PAN AMERICAN HEALTH ORGANIZATION
WORLD HEALTH ORGANIZATION

XI INTER-AMERICAN MEETING, AT THE MINISTERIAL LEVEL, ON ANIMAL HEALTH

Washington, D.C., 13-15 April 1999

RIMSA11/INF/24 (Eng.)
13 April 1999
ORIGINAL: SPANISH

EQUINE ENCEPHALITIDES: SURVEILLANCE AND PREVENTION EFFORTS

CONTENTS

1. Introduction

Equine encephalitides are zoonoses caused by *arbovirus* of the family *Togaviridae*, which maintain sylvatic cycles of infection involving certain vertebrates and diverse vectors, particularly mosquitoes. These diseases have social and economic consequences for the countries of the Region, since they cause outbreaks in horses and occasionally in humans. Three viruses are distinguished by their distribution and the damage they cause in the Americas: eastern equine encephalitis (EEE), western equine encephalitis (WEE), and Venezuelan equine encephalitis (VEE). Of the three mentioned, VEE is the most important because of its pathogenicity in humans and the history of the epizootics and epidemics in the past, which have crossed natural barriers and spread through almost the entire Hemisphere.

The three diseases are found in List B of the International Zoosanitary Code for epizootics of the International Office of Epizootics (IOE), the Food and Agriculture Organization of the United Nations (FAO), and the World Health Organization (WHO), which commits the countries to maintaining surveillance and information systems.

1.1 *Eastern Equine Encephalitis (EEE)*

The disease caused by the EEE virus has been reported in North, Central, and South America. However, the viruses are different antigenically in each region, as are the host vertebrates and mosquito vectors.

In the eastern part of the United States of America, the virus continuously circulates in birds, especially in swampy areas, with the mosquito *Culiseta melanuria* as the principal vector. In other areas *Aedes sollicitans* is involved; this mosquito abounds in marshy regions with brackish water and transmits the virus to birds, horses, and humans. In tropical countries of the Americas the principal vectors are *Aedes taeniorhynchus*, *Culex nigripalpus*, *Culex taeniopus*, *Culex panacossa*, and *Culex dunni.*

Humans and horses are accidental hosts and terminal points in the transmission chain.

Infection with the EEE virus in humans is not as frequent as in horses, but the case-fatality is between 60% to 80% and in children under 5 the infection can leave permanent sequelae with varying degrees of severity.

The case-fatality in equine livestock is between 75% and 90%. High mortality from infection with the EEE virus has been reported in pheasants.

1.2 *Western Equine Encephalitis (WEE)*

The WEE virus has been reported in the United States, Canada, Mexico, and a number of countries in South America. In the United States there is a broad endemic area in the Central Valley of California where sporadic outbreaks are observed, but the disease also occurs elsewhere in the country.

The cases in horses tend to be sporadic at the beginning, but then take on epizootic characteristics.

The principal vector in the western part of the United States is *Culex tarsalis,* although *Aedes dorsalis* is occasionally involved. The former is also a transmitter of San Luis encephalitis virus in the same area. In the eastern region the vector is *Culiseta melanuria*, an essentially ornithophilous mosquito, which explains the absence of human cases and the low frequency in horses.

The natural reservoirs of the WEE virus are birds, especially passerines, which develop a short viremia of two to five days, during which mosquitoes that feed on them are infected. Wild birds harbor the virus for 10 months after their infection.

Humans and equine animals are accidental hosts. The case-fatality rate in humans ranges from 5% to 10% and from 10% to 50% in solidungulates.

As in infection by the EEE virus, there can be neurological sequelae in children infected by the WEE virus, namely, mental retardation and learning disorders.

1.3 *Venezuelan Equine Encephalitis (VEE)*

The VEE virus originated in the Americas. It has been verified only on this continent, where it was isolated for the first time in 1938.

Major epizootics of VEE have occurred in Colombia, Venezuela, Trinidad and Tobago, and Peru between 1955 and 1959. In 1967 there was an epizootic outbreak in various regions of Colombia. It spread to Peru and Ecuador and then in 1969 to Central America, affecting all countries except Panama and finally reaching Mexico and the state of Texas in the United States in 1971.

The VEE virus has been classified into six subtypes, from I to VI, based on the hemagglutination inhibition test. Variants A, B, and C of subtype I have been responsible for the epizootics and epidemics occurring in the Americas (see Table 1). It was previously believed that the enzootic subtypes and variants were not pathogenic for the solidungulates and produced immunity in them that protected them against the epizootic

variants. However, this hypothesis is about to be reviewed, given the variability and mutagenicity of the viruses, which can give rise to new epizootic variants. In 1993, there was an epizootic of Venezuelan equine encephalitis in Mexico; the virus isolated was identified as Subtype 1E, previously known as enzootic.

The sylvatic cycle is observed in the moist jungles of tropical America and in swampy regions, where transmission of the virus is enzootic and involves rodents and several species of mosquitoes of the genus *Culex*. Various species of insectivorous and frugivorous bats occasionally participate in that cycle. Humans can be infected on entering enzootic ecosystems, in which case sporadic cases or small outbreaks are observed.

The epizootic cycle is developed among equine animals and several equinophilous mosquitoes. The epizootics tend to be explosive and dramatic. The infection among the solidungulates can become extreme, reaching almost 100% and mortality can range from 20% to 40% of the total population, with a case-fatality rate ranging from 38% to 83%.

During the epizootics other animals such as cattle, pigs, and dogs, may be infected, although the disease has been verified only in dogs.

Usually, the equine cases precede the human cases, which become fewer and cease when the population of susceptible solidungulates that serve as amplifiers of the infection and maintain the infection in vectors is exhausted.

Venezuelan equine encephalitis is commonly manifested in humans as an undifferentiated benign febrile disease accompanied by headache, myalgia, pharyngitis, and leukopenia with lymphopenia. This symptomatology is frequently confused with that of dengue. The clinical cases usually involve some 11% to 20% of the general population, but the figures can be much higher. Mortality is low and has been estimated at between 0.2% and 1.0% of the clinical cases. In infected children a 4% incidence of encephalitis has been observed and in infected adults, a 0.4% incidence. Birth defects, including anencephalia in the fetuses of mothers that contracted the disease during pregnancy, are frequently seen as sequelae of the outbreaks.

Several species of mosquitoes have been implicated in the epizootics: *Psorophora confinnis*, *Psorophora discolor*, *Mansonia titillans*, *Mansonia indubitans*, *Aedes taeniorhynchus*, *Aedes sollicitans*, *Aedes scapularis*, *Aedes theleter*, and *Deinocerites pseudes*. Isolations of the virus from *Aedes aegypti* suggest it as a vector among humans.

2. Equine Encephalitides Situation in Latin America and the Caribbean

2.1 *General Considerations*

Equine encephalitides are closely associated with environmental conditions that permit a rapid increase in mosquito vectors and amplification of the virus in susceptible vertebrate hosts. The response to these epidemiological events depends on adequate operation of the epidemiological surveillance system. A proactive surveillance system should provide notice of any viral activity through continuous collection of data on several variables that can serve as predictors of the epidemiological event.

