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# VISCERAL LEISHMANIASIS IN THE WEST BANK AND ISRAEL – DISTRIBUTION AND RISK FACTORS, USING GIS

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EXECUTIVE SUMMARY

Visceral leishmaniasis is a disease that infects people and dogs and can be fatal. Dogs and wild canine species are the major reservoir for this disease, which is transmitted to people by sand flies. Our project, "Visceral leishmaniasis in the West Bank and Israel - distribution and risk factors, using GIS" is intended to reveal the ecological factors that determine the geographical spread of visceral leishmaniasis in our region. We are employing a geographical information system (GIS) analysis using images taken from airplanes or satellites to investigate how these factors affect the presence of visceral leishmaniasis, in order to be able to forecast where this disease might outbreak.

This report summarizes the activities and accomplishments during the first year of this project. During this year we have established a database on the distribution of human and canine visceral leishmaniasis in Israel and the Palestinian Authority, have begun comparisons of this distribution to environmental maps (topography, temperatures, land use etc..), have conducted prevalence studies in dog and wild canids populations at the state-wide and local focal levels, isolated and genotyped *Leishmania* strains from different geographical areas and hosts (dogs, people) and have collected sand flies vectors of *Leishmania* in different areas. This raw data forms the foundation for our understanding of the factors that influence visceral leishmaniasis in this region. Collaboration between the Palestinian and Israeli scientists has been continuous, despite the obvious political difficulties in the past year. The fact that Israeli researchers from the Hebrew University and Palestinians scientists from Al Quds University in Jerusalem are able to easily meet and exchange students has proven important for the success of this collaboration. This cooperation was further strengthened by visits from the US advisor to the project. As we progress

into the next stages of the project, more analysis of the data collected and sample material from the field will be performed, and the results will be summarized, presented and published.

SECTION I

A) Research Objectives

1. Determination of the impact of geographic and environmental factors on the prevalence of VL in Israel and the West Bank (Palestinian Authority)

2. Determination of the potential importance of the presence of certain reservoir hosts and vector sand flies in the spread of the disease.

3. Employment of geographic information system (GIS) and spatial statistics for the analysis of risk factors and devising a model that would predict where disease outbreaks may occur.

B) Research Accomplishments

The study has accomplished these goals set for the first year

a) Database on the distribution of reported canine and human visceral leishmaniasis (VL) in Israel and the West Bank-
A database and maps have been constructed describing the geographic distribution of VL in Israel and the Palestinian Authority (Figs 1 & 2). This database is being periodically updated with new locations of VL

b) Overlying of the VL distribution map over environmental database maps (topography, land use, temperatures, soil types)-
The analysis of the distribution of VL in regard to the above environmental factors is not complete yet. An initial impression from the comparisons is that VL in dogs and humans is mostly present in the central and Northern Israel and in the western aspects of the West Bank (Figs. 1 & 2). The foci are mostly in hilly or mountainous regions with a cooler climate, and generally away from deserts and from the coastal plain close to the Mediterranean. Also, most infected dogs and humans are from rural villages and not in urban settings.

c) Prevalence studies in dog populations – A large scale serologic study is being put in dogs in several areas in Israel and in the Northern West Bank. This together with a database from our laboratories and from government offices on canine and human VL infection makes the basis for a macro-environmental analysis of the distribution of VL in this region. The macro-environmental analysis will include a large spectrum view of VL at the country level, indicating what are the environmental characteristics of regions where VL is found, in contrast to the regions where it is not present.

d) Foci studies - In addition to the macro-environmental approach carried out as described in section (b) above, a second study is conducted on finer and detailed micro-environmental data collection and analyses by GIS in positive and negative village foci for VL which are disease foci. The two most detailed studied foci in the project are Nataf in Israel and Jdidah in the northern West Bank. In addition, information is collected in more "positive" villages including Klil, Nili and Sirs and in "negative" dog village populations

e) Wild canine study - Sera from wild canids (mostly jackals and foxes, a few wolves) caught by the National Reserves Authorities are analyzed for

again in September of 2003, for an Israeli-Palestinian GIS workshop. The workshop will be reported in detail in the next scientific report, since it was already in the second year of the study. Both visits included meetings with Palestinian and Israeli students and visits to field sites. These activities further strengthened the collaboration between the Israeli and Palestinian scientists and their research teams.

D) Description of Project Impact

The project's results will be used for understanding where in Israel and the West Bank does visceral leishmaniasis occur, to identify the ecological risk factors and for devising a model that would help predict where disease outbreaks may occur in the future.

Since this is just the beginning of this project, the data is being collected and analyzed currently, and it is still early to demonstrate the use of the project's results. However, some trends regarding the location of *Leishmania* foci and the involvement of domestic dogs and wild canine species in the epidemiology of the disease can be detected. A more definitive report on the analysis of the project's interim results will follow in the future progress reports.

E) Strengthening of Developing Country Institutions

The Palestinian partners in this project from Al Quds University are conducting research both at the field and the laboratory levels in cooperation with the researchers from the Hebrew University in Israel.

