

## Scorpion poisoning in the Acosta and Caripe Counties of Monagas State, Venezuela. Part 1: Characterization of some epidemiological aspects <sup>1</sup>

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Escorpionismo nos Municípios Acosta e Caripe, Estado Monagas, Venezuela.  
Parte 1: Caracterização de alguns aspectos epidemiológicos <sup>1</sup>

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**Resumo** No presente trabalho os autores procuram mostrar o perfil epidemiológico do escorpionismo nos Municípios Acosta e Caripe, localizados na subregião geográfica do maciço montanhoso do Turimiquire do Estado de Monagas, Venezuela. Durante o período de 1987 a 1993, registrou-se um total de 298 acidentes causados por escorpiões, correspondendo 212 ao Município de Acosta e 86 ao de Caripe. Acosta apresentou um índice de incidência anual de 18,3 casos por 10.000 habitantes e 128% para o período meio de estudo; o índice de escorpionismo foi 4,18 vezes maior que o apresentado em Caripe. Os dados indicam que o Município de Acosta é hiperendêmico para este acidente, com um comportamento variável e uma tendência ao incremento ao longo dos anos. Os resultados obtidos evidenciam que estas regiões do Estado de Monagas são endêmicas para o acidente peçonhento causado por escorpiões que assumem importância como problema de saúde pública, mais ainda quando são áreas de dispersão do gênero *Tityus*.  
**Palavras-chave** Escorpiões; Envenenamento; Picada de Escorpião; Epidemiologia

**Abstract** Scorpion poisoning was surveyed in Acosta and Caripe counties, located in the Turimiquire subregion of Monagas State, Venezuela, aiming to expand information on stings by characterizing some epidemiological aspects. From 1987 to 1993, 298 cases of scorpion stings were recorded in Acosta and Caripe counties. Acosta had 212 cases, with an annual incidence rate of 18.3‰ (cases per 10,000 inhabitants) and a period median incidence rate of 128‰. The scorpion poisoning index is 4.18 times greater in Acosta than in Caripe, confirming the former as a hyperendemic zone for this type of injury, with a phenomenon of cyclical temporal fluctuations and an upward trend. This area is infested with scorpions of the genus *Tityus*. Our results show that the region surveyed in Monagas State is endemic for scorpion stings, posing a major public health problem.

**Key words** Scorpions; Poisoning; Scorpion Sting; Epidemiology

## Introduction

Stings and by venomous animals are a concern to health authorities in many countries because of the severity, magnitude, and transcendence of the poisoning they cause (Chippaux et al., 1984). Within this group, scorpions are of major medical importance due to the morbidity/mortality caused by them (González-Sponga, 1984). They pose a serious public health problem in certain regions of the Americas (Dehesa-Dávila, 1989; Biondi-Queiroz et al., 1995). The Buthidae family includes the majority of the species that are hazardous to humans (Broglia & Goyffon, 1980; Illanes, 1981). Amongst other genera, this family is represented in Venezuela by the *Tityus* genus, which is exclusive to the American Continent and is responsible for most of the cases in Brazil and Venezuela (González-Sponga, 1984; Porras et al., 1994; Biondi-Queiroz et al., 1995). Alterations in cardiovascular and pulmonary functions are the most frequent clinical manifestations and causes of death amongst victims of scorpion stings (Broglia & Goyffon, 1980; Illanes, 1981; Abroug et al., 1991; Amaral et al., 1992, 1994).

In Venezuela, in the endemic zones of Monagas State located in the Turimiquire subregion, scorpion poisoning has been classified as a relevant public health problem (Figueredo et al., 1985). During the 1989-1991 triennium, Ve-

lasquez et al., (1992a, 1992b) demonstrated an incidence rate of 2.82‰ (398 cases), establishing the existence of a hyper-endemic zone for scorpion stings. An example of the severity of scorpion poisoning within Venezuela's Northeastern Region was attested by De Sousa et al., (1995a). They describe the case of a nine-year-old child from the Turimiquire subregion of Anzoátegui State, bordering on Monagas State, who developed a cerebral parenchymatous lesion, cardiorespiratory alterations, blood coagulation disorders, and upper digestive hemorrhage following scorpion poisoning.

The scarce epidemiological research on scorpion poisoning to date in Venezuela poses a barrier to adequate understanding of how relevant this problem is for the public health sector. We thus proposed to characterize some epidemiological aspects of scorpion stings in two bordering counties (Acosta and Caripe) of the Turimiquire subregion of Monagas State in Northeastern Venezuela. Our results show that the two are endemic for scorpion poisoning, and thus pose a public health problem.

