VBORNET

"European Network for Arthropod Vector Surveillance for Human Public Health"

AGM Riga 2012

Jolyon Medlock

Workpackage 2
Report of activities: periods 1-4

Overview of activities WP2

- Year 1: Invasive mosquitoes
- Year 2-3: ticks
- Year 3-4: Image library
- Year 4: Anopheline mosquitoes & Phlebotomines
- Year 4: Pilot study on exotic mosquito surveillance

- Year 1: Invasive mosquitoes
  - Details of recent VBORNET paper in *Vector-Borne & Zoonotic Diseases*
- Year 2-3: ticks
  - Details of *Hyalomma factsheet*
  - *Work on Ixodes ricinus presented on Tuesday*
- Year 3-4: Image library
  - Plea for images
- Year 4: Anopheline mosquitoes & Phlebotomines
  - Further information presented on Tuesday
- Year 4: Pilot study on exotic mosquito surveillance
  - Further information presented on Wednesday

WP2 – Period 1 – Invasive mosquitoes

- 6 factsheets - Invasive aedine mosquitoes
  - *Aedes albopictus*
  - *Aedes aegypti*
  - *Aedes japonicus*
  - *Aedes atropalpus*
  - *Aedes triseriatus*
  - *Aedes koreicus*
- Review paper on *Invasive mosquitoes in Europe: Ecology, Public Health Risks, and Control Options*

WP2 – Period 1 – Invasive mosquitoes

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A Review of the Invasive Mosquitoes in Europe: Ecology, Public Health Risks, and Control Options

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Outline of review article

- Overview of invasive mosquito species in Europe
  - Section on each of the six aedine species
    - History of importation, spread, biology, ecology
    - Current distribution

Overview of history of colonisation, and latest information on current geographic distribution

