Biodiversität und Klima Forschungszentrum

LOEWE – Landes-Offensive zur Entwicklung Wissenschaftlich-ökonomischer Exzellenz

senckenberg forschungsinstitut und naturmuseum

GOETHE UNIVERSITÄT FRANKFURT AM MAIN

Alien and native vectors – risks for human and animal health

Programme and Abstracts

Joint conference of the Deutsche Gesellschaft für Medizinische Entomologie und Acarologie e.V. (DGMEA) and the Biodiversity and Climate Research Centre (BiK-F)
Annual meeting of DGMEA

Venue: Senckenberg Research Institute and Natural History Museum, Senckenberganlage 25, 60325 Frankfurt am Main, Germany

29-31 October 2009

Biogents
Science for your protection

NOVARTIS ANIMAL HEALTH

Thursday, 29 October 2009

16:00 Conference opening and welcome address

16:10 *Paul Becker, Deutscher Wetterdienst (DWD), Offenbach am Main*

Predicting climate change in Germany: current trends, problems and outlooks

16:55 *Francis Schaffner, Referenzlabor für Vektor-Entomologie, Universität Zürich*

Mosquito-borne diseases on the way: native or invasive vectors?

17:40 *Martin Pfeffer, Institut für Tierhygiene und Öffentliches Veterinärwesen, Universität Leipzig*

Rift Valley Fever and other Bunyavirus infections

18:00 *Roger Eritja, Servei de Control de Mosquits, Consell Comarcal del Baix Llobregat, Barcelona*

The Asian Tiger Mosquito (*Aedes albopictus*) in Catalonia: dealing with global invasions of disease vectors

18:45 Coffee break

<u>Public evening lecture (in German) / Öffentlicher Abendvortrag</u>:

19:00 *Michael Faulde, Zentrales Institut des Sanitätsdienstes der Bundeswehr, Koblenz*

Krankheitsüberträger, überall: Medizinische Entomologie in einer globalisierten Welt

20:00 Come-together at BiK-F (registered participants and accompanying persons only)

Informal reception in the Biodiversity and Climate Research Centre building, Georg-Voigt-Str. 14-16 (across the street from the conference venue)

Friday, 30 October 2009

09:00 *Carl Beierkuhnlein, Department of Biogeography, Universität Bayreuth*

Alien and native insect vectors in the light of global change – challenges for interdisciplinary research

09:30 *Andreas Krüger, Bundeswehr am Bernhard-Nocht-Institut für Tropenmedizin, Hamburg*

Scientific highlights from the 5th International Congress of the Society of Vector Ecology in Antalya, Turkey, 11-16 October 2009

09:45 *Andreas Rose, Biogents AG & Universität Regensburg*

Technical advances in vector surveillance: comparison of sampling tools for adult mosquitoes

10:15 *Mandy Kronefeld, Biodiversität und Klima Forschungszentrum (BiK-F), Frankfurt am Main*

Filaria prevalence in mosquitoes in Bangladesh: a diversity-oriented pilot study

10:30 Coffee break and poster viewing

10:50 *Helge Kampen, Friedrich-Loeffler-Institut, Insel Riems*

Bluetongue disease in Germany – learning to cope with emerging vector-borne diseases

11:20 *Jörn Gethmann, Friedrich-Loeffler-Institut, Institut für Epidemiologie, Wusterhausen*

Epidemiology of bluetongue disease in Germany

11:35 *Martin Hall, Department of Entomology, Natural History Museum, London*

Traumatic myiasis - a moveable feast!

12:00 *Paul Ready, Department of Entomology, Natural History Museum, London*

Any evidence for the northwards spread of phlebotomine sandflies and canine leishmaniasis in Europe?

12:30 Lunch break

13:45 *Doreen Werner, Senckenberg Deutsches Entomologisches Institut & Leibniz-Zentrum für Agrarlandschaftsforschung (ZALF), Müncheberg*
Andrzej Grzywacz, Animal Ecology Department, Nicolaus Copernicus University, Toruń

Identification of true flies (Muscidae) of medical and hygienic importance (DGMEA Satellite Workshop)

16:45 Coffee break

17:15 DGMEA business meeting (DGMEA members only)

19:30 Dinner among dinosaurs (registered participants and accompanying persons only)

Dinner buffet in the dinosaur hall of the Senckenberg Natural History Museum

Saturday, 31 October 2009

09:00 *Jennifer Pausch, AG Spezielle Zoologie/Parasitologie, Ruhr-Universität Bochum*

Intestinal antibacterial factors and their interaction with symbionts in *Triatoma infestans*

09:15 *Eva Scholl, Nürnberg*

From integrated pest control to holistic risk reduction – sustainable management of nuisance pests, disease carriers and vectors

09:30 *Peter Kraiczy, Institut für Medizinische Mikrobiologie und Krankenhaushygiene, Goethe-Universität, Frankfurt*

Lyme borreliosis: Where do we go from here?

