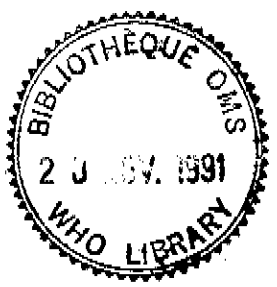
WHO/LEISH/91.30
Distr. LIMITED
ENGLISH ~~ONLY~~

# INFORMATION ON THE EPIDEMIOLOGY AND CONTROL OF THE LEISHMANIASES BY COUNTRY OR TERRITORY

By

P. Desjeux




WORLD HEALTH ORGANIZATION

J7564

WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTE

DISTR. : LIMITED
DISTR. : LIMITEE

WHO/LEISH/91.30

ENGLISH ONLY

# INFORMATION ON THE EPIDEMIOLOGY AND CONTROL OF THE LEISHMANIASES BY COUNTRY OR TERRITORY

by

P. Desjeux[1]

## CONTENTS

| | Page |
|---|---|
| INTRODUCTION | 4 |
| OLD WORLD | 5 |
| Afghanistan | 5 |
| Albania | 6 |
| Algeria | 6 |
| Bangladesh | 6 |
| Burkina Faso | 7 |
| Cameroon | 7 |
| Central African Republic | 7 |
| Chad | 8 |
| China | 8 |
| Cyprus | 9 |
| Djibouti | 10 |
| Egypt | 10 |
| Ethiopia | 10 |
| France | 11 |
| Gambia | 12 |
| Greece | 12 |
| Guinea | 13 |
| Guinea-Bissau | 13 |
| India | 13 |
| Iran (Islamic Republic of) | 14 |
| Iraq | 15 |
| Israel | 16 |
| Italy | 17 |
| Jordan | 18 |
| Kenya | 19 |
| Kuwait | 20 |
| Lebanon | 20 |
| Libyan Arab Jamahiriya | 20 |
| Malawi | 21 |

[1] Medical Officer, Trypanosomiases and Leishmaniases Control, Division of Control of Tropical Diseases, World Health Organization, Geneva, Switzerland.

Page

Mali ... 21
Malta ... 21
Mauritania ... 22
Morocco ... 22
Namibia ... 23
Nepal ... 23
Niger ... 23
Nigeria ... 24
Oman ... 24
Pakistan ... 24
Portugal ... 25
Romania ... 25
Saudi Arabia ... 25
Senegal ... 26
Somalia ... 27
South Africa ... 27
Spain ... 27
Sri Lanka ... 28
Sudan ... 28
Syrian Arab Republic ... 29
Togo ... 30
Tunisia ... 30
Turkey ... 31
Uganda ... 31
USSR ... 31
United Arab Emirates ... 33
United Republic of Tanzania ... 33
Yemen ... 33
Yugoslavia ... 34
Zaire ... 34
Zambia ... 34

NEW WORLD ... 35

Argentina ... 35
Belize ... 35
Bolivia ... 35
Brazil ... 36
Colombia ... 38
Costa Rica ... 39
Dominican Republic ... 40
Ecuador ... 40
El Salvador ... 41
French Guiana ... 41
Guatemala ... 42
Guyana ... 42
Honduras ... 42
Mexico ... 43
Nicaragua ... 43
Panama ... 44
Paraguay ... 44
Peru ... 45
Suriname ... 45
Trinidad and Tobago ... 46
United States of America ... 46
Venezuela ... 46

## ABBREVIATIONS

The following abbreviations are used in this document:

| | |
|---|---|
| ACL | anthroponotic cutaneous leishmaniasis |
| AVL | anthroponotic visceral leishmaniasis |
| CL | cutaneous leishmaniasis |
| DCL | diffuse cutaneous leishmaniasis |
| ELISA | enzyme-linked immunosorbent assay |
| LR | leishmaniasis recidivans |
| MCL | mucocutaneous leishmaniasis |
| PKDL | post-kala-azar dermal leishmaniasis |
| VL | visceral leishmaniasis |
| ZCL | zoonotic cutaneous leishmaniasis |
| ZVL | zoonotic visceral leishmaniasis |

## INTRODUCTION

This document presents a country by country tabulation of data available on the epidemiology and control of the leishmaniases. The main aspects covered include: the parasites, the proven or suspected vectors, the proven or suspected reservoirs, the geographical distribution with indication of the main foci, the severity of the disease with indication of prevalence and incidence, the public health implications with particular reference to morbidity and mortality, the socio-cultural and economic factors involved in transmission of the different forms of leishmaniasis found in the 82 countries or territories dealt with in this document, and finally the main past or ongoing control activities, when known, are briefly reviewed. No bibliographical references are given since these will be the object of a companion document to be issued later, in which some 800 references on the epidemiology of the leishmaniases will be listed by country or territory and by author.

## OLD WORLD

### AFGHANISTAN

No epidemiological studies were carried out before 1962.

1. **Visceral leishmaniasis.** The first case was reported in 1980. 21 cases have been diagnosed to date; the prevalence is low. Visceral leishmaniasis (VL) has a widespread distribution (Kábul, Badakhshtan, Ghazni, Kandahár and Badghis provinces). The parasite has not yet been identified. Reservoir(s) and vector(s) are unknown.

2. **Zoonotic cutaneous leishmaniasis.** This form of leishmaniasis is endemic in the north of the country (Fariab, Jozjan, Balkh, Samangan, Kunduz, Baghlan and Takhar provinces), in the plain areas and possibly also in the south-western lowlands. The vector is probably *Phlebotomus papatasi* and the reservoir, the great gerbil *Rhombomys opimus*. The causative organism is *Leishmania major*. Sometimes outbreaks occur as in 1979 in a military camp at Mazár-i-Sharif. In 1979, a study of prevalence among 591 inhabitants showed a rate of 35% for scars and 1.5% for active lesions. Another survey of 270 000 people revealed a 9.7% global rate of scars and active lesions.

3. **Anthroponotic cutaneous leishmaniasis.** One of the major public health problems in Afghanistan. Anthroponotic cutaneous leishmaniasis (ACL) is an urban disease and occurs in most of the towns and cities in seven provinces, Kábul, Parwan, Herát, Kapisa, Ghazni, Kandahár and Badakhshtan. Each year approximately 6000 cases are reported from the provinces and 4000 from Kábul, all by passive detection. ACL is usually endemic, but during the last years, frequent outbreaks were reported and spread of the disease seems more important than before. In some towns, transmission occurs every year at a high intensity and people become infected very young; in other towns, such as Kábul, and in the Panjshir valley, transmission is not so frequent, but, when it occurs, there are large numbers of nonimmune people and an epidemic may erupt. Humans are considered to be the main reservoir, but in foci of ACL (Herát, Kapisa, Kábul and villages of Parwan province), 37 dogs with skin lesions have been found parasitologically infected; however, dogs seem to be more the victims than the reservoirs. The parasite has not yet been identified. The strongly suspected vector, *P. sergenti*, abundant in the hilly areas of the dense suburbs of the cities, has been found infected by promastigotes but cultures and biochemical identification have not been done. The causative agent of ACL in Afghanistan is *L. tropica*.

4. **Control.** Control measures include the following:

- active detection of patients and their treatment (4618 patients were treated in the first 6 months of 1982);
- insecticide application in infected areas (31 tons of DDT were used during the same period) and 369 000 people covered by insecticiding in 1982;
- programme of health education using leaflets, posters, broadcasting media;
- network of leishmaniasis control units associated with malaria control units.

Currently, indoor resting densities of *P. sergenti* are evaluated weekly in two indicator areas of Kábul city, using sticky papers. Vector control is undertaken by indoor residual spraying with DDT and, if DDT is not available, with malathion; the use of pyrethroid impregnated curtains is planned for 1991.

Leishmaniasis is a notifiable disease.

## ALBANIA

1. **Visceral and cutaneous leishmaniasis.** 133 cases were reported from Albania between 1947 and 1962; in 1990, 100 cases of leishmaniasis were registered, including 30 from the Institute of Paediatrics in Tirana, but it is not specified if these were cutaneous or visceral cases.

## ALGERIA

1. **Visceral leishmaniasis.** The endemicity of visceral leishmaniasis (VL) is increasing and new areas are affected (Algiers, Blida, Medea and Tlemcen). Only northern Algeria is endemic, especially Great Kabylia a mountainous area with a sub-humid bioclimatic influence; however some cases were reported from the arid area of Biskra, the usual focus of cutaneous leishmaniasis (CL). In Algeria, 721 cases were notified between 1975 and 1984. 84% of them were children from 6 months to 4 years old. Now, approximately 200 cases occur each year. Five cases have been diagnosed and confirmed parasitologically in the Hoggar (south Algeria). The parasite has been isolated from humans and dogs and identified as *L. infantum* ss. At present, the dog is still the only proven reservoir (11.4% of dogs infected out of 385 examined in Great Kabylia in 1977). There is strong evidence that *P. perniciosus* is the vector; it bites humans and dogs both inside and outside the home. *P. perfiliewi* and *P. longicuspis* are also present. The breeding sites are still unknown.

2. **Zoonotic cutaneous leishmaniasis.** This very old disease, also called "Biskra boil", is mainly endemic in the sub-Saharan steppes where the most important foci are located. A new resurgence and geographical spread towards the north and west (M'sila, Batna, Ksar Chellala, Djelfa and Bou-Saâda) are taking place and occasionally outbreaks occur. Thousands of cases are reported each year. In 1984-1985 fewer cases were registered probably because of the application of DDT in 1983; but again in 1986 the number of cases increased rapidly. The parasite identified by biochemical characterization is *L. major*. The vector is *P. papatasi* and two reservoirs, *Psammomys obesus* and *Meriones shawi*, have been identified. These two gerbillidae live in semi-desert areas but have different nutritional requirements (important data for any control measure).

In the VL focus of northern Algeria, human cutaneous leishmaniasis has been more recently reported. The parasite is *L. infantum* (one enzyme variant of the *L. infantum* reference strain). The epidemiology is not known. Vectors and reservoirs have not yet been identified.

3. **Control.** Since 1986 a national committee is in charge of the leishmaniasis control programme.

Leishmaniasis is a notifiable disease.

## BANGLADESH

1. **Visceral leishmaniasis.** In the past, kala-azar has been endemic; epidemics used to occur almost regularly every 15-20 years. Between 1950 and 1960, some districts noted 1500-4000 cases of VL per year, but later on visceral leishmaniasis was thought to have been eradicated from Bangladesh as a secondary effect of the malaria eradication programme on the sandfly vector. Since the 1980s, there have been reports of a resurgence of kala-azar following suppression of insecticide spraying in India and in Bangladesh. The number of visceral and post-kala-azar dermal leishmaniasis (PKDL) cases increased sharply and reached a level which could provide a reservoir of sufficient magnitude to spark off a major outbreak. Kala-azar and PKDL are prevalent in many areas of Bangladesh. Between 1980 and 1985, 447 cases were reported from only 5 districts, but since 1985 and up to today, cases have been registered from 61 "upazillas" of 27 districts. During a house-to-house survey from July 1987 to June 1988 in Mymensingh district covering 3 upazillas (427 villages), 1273 cases of VL including 45 cases of PKDL were diagnosed parasitologically or serologically, and treated. The highest incidence was in the 11-15 year age group. The highest death rate was 6.4%. Cases occur mainly

within families, especially PKDL cases. In 1988, 2577 cases were reported from 31 out of 64 districts, and, in 1989, 2303 cases from 38 districts. Recently an alarming increase of cases in the northern districts has been reported; morbidity data are obtained by passive surveillance at the upazilla health complex level; the number of reported cases is largely underestimated and it is now believed that at least 10 000 to 15 000 new cases occurred in 1990. *Phlebotomus argentipes* is the suspected vector in Bangladesh. Humans seem to be the only reservoir.

2. **Cutaneous leishmaniasis.** No data are available.

3. **Control.** DDT spraying was conducted for malaria eradication, but the spraying campaign has been discontinued. From 1985 to 1990 an intercountry visceral leishmaniasis control programme was carried out in Bangladesh, India, and Nepal; it included passive case detection, sometimes house-to-house surveys, early diagnosis, treatment and vector control by DDT spraying. The National Institute of Preventive and Social Medicine (NIPSOM) and the Institute of Epidemiology, Disease Control and Research (IEDCR), are involved in visceral leishmaniasis research programmes. Recently a national kala-azar control programme has been implemented including passive and active case detection, vector control activities and free treatment.

Leishmaniasis is a notifiable disease since July 1987.

## BURKINA FASO

1. **Visceral leishmaniasis.** Only a few cases have been reported. The first case was described in 1971.

2. **Cutaneous leishmaniasis.** From 1960 to 1961, 13 cases of CL were reported and, in 1969, one case of diffuse cutaneous leishmaniasis (DCL) in a newborn. *P. duboscqi* is present. The foci are in the north-west and in the south and have a low endemicity; in the eastern areas, only a few cases were diagnosed. In 1987, in a focus near Aribinda, Soum province, 2 out of 6 patients were parasitologically confirmed.

3. **Control.** Only passive case detection.

## CAMEROON

1. **Visceral leishmaniasis.** One suspected case was reported in 1979 in the western region (Gawar). In 1983, a human case from the north (Kousseri) was diagnosed and parasitologically confirmed.

2. **Cutaneous leishmaniasis.** CL is endemic in northern Cameroon where the Mokolo region is an important focus. Cases reported include: 326 cases in 1936-1946 and 108 cases in 1950-1958 (both in eastern Cameroon), and 68 cases in the Mokolo region in 1974-1975. No recent data are available. *P. duboscqi* is present.

3. **Control.** Only passive case detection.

## CENTRAL AFRICAN REPUBLIC

1. **Visceral leishmaniasis.** The first VL case was reported in 1949; a second parasitologically proven case was seen in a child who seemed to have acquired the disease in the Bangui area; 3 other cases have been noted since 1969 and, from one of them, *L. infantum* s.s. was recently identified through isoenzyme analysis.

2. **Cutaneous leishmaniasis.** Sporadic cases have been reported from the north-west and south-west regions of the Central African Republic.

## CHAD

1. **Visceral leishmaniasis.** This disease is endemic but at a much lower level than in East Africa. Between 1966 and 1973, 64 cases were reported from the N'Djamena central hospital, and 2 infected dogs (positive smears) were identified within a 6-year period of observation in the Veterinary Service of N'Djamena. The vector is unknown (*P. orientalis* is suspected) and the parasite has not yet been identified. The epidemiological knowledge is fragmentary. Between 1969 and 1971, 6 cases of oronasal leishmaniasis were reported in a visceral leishmaniasis area. No recent data are available.

2. **Cutaneous leishmaniasis.** More frequent than previously thought, VL cases reported include 121 cases in 1968, 836 cases in 1975 and 164 cases in 1976 (first semester). There are several different foci in the north and north-east (sub-desert and desert zones), in the N'Djamena area and in south-central Chad along the Chari river. No recent data are available. The presence of *P. duboscqi* has been recorded in the Abéché focus in the sub-desert zone.

3. **Control.** Only passive case detection.

## CHINA

1. **Visceral leishmaniasis.** Before 1950, VL was endemic in 650 countries, 12 provinces and 3 autonomous regions from the east, north-east, to north and north-west of China affecting almost 600 000 people. The north-eastern foci were located mostly in low alluvial plains and those of the north-western areas at high altitudes (1000-2000 m or more). After 1958, following an 8-year campaign against kala-azar with nationwide control measures (mass treatment of patients, killing of infected dogs and use of insecticides against the sandfly vectors), the disease appeared to be under control. During the cultural revolution, control was discontinued and recurrence of the disease was reported between 1968 and 1975 in Beijing and other endemic areas. Now, sporadic cases still occur both in the old endemic areas and in new ones in north-west China (210 cases reported between 1967 and 1970 and 302 cases between January 1980 and September 1982). A recent resurgence of visceral leishmaniasis in China is still in progress: 443 cases (from 1981 to 1984) and 1069 cases (from 1985 to 1988); since 1988, VL cases have been reported (200 to 300 per year) from 5 provinces: Gansu, Shaanxi, Shandong, Shanxi and Sichuan and 2 autonomous regions: Xinjiang and Inner Mongolia.

In China the epidemiological situation of VL is diverse and complex, but 3 nosogeographical entities can be identified:

1.1 **Anthroponotic form in the eastern plains.** In these areas VL is still under control, no cases have been notified since 1960; the control measures (treatment, insecticide spraying) were really effective (*P. chinensis* is strictly peridomestic and endophilic). Sporadic residual cases have been reported since 1970 in the eastern part of the plains region (18 cases in Shandong, including PKDL cases); all the patients were adults; leishmanin skin test surveys confirmed the interruption of transmission (positivity was seen only among people over 30 years old).

1.2 **Zoo-anthroponotic form in mountainous and hilly regions of central and north-west China.** Resurgence of VL in these areas is due to the fact that *P. chinensis* is partly sylvatic and exophilic. The infection rate among dogs (the domestic reservoir) is still high (7% to 20% in 1990). Most of the cases (mainly children under 5 years old) are reported from Gansu province (since 1985, 200 cases per year). Leishmanin skin test surveys have confirmed the continuation of transmission (positivity among each age group). Several isolates from dogs and patients have been typed as *L. infantum*. In 1982 one raccoon-dog (*Nyctereutes procyonoides*)

was reported infected by *L. infantum* in a mountainous area near Beijing; later, a second raccoon-dog was found infected; this animal could play the role of sylvatic reservoir.

1.3 **Anthroponotic form in desert regions of eastern China.** In stony desert areas, sporadic cases are notified among the nonimmune population of migrants. The vector is *P. alexandri*; among 643 specimens examined, 13 were found naturally infected in Tufan county, Xinjiang Uygur autonomous region; 2 isolates were identified by monoclonal antibodies and more recently by isoenzyme analysis as *L. donovani*. No animal reservoir host has been identified.

In dry desert areas of Ejne Banner, Inner Mongolia, only sporadic cases are reported; the epidemiological situation is partly unknown; *P. major wui* is the suspected vector and the search for animal reservoir hosts was unsuccessful (more than 4000 animals studied).

**2. Cutaneous leishmaniasis**

2.1 ***Leishmania* sp(?).** 2 cases of CL without evidence of previous VL were found in Karamay, Xinjiang Uygur autonomous region, in July 1988 (amastigotes were isolated from the lesions); sandflies of the *caucasicus* group (*P. andrejevi*, *P. mongolensis* and *P. caucasicus*) were identified in the area and found infected with promastigotes; in 6 out of 15 specimens of *Rhombomys opimus* from the same area, amastigotes were found in ear lesions. The parasite species remains to be identified; it could be *L. major* or *L. turanica* n.sp. since this species has now been clearly characterized in neighbouring USSR.