The absence of cases and outbreaks in geographical areas has been interpreted erroneously as absence of the disease and as a result, many countries have decreased or deactivated their systems for surveillance of equine encephalitides, as observed in the past 15 years in the Latin American and Caribbean countries.

Some countries continue to utilize the weekly quadrant information system of the Pan American Foot-and-Mouth Disease Center (PANAFTOSA), to which they report cases of syndromes compatible with viral equine encephalitis, indicating the place of occurrence by geographic coordinates. This practice, however, is not accompanied by information on laboratory confirmation of the diagnosis.

Table 2 presents a summary of the information received from the countries from 1989 to 1996. The limited participation of the countries is evident in that during the 1997-1998 biennium only seven countries reported the presence or absence of foci in the 52 epidemiological weeks: Brazil, Colombia, Ecuador, Honduras, Mexico, Panama, and Venezuela. Of the countries listed, only Colombia has sent all the weekly reports due since 1989; Ecuador and Venezuela have complied since 1992.

Some countries only report to the PANAFTOSA system when episodes of syndromes compatible with equine encephalitides occur, as is the case with Mexico, which sent information in 1993 and 1995. Others, such as Belize, which had cases of equine encephalitis during the months of July and August 1996, do not report them.

During 1997,115 foci of syndromes compatible with equine encephalitides in Latin America and the Caribbean were reported to PANAFTOSA, and in 1998, 162. However, the official services of Mexico and Colombia have registered more foci for those two years than were reported to PANAFTOSA for the entire Region.

The greatest activity in 1997 occurred in Mexico, which received reports of 481 foci in that year and 90 in 1998. In Colombia 49 and 216 foci were recorded in 1997 and 1998, respectively (see Table 3).

Of the 849 foci of syndromes compatible with equine encephalitides that were reported in 1997 and 1998, 772 were confirmed in a laboratory (positive or negative for EEE and VEE), corresponding to 90.9% of all the reported foci, a figure that is very significant for epidemiological surveillance.

It should be noted that of the 571 foci reported in Mexico in 1997 and 1998, 100% were found, on laboratory analysis, to be negative for equine encephalitides.

In 1997 there were only two confirmed foci of EEE, one in Venezuela and the other in Brazil. Only VEE activity was confirmed that year in Colombia, which reported 5 foci.

In 1998 48, foci of VEE were confirmed, one in Venezuela, another in Honduras, and the other 46 in Colombia. In addition, there were four confirmed foci of EEE, two of them in Colombia (see Table 3).

Figures 1, 2, 3, and 4 show the distribution of the foci reported in Colombia and Mexico in 1997 and 1998.

The large number of foci reported in Colombia and Mexico do not necessarily represent greater viral activity in these countries. States of alert often increase the number of reports, with many of them turning out to be negative. However, it must be recognized that epidemiological surveillance, including laboratory activity, has improved considerably, as was previously noted for Mexico, where all notified clinical events were investigated in the laboratory.

With the information provided from October 1989 to December 1998, it has been possible to confirm the existence of endemic areas in various countries where clinical episodes of equine encephalitides were reported consistently and VEE and EEE activity has been confirmed. In fact, the foci of syndromes compatible with equine encephalitides reported in Brazil in 1997 and 1998 occurred in Quadrant 3036, where there had been foci in the past. EEE was confirmed in this quadrant in 1997. In 1998 a great deal of VEE activity was detected in Colombia in upper Magdalena, in quadrants that had been hosts to this disease in prior years. Table 4 and Figures 5, 6, and 7 show the locations of these areas in some countries. The distribution and extension of these areas is an approximation, since more information is not available. However, the identification of these areas is useful for selecting strategies and establishing surveillance and control measures.

2.2 *Equine Encephalitides in Colombia*

Taking into account the intense activity of equine encephalitides in this country during the period 1997-1998, special emphasis is being placed on analysis of the situation in this country.

Noting the endemic areas of equine encephalitides in Colombia, it is estimated that some 19 million people inhabit risk areas--that is, 45% of the Colombian population, according to the population projections for June 1998 issued by the National Statistics Department (DANE). This absolutely justifies continuing with the surveillance, prevention, and control programs, whose purpose is to prevent these pathologies from having a social and economic impact.

Colombia has maintained a state of alert for outbreaks of VEE and implements vaccination programs in areas characterized by a warm climate at altitudes of up to 1,500 m above sea level.

It should be pointed out that vaccination in Colombia is free and provided by the official services, which up to 1998 meant the Ministry of Health. In the future, vaccines will be procured with resources from the Ministry of Agriculture, and vaccination will be the responsibility of zoonosis committees coordinated by the agriculture and health authorities.

The majority of the areas with an equine population are difficult to reach, and there is insufficient personnel. Vaccinations are administered in biennial cycles, and foals are immunized in the intermediate years. Current vaccination coverage, however, is inadequate. According to the Colombian Livestock Institute (ICA), the agency designated by the Ministry of Agriculture to carry out vaccination activities, in 1998 488,097 doses of vaccine were administered in risk areas, where the susceptible population is estimated at 1,353,013 head, achieving only 37% coverage. This situation makes it necessary to search for new strategies that will involve all actors without exception, if useful levels of coverage are to be achieved.

In 1995 an outbreak of VEE with epidemic characteristics began in Venezuela and ultimately spread to Colombian territory through the Department of Guajira, obliging Colombian health authorities to request assistance from PAHO, which responded rapidly with the support of personnel from USAMRIID in the United States. This permitted rapid identification of the virus in question, which was confirmed as Subtype 1C. It was also confirmed that vaccine TC83 provided adequate protection against variants of the virus isolated in the field.

The availability today of adequate diagnostic systems with rapid and highly sensitive serologic tests that permit the detection of IgG and IgM antibodies for the three encephalitides (EEE, WEE, and VEE), as well as laboratories with adequate biosafety facilities to isolate the virus have permitted the development of a different approach to the prevention and control of these diseases, with the technical support of PAHO. The foundation for this new approach is the use of integrated epidemiological surveillance mechanisms involving the Ministries of Health and Agriculture, as well as ongoing collaboration between countries traditionally affected by equine encephalitides, such as Colombia and Venezuela.

It must be borne in mind, nevertheless, that government authorities are not the only ones involved in the prevention and control of these diseases. The principal actors are horse owners and everyone residing in risk areas who has the opportunity to observe and report the first indications of the disease. This requires education and information programs to encourage people to become involved in this important epidemiological surveillance activity.

Starting out with these premises, Colombia is implementing a control program based on:

- **Active epidemiological surveillance based on the following:**

1. Reactivation of the zoonosis committees at the national, departmental, and local level, involving all government or private organizations and ranchers who raise horses, mules, and donkeys, together with community organizations.

2. Promotion of active community reporting of all suspected cases to the health and agriculture authorities.

3. Training of health and agricultural personnel in all activities of the control program, emphasizing the collection of samples and their dispatch to the laboratory.

