EDEN

12 first month’s activity report
Malaria sub-project

Partner: IPA (Algeria) (46), coordinator: Z. HARRAT

Date: 12th November 2005

ALGERIA
The general objective of this WP is to characterise at a high resolution scale (30m), dominant ecosystems and environmental parameters linked to Anopheles vectors. During the first 18 months the specific objective are:

- To define the landscapes in 8 model regions in Turkey, Romania, Italy, France, Spain, Portugal, Morocco and Algeria, each of about 1000 Km², representative of the various eco-climatic conditions prevailing in southern Europe and in the Maghreb within the known distribution limits of potential malaria vectors.
- To start establishing the environmental, climatic and other conditions during past endemic and non-endemic periods, including use of satellite imagery.

At a later stage, in years 2-4 and depending on 18 first months results, additional extended areas will be selected to expand data and enrich the first draft of the model.

During the first twelve months, the following activities are carried out: Obtaining the information geo-referenced on the relief, geology, hydrology, ecosystems, human habitat and the climate of the model region (Ouargla). The climatic data (Precipitation, Temperature, Moisture, and winds) have been recorded from of the Météo station of Ouargla; the data of the weather collected on the field come from the local station of the laboratory of entomology. The hydrological data were obtained from the Agence Nationale des Ressources Hydriques. The precise data relating to salinity, temperature and pH of the larval breeding sites have been collected in the field. The satellite imagery including land cover, human habitat, Vegetation, soil have been obtained from the Algerian Space Agency (ALSAT1). They are being analysed and the process of construction of the SIG is implemented.

Located at the South–East of Algiers, (approximately 800 Kms from Algiers), between 31° 54N - 31° 57N and 5°20'E - 5° 30 E . Ouargla was and remains a crossroads for the commercial caravans and the travellers coming from the north of the country and the south of Africa; Of share its strategically position and its importance, it was inhabited by the immigrant populations of the neighbouring areas. The valley of Ouargla, extends on a surface from approximately 2887 Km². It is located at an altitude of 135 meters. The 2/3 of the wilaya is covered by the sand dunes.

Within the framework of Eden malaria sub project, the area for the environmental study is represented by the locality of Sidi Khouiled (131 Km²) where cases of indigenous malaria are regularly reported. The village of Ain Moussa located in the district of Sidi Khouiled was selected for the entomological studies. It’s a recent and small village, the population living are 167 inhabitants, It is located near the Chott Oum Raneb at 15 km in the North-East of ouargla city, N: 32.05168 and E : 005.34180

Ouargla is classified like a receptive zone of malaria with a short seasonal transmission. It is carried out in summer and autumn. Malaria occurs in Ouargla in unstable form with possibilities of epidemic peaks when the climatic conditions are appropriate.

The climate is characterized by a Saharan type with a very weak rainfall (43 mm per year), very high temperatures and a strong evaporation.

The ground water circulates in sands-dunes it is on average to 1.5 m of depth compared to the ground. It causing many harmful effects principally the multiplicity of the larval breeding sites and the development of the mosquitoes.

The salinity of water is very strong; it increases while going from the south towards north. In the area of Ain Moussa the content salt is approximately 30 g/l.

The human activities were especially agricultural, with the exploitation of the palm plantation for the production of dates and the truck farming. The Livestock is made up mainly by the sheep, goat and camels.
Activities planned for next year:
- Comparison between the data recorded and the history of malaria in the area.
- To analyse of environmental changes, the satellite imagery and confrontation of the results obtained with the epidemiological data of the malaria in the model region.
- Determination of the risk factors of resurgence of malaria in Ouargla.
- To undertake studies in a second site: A new site in the north of the country was selected. It relates to the area of El Tarf. El Tarf is located at the North of the country to approximately 600 km East of Algiers. Its main vocations are agriculture and tourism. It has a protected natural reserve. Its relief is composed by mountain, plains, coastal lagoons, marshes and lakes. The significant hydrous resources were mobilized by the achievements of two dam. The wilaya of El Tarf is characterized by its Mediterranean climate (Humid bioclimatic stage), it receives annually between 400 and 1200 mm of precipitations. The water reserves constitute a climate and a biotope favourable to the development of the malaria because of the significant local anophelism and the ecological conditions of transmission. The site of El Tarf is adapted for the analysis of risk of reintroduction of malaria. The villages of El Malha, Righia and Oum Teboul are an old focus of malaria. They are known for the constant presence of Anopheles labranchiae, which is a dominant species in this area.

