE 1
Comparison of Three Characteristics of Scutellation in Two Samples^a of *Cnemidophorus lacertoides* from Uruguay

Characteristic	Cabo Polonio	South of Río Negro
	N=18	N=76
Granules around body	87.5±1.03 (80-96) ^b	87.4±0.69 (74-102)
Femoral pores (total)	20.8±0.32 (18-23)	20.7±0.20 (16-25)
Fourth toe lamellae (total)	44.5±0.63 (39-48)	46.0±0.39 (36-55)

^aSexes pooled as there is no sexual dimorphism in these characteristics.

^bMean ± one standard error of the mean (range).

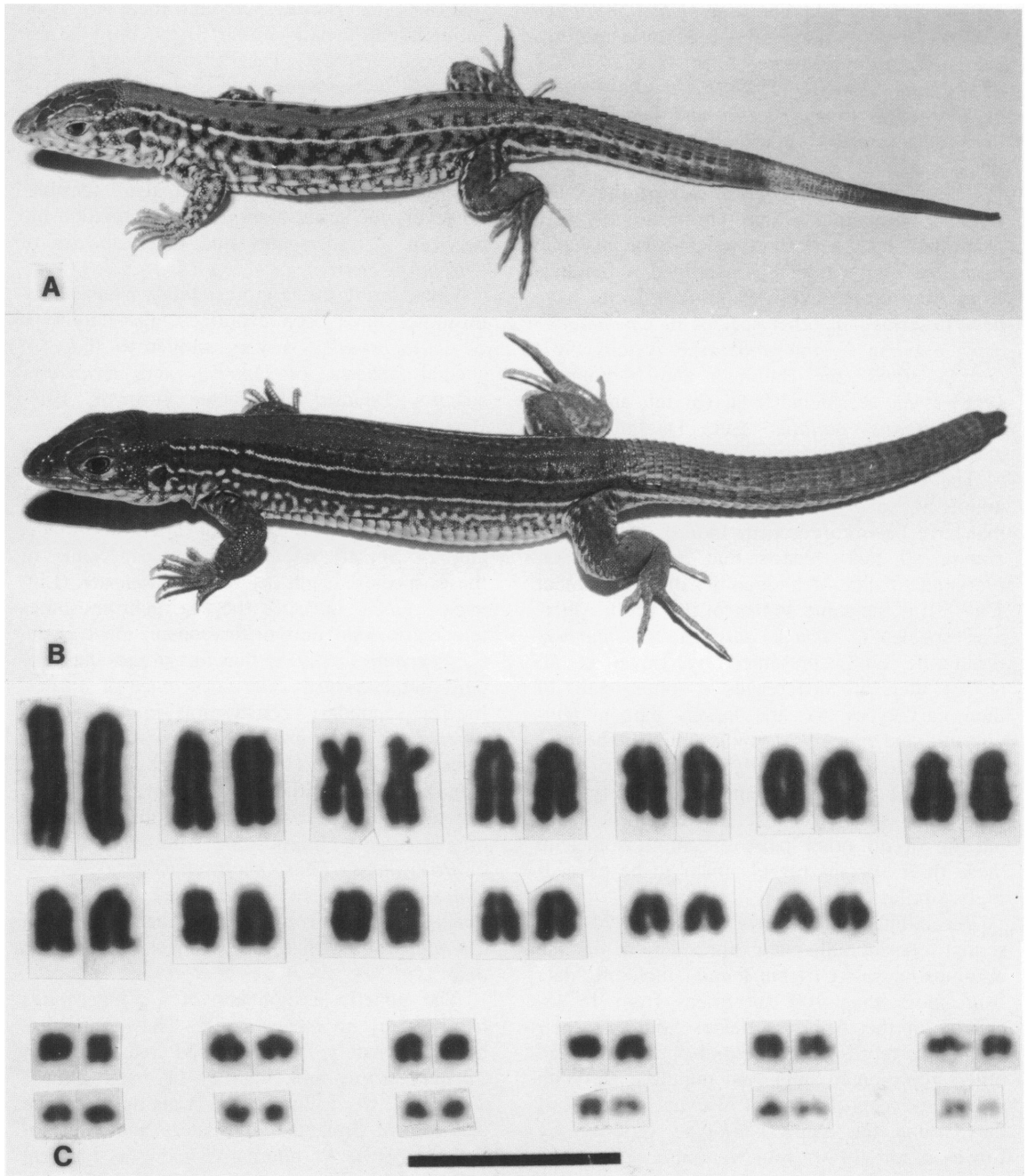


FIG. 1. *Cnemidophorus lacertoides* and chromosomes. A. Living male with typical color pattern from Abra de Perdomo, AMNH 115938, snout-vent length=62 mm. B. Living female with reduced color pattern from Cabo Polonio, AMNH 116321, snout-vent length=70 mm. C. Diploid karyotype, $2n=50$, from a male, AMNH 115939; line represents 10μ .

extreme pattern reduction (e.g., CM 65052) has a broad, green middorsal stripe on a uniform pearl-gray ground color. Others (e.g., MNHN 2532-2533; ZVC-R 2519-2520) show faint broken traces of the dorsal and lateral white lines and scattered black flecks between the lines.