4. Integration of the health and agriculture information and epidemiological surveillance systems, using the methodology recommended by PAHO.

5. Education, information dissemination, and support in areas with indigenous populations, where notification is more unlikely, bearing in mind the customs and cultures of the different regions.

Furthermore, the problems of public order found in the majority of rural areas in the country sometimes merit special treatment, depending on the locality.

6. Laboratories with integrated information systems, with the capacity not only for serological diagnosis but for isolation of the etiologic agents.

7. Epidemiological characterization of risk areas in the national territory, which includes the detection of enzootic areas and identification of the factors associated with their bioecology.

- **Availability of a VEE vaccine with adequate testing that meets international standards**

The existence of areas endemic for VEE raises the possibility of utilizing vaccines manufactured from national strains, a possibility that should be explored. There is currently no adequate vaccine for the prevention of VEE.

- **Vaccination coverage for equines in risk areas**

Colombia has not been the exception in reducing its government apparatus through globalization and the privatization of services, a factor that hinders government action in disease prevention and control. This makes it necessary to seek partnerships, conduct analyses of risk factors that will make it possible to develop not only prevention measures but specific control if we have excellent epidemiological information. In this area efforts have focused on:

1. Targeting vaccination programs to areas with an ecology that favors the emergence of equine encephalitides—that is, areas characterized according to the map of ecological areas in the Holridge classification, which in Colombia include 18 of the 31 departments. Of these, only desert regions are selected, or areas with dry seasons alternating with months of high rainfall, which fosters the presence of vectors and reservoirs of the virus in warm climates.

   Limited personnel and economic constraints make it necessary to target these areas for vaccination, thereby reducing costs and the number of doses of vaccine to administer.

2. Rapid response to suspected cases (equine neurological syndrome) for diagnostic confirmation to determine the action to take. Control of foci, utilizing vaccinations in a wide ring when suspected cases are detected, with the support of measures restricting the movement of equines or imposing a total quarantine on affected areas. The efficacy of these measures could be seen in 1998 when a serious outbreak occurred in the Department of Casanare, with the presence of both EEE and VEE in the same area. Thanks to the organized community support

and the intervention of the official agencies, the outbreak was brought under control.

Thus, the importance of active epidemiological surveillance with broad community participation cannot be emphasized enough. This approach makes it possible to minimize efforts in preventive measures and control activities, especially when resources are scarce, as is the case for the majority of the countries affected by these diseases.

3. Epidemiological Surveillance

Outbreaks and cases of VEE and EEE continue to appear in horses, thus placing large human populations at risk. The need to implement programs for epidemiological surveillance is steadily increasing. The Pan American Health Organization has prepared guidelines for epidemiological surveillance of equine encephalitides based on six elements that as a whole or independently should be taken into account to develop the predictive capacity of epidemiological surveillance systems for these diseases. They are: local ecology, seasonal dynamics, monitoring of meteorological data, surveillance of host vertebrates (reservoirs), surveillance of equine cases, and, lastly, surveillance of human cases. The monitoring of the data on these elements is used to provide information and to alert the health and agricultural authorities to any viral activity, so that timely prevention and control measures are taken.

The implementation and operation of epidemiological surveillance for equine encephalitides require coordinated, joint efforts by the health and agricultural sectors of the countries, with the active participation of horse owners and the international technical cooperation agencies. The system should coordinate the various activities aimed at collecting, analyzing, and distributing at appropriate times and places data on the behavior of the diseases and the factors that determine their prevalence.

For the reestablishment of epidemiological surveillance of equine encephalitides in the Americas, priority should be given to the development of some critical aspects, namely:

3.1. *Strengthening of Laboratory Diagnosis*

The lack of laboratory confirmation of the diagnosis makes this aspect a priority for the reactivation of epidemiological surveillance of equine encephalitides in the countries of the Region.

In the Americas, 11 laboratories in seven countries, including the United States, have the physical and technical capacity to diagnose equine encephalitis. However, those

located in Latin American countries have technical limitations in isolating and typing the virus (see Table 5).

The laboratory is key to the confirmation of viral activity and the identification of the type of equine encephalitis virus (EEE, VEE or another that can affect horses and humans). It is therefore recommended that all countries that in the past have reported cases or outbreaks of equine encephalitides, particularly VEE, have diagnostic laboratory facilities, including facilities for viral isolation and serology. This recommendation applies particularly to Brazil, Colombia, Venezuela, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, and Costa Rica.

In addition, neighboring countries that do not have facilities for laboratory diagnosis should establish collaborative agreements with others that have them. This is the case for the Central American countries, where there may be only one laboratory that could support the countries of the subregion.

Viral isolation is necessary for comparing the characteristics of the viruses associated with endemic transmission and with the clinical disease in humans and solidungulates.

Viral characterization requires molecular biological techniques that can be conducted only in a specialized laboratory. At this time in the Americas, there are two such laboratories, the WHO Reference Center for Arbovirus of the CDC, in Fort Collins, and the United States Army Medical Research Institute for Infectious Diseases (USAMRIID) in Fort Detrick.

3.2. *Epidemiological Characterization*

Experience has taught that regions that have experienced epizootic activity of viral equine encephalitis will sooner or later see such activity again. During the epizootics there is usually explosive infection of a large number of vertebrate animals, both domestic and wild, only some of which remain in the cycle of infection. The optimal conditions for a new outbreak occur when, with the passing of years, the population of surviving immune horses is replaced by susceptible animals, and environmental conditions permit an increase in the population of infected vectors.

Maps, such as those based on the Holridge system, allow identification of the regions where enzootic foci exist and outbreaks can arise and also those that will remain unaffected. It will be necessary to determine the human and equine populations at risk within these regions and to identify the possible wild reservoirs and vectors of the viruses.

The epidemiological characterization of equine encephalitides includes the determination of the immunity and/or susceptibility status of the population of horses, mules, and donkeys, the principal multipliers of the viruses, by means of adequate vaccination and animal mobilization registries.

Complementary serological studies can define the proportion of susceptible horses in an area and will serve as the basis for planning vaccination campaigns.

Detection and Characterization of Enzootic VEE Foci

The interaction of the VEE viruses with their hosts and vectors in the enzootic cycles is determined by ecological conditions in the localities, which differ from one region to another with regard to topography, soils, climate, moisture, and other factors. These ecosystems are frequently modified by human activity or by natural phenomena (hurricanes, increased rainfall), permitting increased propagation and geographic spread of the viruses and thus exposing susceptible equine populations and, secondarily, the human population.

The early detection of these foci and the monitoring of the related factors permit the establishment of measures for surveillance of possible outbreaks of the disease in horses and the prevention of human cases.