2.2 ***L. gerbilli.*** In north-west China, Gansu province (desert west of the Yellow river), a survey was carried out between 1980 and 1981: 8% of the gerbils *Rhombomys opimus* were found infected (amastigotes in the ear tissues). The parasite was isolated and typed as *L. gerbilli*. It seems to have a zoonotic cycle and not to be transmitted to humans. The vector could be *P. mongolensis*.

3. **Control.** Control measures include the following: (1) active and passive case detection; in each province an epidemic prevention station has been established and physicians are specially assigned to control kala-azar; all the cases detected are reported to the Department of Epidemic Prevention at the Ministry of Health; (2) mass treatment of the detected cases; pentavalent antimonials are produced locally; (3) killing of the infected dogs in endemic areas; (4) sandfly vector control, once a year with DDT or gammexane; (5) annual surveillance (checking of sandfly population), followed, at times, by spraying; (6) individual protection: several repellents have been comparatively tested against *P. alexandri*.

Leishmaniasis is a notifiable disease.

## CHINA (PROVINCE OF TAIWAN)

1. **Visceral leishmaniasis.** Reported cases were imported from China: approximately 100 cases between 1948 and 1958.

2. **Cutaneous leishmaniasis.** In 1985, two autochthonous cases were reported. Both were native-born aborigine Taiwanese. *P. kiangsuensis* has been found feeding on humans. Many animals were examined, but all were negative.

3. **Control.** Only detection of cases.

## CYPRUS

1. **Visceral leishmaniasis.** Since the 1944 survey, the once widespread canine VL has apparently disappeared, probably due to dog control measures carried out during the echinococcosis campaign from 1970 to 1975. Human VL formerly found in coastal areas has not been reported for many years. *P. alexandri*,

*P. krimensis*, *P. perfiliewi* and *P. tobbi* are present. Entomological surveys carried out in 1944 and 1985 showed that the island sandfly fauna has remained essentially unchanged, despite 41 years of widespread insecticide use.

2. **Cutaneous leishmaniasis.** Sporadic cases of cutaneous leishmaniasis have been reported in 1990 in some foothill villages of the Kyrenian mountains; the etiological agent is *L. infantum*. *P. tobbi* is the most likely vector of human CL in northern Cyprus.

3. **Control.** Insecticide use, especially in agriculture, includes regular and extensive aerial coverage.

## DJIBOUTI

1. **Visceral leishmaniasis.** 2 cases were reported in 1971 in children and 5 new cases (3 autochthonous) were detected in 1978. *P. bergeroti*, *P. alexandri* and *P. orientalis* are present.

2. **Cutaneous leishmaniasis.** Though CL seems to be rare, it has to be investigated more thoroughly. There have been a few recent reports of CL. The parasite is unknown. *P. papatasi* and *P. sergenti* are present.

3. **Control.** Only passive case detection.

## EGYPT

1. **Visceral leishmaniasis.** Since 1904, rare cases of visceral leishmaniasis have been reported in Egypt; some were imported, others were probably autochthonous. A focus of visceral leishmaniasis was discovered in 1982 at El Agamy, 25 km west of Alexandria. To date, 54 cases have been diagnosed in children. Four human isolates and three isolates from dogs have been typed as *L. infantum*. Canine visceral leishmaniasis now appears to be at a low level. Based on experimental infections and field observations (natural infections), *P. langeroni* is the proven vector of *L. infantum* s.s. in the El Agamy area. In this focus, more stocks from dogs, sandflies and wild animals have to be typed. The confirmed presence of *P. langeroni* in Egypt is particularly relevant since it was previously known only in northern Algeria and Tunisia. Amastigotes in spleen smears of *Rattus norvegicus* have been reported in Ismailiya, but exact identification of the *Leishmania* species has not been carried out.

2. **Zoonotic cutaneous leishmaniasis.** In the past, cases have been recorded from certain areas east and north-east of the Delta (Sharqiya, Ismailiya, Behera, Menufiya, Daqahliya) but there is no recent evidence that old Nile delta foci are still active. From 1982 to July 1985 cutaneous leishmaniasis was diagnosed in 113 soldiers of the peace-keeping force in eastern Sinai. The number of imported cases is increasing due to the fact that many Egyptians go for temporary work to other endemic countries (Iraq, Saudi Arabia). The true prevalence of the disease is unknown. *P. papatasi* is the vector for *L. major* infection in northern Sinai. *Psammomys obesus* has a wide distribution in the coastal region. *L. major* was found in two dogs in El Agamy (isoenzyme characterization) and Saudi Arabia, respectively. *L. major* (new zymodeme) has been isolated from the rodents *Gerbillus pyramidum* and *Meriones crassus* (4/23 in North Sinai governorate).

3. **Control.** Treatment of imported cases to limit the possible spread of parasites from other countries.

## ETHIOPIA

1. **Visceral leishmaniasis.** VL has been reported from at least 7 of the 16 administrative regions of Ethiopia. Up to August 1990, a total of 285 cases were recorded by the Institute of Pathobiology in

Addis Ababa. Several studies have been carried out in the south-western corner of Ethiopia at the mouth of the Omo river; more recently the presence of VL has been noted in southern Ethiopia along the Segen and Woito valleys and epidemiological surveys are in progress in this area. Cases were reported also in Metema-Humera (near the Sudan border) and near the Red Sea coast. Between 1982 and 1990, 149 cases were reported from the Aba Roba focus in the Konso area. *Phlebotomus orientalis* is thought to be responsible for transmitting kala-azar in the south-western Ethiopian focus, but it has not been found east of the Omo river. *P. martini* and *P. celiae* were recently caught in the Segen valley. The absence of *P. orientalis* in this area suggests that *P. martini* and *P. celiae* could play some role in the transmission of VL. Recently some specimens of *P. martini/P. celiae* (5/23) were found infected (suprapylarian infection) in southern Ethiopia (Segen valley). To date, the parasites identified are: *L. infantum* s.s., *L. donovani* s.s. and new zymodemes intermediary between *L. infantum* and *L. donovani*.

2. **Cutaneous leishmaniasis (*L. aethiopica*).** CL is well known in Ethiopia since 1913. The first case of diffuse cutaneous leishmaniasis (DCL) was reported in 1960, after which clinical and epidemiological studies were carried out on CL, especially in the highlands of Ethiopia (between 1500 m and 2700 m) where it is widespread. CL is believed to exist in almost all the administrative regions. The disease is endemic; a recent survey in four villages of Ochollo showed scars in 22-40% of the population and active lesions in 3-5% of the population. Other previous studies identified a global rate of scars and active lesions in 40-45% of the population. There are three clinical forms in Ethiopia: localized cutaneous leishmaniasis, mucosal leishmaniasis and diffuse cutaneous leishmaniasis, all caused by *L. aethiopica*, *P.longipes* and *P. pedifer* are the proven vectors. In different areas the parasitologically confirmed reservoirs are hyraxes (*Procavia habessinica* and *Heterohyrax brucei*). The disease is primarily zoonotic with the parasite being maintained between hyraxes and sandflies.

3. **Cutaneous leishmaniasis (*L. major*).** In 1977, *Arvicanthis niloticus* from north-west and south-west Ethiopia have been found infected with a parasite identified as *L. major* s.l., and infected *Phlebotomus duboscqi* was caught in the Segen valley. *L. major* was also identified in 2 patients from the lower Omo valley.

4. **Cutaneous leishmaniasis (*L. tropica*).** *L. tropica* was isolated from one patient.

5. **Control.** Control measures include:

- active and passive case detection
- treatment
- central diagnostic services available at the Institute of Pathobiology of Addis Ababa University
- project of insect control trial in the Segen valley with the application of DDT on termite hills.

FRANCE

1. **Visceral leishmaniasis.** The incidence of human VL was never high in France. It occurs mostly in southern France: Alpes Maritimes, Cévennes and Pyrénées Orientales; the foci are periurban or rural. Sporadic cases are also reported in other areas of France, but the infection was probably contracted in southern France. Between 1922 and 1950, 304 autochthonous cases were reported. Then the number of cases diminished to 3-4 per year; since 1968, human and canine leishmaniasis have again increased; 89 human cases, mainly from the Pyrénées Orientales, Vaucluse, Var and Bouches du Rhône, were reported from 1968 to 1974, and from 1970 to 1984, 159 cases of VL were registered from two areas: the eastern and western sides of the lower Rhône basin. The increase has been more important since 1984 (90 cases in 1986-1987): Provence (23 cases in 1985), Alpes Maritimes (15 cases in 1985-1988). In the Cévennes (departments of Ardèche, Hérault, Gard, Aveyron), 30 cases were registered in 1970-1980. Currently, the number of cases in adults is increasing (50% of cases in south-eastern France), sometimes associated with immunosuppression: AIDS, immunosuppressive therapy, and immunosuppressive disease.

The main biting species, *P. ariasi* (79%) and *P. perniciosus* (21%) are the proven vectors of VL; in the periurban foci of Marseille and Nice, the predominant anthropophilic species is *P. perniciosus* (almost 100%). Three among 187 specimens of *P. ariasi* were found naturally infected with *Leishmania* in the Cévennes focus. Two isolates were identified as *L. infantum* s.s. by isoenzyme electrophoresis. *P. perniciosus* feeds on dogs and farm animals and is attracted to *Rattus rattus*. It seems to be the vector where *P. ariasi* is rare or absent. *P. ariasi* is the undoubted vector in the Cévennes. It is anthropophilic and zoophilic as well as exophilic and exophagic, but it enters houses when the climatic conditions are poor. It is usually located at mid-slope at 300-500 m, in the zone of mixed oak corresponding to the highest prevalence in dogs.

*L. infantum* s.s. is the causative agent. Characterization by isoenzyme electrophoresis has shown the existence of different zymodemes, especially with human dermotropic strains. The dog is the main domestic animal reservoir host. In the Cévennes, a rate of infection of 4.4% has been reported and the distribution of canine leishmaniasis is related to the same ecological characteristics as the vector *P. ariasi*. In the Alpes Maritimes, 542 dogs were examined and 10-13% were found serologically positive. In the suburbs of Marseille, 557 dogs were studied serologically and 12% were positive; the annual incidence is 5%. Many dogs are asymptomatic (approximately half of the infected dogs), but they are infective for sandflies (the parasite is in the skin). In the Pyrénées Orientales, 2163 dogs were surveyed in 1982-1984: 2.5% were serologically positive and 1.2% parasitologically confirmed. Three red foxes *Vulpes vulpes* were found infected in the Cévennes (infection rate 2.5%). They seem to play the role of wild reservoir. In France, no rodents have been found infected; on Corsica, 2 or 3 new cases of VL are reported each year. *P. perniciosus* is the suspected vector; *P. ariasi* is not present. *L. infantum* has been identified by isoenzyme electrophoresis in humans and in dogs.

2. **Cutaneous leishmaniasis.** It is much less frequent than visceral leishmaniasis, with only a very few sporadic cases reported from southern France. Up to 1975, 35 autochthonous cases were diagnosed. In 1980, cases were seen in the Pyrénées Orientales; one or two new cases are reported annually from Cévennes, and also sporadic cases from Provence; only one parasite is involved: *L. infantum*. Among 15 isolates from cutaneous cases (Tech valley in the Pyrénées Orientales) 12 were typed as one enzyme variant of the *L. infantum* reference strain and 3 were similar; one mucocutaneous case was also related to *L. infantum*. *P. ariasi* is the proven vector for the dermotropic zymodeme of *L. infantum*.

3. **Control.**

3.1 **Visceral leishmaniasis.** Detection of human cases and infected dogs.

## GAMBIA

1. **Visceral leishmaniasis.** Only 3 human cases have been described in 1949, 1980 and 1982, respectively. In 1980, a positive dog was found in the same compound as the human case. The causative agent has not been identified to date. The vector is unknown.

2. **Cutaneous leishmaniasis.** CL also is assumed to be uncommon in the Gambia. 10 cases have been reported, 3 before 1980, one in 1980, and 6 in 1982. The increase of cases could be due to improved recognition or to the increasing prevalence of the disease. *P. duboscqi*, the proven vector in Senegal, has also been found in the Gambia. Reservoirs are unknown.

3. **Control.** Only passive case detection.

## GREECE

1. **Visceral leishmaniasis.** VL is well known in Greece since 1935. During the 1940s an average of 160 cases of kala-azar were recorded each year, then during the 1950s, 32 cases per year; from 1962 to 1978, human VL increased to approximately 60 cases per year. From 1979 to 1981, 153 VL cases were reported

from Attica (near Athens), the Ionian islands and some other areas. Canine visceral leishmaniasis was predominant before the Second World War (5-15% of the dogs being infected in Crete); different surveys were undertaken between 1934 and 1938 showing rates of infection in dogs from 6.5% to 22.5% (733 dogs were examined in Canea). VL is still frequent in several areas of Greece. The parasite is *L. infantum*, identified by isoenzyme electrophoresis (23 isolates from humans and 19 from dogs); 2 zymodemes have been described (glucose-6-phosphate dehydrogenase variant). In Corfu island, the vector is *P. neglectus* (naturally infected by *L. infantum*) and *P. syriacus* seems to be the vector in Crete; however, *P. tobbi* was found to be common in the Greek islands (late in the year) and this species cannot be dismissed as a possible vector of visceral leishmaniasis. *P. perfiliewi* is also present in Greece.

2. **Cutaneous leishmaniasis.** In the past CL was frequent in Crete (1938: 4000 cases) and endemic in several areas of continental and insular Greece (1951-1975: 271 cases). Now it occurs sporadically, particularly in the island of Zakynthos (15 cases reported between 1979 and 1981). The parasite, *L. tropica* (different zymodemes), was identified by isoenzyme electrophoresis on 8 human isolates from various areas. The most suspected vector is *P. sergenti*. In 1938 Adler reported that leishmanial strains of cutaneous cases from Canea in Crete, produced an experimental infection rate that was high in *P. sergenti* and low in *P. papatasi*, and a volunteer was infected by cutaneous inoculation of promastigotes from an experimentally infected specimen of *P. sergenti*. Recently (1990) two cases of cutaneous leishmaniasis due to *L. infantum* have been reported.

3. **Control.** In 1958, a country-wide survey, including Crete, demonstrated the efficiency of DDT house spraying undertaken 10 years before, and susceptibility tests were performed on *P. papatasi*. Now no specific control measures are in progress, only case detection.

## GUINEA

1. **Visceral leishmaniasis.** Unknown.

2. **Cutaneous leishmaniasis.** 3 sporadic cases were reported in 1976 from western Guinea; one from Conakry was parasitologically confirmed.

## GUINEA-BISSAU

In 1990 one case of visceral leishmaniasis associated with an HIV2 infection was reported.

## INDIA

1. **Visceral leishmaniasis.** Until the early 1950s, Indian kala-azar was widely prevalent throughout the alluvial Gangetic belt of Bihar, in West Bengal and in the Bhramaputra valley in Assam, in addition to foci in Tamil Nadu (Madras). It occurred endemically in well-defined areas of the eastern part of the Indian sub-continent. The pattern of intermittent epidemics "once in every decade" was apparently interrupted after 1947, with a long period free of kala-azar; this correlates with the antivector effect of DDT spraying undertaken during the national Malaria Eradication Programme, associated with effective treatment of all cases. However, this programme ended in 1962-1963, and, as expected, cases reappeared with the cessation or reduction of DDT spraying, and new epidemic outbreaks appeared in Bihar (100 000 cases in 1977 and 40 000 in 1978). West Bengal had only 11 cases during 1971-1977 and the Malda district was free of the disease; in 1980, however, an epidemic broke out in this district arising probably from the neighbouring endemic area. In 1987, a total of 4500 cases were reported from the state of West Bengal. Currently the endemic areas are: 30 of the 39 districts of Bihar (extension to south Bihar), 10 districts of West Bengal and 2 districts of Uttar Pradesh. There have also been sporadic cases in Tamil Nadu and Delhi; Assam is free of VL. From June 1987 to June

1988, 22 000 cases and 160 deaths were reported. In addition sporadic cases of VL now occur in the foothills of the Himalayan mountain range in the north-western sector of India in the states of Himachal Pradesh and Jamu and Kashmir. In 1987, the prevalence of kala-azar in Bihar was estimated at 0.5% and the annual incidence at 1/1000. In Bihar state in 1989, 30 000 cases and 450 deaths were reported; in 1990 counted cases reached 54 000 with 590 deaths; it is obvious that the number of reported cases is largely underestimated; some local door to door surveys revealed that the real prevalence of the disease was five times more than reported. In 1991 the situation became epidemic and because of the rapid manner in which the disease is spreading, an alarming situation exists.

*P. argentipes*, the most highly suspected vector of VL in India, breeds in and around cowsheds near human dwellings, is anthropophilic and is a cattle feeder.

Despite the many surveys undertaken to identify animal reservoir hosts, up to now, none has been found. Transmission is believed to occur from human to human. VL and post-kala-azar dermal leishmaniasis cases constitute the source of infection. Several strains were identified as *L. donovani* s.s.

2. **Cutaneous leishmaniasis.** Anthroponotic cutaneous leishmaniasis (ACL) and zoonotic cutaneous leishmaniasis (ZCL) occur in the north-western states of India (foci of Rajasthan and Punjab), which have experienced several outbreaks of CL; in 1976 in the Bikaner district (western Thar desert), there were more than 2000 people infected. This outbreak appeared to be related to the cessation of DDT spraying.

*Leishmania* strains have been isolated and typed as *L. tropica* in humans and dogs in urban areas. *P. sergenti* is the suspected vector.

*L. major* was reported in humans, in the gerbil, *Meriones hurrianae*, and from the sandfly *Phlebotomus salehi*; different zymodemes were identified. It is a typical zoonosis in the dry terrain of the Rajasthan canal region.