The single specimen (female) of the Cabo Polonio population whose chromosomes were examined had a karyotype indistinguishable from that of the typically patterned individuals from Abra de Perdomo. Patternless forms have been described in other species of *Cnemidophorus*: e.g., in *C. inornatus* (see Axtell, 1961) and *C. tigris* (see Ballinger and McKinney, 1968) as an occasional local variant, and in *C. septemvittatus pallidus* (see Duellman and Zweifel, 1962) as characterizing a subspecies.

The karyotype of *C. lacertoides* is unique among those of all species of *Cnemidophorus* that have been karyotyped. Indeed, it is unique among all teiid lizards that have been karyotyped to date. Although its diploid number ($2n=50$) is the same as that of the South American species *C. lemniscatus* and *C. murinus* (Laurenti, 1768) presented by Lowe et al. (1970), there are differences in some details of their karyotypes: (1) the largest pair in *lemniscatus* and *murinus* (which similarly bears a terminal satellite) is clearly subtelocentric; and (2) none of the Set II pairs in *lemniscatus* or *murinus* is submetacentric. Nevertheless, comparison of all other pairs of chromosomes in these three species reveals them to be exceedingly similar.

Peccinini-Seale and Frota-Pessoa (1974) presented considerable new information on the chromosomes of *C. lemniscatus*, including data from more than 100 specimens from 15 localities in the Amazon Basin. Some of their specimens represented bisexual populations and others represented unisexual populations. With only one exception, for all bisexual populations they found the same karyotype reported by Lowe et al. (1970), but variants were found among the unisexuals (although each population sample showed only one karyotype; no local polymorphism was found). The exception was karyotype E, which they found in specimens of both sexes from Urucurituba, Brazil. In this karyotype, the largest pair is more similar to

that of *C. lacertoides*, although there still is no submetacentric pair similar to the third largest pair in *lacertoides*. The karyotypic differences between *C. lacertoides* and *C. lemniscatus* type E could have evolved from a common ancestor by means of fixation of a very few (perhaps two or three) unequal pericentric inversions. Alternative explanations are also feasible, however, including a more distant relationship between *C. lacertoides* and other species of *Cnemidophorus*.

Considering the few other teiids whose chromosomes have been examined, the karyotype of *C. lacertoides* is very similar to those of several species of *Ameiva* and *Kentropyx striatus* (Daudin, 1802) (see Gorman, 1970; Becak, Becak, and Denaro, 1972). As *C. lacertoides*, the five species of *Ameiva* reported and *Kentropyx striatus* all have a diploid number of 50 chromosomes, including no Set I macrochromosomes, 26 Set II macrochromosomes, and 24 Set III microchromosomes. Some of these species, such as *Ameiva ameiva* (Linnaeus, 1758), have all the macrochromosomes telocentric, and thus differ conspicuously from *C. lacertoides* only in that *lacertoides* has one pair submetacentric. The occurrence of a satellite or secondary constriction in species of *Ameiva* or *Kentropyx striatus* was not mentioned by Gorman (1970) or Becak, Becak, and Denaro (1972), although Gorman's figure 3B suggests that *K. striatus* has a terminal satellite on the largest chromosome, similar to that of *C. lacertoides*. Thus, karyotypically, *C. lacertoides* may be more similar to some species of *Ameiva* and *Kentropyx* than to any species of *Cnemidophorus* that has been karyotyped to date.

The generic assignment of *C. lacertoides* has been by no means stable. The species has been alternately assigned and reassigned to *Cnemidophorus* and *Ameiva*. In using *Cnemidophorus*, we followed the Catalogue of the Neotropical Squamata by Peters and Donoso-Barros (1970). An alternative view (assignment to *Ameiva*) can be found in Vanzolini and Valencia ("1965" [1966]). Although the karyotype of *C. lacertoides* appears to be more similar to those of some species of *Ameiva* and *Kentropyx* than to those of other species of *Cnemidophorus*, more detailed karyotypic studies are

needed on the remainder of the South American species of *Ameiva* and *Cnemidophorus* before the chromosomal data can be properly considered in determining their phylogenetic relationships. Additional comments on the generic assignment of *C. lacertoides* and additional details concerning other characteristics and specimens examined will be provided in a forthcoming review of the species, which is being prepared by two of us (CJM and FA).