The purpose of the methodology proposed by PAHO is to orient the field work for the collection of samples for detection of the infection in natural foci of equine encephalitides, in order to establish predictive ecoepidemiological surveillance of outbreaks and epidemics. This methodology will include five phases:

- Detection of the circulating virus and populations at risk;
- Identification of natural sentinels (wild);
- Monitoring of viral activity in the sentinel species;
- Identification of possible mosquito vectors and determination of their guest species and opportunities for spread to other areas, and
- Identification of variants of the VEE virus.

3.3 *Intersectoral Collaboration*

The economic implications of equine encephalitides for horses, as well as the hazards to public health, are evidence of the need for a joint effort between the

agricultural and health sectors for the development of epidemiological monitoring of this disease complex.

The formation of national and local zoonosis committees has been a valuable strategy in some countries to define the responsibilities of each sector and to combine human and financial resources for implementation of the programs for surveillance and prevention of equine encephalitides.

3.4 *Social Participation*

The community should be adequately motivated to collaborate in national programs for surveillance, prevention, and control of diseases. Hence, the development of programs for education and information dissemination is necessary.

Livestock producers, farmers, and owners of solidungulates are expected to participate in the surveillance of equine encephalitides, in particular in the timely reporting of cases or outbreaks of neurological syndromes in horses, mules, and donkeys, which is the basis for effective operation of the information systems and epidemiological surveillance.

The educational components should include not only aspects related to knowledge of equine encephalitides and the elements of epidemiological surveillance, but also motivational aspects that induce the community to participate in prevention and control activities such as vaccination campaigns for horses.

It is reasonable to assume that development of all the aspects of the reactivation of epidemiological surveillance systems for equine encephalitides cited above cannot be carried out simultaneously in all countries, which means that priorities should be established.

It is recommended, meanwhile, that all the countries in the Americas participate in the weekly information system, reporting the presence or absence of clinical syndromes compatible with equine encephalitides to PANAFTOSA. Countries with endemic areas should make an effort to develop diagnostic laboratories and conduct studies aimed at epidemiological characterization of equine encephalitides to facilitate the adoption of effective prevention and control measures (detection of enzootic foci).

The vaccination of horses has yielded excellent results in the prevention of VEE, and this strategy should be continued. Improvement of the information on the immunization status of the population is important in surveillance of the disease and for the prevention of outbreaks and epidemics.

ANNEXES

Table 1

CLASSIFICATION OF THE VIRAL COMPLEX OF VENEZUELAN EQUINE ENCEPHALITIS (VEE).*

Subtype	Variant	Representative strain	Activity	Origin
I VEE	A	TC 83	Vaccinal	Derived from donkey, Trinidad
	A	Trinidad Donkey	Epizootic	Donkey, Trinidad
	B	MF-8	Epizootic	Human, Honduras
	C	P-676	Epizootic	Horse, Venezuela
	D	3380	Enzootic	Human, Panama
	E	Mena II	Enzootic	Human, Panama
	F	78V-3531	Enzootic	Mosquitoes, Brazil
II Everglades		Pe-3-7c	Enzootic	Mosquitoes, Florida
III Mucambo	A	Mucambo	Enzootic	Monkey, Brazil
	B	Tonate	Enzootic	Bird, French Guiana
	C	71D-1252	Enzootic	Mosquitoes, Peru
IV Pixuna		Pixuna	Enzootic	Mosquitoes, Brazil
V Cabassou		Cabassou	Enzootic	Mosquitoes, French Guiana
VI		AG-80-663	Enzootic	Mosquitoes, Argentina

* Taken from C. San Martín. Equine encephalitides caused by viruses transmitted through arthropods. Informative material, ICA, Colombia.

Table 2

OCCURRENCE OF REPORTED FOCI OF SYNDROMES COMPATIBLE WITH EQUINE ENCEPHALITIDES AND NUMBER OF WEEKS REPORTED. LATIN AMERICA, 1989-1998.*

Country	Year									
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Argentina	0/10**	2/52	3/52	--	--	--	--	--	--	--
Belize	--	--	--	--	--	--	--	--	--	--
Bolivia	--	6/31	0/49	0/52	0/52	0/46	--	--	--	--
Brazil	0/2	8/41	3/41	4/52	3/49	2/52	0/52	0/52	1/53	1/52
Chile	--	--	--	--	--	--	--	--	--	--
Colombia	2/13	11/52	8/53	28/53	7/52	19/52	36/52	7/52	6/53	135/52
Costa Rica	--	--	--	--	--	--	--	0/14	0/30	0/8
Cuba	--	--	--	--	--	--	--	--	--	--
Ecuador	--	--	0/20	0/52	1/52	0/52	0/52	0/52	0/53	0/52
El Salvador	--	10/9	11/19	23/24	7/27	--	--	1/50	0/27	0/47
Guatemala	0/1	1/36	8/53	3/6	2/52	0/51	3/45	0/20	--	--
Haiti	--	--	--	--	--	--	--	--	--	--
Honduras	--	--	--	--	--	--	--	--	0/53	3/52
Mexico	--	--	--	--	3/11	--	--	41/51	104/53	62/52
Nicaragua	--	--	--	--	--	--	--	--	--	--
Panama	--	--	--	--	--	0/11	10/52	2/52	1/53	2/52
Paraguay	0/9	0/21	0/52	0/50	0/52	0/52	0/52	0/52	0/53	0/52
Peru	--	--	--	--	--	1/15	0/52	0/52	0/53	0/52
Dominican Republic	--	--	--	--	--	--	--	--	--	--
Uruguay	--	--	--	--	--	--	--	--	--	--
Venezuela	0/5	2/49	0/46	4/52	7/52	0/52	21/52	1/52	3/53	3/52

* Source: Pan American Foot-and-Mouth Disease Center (PANAFTOSA).

** Number of occurrences of foci/number of weeks reported.

-- No information provided.

Table 3

FOCI OF SYNDROMES COMPATIBLE WITH EQUINE ENCEPHALITIDES REPORTED AND CONFIRMED BY LABORATORY ANALYSIS IN THE COUNTRIES, 1997 to 1998.

Country *	Year									
	1997					1998				
	Foci reported	Foci confirmed**				Foci reported	Foci confirmed**			
		VEE	EEE	Neg.	Total		VEE	EEE	Neg.	Total
Brazil	1	0	1	0	1	1	0	1	0	1
Colombia***	49	5	0	43	48	216	46	2	96	144
Honduras	0	0	0	0	0	3	1	0	0	1
Mexico***	481	0	0	481	481	90	0	0	90	90
Panama	1	0	0	1	1	2	0	0	0	0
Venezuela	3	0	1	2	3	4	1	1	0	2
Total	535	5	2	527	534	314	48	4	186	238

* Only countries that reported foci of syndromes compatible with equine encephalitides were included.
** Confirmed by laboratory analysis.
*** Report provided by the official service.

