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PHYSIOLOGICAL RESPONSES OF THE NORTH-WESTERN VENEZUELAN COTTONTAIL RABBIT, *Sylvilagus floridanus continentis* OSGOOD, 1912 (LAGOMORPHA; Leporidae)

Pedro DURANT & Robinson PEREZ
Grupo de Ecología Animal
Facultad de Ciencias
Universidad de Los Andes
Mérida, 5101 Venezuela

ABSTRACT

A sample of 83 wild rabbits (***Silvilagus floridanus continentis***) coming from a subxerophitic habitat (Hda. "La Sabana", State Trujillo, Venezuela) is analyzed for some morpho-physiological responses. Results are as following:

1. Adult females were heavier ($P < 0.005$) and larger than adult males ($P < 0.005$). This sexual dimorphism is interpreted as a consequence of different patterns of behavior within the warren organization.

2. Difference recorded in the fluctuations of the condition index (KI) were not statistically significant neither in males nor in females. Intrasex differences were highly significant ($t = 9.03$; $P < 0.005$).

3. During the first months of the year, male rabbits showed wider variation in the adrenal index (AI) values than females.

Correlation of AI fluctuations against rain was not significant for both sexes. The SNK-Multiple Range test detected significant differences between male's means for two of the six bimonthly samples. A higher number of significant differences was recorded for female's means. Intersexual differences were not significant for this index ($t = 2.2$; 74 df; $P < 0.01$).

4. Differences in the mean values of the spleen index (SI) were highly significant for the female sample ($F = 19.2$; $P < 0.001$) but not for males. Intersex differences were also significant at the 5% level.

5. The SNK-Multiple Range did not find significant differences within female's mean values of the body fat index (BFI). Differences within July-August (JA) and November-December (ND) mean values were significant in males at the 5% level. A significant intersex ($t = 3.76$; $P < 0.001$) and inter-season differences in this index was also found.

Differences recorded in these morpho-physiological indices are interpreted as an answer of the rabbit population analyzed to the changes of the biophysical habitat and as a consequence of thsocial behavior in both sexes.

Key Words: Cottontail rabit. Morpho-physiological index. Body measurrements. Physiological pressure. Adaptation mechanisms.

RESPUESTAS FISIOLÓGICAS DEL CONEJO COLA BLANCA DEL NOR-OESTE DE VENEZUELA *Sylvilagus floridanus continentis* OSGOOD, 1912 (LAGOMORPHA; Leporidae)

RESUMEN

Ochenta y tres conejos cola blanca (***Silvilagus floridanus continentis***) fueron capturados en la Hda. "La Sabana" (Monay, Estado Trujillo) en 1983. Dimorfismo sexual y análisis de cuatro indices morpho-fisiológicos son presentados en este estudio.

En la muestra poblacional, las hembras son mas pesadas ($P < 0.005$), y de mayor tamaño que los machos ($P < 0.005$). Este dimorfismo se interpreta como una consecuencia de los patrones de comportamiento que los dos sexos mantienen en la organización de la "conejera".

Los índices morfo-fisiológicos estudiados fueron: índices de condición (IK), índice adrenal (IA), índice esplénico (IE) e índice graso (IG). Resultados:

1. Las diferencias registradas en las fluctuaciones de IK no fueron estadísticamente significativas en ninguno de los sexos. Diferencias intrasexo fueron estadísticamente significativas ($t = 9.03$; $P < 0.005$). En los dos sexos, los valores promedios bimensuales aumentam con el incremento de las lluvias.

2. Durante los primeros meses del año, los valores de IA en machos varían mas ampliamente que los de la hembra. La correlación entre las fluctuaciones de IA y el período lluvioso no fué significativa en ninguno de los dos sexos. El Test de Rango Multiple SNK detectó diferencias significativas entre las medidas bimensuales Marzo-Abril vs Julio-Agosto (LSR: $1 \rightarrow 6 = 0.2915$) y Marzo-Abril vs Mayo-Junio. Las hembras muestran un mayor número de diferencias significativas en estas fluctuaciones bimensuales.

3. Las diferencias registradas en los valores medios del índice esplénico son significativas en las hembras ($F = 19.2$; $P < 0.001$) pero no en los machos. A nivel del 5%, las diferencias intersexo también son significativas. No fueron detectadas diferencias significativas por el Test de Rango Multiple SNK, en las medias bimensuales de los machos. en las hembras, la diferencia entre las medias Noviembre-Diciembre vs Mayo-Junio es significativa a nivel del 5 % (LSR; $1 \rightarrow 6 = 1.085$).

4. Las fluctuaciónes del índice graso (IG) en relación con el período de lluvia son mas pronunciadas en los machos que en las hembras. El valor mas bajo del IG en machos se corresponde con el inicio de las lluvias Marzo-Abril, mientras que su valor mas alto se ubica entre Diciembre-Enero, al final del período de lluvias mas intensas. Los valores del IG en machos difieren significativamente de los de las hembras ($t = 3.76$; $P < 0.005$).

Las diferencias registradas en estos índices, son interpretados como una respuesta de la muestra poblacional estudiada a los cambios biofísicos del habitat y como una consecuencia del comportamiento social en los dos sexos.

