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MORPHOLOGICAL VARIATION IN SELECTED POPULATIONS OF THE TEIID LIZARDS *Cnemidophorus velox* and *Cnemidophorus inornatus*

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ABSTRACT

With the announcement by Maslin (1962) that several species of the teiid lizard genus *Cnemidophorus* apparently reproduce parthenogenetically, came the possibility of new studies comparing the variability of superficially similar bisexual and unisexual forms. The present study presents a detailed comparison of the variability exhibited by the bisexual *Cnemidophorus inornatus* Baird, where genetic recombination is possible, and the unisexual *Cnemidophorus volex* Springer, where genetic recombination is (*sensu strictu*) theoretically impossible. It was undertaken to test the hypothesis that bisexual species are more variable than unisexual species and to provide a more objective means for distinguishing *C. velox* and *C. inornatus*.

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Analyses of color pattern and four meristic characters, for seven population samples of *velox* and five samples of *inornatus*, demonstrate that, in general, *inornatus* is the more variable species. However, several populations of *velox* exceed *inornatus* in the variability of two characters. Statistically significant differences are found within each species, but biological differences do not appear to warrant taxonomic revisions.

C. velox and *C. inornatus* are sympatric at sites fourteen miles north of Gallup, McKinley County, one mile north of Aztec, San Juan County, and four miles southwest of Santa Fe, Santa Fe County, New Mexico.

The anterior extension of sublabial scales and the relative size of post-antebrachial scales constitute characters which objectively separate all specimens of *velox* and *inornatus* used in this study.

INTRODUCTION

Maslin (1962) reported the possibility of parthenogenesis occurring in six species of the lizard genus *Cnemidophorus*. The evidence for this hypothesis was based on the observation that males were virtually absent from all series examined. Only three males, representing two of these species, were discovered in the course of Maslin's study. One of the males was identified as an example of *Cnemidophorus tesselatus*. The other two were striped, non-spotted whip-tails from northwestern New Mexico and had to be allocated to either *C. velox* or *C. inornatus*. *C. velox* had been collected previously from the northern third of New Mexico, but at the time of Maslin's (1962) report, the northern distributional limits of *inornatus* were thought to be over 100 miles south of the site from which the males had come. On this basis, the two males (UCM 6579-6580) were allocated to *C. velox*. If these were actually specimens of *velox*, they represented the only males found in Maslin's examination of 104 individuals of this species. While this was a large series in total numbers, the two males were from an isolated sample of only three lizards and left some doubt as to their proper identification.

Subsequent to Maslin's paper (1962), populations of *inornatus* were reported from northern New Mexico by Harris (1963). As this new information reduced the value of a geographical criterion for the taxonomic allocation of the small sample containing the males, a more critical examination seemed desirable.

The taxonomic characters that, in part, enabled Lowe (1955) to recognize the specific, rather than subspecific, status of *velox* and *inornatus* are based upon average differences. Because of the broad overlap in ranges of variation, these characters are inadequate for a confident segregation of a mixed sample of museum specimens. This is particularly true if the sample is from the northwestern periphery of the *inornatus* range, where this species apparently attains its largest size. The application of objective characters to this and additional samples from the northwestern New Mexico site reveals that *velox* and *inornatus* are sympatric at this location. The two male "*velox*" reported by Maslin (1962) are reallocated to *C. inornatus.* This corroborates the suggestion advanced by Gehlbach (1965:293,321) that these two males might represent *inornatus* sympatric with *velox.*

Mayr (1963:410) pointed out the need for comparative studies of phenotypic variation in unisexual and bisexual animals. The purpose of this paper is to present such an analysis. It is assumed that the relative variability of *velox* and *inornatus* is partially influenced by their different modes of reproduction. If this assumption is correct, the study provides an indication of the evolutionary potential of these two species.

MATERIALS AND METHODS

To facilitate an analysis of geographic variation, 189 specimens of *Cnemidophorus velox* and 166 specimens of *C. inornatus* were grouped into twelve population samples (see Fig. 1). Samples of *velox* are indicated by numerals; *inornatus* by letters. Inclusion of specimens into a particular sample was based upon geographical proximity, and in some instances, upon availability of corridors which could permit contact of local populations if they were not, in fact, already part of the same population. Although the term population may not be strictly applicable to unisexual forms, such as *velox,* it is herein used to denote a group of individuals from the same general geographic area.

The samples are not intended to define the geographic limits of *velox* and *inornatus* distribution, nor do the gaps between samples necessarily indicate that these species do not occur in the intervening areas. The samples were chosen on the basis of availability of material that might show interpopulational variation patterns in the transect region. Certain samples are too small to accurately reflect the variability of the populations from which they were taken. These small samples were included in the study when they represented an important feature (e.g., sympatry), or partially characterized a previously unreported population.

The *velox* samples (1-7) roughly form a north-south transect through the eastern portion of this species range, located in Colorado and New Mexico. Five samples of *inornatus* (A-E) were used for interspecific comparisons. These samples are from northwest, north-central, and south-central New Mexico, Trans-Pecos, Texas, and central Chihuahua, Mexico. Because of the size of the Chihuahua sample (E), and its central position in the range of *inornatus,* it was at first thought to be representative of the intraspecific variation which could be expected within this species. But the extremely high coefficients of