Table 4

ENDEMIC AREAS OF CLINICAL SYNDROMES COMPATIBLE WITH ENCEPHALITIDES REPORTED IN SIX COUNTRIES. 1989-1998.*

Country	Area no.	Quadrants involved	Location	Virus Involved
Brazil	1	2966-2967-2968-3064-3067	Around the Urquirim Dam, State of São Paulo	---
	2	1373-1374-1474	Jerumenha, Floriano, State of Piauí	VEE
	3	1077-1178	Area of Fortaleza, Cascabel, and Pacujus, State of Caerá	VEE
	4	2459-2460-2360-2260-2261	Pantanal; subareas: Nhecolandia, Santo Antonio de Jacadizo, and Nabileque	EEE ILH TCM
Colombia	1	1039-1139-0939	Region of Urabá and Atrato River, Depts. of Antioquía and Chocó	VEE-CI
	2	0840-0841-0741	Region of Araboletes Cienaga de Oro, Lorica, Montería, Coveñas, and Tolú, Depts. of Antioquía, Córdova, and Sucre	VEE
	3	0742-0641-0542-0543-0743- 0644-0643	Magangué, Buenavista, El Banco, Calamar, and Pivijay, Depts. of Bolivar and Magdalena	VEE-CI
	4	1443-1444-1343	Middle Magdalena. La Dorada, Honda, Pto. Salgar, and Girardot, Depts. of Caldas, Cundinamarca, and Tolima.	VEE
	5	1249-1351	Union of the Meta, Ariporo, and Cravo Norte Rivers, Region of the Sarare, Dept. of Arauca	VEE
	6	2235	Region of Tumaco, Dept. of Nariño	VEE
	7	0645-0646-0845	Region of Codazzi, Curumari, Vituline, Bosconia, Pailitas, Tamalameque, Dept. of César	VEE-CI
	8	1547-1548-1549 - 1448-1449-1443-1450	Region of Villanueva, Aguazul, Yopal, San Luís de Palenque, Nunchia, Pore in Casanare	EEE
	9	0741-0742	Border between Dept. of Sucre and Córdoba	EEE
El Salvador	1	0522-0523-0423 - 0325-0326	Region of San Cristóbal, Region of Dulce Nombre de María con Guatemala, Dept. of Santa Ana	---
Guatemala	1	2643-2543	Region of Mita up to Lake Guija, border with El Salvador	---
Mexico	1	3274-3374-3473	Mapastepec, Nuehuetan in Trinitarian, State of Chiapas	VEE (IE)
	2	3372	Isthmus of Oaxaca	VEE (IE)
	3	2066-2167	Aldama, Madero Co., State of Tamaulipas	EEE
Venezuela	1	EO6-E070-FO6	Eastern shore of Lake Maracaibo, State of Trujillo, State of Zulia	VEE
	2	E04-E05	Mara and Paez Districts, State of Zulia	VEE-CI
	3	DO7	La Carora and San Francisco, State of Lara	VEE

* Occurrence of cases and/or repetitive outbreaks from 1989 to 1998.
--- = Without diagnostic confirmation. EEE = Eastern equine encephalitis.
VEE = Venezuelan equine encephalitis. ILH = Ilheus. TCM = Tacaiuma.

Table 5

LABORATORIES IN THE AMERICAS WITH CAPACITY TO DIAGNOSE EQUINE ENCEPHALITIDES. 1998.

Country	Laboratory	Diagnostic services
Argentina	• Institute of Virology, Province of Córdoba	• Isolation • Serology
Brazil	• Adolfo Lutz Institute, São Paulo	• Isolation • Serology
Colombia	• Colombian Livestock Institute, Bogotá • National Institute of Health	• Isolation • Serology
Mexico	• Livestock Research Institute (INIP), Palo Alto	• Serology • Isolation
Peru	• National Institute of Health • NAMRID, Lima	• Serology • Serology • Isolation • Typing
Venezuela	• Institute of Veterinary Research, Maracay • National Hygiene Institute Caracas	• Isolation • Serology • Isolation • Typing • Serology
United States	• Centers for Disease Control (CDC), Arbovirus Disease Reference Laboratory, Fort Collins • USAMRIID, Fort Dietrick	• Isolation • Typing • Serology • Molecular biology

Please note that the following pages of the Annex (Figures 1-7) are only available in Spanish.

Figura No. 1: Colombia. Focos de síndromes compatibles con encefalitis equinas reportados, 1997