## Methodology

### Material and methods

This is a retrospective epidemiological study carried out in Acosta and Caripe counties in the Turimiquire subregion of Monagas State, in Northeastern Venezuela (Figure 1). The data cover a longitudinal chronological series from January 1987 to December 1993. All cases within this area, attended and recorded in the daily morbidity records of the emergency service of the county hospitals in the town of San Antonio de Capayacuar (Acosta) and Caripe (Caripe) were included in the study.

Scorpion sting incidence rates were expressed on a base of 10,000 inhabitants per year, considering the population progression. This progression was calculated with figures obtained from the Settlement Population Nomenclator Report of the Northeastern Region of Venezuela, published by the statistics bureau, or Oficina Central de Estadística e Informática (OCEI). For each county, the incidence rates for each year of the study period (1987-1993), the average annual rate (AAR), and the reference period median (RPM) were calculated. The scorpion poisoning index for both counties was obtained as a quotient that relates their average incidence rate values.

Figure 1

Relative geographic situation of Monagas state in the north-eastern region of Venezuela, showing the location of the Acosta and Caripe municipalities.

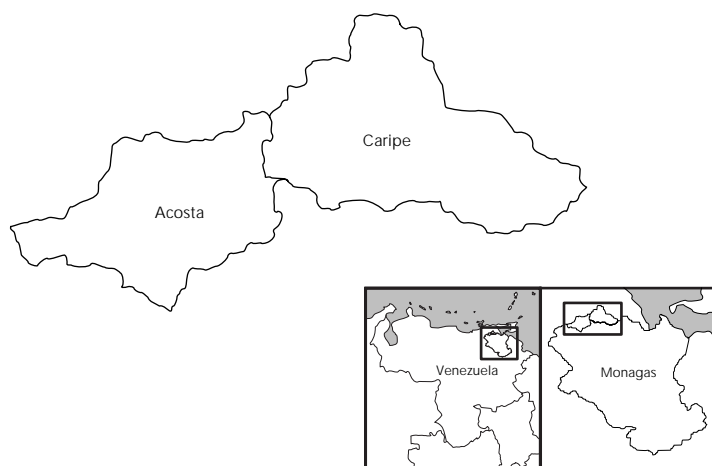


Table 1

Cases of scorpion stings per year in Acosta and Caripe Counties, Monagas State, Venezuela.

	1987	1988	1989	1990	1991	1992	1993	Total
<b>Acosta</b>								
Cases*	26	21	38	34	31	28	34	212
X	2.17	1.75	3.17	2.83	2.58	2.33	2.83	30.29
$\sigma$	$\pm$ 1.27	1.06	2.17	2.17	1.16	1.67	1.03	5.73
<b>Caripe</b>								
Cases**	15	10	9	7	10	14	21	86
X	1.25	0.83	0.75	0.58	0.83	1.17	1.75	12.28
$\sigma$	$\pm$ 1.14	0.58	0.62	0.90	0.58	1.47	1.22	4.75

X Average per month for each year

 $\sigma$ : Standard deviation of the mean

\* Number of cases recorded in the San Antonio de Capayacuar Hospital (Acosta County)

\*\* Number of cases recorded in the Caripe Hospital (Caripe County)

### Data processing

Statistical analysis of variables was done by applying parametric methods: 1) descriptive measurements for univariate central tendency and dispersion of data; 2) distribution of Student's *t* differences between means; 3) demonstrations concerning proportions of large samples' inference test with respect to the difference of proportions with independent sampling; and 4) time series analysis test of cyclical fluctuations. A significance value of 95% confidence ( $p < 0.05$ ) was considered.