Palabras Clave : Conejo Cola de Algodón. Índices morfo-fisiológicos. Medidas corporales. Presión Fisiológica. Mecanismosds de adaptación. ***Silvilagus floridanus***

INTRODUCTION

The north-western Venezuelan wild rabbit (***Sylvilagus floridanus continentis***) inhabits the xerophitic and subxerophitic life zones (Tamayo, 1975) of the four north-western states of the country: Zulia, Falcon, Lara and Trujillo. The distribution of this rabbit subspecies provided by Hershkovits (1950) includes "savannas, swamps and scrublands of the Maracaibo Lake Basin, adjacent to coastal plains and highlands of Zulia, Falcon and Lara". It has been described as the "continental dark-naped cottontail" of South America (Hershkovits, op. cit.). Few studies have dealt with the reproductive aspects of this mammal. Ojeda & Keith (1982) found a survival monthly rate of 0.6 to 0.7 in a population sample collected at the Paraguaná Península, Falcon. This low survival rate "would reduce the number of youngs born per adult female from about 22 to five per year". Durant (in prep.) found that the ovulation rate in 17 pregnant females of a sample coming from Hacienda "La Sabana", Monay, Trujillo, gave a mean of 6.3 ova, and a litter size of 3.2 pups. Intrauterine mortality and/or reabsortion would reach about 50%. Such data indicate that this rabbit subspecies has a higher potential natality than that previously estimated.

The present work is part of a wider project on the ecology of the venezuelan wild rabbits, and its objective are as following:

1. To analyze four physiological responses, or physiological cycles in a population of ***S. f. continentis*** collected in Hacienda "La Sabana", Monay, Trujillo State in 1983.

2. To compare the data with those of related rabbit species of the temperate zones, in order to find analogous or different sources that make up the nature of these responses.

STUDY AREA

Hacienda "La Sabana" is a cattle ranch of about four thousand ha., lying south of the Monay plains (9º 33' N; 7º 28' W; at about 272 masl), 35 Km NO Valera City, Trujillo State, Venezuela (Fig. 1). Ambient temperature ranges from 23ºC to 30ºC , with an annual precipitation of 500 mm to 1000 mm. Vegetation is poorly stratified with very few trees of four to six m tall, represented mostly by ***Prosopis juliflora*** (Mimosaceae), ***Platymiscium polystachyum*** (Papilionaceae), ***Protium sp***. (Burceraceae), and cactaceas of the columnar type, offering almost no cover to the soil surface. The herbaceous layer provides a higher plant cover, and it is

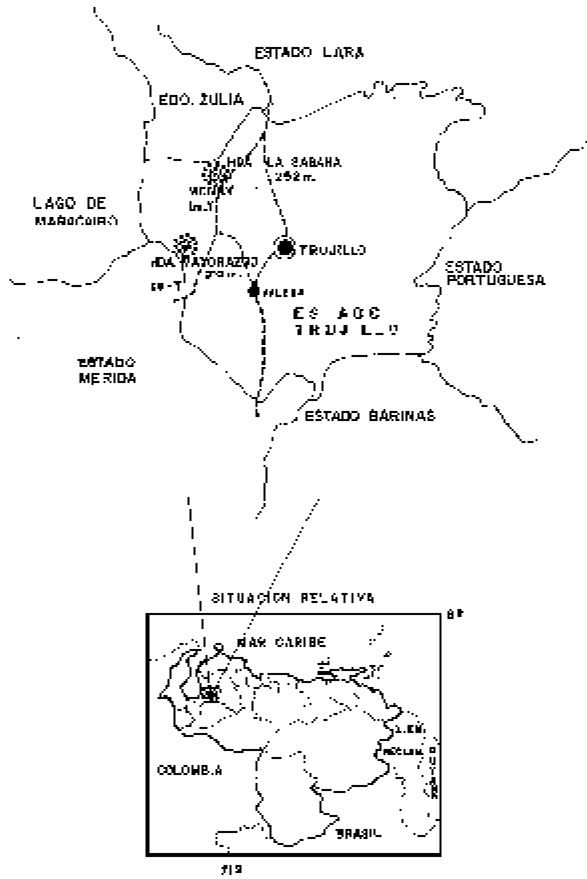

Fig. 1 The study area, hacienda "La Sabana". Monay. Trujillo State, Venezuela. bs-T: Tropical Dry Forest. be-T: Thorny- Tropical Forest.

made up by at least five native grass species (Poaceae), two or three species of cultivated grasses, and several groups of malvaceas and leguminous as dominants. The soil is clay of the reddish chesnot type. Five of the explotation units (Potreros) of the cattle ranch were selected for this study. Details of the area's floristic composition were published elsewhere.

MATERIALS AND METHODS

Rabbits were hunted using a shot gun and a spot light during two or three consecutive nights once a month (1983). Each specimen was sexed, weighed, and body length (BL), hind foot (HFL), tail (TL) and ear length (EL) recorded for intra-groupal differences. Data about morpho-physiological indices were recorded according to Chapman, et al. (1977); Willner, et al. (1979), and Lattanzio & Chapman (1980) indications. Morphophysiological indices studied in this report were:

1. Condition index (KI). This index describes the general physiological state of an organism independent of size and body weight. It has been defined as: K=W(g)/L. Were W = body weight, and L is the greatest length (in dm^3) from tip of nose to tip of middle toe of the hind foot in a fully extended rabbit. This index ranges from 1 to 10.