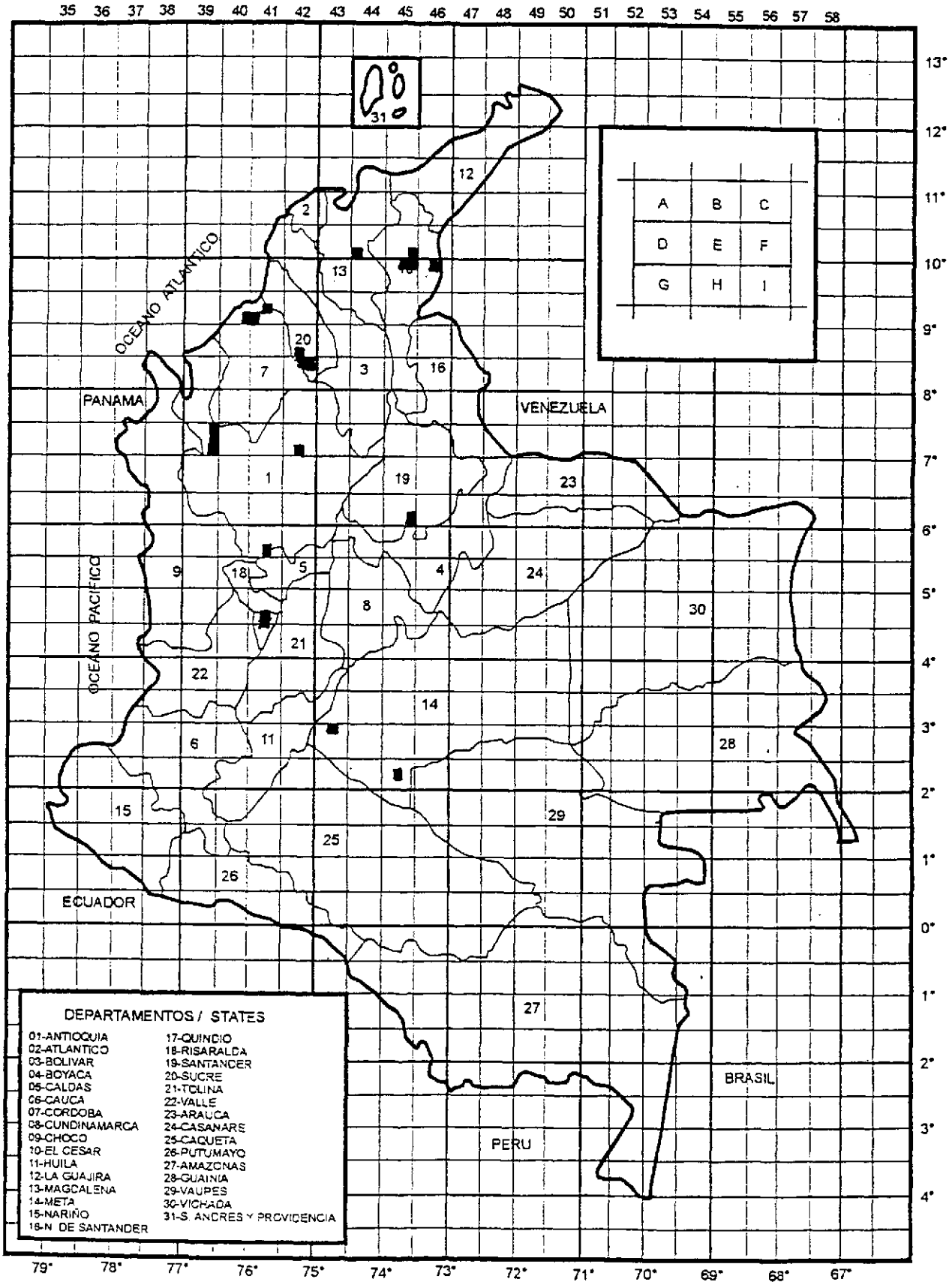

Figura No. 2: Colombia. Focos de síndromes compatibles con encefalitis equinas reportados, 1998

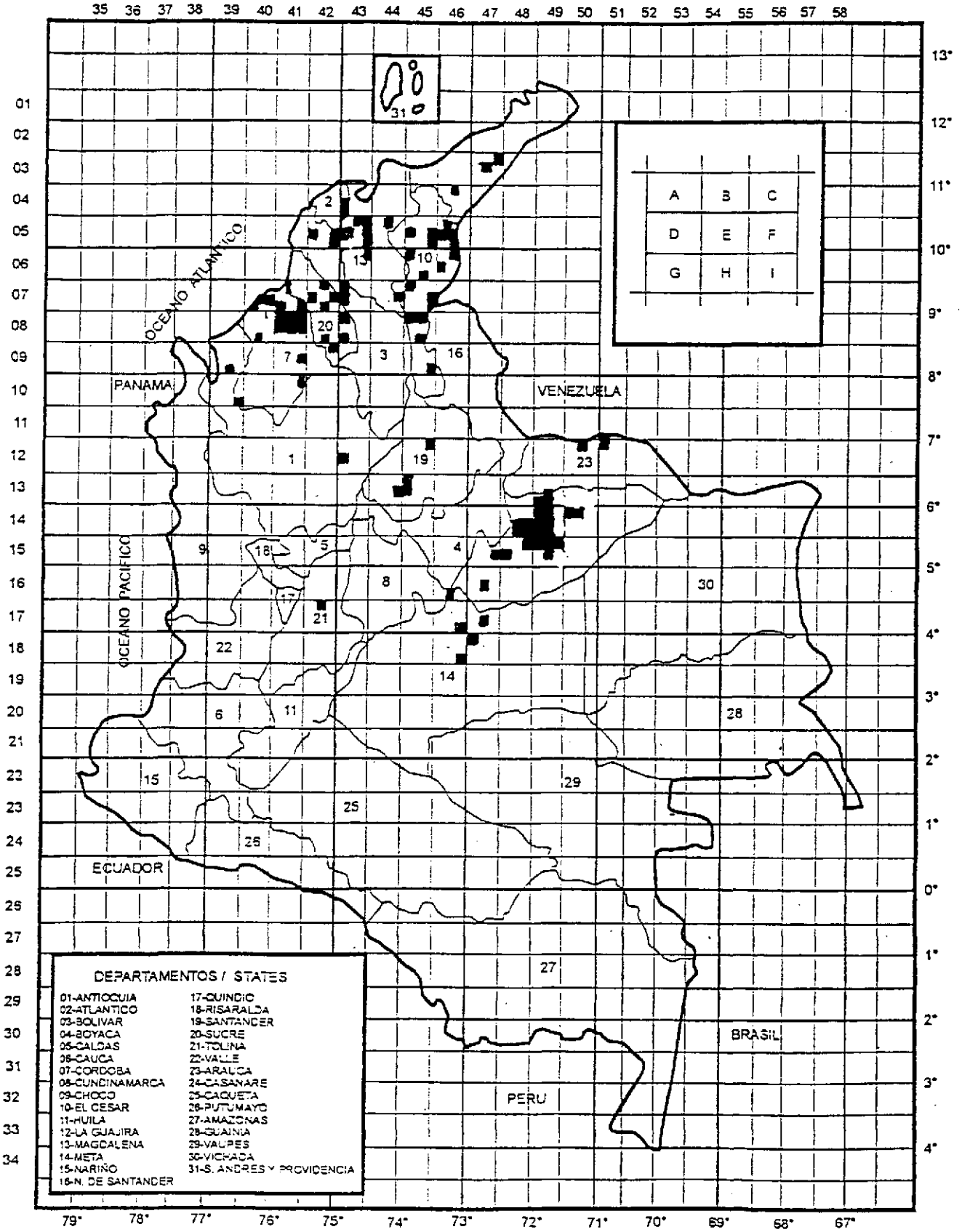

Figura No. 3: México. Focos de síndromes compatibles con encefalitis equinas reportados, 1997