Palestinian students are highly involved in the project and connected to the various aspects of research. Some of the Palestinian students are in Al Quds University while others are benefiting from studying in the research environment of the Hebrew University. For example, one of the Palestinian students involved in this project, Ms Suheir Zaloum, has recently begun a Masters of Public Health (MPH) degree at the Hebrew University School of Public Health. Before entering the MPH course, Suheir trained for 3 months on molecular techniques for the detection of leishmaniasis at the Hebrew University. Her thesis project at the course will include GIS analysis of the spread of canine leishmaniasis in an endemic focus.

The Israeli-Palestinian GIS workshop held recently and tutored by Prof. Wilson and Dr. Baneth, in which 10 Palestinian students affiliated with Al Quds University participated, was another important aspect in the strengthening of the Palestinian research capacity. The direct tutoring of students, group discussions and demonstration of use of internet resources for research were helpful for students in improving their research projects.

F) Future Work

In general, the project is on schedule and the goals set for the first year, which included mostly data and sample collection, development of detection *Leishmania* techniques in sand flies, initial data analysis and training, have been carried out. The project is continuing with the mission planned for the second year. We hope, in the near future, to report on the data collected and analyzed in a future international scientific congress, and in the form of scientific manuscripts authored by the Israeli and Palestinian principal and co-principal investigators, together with research students.

SECTION II

A) Managerial Issues

The political situation in Israel and the West Bank, and the difficulties of movement between the West Bank, East Jerusalem and Israeli West Jerusalem, are making the job of data collection more difficult than was planned initially. Fortunately, there are no difficulties in movement between East Jerusalem, where most of the Palestinian students and researchers involved in the project live, and Israel. The difficulties in movement to the West Bank are due to the road blocks and inspection points, and also the need for permits to get into Israel. This makes data and sample collection in the West Bank more difficult and slower, but it is still possible to collect samples such as dog sera samples and sand flies, in the West Bank.

B) Budget changes

No major budget changes are currently needed.

C) Special Concerns

No protocols addressing the special concerns analysis made when the project proposal was written have been changed.

D) Collaboration, Travel, Training and Publications

The main collaborative and training activities that have taken place in the project's first year are:

1. Training of staff –

Palestinian and Israeli technicians were trained in sampling blood and tissues from dogs at the Hebrew University Veterinary Teaching Hospital in Rishon LeZion, Israel. The use of syringes to draw venous blood and to aspirate lymph nodes and skin for parasite culturing was demonstrated and practiced. The Palestinian technicians have since been able to implement these techniques in the field and have collected blood from dogs in the West Bank for *Leishmania* serology. They have also isolated parasites from dogs and maintained them in culture for further analysis. Technicians have also learned to assist in trapping of sand flies.

2. Training of students –

Students have trained in serological and molecular biological techniques at the Hebrew University Hadassah School of Medicine. These techniques included serology for *Leishmania* by ELISA, extraction of DNA and PCR, restriction fragmentation length polymorphism and more. In addition to that, the students also practiced sampling of animals with the technical staff.

3. Visit by the US GIS consultant –

Prof. Mark Wilson from the University of Michigan at Ann Arbor visited Jerusalem for the first time during August of 2002. Prof. Wilson's visit was dedicated to meeting the Palestinian and Israeli collaborators in the project, visiting field sites, meeting with potential students and planning the initial steps for the study. Prof. Wilson kept in contact with the Israeli and Palestinian partners during the year through e-mail mostly, and came for a second visit and training workshop in September of 2003.

4. Mutual researchers contacts and meetings –

The principal Israeli and Palestinian investigators keep in touch on a regular basis and meet frequently to discuss issues related to the project and its progress.

Travel:
Travel for the purpose of this project is restricted to local travel to field sites for the purpose of data and sample collections. This takes place by both Israeli and Palestinian research teams. The international travel included in this project is Prof Wilson's travel from Michigan to Israel.

Publications:
No scientific papers have been published with results from this study at this early stage. However, there are preparations for papers and it is expected that we will be able to submit a first paper to a scientific journal in the next months.

Requests for American Embassy Tel Aviv or A.I.D. actions:
We have no special requests at this stage. Thank you.