2. Adrenal index (AI). The adrenal index (AI) is defined as the relationship of adrenal weight (AW) to body weight (BW) x 10^4 (Willner, et al. (op. cit.). Adrenal glands were dissected, cleaned up under a stereoscopic microscope and weighed on a top-loading Mettler balance. Changes in the weight of this organ have been interpreted as a sensitive indicator of some environmental conditions for the wild rabbit (Myers, 1967; Bittner & Chapman, 1981).

3. Spleen index. For this study, the spleen index (SI) is defined as: SI = SW/BW x 10^4, which gives the amount of splenic tissue per gram of body weight. Spleen was dissected, cleaned up and weighed on a top-loading Mettler balance. Changes in spleen weight (SW) have also been interpreted for some workers as a valuable indicator of stress for several mammal species (Bittner & Chapman, 1981).

4. Body fat index (BFI). This index describes the amount of body fat in an individual rabbit. The BFI used here is a qualitative estimated of fat reserves. Rabbits were ranked in categories from one to four, the former indicating large amounts of fat deposit (Lattanzio & Chapman, op. cit.).

The four index data were grouped in two monthly periods to facilitate the statistical treatment for a more representative sample. Each one of the morpho-physiological index data is related to the rain pattern of the area. Weather records were provided by the Mérida Office of the Ministerio del Ambiente, and the Institute of Geography of the Universidad de Los Andes. Statistical treatment includes a two-way analysis of variance and the Student- Newman-Keul Multiple range test. Student t-test and Pearson correlation analysis were also used where appropriate.

RESULTS AND DISCUSSION

In the analyzed sample (N = 83) adult females were heavier (t = 6.2; P < 0.005) and larger than adult males (t = 4.4; P < 0.005). See annex 1 &2. Within leporids this sexual dimorphism is not unusual, and it is interpreted as a consequence of some behaviors such as territoriality and hierarchy organization of the "warren" (Gibb, et al., 1978). Females seem to be less active than males but their main energy drainage is toward nest building and maintenance, nursing and care offspring. As these processes are more permanent, they perform a higher physiological pressure. Differences of this sort could also be related with the weight and functioning of several organs and tissues. Should this be true, it would give a better understanding of some ecological aspect of the population, such as biological productivity, turn-over rate, and adaptation capacity (Shvarts, 1975). Results of the four morpho-physiological indices analyzed in this study are as following:

1. A high value of KI means good animal physiological condition. Males seem to be more sensitive to the dry season than females during the first month of the year as shown by the KI (Fig. 2A). Fluctuations were less intense throughout the rainy season, reaching its highest values at the end of the year, with the most intense period of the second rainy peak. Correlation between these two parameters was low (r = 0.54) (Annex 1). Decreasing values of females KI began later (February-March) than in males (Fig. 2A). Fluctuations tended to keep an increasing correlation with the progress of rains. At the end of the year (Nov.-Dec.), values of the KI were higher than those observed in males. Even so, correlation was much lower (r = 0.38). Differences recorded in these KI fluctuations were not statistically significant neither in males nor in females (Tables 1,2,3). On the other hand, intersex differences (Table 4) were highly significant (t = 9.03, 74 df; P < 0.005). When KI values were grouped according with the dry and rainy season, the t-test showed significant differences at 5 % level in both sexes (Table 5). Similar results were found in ***S. floridanus*** from St. Clements Island in U.S.A. (Bittner & Chapman, 1981), and ***S. brasiliensis meridensis***, the venezuelan paramo rabbit (Durant, in press). These data support the idea that KI responds to vegetation changes induced by rain variations.

TABLE 1. Analysis of Variance for the Morpho-Physiological Indices in the North-Western Cottontail Rabit of Venezuela.

	MALES (df=40)				FEMALES (df=35)			
IN-DI-CES			Variations (%)				Variations (%)	
	F	P	Between Groups	Within Groups	F	P	Between Groups	Within Groups
KI	0.57	ns	5.73	94.27	2.11	ns	32.34	67
AI	2.22	ns	14.52	85.48	3.95	*	55.98	44.02
SI	2.08	ns	13.22	86.78	19.20	**	88.69	11.31
BFI	2.79	ns	20.00	80.00	0.38	ns	21.10	78.90

* : Statistaically significant **: Highly significant ns: No significant

TABLE 2. SNK-MULTIPLE ARNGE TEST FOR VERIATION IN MEAN MORPHO-PHYSIOLOGICAL INDICES OF THE NORTH-WESTERN COTTONTAIL RABBIT MALES CAPTURED IN THE STUDY AREA. MONAY. STATE OF TRUJILLO. VENEZUELA

		Ord	MJ	MA	SO	ND	JA	JF	
KI		$\overline{Y}$	6.64	6.69	7.22	7.56	7.67	8.13	
Order	$\overline{Y}$	ni	4	6	8	9	5	8	
1. MJ	6.64	4							LSR (1→6)= 3.1515 ns
2. MA	6.69	6	0.05						LSR (2→6)= 5.1463 ns
3. SO	7.22	8	0.58	0.53					
4. ND	7.56	9	0.92	0.87	0.22				
5. JA	7.67	5	1.03	0.98	0.45	0.11			
6. JF	8.13	8	1.49	1.44	0.91	0.57	0.46		