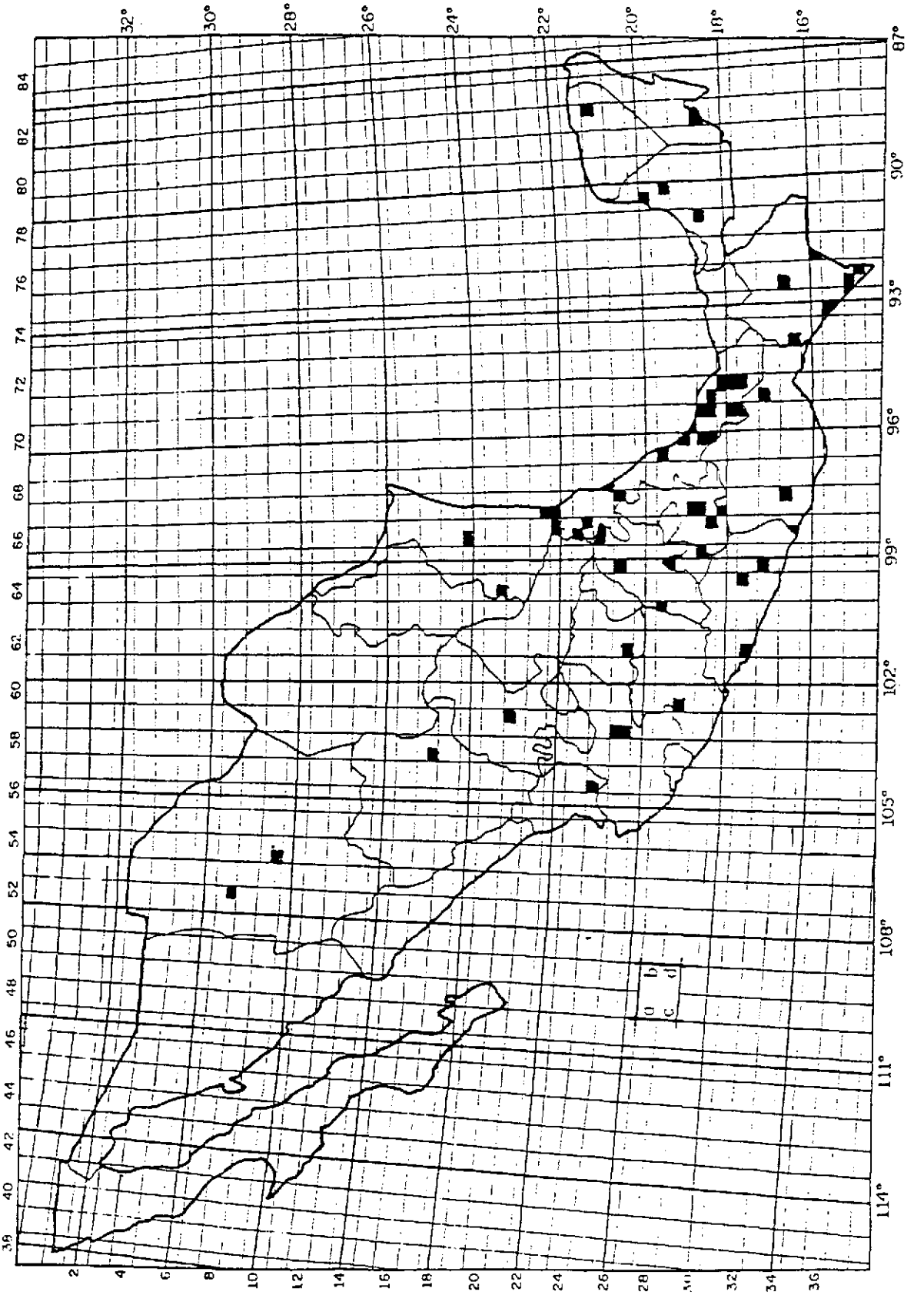

Figura No. 4: México. Focos de síndromes compatibles con encefalitis equinas reportados, 1998

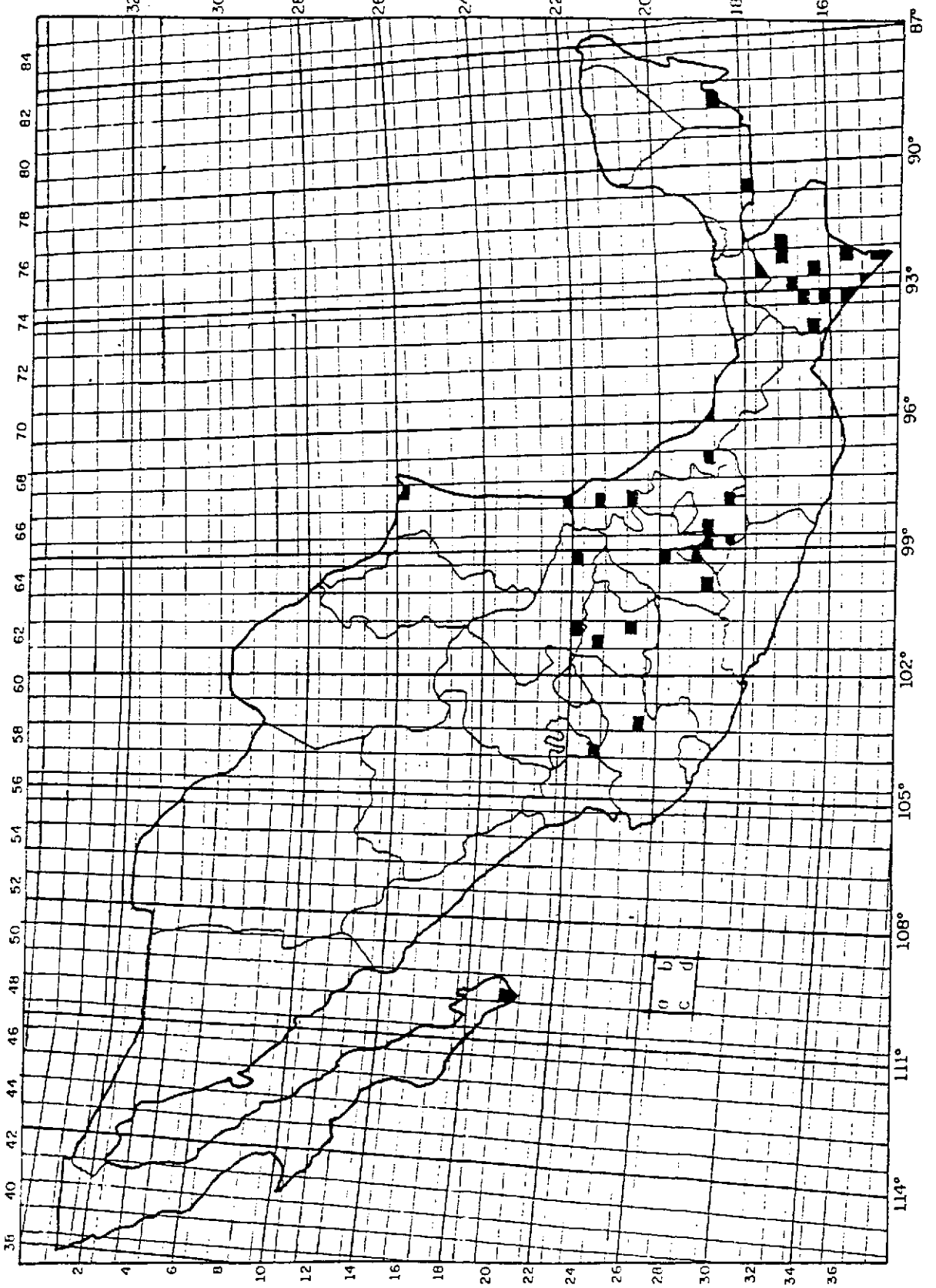

Figura No. 5: Brasil. Áreas endémicas de síndromes compatibles con encefalitis equinas. 1989-1998