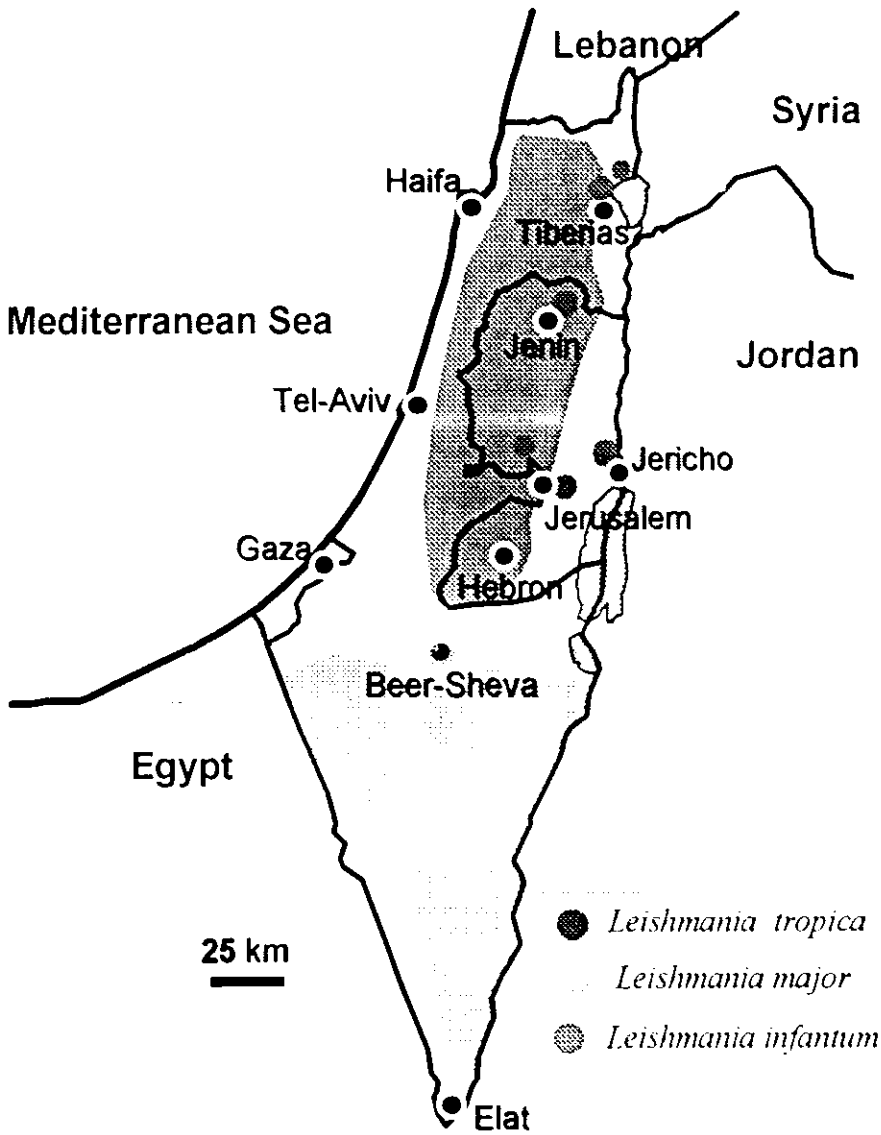


Figure 1 – The general distribution of the three *Leishmania* species that infect humans in Israel and the Palestinian Authority. *Leishmania major* and *L. tropica* cause cutaneous leishmaniasis, whereas *L. infnatum* is the causative agent of visceral leishmanisis.

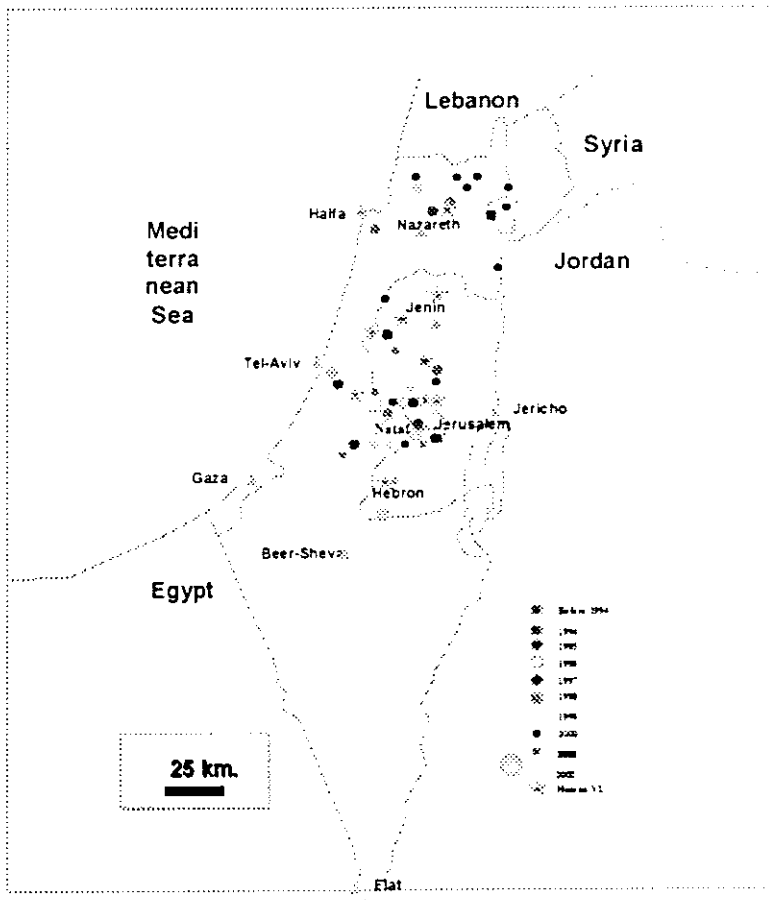


Figure 2 – The distribution of visceral leishmaniasis in dogs (circles) and humans (stars) in Israel and the West Bank. The distribution of infection in dogs is arranged according to the year of initial detection in the different disease foci.