WP MAL 2 – Vector bionomics and competence (First 12 months)

Objectives:
The general objective of this WP is to study the population ecology of anopheline larvae and adult populations in Europe in order to estimate the mosquitoes’ Vectorial Capacity and competence. During the first 18 months the specific objectives are:

- To obtain historical data on the distribution and bionomics of anopheline species in Europe and Maghreb, particularly in the 8 “field” countries selected. In some regions, most data are already available, in others, old records will have to be compiled and collated from archives.
- To conduct population dynamics studies through sampling of anopheline larvae and adult populations periodically in the 8 model regions (1 or 2 weeks per month, depending on site, during favourable seasons: breeding sites, population size and dynamics, gonotrophic cycles, longevity, feeding behaviour, survival rate, over wintering behaviour, infection rate, etc.)
- To establish the vector competence of known, or suspected potential vector, species for Plasmodium strains (from Africa, and possibly from eastern Europe) in order to estimate vectorial capacity and competence; (experimental transmission will be initiated only by three partners during the first 18 months.
- To identify and characterise, by morphological and molecular approaches, species and populations in the Anopheles maculipennis, An. claviger, An. sergentii and An. hyrcanus complexes (population structures and gene flow) and to establish their geographical distributions.

Activities already done:
The studies on the ecology and the biology of the populations of adults and the larvae of anopheles in the model area were undertaken to consider the vectorial capacity and the competence of the mosquitoes.
The bibliographical data on the distribution and bionomics of the species of anopheles were collected.

Distribution and dynamics of anopheles populations (Boubidi SC et al)

Mosquitoes trapping
Two techniques of captures were used

Trapping on man: 5 houses were selected near a permanent breeding site. Each house comprises a collector. The trapping consists of twelve rounds every hour. They start at 19h00 pm to 07h00 am. Two nights per week. One week over two from July to November

trapping with CDC traps

The trapping with CDC light traps were carried out during two nights per week, twice per month: 05 CDC light trap were placed each one in a house.
Two rounds per night of trapping were carried out: 19h00 pm to 01h00 am and 01h00 am to 07h00 am.

After trapping, mosquitoes are collected, identified and dissected for calculating the parity.

Nycthemerous Activity: evaluated by trapping on man, from 19h00pm to 07h00 am in order to determine the dynamic activity of the anopheline.

Agressivity to human: 14 nights of captures on man were realized to evaluate the rate of bites per man and per night.

Agressivity to animals: 1 goat baited trap (2 nights of trapping)

Endophagy- Exophagy: trapping of mosquitoes on man indoor and outdoor, 4 nights (twice inside and twice outside).

Endophily- Exophily (resting places): to catch mosquitoes on the vegetation, in the houses and inside the stables. (two times)

Gonotrophic cycle: calculation of the time of blood meal digesting

- Larvae biology: twice per week (one week over two).

The identification of the anophelines was made according to their morphology.

Results are detailed in **Annex 1**.

**Activities planned for next year:**

**Historical data:**

to supplement the bibliographical data on the Algerian anopheline fauna and to compile a document on the inventory of the anopheline of Algeria.

Implementation of ELISA-CSP and ELISA- blood meal tests.

Continuation of the entomological investigation (if necessary) in other sites of the wilaya of Ouargla.

Attempt of the breeding of *An. multicolor* and *An. sergentii*.

Study of the vectorial competence of *An. multicolor* and *An. sergentii*.

To test the anophelines sensitivity to insecticides.

Installation of an insectarium at the service of parasitology of Institut Pasteur of Algiers.

To start the entomological investigation in the north of the country (region of El Tarf, second model area) for the dynamics and biological studies of the anopheline *Maculipennis* complex.

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**WP MAL 3 – Public health and human activities (First 12 months)**

**Objectives**

The general objective of this WP is to understand area-wide historical malaria incidence and risk patterns in relationship with recorded public health activities and surveillance, warning and control campaigns and changing human movements patterns and activities. During the first 18 months the specific objectives are:

- To evaluate the impact of public health activities, human movements (and parasite importation), and human activities, including cattle breeding on malaria incidence and risk, at various geographical scales.