**3. Control**

3.1 **Visceral leishmaniasis.** The most important measures applied have been: (1) deployment of the health infrastructure to the remotest corners of the country, to evaluate the specific needs; (2) supplying the specific drug for the effective treatment of all cases after house-to-house detection; (3) antivector measures by DDT residual spraying of houses and cattlesheds; (4) intensive health education programme; (5) intensive training programme for medical and health officials; (6) epidemiological surveys to adapt the control measures. In north Bihar, the reduction of insecticide applications in 1979 resulted in a 30-47% increase in the phlebotomine sandfly population in 1980 and 7.23% in 1981. From 1985 to 1990 an intercountry visceral leishmaniasis control programme was undertaken in Bangladesh, India, and Nepal; an integrated vector control programme for malaria, filariasis, kala-azar and Japanese encephalitis is planned. In infected areas house-to-house DDT spraying is being reintroduced. Sodium antimony gluconate is produced in India and pentamidine isothionate is imported for the 10% of cases that do not respond to antimony treatment. In 1988, in two pilot districts of West Bengal (24 Parganas North and South), kala-azar control programmes were launched. They consist of active and passive case detection, vector control activities (DDT residual house spraying) and first-line treatment; the control strategies are integrated in the primary health care (PHC) context. The carrying out of DDT spraying of 9 endemic districts of north Bihar has been planned for 1990.

Leishmaniasis is a notifiable disease in Bihar state since 1991.

## IRAN (ISLAMIC REPUBLIC OF)

1. **Visceral leishmaniasis.** The most highly endemic areas are: province of Fárs in the south, and the districts of Meshkin-Shahr and Moghan in the north-west. In the last five years there were approximately 600 cases from the latter area and 50 cases per year from Fárs. Most of the cases in the Meshkin-Shahr focus are children under 9 years old. *P. major* is the probable vector in most of the infected areas, but the only domestic and peridomestic sandfly recorded in the Meshkin-Shahr focus is *P. kandelakii*; however, *P. major*, *P. alexandri*,

and *P. chinensis* are also present. Infected dogs have been identified in the Meshkin-Shahr focus as well as in other foci. The wild reservoir hosts seem to be jackals or foxes which have been found infected in various areas of the country (2 foxes in Meshkin-Shahr). The parasite is probably *L. infantum*.

2. **Zoonotic cutaneous leishmaniasis.** ZCL is endemic and is very common in many rural areas, especially in the plains of the north-east near the USSR border and in the province of Esfáhán in the centre of the country. The latter area is considered to be a very big focus, probably the most important. From 1976 to 1984, a total of nearly 50 000 cases of ZCL was officially reported but this is probably a large underestimate. The endemicity is so high that almost 80% of the rural population contract the disease before the age of 10 and, when nonimmune newcomers move to this part of the country, practically all become infected. In Khuzestán the disease has a low endemicity but during the last few years more than 10 000 cases have been reported annually among soldiers and war refugees. In the Esfáhán area, new industrial projects, steel mills, refineries, and housing projects have led to the migration of nonimmune populations. The vector is *P. papatasi* and the main animal reservoir is *Rhombomys opimus*, with perhaps other gerbils playing a secondary role (*Meriones libycus* was found infected in Esfáhán and Turkmen-Sahara). In the desert areas between Iran and Iraq, the reservoirs are *Tatera indica* and *Nesokia indica* and, in Baluchestan, *M. hurrianae*. The parasite has been identified as *L. major*.

3. **Anthroponotic cutaneous leishmaniasis.** ACL is found in Teheran as well as in some other large or medium-sized cities. Sometimes the villages near the cities are also infected because of the movement of infected people; usually there are local outbreaks that occur in one compound after another. Outbreaks occur because of population increase, unplanned urban development, and sandfly population increase. In Teheran between 1979 and 1981, the overall prevalence of active lesions was estimated at 1.5% and the scar rate at 23.3%. In Kermán in 1981-1982, of 36 000 schoolchildren examined, 312 were found infected (prevalence 0.9%). Reports of health departments in Shiráz and Meshed show a considerable increase in reported cases in the last 7-8 years. The parasite is *L. tropica*; the vector is supposed to be *P. sergenti*; natural infections have been observed but characterization of the parasite in the sandfly has not been achieved.

**4. Control**

4.1 **House-spraying with DDT.** The incidence of leishmaniasis fell but transmission continued and, when spraying was discontinued, the incidence rose considerably.

4.2 **Poisoning of gerbils and application of DDT powder in rodent burrows** (300 metres wide around a settlement). This measure failed to control zoonotic cutaneous leishmaniasis.

4.3 **Spraying of foxholes in the Iraq/Iran war area** (where soldiers were living) and distribution of repellents did not modify transmission.

4.4 **Leishmanization.** This control measure was carried out in the army up to 1989. The soldiers were sent to the front 3 months after leishmanization. Around Esfáhán, leishmanization was carried out once a year in January or February. In the last 6 years (up to 1989), 160 000 people have been inoculated in this area; it is believed that 1 250 000 soldiers and 60 000 civilians (war refugees) were also inoculated; a total of approximately 2 million people received leishmanization; according to reports, the lesions in 2-3% of the individuals do not heal for 2-3 years and require treatment. In the absence of any other control measures, leishmanization is advisable; however, the inoculum must be standardized, produced under suitable conditions and controlled frequently.

Leishmaniasis is a notifiable disease.

**IRAQ**

1. **Visceral leishmaniasis.** The disease is known since 1916. It is a great public health problem in Iraq. The most highly endemic areas are central Iraq and the Greater Baghdad area. Most cases are in children of under seven years (99%) and under one year (45%). There are 1000-1500 cases reported yearly and the

annual incidence of VL among children 0-4 years old in the rural population is estimated at 70/100 000. Two isolates (from a human and a dog) were recently typed and identified as *L. donovani* s.s. The reservoirs are possibly dogs and jackals (*Canis aureus*); during serological surveys, dogs and jackals showed high rates of positivity in the indirect fluorescent antibody test (IFAT). The transmission from human to human is another possibility. The vector is unknown but *P. alexandri* is strongly suspected since it has been incriminated in China as a vector of *L. donovani*.

2. **Zoonotic cutaneous leishmaniasis.** ZCL is widespread throughout the country except for the three provinces in the north-east bordering Turkey and Iran where cases are rare. It seems that the majority of CL cases reported in Iraq are of the zoonotic form (in 1983, 1566 cases, in 1984 approximately 2500 cases). An outbreak with 50 cases was noted in Sinjar, north Iraq. The Iran/Iraq war exposed many people to the infection since it produced greater population movement. Several human isolates have been typed; the parasite is *L. major*. The vector is supposed to be *P. papatasi*, and gerbils the reservoirs.

3. **Anthroponotic cutaneous leishmaniasis.** This very old disease was extremely common during the last two decades. Although the incidence has recently fallen sharply, outbreaks can occur as in a school in Baghdad (38 cases out of 1200 children). The causative agent is *L. tropica* (isolated from patients). Humans are the main reservoir and *P. sergenti* the suspected vector. One specimen of *Rattus rattus* has been found infected by *L. tropica*.

**4. Control**

4.1 **Visceral leishmaniasis.** Between 1980 and 1983, it was decided to restrict contact between jackals and dogs by burning dead animals around the chicken farms and slaughter houses; as a result, the incidence of infantile VL in these areas decreased by over 70% compared to a control area where it fell by only 40% during the time of observation.

4.2 **Cutaneous leishmaniasis.** The use of insecticides and the replacement of slums by new buildings are the control measures currently being applied.

Leishmaniasis is a notifiable disease.

## ISRAEL

1. **Visceral leishmaniasis.** Only sporadic cases occur (2 cases notified in 1989) and the epidemiology of the disease is not well known. Infection in dogs has been reported in the past but not recently and the role of canids has not been determined. The suspected vector is *P. syriacus*. The parasite is *L. infantum*. Recently *L. donovani* s.l. was isolated from dogs in north-eastern Israel.

2. **Zoonotic cutaneous leishmaniasis.** Hyperendemic in the Jordan valley (especially in the lower and middle valley), ZCL occurs mainly in the southern regions of Israel. There are small zoonotic foci in the Negev and Arava. ZCL in the Jordan valley is known since 1914; in 1970, a human infection rate of 50% was reported among soldiers; the majority of cases are newcomers or visitors because local people have acquired immunity. Between 1983 and 1987, there was a gradual decrease in the incidence of ZCL as a result of the drought which reduced the zoonotic foci and the *Psammomys* population. The parasite is *L. major* with some variants related to the different geographical areas (isoenzyme characterization). *Phlebotomus papatasi* is the most prevalent species of *Phlebotomus* and the only known vector. *Psammomys obesus* and *Meriones crassus* (the latter not in the Jordan valley) are the reservoirs. The close contact between vector and reservoirs forms a very efficient cycle for the transmission of the disease. The Indian rat *Nesokia indica* has been found infected in the Jordan valley.

3. **Anthroponotic cutaneous leishmaniasis.** *L. tropica* infection has been reported in Israel (a few sporadic cases) and one female *Phlebotomus sergenti* has been found infected in the Arava area, but the parasite has not been formally identified.

4. **Control.** For the last 3 years or so the procedure was: house spraying of 4% DDT on the outer walls and of 0.1-0.2% permethrin on the inside walls; the introduction of rags soaked with the low-vapour pressure organophosphorous insecticides, bromex or dichlorvos, into rodent burrows within the perimeter of human dwellings. *P. papatasi* having been observed to feed on honey dew from plants, it was suggested that a solution containing food dye could be sprayed on these plants and this marking method could be used to assess the effect of a given microorganism. (The test agent can be added to the sprayed dye solution.) The attraction of *P. papatasi* to turkeys has been reported and it has therefore been suggested that turkeys be used as a complementary control measure. Leishmanization has been used for years on groups at high risk.

Leishmaniasis is a notifiable disease.

ITALY

1. **Visceral leishmaniasis.** A considerable increase of infantile VL cases was recorded in the post-war period. In 1971-1972 an outbreak of VL in adults occurred in Emilia Romagna. Currently, the most important foci are in Tuscany, Sicily, Campania and Sardinia. There has been a moderately high frequency of VL cases in Italy in recent years. In Sicily the number of VL cases among adults has been increasing since 1970. The overall number of VL cases reported in Italy was 32 in 1987 and 54 in 1988.

Recently, high prevalences of canine VL have been recorded: Tuscany (23.9%), Sicily (11.7% to 37%), Puglia (7.5% to 10.9%). In some endemic foci of canine leishmaniasis, no human cases have been recorded: island of Ustica or near Florence (last case in 1942). In other foci canine VL is still highly endemic and human VL is decreasing.

In Tuscany, province of Grosseto, natural infections of *Rattus rattus* (4) and *Vulpes vulpes* (1) were demonstrated by the experimental infection of hamsters with spleen homogenates of these animals.

The parasite is *L. infantum* s.s. isolated from humans, dogs, *V. vulpes*, *R. rattus*, and the sandflies *P. perfiliewi* and *P. perniciosus*. Different zymodemes have been identified in dogs (3 and 4 enzyme variants), in *V. vulpes* (4 enzyme variants) and in human cases (1 enzyme variant).

The proven vectors are: *P. perfiliewi*, of which one specimen out of 213 in Abruzzi region was found infected with *Leishmania* identified as *L. infantum* s.s.; and *P. perniciosus* which is the vector in Sardinia (province of Cagliari). *P. perniciosus* is predominant in Apulia (Parabita). One specimen out of 59 has been found infected by *L. infantum*. *P. perfiliewi* was found to be the dominant species in Tuscany, more than 99% in Baccinello. *P. perniciosus* and *P. perfiliewi* coexist in Calabria. *P. perfiliewi* is attracted to dogs, foxes and black rat, *Rattus rattus* (in Tuscany 80% to 90% of experimentally engorged females). *P. perniciosus* feeds on dogs, farm animals, *Rattus rattus* and humans.

2. **Cutaneous leishmaniasis.** CL is endemic in Italy at a relatively constant level since the 1970s. Cases have been mostly reported from Sardinia, Sicily, north of Calabria, the Tyrrhenian littoral, Tuscany, central Italy, the Adriatic region of Abruzzi, and Molise. From 1946 to 1948 the incidence clearly increased with the appearance of new foci, but from 1948 to 1961 surveys showed the beneficial effects of insecticide spraying with a consequent low level of incidence. CL cases from Abruzzi represented 30% of all CL cases recorded in Italy up to 1969.

Several isolates from different regions have been typed as *L. infantum* s.l. (dermotropic strain): most of them showed zymodemes different from the reference strain. These zymodemes were not isolated from animal reservoirs. Several surveys undertaken in different foci of Italy failed to isolate *L. tropica* from any species of wild mammals. *P. perfiliewi* is the vector; it is extremely abundant in some foci of CL (especially in the Abruzzi region) and it is endophilic.

3. **Control**

3.1 **Visceral leishmaniasis.** Several insecticide spraying campaigns using DDT and an organophosphorous compound were carried out in 1948; DDT was sprayed indoors in some villages of the Abruzzi region and brought about a dramatic decrease in *P. perfiliewi*. Today, in Sicily, a systematic search for *Leishmania* in bone marrow aspirates is obligatory in children with fever, anaemia and spleen enlargement. Thus the few cases detected can be diagnosed and treated. On the island of Elba the control of canine leishmaniasis has led to a 64% reduction in the incidence of canine VL.

Leishmaniasis is a notifiable disease.

## JORDAN

1. **Visceral leishmaniasis.** VL is rare; only 20 cases have been reported mostly from Aqaba, Karak and Irbid. Canine leishmaniasis used to be common; today the role of infected dogs appears to be slight. The vector is unknown, but *P. alexandri*, *P. syriacus* and *P. tobbi* are present.

2. **Zoonotic cutaneous leishmaniasis.** The disease is endemic; from 1983 to 1989, 1880 cases were notified in the Dermatology Department of King Hussein Medical Center (250 in 1989, mainly from the Jordan valley). From December 1982 to April 1983 in the Muwaqqar area near Amman, 193 cases were detected; outbreaks have appeared since 1985 in areas where cutaneous leishmaniasis was previously unknown; they seemed related to agricultural or industrial projects, with new settlements (houses located near the crop fields); the reservoir is *Psammomys obesus* confirmed parasitologically in the Jordan valley (the burrows are in the vicinity of the houses). Near Amman, one *Rattus norvegicus* and one *Meriones* sp. have been found with *Leishmania* infection but no isolations were made. *Meriones libycus* is abundant in Al Hasa and Al Hallabat (50 km north-east of Amman). *Phlebotomus papatasi* is the suspected vector. The etiological agent is *L. major*.

3. **Control**

3.1 **Cutaneous leishmaniasis.** Since the first report of the CL outbreak in 1982, a technical committee was formed; the major activities are:

**Case detection:**

- active and passive detection of human cases.

**Treatment**

**Sandfly control:**

- residual house spraying and space spraying with DDT, carried out by the malaria section of the Primary Health Care Directorate.

**Animal reservoir control:**

- destruction of the *Psammomys* colonies by flooding, digging and more recently ploughing in a radius of 1 to 1.5 km around the town of Al Hasa to remove the chenopods.

The leishmaniasis control programme is incorporated into the primary health care system.

Leishmaniasis is a notifiable disease.

KENYA

1. **Visceral leishmaniasis.** The disease seems to have been imported by soldiers returning from southern Ethiopia after the Second World War. The disease spread with epidemic resurgences in different foci during the years that followed. Old foci are in the eastern part of the country in the densely populated areas while new ones are located mostly in the arid north-western part with sparsely populated areas. Since 1980 the number of cases reported increased considerably; it is a sporadic disease with outbreaks. Visceral leishmaniasis is a drawback to rural development. In the endemic areas there is a high mortality rate.

1.1 **Kitui focus.** An outbreak occurred in 1952-1953 (more than 3000 cases), and between 1957 and 1960 a new resurgence of the disease affected 1487 people; an outbreak flared up in 1963 and, after a period of calm, the disease reappeared in 1980. A good correlation was established between the proximity of houses to termite hills and the risk of transmission. *Phlebotomus martini* is the proven vector. The parasite isolated from infected specimens is *L. donovani* s.s. (isoenzyme electrophoresis identification). Infected dogs have been reported, but they seem more likely to be "accidental" hosts rather than a source of infection to humans; mongooses and genet cats with *Leishmania* infection have been reported but the parasite was not identified. The transmission is believed to be mainly from human to human.

1.2 **Machakos focus.** The first cases appeared between 1942 and 1950. In 1977-1979, 2000 cases were noted. The disease has now declined after the introduction of control measures in 1981-1983. The natural infection rate of *P. martini* was estimated at 1 in 1000.

1.3 **West Pokot focus.** This focus reached an epidemic level during the late 1970s with an annual increase since 1978. It is the first place where one infected dog was reported. An entomological study revealed the very high degree of endophily of *P. martini*. A human isolate from this focus was identified as *L. infantum* s.s.

1.4 **Masinga focus.** This focus is related to new settlements and the building of dams for hydroelectric power.

1.5 **Meru focus.** The focus has been at an epidemic level since 1963.

1.6 **Baringo focus (Rift valley).** In 1981 the disease was still endemic and now the incidence is around 100 cases per year; human stocks isolated in this focus were typed as *L. infantum* s.s. and *L. donovani* s.s. Six out of 2000 females of *P. martini* were found infected; two isolates were identified by isoenzyme electrophoresis as *L. donovani* s.s. similar to *L. donovani* strains isolated from humans; *P. celiae* could play a secondary role as vector in some limited areas of eastern Kenya.

2. **Zoonotic cutaneous leishmaniasis.** Reported in the lowlands of Baringo district (Marigat) below 1200 metres, the causative agent of ZCL is *L. major*. To date, more than 6 different species of rodents have been shown infected with *L. major*: *Xerus rutilus*, *Tatera robusta*, *Arvicanthis niloticus*, *Taterillus emini*, *Mastomys natalensis*, *Aethomys kaiseri*, and one vervet monkey *Cercopithecus aethiops*, in Thika, Kiambu district. *P. duboscqi* is the proven vector; natural infection with *L. major* was reported in many specimens taken from the rodents' burrows. Finally, *L. major* was isolated from three human indigenous cases in Baringo district. Some control measures using rodenticides are being undertaken to limit the rodent populations.

3. **Anthroponotic cutaneous leishmaniasis.** *L. tropica* was isolated and identified from 3 Canadian patients and 2 indigenous Kenyans; the isolates were not infective for mice, but they were indistinguishable by isoenzyme analysis from the *L. tropica* WHO reference strain. The only potential exposure of the 5 patients to sandfly bites was in Kenya; to date several other cases have been reported. *P. guggisbergi* is the proven vector in Muruku, Laikipia district, where human cases have been reported.

4. **Cutaneous leishmaniasis (*L. aethiopica*).** This form of leishmaniasis is well known in the mountainous regions such as Mount Elgon, and in the Rift valley escarpments: Aberdare range in Myandarna district at 1800-1900 m. The vector is *P. pedifer*, and, at certain times of the year, its natural infection rate can reach 8%. Another sandfly, *P. elgonensis* is non-anthrophilic but lives in the same niches and feeds on similar hosts; it could be a zoonotic vector.