		Ord	MA	ND	SO	JF	MJ	JA	
AI		$\overline{Y}$	0.91	0.92	0.96	0.97	1.27	1.45	
Order	$\overline{Y}$	ni	6	9	8	8	4	5	
1. MA	0.91	6							LSR (1→6)= 0.2915+
2. ND	0.92	9	0.010						LSR (2→5)= 0.5484 ns
3. SO	0.96	8	0.050	0.040					
4. JF	0.97	8	0.060	0.050	0.010				
5. MJ	1.27	4	0.355*	0.345	0.305	0.295			
6. JA	1.45	5	0.540*	0.350*	0.490	0.480	0.185		

		Ord	ND	JA	MA	SO	JF	MJ	
SI		$\overline{Y}$	2.97	3.17	3.76	3.97	4.53	5.12	
Order	$\overline{Y}$	ni	5	5	6	8	8	4	
1. ND	2.97	9							LSR (1→6)= 2.5228 ns
2. JA	3.17	5	0.20						LSR (2→5)= 2.2858 ns
3. MA	3.76	6	0.79	0.59					
4. SO	3.97	8	1.00	0.80	0.21				
5. JF	4.53	8	1.56	1.36	0.77	0.56			
6. MJ	5.12	4	2.15	1.95	1.36	1.15	0.59		

		Ord	JA	MA	JF	MJ	SO	ND	
BFI		$\overline{Y}$	1.60	1.97	2.63	2.67	2.79	3.23	
Order	$\overline{Y}$	ni	5	6	8	4	8	9	
1. JA	1.60	5							LSR (1→6)= 0.5885+
2. MA	1.97	6	0.37						LSR (2→5)= 1.3799 ns
3. JF	2.63	8	1.03	0.66					
4. MJ	2.67	4	1.07	0.70	0.04				
5. SO	2.79	8	1.19	0.82	0.16	0.12			
6. ND	3.23	9	1.63*	1.26	0.60	0.56	0.44		

TABLE 3. SNK-MULTIPLE RANGE TEST FOR VARIATIONS IN MEANS MORPHO-PHYSIOLOGICAL INDICES OF THE NORTH-WESTERN COTTONTAIL RABBIT FEMALES CAPTURED IN THE STUDY AREA, MONAY. STATE OF TRUJILLO. VENEZUELA.

		Ord	MJ	SO	JA	MA	JF	ND	
KI		$\bar{Y}$	7.54	7.63	7.84	7.93	8.31	8.43	
Order	$\bar{Y}$	ni	7	5	6	3	5	9	
1. MJ	7.54	7							LSR (1→6)= 1.1364 ns
2. SO	7.63	5	0.09						LSR (2→6)= 1.3598 ns
3. JA	7.84	6	0.03	0.21					
4. MA	7.93	3	0.39	0.30	0.09				
5. JF	8.31	5	0.77	0.68	0.47	0.38			
6. ND	8.43	9	0.89	0.80	0.59	0.50	0.12		

		Ord	ND	JA	MJ	JF	SO	MA	
AI		$\bar{Y}$	0.88	0.94	0.96	1.05	1.16	1.68	
Order	$\bar{Y}$	ni	9	6	7	5	5	3	
1. ND	0.88	9							LSR (1→6)= 0.5796+
2. JA	0.94	6	0.06						LSR (2→5)= 0.5971 ns
3. MJ	0.96	7	0.08	0.02					
4. JF	1.05	5	0.17	0.11	0.09				
5. SO	1.16	5	0.28	0.22	0.20	0.11			
6. MA	1.68	3	0.80+	0.74+	0.72+	0.63	0.52		

		Ord	ND	JA	SO	JF	MA	MJ	
SI		$\bar{Y}$	3.36	3.67	3.83	3.98	4.47	4.58	
Order	$\bar{Y}$	ni	9	6	5	5	3	7	
1. ND	3.36	9							LSR (1→6)= 1.085+
2. JA	3.67	6	0.31						LSR (2→5)= 1.4496 ns
3. SO	3.83	5	0.47	0.16					
4. JF	3.98	5	0.62	0.31	0.15				
5. MA	4.47	3	1.11	0.80	0.64	0.49			
6. MJ	4.58	7	1.22+	0.91	0.75	0.60	0.11		

		Ord	SO	ND	MA	MJ	JA	JF	
BFI		$\bar{Y}$	2.59	2.66	2.93	2.95	2.96	3.04	
Order	$\bar{Y}$	ni	5	9	3	7	6	5	
1. SO	2.59	5							LSR (1→6)= 1.4209 ns
2. ND	2.66	9	0.07						LSR (2→5)= 1.1291 ns
3. MA	2.93	3	0.34	0.27					
4. MJ	2.95	7	0.36	0.29	0.02				
5. JA	2.96	6	0.37	0.30	0.03	0.01			
6. JF	3.04	5	0.45	0.38	0.11	0.09	0.08		

TABLE 4 ADULT SEX DIFERENCES OF MORPHO-PHYSIOLOGICAL INDICES FOR THE NORT-WESTERN COTTONTAIL RABBIT CAPTURED IN THE STUDY AREA. MONAY. STATE OF TRUJILLO. VENEZUELA.