10:00 *Jasmin Skuballa, Abteilung für Ökologie und Parasitologie, Universität Karlsruhe*

The role of the European hedgehog (*Erinaceus europaeus*) in the epidemiology of arthropod borne diseases

10:15 *Silvia Pluta, Landesgesundheitsamt Baden-Württemberg, Stuttgart*

Dermacentor ticks as vectors for *Coxiella burnetti* and *Rickettsia* spp. in southern Germany

10:45 Coffee break and poster viewing

11:15 *Doreen Werner, Senckenberg Deutsches Entomologisches Institut & Leibniz-Zentrum für Agrarlandschaftsforschung (ZALF), Müncheberg*

The mass occurrence of black flies (Diptera: Simuliidae) in European lowland rivers and their manipulation by chemical control and the renaturalization of rivers

11:45 *Daniel Boakye, Noguchi Memorial Institute for Medical Research, University of Ghana*

Climatic and ecological changes and the movement and establishment of members of the *Simulium damnosum* complex in West Africa

12:15 *Anges Yadouleton, Centre de Recherches Entomologiques de Cotonou, Bénin*

Development of vegetable farming: a cause of the emergence of insecticide resistance in populations of *Anopheles gambiae* in urban areas of Benin

12:30 *Martin Geier, Biogents AG & Universität Regensburg*

Control of mosquitoes by mass trapping: field studies in Italy and Brazil with BG-Sentinel traps

12:45 *Rainer Ulrich, Friedrich-Loeffler-Institut, Institut für neue und neuartige Infektionskrankheiten, Insel Riems*

Network “Rodent-Borne Pathogens” in Germany: Molecular epidemiology of hantavirus and *Leptospira* infections in rodent hosts

13:00 Presentation of Biogents Student Awards for best contributed talks and posters

13:15 Conclusions and closing of conference

Poster presentations

Posters will be displayed throughout the conference. The morning coffee breaks on Friday and Saturday are designated for viewing and discussing posters. All poster presenters are requested to be available for questions next to their poster during these two coffee breaks.

List of poster presentations

P1 *Hilaria Amuzu, Noguchi Memorial Institute for Medical Research, University of Ghana*

Variation in *Anopheles gambiae* s. l. exhibiting different vectorial capacities for lymphatic filariasis transmission in coastal Ghana

P2 *Maike Förster, Heinrich-Heine-Universität, düsseldorf*

Synanthropic flies as potential vectors of pathogenic agents

P3 *Ruth Jesse, Institute of Ecology, Evolution & Diversity, Goethe University*, *Frankfurt am Main*

Tiger mosquitoes: the invasion of Europe

P4 *Mandy Kronefeld, Biodiversität und Klima Forschungszentrum (BiK-F), Frankfurt am Main*

Diversity and population structure of *Culex pipiens* complex mosquitoes in Bangladesh: preliminary results from mitochondrial DNA sequence analysis

P5 *Erik Schmolz, Bundesumweltamt, Sektion IV 1.4 Gesundheitsschädlinge und ihre Kontrolle, Berlin*

Heat tolerance of the bed bug *Cimex lectularius*

P6 *Konstans Wells, Institut für Experimentelle Ökologie, Universität Ulm*

Landscape attributes influence ectoparasite infestations of hedgehogs (*Erinaceus europaeus*) in an urban-suburban environment

PREDICTING CLIMATE CHANGE IN GERMANY: CURRENT TRENDS, PROBLEMS AND OUTLOOKS

Paul Becker

Deutscher Wetterdienst, Frankfurter Str. 135, 63067 Offenbach, Germany, paul.becker@dwd.de

Climate monitoring networks and modelling techniques commonly used for climate change research for Germany are briefly introduced. Knowledge of their limitations is essential for the robust estimation of mean climate values and trends. Observational data have to be homogenised to eliminate unwanted effects of sensor renewals, station relocations, or changes in the station environment such as urbanisation or deforestation. While numerical models represent the majority of global climate models evaluated by the Intergovernmental Panel on Climate Chance (IPCC), both numerical and statistical regional climate models are used for downscaling climate change signals in Germany. Model projections to estimate possible future climatic conditions have to include evaluation and control runs for past periods of time to allow comparison with homogenised observations to quantify the model bias. The improvement of suitable bias correction and post-processing methods is still in the focus of current research. Examples of observed and projected climate trends are presented for Germany. Despite significant consistency between the models in predicting the sign of changes in mean temperature and precipitation, the models still show large scatter in terms of magnitude and regional location of the change signal. Therefore, the evaluation of a large ensemble of model projections with multiple regional climate models driven by multiple global models is recommended for climate impact studies. Predicted changes in the locality, frequency and intensity of extreme weather events are of high interest due to their associated hazards. So, the improvement of model skills to simulate these events is particularly needed. Besides model improvements, future activities in climate change research include the derivation of further high quality observational data sets, the development of additional scenarios and the transition from coupled ocean-atmosphere models to full earth system models, where for example vegetation types can alter due to a changing climate. Furthermore, efforts will be made to develop the skill to perform decadal climate predictions. This aims towards the ability to robustly estimate climate change for the next 10 years, which is of particular interest for the development of climate adaptation strategies.

Invited lecture

MOSQUITO-BORNE DISEASES ON THE WAY: NATIVE OR INVASIVE VECTORS?