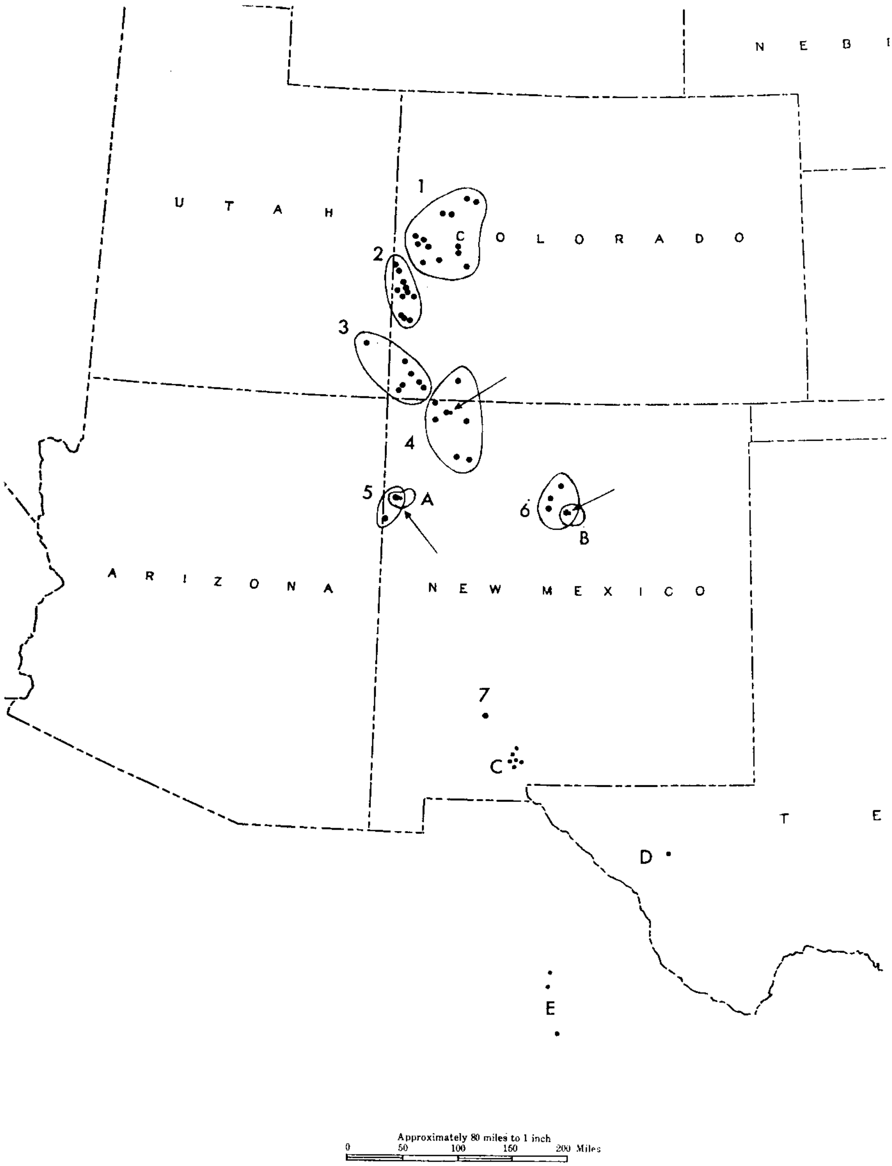

FIGURE 1. Localities of *Cnemidophorus velox* (large dots) and *Cnemidophorus inornatus* (small dots) used in this study. Samples of *velox* are denoted by the numerals 1-7, and samples of *inornatus* by the letters A-E. Sites at which sympatry has been established are indicated by arrows.

variation for several characters suggested that a cryptic species might be mixed with the *inornatus* representatives of this sample. This proved to be the case, and individuals of an undescribed, all-female species* were segregated from this sample. Ultimately, 45 individuals of this new form were separated from samples 7, C, and E.

Samples are homogeneous only in representing one of the two species. The *velox* samples are composed entirely of females with the exception of sample 1, which includes a single male (UCM 20503).

A statistical test, "2-sided" Student's t (Simpson, Roe, and Lewontin, 1960), for significance of differences was calculated for all adjacent samples for each meristic character employed. This test was also applied to two sympatric populations of *velox* and *inornatus* (5 and A; 6 and B). A null hypothesis, that there was no difference between the means of the samples tested, was used. The hypothesis was rejected if the probability of the observation was less than five percent.

Samples were grouped as follows:

C. velox

Sample 1 — 54 specimens from central Garfield County, central Mesa County, and western Delta County, Colorado.
Sample 2 — 25 specimens from southwestern Mesa County, western Montrose County, and western San Miguel County, Colorado.
Sample 3 — 16 specimens from east-central San Juan County, Utah and central Montezuma County, Colorado.
Sample 4 — 17 specimens from central La Plata County, Colorado and eastern San Juan County, New Mexico.
Sample 5 — 8 specimens from western McKinley County, New Mexico.
Sample 6 — 58 specimens from eastern Sandoval County, northwestern and west-central Santa Fe County, New Mexico.
Sample 7 — 11 specimens from south-central Sierra County, New Mexico.

C. inornatus

Sample A — 14 specimens from western McKinley County, New Mexico.
Sample B — 56 specimens from west-central Santa Fe County, New Mexico.
Sample C — 10 specimens from central Dona Ana County, New Mexico.
Sample D — 16 specimens from southeastern Culberson County, Texas.
Sample E — 70 specimens from central Chihuahua, Mexico.

*Recently described as *Cnemidophorus uniparens* by Wright and Lowe (1965).

TAXONOMIC CHARACTERS

Objective characters which can be used to distinguish between individual specimens of *velox* and *inornatus* are the anterior extent of the sublabial scales and the relative size of postantebrachial scales. The relative degree of blue pigmentation on the tail and ventral surfaces is useful in the field. Four meristic characters and one ratio are tested for their diagnostic value and used to analyze the relative degree of variability expressed by the two species.

COLOR AND COLOR PATTERN

C. velox and *C. inornatus* are among the few species of the *sexlineatus* species group which exhibit almost no ontogenetic change in color and color pattern. The basic pattern of both species consists of six complete white or yellowish stripes on a dark, unspotted dorsum. Certain individuals or populations may have a seventh vertebral stripe. This stripe is usually less distinct than the others and sometimes is discernable only in alcohol. In addition to the primary stripes, most individuals of *velox* have a distinct stripe on the side of the neck, extending from the ventro-posterior border of the tympanum to the shoulder. Northern populations of *velox* have the neck stripe joined to the dorsolateral by a vertical white bar bordering the tympanum posteriorly.

Hatchlings are more brilliantly patterned than adults due to a greater contrast between the light stripes and black dark fields. The dark fields between the stripes tend to lighten from black in the subadults to a grayish or brownish appearance in the adults. This slight color metamorphosis appears to result from a progressive diminution of melanin in the anterior halves, or entire margins, of the dorsal granules. Only a few scattered granules are involved in juveniles, more granules becoming bicolor with increased growth. This color change is less pronounced on the anterior body regions, and throughout ontogeny the flanks are always less heavily pigmented than the other dark fields.

Certain *inornatus* populations exhibit a high variability in dorsal color and color pattern. Four color-morphs were represented by the adult *inornatus* of sample B. These specimens were either (1) medium gray in all dark fields except the flank; (2) light, brownish-gray in all dark fields except the flank; or had (3) a progressive transition from black paravertebral fields, dark gray dorsolaterals, gray laterals, to light gray flank fields; (4) a striking contrast of black paravertebral and dorsolateral fields and light, copper-shaded lateral and flank fields.

One salient feature of the dorsal color pattern of these species is the variability in degree of vertebral stripe development (see Table 1). The size separation used in Table 1 follows Axtell's (1961) interpretation that adult *inornatus* have a body length of 50 millimeters or longer. This length was

TABLE 1. Vertebral Stripe Variation in *Cnemidophorus velox* and *C. inornatus*. 6 = no vertebral stripe; 6+ = vertebral stripe on nape only; 6++ = vertebral stripe extending past axillae but not to rump; 7 = vertebral stripe complete.

Sample	Body Length	N	Frequency			
			6	6+	6++	7
1	under 50 mm.	16	0%	19%	31%	50%
1	over 49 mm.	38	21%	18%	16%	45%
2	under 50 mm.	6	0%	50%	33%	17%
2	over 49 mm.	19	26%	37%	26%	11%
3	under 50 mm.	3	0%	0%	0%	100%
3	over 49 mm.	12	17%	17%	25%	41%
4	under 50 mm.	7	0%	29%	14%	57%
4	over 49 mm.	10	0%	60%	20%	20%
5	under 50 mm.	2	0%	50%	0%	50%
5	over 49 mm.	6	0%	50%	33%	17%
6	under 50 mm.	35	20%	74%	6%	0%
6	over 49 mm.	23	22%	52%	17%	9%
7	under 50 mm.	0				
7	over 49 mm.	11	55%	9%	27%	9%
A	under 50 mm.	2	0%	0%	50%	50%
A	over 49 mm.	12	17%	0%	8%	75%
B	under 50 mm.	4	0%	0%	0%	100%
B	over 49 mm.	52	0%	0%	0%	100%
C	under 50 mm.	6	0%	0%	17%	83%
C	over 49 mm.	3	33%	0%	0%	67%
D	under 50 mm.	5	0%	0%	0%	100%
D	over 49 mm.	11	0%	0%	0%	100%
E	under 50 mm.	12	0%	42%	25%	33%
E	over 49 mm.	58	2%	19%	21%	58%

arbitrary for *velox* and was chosen only to facilitate comparisons. Axtell (1961: 151) recognized four ". . . fairly homogeneous geographic populations . . ." of *inornatus,* based upon the number of stripes. Difficulty arises with this arrangement when an attempt is made to place those specimens with an abortive vertebral stripe into either the six or the seven-striped category. Only *inornatus* samples B and D were homogeneous for this character, all individuals having seven complete stripes.