INDEX	Sex	N	$\overline{X}$	(n-1)S^2	t	P
Condition	Males	41	7.478	31.9694	9.026	+++
(KI)	Females	34	7.850	23.9548		
Adrenal	Males	41	1.060	7.4304	2.169	++
(AI)	Females	34	1.042	3.8373		
Esplénic	Males	41	3.841	97.4688	2.132	++
(SI)	Females	34	4.149	80.4118		
Body Fat	Males	41	2.573	41.5344	3.764	+++
(BFI)	Females	34	2.747	22.5121		

++ : Very significant +++: Highly significant

2. Adrenal index. Low values of AI mean less expenditure of energy and less stress of the organism in the presence of external and internal environmental changes. In this study, male rabbit showed wider variation in the AI values than females, especially during the first months of the year (Fig. 2B). Females seem to be less affected by the dry season. By them, plant diversity was highly reduced, and probably food, cover, shelter and water were also limited due to low precipitation (40 mm to 50 mm from Jan. to March). For males this critical period includes Feb.-April, and March-May for females (Fig. 2B). AI values tended to stabilize at beginning of the second rainy peak (Oct.-Dec.). Correlation of AI against rain was not significant for both sexes (r = -0.50 for males, and r = -0.15 for females). Differences of the monthly average of these AI values were not significant for females (F = 3.95) at the 5% level (table 1). However, the higher sensibility of the SNK-Multiple Range test detected significant differences (Table 2) between male's means for March-April (MA), and July-August (LSR: 1®6 = 0.2115); and for May-June (LSR: 1®6 = 0.3164). A higher number of significant differences were recorded for female's means (Table 4) corresponding to Nov.-Dec. (ND), and to March-April (LSR: 3® 6 = 0.5769); May-June (MJ), and March-April (LSR: 3®6 = 0.5971). Intersexual differences were not significant for this index (t = 2.2, 74 df; P > 0.05) (Table 4). In rabbits of the temperature zones, AI is a much more sensitive physiological index (Bittner & Chapman, op. cit.) than KI. For the north-western Venezuelan rabbit sample, the differences in the AI means were less significant than those recorded for KI of the sample rabbit group (Table 4). For dry and rainy season, the differences observed in AI values were not statistically significant (Table 5).

3.- Information recorded for some rabbits and rodent species of the temperate zone (Willner, et al., op. cit.; Lattanzio & Chapman, op. cit.) demonstrate that the spleen index is as sensitive as AI to indicate the physiological capacity of the organism. As for AI, a low value of SI means the best physiological animal status. Similar informations have been found in ***S. b. meridensis*** (Durant, in press). Fluctuations of SI values in ***S. f. continentis*** were almost inverse in relation to tho000000000se

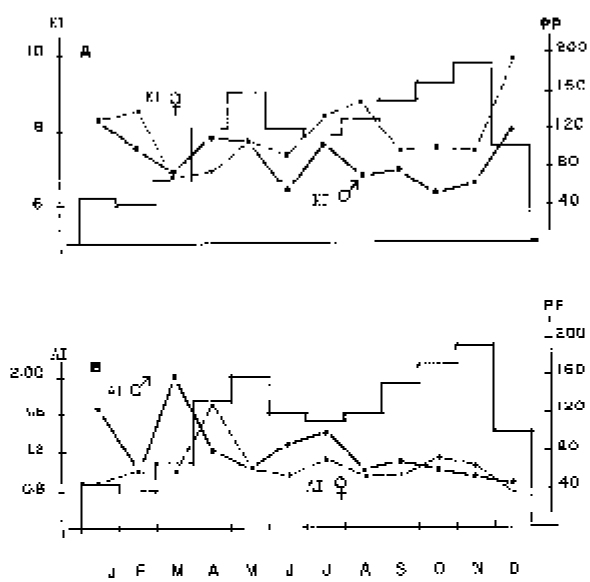

Fig. 2 Mle-Female Condition (A) and Adrenal (B) indices, and Their relationships with Precipitation in the study area. Monay. State of Trujillo. Venezuela.

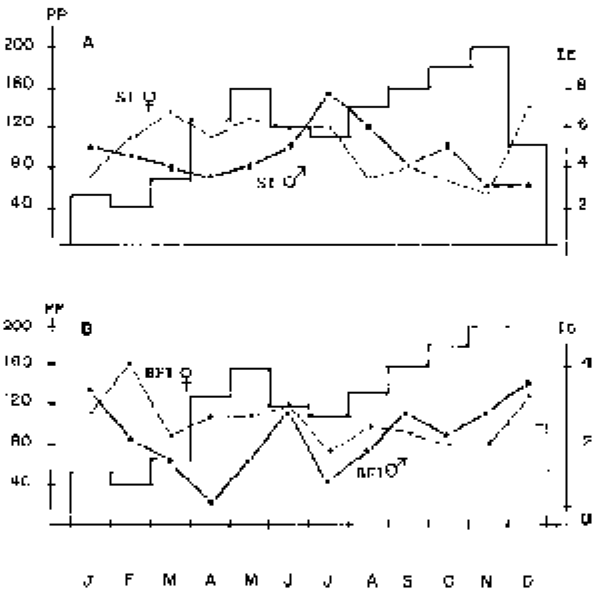

Fig. 3. MALE-FEMALE SPLEEN (A) AND BODY FAT (B) INDICES, AND THEIR RELATIONSHIPSWITH PRECIPITATION IN THE STUDY AREA. MONAY. STATE OF TRUJILLO. VENEZUELA.

recorded for AI (Fig. 3A). There were slow and progressive decreasing SI values from December to April. An interpretation of these results would be that SI response is less sensitive than KI and AI in relation to the effects of food, cover, and shelter furnished at the most intense phase of the rainy season. This reasoning would also be valid for data found for the paramo rabbit. But it does not explain the results recorded for female rabbits of this study. Similar fluctuations have been recorded in ***S. floridanus*** from different habitat types, and even in populations of the same geographic area (Bittner & Chapman, op. cit.).