Francis Schaffner

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Numerous viruses, protozoa and nematodes are transmitted by mosquitoes to animals and humans but their epidemiology is changing. Currently, Europe faces emerging or resurging mosquito-borne diseases, such as Chikungunya disease and West Nile fever. In parallel, several invasive mosquitoes have been introduced and some of them are spreading in Europe. This raises the question on the roles of native and invasive mosquitoes in outbreaks of mosquito-borne diseases. The tiger mosquito *Aedes albopictus* has been recorded to date from 16 European countries. This mosquito was responsible for the Chikungunya disease outbreak in Northern Italy in 2007 and it is known to be also a vector for Dengue viruses. The Asian rock pool mosquito *Ae. japonicus* is currently established in Switzerland, Germany and Belgium, and is suspected to be an efficient bridge vector of West Nile virus. Among the more than 100 native mosquito species in Europe, around 30 species are suspected to act as vectors, their actual role being dependent on their vector competence and capabilities. For example, the two salt marsh mosquitoes *Ae. caspius* and *Ae. detritus* have a high vector competence for Chikungunya virus when tested in the laboratory but their capabilities to transmit in the field will remain very low. Many mosquito species show high vector competence for West Nile virus when tested in the laboratory, but their capabilities and their role in transmission in nature differs. Dengue virus was transmitted in Europe by *Ae. aegypti* when it was widely distributed in the Mediterranean, and the comeback of this mosquito on Madeira Island and in Southern Russia as well as the widespread establishment of *Ae. albopictus*, is of great concern. In conclusion, many native mosquitoes are competent for transmitting pathogens including 'exotic' ones but, unfortunately, invasive species also show high vector competence and capabilities. The introduction and spread of vectors and pathogens is therefore of great concern, especially in a context of global change.

Invited lecture

RIFT VALLEY FEVER AND OTHER BUNYAVIRUS INFECTIONS

Martin Pfeffer

Institute for Animal Hygiene and Veterinary Public Health, Center for Veterinary Public Health, Veterinary Faculty, University of Leipzig, An den Tierkliniken 1, 04103 Leipzig, Germany, pfeffer@vetmed.uni-leipzig.de

Rift Valley fever is a serious disease in livestock animals in Africa and the Saudi Arabian peninsula. Enzootically maintained and transmitted by various mosquito species, it irregularly causes large epidemics with enormous economic losses in the affected areas. All big epidemics thus far have been associated with huge flooding and massive vector mosquito population increases. Hence, heavy rainfall and favoring climate conditions have been studied in depth in order to relate RVFV epidemics to weather and to subsequently develop predictive risk maps. These forecasts have been shown to allow an early warning system and corresponding prevention strategies for East Africa. However, when applying similar models of risk analyses for West Africa or Madagascar, the predictive risk maps and actual RVFV outbreaks did not overlap. Different ecology of the main vector mosquito species and local rainfall dynamics may be responsible for these differences. Because many mosquito species have been shown to be capable to transmit RVFV, and because the mosquito life cycle is strongly influenced by the availability of water and its temperature, climate change will have a strong impact on Rift Valley fever occurrence in the near future. Further, because RVFV is such a promiscuous virus in terms of its transmitting vector, it is among the most feared transboundary pathogens including Europe. Many other bunyaviruses are as well the cause of outbreaks of animal and human diseases worldwide, but for most of them we do not have solid data about their geographic distribution, prevalence, or animal and vector species involved in their respective endemic transmission cycle. While for example La Crosse virus in North America seems to be transmitted in a “stable” cycle leading to roughly the same number of human infection each year, members of the Genus Phlebovirus currently seem to emerge in many regions around the Mediterranean basin.

Invited lecture

THE ASIAN TIGER MOSQUITO (*AEDES ALBOPICTUS*) IN CATALONIA: DEALING WITH GLOBAL INVASIONS OF DISEASE VECTORS

Roger Eritja

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Aedes albopictus is a worldwide invasive mosquito species. Mosquito invasions are not a new issue in Europe: the Yellow Fever mosquito (*Aedes aegypti)* already colonized large Mediterranean areas from the New World in the XIXth century causing YF and Dengue epidemies that accounted for an estimate of more than 500,000 human lives in half a century only in Spain. To our knowledge, at least twelve countries in Europe presently have established populations of *Aedes albopictus* resulting in variable nuisance levels on the human population, depending on densities, climate and other environmental factors. In warmer Mediterranean areas like the Baix Llobregat region in Catalonia (autonomous region in the NE Spain), attack rates may be as high as 60 to 100 bites per hour. This means in practice that no outdoor activity can be held in residential areas such as private gardens as well as in public areas like cemeteries and parks. Whereas the reasons for the extinction of *Ae.aegypti* are unclear, its cousin species *Ae.albopictus* will not follow a similar path. Considering its associated health risks and the strong nuisance levels it is necessary to undertake control actions where the Tiger mosquito is already present, and attempting local eradications when possible. However, the awareness level within most public authorities is very poor in Spain. The problem is only dealt with by municipalities as they are confronted with the problem first hand. Amongst them, some Catalan groups of municipalities had three Mosquito Control Services established from the 1980s which is a good starting point for *Ae.albopictus* control. The Baix Llobregat MCS (created 1983) was carrying out from 2002 the early monitoring of the species throughout Spain, and from 2005 has to deal with the species in its influence area, located near Barcelona. The history of *Ae.albopictus* and *Ae.aegypti* in Spain will be discussed, as well as the control and monitoring campaigns carried out in the Baix Llobregat region with special emphasis on the social aspects of the problem.