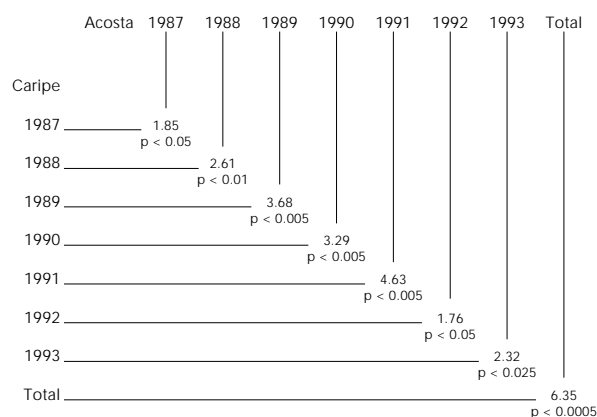
### Results

Cases of scorpion poisoning in Acosta and Caripe counties from 1987 to 1993 are shown in Table 1. Acosta recorded 212 scorpion stings during the study period. The highest frequency of scorpion poisoning was in 1989 and the lowest in 1988. Caripe recorded a total of 86 cases of scorpion poisoning, with 1993 having the most cases and 1990 the least. Cases for Acosta ranged from 2 to 3 per month and about 30 per year. Caripe averages about one patient per month and twelve per year. Comparison of the monthly mean cases of scorpion poisoning for each year among both counties is shown in Figure 2; Acosta as compared to Caripe showing statistically significant differences in all years evaluated ( $p < 0.05$ ).

The observed seasonal behavior of poisoning in both counties, accumulated for each month during the 1987-1993 period is shown in Figure 3. Acosta County displays a cyclical fluctuation phenomenon that is statistically

Figure 2

Comparison of average of scorpion sting per month for each year in Acosta and Caripe municipalities of Monagas state, Venezuela.



significant ( $p < 0.05$ ). It presents approximately three cycles a year with three peaks of maximum incidence, in February, June, and September. The month of June accumulates the highest frequency with 27 scorpion stings in the 1987-1993 period. For Caripe, this cyclical fluctuation did not show statistically significant differences ( $p > 0.05$ ), presenting only two peaks of maximum incidence, in the months of March and August; the latter accumulating the most number of cases with 13 scorpion stings. An opposite trend in both counties is observed when comparing the fluctuation trends in the frequency of cases; that is, when the incidence in Acosta increases, it decreases in Caripe, and

Figure 3

Plotting of seasonal behavior of scorpion poisoning accumulated for each month in the chronological series (1987-1993) in Acosta and Caripe municipalities of Monagas state, Venezuela.

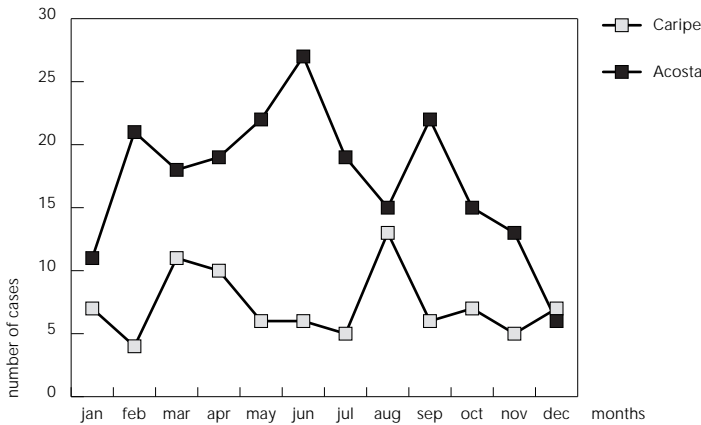
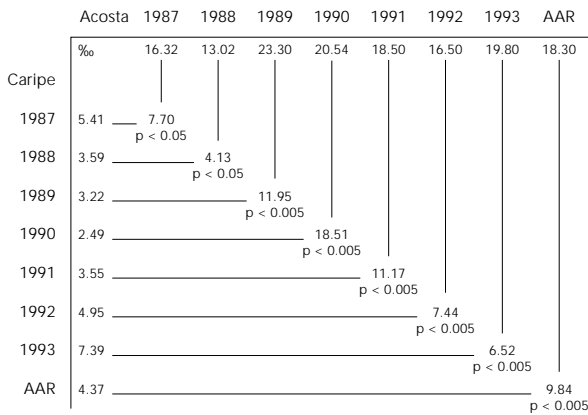


Figure 4

Comparison of annual incidence rates per 10,000 inhabitants of scorpion poisonings between 1987 and 1993 in Acosta and Caripe municipalities of Monagas state, Venezuela.



the months of maximum incidence in each region do not coincide.

Table 2 shows that the scorpion poisoning incidence was higher in Acosta County, with an average annual rate of 18.30‰, and lower in Caripe County, with a corresponding value of 4.37‰. The reference period median was 30.63‰ for Caripe and 128‰ for Acosta. The scorpion poisoning incidence coefficient was 4.18 times higher in Acosta County than in Caripe. In Acosta, the years of greatest epidemiological importance for scorpion poisoning were 1989, 1990, and 1993, with incidences

of 23.30‰, 20.54‰, and 19.80‰ respectively, presenting a significantly higher incidence rate than other years in the study period (p<0.05). For Caripe, the most significant epidemiological year was 1993 (p<0.05). As shown in Figure 4, incidence rates were higher in Acosta for all the study period, displaying statistically significant differences when compared to those of Caripe (p<0.05).