The vertebral stripe of velox hatchlings may exist in several conditions: (1) complete from occiput to rump; (2) disrupted into short segments from occiput to rump, as in the hatchlings of certain *C. exsanguis* populations; (3) partially developed, extending past the axillae but ending anterior to rump; (4) partially developed, just on the nape; or (5) absent altogether. Adult *velox* specimens exhibit all of these patterns, but the frequencies in both hatchlings and adults vary according to population.

The four striping patterns are represented in all *velox* samples except 4 and 5. These two samples lack individuals with no vertebral stripe. There is an alternation in the northern samples (1-4) between a predominance of individuals with seven complete stripes and a predominance of individuals with the vertebral stripe slightly developed on the nape. Southward, the highest frequency is stablized at the latter pattern in samples 5 and 6, and shifts to the six-striped pattern in sample 7.

All of the *inornatus* samples have the highest frequency for seven complete stripes. The eastern samples (B and D) are homogeneous for this character, and sample D can be allocated to *C. inornatus heptagrammus* Axtell on the basis of scutellation as well. The three western samples (A, C, and E) are composed of predominantly seven striped individuals, but A and C also contain individuals with no vertebral stripe and representatives with the vertebral stripe terminating anterior to the rump. Sample E contains individuals exhibiting all four degrees of vertebral stripe development.

Dean and Stock (1961:126) were hesitant in allocating whiptail lizards from the Navajo Reservoir Basin of New Mexico to *velox* because many of their specimens had a blue venter. Although there is a possibility that *inornatus* specimens were included in their series, a light blue ventral coloration is not unusual for *velox*. The ventral surfaces of living *velox* range in color from white or light blue to bluish-gray. The ventral coloration of live *inornatus* is ordinarily darker than *velox* but more variable, being either white (in some females), light blue, medium blue, or bluish-gray. The blue pigmentation is usually pronounced, especially in adult males.

At a contact zone in McKinley County, New Mexico (samples 5 and A), all but two of twenty-two individuals, of a mixed sample, could be allocated on the basis of tail color alone. The tail coloration of the *inornatus* specimens was an intense blue-violet for both sexes, with the exception of light blue in one male and blue-gray in one female. This obvious difference in tail color was not evident between the two species at the Santa Fe County site (samples 6 and B), because the *inornatus* specimens lacked any indication of violet pigmentation. Hatchlings and juveniles of both species normally have a blue tail. This color may persist in the adults or fade to various shades of gray.

SUBLABIAL SCALES

I follow Smith's (1946:26) definition of sublabials as the scales extending anteriorly between the infralabials and chinshields. The distance these scales extend anteriorly serves to separate all *velox* and *inornatus* specimens examined. In *inornatus*, the sublabials extend anteriorly past the posterior suture of the third infralabial. In *velox*, these scales do not extend past the middle of the fourth infralabial.

POSTANTEBRACHIAL SCALES

The relative size of the scales covering the posterior surface of the forearm readily separates individuals of *velox* and *inornatus.* Duellman and Zweifel (1962) characterize both *velox* and *inornatus* as having slightly enlarged postantebrachials. These species actually have a significant difference in the size of these scales. *C. inornatus* has postantebrachials that vary from being granular, in some males, to very slightly enlarged in the majority of specimens. The scales are distinctly enlarged in *velox,* although obviously smaller than those of *C. exsanguis.*

FEMORAL PORES (FP)

In *Cnemidophorus* systematics, the mean number of femoral pores is often so similar for different species, that its primary usefulness is as an indicator of intraspecific variation. It has been the custom for several years to combine the counts for both femora, because the number of pores often differs for each of the two legs.

There are no obvious geographic trends in the number of femoral pores, and overlap of ranges of variation, for both species, is virtually complete (see Table 2). The highest mean number of femoral pores is in the northernmost sample of *velox.* Sample 5 *velox,* sympatric with sample A *inornatus,* has the lowest mean number of pores of the *velox* samples. The low coefficient of variation for this sample could indicate that the variability characterizing this popu-

TABLE 2. Variation in the Number of Femoral Pores in *Cnemidophorus velox* and *C. inornatus.*
N = sample size; M = mean; SD = standard deviation;
SE = standard error; CV = coefficient of variation

Sample	N	Range and Frequency													M	SD	SE	CV
		28	29	30	31	32	33	34	35	36	37	38	39	40				
1	52				1	3	7	8	17	10	2	4			34.8	1.6	0.2	4.6
2	20				2	5		7	6						33.5	1.4	0.3	4.2
3	15			1	1	1	2	6	1	3					33.7	1.8	0.5	5.3
4	15	1	1		2	2	1	3	3	1	1				33.1	2.6	0.7	7.8
5	7			1	2	4									31.4	0.8	0.3	2.5
6	57	1			5	14	13	21	2	1					33.0	1.3	0.2	3.9
7	11				1	3	3	1	2		1				33.4	1.8	0.5	5.4
A	12				3	3	2	2	1	1					32.8	1.3	0.4	4.0
B	50		1	4	6	7	8	2	9	4	5	2	1	1	33.8	2.6	0.4	7.7
C	8			1		1	1	2	2	1					33.6	1.9	0.7	5.6
D	14	1		3	6		4								31.1	1.4	0.4	4.5
E	66	1	1	9	11	11	9	8	5	5	5		1		32.8	2.4	0.3	7.3

TABLE 3. Comparisons of Mean Number of Femoral Pores Between Adjacent and Sympatric Groups of *Cnemidophorus velox* (Numerals) and *C. inornatus* (Letters). t = Student's t value; P = probability. An observation is regarded as statistically significant if the probability is 5 percent or less.

Samples	t	P
1 and 2	3.1	.01-.001
2 and 3	.375	.8 -.7
3 and 4	.727	.5 -.4
4 and 5	.318	.8 -.7
4 and 6	.212	.9 -.8
5 and 6	3.1	.01-.001
5 and 7	2.8	.02-.01
6 and 7	.857	.4 -.3
5 and A	2.6	.02-.01
6 and B	2.0	.05-.02
7 and C	.222	.9 -.8
A and B	1.3	.2
A and C	1.1	.3 -.2
B and C	.208	.9 -.8
C and D	3.4	.01-.001
D and E	2.5	.02-.01

lation is not adequately represented, because of the small sample size. There might also be an intense selection pressure at this site, which is producing or accompanying a decline in population density (see Ford, 1964:12). An indication of the relative sizes of the *velox* and *inornatus* components is given under the Sympatry section of this paper.

Intraspecific differences, which are statistically significant, exist between three pairs of adjacent *velox* samples and between two pairs of adjacent *inornatus* samples (see Table 3). Interspecific differences are significant between samples 5 and A, and 6 and B, but not between the adjacent samples 7 and C.