Invited lecture

KRANKHEITSÜBERTRÄGER ÜBERALL: MEDIZINISCHE ENTOMOLOGIE IN EINER GLOBALISIERTEN WELT

Michael Faulde

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Blutsaugende Gliedertiere, sogenannte „Vektoren“, haben weltweit einen bedeutenden Stellenwert bei der Erregerverbreitung auf Mensch und Tier. Im Jahre 2000 waren insgesamt 1709 Erreger bekannt, die Erkrankungen am Menschen hervorrufen können. Von diesen waren 823 (=49%) Zoonosen, also Erkrankungen, die vom Tier aus auf den Menschen übertragbar sind. Von diesen Erregerarten sind 156 als gegenwärtig häufiger auftretend (=„emerging“) definiert worden; davon etwa ¾ (114) Zoonosen. Allgemein wird anerkannt, dass Vektor übertragene Erkrankungen auf globaler Ebene bereits heute eine große Bedeutung bei Seuchengeschehen haben und künftig weiterhin haben werden. Seit Beginn der 1990er Jahre ist eine drastische, weltweite Zunahme von Zoonose-Epidemien in bekannten Endemiegebieten, besonders in Krisen- und Katastrophengebieten, zu verzeichnen. Zudem fand in der letzten Dekade eine geographische Ausbreitung verschiedener vektorassoziierter Infektionserkrankungen, auch über Kontinente hinweg, deutlich häufiger statt. Obwohl multifaktoriell bedingt, spielt die forcierte Globalisierung eine herausragende Rolle bei der simultanen Verschleppung und Ausbreitung von Überträgern, Erregern und deren Reservoiren. Hinzu kommen weitere Faktoren, wie etwa die weltweiten Klima- und Habitatveränderungen. Über 30 endemische vektor-übertragene Erkrankungen belegen ein bedeutendes gesundheitliches Potential auch für Deutschland. Zecken übertragene Erkrankungen, allen voran die Schildzecken-Borreliose mit mehreren Zehntausend Fällen pro Jahr, sind hier am bedeutungsvollsten. Aktuell finden umfangreichere nationale und internationale Forschungsvorhaben sowie Netzwerkbildungen zur Thematik statt. Aufgrund der aktuellen globalen Entwicklungen wäre eine Renaissance des Lehr- und Fachgebietes der „Medizinischen Entomologie“ auch in Deutschland zu erwarten und zu wünschen. Eine Bestandsaufnahme zum Fachgebiet wird vorgestellt und auf aktuelle Beispiele und Hintergründe bei der Ausbreitung Vektor übertragener Erkrankungen wird exemplarisch näher eingegangen.

Public evening lecture (in German)

ALIEN AND NATIVE INSECT VECTORS IN THE LIGHT OF GLOBAL CHANGE – CHALLENGES FOR INTERDISCIPLINARY RESEARCH

Carl Beierkuhnlein, Stephanie Thomas, Dominik Fischer

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The increasing interchange between regions and ecosystems by human traffic and trade contributes to the spread of many species into areas that could not be reached by them so far. Among them are insect species that function as vectors for human diseases. Such species have dispersed over large areas. *Aedes albopictus* as potential vector of West Nile fever, Chikungunya fever and Dengue fever is an invasive alien species in North America, South America and Europe. *Phlebotomine* sandflies, vectors of leishmaniasis, are native in the Mediterranean and adjacent regions but are expected to move north as a consequence of global warming. Mosquitoes and sand flies cannot regulate their body temperature. Thus, they are closely connected to the thermal conditions of their environment. We briefly review the main effects of global change, namely climate and environmental changes, consequences of human transport systems as well as demographic population growth and socioeconomic discrepancies. Multi-factorial impacts, which determine the occurrence of vectors, require target-oriented interdisciplinary research activities. Hence, we emphasise the necessity to link approaches from biology, medicine and ecology and their sub-disciplines like entomology, microbiology, parasitology, and biogeography. A structured literature search analyses the existing connections between disciplines and points at deficits and research challenges. Ecological and especially biogeographical methods enable an estimation of potential vector habitats on different spatial and temporal scales. Species distribution models allow the detection of climatic envelopes of native vectors (e.g. *Phlebotomine* sandflies) and alien vectors (e.g. *Aedes albopictus*) in Europe and the transfer of their requirements to future climate change scenarios. Alien and native vectors can react in a different way to climate change, but for both range shift tendencies and spreading tendencies respectively, will result in new challenges for the public health sector.