### Discussion

Previous research by Figueredo et al., (1985) in Monagas State shows that scorpion sting morbidity/mortality is relevant in this region. Velasquez et al., (1992a, 1992b) determined an average annual incidence of 2.82‰ in this State for the 1989-1991 triennium. They also established Acosta County as a hyperendemic area (18.30‰) in comparison to the other regions of the same State. Expanding the longitudinal period of study (1987-1993) in Acosta County, our results yield an average annual rate of 18.30‰ and an RPM of 128.00‰. The scorpion poisoning index confirms the conclusions of Velasquez et al., (1992a, 1992b) classifying Acosta County as a hyperendemic zone for such injuries. We observed greater incidence values in 1989, 1990, and 1993 for Acosta, leading us to assume that the frequency of scorpion stings has tended to increase. The incidence for Caripe shows a much greater stability throughout the study period. The significantly greater frequency of cases for Acosta indicates that 2 or 3 reported scorpion stings per month and about 30 per year may be expected in this region. However, we expect one patient per month and around twelve per year within the Caripe area.

Plotting of the frequency of recorded scorpion sting cases shows cycles of maximum and minimum peaks that display an opposite behavior when comparing the two counties; when the number of cases increases in Acosta, it decreases in Caripe. This phenomenon of cyclical fluctuations over time is statistically significant for Acosta. As in other countries, the maximum peaks of scorpion poisoning incidence coincide with the beginning of rainy season cycles (Velasco-Castrejon et al., 1976; Illanes, 1981; Dehesa-Dávila, 1989). The appearance of the maximum peaks in different months for the two counties (Acosta and Caripe) is probably due to the variation in the beginning of the rainy season in these two areas of the Turimiquire subregion of Monagas State.

Table 2

Scorpion poisoning incidence rate per 10,000 inhabitants in Acosta and Caripe Counties, Monagas State, Venezuela.

	Acosta		Caripe	
	Cases /Population <sup>£</sup>	Incidence Rate ‰	Cases /Population <sup>£</sup>	Incidence Rate ‰
1987	26/15,931	16.32	15/27,745	5.41
1988	21/16,133	13.01	10/27,856	3.59
1989	38/16,338	23.30*	9/27,967	3.22
1990	34/16,546	20.54*	7/28,079	2.49
1991	31/16,754	18.50	10/28,191	3.55
1992	28/16,963	16.50	14/28,304	4.95
1993	34/17,175	19.80*	21/28,417	7.39*
AAR	212/16,546/7	18.30	86/28,079/7	4.37
RPM	212/16,546	128.00	86/28,079	30.63
Index:		$\frac{128.00‰}{30.63‰} = 4.18^{**}$		

AAR: average annual rate, calculated as the quotient between the cases for the seven-year period and the population for 1990

RPM:reference period median, calculated as the quotient between the cases for the total period and the population for 1990

Index:Obtained by dividing the RPM for Acosta and Caripe counties

£ Census recorded by the Oficina Central de Estadística e informática (OCEI)

\* p<0.05

\*\* p<0.0001

De Sousa et al. (1995b) describe a scorpion poisoning epidemic in Montes County, Sucre State, during 1993. This county borders on Acosta and shares the same physical-geographic and ecological area of the Turimiquire subregion, located in Venezuela's Northeastern Region. This subregion has several different ecosystems within its area of influence (Manzanilla-Puppo, 1992), including a tropophilous jungle and evergreen woods (rain and misty forests) (González-Sponga, 1984). The tropophilous jungle occupies the foothills region and is characteristic of the three States making up the Turimiquire subregion (Anzoátegui, Monagas, and Sucre). With an average annual temperature between 25 and 28°C, average annual precipitation between 1,000 and 2,500 mm, vegetation with trees 30 to 40 meters high, scarce epiphytes, and a well-developed herbaceous stratum, this tropophilous jungle is one of the habitats described as harboring the *Tityus* genus in Venezuela.