**Reservoirs:** rock hyrax (*Procavia johnstoni*), tree hyrax (*Dendohyrax arboreous*), giant rat (*Cricetomys* sp.) were reported with leishmanial infection in the caves of the Mount Elgon focus. The parasite was *L. aethiopica* (identified by isoenzyme characterization). They are the main reservoirs. With the extension of farming and grazing in the region, there is an increased risk of cases since farmers and shepherds tend to sleep in the caves.

5. **Control of visceral leishmaniasis.** Control measures include: mass screening of populations for detection; spraying of DDT 2% on termite hills and human dwellings in villages; placing sticky traps around the termite hills for trapping sandflies; large-scale destruction of termite hills (20 m radius from houses); treatment of patients; killing infected dogs; public health education in schools and villages. Recently, wall screens impregnated with a pyrethroid have been used inside houses in Marigat, Baringo district.

Leishmaniasis is a notifiable disease.

## KUWAIT

1. **Visceral leishmaniasis.** A few cases of VL have been recorded (mostly imported).

2. **Cutaneous leishmaniasis.** CL was not recorded before 1967; ZCL and ACL are endemic and the number of cases has increased (more than 200 cases in 1975). Different reasons can explain such an increase: (1) a growing number of imported workers: from 1965 to 1975 (more recent data not available), the population increased by 115% and 3 million people crossed the borders in 1977 (all the countries around Kuwait are endemic for CL), (2) greater economic activity producing big changes in ecological conditions, and (3) rapid urbanization. *L. major* and *L. tropica* have been isolated and identified in humans. The diversity of the strains would indicate that part of them are imported. *Phlebotomus papatasi*, the suspected vector is present in Kuwait and is especially abundant in newly-developed areas on the periphery of Kuwait city. Reservoirs are unknown.

3. **Control.** Only detection of cases.

## LEBANON

1. **Visceral leishmaniasis.** Sporadic cases of VL were recorded in western Lebanon near the sea coast among children under 10 years old (72 cases between 1962 and 1964); dogs are the domestic reservoir hosts; a 2% infection rate was reported among the 150 dogs examined in 1960. No recent information is available, but it is likely that a few cases of VL occur; zymodemes intermediary between *L. donovani* and *L. infantum* were identified. *P. syriacus* is the suspected vector of VL.

2. **Cutaneous leishmaniasis.** Known foci of cutaneous leishmaniasis existed in the past but, since 1969, reports are lacking; no recent data are available. *P. papatasi* is present.

3. **Control.** House spraying for malaria eradication was applied for several years, but did not show great effect on the sandfly population.

## LIBYAN ARAB JAMAHIRIYA

1. **Visceral leishmaniasis.** The disease has been known since 1910 with a few sporadic cases from Tripoli and Cirenaica. There is very little information about the epidemiology of VL in Libya. In 1971, a survey of dogs showed a natural rate of infection of 1.6% among 638 dogs examined in Tripolitania. *P. perniciosus* and *P. longicuspis* are present.

2. **Zoonotic cutaneous leishmaniasis.** ZCL has been reported only sporadically but the disease is endemic with also occasional epidemics. Numerous cases were recorded from a wide area south and west of Tripoli extending almost to the Tunisian border. In 1971, 241 cases were reported from Zawiyah and Gharyan; in 1984, hundreds of cases were notified. The increasing number of cases was related to better detection by improved medical services and the increased risk due to the development of new tracts of land for agriculture and housing. (The total number of cases reported from 1961 to 1987 reached 4036.) From 1987 to 1988 in the Walid area (new settlements), 722 cases were reported. The vector seems to be *P. papatasi* and the animal reservoirs are *Psammomys obesus* and *Meriones libycus*; the parasite is *L. major* (human and rodent isolates were typed).

3. **Control.** Only detection of cases. During epidemics, house spraying is carried out (DDT, twice yearly).

Leishmaniasis is a notifiable disease.

## MALAWI

1. **Visceral leishmaniasis.** The first confirmed case of VL was reported in 1979 from northern Malawi. The patient, an African 38 years old, had never left Malawi.

2. **Cutaneous leishmaniasis.** Unknown.

## MALI

1. **Visceral leishmaniasis.** Unknown.

2. **Cutaneous leishmaniasis.** There are endemic foci of CL in eastern, northern, central and south-western (Nioro district) Mali. Between 1957 and 1966, 589 cases of CL were reported: 70% were from the Kayes area (413 cases) in south-western Mali; between 1958 and 1974 several leishmanin test surveys were undertaken, and in one study, among 1649 subjects from the Kayes and Segou areas, the global positivity rate was 18.6%; only 14 cases were diagnosed from 1973 to 1977. *Phlebotomus duboscqi* and *P. sergenti* are present. In 1985, the first identification of *L. major*, in a human cutaneous case, was achieved by isoenzyme electrophoresis. In 1989 another zymodeme of *L. major* was isolated from an autochthonous patient (Mopti area). No recent data on prevalence or incidence are available.

3. **Control.** Passive and active case detection.

Leishmaniasis is a notifiable disease.

## MALTA

1. **Visceral leishmaniasis.** In the islands of Malta and Gozo, between 1946 and 1984, 1185 cases of VL were reported usually in children under 5 years old. During the last 10 years, there were approximately 8 new cases per year. Canine leishmaniasis is still endemic. In 1989, after a door to door serological survey, the point prevalence of canine leishmaniasis in Gozo was estimated as 21%; 3 isolates from dogs were typed as *L. infantum*. *P. perniciosus* is very common in Gozo and is the proven vector. Six specimens of *P. perniciosus* were found infected and 4 isolates were biochemically typed as *L. infantum*; *P. perfiliewi* and *P. neglectus* were recorded.

2. **Cutaneous leishmaniasis.** 24 cases were diagnosed between February 1983 and February 1988, mostly from a small eastern coastal area of Gozo. One strain of *L. infantum* was isolated from a cutaneous case and identified as a variant by isoenzyme electrophoresis. Six other isolates from human cases in Gozo were identified as *L. infantum* s.s.; *P. perniciosus*, *P. perfiliewi* and *P. sergenti* were recorded.

3. **Control**

3.1 **Visceral leishmaniasis.** In 1971, VL was considerably reduced in Malta as a result of a combination of measures: vector control, elimination of infected dogs, treatment of human cases and improvement of environmental sanitation.

## MAURITANIA

1. **Visceral leishmaniasis.** Unknown.

2. **Cutaneous leishmaniasis.** The real endemicity is probably higher than the few cases of CL recorded. These originated from Aïoun-el-Atrouss, the Nema region and near the borders with Senegal and Mali. *P. duboscqi* was recorded in several areas.

3. **Control.** Only passive case detection.

Leishmaniasis is a notifiable disease.

## MOROCCO

1. **Visceral leishmaniasis.** The first case was described in 1922. The level of endemicity in Morocco has always been lower than in Algeria or Tunisia (19 cases before 1956 and 61 cases from then until 1978). It is a sporadic disease with scattered cases widely distributed. Northern Morocco is endemic for VL (Nador, Al-Hoceima and Tetouan provinces), but central Morocco (Moyen Atlas, Fes and Meknes areas) seems to be more frequently infected. Recent studies (1980-1984) reported 216 cases of VL from northern Morocco. *P. perniciosus* is the most suspected vector. Only a few cases of canine visceral leishmaniasis have been reported but a recent increase in canine leishmaniasis has been observed. In southern and central Morocco, *L. infantum* (same zymodeme) has been isolated from a human case and from 3 dogs. The most suspected vectors in this area are *P. ariasi* and *P. longicuspis*.

2. **Zoonotic cutaneous leishmaniasis.** Previously sporadic, ZCL has become epidemic since 1976, with explosive outbreaks. Zoonotic cutaneous leishmaniasis is mostly present in the sub-Saharan districts of Er-Rachida, Ouarzazate and Tata. In the 1980s, 20 000 cases were notified (in Tata province, some surveys during 1980-1981 demonstrated the existence of 2295 clinical cases). The parasite identified in this focus was *L. major*. The proven vector is *P. papatasi* (28 strains isolated and identified as *L. major*). The proven reservoir is *Meriones shawi* (4 out of 28 had lesions on the ear); 2 strains were identified as *L. major* (same zymodeme as *P. papatasi* strains and human strains).

3. **Anthroponotic cutaneous leishmaniasis.** In March 1990, 69 autochthonous cases of ACL were diagnosed in villages of central Morocco (north of the Haut Atlas); 41 isolates from patients, 2 from dogs and 90 from *P. sergenti* were identified as *L. tropica*.

4. **Control.** Only detection of cases.

## NAMIBIA

1. **Visceral leishmaniasis.** Unknown.

2. **Cutaneous leishmaniasis.** The first case was described in 1970. Sporadic human infections have been reported (23 up to 1981) from a wide area. The ecology is partly similar to *L. aethiopica* but the causative agent is different (recently claimed to be *L. tropica*). *Phlebotomus rossi* (possibly more than one species) caught in hyrax habitats was found infected with *L. tropica* (same zymodeme as in humans), but the zymodeme isolated from the hyrax, *Procavia capensis*, is different. It seems that at least two zymodemes of *L. tropica* are present in Namibia, but further biochemical identification is necessary.

3. **Control.** Only passive case detection.

## NEPAL

1. **Visceral leishmaniasis.** The disease was already reported before 1958, and in 1980-1986, 718 cases and 48 deaths were registered. In 1990 the most endemic areas in the Terai were: Dhanusha, Mahotari, Morang, and Sarlahi districts. In 1988 during a survey, mainly by passive case detection, 156 cases were detected and treated in Siraha district; during the same year, another study reported 200 cases in the neighbouring Morang district. In 1990, 327 cases and 14 deaths were notified from the Terai. *Phlebotomus argentipes* has been captured indoors in villages of the Dhanusha district.

2. **Cutaneous leishmaniasis.** Unknown, but the presence of *P. papatasi* and *P. sergenti* has been reported.

3. **Control.** The Division of Epidemiology of the Ministry of Health and the Central Health Laboratory in collaboration with the Nepal Malaria Eradication Organization are involved since 1985 in an intercountry VL control programme with Bangladesh and India; the programme consists of passive and active case detection, serological diagnosis and antimonial chemotherapy (free drug supply). Vector control through DDT spraying was carried out in 1990. During recent years, training of laboratory technicians and medical officers has been carried out.

## NIGER

1. **Visceral leishmaniasis.** From 1981 to 1987, 9 autochthonous cases were reported from the Aïr mountains near the Algerian border: one case was confirmed parasitologically and the others serologically. In 1987 a new case from Zinder in south-east Niger was parasitologically proven. *P. orientalis* is present in Tahoua. In the neighbouring focus of Hoggar in Algeria *P. perniciosus* and *P. longicuspis* have been identified.

2. **Cutaneous leishmaniasis.** CL endemicity is low in southern, central and western Niger. Although only a few sporadic cases of CL have been noted, the disease seems common, but few data are available. During 1984-1986, 58 cases were diagnosed and confirmed parasitologically in Niamey (Laboratory of Parasitology, Faculty of Medicine, and Anti-leprosy Centre). Recently (1988), *L. major*, same zymodeme as in Mali and Senegal, was identified by isoenzyme electrophoresis in a patient from the Boubon area, near Niamey; *P. duboscqi* and *P. sergenti* are present; transmission is seasonal, most of the cases are reported in September and October.

3. **Control.** Only passive case detection.

NIGERIA

1. **Visceral leishmaniasis.** Doubtful cases were reported during 1936-1947; no recent reports.

2. **Cutaneous leishmaniasis.** The endemicity was low but recently a sharp increase occurred in the north which is the extension of the southern focus of Niger; cases were also notified from the Plateau state in central Nigeria. *P. duboscqi* was reported from the focus of cutaneous leishmaniasis in northern Nigeria. *P. rodhaini* is present.

3. **Control.** Only passive case detection.

OMAN

1. **Visceral leishmaniasis.** VL is endemic in the country; from 1978 to 1989 186 cases were recorded from Al Nahda hospital in Muscat; the disease occurs mainly in the mountainous areas of the north (Sharkiya and Dhahira regions) and throughout the western and eastern Hajar, but recently 10 cases were reported in the south of Oman. No animal reservoir is known. The parasite has not yet been identified. *P. alexandri* is present. *Canis lupus*, *Vulpes vulpes* and *Rattus rattus* exist.

2. **Cutaneous leishmaniasis.** Only a few imported cases of cutaneous leishmaniasis have been reported in Sudanis and some indigenous cases from different areas. The parasite is unknown. *P. papatasi* is present.

3. **Control.** The malaria control programme has facilities for field research. Only passive case detection.

PAKISTAN

1. **Visceral leishmaniasis.** VL has been mostly reported from the north (Baltistan) and recently from Azad Jammu and Kashmir, parts of northern Punjab and the adjacent regions in the North West Frontier province (approximately 100 cases from 1962 to 1987); in the north, the foci are at high altitudes (2600-2800 m); most cases are children under 6 years old. Serological surveys indicate the existence of many asymptomatic or self-curing infections. The parasite isolated from a child in Azad Jammu and Kashmir has been typed as *L. infantum* s.s. No reservoirs are known. Dogs are suspected in Azad Jammu and Kashmir, however, some domestic dogs clinically suspected, appeared parasitologically negative. Few dogs are present in the Baltistan area, but wild canid could be involved; the vector has not yet been identified, and several anthropophilic sandflies are present: *P. alexandri*, *P. hindustanicus*, *P. kandelakii burneyi* and *P. longiductus*.

2. **Zoonotic cutaneous leishmaniasis.** It is endemic in several areas of Pakistan; still present in Gilgit Agency of northern Pakistan, in Balúchistán and in the extreme south, as reported in 1974-1980. Several outbreaks have been recorded in Balúchistán: 1970-1972 (2500 cases); 1974 (892 cases); 1975 (502 cases); 1977 (100 cases among 500 textile workers). In 1982, 500 cases were reported and in 1990 an epidemic occurred in Quetta. In this region, the disease is frequent in newcomers (immigrant labourers); there are few cases among permanent residents. In 1988, 500 cases were reported including those in Afghan refugees. On a clinical-epidemiological basis, it seems that *L. major* is the etiological agent. The probable vector is *P. papatasi*, but *P. salehi* is also present; *Meriones hurrianae* or other species of gerbils, *Rhombomys opimus*, *Tatera indica*, *Meriones* spp. could be the animal reservoir hosts.

3. **Anthroponotic cutaneous leishmaniasis.** *L. tropica* has been reported from Pakistan and *P. sergenti* is present.

4. **Control measures.** House spraying was undertaken first with DDT and then with malathion and HCH in certain areas.

PORTUGAL

1. **Visceral leishmaniasis.** The incidence was high until 1951 (1616 cases reported between 1942 and 1951), then a decline of VL occurred because of the antimalaria campaign and the lowest prevalence was reached in 1970 (20 cases); the incidence increased again, reaching 54 cases in 1983. The most important focus (80% of the cases) is the Villa Real district in the Alto Douro region (annual incidence: 9.7/100 000 inhabitants). The second endemic focus is the Lisbon region and recently, a new focus appeared in the Algarve, south Portugal. Most of the cases are children under 3 years old. The parasite is *L. infantum* s.s. (2 human strains typed). *P. perniciosus* and *P. ariasi* are the suspected vectors with a natural infection rate of 2% and 4.9% respectively, in the focus of Arrabida in the Setúbal peninsula and 5% for *P. perniciosus* in the Algarve. In *P. ariasi*, the *Leishmania* parasite has definitely been identified as *L. infantum* s.s. in the Alto Douro region. In the Arrabida focus, the prevalence rate of visceral canine leishmaniasis is 11.6%; 4 out of 71 foxes (*Vulpes vulpes*) were found infected (rate of infection 5.6%); 18 isolates from dogs, foxes and humans were typed as *L. infantum* s.s.

2. **Cutaneous leishmaniasis.** CL is very rare; only 21 cases were reported up to 1970, but in 1981, 10 cases were diagnosed in south Portugal. The epidemiology is unknown. The etiological agent is probably *L. infantum*.

3. **Control.** Previously there was an antimalaria campaign with insecticide spraying, but now only detection of human and canine visceral cases is carried out.

Leishmaniasis is a notifiable disease.

ROMANIA

1. **Visceral leishmaniasis.** No recent report; the last registered outbreak of infantile VL occurred in Oltenia during 1953-1954. *P. perfiliewi* was the suspected vector in this focus; *P. neglectus* and *P. longiductus* were also identified; canine VL was formerly reported.

2. **Cutaneous leishmaniasis.** One recent indigenous case of CL was reported in a tourist area.

SAUDI ARABIA

1. **Visceral leishmaniasis.** An increasing number of cases has been reported by the Ministry of Health, 1983: 48, 1984: 91, 1985: 188, 1986: 248, 1987: 291 and 1988: 305, with a total of 1300 cases reported to date. VL is endemic in the south-western part of the Asir mountains especially in Tihama and Gizan adjoining Yemen. Children are infected, sporadic cases being reported from the centre of the country. The parasites isolated from 11 patients in Gizan and Southern (formerly Asir) province were identified as *L. donovani* s.l., similar to the Ethiopian *L. donovani* but different from *L. donovani* s.s. (India). The reservoir and the vector are unknown; the presence of *P. orientalis*, vector of VL in Sudan, has been recorded, but *P. alexandri*, *P. chinensis*, *P. arabicus* and *P. naqbenius* are also present. Dogs have been reported infected by *L. infantum* s.s. (6 positives among 89 feral dogs from Gizan and Southern province).