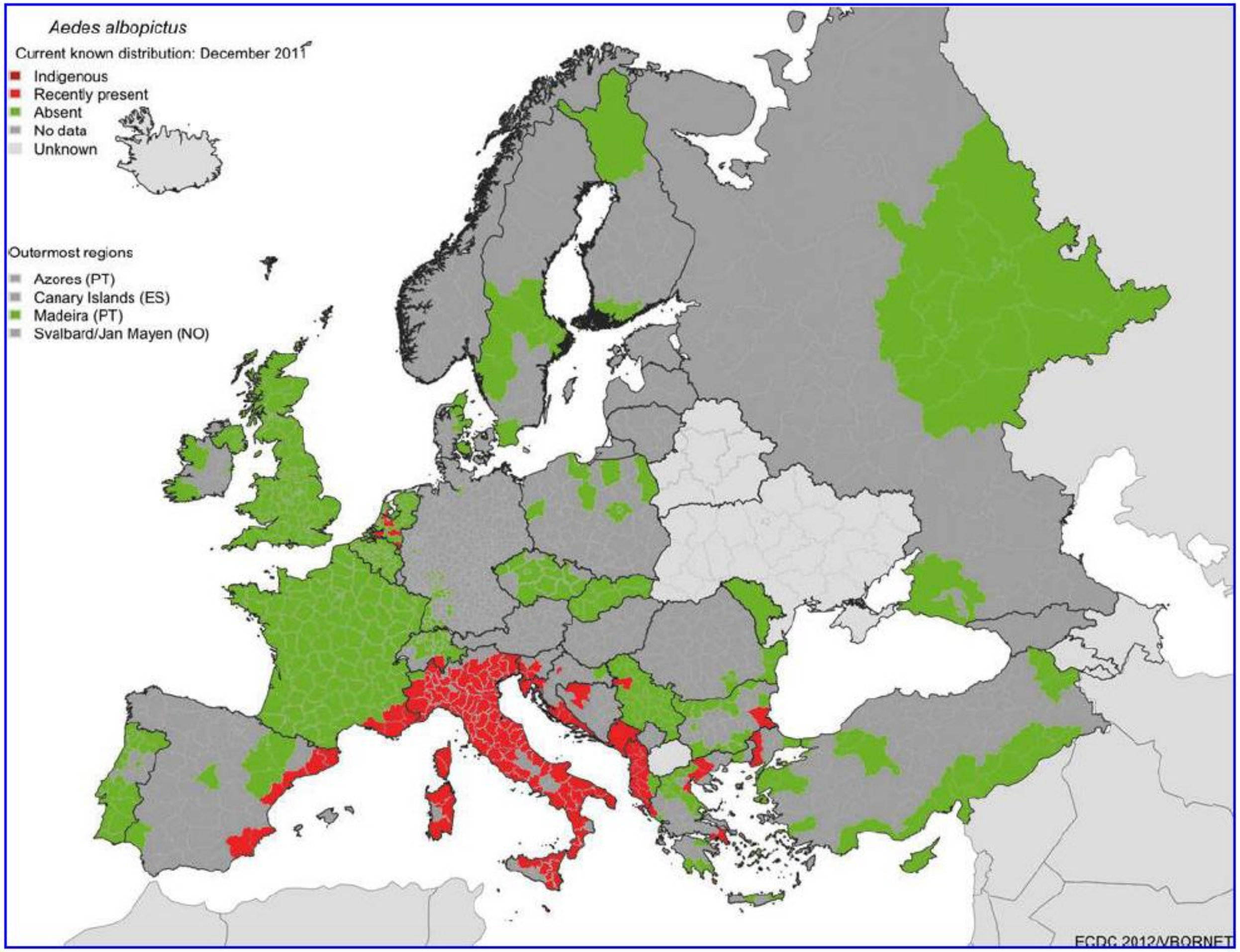

FIG. 1. The currently known distribution of *Aedes albopictus* in Europe in September 2011. The most recent updated map can be downloaded from www.vbornet.eu (ES, Spain; PS, Portugal; NO, Norway).

Outline of review article

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    - Current distribution
  - Risk pathways into Europe

TABLE 1. OVERVIEW OF THE IMPORTATION ROUTES OF THE EXOTIC AEDINE MOSQUITOES ESTABLISHED OR INTERCEPTED IN EUROPE

Country where species is established or where it was intercepted at least once	*atropalpus*	*aegypti*	*albopictus*	*japonicus*	*koreicus*	*triseriatus*
Albania			Used tire trade			
Austria				Unknown route of import		
Belgium[1]			Used tire trade	Used tire trade	Unknown route of import	
Bosnia & Herzegovina			Public/private ground transport			
Bulgaria			Unknown route of import			
Croatia			Public/private ground transport			
France[2]	Used tire trade		Used tire trade	Used tire trade		Used tire trade
France–Corsica			Public/private ground transport			
Germany[1]			Public/private ground transport	Public/private ground transport		
Greece			Public/private ground transport			
Italy	Used tire trade		Used tire trade		Unknown route of import	
Italy–Sardinia			Used tire trade			
Italy–Sicily			Public/private ground transport			
Malta			Unknown route of import			
Monaco			Public/private ground transport			
Montenegro			Public/private ground transport			
Portugal - Madeira		Unknown route of import				
San Marino			Public/private ground transport			
Serbia			Public/private ground transport			
Slovenia			Public/private ground transport	Unknown route of import		
Spain			Public/private ground transport			
Switzerland			Public/private ground transport	Unknown route of import		
The Netherlands	Used tire trade	Used tire trade	Both used tire and Lucky bamboo trades			
Vatican City			Public/private ground transport			
Russia, Georgia, Abkhasia		Unknown route of import				

Used tire trade

Both used tire and Lucky bamboo trades

Public/private ground transport

Unknown route of import

Species not present

[1] *Aedes albopictus* was not able to establish in Belgium or Germany.

[2] *Ae. albopictus* established successfully via ground transport.

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  – Risk pathways into Europe
  – Biotic and abiotic factors constraining establishment in Europe
  – Effectiveness of control methods

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TABLE 3. OVERVIEW OF CURRENTLY AVAILABLE CONTROL METHODS FOR AEDINE CONTAINER-BREEDING SPECIES AND THEIR CHALLENGES