According to these findings, SI is probably more variable than AI at the population level. For this study, variations observed were also characteristics for each sex, indicating that male and female rabbits respond in different ways to the same environmental variables. This fact would explain why the analysis of variance did not detect significant differences within the SI mean values in males. These figures were highly significant (Table 1) for female sample ($F = 19{,}2$; $P < 0.005$). The SNK-Multiple Range also shows significant differences for this sex between the mean values on Nov.-Dec. (ND), and May.-June (LSR: $1 \rightarrow 6 = 1.085$) at the 5% level. Intersex differences were also significant ($t = 2.13$, 74 df; $P < 0.005$). There were not significant differences between the mean values grouped according to dry and rainy season (Table 5).

TABLE 5. MEANS OF MORPHO-PHYSIOLOGICAL INDICES OF THE NORTH-WESTERN COTTONTAIL RABBIT CLUSTERED ACCORDING TO THE DRY (LESS THAN 100 mm) AND RAINY (MORE THAN 100 mm) SEASONS AT THE STUDY AREA.

Season	Between Seasons		Between Sexes
Sex	F	M	F & M
KI	S	S	NS
AI	NS	NS	NS
SI	NS	NS	NS
BFI	S	NS	S

S: Significant at the 5% level NS: No significant
F: Females. M: Males

4.- Low values of the body fat index (BFI) means reduced energy sources (Shvarts, 1975; Myers, et al., 1981). Males high mean values of BFI fitted with the increasing rain period (Fig. 3B). Lower mean values are recorded during the first four months of the year (Fig. 3B) as a consequence of less rain and the probable interaction with other environmental parameters. Significant differences of the male mean values were found only between July-August (JA), and November-December (LRS: $1 \rightarrow 6 = 0.5885$) (Table 3). These records are in agreement with the behavior of the other index but SI. Mean values fluctuations of BFI are less pronounced in females.

Haigher values of this index go through the first part of the dry season, indicating a greater female capacity to keep and handle the energetic sources gained during the rainy season (table 5).

5.- Index interactions. As was also observed for the Venezuelan paramo rabit (Durant, in press), differences of the phisiological responses found in the sample of ***S. f. continentis***, seem to be the answer to differences in biophysical habitat and social behavior in both sexes.

During the dry season, high AI mean values correspond with low KI values in specimens of both sexes (Fig. 2A, B). This fact reduces the physiological capacity of the animals as a consequence of progresive decreasing in the quality of some environmental parameters. This situation increases the competition for limited resources. An inverse relationship was observed at the end of the second rainy peak in the area. Similar relationships have been found in ***S. floridanus*** (Chapman, et al., 1977). Female ***S. f. continentis*** SI and BFI have a similar statistical fashion.

A high negative correlation was recorded between male and female AI mean values ($r = -0.724$, 23 df; $P < 0.005$). Similar relationship was found (Table 7) between female's AI and BFI ($r = -0.733$, 23 df; $P < 0.005$), while in males these correlations were much lower and not significant.

TABLE 6. CORRELATIONS HIGHER THAN 0.5 BETWEEN THE MORPHOPHYFIOLOGICAL INDICES AND SOME MORPHOMETRIC AND ENVIRONMENTAL MEASUREMENTS IN THE NORTH-WESTERN COTTONTAIL RABBIT STUDIED. MONAY. STATE OF TRUJILLO. VENEZUELA.

MEASUREMENTS COMPARED	MALES r+	N=45 t	MEASUREMENTS COMPARED	FEMALES r+	N=34 t
BW VS BFI	0.774	8.02	KI VS BS	0.816	7.99
KI VS AI	0.866	11.40	AI VS OI	-0.733	6.10
SI VS MT	0.761	7.69	SI VS BS	-0.771	6.85
KI VS BS	0.586	4.74	KI VS BW	0.567	3.89
KI VS MT	-0.543	4.24	BFI VS PR	-0.667	5.06

+: Highly significant. $P<0.0005$

TABLE 7. MORPHO-PHYSIOLOGICAL INDICES OF PREGNANT (N=17) AND NON-PREGNANT (N=18) FEMALES OF NORTH-WESTERN COTTONTAIL RABBIT. MONAY. STATE OF TRUJILLO. VENEZUELA.

	Pregnat females				Non-pregnat females			
Statistics	KI	AI	SI	BFI	KI	AI	SI	BFI
$\overline{X}$	8.19	1.00	3.54	2.89	7.78	1.10	3.91	2.84
SD	0.83	0.33	1.25	0.77	0.62	0.38	1.23	0.67
VC	10.1	32.9	3.5	26.7	7.9	34.2	31.5	23.5

$\overline{X}$: Mean. SD : Standard Deviation. VC : Variation coefficient.

Interactions between indices studied and some morphometric (BW, BS), and climatic (PR, MT) characteristics, are provided in Table 6.

It was also observed (Table 7) that the diferences between the total means of the four indices analysed are small and not significant when pregnant and non-pregnant females specimens are compared. These data are in agreement with those found for the temperate zone rabbits (Chapman, et al. op. cit.). All these factors considered for a particular time and place, could bring about a response that would be different in male and female rabbit specimens. Even so, more studies need to be done to get a better understanding of the adaptation mechanisms in this rabbit species.