2. **Zoonotic cutaneous leishmaniasis.** Until 1975, leishmaniasis in Saudi Arabia was considered a minor problem. In 1982 a National Leishmaniasis Research Programme (NLRP) was established for an in-depth evaluation of the clinical and epidemiological aspects of the leishmaniases in Saudi Arabia with the aim of establishing optimal methods for the elimination of leishmaniases from the Kingdom. Recently, several factors produced an increase of transmission: rapid urbanization, migration, intensive agriculture, poor living conditions in the farms, and massive immigration, and consequently leishmaniasis became a public health problem. Zoonotic cutaneous leishmaniasis is known in several areas of the country. From August 1972 to

November 1974, 726 cases were notified by the central laboratory of the Ministry of Health in Riyadh. In 1978 there was an outbreak among expatriate Europeans in Hofuf. In 1983 more than 18 000 cases were notified. During the last few years over 1500 cases were recorded annually in the King Fahad hospital. In 1984, in the dermatology clinic of Al Kharaj hospital, 413 patients were clinically diagnosed as CL (86% of them were non-Saudi people). The parasite was *L. major*. More than 50 isolates from humans were typed as *L. major* (one enzyme variant) like other isolates from Iraq and Kuwait. The gerbil *Psammomys obesus* is a proven reservoir; it was found infected in Al Hassa, Hofuf area, and 15 isolates were typed as *L. major* (one enzyme variant). Leishmanial infection was also reported from another gerbil (*Meriones libycus syrius*) and from one feral dog with a skin lesion. The parasite isolated from the gerbil and from the dog was the same zymodeme of *L. major*. *Phlebotomus papatasi* is the vector in Al Hassa and a rate of infection of 3.5% to 21% has been reported; the parasite was also *L. major* (one enzyme variant compared to the reference strain).

3. **Anthroponotic cutaneous leishmaniasis.** This form of the disease is endemic in the south-western part of the country (Abha, a town in the Asir plateau 2000 m above sea level), with 4500 cases reported in 1988. Cases of leishmaniasis recidivans are not uncommon in the area. Two isolates from the Gizan area were identified as *L. tropica*. Recently, two specimens of *P. sergenti* were found naturally infected by *L. tropica* identified by isoenzyme and monoclonal antibody typing. This zymodeme was found to be the same as that isolated from human cases in the same locality. Reservoirs are unknown.

4. **Cutaneous leishmaniasis** due to *L. arabica*. In the Eastern province of Saudi Arabia, a new parasite has been isolated from the gerbil *Ps. obesus* (4/19) and from a feral dog (1/3) (6 out of 11 enzymes were different from *L. major* on isoenzyme characterization). At present no infection in humans has been reported. The vector is supposed to be *P. papatasi*, but it is not proved.

5. One specimen of *Ps. obesus* and one dog have been found infected by an intermediary zymodeme, between *L. major* and *L. arabica*.

6. **Control.** Detection, reporting and treatment of cases are usually carried out. The epidemiology of *L. major* in the Eastern province is now well known; to eliminate *Ps. obesus* from the vicinity of dwellings, attempts at removing their main food source (*chenopodium*) are being made but more epidemiological surveys are necessary.

Leishmaniasis is a notifiable disease since 1978.

## SENEGAL

### 1. Visceral leishmaniasis

1.1 **Human VL.** To date, the existence of human VL has not been proved (no cases reported).

1.2 **Canine VL.** Well known since 1910, the disease is widespread and very common in domestic and stray dogs. It was especially investigated in western Senegal where it is enzootic. Several strains were isolated from dogs and identified as *L. infantum* s.s. The dog is the only proven reservoir host, but it is possible that carnivores such as *Vulpes pallida* and *Genetta genetta senegalensis* could play a role as wild reservoirs. The vector remains unknown.

2. **Zoonotic cutaneous leishmaniasis.** Known since 1933, the disease is endemic throughout Senegal, but it is very difficult to have a true estimate of the actual incidence and a good appreciation of its public health impact. Between 1976 and 1980, an intensive study, carried out during an outbreak in a localized focus (Keur Moussa Monastery) between the cities of Dakar and Thies, revealed an endemo-epidemic type of evolution with a permanent active focus maintaining the endemicity and, from time to time, an outbreak with a great number of cases; the outbreaks occur when the ecology is modified by a new agricultural project and/or by the introduction of a new nonimmune population; the zoonosis itself is related to the fluctuations in rodent populations. In this focus, the global prevalence rate of scars and active lesions among 1049 people was estimated in 1979 at 12.39%. The causative agent is *L. major*. The confirmed vector is *P. duboscqi*, usually

caught at the entrance of rodent burrows (93.7% of the specimens). This biotope is also the larval breeding site for *P. duboscqi*; 7 female sandflies were found infected with *L. major* (identified by isoenzymes). Three species of rodents are the proven reservoir hosts: *Arvicanthis niloticus*, *Tatera gambiana* and *Mastomys erythroleucus*.

3. **Control.** No specific measures, only case detection.

## SOMALIA

1. **Visceral leishmaniasis.** VL is endemic along the Webe Shebelle and Juba river basins of southern Somalia. The ecological features are the same as in southern Ethiopia and Kenya. *P. martini* and *P. celiae* have been reported in termite hills of different regions. *P. orientalis* is found in the north.

2. **Cutaneous leishmaniasis.** Sporadic cases have been reported from the south and a few cases of mucosal and cutaneous leishmaniasis have been reported from northern Somalia. The identity of the parasite is unknown.

3. **Control.** Only passive case detection.

## SOUTH AFRICA

1. **Visceral leishmaniasis.** Unknown.

2. **Cutaneous leishmaniasis.** Only one case was reported in 1979 from Okiep in the north-west of Cape province. *P. rossi* and the hyrax *Procavia capensis* have been recorded in the same area. The *Leishmania* species could be the same as in Namibia.

3. **Control.** Only passive case detection.

## SPAIN

During the first 10 months of 1990, 124 cases of leishmaniasis (VL + CL) were reported.

1. **Visceral leishmaniasis.** Most of the cases have been reported from the eastern coast in the provinces of Alicante and Murcia (1970-1977: 11 cases, 1976-1978: 17 cases). No cases have been reported from the western border with Portugal. Usually fewer cases than in Portugal and only sporadic cases are registered. Between 1972 and 1982, 18 cases of VL were reported in children under 5 years old at the Granada City Hospital. Reported cases of VL are increasing in Catalonia (106 during 1982-1984); *L. infantum* s.s. is the causative agent. Demotropic and viscerotropic strains have been isolated from human cases in Catalonia. *Phlebotomus perniciosus* and *P. ariasi* are the proven vectors; both have been found infected by 2 dermotropic and 1 viscerotropic zymodemes of *L. infantum* in Catalonia in the same locality of Torroja del Priorat. Canine visceral leishmaniasis is endemic with a natural rate of infection between 1.3% and 18.5%; recently canine visceral leishmaniasis in Mallorca appeared to be a real problem (seropositivity ranged from 10% to more than 20%); in the city and suburbs of Barcelona the seropositivity among dogs was 45/484 (9.3%). Dogs are infected by viscerotropic and dermotropic zymodemes of *L. infantum*. (In Catalonia, 2 different zymodemes were isolated from the same dog simultaneously.) An isolate from *Vulpes vulpes* (3 specimens examined) was identified as *Leishmania* sp. in Murcia; 1 strain isolated from *Rattus rattus* and 5 from dogs in the province of Granada were typed as *L. infantum* s.s. In one area of Almeria province, 25% of dogs and 4.6% (24/522) of

*P. perniciosus* sandflies were found infected. During the last years, several cases of VL associated with HIV infection or other immunosuppressive disease have been notified.

2. **Cutaneous leishmaniasis.** More cases than in Portugal. CL occurs mostly in the foci of the provinces of Alicante and Murcia (1970-1973: 219 cases, 1976-1978: 256 cases). Two human isolates from south-east Spain were typed as *L. infantum*. In 1990, a case of mucocutaneous leishmaniasis was related to *L. infantum*. *P. ariasis* and *P. perniciosus* are the vectors.

3. **Control.** Control measures include: case diagnosis, case treatment, and improvement of housing and hygiene conditions.

Leishmaniasis is a notifiable disease.

## SRI LANKA

1. **Visceral leishmaniasis.** Currently there is no autochthonous VL; there is historic record of two possible cases. *P. argentipes* is common and predominantly anthropophilic in the highlands (it has more zoophilic tendencies in the lowlands).

2. **Cutaneous leishmaniasis.** A report in 1978 showed several CL cases imported from Saudi Arabia, but no autochthonous cases.

## SUDAN

1. **Visceral leishmaniasis.** VL is endemic with severe outbreaks and is considered an important socioeconomic problem. It is associated with *Acacia balanites* "forest" and deeply cracked black clay soil. Following upon reports of sporadic cases, the first outbreak appeared in the Upper Nile province, southern Sudan, in 1955; subsequently a new violent epidemic occurred between the Blue and White Niles. The main endemic area for kala-azar is traditionally in eastern and central Sudan stretching from Malakal in the south to Kassala in the north-east; later new foci were noticed in the west (El Fasher and El Nahud) and Kapoeta in the far south. Since 1971, the reported incidence is between 3000 and 5000 cases per year, but prevalence is probably higher; an estimated 100 000 people are at risk (1980 study) and a 75% mortality rate in infected children has been reported. More recently in 1988, an epidemic of VL occurred in the western Upper Nile region in southern Sudan, with a massive displacement of people towards Khartoum, and numerous cases were reported among the refugees in the Khartoum area. In 1989, in western Upper Nile, an epidemiological study among the Nuer people revealed a seropositivity of 18.2% in a previously non-epidemic area and an estimated 40 000 deaths were reported in a population of 350 000. The parasite causing VL in Sudan has been typed as *L. donovani* s.s. More recently human isolates have been identified as *L. donovani s.s., L. infantum* s.s. and zymodemes intermediary between *L. donovani* s.s. and *L. infantum* s.s. The proven vector of VL in Sudan is *P. orientalis*; three rodents (the Nile rat *Arvicanthis niloticus*, the spiny mouse *Acomys albigena* and a *Rattus rattus*) and two carnivores (the genet *Genetta genetta* and the serval cat *Felis serval*) were claimed to be infected with *L. donovani* s.s. In 1987 a massive VL infection was reported in one jackal, but further studies are needed to incriminate any additional animal source of human infection. Human to human transmission is suspected in epidemics.

2. **Cutaneous leishmaniasis.** The reporting of sporadic cases was followed by three outbreaks: 1976/1977 in the Shendi Atbara area, early 1985 in El Garrasa of the White Nile area, and October 1985 in Tuti island at the junction of the Blue and White Niles with a population of 20 000. In 1986 the number of cases increased dramatically; all age groups were affected with a total of 100 000 cases. An entomological survey in the area showed that *P. apatasi* is the dominant species (52%); no natural infection was found but it is assumed to be the vector; *P. duboscqi* may perhaps also play a role. The parasite isolated from several patients was identified as *L. major*. Natural infection was demonstrated in 13 *Arvicanthis niloticus*.

3. **Mucosal leishmaniasis.** This disease is widespread in Sudan (central, western and northern desert areas). The first report of mucosal leishmaniasis in Sudan was by Cristopherson (1914); to date, approximately 50 cases have been reported, all adult males, none with a history of cutaneous leishmaniasis. The parasite has been identified in certain cases as *L. donovani* and in certain others as *L. major*.

**4. Control**

4.1 **Visceral leishmaniasis.** In the 1950s, an attempt was made to control transmission of VL in southern Sudan by DDT house-spraying, active case detection and treatment, but house-spraying was not very effective and reinvasion of treated woodlands was rapid. Currently, control measures include passive or active case detection, early diagnosis and treatment.

4.2 **Cutaneous leishmaniasis.** Control measures include: chemotherapy of patients; vector control through a massive campaign of indoor, outdoor and aerial spraying with residual insecticides (indoors: malathion 50%, fenitrothion 40%, and outdoors: DDT 25%), together with a nationwide rodent control programme. The recent outbreak (May 1987) could be related to the interruption of spraying, the increase of sandfly density and population movement.

Leishmaniasis is a notifiable disease.

**SYRIAN ARAB REPUBLIC**

1. **Visceral leishmaniasis.** A few cases have been recorded from areas where the climate is humid, mainly from the north-west of the country (Kessab, Doi'a, Idlib, Latakia and Tartous) but also from the south-west (Suweida); 20 cases from 1976 to 1985 and 5 cases in 1987. *P. galilaeus*, *P. syriacus*, *P. tobbi* and *P. halepensis* are potential vectors but the epidemiology is only partly known. In the past, canine VL was very frequent. Foxes and jackals are common and can play a role in the maintenance of endemic VL. In 1990, *L. infantum* was isolated from 2 dogs in Kessab.

2. **Cutaneous leishmaniasis.** CL is a very old endemic disease in Syria but in the 1950s antimalaria spraying caused a considerable decrease of the incidence, and, during the following years, just a few cases were reported. However, in 1980-1983, several outbreaks occurred again with an important increase of cases: more than 800 were reported from several different provinces. In 1987, 1650 cases and in 1988, 3084 cases, all parasitologically confirmed, were notified. More recently in 1990, over 8300 cases were reported from the foci of Aleppo and Dmeir. ACL seems to occur in towns and cities and ZCL in rural areas, but there is a great need for isolation and typing of more *Leishmania* stocks from patients, sandflies and rodents to clarify the epidemiological situation. *Psammomys obesus* is the proven reservoir of ZCL (17 positive out of 60) in villages east of Damascus, near Dmeir (study carried out in 1990). *Phlebotomus papatasi* is the suspected vector of ZCL. *L. major* was identified from several human cases by isoenzymes in 1990. A new zymodeme of *L. tropica* has recently been isolated from 2 patients in Aleppo and biochemically identified. In 1990 more than 20 new stocks isolated from human cases were identified as *L. tropica*. ACL cases do not self-heal in less than one year and sometimes they develop the recidivans form; *P. sergenti* is the probable vector in Aleppo; dogs have been found infected but they seem to be more victims than reservoirs; transmission is believed to be from human to human.

3. **Control.** Control measures include case detection and antivectorial activities by insecticide spraying.,

Leishmaniasis is a notifiable disease.

## TOGO

1. **Visceral leishmaniasis.** The first parasitologically proven case of VL was reported in 1974 from Lama-Kara, northern Togo. No recent data are available.

2. **Cutaneous leishmaniasis.** In 1978 1 case of CL was reported but the patient had not contracted the infection in Togo. *P. duboscqi* is present.

3. **Unspecified leishmaniasis.** 5 cases were observed in 1964 (WHO official report). No recent data are available.

4. **Control.** Only passive case detection.

## TUNISIA

1. **Visceral leishmaniasis.** Endemic in the north of the country. The number of cases decreased during the antimalaria spraying campaign (1968-1974). The patients are mostly children (80%) from 1 to 5 years old. There are approximately 100 cases reported annually with a 5-8% mortality. The cases occur in the semi-arid areas under a sub-humid bioclimatic influence and with a recent extension to central Tunisia; the dog is the proven domestic reservoir host. The parasite is *L. infantum* s.s. (6 human stocks and 2 canine showed the same zymodeme). There is strong evidence that *P. perniciosus* is the vector. *P. perfiliewi* and *P. longicuspis* are also present.

2. **Zoonotic cutaneous leishmaniasis.** ZCL occurs mainly in central and south-western Tunisia (semi-arid and arid areas) with thousands of cases. The disease has an endemo-epidemic type of evolution as in other countries of North Africa. There are foci with a permanent active transmission and, from time to time, outbreaks occur related to new agricultural projects or large population movements (introduction of nonimmune people). From 1982 to 1988, 26 000 cases were notified. Currently more than 6000 new cases are reported annually. In some villages up to 60% of the population are infected. The lesions are large and multiple. The parasite responsible for the disease is *L. major* (30 human stocks identified). The vector is *P. papatasi* (2 typed stocks). Transmission is mainly seasonal. In central and south-western Tunisia, *Psammomys obesus*, *Meriones shawi* and *M. libycus* are the proven reservoirs; several stocks have been identified as *L. major*, similar to human strains.

3. **Anthroponotic cutaneous leishmaniasis.** Less frequent than ZCL, ACL occurs mostly in south-eastern Tunisia (in the Tataouine region where a small focus was discovered in 1980). The causative agent is *L. tropica* (25 stocks typed by isoenzyme electrophoresis), but it is a new taxon of the *L. tropica* complex, named *L. killicki*. The suspected vector is *Phlebotomus sergenti*. No reservoir is known to date (175 rodents examined in this focus appeared to be negative).

4. **Sporadic cutaneous leishmaniasis in northern Tunisia.** Sporadic CL occurs in the known VL foci. Among the 71 cases reported, 96% presented a small single lesion on the face that usually heals in 2 years or more. The parasite is *L. infantum*; it is very difficult to maintain it in culture. The epidemiology is unknown.

5. **Control**

5.1 **Visceral leishmaniasis.** DDT spraying during the antimalaria campaign had a transient effect; passive case detection, active medical surveillance, reporting and treatment of patients are undertaken; the active detection and subsequent killing of infected dogs, together with health education and community participation, are now being undertaken in several VL foci.

5.2 **Cutaneous leishmaniasis.** Limited action has been carried out mostly against the reservoirs: *Psammomys obesus* (controlled with an anticoagulant rodenticide) and *Meriones shawi* (controlled with wheat with zinc phosphorus in the burrows).

Leishmaniasis is a notifiable disease.

TURKEY

1. **Visceral leishmaniasis.** VL is endemic, with sporadic cases notified from several areas of the country. Up to 1982, more than 500 cases have been reported, almost exclusively in children. No recent data are available; the vector is unknown. *Phlebotomus major*, *P. alexandri* and *P. tobbi* are present. Dog infection has been confirmed parasitologically and serologically and it seems to be the main animal reservoir for the moment (in 1982, the natural infection rate among 1150 dogs examined was 1.6%).

2. **Cutaneous leishmaniasis.** CL is hyperendemic in south-eastern parts of Turkey neighbouring Iraq and Syria. In this area between 1981 and 1984 there was an outbreak with thousands of cases (Urfa: 1670 cases). In the central part of the country, only sporadic cases have been reported; they are supposed to be anthroponotic. *L. tropica* was identified from 4 human isolates but *L. major* is also present. Rodents belonging to the genera *Meriones* and *Microtus* are suspected of being wild reservoirs. *P. sergenti* and *P. papatasi* are the suspected vectors.

3. **Control.** Only detection of cases.

UGANDA

1. **Visceral leishmaniasis.** The first case was recorded in 1946; between 1946 and 1957, 9 cases were reported, 6 from north-eastern Uganda and the others from the border with Sudan (Kapoeta). In 1959, VL appeared to be endemic in Karamoja district, Amudat village, an area of semi-arid steppe (north-eastern Uganda). Among 1498 people, 39% had an enlarged spleen and a high rate of positivity was observed by serology (73%). Some were parasitologically confirmed by spleen puncture (16/45). The probable vector is *P. martini*. In 1969 and 1970 a few more cases were reported. No recent data are available.

2. **Cutaneous leishmaniasis.** CL has been reported for several years (1926-1936); today, it probably occurs in the foothills of Mount Elgon but needs confirmation.