Control method		*Successes and challenges*
Sampling - collection	Sampling collection of adults and larvae using larval habitat surveys and intensive use of oviposition and CO2-baited traps. Sticky traps have also been used.	This methods in combined with insecticides and source reduction was used in New Zealand after the discovery of an *Ae. albopictus* population at a port. The combination of these methods was successful in the eradication of this population (Holder et al., 2010)
Source reduction	Reducing sites that could provide suitable aquatic habitats for larval development.	Due to the vast number of breeding sites and containers that these mosquito species can utilise as breeding sites and the difficulty to access private grounds, this can be very difficult to achieve.
Insecticides	*Bacillus thuringiensis israeliensis ser.* H14, *B. sphaericus*, methoprene and diflubenzuron (insect growth regulators) and pyrethroid derivatives can be used to target larvae or adults for the latter.	The application of insecticides can be logistically challenging due to the wide range of containers these invasive mosquito species can utilise as breeding sites.
	Additionally, indoor living space can be sprayed with pyrethrin to control populations that inhabit human living spaces (Monath & Cetron, 2002).	Insecticide resistance might jeopardize the application of insecticides e.g. resistance among *Ae. albopictus* populations in Thailand and more recently in La Reunion have been reported. An insecticide resistance gene (Rdl resistance allele) was detected in *Ae. albopictus* populations collected in La Reunion during 2008 (Tantely et al., 2010).
	Monomolecular films can also be applied to larval habitats which stop larvae and pupae from staying at the surface of the water (Nelder et al., 2010).	Indoor residual spraying will have limited impact on these *Aedes species* as only small proportion of adults show to be endophilic.
		Bio-insecticides (Bti and Bs) are the most specific insecticides. All other including monomolecular films have unwanted impact on non-targeted fauna.
Public health education	Informing people of the risks of invasive mosquito species and their associated disease risks can help reduce the contact people have with infected or nuisance biting mosquitoes. For both *Ae. albopictus* and *Ae. aegypti*, the available aquatic habitats in urban areas are largely governed by human activities (e.g. waste containers and storage of water outside), so control methods need to be directed at these factors (Jensen & Beebe, 2010). Educating people about mosquito habitats and encouraging them to reduce potential aquatic sites around their home, wear protective clothing and use mosquito repellent can also help to reduce mosquito biting and arbovirus transmission.	

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  - Risk pathways into Europe
  - Biotic and abiotic factors constraining establishment in Europe
  - Effectiveness of control methods
  - Public health significance and risk for Europe

Table 2. Overview of the Vector Status of the Exotic Aedine Mosquito Species Intercepted or Established in Europe

pathogen			*aegypti*	*albopictus*	*atropalpus*	*japonicus*	*koreicus*	*triseriatus*
Viruses	*Alphavirus*	Chikungunya	■	■				
		Eastern Equine encephalitis		▨		▒		▒
		La Crosse		▨	▒	▒		■
		Venezuelan Equine encephalitis		▨				▒
		Western equine encephalitis						▒
	Flavivirus	Dengue	■	■				▒
		Japanese encephalitis		▨		▒	▨	
		St Louis encephalitis				▒		▒
		West Nile		▨	▨	▨		▨
		Yellow fever	■					▒
		Zika	▨					
	Bunyavirus	Jamestown Canyon						▨
Nematodes	*Dirofilaria*	*D. immitis* and *D. repens*		■			▒	

■ Proven vector in the field

▨ Found infected in field and laboratory competence studies having potential role as vector, but no proven vector in the field

▒ Only laboratory competence studies having showed potential involvement in transmission

☐ No vector or not known

WP2 – Period 2 & 3 – Ticks

- 2 factsheets - Ticks
  - *Ixodes ricinus*
  - *Hyalomma marginatum*
- Review paper on *Driving forces for change in geographical distribution of Ixodes ricinus in Europe*