C. inornatus is the more variable species in the number of femoral pores, but sample 4 *velox* has the highest variability for any single sample.

DORSAL GRANULES AROUND MIDBODY (GAB)

This character is based on the number of dorsal granules included in a single row around midbody, a point visually picked approximately midway between axillae and anterior margin of thighs. The number of such granules has proven to be relatively constant within a species. Zweifel (1959) has reviewed the history and use of this character as a means of elucidating relationships within several species groups of *Cnemidophorus*.

There is a general trend of high to low counts from north to south through the transect (see Table 4). All *velox* samples exhibit a low variability for this character. The mean difference between adjacent samples of *velox* from Colorado and northwestern New Mexico (1-4) is only 1.1 granules. Between sample 4 and populations immediately to the south (samples 5 and 6), there is a latitudinal separation of approximately 40 miles (see Fig. 1). An abrupt step and change in values occurs somewhere in this short distance. The counts become stabilized at a lower mean number of granules in samples 5-7. These three southern samples of *velox* have a mean difference of only 0.3 granule. But there is a three granule difference between means of samples 1-4 and samples 5-7. The statistical significance of this geographic shift in frequencies is indicated in Table 5 between samples 4 and 5, and samples 4 and 6. No statistical significance was demonstrated for the other adjacent samples of *velox* tested.

All *inornatus* samples exceed *velox* in variability, as is indicated by the higher coefficients of variation in Table 4. The high intraspecific variation within *inornatus* is illustrated in Table 5, where three of the five pairs of adjacent samples have a statistically significant difference between the means.

Interspecific tests reveal a high statistical significance between samples 6 and B, 7 and C, but none between 5 and A. Because of the extensive overlapping of ranges of variation, the GAB has but limited usefulness in separating these two species. This is particularly true for those geographical areas where their ranges approach or contact one another.

DORSAL GRANULES OCCIPUT TO RUMP (OR)

This character is of special interest, because Lowe (1955) emphasized it in demonstrating the species relationship of *inornatus* and *velox* and the validity of the latter. Zweifel (1959), Duellman and Wellman (1960), and Duellman and Zweifel (1962) have proposed that the dorsal granule counts indicate relative granule size. Scatter diagrams made by a graphical plotting of individual GAB counts against individual OR counts, for the corresponding specimens, disclosed little if any correlation between the two characters. Several samples were checked in this manner; thus, granule size might not be the factor expressed by this character. The GAB counts involve fewer and more regularly disposed scales, are more conservative of time, and are subject to a lower counting error.

TABLE 4. Variation in the Number of Dorsal Granules Around Midbody in *Cnemidophorus velox* and *C. inornatus*. N = sample size; M = mean; SD = standard deviation; SE = standard error; CV = coefficient of variation.

Range	Sample Frequencies											
	1	2	3	4	5	6	7	A	B	C	D	E
57												1
58										1		
59										1	2	
60									1	1		
61								1	3	1	1	3
62								1	5		3	3
63								1	5	1	1	8
64						3		1	4			2
65						1			6	1		7
66					1	3	2	1	8	1	1	6
67	2	1	1		2	6		1	6	1	2	8
68	4	1		1	1	7	1	2	2		1	9
69	4	5		2	1	8	2	1	5	1	1	7
70	3		1	1	1	5	2	2	5			5
71	6	3			1	11	4					1
72	8	3	2	2		8			1		1	1
73	14	2	3	4		2		1	2			3
74	5	4	3	3	1	1		2	1			
75	2		1	3		1						
76	2	1	1			2			1			
77	3											
78			1									
79												
80		1	1									

Sample	N	M	SD	SE	CV
1	53	72.0	2.5	0.3	3.5
2	21	71.8	2.8	0.6	3.9
3	14	73.6	3.2	0.9	4.3
4	16	72.4	2.3	0.6	3.2
5	8	69.0	2.6	0.9	3.8
6	58	69.6	2.8	0.4	4.0
7	11	69.3	1.9	0.6	2.7
A	14	67.8	4.2	1.1	6.2
B	55	66.2	3.6	0.5	5.4
C	9	63.1	3.9	1.3	6.2
D	13	64.4	4.1	1.1	6.4
E	64	66.4	3.3	0.4	5.2

TABLE 5. Comparisons of Mean Number of Granules Around Midbody Between Adjacent and Sympatric Groups of *Cnemidophorus velox* (Numerals) and *C. inornatus* (Letters). t = Student's t value; P = probability. An observation is regarded as statistically significant if the probability is 5 percent or less.

Samples	t	P
1 and 2	.308	.8-.7
2 and 3	1.7	.1
3 and 4	1.1	.3-.2
4 and 5	3.2	.01-.001
4 and 6	3.6	<.001
5 and 6	.571	.6-.5
5 and 7	.273	.8-.7
6 and 7	.333	.8-.7
5 and A	.757	.5-.4
6 and B	5.6	<.001
7 and C	4.5	<.001
A and B	1.4	.2-.1
A and C	2.6	.02-.01
B and C	2.4	.02
C and D	2.7	.01-.001
D and E	1.9	.1-.05

Despite these factors, the OR counts provide a distinction between *velox* and *inornatus* that is *not* attained with the GAB character.

A linear count was made of all granules from the first unkeeled rump scale to the enlarged occipitals. The midline was followed as closely as possible, but the granules of this region are often irregularly arranged, and lateral deviations must be made to avoid skipping scales. Unexpected deviations such as the extremely low count of 148 granules for an individual of sample 6 *velox* were rechecked carefully.

The general geographic pattern of this character in the *velox* samples is one of alternating low and high mean values, from north to south in Colorado and northwestern New Mexico. There is an eastward shift from a high mean in the latter region (sample 5) to stable and lower means in central and southern New Mexico (see Table 6). In contrast, the means for the *inornatus* samples are remarkably uniform, and no significant differences in the number of these granules are demonstrated for the adjacent samples (see Table 7.) The differences between all *velox* and *inornatus* samples are highly significant. *C. inornatus* is the more variable species in the OR character.

TABLE 6. Variation in the Number of Dorsal Granules, Occiput to Rump, in *Cnemidophorus velox* and *C. inornatus*. N = sample size; M = mean; SD = standard deviation; SE = standard error; CV = coefficient of variation.

Range	Sample Frequencies											
	1	2	3	4	5	6	7	A	B	C	D	E
142-144									2			
145-147												
148-150						1			1	1		2
151-153									1		2	3
154-156								2	5		1	3
157-159								2	3	2	1	3
160-162								1	5		2	3
163-165	1					2		4	10	1	3	7
166-168	2		1			1		1	4	4	1	8
169-171			2			8	2		5			6
172-174	7	2	4	2	1	9	1	1	2		1	3
175-177	13	4	1	3	1	17	5	1	4	1	1	4
178-180	10	6	2	1		9	2	1	3		1	1
181-183	4	1	3	7	3	7	1		1		1	3
184-186	4	2	1	2	1	3			1			1
187-189	1	2	1	1	2	1						1
190-192	1								1			
193-195		2										
196-198												
199-201		1										

Sample	N	M	SD	SE	CV
1	43	177.4	5.6	0.8	3.2
2	20	181.8	7.6	1.7	4.2
3	15	177.0	6.2	1.6	3.5
4	16	180.6	4.4	1.1	2.4
5	8	182.2	5.5	2.0	3.0
6	58	175.6	6.2	0.8	3.5
7	11	176.0	3.7	1.1	2.1
A	13	164.7	7.8	2.7	4.7
B	48	165.6	10.2	1.5	6.2
C	9	163.8	7.6	2.5	4.6
D	14	164.8	9.8	2.6	5.9
E	48	166.3	9.3	1.3	5.6

GRANULES BETWEEN PARAVERTEBRAL STRIPES (PV)

The number of dorsal granules separating the paravertebral stripes at midbody gives an indication of the relative spacing of these stripes. Zweifel (1959:67) observed that in using this character, "The counts of two or more populations are not directly comparable unless the numbers of scale rows around the body are highly similar in the populations . . .;" and, if the circumferential counts are substantially different, the spacing of the stripes may be due to scutellation differences and not to color pattern. The GAB counts for both *inornatus* and *velox* appear to be sufficiently similar to permit inferences to be drawn from an analysis in which this character is utilized.