3. **Control.** Only passive case detection.

Leishmaniasis is a notifiable disease.

USSR

1. **Visceral leishmaniasis.** Before the 1950s VL was regularly reported in big cities of Middle Asia and sporadically reported in small cities and villages of Middle Asia and Transcaucasia, as well as in the south of Kazakhstan. Control campaigns were started in the 1950s and, after some years of maintaining the control measures (detection and treatment of human cases, indoor and outdoor insecticide spraying, treatment or killing of infected dogs, improvement of housing), VL was practically eradicated (Uzbekistan in 1943-1949: 1220 cases, in 1967, 2 cases). However, cases of VL (fewer than 10 cases per year) are still being reported from rural areas of south-eastern Turkmen SSR, eastern Azerbaijan and southern Kazakh SSR. Today, VL affects mostly children. The parasite is *L. infantum* s.s.; isolates from a human and a badger (*Meles meles*)

from Georgia have been typed as *L. infantum* s.s. In Azerbaijan, 8 strains from human cases were identified as *L. infantum*. The reservoirs include dogs (5% infected in the Kzyl-Orda) and foxes (*Vulpes vulpes* and *V. corsak*). The porcupine, *Hystrix indica*, was also suspected. The proven vectors are *P. longiductus* in the foothills of the Khieghiz ridge and *P. smirnovi* in the Kzyl-Orda region.

2. **Anthroponotic cutaneous leishmaniasis.** In the past, ACL was the cause of considerable morbidity; by the mid-1960s, it was practically eradicated as a result of a wide-scale control programme with insecticide spraying, improvement of housing conditions, and active case detection and treatment followed by continuous surveillance. In Kirovabad town where previously 1500-2000 ACL cases were reported annually, no cases have been registered since 1966, but long-term careful surveillance is needed (in 1973 just one case was registered in Ashkhabad). Sporadic cases are still reported and also a few patients with leishmaniasis recidivans. The parasite is *L. tropica* and the suspected vector *P. sergenti*.

3. **Zoonotic cutaneous leishmaniasis.** ZCL is still a great public health problem in Turkmen SSR and Uzbek SSR, from where the majority of cases are reported. The increase in the number of cases can be related to agricultural and settlement projects and to road construction in new districts when these bring nonimmune populations in contact with natural foci. ZCL has an irregular distribution and shows wide annual variations in morbidity in relation to natural factors and population migration. Natural foci occupy vast areas of the Turan plain coinciding with the areas of distribution of *Rhombomys opimus*. Very active foci exist in the irrigated oases of Turkmen SSR and Uzbek SSR. On the basis of quantitative measurement of the level of transmission the foci were classified as hyperendemic, endemic and hypoendemic. Two types of ZCL natural foci were identified:

- foci with *P. papatasi* as principal vector: these occur in ancient valleys and oases where intense epizootic conditions prevail among *Rhombomys opimus* and where the risk of epidemics is high because of the anthropophily of *P. papatasi*.

- foci with *P. caucasicus*, *P. andrejevi* and *P. mongolensis* (*caucasicus* group) as the main suspected vectors: these occur in foothills and sandy desert regions where intensive epizootics affect *R. opimus*. Since these three sandflies are mostly zoophilic, they were supposed to transmit *L. major* among *R. opimus*. However, based on new isoenzyme studies, the epidemiological situation appears to be still more complex; three different species of *Leishmania* associated with different species of sandflies seem to coexist sympatrically in the great gerbil *Rhombomys opimus*: *L. major*, *L. gerbilli* and *L. turanica* n.sp. (287 isolates studied). *L. turanica* n.sp. was clearly differentiated through isoenzymes and DNA studies (23 strains); it is different from *L. major*, *L. gerbilli*, and *L. arabica*; 13 zymodemes of *L. turanica* have been individualized. The new species does not seem to be pathogenic for humans; it has been found throughout the area of distribution of *R. opimus*: Turkmen SSR, Uzbek SSR, south Kazakh SSR. *L. turanica* n.sp. has been isolated from *P. andrejevi* and *P. papatasi*. The new species seems to be predominant in most areas; *L. major* is frequent only during outbreaks of ZCL (great numbers of infected *R. opimus* and high densities of *P. papatasi*).

In the light of this discovery, the concept of "low virulent" *L. major* has to be reviewed together with the hypothesis of "*L. major* becoming avirulent" when transmitted by *Paraphlebotomus*.

In the USSR approximately 100 000 animals have been studied. *R. opimus* is the main reservoir host (in autumn, the infection rate commonly reaches 20%, sometimes 100%). *Meriones libycus* is able to maintain a natural focus (rate of infection reaches 20% in Uzbekistan). *Leishmania* sp. (perhaps *L. major*) was isolated from incidental hosts: *Meriones meridianus* (19.1%) and *Meriones erythrouros* (1.8%) in a focus of ZCL in the Kizilarvat district (along the Kara Kum canal). The parasite is *L. major* (reference strain). Recently the first case of CL due to *L. infantum* was reported from the Geokchai region in Azerbaijan SSR.

## 4. Control

4.1 **Visceral leishmaniasis.** The purpose of the different control measures (described above) was: (1) interruption of the host-parasite system in human settlements by acting simultaneously against the sandflies, the dogs and the parasite harboured by infected people; (2) elimination of the ecosystems in which *L. infantum* circulates, especially by the replacement of traditional buildings by modern ones; (3) interruption of the spatial relationships between elements of the host-parasite system in natural foci and in human settlements.

4.2 **Cutaneous leishmaniasis.** Control measures included: (1) **leishmanization** - more than 20 000 subjects received a virulent strain of *L. major* (in high endemic areas); (2) **control of sandflies** - application of insecticides in breeding places not less than 1 km around houses and spraying of indoor and outdoor resting places; (3) **control of the reservoir** (after large-scale mapping) - destruction of the *R. opimus* burrows by ploughing (in the Golodnaya steppe) 50 cm deep within a radius of more than 3 km and control of *R. opimus* by using poisoned bait (wheat mixed with $Zn_3 P_2$) could reduce the density of the great gerbil from 17.9 to 0.35 per hectare; anticoagulant baits are also used; construction of large irrigation canals which serve as natural barriers to the migration of *R. opimus* are useful. The application of DDT in the entrance of the burrows or ultra-low volume spraying and the use of rags impregnated with DDT have also been suggested. Rodent control is more feasible if the area is surrounded by natural barriers which prevent reinfestation from the surrounding untreated area.

## UNITED ARAB EMIRATES

1. **Visceral leishmaniasis.** There have been reports of a few cases of VL in Fujairah (the eastern Emirate). *Phlebotomus alexandri* and *P. bergeroti* have been found near the city of Al-Ain, 160 km east of the capital Abu Dhabi.

## UNITED REPUBLIC OF TANZANIA

1. **Visceral leishmaniasis.** A case of VL described in Burundi (1988) could have originated in Tanzania (near the border).

2. **Cutaneous leishmaniasis.** Several cases were reported but, after further investigation, it appeared that none was parasitologically confirmed. In 1964 a DCL case was reported in western Tanganyika and in 1977 it was indicated that CL could occur on the slopes of Mount Kilimanjaro.

3. **Control.** Only passive case detection (disseminated leishmaniasis).

## YEMEN

1. **Visceral leishmaniasis.** Between February 1983 and October 1984, 53 cases were diagnosed in the Ta'iz hospital (55% were children under 5 years). *L. infantum* has been isolated from human cases and dogs and *L. donovani* only from human cases; they were identified by isoenzyme electrophoresis. It has been observed that the *L. infantum* complex is sympatric with *L. donovani* in mountainous areas and is present alone in the Tahima coastal plain. *P. orientalis* and *P. alexandri* are present.

2. **Cutaneous leishmaniasis.** In 1984 and 1985 more than 200 cases per year were notified. ZCL seems to be endemic in the lowlands and ACL occurs in the cities: San'a, Tahima, Ibb, Ta'iz (50 cases) and Hodeida. *L. major* and *L. tropica* were identified. *P. duboscqi* and *P. papatasi* as well as *P. sergenti* and *P. saevus*, all potential vectors, have been reported; cases have been notified from the mountainous villages in Lahij governorate.

3. **Control.** Reported cases only.

## YUGOSLAVIA

1. **Visceral leishmaniasis.** Human visceral leishmaniasis was highly endemic in Serbia during the 1940s and 1950s (more than 930 cases), but then only a few sporadic cases occurred up to 1968. All the active foci decreased sharply: Macedonia, Dalmatia, the island of Mljet (Croatia) and Montenegro.

Canine visceral leishmaniasis seems to be extinguished (no positivity detected by serological tests) since 1974. Two species are suspected to have been the vectors, *P. perfiliewi* and *P. neglectus*; *P. tobbi* is present. Two black rats, *Rattus rattus*, were reported infected by *Leishmania* sp. and 3 years later in the same village, 2 out of 68 black rats (3%) were found with parasites in the liver, but the parasites were not identified.

2. **Cutaneous leishmaniasis.** Few data are available. During the 1960s sporadic cases occurred in Dalmatia and Serbian islands. In 1982-1983, imported cases from Iraq were reported. CL is claimed to occur in some coastal areas and on islands of the Adriatic. *P. sergenti* is present.

3. **Control.** Only detection of cases.

In central Serbia, a specific DDT campaign against *P. perfiliewi* maintained for two years led to a dramatic reduction of sandfly populations in 1977.

## ZAIRE

1. **Visceral leishmaniasis.** One case was described in 1968: an adult Rwandese who had been living for two years in the Shaba region of south-eastern Zaire, but it is not sure if the disease was acquired in Zaire. In 1978, the first autochthonous VL case (histologically confirmed) was reported from the Gemena region in the Guinean savanna, north of the equatorial forest in north-western Zaire.

2. **Unspecified leishmaniasis.** From 1983 to 1988, 6 new cases with disseminated cutaneous nodules were reported (at least 3 autochthonous) from south-eastern Zaire (Kasai and Shaba) in the savanna belt, south of the forest; for all 6 cases, the histological diagnosis showed numerous *Leishmania* in the histiocytic infiltrates of the skin. Two had previous or coexisting leprosy (lepromatous leprosy). One strain has been isolated; the isoenzyme identification is in progress; it seems to be a new taxon.

3. **Control.** Only passive case detection.

## ZAMBIA

1. **Visceral leishmaniasis.** Two parasitologically proven cases were reported, one in 1973 from a village near Chipata (eastern area) and the other in 1976 from southern Zambia (Katete). Both had cutaneous manifestations and coexisting tuberculosis.

2. **Cutaneous leishmaniasis.** Unknown.

3. **Control.** Only passive case detection.

## NEW WORLD

### ARGENTINA

1. **Visceral leishmaniasis.** The first case was described in 1926 in the Chaco region; up to 1967, 11 cases were reported from the same area and from Salta province. The epidemiology is unknown. No recent data are available.

2. **Cutaneous leishmaniasis.** Most of the reported cases are from northern Argentina (Tucumán, Salta and Jujuy provinces. The number of cases increased after 1980: 76 cases in 1981, 138 in 1982, 78 in 1983, 328 in 1984 and, in 1985, only from the periurban area of Salta, 263 cases of which 28% were children under 15 years old. The parasite was *Leishmania braziliensis* (identification by isoenzymes). In Tucumán, dogs have been reported with cutaneous leishmaniasis and in Salta province with scrotal ulcer and ear lesions; the isolated parasite was *L. braziliensis* (isoenzymes); equines have also been found infected; in the periurban foci the most suspected vector is *Lutzomyia intermedia* (peridomestic area). Mucocutaneous cases are fairly common.

3. **Control.** Control measures include case detection and treatment; in the Salta focus, the houses of the compounds with patients were sprayed by DDT and BHC.

Leishmaniasis is a notifiable disease since 1985.

### BELIZE

1. **Visceral leishmaniasis.** VL has never been reported.

2. **Cutaneous leishmaniasis.** Although CL had been endemic for many years, only one causative agent was known: *Leishmania mexicana*, frequently reported from the northern area. The vector is *Lutzomyia olmeca olmeca* and different rodents have been identified as reservoir hosts (*Heteromys*, *Nyctomys*, *Ototylomys* and *Sigmodon*). In 1984, a second *Leishmania* was identified: *L. braziliensis* among British military personnel, infected in the southern part of Belize.

The frequency of the infection among soldiers suggests that the vector is a highly anthropophilic species, such as *Lutzomyia ovallesi* or *Lu. cruciata*.

3. **Control.** Only detection of cases.

### BOLIVIA

1. **Visceral leishmaniasis.** Only a few sporadic cases have been reported, mainly from the Yungas valleys of the La Paz department; in the same area, visceral canine leishmaniasis has been recorded and *Lu. longipalpis*, the predominant peridomestic species, was found naturally infected at a rate of 0.1% to 4%. The isolates from human cases (5), dogs (3) and infected sandflies (5) were identified by isoenzyme electrophoresis; all exhibited the same pattern and appeared to be similar to the *L. chagasi* reference strain from Brazil and the *L. infantum* strain from Morocco. It was concluded that the dog was the domestic reservoir, that *Lu. longipalpis* was the vector in this focus, and that the causative agent was *L. chagasi*, similar to *L. infantum*.

2. **Cutaneous leishmaniasis.** Cutaneous, mucocutaneous and diffuse cutaneous leishmaniasis occur in Bolivia. CL disease is widespread. Up to recently, two-thirds of the population lived at high altitudes in non-endemic areas (sandflies are not caught above 2500 m). However, a few years ago, this situation changed

radically as a result of a large population migration to the new settlement area in the lowlands. For economic reasons, people who were formerly miners have had to change to agriculture. Old foci, with a low rate of transmission but frequent mucosal involvement, are at the middle altitude (1200-1500 m) in the Yungas valleys of the Andes range. The transmission occurs mainly indoors and during the night (most of the cases are children of both sexes, with multiple lesions on the face); the suspected vector is *Lu. nuneztovari anglesi*. The new, highly active foci are in the tropical lowlands (new settlement areas) where there is very close contact with the primary forest. Two lowland areas were particularly studied, one in the La Paz department (Alto Beni) and the other in the Santa Cruz department (Yapacani). In the Alto Beni focus, a team of oil prospectors showed an infection rate of 52.8% (185 out of 350 workers) during the first year of working in the primary forest. In the same area, 3 sandflies, *Lu. (Psychodopygus) yucumensis*, *Lu. (P.) llanos martinsi* and *Lu. (P.) carrerai carrerai*, were found infected; transmission occurs mainly during the occupational activities (deforestation); the patients are young adults or adolescents, mainly males, with lesions located on the lowest parts of the legs. The isoenzyme characterization showed that the *Leishmania* isolated from human lesions (26 stocks) and from sandflies (2) were indistinguishable and very similar to the *L. braziliensis* reference strain (2 enzyme variants). In the Yungas valleys of the La Paz department, the causative agent was identified from 24 human isolates as *L. braziliensis*. Among the 50 *L. braziliensis* isolates from these areas (Alto Beni and Yungas), 3 different zymodemes were identified. No reservoir is known (500 animals studied). In the Yapacani region (Santa Cruz department) transmission seems less active; colonization of the area is less recent and the area is partly covered by secondary forest (among 236 people surveyed, 2 ulcers and 6 scars were diagnosed and 12% had a positive leishmanin skin test). Eleven strains were identified by isoenzyme and DNA studies; 10 were *L. braziliensis* and one *L. amazonensis*. No reservoir is known (76 rodents and marsupials from this area did not show any positivity). Recently, a rodent, *Oryzomys capito*, has been found infected; the parasite has been identified as *L. amazonensis* by isoenzyme electrophoresis. No vector has as yet been identified in this area.

In the La Paz department, 3 cases of diffuse cutaneous leishmaniasis were reported, but the parasite has not been identified.

3. **Control.** Some measures are being undertaken.

3.1 **Visceral leishmaniasis.** Serological detection of human cases (asymptomatic or oligosymptomatic) and infected dogs (especially asymptomatic ones) is being carried out to know the exact prevalence. Since January 1987, residual house-spraying with pyrethroids of human dwellings and animal shelters has been conducted in a focus of visceral leishmaniasis in the Yungas valleys (50 houses), with monthly control of peridomestic sandfly fauna (*Lu. longipalpis* density).

3.2 **Cutaneous leishmaniasis.** Improvement of case detection and treatment.

Leishmaniasis is a notifiable disease.

## BRAZIL

1. **Visceral leishmaniasis.** VL is widely distributed in Brazil and has been notified from at least twelve states. To date, more than 15 000 cases of VL have been reported. The most highly endemic foci (70% of cases) are in north-eastern Brazil in the states of Ceará, Piaui, Pernambuco and Bahia where there are semi-arid, dry, poorly forested areas with xerophilic vegetation. VL is mostly a rural disease, with a domestic or peridomestic epidemiology, but some persons contract the disease in towns or in the outskirts of cities. In the Jacobina focus, Bahia, the prevalence is 3.1% among children under 15 years old and the annual incidence is 4.3 cases/1000 children. 60% of the cases are children under 5 years old, 60% are males. Serologically positive cases are frequently asymptomatic or oligosymptomatic. Risk factors, such as concomitant malnutrition or infectious diseases, seem very important with respect to future clinical evolution.

Canine visceral leishmaniasis is widespread; in some highly endemic localities, more than 20% of the dogs are infected, but usually the rate of infection is between 3% and 13%. From 1979 to 1986, 611 148 dogs were serologically tested and 32 264 (5.28%) were positive. The wild animals so far found infected are the fox,

*Lycalopex vetulus* (11 specimens), in Ceará, and the fox *Cerdocyon thous* (13 specimens), in the island of Marajo, Pará state. The opossum, *Didelphis albiventris* has been reported infected by *L. chagasi*. The proven vector is *Lu. longipalpis*, in Pará state, Santarem focus (7.14% were found infected) and in the island of Marajo (0.5%); *Lu. longipalpis* is the predominant sandfly in domestic and peridomestic areas; recently it has been suggested that, since large numbers of *Lu. longipalpis* have been caught in a sylvatic habitat (at least part of the year), there may be an enzootic of *L. chagasi* maintained in foxes from which peridomestic foci of canine and human VL might be derived.

The parasites isolated from humans, *Lu. longipalpis* and *C. thous*, appeared to be indistinguishable biologically and biochemically from the *L. chagasi* WHO reference strain. There are dermotropic strains inducing primary cutaneous lesions in dogs and in humans (1 case reported in Rio de Janeiro). Dermal parasitism has been reported in macroscopically normal skin.