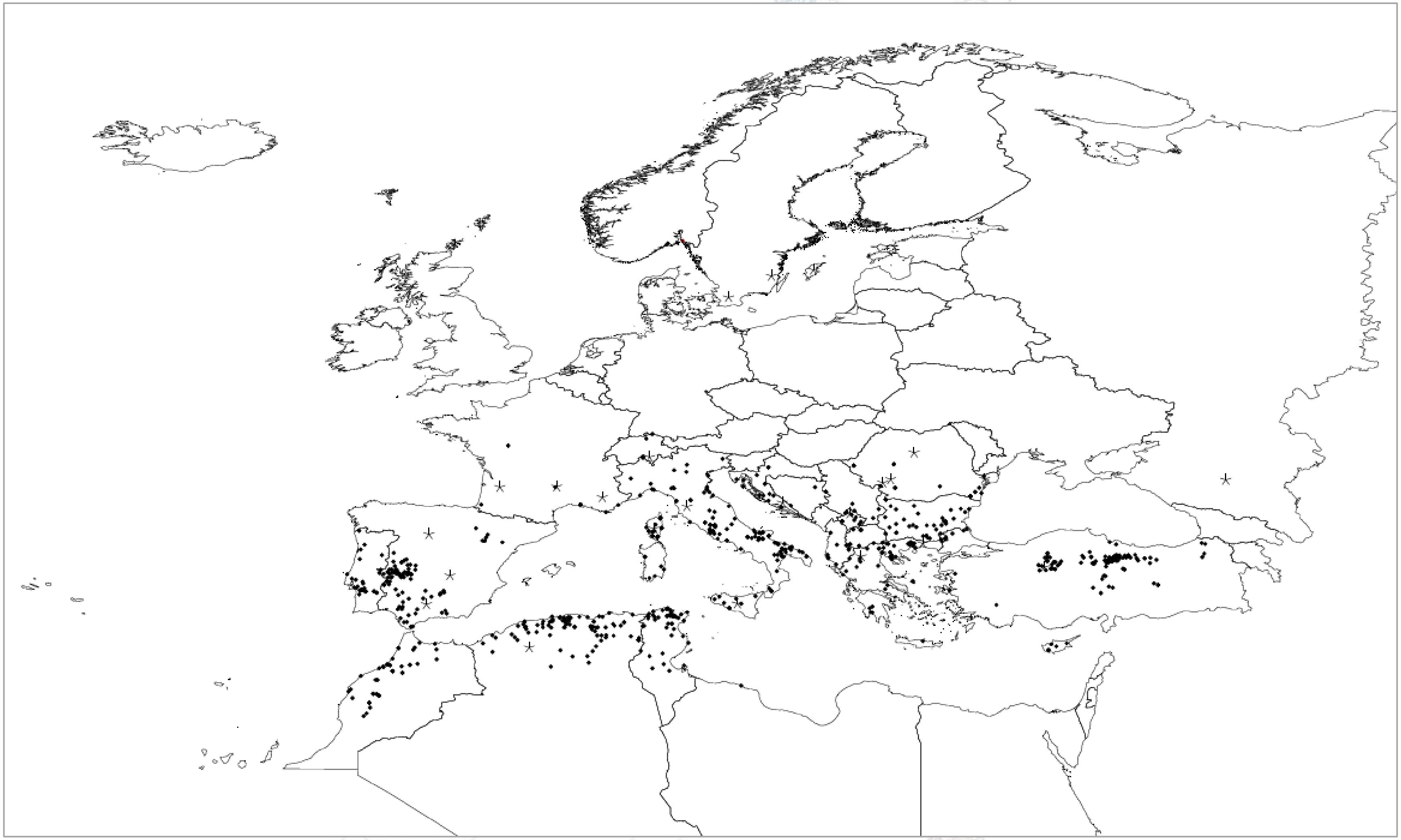
Hyalomma marginatum factsheet

- Acknowledgements
  - Agustin Estrada-Pena
  - Zati Vatansever
  - Lisa Jameson

Content of *Hyalomma* factsheet

- Current issues
  - Upsurge in Turkey and parts of Russia
  - Importation by migratory birds
  - Disease risk – CCHF
  - Importation of ticks by livestock
  - Ecological plasticity of the tick
- Geographical distribution

Geographical distribution (Estrada-Pena)



Content of *Hyalomma* factsheet

- Taxonomy
- Life cycle
  - Immatures
  - Adults
  - Generations
- Host preferences
  - Host seeking strategies
  - Adult hosts
  - Immature hosts
  - Feeding sites on hosts

Content of *Hyalomma* factsheet

- Favoured habitats
- Environmental thresholds/constraints/development criteria
  - Environmental/climatic thresholds
  - Overwintering strategies
  - Dispersal range
- Potential for future spread
- Vector status - CCHF
- Collection techniques
- Control methods

Content of *Hyalomma* factsheet

- Current uncertainties
  - Little research of resistance of *Hyalomma* to acaricides
  - Some evidence of subpopulations of tick with different climate niches – more research required
  - Reasons for upsurge in tick numbers still debated
    - Increase in wild animal populations (hare, boar)
    - Local predator / prey imbalance
    - Changes in agricultural practice – importation of crops
    - Migration towards urban centres and decline in land under plough
    - Changes in animal husbandry – local sheep populations
      - May influence hare and bird populations
      - Change in dominance of tick species
- Conclusion – better field data, further ecological studies are needed

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Driving forces for change in geographical distribution of *Ixodes ricinus* ticks in Europe

WP 2 – Period 3

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[12] University of Thessaloniki, Greece

[13] University of Munich, Germany

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[15] Oxford University, UK

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[18] CIRAD, France

[19] European Centre for Disease Prevention and Control, Sweden

Riga, May 2012 VBORNET AGM

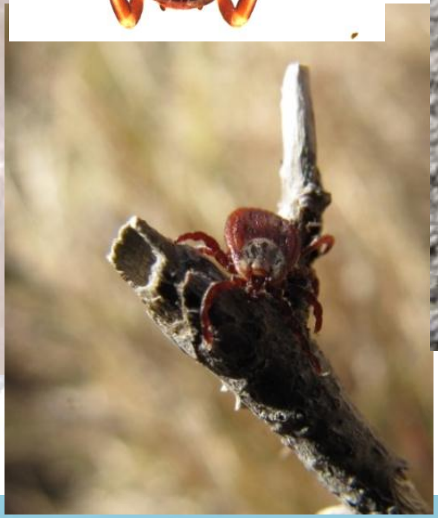
Aims

- Review drivers for change in distribution of *Ixodes ricinus* in Europe
  - Published literature
  - Expert opinion
    - Input from 19 institutions (academia, government, ECDC)
    - Experts from 14 EU member states
- Drivers include:
  - Climatic effects at altitude and latitude
  - Land use change; habitat connectivity; urban green space
  - Changes in agriculture
  - Changes in tick host distribution