In Venezuela, scorpions have a wide geographical distribution (González-Sponga, 1984). Potential risk areas for poisoning coincide with the dispersion of the *Tityus* genus (González-Sponga, 1984; De Sousa et al., 1996). In the country's central regions, such as the Federal District and Miranda State, cases of scorpion stings are related to the presence of *Tityus dis-*

*crepans* (González-Sponga, 1984; Porras et al., 1994). A new species of this genus (Quiroga, 1988) has been reported in Punceres and Bolívar Counties in the Northern-Central Region of Monagas State (Velasquez et al., 1992a, 1992b). This suggests that scorpion poisoning in Acosta and Caripe, especially severe cases, is associated with the presence of this genus. We have collected several specimens of this taxonomic classification in field captures.

In other regions of the Americas, severe stings by these arthropods have also been correlated with different species belonging to this genus. In Brazil, *Tityus serrulatus*, *Tityus bahiensis* (Bücherl, 1953, 1969, 1978; Spirandeli-Cruz et al., 1995; Lourenço & Cuellar, 1995), and *Tityus stigmurus* have been involved in most cases; the latter predominant in the Northeastern Region of Brazil (Eickstedt, 1983/84; Azevedo-Marquez et al., 1992). In Bahía State, Biondi-Queiroz et al. (1995) have verified an increase in the scorpion poisoning incidence during the period 1992-1994 in the Greater Salvador Metropolitan Area. In this study, the *Tityus* genus was identified as the etiologic agent in 98.1% of the cases.

It would be interesting to characterize the geographical distribution of the scorpionic fauna in Acosta and Caripe, determining which species of scorpions are present there. Regard-

ing this, Manzanilla-Puppo (1992), applying a morphometric study, Truss Network and other techniques, characterized in Venezuela the geographical distribution and ecological niches of the *Rhopalurus* genus. Application of this methodology or its alternatives would help extend the knowledge on the scorpionic fauna of this region and its relation to venomous stings.

We conclude that Acosta County in the Northwestern area of Monagas State is a hyperendemic zone for scorpion poisoning, thus constituting a public health problem. The results of this study lead us to more detailed research on the epidemiological characterization of such poisoning and the identification of species within the study area.

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## References

- ABROUG, F.; BOUJDARIA, R.; BELGHITH, M.; NOUIRA, S. & BOUCHOUCHA, S., 1991. Cardiac dysfunction and pulmonary edema following scorpion envenomation. *Chest*, 100:1057-1059.
- AMARAL, C.; FERREIRA, D.; CAMPOLINA, D.; OLOTTEGUI, C. & DINIZ, C., 1992. Evidências de mecanismo não cardigênico na gênese do edema pulmonar agudo secundário a acidente escorpiônico (*Tityus serrulatus*). *XXVIII Congresso da Sociedade Brasileira de Medicina Tropical*. Belém.
- AMARAL, C.; BARBOSA, A.; RIOS LEITE, V.; TAFURI, W. & ALVES DE REZENDE, N., 1994. Scorpion sting-induced pulmonary oedema: evidence of increased alveolocapillary membrane permeability. *Toxicon*, 32:999-1003.
- AZEVEDO-MARQUEZ, M. M. de; CUPO, P. & HERING, S. E., 1992. Acidentes por animais peçonhentos. *Medicina*, 25: 539-554.
- BIONDI-QUEIROZ, I.; FREITAS, I. E. S.; SANTANA, V. P. G. & RODRIGUES, D. S., 1995. Epidemiologia de acidentes por escorpiões na Região Metropolitana de Salvador (BA). *III Congresso Brasileiro, II Congresso Iberoamericano e I Congresso Latinoamericano de Epidemiologia*. Salvador.
- BROGLIO, N. & GOYFFON, M., 1980. Les accidents d'envenimation scorpionique. *Le Concours Médical*, 102:5615-5622.
- BÜCHERL, W., 1953. Escorpiões e escorpionismo no Brasil. I. Manutenção de escorpiões em viveiros e extração do veneno. *Memórias do Instituto Butantan*, 25:53-82.
- BÜCHERL, W., 1969. Escorpionismo no Brasil. *Memórias do Instituto Butantan*, 34:9-24.
- BÜCHERL, W., 1978. Venoms of Tityinae. In: *Arthropod Venoms*. (S. Bettini, ed.). pp. 371-379, Berlin: Ed. Springer-Verlag.
- CHIPPAX, J.; GALTIER, J. & LEFAIT, J., 1984. Épidémiologie des envenimations en Guyane Française. *Bulletin de la Société de Pathologie Exotique*, 77:206-207.
- DEHESA-DAVILA, M., 1989. Epidemiological characteristics of scorpion sting in Leon, Guanajuato, Mexico. *Toxicon*, 27:281-286.
- DE SOUSA, L.; KIRIAKOS, D.; JIMENEZ, J.; MICHELI, D.; RODRIGUEZ, C.; MIRABAL, J. & QUIROGA, M., 1995a. Accidente cerebrovascular isquémico por emponzoñamiento escorpiónico: Observación clínica. *SABER, Revista Científica del Consejo de Investigación de la Universidad de Oriente*, 7:7-14.
- DE SOUSA, L.; GARCIA, Y.; CAMPAÑA, J.; PARRILLA, P.; LEDEZMA, E.; JORQUERA, A. & QUIROGA, M., 1995b. Epidemia por escorpionismo en la Subregión Turimiquire del Estado Sucre, Venezuela. *III Congresso Brasileiro, II Congresso Iberoamericano e I Congresso Latinoamericano de Epidemiologia*. Salvador.
- DE SOUSA, L.; BONOLI, S.; QUIROGA, M. & PARRILLA, P. 1996. Scorpion sting epidemiology in Montes Municipality of the State of Sucre, Venezuela: geographic distribution. *Revista do Instituto de Medicina Tropical de São Paulo*, 38:147-152.
- EICKSTEDT, V. R. D. von., 1983/84. Escorpionismo por *Tityus stigmurus* no Nordeste do Brasil (Scorpiones; Buthidae). *Memórias do Instituto Butantan*, 47/48:133-137.
- FIGUEREDO, V.; BADDOUR, Z. & LEON, B., 1985. *Escorpionismo en Algunas Regiones del Estado Monagas. Lapsos 1981-1983*. Tesis de Grado, Ciudad Bolívar: Escuela de Medicina, Universidad de Oriente.
- GONZALEZ-SPONGA, M. A., 1984. *Escorpiones de Venezuela*. Caracas: Ed. Lagoven.
- ILLANES, A., 1981. *Farmacología de los Venenos de Escorpiones*. Trabajo de Ascenso a Profesor Titular. Ciudad Bolívar: Escuela de Medicina, Universidad de Oriente.
- LOURENÇO, W. R. & CUELLAR, O., 1995. Scorpions, scorpionism, life history strategies and parthenogenesis. A review article. *Journal of Venomous Animals and Toxins*, 1:51-62.