2. **Cutaneous leishmaniasis.** Cutaneous and mucocutaneous leishmaniasis are very widespread in Brazil. Almost 60 000 new cases have been reported between 1979 and 1986 (12 000 are from Amazonas state). In 1987, 1988 and 1989, an average of 20 000 new cases per year were reported. This represents a sharp increase due to better detection and/or explosive economic development, uncoordinated urbanization, large migrations of people to new settlement areas for agricultural projects (massive deforestation), building of dams for hydroelectric power in primary forest, opening of new roads. Three parasites are the principal causative agents, *L. guyanensis*, *L. braziliensis* and *L. amazonensis*, plus some new species: *L. lainsoni*, *L. naiffi*, and *L. shawi*.

2.1 ***L. guyanensis.*** Infections with this parasite are found in northern Amazon (states of Pará, Roraima, and northern Mato Grosso); thousands of cases have been notified in the outskirts of Manaus, mainly the suburbs such as "Cidad Nova". The parasite is usually associated with high and rather dry forests. The primary vector is *Lu. umbratilis*; its favourite resting place is the trunk of large trees in primary forest; it is especially abundant during the rainy season with diurnal and nocturnal transmission. *Lu. whitmani* is a secondary vector. *Lu. anduzei* has been identified (2 specimens naturally infected). The proven reservoirs are arboreal edentates, *Choloepus didactylus* (two-toed sloths), *Tamandua tetradactyla* (lesser anteater), the opossum (*Didelphis marsupialis*) and the spiny rat (*Proechimys guyanensis*).

2.2 ***L. amazonensis.*** Human disease is not frequent (3% of all human cases were observed in the Evandro Chagas Institute in Belém) since the vector is not very anthropophilic. It has been mostly recorded in the Amazon Basin (Pará, Amazonas, Mato Grosso), in the north-east (Maranhao, Ceará, Bahia) and in the south-east (Minas Gerais, Espírito Santo). Usually its biotope is the low, secondary, swampy forest, but it has also been recorded in woodland plantations. The human being is an accidental host; the severity of the disease is due to the fact that 30% of the cases exhibit the diffuse cutaneous form, highly difficult to treat.

The principal vector is *Lu. flaviscutellata*.

The proven reservoir hosts are mainly ground mammals (rodents): *Proechimys guyanensis* and *Oryzomys capito* are the most important. Several species of marsupials have been found infected without any lesions.

Four zymodemes of *L. amazonensis* have been identified but without any geographical or host correlation.

2.3 ***L. braziliensis.*** *L. braziliensis* produces large and chronic ulcers, known for their tendency of metastasing to rhinopharyngeal tissues (4-5% of the cases). Mainly frequent in Pará, Mato Grosso, Minas Gerais and São Paulo, it is also widespread throughout Brazil. The typical biotope is the primary forest. Transmission is usually related to occupational activities in this biotope.

The vector in the northern Amazon (Serra dos Carajas, Pará state) is *Lu. wellcomei*. It is a fairly anthropophilic vector. Three specimens of *Lu. whitmani* have been found naturally infected by *L. braziliensis* in the cocoa growing region of the littoral forest in Bahia state and in the Baturité hills of Ceará state. *Lu. intermedia* is the strongly suspected but not proven vector in an urban focus of CL near Rio de Janeiro city; to date, the sylvatic reservoirs are unknown. *L. braziliensis* has been isolated from dogs in at least six different states of Brazil, from equines in Ceará, Rio de Janeiro and Bahia, and from rodents (*Rattus frugivorus* in Ceará and *Akodon aviculoides* in Minas Gerais); the parasite shows relatively poor variability.

2.4 ***L. lainsoni.*** Six human cases (CL) have been reported, all from Pará state; 3/13 (23% *Cuniculus paca* from Tucurui (Pará state) appeared to be infected with *L. lainsoni*; the vector is *Lu. ubiquitalis*.

2.5 ***L. shawi.*** The parasite has been isolated from monkeys, sloths, procyonids; the vector is *Lu. whitmani* in Amazonian Brazil (Pará state) and human cases (CL) have been reported from the states of Acre and Pará.

2.6 ***L. naiffi.*** The parasite has been identified in edentates (*Dasypus novemcictus*) in Pará state, the vectors are *Lu. ayrozai* and *Lu. paraensis*, and the notified human cases (CL) were from the state of Amazonas.

2.7 Other *Leishmania* species. Species never isolated from humans have been reported from Brazil: *L. hertigi* complex, *L. deanei* from porcupines in the states of Piauí and Pará.

**3. Control**

3.1 **Visceral leishmaniasis.** The main control programmes undertaken by the SUCAM (Ministry of Health) in the states of Ceará, Minas Gerais and Rio de Janeiro include:

(i) active and passive detection of human cases for specific treatment;

(ii) serological detection and elimination of infected dogs (more than 50 000 dogs killed);

(iii) spraying of animal shelters and human dwellings (inside and outside) for *Lu. longipalpis* control. The insecticide mostly used was DDT (1.5 mg/m$^2$) and now in some areas it is replaced by pyrethroids (deltamethrin 2.5%). During 1979-1986, 225 000 houses were sprayed.

3.2 **Cutaneous leishmaniasis**

3.2.1 ***L. guyanensis.*** A vector control measure using insecticide (pyrethroid) spraying of the trunks of big trees in a 2400 m$^2$ area of Monte Dourado (Rio Jari), is being carried out.

3.2.2 ***L. braziliensis.*** In the urban focus near Rio de Janeiro, where *Lu. intermedia* is endophilic and anthropophilic, DDT house spraying for malaria reduced the incidence; in the primary forest, individual protection is useful; insecticide spraying is a possibility if the camps are relatively permanent.

**COLOMBIA**

1. **Visceral leishmaniasis.** Known in Colombia since 1944, VL is mainly endemic in the Magdalena river valley and its tributaries with a progressive extension to the north and south; 107 cases were recorded between 1944 and 1980 and 80% were children under 5 years; 53 cases were recorded in 1988 and 150 in 1990. The causative agent is *L. chagasi*. Since 1972, *Lu. longipalpis* was reported from different places throughout this area (in dry, rocky places below 900 m). The first infected dog was diagnosed in 1969; in some areas the seropositivity among dogs can reach 20%; *Didelphis marsupialis* appeared highly infected and in one focus, 12/37 (32%) were parasitologically confirmed; strains from dogs, opossums and sandflies (*Lu. longipalpis*) have been identified by isoenzymes as *L. chagasi*; recently *Lu. evansi* was found naturally infected in a VL focus of the Córdoba department.

2. **Cutaneous leishmaniasis.** Widely distributed (23/31 administrative areas), CL is endemic in the following areas: the Atlantic coastal region, Amazon, the eastern plains, Magdalena river valley, Cauca river valley and the Pacific coastal area. Approximately 1900 cases were reported during 1929-1979. In 1981, the annual rate of cutaneous leishmaniasis rose to 2.49/100 000 inhabitants. The increase seems related to better detection and greater migration of populations to new settlement areas (between 1981 and 1986, more than 9300 cases were reported, including 600 with MCL and, in 1988, 3322 cases were reported including 139 with MCL). To date, different parasites have been identified, by isoenzyme characterization, monoclonal antibodies and DNA studies.

2.1 **Braziliensis complex.** The identification of 151 isolates from the Pacific coast showed: *L. panamensis* variants (82%), *L. braziliensis* variants (14.5%) and stocks with intermediary phenotypes between *L. panamensis* and *L. guyanensis* (3.5%). It was demonstrated that mucosal involvement is related to different parasites: *L. braziliensis* and *L. panamensis*, but with *L. braziliensis* the frequency is higher and the severity greater; in the Antioquia area, 4 different zymodemes of *L. panamensis* have been reported. A new species *L. colombiensis* has been recently isolated from human cases and specimens of *Lu. hartmanni*.

Anthropophilic sandfly species, main vectors, and some animal reservoirs were identified: (1) *Lu. trapidoi* is a proven vector; it has been found naturally infected in two areas (Tolima and the Pacific coast); the parasite has been identified as *L. panamensis* by isoenzymes and monoclonal antibodies; (2) *Lu. (Psychodopygus) panamensis* could be a secondary vector. *L. panamensis* has been isolated from dogs in Bajo Calima (Buenaventura), *Akodon* sp. and marsupials. *Choloepus hoffmanni* has been identified as an important reservoir host of *L. panamensis*. Recently 1 specimen of *Lu. spinicrassa* has been found infected by *L. braziliensis* in Arboledas, north of Santander, and previously, *L. braziliensis* was isolated from dogs and equines; *L. braziliensis* is the most widely distributed species. *L. guyanensis* has been isolated from a specimen of *Lu. umbratilis* near Leticia city, Amazonas, in southern Colombia.

2.2 **Mexicana complex.** Two human strains (from Pueblo Rico and Tolima) were identified by isoenzymes as *L. mexicana* and a strain from the Amazon region (Puerto Santander) as *L. amazonensis*. *Lu. olmeca bicolor* and *Lu. flaviscutellata* are present in Colombia. Four cases of DCL associated with *L. amazonensis* and *L. mexicana* were reported in the departments of César, Meta, Cauca and Nariño.

3. **Control**

3.1 **Visceral leishmaniasis.** During DDT spraying for the antimalaria campaign in 1958-1962, no human cases were reported, but the reappearance of cases coincided with the cessation of DDT spraying.

3.2 **Cutaneous leishmaniasis.** Case detection and treatment.

Leishmaniasis is a notifiable disease since 1980.

## COSTA RICA

1. **Visceral leishmaniasis.** VL has never been reported, but *Lu. longipalpis*, the usual vector of the disease has been found in Costa Rica.

2. **Cutaneous leishmaniasis.** Considered to be a great public health problem, CL is highly endemic in different regions (Limón, Puntarenas, Alajuela and San José provinces). Approximately 1500 cases were recorded in 1985, including cutaneous and mucocutaneous leishmaniasis. There has been a great increase in the number of cases of leishmaniasis in the last five years or so. In 1987, the estimated number of cases was more than 2000 and in 1989 it was 2500.

Two parasites were identified in humans: *L. panamensis* (95%) and *L. braziliensis* (5%). Two sandflies are the proven vectors: *L. panamensis* was isolated from *Lu. ylephiletor* (2 specimens) and *Lu. trapidoï* (1). *Lu. youngi* is a suspected vector in Acosta (San José province) because of its anthropophily and endophily. Different animals are the reservoir hosts for *L. panamensis*: the three toed sloth (*Bradypus griseus*), the two-toed sloth (*Choloepus hoffmanni*) and a rodent, the spiny pocket mouse (*Heteromys desmarestianus*). Domestic dogs are sporadically found infected and could serve as a secondary peridomestic reservoir. Recently a human case reportedly due to *L. mexicana* was notified in Guanacaste. In 1986-1987 in north-west Cost Rica, Guanacaste province, an outbreak of CL occurred among Nicaraguan refugees: 200 people, mainly children; the etiological agent was identified as *L. chagasi*, the suspected vector is *Lu. Longipalpis*; no VL has been reported in the area.

**3. Control**

3.1 **Cutaneous leishmaniasis.** CL is currently seventh on the list of notifiable diseases. A national leishmaniasis control programme would like to: (1) establish case detection and treatment at the primary health care level throughout the country, (2) improve the training of auxiliary and professional personnel, (3) initiate vector and reservoir control within a pilot project, and (4) stimulate epidemiological research.

Leishmaniasis is a notifiable disease.

## DOMINICAN REPUBLIC

1. **Visceral leishmaniasis.** Unknown.

2. **Cutaneous leishmaniasis.** Since 1975, 29 human cases of diffuse cutaneous leishmaniasis have been reported from the provinces of El Seibo, La Altagracia and Sánchez Ramírez in the north-eastern part of the country. Subclinical forms are frequent. In 1982, one of the DCL cases presented also a mucosal involvement. Some isolates were typed by isoenzymes and appeared to be related to the *L. mexicana* complex but the stocks were different from the reference strains; in culture medium (slow growth) and after experimental inoculation to the hamster (no metastases and slow development), the parasite appeared to be more related to the *L. braziliensis* complex. Finally, the parasite, characterized by different methods, belongs to a subgenus of *Leishmania* but to a new taxon. In experimental infection of *Lu. longipalpis*, the parasites exhibited a suprapylarian development. To date, only two species of sandflies have been caught in the island: *Lu. christophei* and *Lu. cayennensis hispaniola*. *Lu. christophei* is highly suspected to be the vector. It was experimentally infected (suprapylarian development) and it is the only anthropophilic sandfly species. Suspected reservoirs include the black rat (*Rattus rattus*), a capromid rodent (*Plagiodontia aedium*) and the mongoose (*Horpestas auropunctatus*).

**3. Control**

3.1 **Cutaneous leishmaniasis.** Detection of cases.

## ECUADOR

1. **Visceral leishmaniasis.** One suspected case of VL was noted in western Ecuador, but *Lu. longipalpis* has never been reported in the country.

2. **Cutaneous leishmaniasis.** The disease is endemic in most provinces. The foci of cutaneous leishmaniasis in Ecuador are located in areas on both sides of the Andean range (Pacific and Amazonian) up to 2400 m. Mucocutaneous cases have been reported from the Amazonian region of Ecuador. It is an important public health problem especially, as in many Andean countries, in the new settlement areas. Very few data on prevalence or incidence are available. In 1982 a study was carried out in a 5-year old settlement situated at 1000 m in dense tropical forest south of Guayaquil. Of 95 people examined, 15 (15.8%) had active lesions and 42 (44.2%) had scars. The annual prevalence was estimated at approximately 16%. Between 1983 and 1986, 4100 cases were reported by the Ministry of Health, 1650 cases in 1988 and 3000 in 1990. Human isolates have been identified by monoclonal antibodies and isoenzymes as *L. panamensis*. Recently, in 1990, 26 strains from human cutaneous lesions in three different geographical areas of Ecuador have been identified by isoenzyme electrophoresis: 12 were *L. panamensis*, 7 *L. guyanensis*, 4 *L. braziliensis*, 2 *L. amazonensis* (first report) and 1 *L. mexicana* (first report).

Forty-seven species of sandflies have been identified in Ecuador; some anthropophilic sandfly species have been found with natural leishmanial infection in the province of Cañar: *Lu. trapidoi* (7%), *Lu. hartmanni*

(1.9%) (hamsters inoculated with the parasite isolates developed nodules and ulcers with amastigotes), and *Lu. gomezi* (0.7%). Exact identification of the parasites is under way.

A study of potential reservoir hosts was carried out. *Leishmania* isolates were obtained from spleen and liver homogenates of wild animals (*Potus flavus*, *Tamandua tetradactyla*, *Sciurus vulgaris*) and identified as *L. amazonensis*. Exact identification of the parasites isolated from *Sciurus granatensis* and *Choloepus didactylus* is under way. One case of DCL was reported in the past.

**3. Control**

Leishmaniasis is a notifiable disease.

## EL SALVADOR

1. **Visceral leishmaniasis.** Only 31 cases have been reported between 1974 and 1984 (27 were autochthonous, 4 were from Honduras); most of them were children under 5 years old. The focus is located in eastern El Salvador near the border with Honduras. *Lu. longipalpis* is well known and is the suspected vector. The dog is suspected to be the domestic reservoir.

2. **Cutaneous leishmaniasis.** Up to 1984, only 7 autochthonous cases were reported. The epidemiology is mostly unknown. Few strains have been identified; CL seems mainly related to *L. mexicana*.

3. **Control.** Detection of cases.

## FRENCH GUIANA

1. **Visceral leishmaniasis.** Unknown in French Guiana.

2. **Cutaneous leishmaniasis.** Tegumentary leishmaniasis called "Pian Bois" or "bush yaws" is a very old endemic disease, but, since 1978, a resurgence has been observed because of the new settlements in primary forest. It is a wild zoonosis. During the last six years or so, the annual incidence was evaluated at 230/100 000. The transmission is directly related to occupational activities in the primary rain forest. The existence of two different species of *Leishmania* has been demonstrated.

2.1 ***L. guyanensis.*** The proven vector is *Lu. umbratilis;* its favourite resting site is the trunk of large trees. An average rate of infection of 15% has been reported (at ground level) at the beginning of the rainy season. Transmission to humans occurs mainly during the rainy season. Nine isolates from *Lu. umbratilis* have been typed as *L. guyanensis*. Several animals are reservoir hosts; part of the zoonosis occurs in the canopy with the edentates: *Choloepus didactylus* (the two-toed sloth) and *Tamandua tetradactyla* (the lesser anteater) are the main reservoirs. Some other animals have been found infected: *Proechimys* sp. and *Didelphis marsupialis*; *L. guyanensis* has been isolated from all these animals (isoenzyme characterization). To date 88 human isolates have been identified as *L. guyanensis*.

2.2 ***L. amazonensis.*** In 1982 the existence of this parasite in French Guiana was noticed, firstly in *Proechimys* sp., then in *Proechimys cuvieri*, later in the sandfly *Lu. flaviscutellata* (1 specimen), and finally in 3 human cases. All these isolates were indistinguishable and exhibited the same isoenzymic pattern, very similar to the reference strain (just one enzyme variant, G6PD). By analogy with other areas of the northern Amazon basin, the level of transmission to humans is supposed to be very low, because of the poor anthrophily of the vector.

2.3 Recently three human isolates have been identified as *L. braziliensis*.

3. **Control.** In a new settlement area (Cacao village), indoor transmission had been registered with an annual incidence that rose to 40/1000. In July 1983, a forest clearance operation with daily insecticide spraying was carried out during three months. The efficacy of the programme was assessed over a 18-month period. The annual incidence fell sharply (20 cases in 1982, 7 in 1983, none in 1984). The density of *Lu. umbratilis* in the village reached zero after one and a half years. It was concluded that it would be of interest to create a forest-free zone (400 m) around human settlements in the primary forest.

Leishmaniasis is a notifiable disease.

## GUATEMALA

1. **Visceral leishmaniasis.** Only 6 cases have been diagnosed over the last 30 years. The endemic area is located in the arid Montagua river valley (Guastatoya) in the south-east of Guatemala. *Lu. longipalpis* is supposed to be the vector and dog the domestic reservoir.