The means for the *velox* samples are fairly uniform, and no geographic patterns are obvious. The most divergent sample is 6 (see Table 8). One individual from this sample has the paravertebral stripes fused at midbody. It was given a count value of 0 and included in the analysis because two other lizards, taken alive from this population, have the same pattern.

There is a trend, in the *inornatus* samples, of progressively higher means from north to south, then a sharp drop to a low mean number of granules in the southernmost sample. This is complicated by an indication of east-west trends of variation, with lower means characterizing the western samples (see Table 8).

The variability of *velox,* for this character, has a pattern of low variability in the northern samples (1-3) and a high variability in the southern samples (5-7).

TABLE 7. Comparisons of Mean Number of Dorsal Granules, Occiput to Rump, Between Adjacent and Sympatric Groups of *Cnemidophorus velox* (Numerals) and *C. inornatus* (Letters). t = Student's t value; P = probability. An observation is regarded as statistically significant if the probability is 5 percent or less.

Samples	t	P
1 and 2	2.6	.02-.01
2 and 3	2.0	.05
3 and 4	1.9	.1-.05
4 and 5	.771	.5-.4
4 and 6	3.0	.01-.001
5 and 6	2.8	.01-.001
5 and 7	2.9	.01-.001
6 and 7	.203	.9-.8
5 and A	5.5	<.001
6 and B	6.2	<.001
7 and C	4.6	<.001
A and B	.296	.8-.7
A and C	.273	.8-.7
B and C	.510	.6
C and D	.769	.5-.4
D and E	.532	.6-.5

TABLE 8. Variation in the Number of Dorsal Granules Separating Paravertebral Stripes at Midbody in *Cnemidophorus velox* and *C. inornatus*. N = sample size; M = mean; SD = standard deviation; SE = standard error; CV = coefficient of variation.

Sample	N	Range and Frequency														M	SD	SE	CV
		0*	1	2	3	4	5	6	7	8	9	10	11	12	13				
1	53						1	16	25	11						6.9	0.8	0.1	11.6
2	24						3	12	8	1						6.3	0.8	0.2	12.7
3	15							3	9	2	1					7.1	0.8	0.2	11.3
4	17							12	2	2		1				6.6	1.1	0.3	16.7
5	8					1	3	2	1	1						5.8	1.3	0.5	22.4
6	58	1		1	2	22	13	12	6		1					4.9	1.4	0.2	26.8
7	11					3	1	3	4							5.7	1.3	0.4	22.8
A	14					1		1	5	5	1	1				7.4	1.4	0.4	18.9
B	56						1	2	11	14	12	13	3			8.5	1.3	0.2	15.3
C	9								1	2		4	1		1	9.7	1.8	0.6	18.6
D	15									2		4	1	4	4	11.1	1.7	0.4	15.5
E	67				1	2	5	16	16	16	5	5		1		7.1	1.6	0.2	22.5

*Paravertebral Stripes fused at midbody.

Sample 4 bridges the two groups with an intermediate CV value. *C. inornatus* samples A and C, from the western portion of the transect, have a relatively high variability; whereas, the eastern samples B and D possess a lower variability. Sample E *inornatus* has the greatest variability for this species, but this is equaled or surpassed by *velox* samples 5-7.

The interspecific differences were all statistically significant, as were the intraspecific differences between all adjacent samples of *inornatus*, and several of the adjacent *velox* samples (see Table 9).

While this character is suitable for an analysis of geographic variation and variability, it is obvious from Table 8 that its use in demonstrating the specific status of these two forms is restricted to certain populations.

GRANULES BETWEEN PARAVERTEBRAL STRIPES X 100/GRANULES AROUND MIDBODY (PV/GAB)

Use of this ratio was proposed by Zweifel (1959:67). It is allegedly a better character than the PV alone, because in the ratio, ". . . the separation [of the paravertebral stripes] is related to the circumference of the body and divorced from variation in the size of the scales." This character has not previously been applied to either *velox* or *inornatus*.

Combination of the two characters demonstrates little that was not shown by the PV alone. All data on trends of variation, variability, intraspecific and interspecific differences, discussed under the PV character, are also applicable here. Both sets of parameters and values parallel one another (see Tables 10 and 11).

Table 12 presents data reductions which characterize the *velox* and *inornatus* used in this study.

TABLE 9. Comparisons of Mean Number of Granules Separating Paravertebral Stripes Between Adjacent and Sympatric Groups of *Cnemidophorus velox* (Numerals) and *C. inornatus* (Letters). t = Student's t value; P = probability. An observation is regarded as statistically significant if the probability is 5 percent or less.

Samples	t	P
1 and 2	3.1	.01-.001
2 and 3	3.4	.01-.001
3 and 4	1.4	.2-.1
4 and 5	1.5	.2-.1
4 and 6	4.7	<.001
5 and 6	1.6	.2-.1
5 and 7	.154	.9-.8
6 and 7	1.7	.1-.05
5 and A	2.6	.02-.01
6 and B	14.7	<.001
7 and C	5.5	<.001
A and B	2.8	.01-.001
A and C	3.3	.01-.001
B and C	2.4	.02-.01
C and D	4.6	<.001
D and E	8.8	<.001

TABLE 10. Variation in Number of Granules Separating Paravertebral Stripes × 100/Number of Granules Around Midbody in *Cnemidophorus velox* and *C. inornatus*. N = sample size; M = mean; SD = standard deviation; SE = standard error; CV = coefficient of variation.

Range	Sample Frequencies											
	1	2	3	4	5	6	7	A	B	C	D	E
0.0-0.9						1						
1.0-1.9												
2.0-2.9						1						
3.0-3.9												
4.0-4.9						2						1
5.0-5.9					1	15	1	1				2
6.0-6.9		1				7	2					
7.0-7.9	1	2			3	12	1		1			4
8.0-8.9	15	10	3	11	1	13	3	1				5
9.0-9.9	24	8	8	2	1	5	1		2			11
10.0-10.9	6		3	1	2		3	4	6			11
11.0-11.9	7			1				3	8	1		12
12.0-12.9								4	11	1	1	8
13.0-13.9				1		1		1	10	1	1	4
14.0-14.9									10			4
15.0-15.9									7	1		1
16.0-16.9										3	3	1
17.0-17.9										1	2	
18.0-18.9										1	1	
19.0-19.9											2	
20.0-20.9											1	
21.0-21.9											2	

Sample	N	M	SD	SE	CV
1	53	9.5	0.9	0.1	9.5
2	21	8.6	0.9	0.2	10.5
3	14	9.3	0.7	0.2	7.5
4	16	9.2	1.6	0.4	17.4
5	8	8.3	1.7	0.6	20.5
6	57	7.1	1.9	0.2	26.8
7	11	7.1	1.9	0.3	26.8
A	14	11.0	2.1	0.6	19.1
B	55	12.8	1.8	0.2	14.1
C	9	15.3	2.6	0.9	17.0
D	13	17.8	2.5	0.7	14.0
E	64	10.8	2.3	0.3	21.3

TABLE 11. Comparisons of Number of Granules Separating Paravertebral Stripes × 100/Number of Granules Around Midbody Between Adjacent and Sympatric Samples of *Cnemidophorus velox* (Numerals) and *C. inornatus* (Letters). t = Student's t value; P = probability. An observation is regarded as statistically significant if the probability is 5 percent or less.