- MANZANILLA-PUPPO, J., 1992. *El género Rhopalurus Thorell (Scorpionida: Buthidae) en Venezuela. Consideraciones Biogeográficas, Taxonómicas y Ecológicas*. Tesis de Maestría. Maracay: Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela.
- PORRAS, J. L.; ROSILLO-GONZÁLEZ, M. & GUIRADO-PASTOR, M., 1994. Escorpionismo por *Tityus discrepans*. Estudio retrospectivo 1983-1986. *Archivos Venezolanos de Pediatría y Puericultura*, 57:98-105.
- QUIROGA, M., 1988. *Descripción de una nueva especie de escorpión del género Tityus (Koch, 1836) Tityus caripitensis sp.n. Estudio histológico de la glándula del veneno*. Trabajo de Ascenso a Profesor Asociado. Ciudad Bolívar: Escuela de Medicina, Universidad de Oriente.
- SPIRANDELI-CRUZ, E. F.; WINTHER-YASSUDA, C. R.; JIM, J. & BARRAVIERA, B., 1995. Programa de control de surto de escorpião *Tityus serrulatus*, Lutz e Melo 1922, no Município de Aparecida, SP (Scorpiones, Buthidae). *Revista da Sociedade Brasileira de Medicina Tropical*, 28:123-128.
- VELASCO-CASTREJON, O.; LARA-AGUILERA, R. & ALATORRE, H., 1976. Aspectos epidemiológicos y clínicos de la picadura de alacrán en un área hiperendémica. *Revista de Investigación de Salud Pública*, 36:93-103.
- VELASQUEZ, A.; DE SOUSA, L.; QUIROGA, M. & RODRIGUEZ, R., 1992a. Escorpionismo en el Estado Monagas, Venezuela. Parte I: Algunos aspectos epidemiológicos. *Memorias II Congreso Científico, Universidad de Oriente*. Nueva Esparta.
- VELASQUEZ, A.; QUIROGA, M. & DE SOUSA, L., 1992b. Escorpionismo en el Estado Monagas, Venezuela. Parte II: Hiperendemismo en el Municipio Acosta. *Memorias II Congreso Científico, Universidad de Oriente*. Nueva Esparta.