Contributed talk

TECHNICAL ADVANCES IN VECTOR SURVEILLANCE: COMPARISON OF SAMPLING TOOLS FOR ADULT MOSQUITOES

Andreas Rose,[1,2] Martin Geier [1,2]

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[2]*Institut fürZoologie, Universität Regensburg, Universitätsstr. 31, 93055 Regensburg, Germany*

Although the main purpose of mosquito sampling is to assess their risk as disease vectors, such projects may have different aims, ranging from obtaining a comprehensive species overview to the surveillance of disease vector populations and to the early detection of invasive species. Depending on the aim, different tools and methods should be used or combined. These include sampling the mosquito eggs using ovitraps, the collection of larvae and pupae from their habitats, and catching adults. Adult mosquitoes can be captured from their resting places using special aspirators or similar tools, or they can be collected using traps. Trap types can be optimized for oviposition-site or host-seeking mosquitoes, or also for the collection of certain species that are the focus of interest. Capturing host-seeking mosquitoes is especially important as an alternative for the ethically questionable collection of mosquitoes from human volunteers, which is the gold standard for the risk assessment of mosquito-borne diseases. In our presentation, we evaluate established surveillance methods, review and present data on the sensitivity of different trapping methods for adult mosquitoes (such as aspirators, sticky traps, Fay-Prince traps, CDC-traps, and the recently developed BG-Sentinel trap) and how this compares to the human landing collection. The results show that the BG-Sentinel is an especially efficient traps for important anthropophilic mosquitoes (*Aedes aegypti, Ae. albopictus, Ae. polynesiensis*, as well as *Anopheles*) without the need to use carbon dioxide. The addition of carbon dioxide makes the trap attractive for mosquitoes with more catholic host preferences.

Contributed talk

FILARIA PREVALENCE IN MOSQUITOES IN BANGLADESH: A DIVERSITY-ORIENTED PILOT STUDY

Mandy Kronefeld,[1] F.M.H. Nurunnabi Chaudhury,[2] Jens Amendt,[1,3] Richard Zehner,[1,3] Moazzem Hossain,[2] Ulrich Kuch [1]

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Filarial nematode parasites are a serious cause of morbidity in humans and animals. Lymphatic filariasis, with an estimated 90 % of cases caused by *Wuchereria bancrofti* and the remainder by *Brugia malayi* and *Brugia timori*, is a mosquito-borne disease which affects 128 million people in at least 83 countries, particularly in tropical and subtropical areas. Other filarial infections, which are common in companion animals, can also be transmitted to humans by a number of mosquito species belonging to a wide range of genera, including *Culex*, *Aedes*, *Ochlerotatus*, *Anopheles*, *Armigeres* and *Mansonia*. *Dirofilaria immitis* and *D. repens* are such well-known zoonotic agents. Humans are dead-end hosts for these filarial parasites of dogs and cats, but the developing parasites can nevertheless cause pathologic changes in humans. To obtain first molecular data on the diversity of mosquito-borne filarial parasites in Bangladesh, we conducted a pilot study in two districts whose endemicity status for lymphatic filariasis is uncertain. We collected mosquitoes belonging to the *Culex*, *Anopheles* and *Mansonia* genera in December 2008 and February 2009 in southeastern (Chittagong) and northeastern Bangladesh (Maulavibazar). Conserved primers were used to amplify and sequence a region of the mitochondrial 12S rRNA gene. Filarial DNA sequences were identified in 31 of a total of 503 adult female mosquitoes belonging to five genera. Overall, the percentage of filaria positive mosquitoes was 5.34 % in Chittagong and 7.83 % in Maulavibazar. The commonest species were *W. bancrofti* and *D.immitis*, both of which were also present in Chittagong City. However, there were also four species of *Onchocera* whose 12S sequences could not be assigned to any of the species for which overlapping sequences have been published. Further work is required to identify and characterize these, and to distinguish between infected mosquitoes that contain any stage of the parasite and infective mosquitoes that harbor third stage larvae competent of establishing infections in humans and animals.

Contributed talk

BLUETONGUE DISEASE IN GERMANY – LEARNING TO COPE WITH EMERGING VECTOR-BORNE DISEASES

Helge Kampen

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After the eradication of malaria in the first half of the 20th century, Germany has not encountered any insect-borne disease of epidemic scope for decades. Although ticks have gained importance as vectors of disease the interest in vector biology has generally decreased over time, funding sources have become scarce and experts in medical entomology have disappeared. It was therefore not surprising that, when bluetongue disease (BTD) broke out in 2006, German authorities and scientists were completely unprepared: there was hardly any data on indigenous ceratopogonid species that may serve as vectors of the bluetongue virus (BTV) and few medical entomologists were available, with none specialized in biting midges. In 2006, BTD affected almost 1,000 ruminant farming facilities in western Germany, while in 2007 the epidemic spread over much of the country with more than 20,000 holdings involved. Due to extensive vaccination, in 2008 numbers of new outbreaks (ca. 1,700) were much lower than in 2007, however, BTD still expanded geographically and BTV serotypes 1, 6 and 11 appeared on the central European scene in addition to serotype 8. In 2009, only France reported central European BTD outbreaks (serotypes 1 and 8) until mid-September. The northwards spread of the tiger mosquito, *Aedes albopictus*, in southern Europe, the 2007 Chikungunya fever outbreak in Italy and the recent establishment of the Asian rock pool mosquito, *Ae. japonicus*, in northern Switzerland/southern Germany tend to suggest that BTD was only the first vector-borne disease outbreak in central Europe of others still to come in our changing environment. The lessons to be learnt from the BTD incidence in order to be better prepared for the future therefore must be (i) to monitor our arthropod fauna and identify possible vectors of disease, (ii) to educate specialists in medical entomology, and (iii) to better check the import of goods and animals for arthropod vectors and pathogens coming along with them.