Image library

	A	B	C	D	E	J	O	T	Y	AD
4	Species	Priorities	Available strains	Location	Whole adult F	Head/ Thorax	Whole larvae	Last abdo. segments	Whole male	Whole pupae/nymph
5	**Mosquitoes**									
6	*Aedes aegypti*	1	☑	UZH, IPZ, CH	☐	☑				
7	*Aedes albopictus*	1	☑	UZH, IPZ, CH	☐	☑				
8	*Aedes japonicus*	1	☑	UZH, IPZ, CH	☐	☑				
9	*Anopheles plumbeus*	1	☑	UZH, IPZ, CH	☐	☐				
10	*Culex pipiens*	1	☑	UZH, IPZ, CH	☐	☑				
11	*Aedes atropalpus*	2	☑	UZH, IPZ, CH	☐	☑				
12	*Aedes koreicus*	2	☑	UZH, IPZ, CH	☐	☑				
13	*Aedes vexans*	2	Field	x	☐	☐				
14	*Culex modestus*	2	Field	x	☐	☐				
15	*Aedes triseriatus*	3	☑	UZH, IPZ, CH	☐	☑				
16	**Ticks**									
17	*Dermacentor reticulatus*		☐	Berlin/ J. Demeler	☑	▪	☐	▪	☑	?
18	*Hyalomma marginatum*		☐		☐	▪	☐	▪	☐	?
19	*Ixodes persulcatus*		☐		☐	▪	☐	▪	☐	?
20	*Ixodes ricinus*		☐	Berlin/ J. Demeler	☑	▪	☐	▪	☐	?
21	*Ornithodoros sp.*		☐		☐	▪	☐	▪	☐	?
22	*Rhipicephalus sanguineus*		☐	Berlin/ J. Demeler	☐	▪	☐	▪	☐	?
23	**Phlebotomines**									
24	*Phlebotomus ariasi*		☐		☐	▪	▪	▪	?	▪
25	*Phlebotomus neglectus*		☐		☐	▪	▪	▪	?	▪
26	*Phlebotomus papatasi*		☐		☐	▪	▪	▪	?	▪
27	*Phlebotomus perfiliewi*		☐		☐	▪	▪	▪	?	▪



Objectives WP 2.2 for 2012

- Deliverables:
  - Factsheets on ecology & biology of four Anopheline species considered to be important for malaria transmission in Europe
  - Factsheet on survey techniques/surveillance for Phlebotomine vectors
  - Factsheet on driving forces for change in distribution of Phlebotomine vectors

Ecology & Biology of Anophelines -Factsheets

- *An. labranchiae & An. sacharovi*
  - deadline 31 May 2012
- *An. atroparvus & An. plumbeus*
  - deadline 30 Jun 2012
- Seeking expert opinion

Achievements so far

- Factsheet structure/content
- Extensive literature search (English literature only)
  - PubMed
  - Google scholar
  - ScienceDirect
- ~40/100 papers assessed and noted ready for inclusion in factsheet

Keywords:
An. labranchiae
An. sacharovi
An. atroparvus
An. plumbeus
(all above & habitat, ecology, biology, biting behaviour, control, distribution)

Additional searches:
Malaria vector & Europe
Malaria transmission & Europe
Autochthonous malaria & Europe

We need your expert opinion

- Factsheets need to be up-to-date
- Need help identifying local/unpublished information or literature
- Particularly information on the **ecology/biology** of each species

Phlebotomine sampling and drivers for change

- Sampling strategies – flight traps, light traps, animal-baited overnight trapping etc
  - *Ph. ariasi, neglectus, papatasi, perfiliewi*
  - Final to be completed Dec 2012

- Drivers for change
  - Focus of vectors of Leishmania and sandfly fever
  - Final to be completed Dec 2012

Please remember to share your expertise

- Contacts for WP 2
  - Work package leader Jolyon Medlock
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  - Scientific support Kayleigh Hansford
    - kayleigh.hansford@hpa.org.uk

Thank you