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ANEXO 1

HOJA DE DATOS PARA CONEJO 1: MACHOS *S. f. continentis*

MESES	PC	IK	IA	IE	IG	AG	PG	VG	TC	PR	T.MED	T.a. MED
ENE	+0.116E+04	+0,8,31E+01	+0,164E+01	+0,508E+01	+0,334E+01	+0,171E+03	+0,971E+00	+0,121E+01	+0,380E+03	+0,550E+02	+0,247E+02	+0,180E+02
FEB	+0,121E+04	+0,7,47E+01	+0,105E+01	+0,459E+01	+0,234E+01	+0,165E+03	+0,954E+00	+0,123E+01	+0,374E+03	+0,410E+02	+0,260E+02	+0,186E+02
MAR	+0,104E+04	+0,6,89E+01	+0,192E+01	+0,422E+01	+0,148E+01	+0,143E+03	+0,816E+00	+0,114E+01	+0,370E+03	+0,620E+02	+0,254E+02	+0,188E+02
ABR	+0,966E+03	+0,7,71E+01	+0,118E+01	+0,346E+01	+0,500E+00	+0,178E+03	+0,105E+01	+0,147E+01	+0,393E+03	+0,124E+03	+0,247E+02	+0,186E+02
MAY	+0,967E+03	+0,7,65E+01	+0,106E+01	+0,414E+01	+0,150E+01	+0,131E+03	+0,753E+00	+0,116E+01	+0,379E+03	+0,145E+03	+0,250E+02	+0,192E+02
JUN	+0,103E+04	+0,6,43E+01	+0,126E+01	+0,487E+01	+0,277E+01	+0,144E+03	+0,767E+00	+0,110E+01	+0,374E+03	+0,108E+03	+0,254E+02	+0,192E+02
JUL	+0,984E+03	+0,7,58E+01	+0,129E+01	+0,791E+01	+0,100E+01	+0,928E+02	+0,882E+00	+0,110E+01	+0,372E+03	+0,111E+03	+0,252E+02	+0,188E+02
AGO	+0,105E+04	+0,6,81E+01	+0,108E+01	+0,635E+01	+0,180E+01	+0,119E+03	+0,102E+01	+0,130E+01	+0,370E+03	+0,114E+03	+0,250E+02	+0,193E+02
SEP	+0,113E+04	+0,6,88E+01	+0,107E+01	+0,432E+01	+0,280E+01	+0,213E+03	+0,795E+00	+0,980E+00	+0,374E+03	+0,143E+03	+0,255E+02	+0,193E+02
OCT	+0,114E+04	+0,6,24E+01	+0,114E+01	+0,526E+01	+0,215E+01	+0,193E+03	+0,863E+00	+0,110E+01	+0,373E+03	+0,169E+03	+0,251E+02	+0,191E+02
NOV	+0,109E+04	+0,6,51E+01	+0,927E+00	+0,261E+01	+0,275E+01	+0,163E+03	+0,753E+00	+0,983E+00	+0,372E+03	+0,193E+03	+0,243E+02	+0,189E+02
DIC	+0,120E+04	+0,8,01E+01	+0,846E+00	+0,296E+01	+0,348E+01	+0,133E+03	+0,928E+00	+0,106E+01	+0,380E+03	+0,890E+02	+0,245E+02	+0,188E+02

ÍNDICES	PC	IK	IA	IE	IG	AG	PG	VG	TC	PR	T.MED	T.a. MED
Media	+.108E+04	+.721E+01	+.120E+01	+.465E+01	+.216E+01	+.154E+03	+.879E+00	+.115E+01	+.376E+03	+.113E+03	+.251E+02	+.189E+02
Varianza	+.774E+04	+.446E+00	+.909E- 01	+.210E+01	+.857E+00	+.111E+04	+.110E- 01	+.189E- 01	+.414E+02	+.212E+04	+.249E+00	+.142E+00
Desv. Est.	+.880E+02	+.668E+00	+.302E+00	+.145E+01	+.926E+00	+.333E+02	+.105E+00	+.137E+00	+.643E+01	+.461E+02	+.499E+00	+.376E+00

MESES	PC	IK	IA	IE	IG	AG	PG	VG	TC	PR	T.MED	T.a. MED
ENE	+.100E+01											
FEB	+.113E+00	+.100E+01										
MAR	-.186E+00	+.866E- 01	+.100E+01									
ABR	-.246E+00	-.228E- 01	+.261E+00	+.100E+01								
MAY	+.774E+00	+.169E- 01	-.198E+00	-.326E+00	+.100E+01							
JUN	+.412E+00	-.225E+00	-.545E- 01	-.462E+00	+.288E+00	+.100E+01						
JUL	+.155E+00	+.491E+00	+.132E- 01	+.199E+00	-.209E+00	-.407E- 01	+.100E+01					
AGO	-.315E+00	+.365E+00	+.160E+00	+.111E+00	-.568E+00	-.782E- 01	+.785E+00	+.100E+01				
SEP	-.176E+00	+.586E+00	-.125E+00	-.397E+00	-.222E+00	+.240E+00	+.468E+00	+.600E+00	+.100E+01			
OCT	-.333E+00	-.543E+00	-.503E+00	-.180E+00	-.113E+00	+.211E+00	-.445E+00	-.335E+00	-.403E- 01	+.100E+01		
NOV	+.658E- 01	-.270E+00	+.161E+00	+.495E+00	-.178E+00	-.255E- 01	+.490E- 01	+.118E+00	-.461E+00	-.409E+00	+.100E+01	
DIC	-.310E+00	-.685E+00	-.421E+00	+.761E- 01	-.123E+00	-.650E- 01	.-483E+00	-.331E+00	-.414E+00	+577E+00	+317E+00	+.100E+01