Invited lecture

EPIDEMIOLOGY OF BLUETONGUE DISEASE IN GERMANY

Jörn Gethmann, Carolina Probst, Christoph Staubach, Franz J. Conraths

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In August 2006, bluetongue virus serotype 8 (BTV-8), which had occurred before in the sub-Saharan region, Asia and South America, was introduced into Central Europe. The virus hit an area with a high population density of BTV-naive animals, suitable vectors (*Culicoides spp.*) and climatic conditions favourable for virogenesis in the midges and for transmission. Until the end of the year, 892 cases/outbreaks were registered in Germany. In June 2007, BTV-8 reoccurred and spread rapidly over Europe. By the end of December 2007, more than 20,000 farms were reported to be affected in Germany. As consequence, it was decided in Winter 2007/2008 to implement a compulsory mass vaccination program for cattle, sheep and goats that started in May 2008. Approximately 18 million doses were applied to cattle, about 2.6 million doses used in sheep and about 0.2 million doses in goats. The number of BTV-8 cases/outbreaks decreased from more than 20,000 registered in 2007 to about 3,000 reported in 2008. Most cases/outbreaks occurred in a ring-shaped area adjacent to the epidemic area affected in 2007. Due to the late availability of vaccines many animals were not fully protected when the bluetongue season started. As a consequence, there was still a limited number BTV-8 cases/outbreaks. In 2009, the number of cases decreased further. Between 1st of May and 11th of August only 3 cases were reported. In the meantime, other BTV serotypes have also appeared in the region, namely BTV-1, which is currently expanding in France in north-eastern direction, BTV-6, which has appeared for the first time in late summer/autumn 2008 in the Netherlands and Germany, and BTV-11, which has been detected in Belgium. The current epidemiological situation of bluetongue disease in Germany will be described and analysed.

Contributed talk

TRAUMATIC MYIASIS - A MOVEABLE FEAST!

Martin J. R. Hall

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Traumatic myiasis of livestock is a major animal welfare issue and, if untreated, can result in serious tissue injury, productivity losses, reproduction losses and death. It is also a zoonosis, human cases generally occurring in the very young or very old, even in modern hospital settings. Most of the calliphorid species that cause traumatic myiasis in Europe, such as *Lucilia sericata* and *Chrysomya albiceps*, are facultative parasites. The single obligate parasite causing this condition in Europe is the sarcophagid flesh fly, *Wohlfahrtia magnifica*, Wohlfahrt's wound myiasis fly. This species occurs in Southern Europe, around the Mediterranean Basin and eastwards into Eurasia. In Europe there are two major genetic lineages of this species, one in the west and another in central regions and the east. The eastern lineage is also found in the far south-east of the distribution, in Afghanistan, differing little from populations in Europe and suggesting that human trade along the Eurasian "Ruminant Street" has helped to spread the parasite. Prevention and control of myiasis due to *W. magnifica* can be problematic, especially of lactating females in sheep and goat herds which are kept for milking, because of the withdrawal periods for many of the insecticidal products. *Wohlfahrtia magnifica* is a potentially invasive species, with a recent flare up in Morocco and an introduction to Crete as examples. Like many other pest species, global warming could enable it to move northwards in Europe, with damaging consequences for the naïve hosts that would thereby be exposed.

Invited lecture

ANY EVIDENCE FOR THE NORTHWARDS SPREAD OF PHLEBOTOMINE SANDFLIES AND CANINE LEISHMANIASIS IN EUROPE?

Paul D. Ready

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Phlebotomus species of the subgenus *Larroussius* (Diptera, Psychodidae, Phlebotominae) are the most frequently incriminated European vectors of *Leishmania infantum* Nicolle (Kinetoplastida, Trypanosomatidae), the causative agent of zoonotic leishmaniasis in the Mediterranean region (Ready, P.D. 2008. Leishmaniasis emergence and climate change. In: Climate change: impact on the epidemiology and control of animal diseases (Ed., S. de la Roque). *Rev. sci. tech. Off. Int. Epiz.* 27 (2), 399-412). This talk weighs the evidence for and against the spread of the vectors and canine leishmaniasis during the last three decades, in the period of increased global warming. *Phlebotomus (Transphlebotomus) mascittii* is widespread in northern France, Belgium and southern Germany, and reports on its vector competence have long been awaited. Even if vector competence is demonstrated, the vectorial role of *P. mascittii* is likely to be restricted by its low biting rates. Any northwards spread of this canine and human disease is likely to involve dogs (the reservoir hosts) that originate from the Mediterranean region, or have accompanied their owners on holidays to rural Mediterranean areas. Dog-to-dog transmission should be investigated in more depth. Acknowledgements: This work was partially funded by EU grant GOCE-2003-010284 EDEN (http://www.eden-fp6project.net/). The contents of this abstract and talk are the responsibility of the author and do not necessarily reflect the views of the European Commission.