- To record and analyse past and present data on malaria incidence (imported/indigenous cases) and the impacts of surveillance, warning and control campaigns on malaria incidence.

**Activities already done:**

The malaria epidemiological situation in Algeria and particularly in Ouargla (model region) in the past and present had been reviewed. The impact of malaria control on the incidence of the disease, especially by the environment improvement and cleansing was evaluated with the National Institut of Public Health (INSP)(Dr Tchicha, Dr Hammadi) and Dr Chaib (Service of Epidemiology. Hospital of Ouargla). The study of the human behaviour relating to malaria and the mosquitoes biting and their reproduction has started last month;

The data on malaria imported cases, and migratory flow have been collected (Dr Tchicha, Dr Bouakaz, Dr Hammou, M; INSP, Ministry of Public Health and the Population, National Office of Immigration).
Activities planned for next year:
- to carry out investigations and interviews close to the immigrant population, carriers, students, and travellers
- to analyse the human behaviours at the risk of transmission and diffusion of the disease in the model region
- to compile and publish the data on the history and on the situation of malaria in South Algeria,
- to analyse the incidence of the Tran Saharan road on the diffusion of the disease across the country
- to report human practices which contribute to the creation of the larval breeding sites or multiplicity of mosquitoes

WP MAL 5 – Data management (First 12 months)

Objectives:
The general objective of this WP is to model the risk of malaria transmission and spread in Europe and the likely impact of environment, human behavioural and climate changes using data generated by WP1-2-3. During the first 18 months, the specific objectives are:

- To collate in collaboration with relevant horizontal integration team all geo-referenced databases, and to analyse them to associate the distribution of malaria vectors, and malaria cases, in the study locations with climate & environmental descriptors.
- To model within a GIS framework, the distribution of malaria vectors, the risk of malaria transmission and spread in Europe, and the likely impact of environment, human behavioural and climate changes on the vector populations and the risk of transmission.

Activities already done:
- cartography of the permanent larval breeding sites
- Design of the geographical database;
- GIS Integration of different thematic layers (topographic map, geological map, hydro geological map, ... and data collected of mosquito's capture;
- Preparation and preliminary treatment of remote sensing data (archive and recent): landsat TM, Landsat ETM+ and Alsat-1;
- Space based methodology for extraction physical parameters of the study area (seasonal moisture and temperature...).
- Pedagogic workshop dedicated to the GIS (planned for November 2005).

Activities planned for next year:
- To collate and analyse all georeferenced data
- Implementation of the geographical database,
- Space based Cartography of vegetation, wetlands et others themes;
- Extraction and integration of physical parameters by remote sensing techniques in the Database;
- First analyse of the environmental indicators.

WP MAL 7 – Tools and scenario (First 12 months)
Not done

WP MAL 8 – Training, Management, Coordination (First 12 months)
One biologist (Boubidi SC) was trained (one month) on malaria entomology in the LIN of Montpellier (Didier Fontenille)
Framing of a meeting of work in Algiers with the EDEN MAL coordinator and his assistants and the Algerian team taking part in the project

**DEVIATION**
the major deviation encountered consisted particularly in the recruitment of the specialists in medical anthropology and of environment, however we have recently overcome this constraint
Certain reagents and equipment essential to work were delivered late

**Major weaknesses and concerns for Algeria**
Until now, concerning the entomological studies, we met only one species of anopheles in the studied zone. An. Multicolour, however this species does not appear among the species usually observed in Europe, from where the difficulty for modelling with HIT.
The choice of another site having the same characteristics that those studied in Europe proves to be essential (extended areas must be added)
Scientists involved in the project in Algeria

Key persons

<table>
<thead>
<tr>
<th>Algeria IPA</th>
<th></th>
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<tbody>
<tr>
<td>leader (management)</td>
<td>Z. Harrat</td>
</tr>
</tbody>
</table>