Samples	t	P
1 and 2	4.4	<.001
2 and 3	2.5	.02-.01
3 and 4	.231	.9-.8
4 and 5	1.3	.2
4 and 6	4.1	<.001
5 and 6	1.6	.2-.1
5 and 7	1.4	.2-.1
6 and 7	0.0	1.0
5 and A	3.2	.01-.001
6 and B	16.8	<.001
7 and C	8.2	<.001
A and B	3.3	.01-.001
A and C	4.3	<.001
B and C	3.7	<.001
C and D	5.5	<.001
D and E	10.0	<.001

TABLE 12. Grand Means for Taxonomic Characters Used in an Analysis of *Cnemidophorus velox* and *C. inornatus*. A = Each locality treated as a separate entity; B = All individuals treated as a single sample. FP = femoral pores; GAB = granules around midbody; OR = granules from occiput to rump; PV = granules separating paravertebral stripes at midbody.

Character	N	Range		A		B
FP	177	28-38	*velox*	33.3 ± 0.4	*velox*	33.6
	150	28-40	*inornatus*	32.8 ± 0.4	*inornatus*	33.0
GAB	181	64-80	*velox*	71.1 ± 0.6	*velox*	71.1
	155	57-76	*inornatus*	65.6 ± 0.9	*inornatus*	66.1
OR	171	148-200	*velox*	178.6 ± 1.3	*velox*	177.7
	132	143-190	*inornatus*	165.0 ± 2.1	*inornatus*	165.6
PV	186	0*-10	*velox*	6.2 ± 0.3	*velox*	6.1
	161	3-13	*inornatus*	8.8 ± 0.4	*inornatus*	8.1
PV X 100	180	0.0-13.7	*velox*	8.4 ± 0.3	*velox*	8.4
GAB	155	4.7-21.0	*inornatus*	13.5 ± 0.5	*inornatus*	12.4

*Paravertebral stripes fused at midbody.

SYMPATRY

The lack of information regarding geographical contact of *velox* and *inornatus* has been pointed out by Maslin, Beidleman, and Lowe (1958:341), Duellman and Zweifel (1962:206), and Gehlbach (1965:293). I can now report three sites at which these species are sympatric. One site is located fourteen miles north of Gallup, McKinley County, New Mexico. Specifically, the collecting area is immediately north of the Toh La Kai Trading Post, west of U.S. 666. The site has been visited four times by University of Colorado Museum personnel. On 10 June 1953, one female *velox* and two male *inornatus* were collected by Dr. T. Paul Maslin. The second visit was made on 11 June 1964, but the day was cool and cloudy and only a few *Sceloporus* were active. The second sample was secured on 3 July 1964 and consisted of four *velox* and eight *inornatus*. I collected one additional *velox* and four *inornatus* on 2 September 1964.

The site consisted of five or six acres of relatively flat basin land, enclosed in a pocket by cliffs and rock outcrops on the south, west, and north (see Fig. 2). The northern cliffs approach U.S. 666, then retreat to the northwest. The substrate was composed of hard packed clay, with scattered patches of loose sand and soil. An arroyo extended eastward and paralleled the south cliffs. At its head in the southwestern cliffs, there was a small cave containing standing water on the last three visits. None of this water reached the arroyo or surrounding habitats.

The dominant vegetation was composed of short grasses (heavily grazed by sheep) and scattered shrubs, predominantly big sagebrush (*Artemisia tridentata*) and snakeweed (*Gutierrezia sarothrae*), with a lesser abundance of rabbitbush (*Chrysothamnus nauseosus*) and apache plume (*Fallugia paradoxa*). A slight ecotone was evident between the Plains Life Belt* to the east, and Roughlands Life Belt* to the west, as widely scattered pinyon (*Pinus edulus*) was encroaching upon the area from the broken highlands west of the site proper.

Both species were taken from the hard pack, especially around rodent burrows at the bases of shrubs, but the majority of the specimens came from a sandy area adjacent to a broken rock slope at the western margin of the flat land (shown at the right in Fig. 2). On two separate occasions, investigation of the surrounding countryside for about one-fourth mile in each direction located additional representatives of these species only to the northwest, on flats adjacent to the cliffs. The species ratio, from specimens obtained, is approximately two *inornatus* for each *velox*. Each lizard seen was shot, and only two or three individuals were known to have escaped capture. No collecting bias is thought to be involved.

The distribution of *inornatus* throughout the transect region is highly disjunct. This seems to be especially true in the northwestern periphery of its range. Gehlbach (1965) made extensive collections in McKinley and Valencia

*Characterized for this region by Gehlbach (1965:249-252).

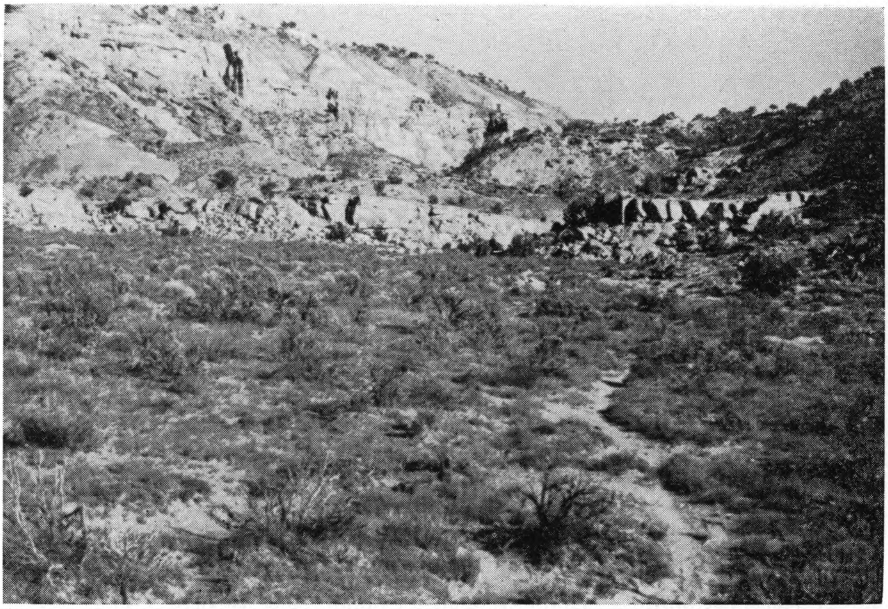

FIGURE 2. Site of sympatry between *Cnemidophorus velox* and *Cnemidophorus inornatus,* fourteen miles north of Gallup, McKinley County, New Mexico. Photo depicts a view to the southwest.