Invited lecture

IDENTIFICATION OF HOUSE FLIES OF MEDICAL AND HYGIENIC IMPORTANCE (DIPTERA: MUSCIDAE)

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The Muscidae is a large dipteran family of some 4500 species and with a cosmopolitan distribution. Many species exhibit various degrees of synanthropy, and some are important from a medical and veterinary point of view. These include species which annoy humans and animals as well as parasites and vectors of disease. The mere presence of house flies, for example, can be irritating to animals and people when they settle on their hosts in huge numbers and/or feed on glandular secretions (e.g. *Musca autumnalis*, *Hydrotaea* spp.). Such activity may also impact on animal behaviour and health and may cause significant economic losses in animal husbandry. In rare cases, house flies can even cause allergic reactions. Non-biting species like *Musca domestica* can be mechanical vectors that transfer pathogens (viruses, bacteria, fungi, protozoa, and nematodes) when they move from contaminated faeces to food products. Biting species such as *Stomoxys calcitrans* and *Haematobia irritans* feed on animal blood, causing pain and leading to discomfort as well as to pathological reactions caused by loss of blood, toxic reactions due to injected saliva, and transmission of pathogens or retardation in wound healing. Larvae of some species (e.g. *Musca domestica*, *Muscina levida*) can be involved in cases of secondary myiasis. In contrast to the harm caused by many species, some Muscidae such as *Hydrotaea aenescens* and *Muscina* spp. are proposed as biological agents for pest control. The main aim of the workshop is to present information about the biology and short keys for the identification of important genera and species of Muscidae with medical and veterinary relevance. The characters discussed in the workshop should facilitate the easy and quick identification of these species. In other cases, species identification might require more sophisticated identification keys.

Conference satellite workshop

INTESTINAL ANTIBACTERIAL FACTORS AND THEIR INTERACTION WITH SYMBIONTS IN *TRIATOMA INFESTANS*

Christian Meiser,[1] Jennifer Pausch,[1] Marina Oldenburg,[1] Eileen Knorr,[1] Astrid Kollien,[1] Carsten Balczun,[1] Sandra Schmidt,[2] Wolfgang Schuhmann,[2] Günter Schaub[1]

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Triatomines are important vectors of *Trypanosoma cruzi*, the aetiological agent of Chagas disease, which is endemic in Latin America. These insects are obligate bloodsuckers and their development depends on symbionts. After blood ingestion the number of symbionts in the cardia and stomach of *Triatoma infestans* increases about 18-fold, up to 18 x 10^8 CFUs and after passage to the small intestine only 0.01% of this population survives. In potentiometric pH measurements, the ingested blood increased the pH in the stomach from 6.2-6.7 up to pH 7.3. One, 10 and 20 days after feeding, the pH changed to 6.7, 5.2 and 5.6, respectively. In the small intestine the pH values followed this schedule without the initial increase. In photometric determinations, the antibacterial activity in both regions against *Micrococcus lysodeikticus* was highest at pH 4 and 7. No activity seems to occur against the symbiont. Zymography of the intestinal content revealed that the main activity is caused by proteins of about 14 kDa and results from different factors. In *Triatoma infestans* two genes encoding for lysozyme had been sequenced. The two lysozymes belong to Glycoside-hydrolase family 22 and consist of a hydrophobic signal peptide and a mature protein. The gene encoding for lysozyme 1 is strongly expressed in the stomach and at a much lower level in the small intestine in which the mRNA of lysozyme 2 with a much lower pI is present. Therefore, lysozyme 1 seems to be not directly involved in the control of the symbionts in the stomach.

Contributed talk

FROM INTEGRATED PEST CONTROL TO HOLISTIC RISK REDUCTION – SUSTAINABLE MANAGEMENT OF NUISANCE PESTS, DISEASE CARRIERS AND VECTORS

Eva Scholl

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Human understanding of pests and disease through history underwent several major changes. A biblical reference list to plague was given in The Book of Job. May beetle control remained priest responsibility until the 19th century. On the other side, the 1347 European plague was already recognized as a vector borne disease. Entomology in the United States of America was pushed by xenophobia and supported by German immigrants. Overseas activities of the United States, Great Britain and others provided comprehensive Public Health experience. The focus in Germany – except for the GDR – moved to agrochemicals, which were considered more profitable for the industry. Based upon Global 2000 and the need for resistance prophylaxis, Medical Entomology in Germany started at the US-Army Europe in the 1980´s under the umbrella of Preventive Medicine, followed by multi-chemical sensitivity management and holistic risk reduction. Greatly improved pest management and a drastic pesticide use reduction were the main results. As a consequence, Pest Biology (Schädlingsbiologie) evolved as Preventive Medicine for the human environment. The focus is the immediate human environment including indoor and recreation areas. Major issues are to achieve and to maintain pest absence; risk reduction consistency, including economy and ecology; holistic approaches for complex systems; considering all aspects of influence; aiming properly prior to action: “leave more, do less”; the wise use of synergies, etc. Many improvements to reduce risks can be implemented without delay, e.g., tick bite reduction as an interim target, before complete knowledge is acquired. Quality assurance for pest control needs attention. An incentive system for less effort / more efficiency should be introduced.

Contributed talk

LYME BORRELIOSIS: WHERE DO WE GO FROM HERE?