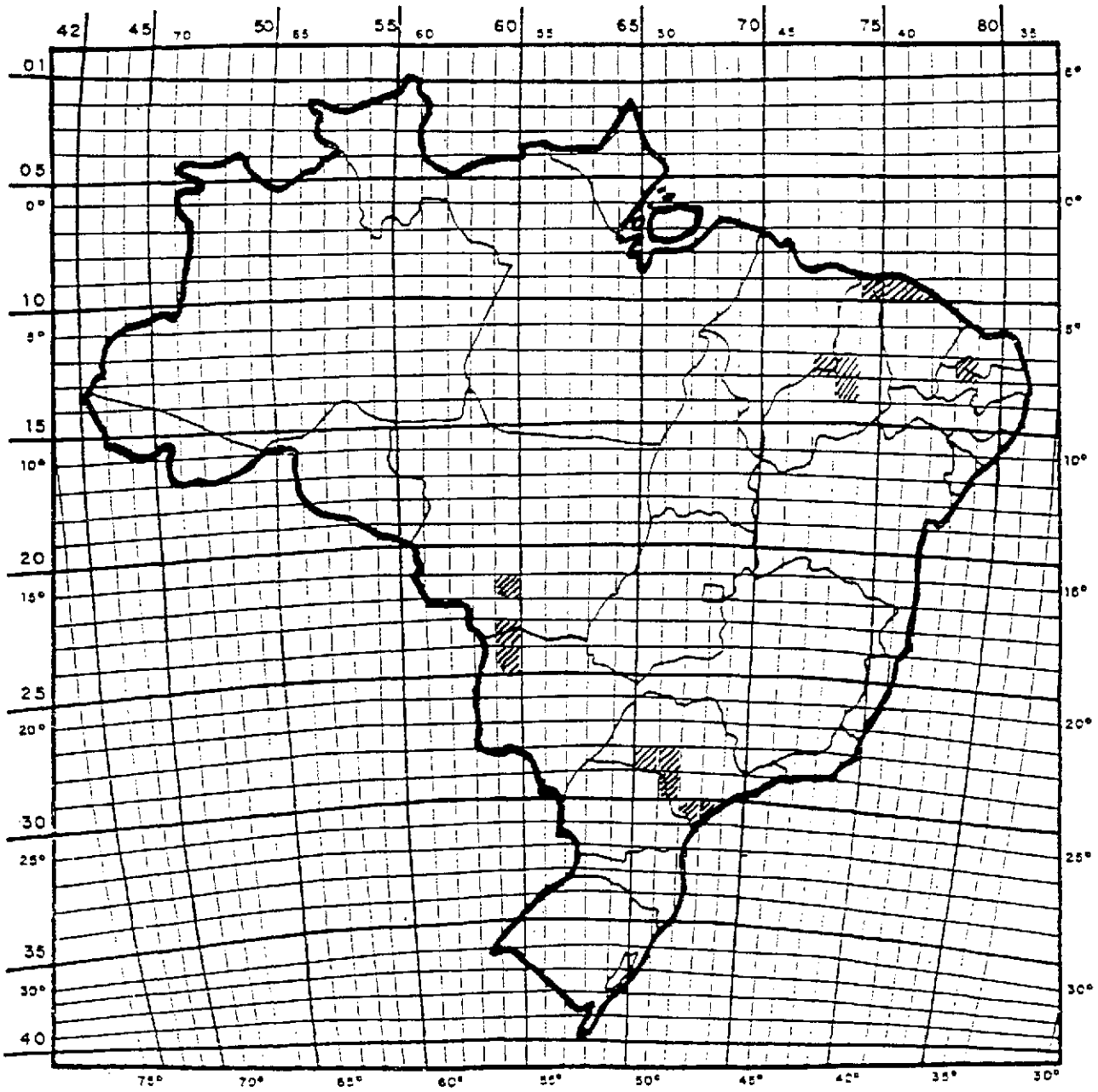

Figura No. 6: Colombia. Áreas endémicas encefalitis equinas. 1989-1998

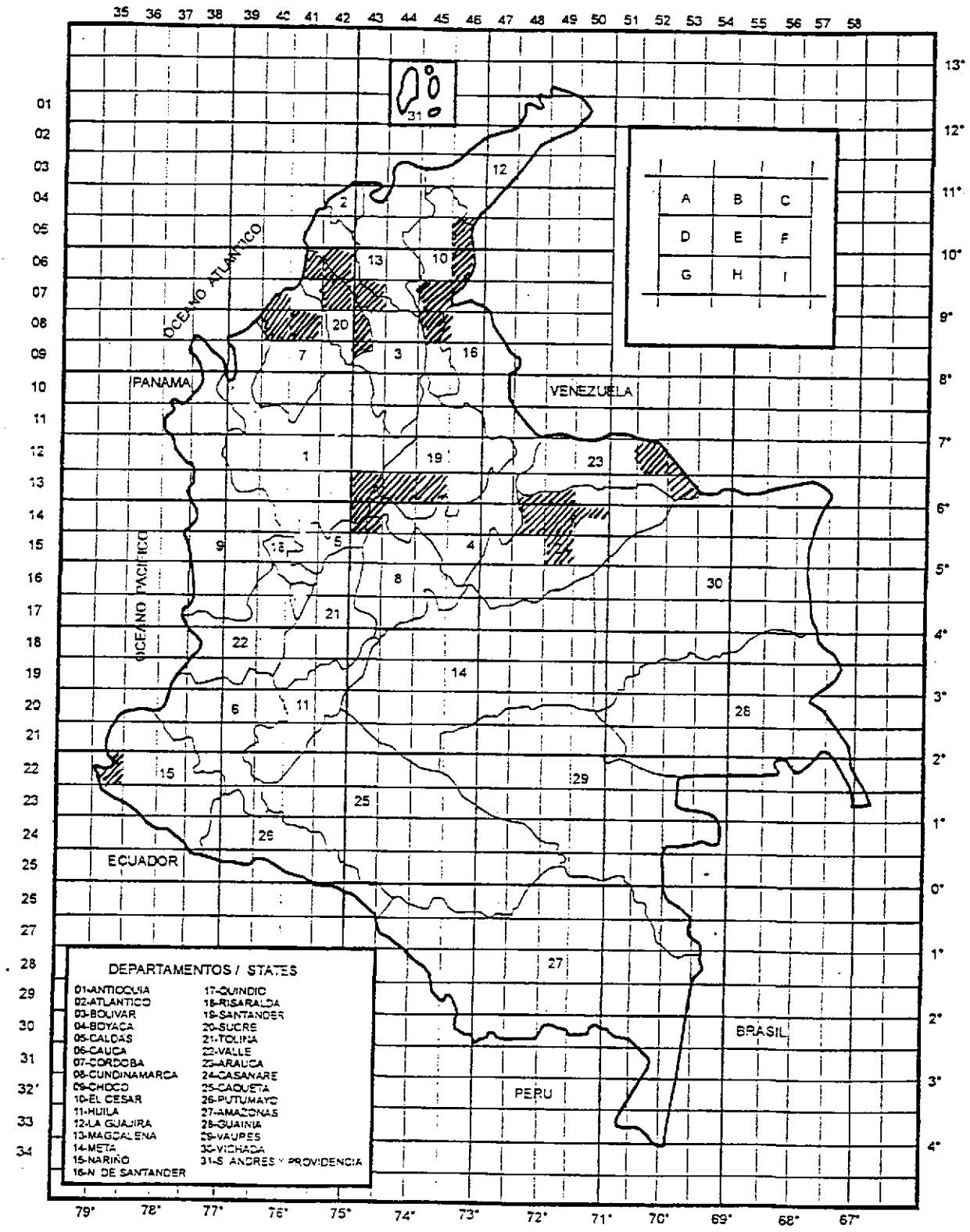

Figura No. 7: Venezuela: Áreas endémicas de síndromes compatibles con encefalitis equinas. 1989-1998