2. **Cutaneous leishmaniasis.** CL is most endemic in the Petén department and less in the departments of Izabal, Escuintla, Alta Verapaz, Quiché and Huehuetenango. Since 1988, approximately 1000-1500 cases are reported annually. Numerous cases occur among military personnel (new recruits living in endemic areas). Transmission is related to occupational activities in the forest. Frequently cutaneous and seldom mucocutaneous leishmaniasis are reported. Recently, 34 human strains were identified of which 51% were *L. mexicana* and 49% *L. braziliensis*. *L. panamensis* is also present. *Lu. olmeca* is the most suspected vector of *L. mexicana*. Recently a specimen of *Heteromys* sp. has been found infected and identification of the *Leishmania* is in progress. One specimen of *Lu. ylephiletor* has been found naturally infected; the parasite was reported to be *L. mexicana* but the result needs confirmation. In the department of Petén *Lu. ovallesi*, *Lu. panamensis* and *Lu. ylephiletor* have been found infected with *Leishmania* of the *L. braziliensis* complex.

3. **Control.** Detection of cases.

## GUYANA

1. **Visceral leishmaniasis.** Unknown.

2. **Cutaneous leishmaniasis.** Until recently CL was almost exclusively an occupational disease of forest workers, but, since 1977, numerous cases have been detected among military and paramilitary personnel (120 cases from November 1977 to April 1980). All were infected in the tropical rain forest at Takama in the Berbice Savannahs. The epidemiology has not been studied. The *Leishmania* parasite has not been identified. *Lu. umbratilis* is present.

3. **Control.** Detection of cases.

## HONDURAS

1. **Visceral leishmaniasis.** Between 1975 and 1983, 53 patients with parasitologically proven visceral leishmaniasis and 16 patients with suspected VL were reported in Honduras; 95% were under 3 years old; the most important focus is in southern Honduras: departments of Choluteca, Valle and El Paraíso. *L. chagasi* has been isolated and identified from one VL patient. *Lu. longipalpis*, the presumed vector, is very common. The dog is suspected to be the domestic reservoir.

2. **Cutaneous leishmaniasis.** The disease occurs especially along the Caribbean coast, but cases have been reported in El Paraíso department in the central south-east region of Honduras and also in the north. Both CL and MCL occur in the country.

*L. panamensis* was identified in Santa Bárbara and Yoro departments near the Guatemalan border. The sandflies *Lu. trapidoï*, *Lu. ylephiletor* and *Lu. (Psychodopygus) panamensis* are present. *L. braziliensis* was reported in El Paraíso department near the Nicaraguan border; several anthropophilic sandfly species were recorded. Cases of "espundia" due to *L. panamensis* and *L. braziliensis* have been recorded. As a case of DCL has been reported, parasites of the *L. mexicana* complex are supposed to be present in Honduras. *L. mexicana* has been identified. *Lu. olmeca olmeca* is present. One case of CL due to *L. chagasi* (dermotropic) was reported in 1988.

3. **Control.** Detection of cases.

## MEXICO

1. **Visceral leishmaniasis.** To date five cases of VL have been reported, all from an area north of Mexico city (Cuenca del Balsas). *Lu. longipalpis* is present in the area and dog is the suspected domestic reservoir.

2. **Cutaneous leishmaniasis.** The cutaneous form or "chiclero ulcer" occurred mainly in southern Mexico: states of Veracruz, Oaxaca, Quintana Roo, Tabasco, Yucatán, Campeche, and Chiapas. In the state of Tabasco during 1987-1989, 397 cases were registered including 7 of DCL and 2 of MCL. By analogy with Belize, the rodents *Heteromys*, *Nyctomys*, *Ototylomys* and *Sigmodon*, are supposed to be reservoirs; dogs were found with amastigotes in cutaneous lesions. The proven vector in Yucatán is *Lu. olmeca olmeca*. *L. mexicana* was isolated and identified in Michoacán, Quintana Roo and Yucatán by isoenzyme analysis. In the north near the border with Texas (USA) and in the mining area of Coahuila state, a focus was recently recognized; it is characterized by simple, cutaneous leishmaniasis with a proportion of patients suffering from diffuse cutaneous leishmaniasis: 7/16 (43%). Although not completely characterized, the parasite is closely related to *L. mexicana*, but it did not grow quickly and abundantly in culture media. In this latter area, *Lu. diabolica* is the suspected vector. In 1989, 1 case of CL due to *L. braziliensis* was reported in Yucatán.

3. **Control.** Detection of cases.

## NICARAGUA

1. **Visceral leishmaniasis.** To date, no human case of VL has been reported, but the disease probably exists in north-western Nicaragua where *Lu. longipalpis* is the predominant species of peridomestic sandflies. The biotope is the same as in Honduras on the other side of the border where VL is common. The dog is suspected to be the domestic reservoir.

2. **Cutaneous leishmaniasis and mucocutaneous leishmaniasis.** A relevant public health problem in Nicaragua. In 1980, the Nicaraguan health authorities reported 493 cases, then a progressively increasing number of cases were notified (1981: 1047, 1982: 3097). Between 1980 and 1987, more than 9500 cases were reported. The endemic areas are: Jinotega, Nueva Segovia, Estelí and Zelaya Norte (50% of the cases); Matagalpa, Boaco and Zelaya Centro (30% of the cases); and Rio San Juan and Zelaya Sud (20%). 80% of the mucocutaneous cases are from Jinotega, a northern mountainous region. *L. panamensis* has been isolated and characterized by isoenzymes from several human cases; different zymodemes have been reported. *L. braziliensis* was identified for the first time in 1990, together with *L. braziliensis*/*L. panamensis* hybrids. Vectors and reservoirs are unknown, but *Lu. trapidoï* and *Lu. ylephiletor* were found in Nicaragua.

3. **Control.** Detection of human cases.

**PANAMA**

1. **Visceral leishmaniasis.** Unknown, but *Lu. longipalpis* is present.

2. **Cutaneous leishmaniasis.** Since 1977, the number of CL cases is increasing. Approximately 1500 cases were reported in 1986 largely due to the increased migration of people to new settlements in the endemic areas (northern, eastern and south-central regions). Previously, the most highly endemic areas were in the provinces of Colón and Panama. Between 1979 and 1980, 362 cases were diagnosed at the Gorgas Memorial Laboratory. In Bocas del Toro province, the incidence has been evaluated at approximately 20 cases/100 000 inhabitants. CL occurs throughout the year. In Panama, four *Leishmania* pathogenic to humans coexist.

*L. panamensis* is the most widespread and is responsible for the majority of human cases (5% with mucosal involvement). *Lu. trapidoi* is the proven vector. Other natural infections have been found in *Lu. ylephiletor, Lu. gomezi* and *Lu. (Psychodopygus) panamensis* (this last could be a secondary vector). The principal mammalian reservoir host is *Choloepus hoffmanni* with a high rate of infection (96/498) which is not usually apparent. Several other reservoirs have been identified (mainly primates and procyonids); the parasite is *L. panamensis* (MDH enzyme variant). *L. braziliensis* has also been reported from human cases.

*L. amazonensis* has been isolated in 10 patients from different areas and identified by isoenzyme analysis. *L. mexicana* has been identified in human cases. *L.chagasi* (dermotropic) was isolated from a human case.

Recently, a new species *L. colombiensis* was identified in the sloth *Choloepus hoffmanni* and in specimens of *Lu. gomezi* and *Lu. panamensis*.

Two other *Leishmania* have been reported from Panama but never isolated from humans. The *L. hertigi* complex has as its natural reservoir host the porcupine *Coendou rothschildi* (very high rate of infection, 89%). *L. aristidesi* isolates were obtained from rodents and marsupials; *Lu. olmeca bicolor* is the suspected but not proven vector.

3. **Control.** Vector control was undertaken by ultra-low volume malathion bi-monthly spraying and a 30% reduction of the anthropophilic sandfly fauna was obtained. To eliminate indoor transmission, deforestation was used around villages and the forest was replaced by grazing areas for cattle breeding.

Leishmaniasis is a notifiable disease.

**PARAGUAY**

1. **Visceral leishmaniasis.** The first VL case in South America was described in Paraguay in 1913, but was possibly not autochthonous. The current prevalence is unknown. *Lu. longipalpis* is present and dog is suspected to be the domestic reservoir. No recent data are available.

2. **Cutaneous leishmaniasis.** From 1972 to 1981, approximately 100-200 cases per year were reported and suddenly, in 1982, a sharp increase of the human cases was reported: over 1600 notified; then in 1983-1984, the epidemiological situation was as before 1982, with 100-200 cases annually. In 1985, 1083 cases were registered. The increase could be related to new settlements in connection with agricultural projects. The epidemiology is unknown; the sandfly and mammalian fauna seem to be somewhat like that of southern Brazil. The parasites have been only partly identified. Recently, isolates from south-east Paraguay have been identified as *L. braziliensis*. Probably different parasites are responsible for cutaneous leishmaniasis. Mucocutaneous leishmaniasis has been notified. *L. braziliensis* is supposed to occur widely; *L. amazonensis* may occur in the north-east; a case of DCL was recorded from this area.

3. **Control.** Only detection of cases.

## PERU

1. **Visceral leishmaniasis.** Unknown.

2. **Cutaneous leishmaniasis.** There are two forms of cutaneous leishmaniasis in Peru, mainly defined by geographical and clinical characteristics: Andean leishmaniasis ("uta") and sylvatic leishmaniasis (espundia). Both etiological agents are from the *L. braziliensis* complex; the total number of cases reported to the Ministry of Health in 1990 were 5500: "uta" Andean leishmaniasis (1500) and sylvatic leishmaniasis (4000).

"Uta" occurs on the western slopes of the Andean and inter-Andean valleys, between 800 and 3000 m. People are mainly engaged in agriculture and "uta" is associated with rural activities. The prevalence is extremely high. Most cases are children and more than 80% of the adult population exhibit scars. During the antimalaria campaign (1962-1974), indoor and peridomestic DDT spraying had merely a temporary effect because of the discontinuity of the spraying operation. The parasite named *L. peruviana* is still regarded as a distinct species but seems to be a variant of *L. braziliensis*, very similar to the *L. braziliensis* reference strain (1 enzyme different). *Lu. peruensis* is the proven vector since the discovery of natural infection with *L. peruviana* in 4 out of 613 *Lu. peruensis* specimens examined in the Trujillo area. In some areas of Amcash department *Lu. peruensis* represents 51% of the catches in indoor collections and 85% of the total specimens captured with human baits. In other areas of Peru, *Lu. verrucarum* and *Lu. ayacuchensis* are proven vectors. *L. guyanensis* has been recently isolated from a human case. DCL probably due to *L. amazonensis* was reported in north-west Peru.

**Reservoirs.** Cutaneous canine leishmaniasis is well known since many years in endemic areas of "uta" (in some places, 25-32% of dogs infected), but the parasite was never clearly identified. In the Trujillo area, there are 3 different rodents: *Rattus rattus* (10/90), *Akodon mollis* (1/25) and *Phyllotis andinum* (5/21), which were claimed to be infected with *Leishmania*; in 1990 one specimen of *Didelphis albiventris* and two of *Phyllotis andinum* were found infected with *L. peruviana* in the Huaillacayan district, Ancash department.

**Espundia** is a zoonosis. Human transmission is directly related to the occupational activities in the primary forest where there is close contact between humans and the sylvatic vector. The number of cases is increasing rapidly because of the new settlement areas in the lowlands. The mucocutaneous forms are common. The parasite is *L. braziliensis* (identified from human isolates), indistinguishable from the WHO reference strain and slightly different from the "uta" causative agent (one enzyme variant). The vector and the reservoirs are, to date, unknown.

3. **Control.** Detection of human cases.

During the 1950s and 1960s, reduction of the infection rate to less than 2% was obtained by DDT peridomestic spraying of "uta" foci, but due to the interruption of this programme, CL has increased again since 1970 on the western slopes of the Andean and inter-Andean valleys.

## SURINAME

1. **Visceral leishmaniasis.** One case of VL has been reported from the north.

2. **Cutaneous leishmaniasis.** CL was first reported in 1911. From 1979 to 1982, approximately 90 clinical cases of CL were observed each year. *L. guyanensis* is widespread; *L. braziliensis* and *L. amazonensis* may also exist; however, CL is usually considered to be a minor health problem. The current prevalence is unknown. Studies on the sandfly fauna revealed the existence of more than 15 species and, in particular, *Lu. umbratilis* and *Lu. flaviscutellata*, vectors of CL in neighbouring French Guiana. The epidemiology of CL is unknown.

3. **Control.** Detection of human cases.

## TRINIDAD AND TOBAGO

Only one case of cutaneous leishmaniasis has been reported from Trinidad and Tobago over the last 15 years, but, as forest activities are increasing, it is likely that more cases will be recorded in the future.

Among the 20 species of *Lutzomyia* recorded in Trinidad, 2 (*Lu. flaviscutellata* and *Lu. gomezi*) have been incriminated as vectors of *Leishmania* in the New World.

*L. mexicana* has been isolated from rodents.

## UNITED STATES OF AMERICA

1. **Visceral leishmaniasis.** *L. infantum* has been identified in dogs at Edmond near Oklahoma City. 14 cases of autochthonous canine VL have been diagnosed in the USA. *Lu. longipalpis* is not present in these foci; the vector is unknown. No autochthonous human cases have been reported to date.

2. **Cutaneous leishmaniasis.** In 1945, in Texas near the border with Mexico, the first autochthonous case of cutaneous leishmaniasis in this focus was reported: a young boy 6 years old from Alice. The second case was a 64-year-old woman from San Benito, who had diffuse cutaneous leishmaniasis. Of 12 autochthonous cases registered from Texas, only one was DCL (9%). All the parasites isolated appeared to be related to *L. mexicana* (*L. mexicana* variant).

*Lu. diabolica*, an anthropophilic sandfly present in this focus, could be the vector; its distribution is the same as that of human cases.

A domestic feline infection has been reported from Uvalde, Texas. Between 1976 and 1985, drugs (antimonials) were provided to treat 256 imported cases (238 with CL or MCL, 18 with VL). 81% were USA residents who had spent some time in endemic areas.

## VENEZUELA

1. **Visceral leishmaniasis.** Approximately 500 cases have been recorded up to date in Venezuela. Most were children under 10 years old. *Lu. longipalpis* is suspected to be the vector since specimens became infected after feeding on a naturally infected dog. The dog is considered to be the main domestic reservoir. During a survey, 52 out of 2276 dogs examined appeared to harbour *Leishmania*. VL in Venezuela is usually considered to occur sporadically with a very low endemicity, but in almost all the states.

2. **Cutaneous leishmaniasis.** CL is mainly an occupational disease affecting among others, farmers, hunters and military personnel. It occurs throughout the Venezuelan territory, in 21 of the 23 states. It can be considered as both a rural and urban disease. Cases are reported from small villages, new settlements located near wooded areas and outskirts of towns or cities. Among the 37 000 cases registered (from 1955 to 1990), 70% were from the 4 states of the Andean area (in Lara state, 400 new cases per year). Western, central and south-western Venezuela harbour old endemic foci, the new ones being mainly located in the lowlands of the Amazonian basin. Since 1985, 2500 new cases per year are centrally reported from the dermatology centres.

Different parasites coexist in Venezuela, and 100 species of *Lutzomyia* sandflies are known in the country, 30 of which are anthropophilic.

2.1 ***L. braziliensis.*** Infection with this parasite is widely distributed, at least in five states of Venezuela. It seems very common especially in the foci of the Andean area and at the foothills of the Venezuelan coastal

area. Recently, a biochemical and molecular characterization of 99 *Leishmania* stocks from different endemic areas was achieved: 55 were *L. braziliensis*.

Sometimes, as in Lara state, the foci can be periurban (Barquisimeto city) or rural (with peridomestic or sylvatic transmission). In these foci, domestic animals (dogs and donkeys) have been found infected by *L. braziliensis* (among 116 donkeys examined, 28 had ulcerative lesions and 17 were parasitologically confirmed). Five strains from donkeys were identified as *L. braziliensis*. In Las Rosas, a locality in a forested hilly area of Cojedes state, 16 of the 124 inhabitants examined (12.9%), 3/43 dogs (7%) and 6/29 donkeys (21.9%) were found infected with *L. braziliensis*. The 118 wild animals examined were negative. *Lu. trinidanensis* in the Maputo forest near Barquisimeto and *Lu. ovallesi* in Carabobo state have been found with peripylarian infection due to *L. braziliensis*. *Lu. spinicrassa* might be the vector in Táchira state.

2.2 ***L. panamensis.*** This parasite has been isolated from human cases and identified by biochemical characterization. *Lu. (Psychodopygus) panamensis* is present.

2.3 ***L. venezuelensis.*** The first human case was diagnosed in 1974 in a "pocket focus", the Maputo forest, a lush gallery forest near Barquisimeto in Lara state. To date, approximately 90 cases have been reported in the Barquisimeto area. More than 90% of the isolates were identified by biochemical or molecular characterization as *L. venezuelensis* (the development in hamsters clearly indicates that it belongs to the *L. mexicana* complex, but it is very difficult to maintain in culture medium). In the same focus, *Lu. olmeca bicolor* were caught: it is strongly suspected to be the vector; no reservoirs are known. In 1990, in Barquisimeto 3 cats were found infected with *Leishmania* in cutaneous lesions; the biochemical identification is in progress.

2.4 ***L. pifanoi.*** Originally associated with the diffuse cutaneous form (DCL), *L. pifanoi* is not always considered to be a separate species, since some controversy exists on differentiation between *L. pifanoi* and *L. amazonensis*.

2.5 ***L. garnhami.*** This parasite occurs in the Andean range between 800-1800 m. It was described in rural and suburban regions of Mérida state. Most of the lesions heal spontaneously within 6 months. *Lu. youngi* from the *Lu. verrucarum* group is considered to be the probable vector because of its prevalence at altitudes between 800 and 1800 m; in 1982, in Mérida state, one specimen was found spontaneously infected by promastigotes which produced a lesion with amastigotes in hamsters and an experimental infection appeared to be of the peripylarian type. The reservoir is unknown and there are some problems in the differentiation of *L. garnhami*; some authors do not consider it to be a separate species.

2.6 ***L. amazonensis.*** Different human isolates from cutaneous and diffuse cutaneous leishmaniasis cases from Carabobo, Guárico and Mérida states were identified as *L. amazonensis* by the monoclonal antibody technique. The suspected vector is *Lu. flaviscutellata*. Different rodents were found naturally infected, but unfortunately the *Leishmania* were not clearly identified. The epidemiology of this parasite in Venezuela is partly unknown.

3. **Control.** Large-scale and long-term campaigns against malaria and Chagas disease with housing improvement and insecticide spraying have certainly modified the sandfly fauna behaviour, but there is no strict evaluation of leishmaniasis transmission.

Detection of human cases.

= = =