**WP 1: Landscape, Biotopes, Habitats**

- Mosquito Environnement (landscape) and ecology
  
  Kamel Cherif
  Berchi S
  Boudrisa A

**WP 2: Vector Bionomics and competence**

- historical data on anopheline species and distribution
  
  Boubidi SC

- Anopheline Systematics and population genetics
  
  Seridi N
  Boubidi SC

- Anopheline Population Biology
  
  Boubidi SC
  Harrat .Z
  Chaib SE

- Experimental transmission of Plasmodium
  
  coll Nijmegen

**WP 3: Public Health and Human activities**

- Malaria Parasitology and incidence
  
  Hammadi D
  Tchicha B
  Harrat Z

- Public health activities and structure, imported malaria cases
  
  Z.Harrat
  D;Hammadi

- historical data on malaria
  
  Hammadi D
  Tchicha B
  Chaib SE

- Impact of public health activities on malaria incidence,
  
  Hammadi D
  Tchicha B
  Chaib SE

- human movements
  
  R.Bouakkaz
  M.Hammou,

**WP 5: Data Management**

- Data management
  
  Z.Harrat

- Remote sensing - GIS
  
  Benhamouda F

- MODELING (HIT :David Rogers Eric Lambin, Hans Hesterbeeck)
  
  Benhamouda F
  R .Garni

Training in morphol systematics

Training in Molec systematics and Pop genetics

Training in Elisa

MSc & PhD students

Boubidi SC

Junior researcher
ANNEX 1

Anopheline Biology in Ouargla, Algeria
(Said Chawki BOUBIDI et al.)

1-introduction
The site selected for field investigation (village of Aïn Moussa), is a locality located to 15 km from the town of Ouargla. This area contains permanent and very active larval breeding sites. It is distant to approximately 400 m from the village. Five houses were selected. In each house one man was recruited for collecting mosquitoes in twelve rounds from 19h00 pm to 7h00 am. The mosquitoes were caught by traditional techniques (trapping on man, CDC light traps, catching on animal). The captures by light traps are done during two nights per week, twice per month. 05 CDC light traps are placed in each house. Two rounds per night were carried out to collect the mosquitoes; after each round specimens are collected, identified and dissected for the calculation of the parity. The female of anopheline are frozen at - 20°C for later studies.

The larvae are preserved in alcohol at 70%. Until now we have caught only 02 species of mosquitoes, one species of Anopheles: Anopheles multicolor and one species of Culicinae: Aedes caspius. Numerous larval breeding sites were prospected and listed through the wilaya of Ouargla.

Preliminary Results

2-SPECIES COLLECTED:

<table>
<thead>
<tr>
<th>Anopheles</th>
<th>Aedes</th>
<th>Culiceta</th>
<th>Culex</th>
<th>Culicoides</th>
</tr>
</thead>
<tbody>
<tr>
<td>An.(cella)multicolor</td>
<td>Ae.caspius</td>
<td>Cs.longiareolata</td>
<td>Cx.pipiens</td>
<td>Sp.</td>
</tr>
</tbody>
</table>


3- SEASONAL DYNAMIC

The curves of the seasonal dynamic of An.multicolor, caught by CDC light traps and by human biting, revealed a common peak during October and August. In fact there is a first peak in June. Indeed, we have noted during the last eight months, that the captures on man are more reliable, and more instructive because our CDC traps are not very powerful what increases skews due to the technique. In addition it was noticed that An.multicolor is a species which has a significant phototactism (near of 50% of the anopheles captured by...
CDC traps) and that this species as others is very sensitive to the winds. It does not enter in the houses when the wind blows.

4- MOSQUITOES ACTIVITY

According to the observations we know that during the first part of the night (from the twilight until 23h00 pm) it is *Aedes caspius* which starts to bite. This species may be an important nuisance locally. *An. multicolor* reaches the maximum of activity between midnight and 04h00 am. It bites man as well inside as outside of the houses.

5- FEEDING PREFERENCES
Mosquitoes were captured inside the houses, in the stables and under vegetation.

The abdomen of one part of mosquitoes was crushed on filter paper, the other part of the gorged females were preserved at -20°C for the needs ELISA test blood meal.