Counties, New Mexico, and mentioned no additional specimens of *inornatus* from this region, other than the two males previously reported by Maslin (1962).

The largest specimens of each species from this site are shown in Fig. 3. Gehlbach (1965:290) noted that *inornatus* from western New Mexico does not exceed 67 millimeters in snout-vent length. Five of the fourteen *inornatus* from the site exceed this length, the largest specimen having a snout-vent length of 72 millimeters.

Other reptiles collected at the site include *Crotaphytus collaris baileyi, Sceloporus graciosus graciosus, S. undulatus elongatus,* and *Urosaurus ornatus wrighti.* Gehlbach (1965) reported extensive intergradation between subspecies in this region, but the taxa listed above were not checked for possible intergrades. No amphibians were seen on any of the visits to the site.

The northernmost distribution records for *inornatus* were reported by Harris (1963) from the San Juan Basin of northwestern New Mexico. The range of *inornatus* in this area was restricted to grassland areas south of the San Juan River. *C. velox* also occurs in this area, but no contact zones between the two species were discovered. I have just recently examined a small series of speci-

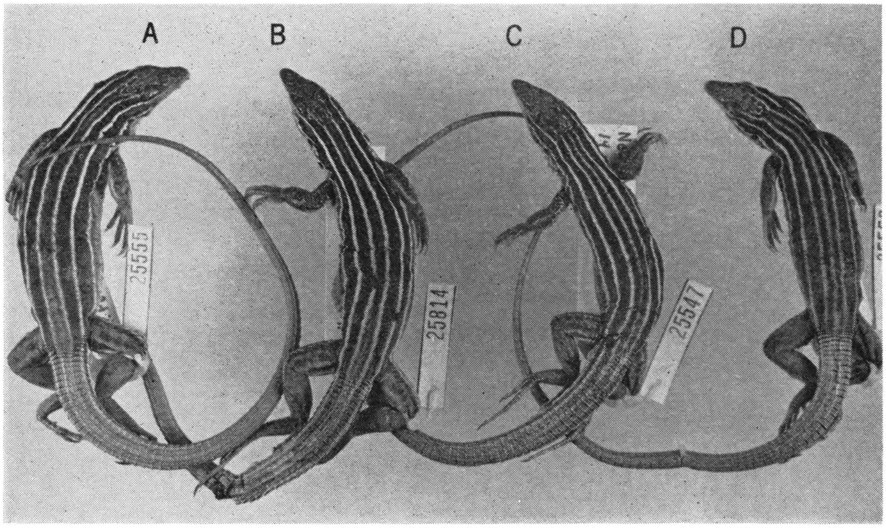

FIGURE 3. Largest specimens of *Cnemidophorus velox* and *C. inornatus* from a site fourteen miles north of Gallup, McKinley County, New Mexico. (A) *C. velox*, SVL 80 mm.; (B) *C. velox*, SVL 78 mm.; (C) *C. inornatus*, male, SVL 70 mm.; (D) *C. inornatus*, female, SVL 72 mm.

mens catalogued as *Cnemidophorus velox,* from the Museum of Comparative Zoology at Harvard University. Two of the specimens (MCZ 62448 and 62449) are recorded as having come from one mile north of Aztec (San Juan County), New Mexico. These specimens establish another instance of sympatry. MCZ 62448 is a representative of *velox*, but MCZ 62449 is a specimen of *inornatus*. The characteristics of these two specimens are as follows: MCZ 62448, *C. velox* —postantebrachial scales enlarged; sublabial scales extend anteriorly to posterior suture of fourth infralabial; stripes, 7; femoral pores, 38; granules around midbody, 83; granules occiput to rump, 190. MCZ 62449, *C. inornatus*—Postantebrachial scales slightly enlarged; sublabial scales extend anteriorly to middle of third infralabial; stripes, 7; femoral pores, 37; granules around midbody, 69; granules occiput to rump, 167.

On 18 July 1965, *velox* and *inornatus* were found sympatric at a site approximately four miles southwest of Santa Fe, Santa Fe County, New Mexico. Immediately south of the junction of U.S. 85 and N.M. 10, a wide, dry arroyo extends east-west and is spanned by both highways. The arroyo bed and margins constituted the habitat for both species. Three hours of collecting produced 62 *inornatus* and eight *velox* specimens. Of these, 56 and four respectively were available for study. The four *velox* specimens have scale counts that are well within the ranges of variation exhibited by three samples from areas northwest of the site. All four groups were combined to form sample 6.

Excluding scutellation, the principal difference between the two species from the site is in the degree of vertebral stripe development. All of the *inornatus* specimens have a complete vertebral; whereas, two of the *velox* have the stripe developed only on the neck, and the other two have the stripe terminating anterior to the rump.

The dominant vegetation consisted of rabbitbush (*Chrysothamnus nauseosus*) interspersed with scattered stands of western wheat grass (*Agropyron smithii*). The substrate was predominantly sandy, and the highest population density of *inornatus* occurred where the sand was loose.

Whether or not a microhabitat preference existed for *velox* was difficult to discern, although the specimens collected by me came from the arroyo margins, where shrubs predominated. Even there, both species were taken from the same cluster of shrubs. One undisturbed *velox* was basking two feet off the ground in a shrub when collected. *C. inornatus* readily climbed into the shrubs when disturbed, and one individual was observed actively foraging, climbing and making its way through the branches.

C. inornatus was the most abundant species, followed by *Sceloporus graciosus*, *C. velox*, and *Holbrookia maculata approximans*. One *Masticophis flagellum* completes the forms taken.

Maslin, et al. (1958:342) observed that both *velox* and *inornatus* are less abundant in regions where their ranges approach one another. This situation was evident at the McKinley County site, but at the Santa Fe County site, *inornatus* was extremely abundant. The low density of *velox*, at the latter site, indicates that this habitat is sub-optimal for this species.

DISCUSSION

A high individual variation within a population provides a greater probability that certain individuals will survive should an environmental change produce new selection pressures. Of the two species considered here, *inornatus*, in general, possesses the greater variability. But when individual samples and characters are considered, certain *velox* samples exceed all *inornatus* samples in variability.

In any discussion of sexual vs. asexual reproduction, it is generally agreed that sexually reproducing organisms have the potential for a greater variability because segregation and recombination of various genes from the population gene pool is a normal result of this process. That considerable variability might also be found in unisexual organisms was considered by Mayr (1963:410): "Since each individual and the clone to which it gives rise remain permanently independent of all related clones, one would expect, owing to mutation, a steady genetic divergence between clones, ultimately resulting in high variability in the parthenogenetic 'species' . . . ." When this reasoning is applied to *velox*, difficulties are immediately evident. For an organism that has to rely upon mutation for its variability, the triploid endowment of *velox* (Pennock, 1965) would appear to place it under a severe disadvantage. Most spontaneous mutations occurring in well-studied organisms appear to be recessive. To result in expression, recessives in a triploid such as *velox* might have to occur in a double dose, or possibly in a triple dose, at the same locus in chromosomes of the same individual. Without complex cytogenetic activity, this remains an extremely remote possibility. However, the mutation of one gene changes the genetic background of an individual, regardless of whether penetrance is fully realized or not. The effect of the total genotype producing a selection differential could account for the divergence of groups of *velox*. The lack of detailed genetic, cytogenetic, and ecological data makes speculation on the causal factors of *velox* variability premature.