LITERATURE CITED

- Axtell, Ralph W.
1961. *Cnemidophorus inornatus*, the valid name for the little striped whiptail lizard, with the description of an annectant subspecies. *Copeia*, 1961, no. 2, pp. 148-158.
- Ballinger, Royce E., and Charles O. McKinney
1968. Occurrence of a patternless morph of *Cnemidophorus*. *Herpetologica*, vol. 24, no. 3, pp. 264-265.
- Becak, Maria Luiza, Willy Becak, and Leonor Denaro
1972. Chromosome polymorphism, geographical variation and karyotypes in sauria. *Caryologia*, vol. 25, no. 3, pp. 313-326.
- Bickham, John W., Charles O. McKinney, and Michael F. Mathews
"1976" [1977]. Karyotypes of the parthenogenetic whiptail lizard *Cnemidophorus laredoensis* and its presumed parental species (Sauria: Teiidae). *Herpetologica*, vol. 32, no. 4, pp. 395-399.
- Cole, Charles J.
1970. Karyotypes and evolution of the *spinus* group of lizards in the genus *Sceloporus*. *Amer. Mus. Novitates*, no. 2431, pp. 1-47.
1975. Evolution of parthenogenetic species of reptiles. In Reinboth, R. (ed.), *Intersexuality in the animal kingdom*. Berlin, Heidelberg, and New York, Springer-Verlag, pp. 340-355.
- Duellman, William E., and Richard G. Zweifel
1962. A synopsis of the lizards of the *sexlineatus* group (genus *Cnemidophorus*). *Bull. Amer. Mus. Nat. Hist.*, vol. 123, art. 3, pp. 155-210.
- Fritts, Thomas H.
1969. The systematics of the parthenogenetic lizards of the *Cnemidophorus cozumela* complex. *Copeia*, 1969, no. 3, pp. 519-535.
- Gorman, George C.
1970. Chromosomes and the systematics of the family Teiidae (Sauria, Reptilia). *Copeia*, 1970, no. 2, pp. 230-245.
- Hoogmoed, Marinus Steven
1973. Notes on the herpetofauna of Surinam. IV. The lizards and amphisbaenians of Surinam. The Hague, Dr. W. Junk, ix+419 pp.
- Lowe, Charles H., and John W. Wright
1966. Evolution of parthenogenetic species of *Cnemidophorus* (whiptail lizards) in western North America. *Jour. Arizona Acad. Sci.*, vol. 4, no. 2, pp. 81-87.
- Lowe, Charles H., John W. Wright, Charles J. Cole, and Robert L. Bezy
1970. Chromosomes and evolution of the species groups of *Cnemidophorus* (Reptilia: Teiidae). *Syst. Zool.*, vol. 19, no. 2, pp. 128-141.
- Peccinini-Seale, Denise, and O. Frota-Pessoa
1974. Structural heterozygosity in parthenogenetic populations of *Cnemidophorus lemniscatus* (Sauria, Teiidae) from the Amazonas Valley. *Chromosoma*, vol. 47, no. 4, pp. 439-451.
- Pennock, Lewis A.
1965. Triploidy in parthenogenetic species of the teiid lizard, genus *Cnemidophorus*. *Science*, vol. 149, pp. 539-540.
- Peters, James A., and Roberto Donoso-Barros
1970. Catalogue of the Neotropical Squamata: Part II. Lizards and amphisbaenians. *U. S. Natl. Mus. Bull.* 297, pp. viii+293.
- Robinson, Michael D.
1973. Chromosomes and systematics of the Baja California whiptail lizards *Cnemidophorus hyperythrus* and *C. ceralbensis* (Reptilia: Teiidae). *Syst. Zool.*, vol. 22, no. 1, pp. 30-35.
- Vanzolini, P. E.
1970. Unisexual *Cnemidophorus lemniscatus* in the Amazonas Valley: A preliminary note (Sauria, Teiidae). *Papeis Avulsos Zool.*, São Paulo, vol. 23, no. 7, pp. 63-68.
- Vanzolini, P. E., and J. Valencia
"1965" [1966]. The genus *Dracaena*, with a brief consideration of macroteiid relationships (Sauria, Teiidae). *Arq. Zool.*, vol. 13, pp. 7-35, 5 pls.