6- PARITY RATIO
For determination of the parity rate, the females are dissected, according to the method of Détinova, the dissections were carried out from June to November
<table>
<thead>
<tr>
<th>Weeks</th>
<th>Total Anopheles</th>
<th>Parity ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1 (C-H) 25/06/05</td>
<td>284</td>
<td>0.57</td>
</tr>
<tr>
<td>W2 (CDC) 02/07/05</td>
<td>29</td>
<td>0.52</td>
</tr>
<tr>
<td>W3 (C-H) 09/07/05</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>W4 (CDC) 16/07/05</td>
<td>70</td>
<td>0.16</td>
</tr>
<tr>
<td>W5 (C-H) 23/07/05</td>
<td>164</td>
<td>0.24</td>
</tr>
<tr>
<td>W6 (CDC) 30/07/05</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>W7 (C-H) 07/08/05</td>
<td>291</td>
<td>0.33</td>
</tr>
<tr>
<td>W8 (CDC) 13/08/05</td>
<td>73</td>
<td>0.12</td>
</tr>
<tr>
<td>W9 (C-H) 20/08/05</td>
<td>202</td>
<td>0.15</td>
</tr>
<tr>
<td>W10 (CDC) 27/08/05</td>
<td>179</td>
<td>0.31</td>
</tr>
<tr>
<td>W11 (C-H) 03/09/05</td>
<td>198</td>
<td>0.27</td>
</tr>
<tr>
<td>W12 (CDC) 10/09/05</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>W13 (CDC) 17/09/05</td>
<td>309</td>
<td>0.05</td>
</tr>
<tr>
<td>W14 (CDC) 24/09/05</td>
<td>67</td>
<td>0.09</td>
</tr>
<tr>
<td>W15 (CDC) 01/10/05</td>
<td>56</td>
<td>0</td>
</tr>
<tr>
<td>W16 (CDC) 09/10/05</td>
<td>76</td>
<td>0.2</td>
</tr>
<tr>
<td>W17 (CDC) 15/10/05</td>
<td>130</td>
<td>0.15</td>
</tr>
<tr>
<td>W18 (C-H) 22/10/05</td>
<td>201</td>
<td>0.28</td>
</tr>
<tr>
<td>Total</td>
<td>2378</td>
<td></td>
</tr>
</tbody>
</table>

W1, W2, W3.........W18: Weeks of capture (two consecutives nights per week).

CDC: trapping by CDC light trap.
C-H: Capture on human.

The results show three peaks of the parity rate. The first at the beginning of the season of activity ([June]), the second during August, and the third during October. The weak of the parity rate observed in September corresponds to a fall of the larval concentration in the permanent breeding site selected for the study, but we have noted a high density of larvae in new temporary breeding sites which appeared because there is an increase of the ground water. It corresponds in fact to a new generation of mosquitoes, this explains the significant rate of nulliparous females during September.
7- BREEDING SITES
Numerous larval breeding sites were prospected from Mars to June, most of them did not contain larvae. In June, and following the recommendations of P. Carnevale, only one permanent breeding site was selected to follow the dynamics of larvae during the season of activity;
A total of 893 larvae was collected in the selected breeding site. The technique used is a larval fishing with the ladle, ten ladles filled with water are taken in two different places from the same breeding site.

Seasonal dynamic of larvae

we note a very weak concentration of larvae during August because of the small quantity of water in the breeding site due to the strong evaporation recorded during July and of its very strong content of salts.

<table>
<thead>
<tr>
<th>Species</th>
<th>Date</th>
<th>Area</th>
<th>Biotope</th>
<th>pH</th>
<th>Salinity g/l</th>
<th>T °C</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>An. multicolor</td>
<td>05/03/05</td>
<td>Rouissat, N’goussa Aïn moussa, Sidi Khouiled,</td>
<td>Wells, drains, ponds,</td>
<td>8</td>
<td>20.6</td>
<td>18</td>
<td>SUNNY</td>
</tr>
<tr>
<td>An. multicolor</td>
<td>06/08/05</td>
<td>Aïn Moussa melting pot crater</td>
<td>6.4</td>
<td>38.9</td>
<td>27</td>
<td></td>
<td>SUNNY</td>
</tr>
<tr>
<td>An. multicolor</td>
<td>03/09/05</td>
<td>Aïn Moussa melting pot crater</td>
<td>6.5</td>
<td>35.3</td>
<td>26</td>
<td></td>
<td>SUNNY</td>
</tr>
<tr>
<td>An. multicolor</td>
<td>22/10/05</td>
<td>Aïn Moussa melting pot crater</td>
<td>7.5</td>
<td>29.5</td>
<td>22</td>
<td></td>
<td>SUNNY</td>
</tr>
</tbody>
</table>
ANNEX 2

Fig 1: Ouargla Model region : Geographic situation

Fig 2: sites 1, 2, 3 selected for the field works
A, B, C, D, E: houses where mosquitoes catching was done

**Fig.1**: map of Ain Moussa village, area of entomological study