ANEXO 2

HOJA DE DATOS PARA CONEJO 2: HEMBRAS *S. f. continentis*

MESES	PC	IK	IA	IE	IG	AG	PG	TC	PR	T.MED	T.a.MED
ENE	+.134E+04	+.829E+01	+.816E+00	+.357E+01	+.289E+01	+.398E+02	+.680E-01	+.407E+03	+.550E+02	+247E+02	+.180E+02
FEB	+.126E+04	+.854E+01	+.130E+01	+.546E+01	+.400E+01	+.309E+02	+.700E-01	+.404E+03	+.410E+02	+.260E+02	+.186E+02
MAR	+.901+E03	+.681E+01	+.106E+01	+.684E+01	+.220E+01	+.240E+02	+.430E-01	+.394E+03	+.620E+02	+.254E+02	+.188E+02
ABR	+.122E+04	+.686E+01	+.176E+01	+.549E+01	+.264E+01	+.387E+02	+.690E-01	+.410E+03	+.124E+03	+.247E+02	+.186E+02
MAY	+.126E+04	+.773E+01	+.980E+00	+.629E+01	+.263E+01	+.455E+02	+.950E-01	+.392E+03	+.145E+03	+.250E+02	+.192E+02
JUN	+.121E+04	+.729E+01	+.934E+00	+.603E+01	+.290E+01	+.346E+02	+.610E-01	+.400E+03	+.108E+03	+.254E+02	+.192E+02
JUL	+.102E+04	+.838E+01	+.115E+01	+.598E+01	+.188E+01	+.297E+02	+.530E-01	+.396E+03	+.111E+03	+.252E+02	+.188E+02
AGO	+.136E+04	+.876E+01	+.941E+00	+.350E+01	+.253E+01	+.362E+02	+.770E-01	+.397E+03	+.114E+03	+.256E+02	+.193E+02
SEP	+.125E+04	+.738E+01	+.937E+00	+.390E+01	+.233E+01	+.480E+02	+.590E-01	+.392E+03	+.143E+03	+.255E+02	+.193E+02
OCT	+.110E+04	+.751E+01	+.128E+01	+.339E+01	+.200E+01	+.427E+02	+.640E-01	+.390E+03	+.169E+03	+.251E+02	+.191E+02
NOV	+.137E+04	+.742E+01	+.116E+01	+.284E+01	+.195E+01	+.350E+02	+.670E-01	+.399E+03	+.193E+03	+.243E+02	+.189E+02
DIC	+.120E+04	+.988E+01	+.786E+00	+.688E+01	+.317E+01	+.440E+02	+.690E-01	+.394E+03	+.890E+02	+.245E+02	+.188E+02

ÍNDICES	PC	IK	IA	IE	IG	AG	PG	TC	PR	T.MED	T.a.MED
Madia	+.121E+04	+.790E+01	+.109E+01	+.501E+01	+.259E+01	+.374E+02	+.663E-01	+.398E+03	+.113E+03	+.251E+02	+.189E+02
Varianza	+.195E+05	+.797E+00	+.710E- 01	+.216E+01	+.364E+00	+.502E+02	+.161E-03	+.399E+02	+.212E+04	+.249E+00	+.142E+00
Desv. Est.	+.140E+03	+.893E+00	+.267E+00	+.147E+01	+.603E+00	+.709E+01	+.127E-01	+.632E+01	+.461E+02	+.499E+00	+.376E+00

MESES	PC	IK	IA	IE	IG	AG	PG	TC	PR	T.MED	T.a.MED
ENE	+.100E+01										
FEB	+.567E+00	+.100E+01									
MAR	-.311E+00	-.478E+00	+.100E+01								
ABR	-.276E+00	+.103E+00	-.319E- 01	+.100E+01							
MAY	+.556E+00	+.441E+00	-.733E- 01	+.308E+00	+.100E+01						
JUN	+.614E+00	+.173E+00	-.201E+00	-.272E+00	+.286E-01	+.100E+01					
JUL	+.694E+00	+.291E+00	-.532E- 01	-.118E+00	+.328E+00	+.564E+00	+.100E+01				
AGO	+.283E+00	-.816E- 01	+.428E+00	-.771E- 01	+.442E+00	-.244E+00	+.547E- 01	+.100E+01			
SEP	-.451E- 01	-.331E+00	+.195E+00	-.465E+00	-.666E+00	+.440E+00	+.230E+00	-.397E+00	+.100E+01		
OCT	-.150E+00	-.382E- 01	-.154E- 01	+.128E+00	+.320E+00	-.311E+00	-.157E+00	-.129E+00	-.409E+00	+.100E+01	
NOV	-.580E- 01	-.146E+00	.-135E+00	-.208E- 01	-.319E+00	+.248E+00	+.149E+00	-.694E+00	+.577E+00	+.317E+00	+.100E+01

FICHA

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