Sympatric species of *Cnemidophorus* often exhibit the greatest morphological differences within the area of sympatry, with these differences being less pronounced in other parts of their range (e.g., *sexlineatus* and *gularis; sexlineatus* and *tesselatus;* J. Martin Walker, unpublished data). This phenomenon of character divergence is thought to be produced in other organisms by the intense selection pressure of competition within the zone of contact (Mayr, 1963:82). To establish if sympatry produces such differences in *velox* and *inornatus*, the sympatric samples 5 and A, and 6 and B were compared with the allopatric groups 7 and C. Within the contact zones, there is a reinforcement of differences in number of femoral pores and number of granules separating the paravertebral stripes; there is a character convergence in the number of granules around midbody. In the number of granules from occiput to rump, one pair of sympatric samples was less, one more divergent than the allopatric samples.

SPECIMENS EXAMINED

This study was based on the examination of 189 specimens of *velox* and 166 of *inornatus;* only these individuals are listed below. Comparative material examined, from localities outside of the study area, included 42 *velox* and 17 *inornatus*.

Catalog numbers without prefixes refer to University of Colorado Museum specimens; BYU = Brigham Young University, Provo, Utah; UI = University of Illinois, Museum of Natural History, Urbana, Illinois; MCZ = Museum of Comparative Zoology, Harvard University, Cambridge, Mass.

SAMPLE 1
COLORADO: *Garfield Co.*: 9.8 mi. W Grand Valley (10785, 10786); 4 mi. N Silt, Harvey Gap (19698); 6 mi. N Rifle (19699); Una (23946, 23947). *Mesa Co.*: Colorado National Monument (6023, 9359, 9654, 20145, 24905*, 24908-24910*); Colorado National Monument, No Thoroughfare Canyon (18138); Saddlehorn area

*Laboratory hatchlings derived from eggs laid by females from the indicated localities.

(20501, 20502); 8 mi. W Grand Junction (20503); Whitewater (22136); W Fruita bridge, Colorado River, south bank (23945); 21 mi. S Grand Junction (25601, 25602); Grand Junction (BYU 12493); No Thoroughfare Canyon (UI 53247). *Delta Co.*: 4 mi. NW Cedaredge, "Cedar Breaks" (7138-7143); Dominguez Canyon (19823, 19824, 27244); 16 mi. NW Delta, Dominguez Canyon (21069, 21070); 20 mi. N Delta, Dominguez Canyon (21072-21084); 2 mi. S Lazear(25815-25820).

SAMPLE 2

COLORADO: *Mesa Co.*: along Little Dolores River, 20 mi. WSW Glade Park (6022); Dolores River, along Colo. 141, extreme southern Mesa Co. (1358); 1 mi. SE Gateway (6563). *Montrose Co.*: San Miguel River Canyon, about 3 mi. N Uravan (1335-1337); Dolores River at bridge on Colo. 141, N Uravan (1357); gravelly benchland above San Miguel River, 14 mi. NW Naturita (1385); 10 mi. N Naturita, river benches on Dolores River (3182); 3 mi. NW Paradox (17332); Bedrock (17357); 1 mi. S Bedrock (17358, 17360, 17362); 7.4 mi. SSE Mesa-Montrose County line, Colo. 141 (25603). *San Miguel Co.*: Joe Davis Gulch, Dolores River (451); 10 mi. NW Gypsum Gap, Hamm's Canyon (4320); 1.5 mi. N Gypsum Gap (4321, 4322); Gypsum Gap (4323, 4325, 4327-4330).

SAMPLE 3

COLORADO: *Montezuma Co.*: 5 mi. SW Towaoc (1313); McElmo Creek, 5 mi. W Cortez (4331-4333, 4336, 4337, 4339-4341); 10 mi. SW Towaoc (9360); 16 mi. SW Mancos (10405); 3 mi. S, 3 mi. W Yellow Jacket, Reed Ranch (11330, 11825); Mesa Verde National Park, Main Camp (18743); Mesa Verde National Park (BYU 125). UTAH: *San Juan Co.*: 12 mi. S Monticello, Devil's Canyon, Utah 47 (6562).

SAMPLE 4

COLORADO: *La Plata Co.*: Ft. Lewis College campus, Durango (21549). NEW MEXICO: *San Juan Co.*: Farmington (135, 135); 0.5 mi. S Colo. state line, below Redmesa, La Plata Co., Colo., along N.M. 17 (1305); 7 mi. E Blanco (7250-7259); 43 mi. SE Bloomfield (7260, 7261); 34 mi. SSE Bloomfield 7262); 1 mi. N Aztec (MCZ 62448)—data included in Sympatry section only.

SAMPLE 5

NEW MEXICO: *McKinley Co.*: 14 mi. N Gallup, Powell's Trading Post (6578); 2 mi. E New Mexico state line, W U.S. 66 (18644, 18645); 14 mi. N Gallup, W U.S. 666, N Toh La Kai Trading Post (25548, 25551, 25555, 25558, 25814).

SAMPLE 6

NEW MEXICO: *Sandoval Co.*: 3 mi. N Pena Blanca (22817-22822, 23343, 24831-24861, 24897*, 24898*); 8 mi. SW Espanola, N.M. 4 and Rio Grande River (29457, 29470); Bandelier National Monument, Tyounyi Ruin (29458-29469). *Santa Fe Co.*: 4 mi. SW Santa Fe, junction of U.S. 85 and N.M. 10 (29538-29541).

SAMPLE 7

NEW MEXICO: *Sierra Co.*: vicinity of Caballo Reservoir Dam (25609, 25610, 25612-25614, 25616-25618, 25621-25623).

SAMPLE A

NEW MEXICO: *McKinley Co.*: 14 mi. N Gallup, Powell's Trading Post (6579, 6580); 14 mi. N Gallup, W U.S. 666, N Toh La Kai Trading Post (25547, 25549, 25550, 25552-25554, 25556, 25557, 25810-25813).

*Laboratory hatchlings derived from eggs laid by females from the indicated localities.

SAMPLE B

NEW MEXICO: *Santa Fe Co.*: 4 mi. SW Santa Fe, junction of U.S. 85 and N.M. 10 (29480-29537).

SAMPLE C

NEW MEXICO: *Dona Ana Co.*: College Ranch (25532); Las Cruces (27201); near Mesilla Dam (27202); 1 mi. S Dona Ana (27203); Bill Montoya farm, near Dona Ana (27204); W Levee Rd., 0.5 mi. S U.S. 70, Las Cruces (27206); Las Cruces (27207); 4 mi. W Las Cruces (27208); along Rio Grande (27209).

SAMPLE D

TEXAS: *Culberson Co.*: 20 mi. E Van Horn (14382-14397).

SAMPLE E

MEXICO: *Chihuahua*: 50 mi. N Chihuahua (city), highway 45 (12547-12552); 9 mi. N Chihuahua (city), highway 45 (12555, 12558, 12560, 12564, 12565); 18 mi. S Gallego (22679, 22680, 22683-22686, 22688-22692, 22694-22696, 22698-22711, 22713-22715, 22717, 22719-22722, 22724, 22726-22736, 22739-22743, 22745-22750).

Data on MCZ 62449, *C. inornatus*, is included in Sympatry section only.

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