Peter Kraiczy

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Lyme borreliosis is the most prevalent vector-borne anthropozoonosis affecting humans in Europe, the United States, and a broad swath across Asia with 60,000 newly reported clinical cases per year in Germany. Symptoms of human Lyme borreliosis generally include non-specific “flu-like” complaints such as fever and body aches, and may or may not include symptoms such as skin rashes and lesions, arthritis, and neurological or cardiac difficulties. Genetic analyses of the causative agent, the spirochete *Borrelia burgdorferi* sensu lato (s.l.), have divided that species into at least 15 species including *B. burgdorferi* sensu stricto (s.s.), *B. afzelii*, *B. garinii*, *B. spielmanii*, *B. valaisiana*, *B. lusitaniae*, *B. andersonii*, *B. bissettii*, *B. japonica*, *B. turdi*, *B. sinica*, *B. tanukii*, *B. californiensis*, *B. carolinensis*, and *B. bavariensis*. In Central Europe, *B. burgdorferi* s.s., *B. afzelii*, *B. garinii*, *B. spielmanii* as well as *B. bavariensis* are the most common causative agents of Lyme borreliosis while also *B. bissettii*, *B. valaisiana*, and *B. lusitaniae* appear to be associated with this multisystemic disorder. Spirochetes of the *B. burgdorferi* s.l. complex alternates in nature between diverse vertebrate hosts and ixodid tick vectors. For Europe, the hard-bodied tick, *Ixodes ricinus* plays a central role as vector in transmission of all borrelial species known to be pathogenic for humans. *I. ricinus* is indigenous to the whole of Europe (except Iceland) between sea levels and altitudes of up to 2000 m, and prefers locations with high humidity and moderate temperatures. To complete their life cycle, ticks take a single blood meal at each parasitic postembryonic stage: larva, nymph, and adult. Seemingly, climate change impacts the density of ticks, the distribution of the vector at higher altitudes, and the severity of Lyme borreliosis by influencing the feeding patterns of an infected tick. Certain ecological and social factors also have an effect on the frequency of Lyme borreliosis. Interestingly, the broad spectrum of reservoir hosts contributes differentially to the prevalence of a particular borrelial species which appears to be associated with a distinct pattern of host specialization. A growing body of experimental evidence also indicates that the reservoir competence of a host for a borrelial species is independent of extrinsic ecological factors but strongly correlates with the spirochetes´ susceptibility to the innate immune system of a particular host.

Invited lecture

THE ROLE OF THE EUROPEAN HEDGEHOG (*ERINACEUS EUROPAEUS*) IN THE EPIDEMIOLOGY OF ARTHROPOD-BORNE DISEASES

Jasmin Skuballa,[1,2] Miriam Pfäffle,[1] Trevor Petney,[1] Horst Taraschewski,[1] Rainer Oehme,[2] Kathrin Hartelt,[2] Peter Kimmig [2]

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Over the last four decades, a number of vector-borne infections have been recognized for the first time. These have become increasingly important as a public health problem. In the transmission of many zoonotic diseases, species of blood-feeding arthropods act as vectors while domesticated and/or wild animals often serve as reservoir hosts for the pathogens. The European hedgehog (*Erinaceus europaeus*) is a common wild mammal in Central Europe. Although frequently found in rural and suburban habitats (e.g. gardens), only little information is available on the role of this protected species in the epidemiology of vector-borne diseases. In Central Europe, many conservation activists, running hedghehog rehabiltation centres, care for sick, injured or underweight hedgehogs. These animals are often heavily infested with ticks, fleas and mites. Hedgehogs are known to host all life history stages of the hedgehog tick, *Ixodes hexagonus*, as well as the most common European tick, *Ixodes ricinus*. Both parasites are known as vectors of *B. burgdorferi* s.l., tick-borne encephalitis virus and other pathogens. We have detected 3 species of the *B. burgdorferi* s.l. complex (*B. afzelii*, *B. garinii*, *B. spielmanii*), and another vector-borne pathogen *Anaplasma phagocytophilum* in hedgehogs and in the ticks attached to them. In addition, fleas can reach high numbers on hedgehogs and are known to transmit diseases such as *Rickettsia* spp. Additional studies are necessary to define the role of this animal in the epidemiology of vector-borne diseases in Europe.

Contributed talk

DERMACENTOR TICKS AS VECTORS FOR *COXIELLA BURNETII* AND *RICKETTSIA* SPP. IN SOUTHERN GERMANY

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Two species of *Dermacentor* ticks exist in Germany: *Dermacentor marginatus* is restricted to some areas along the Rhine and Main valley, whereas *D. reticulatus* occurs in small foci throughout Germany. *D. reticulatus* has already extended its distribution in the last years, probably due to increasing temperatures; this process is supposed to go on in the future, and *D. marginatus* might spread likewise. In the Mediterranean area, *Dermacentor* ticks are known as vectors for a number of pathogens, including *Coxiella burnetii*, the causative agent of Q-fever, and *Rickettsia* spp. If *Dermacentor* spp. spread further throughout Germany, the pathogens might also spread and thereby cause new risks for human infections. To assess this prospective risk, it is important to know the current distribution and prevalence of these agents in tick populations. Therefore, we collected 666 *Dermacentor* ticks and 119 rodents at three collection sites in Southern Germany. Ticks and rodents were screened by PCR and ELISA, respectively, for *C. burnetii* and *Rickettsia* spp. No *C. burnetii*-positive samples could be detected by PCR or ELISA, suggesting that ticks and rodents do not play an essential role in the epidemiology of Q-fever in Germany. *Rickettsia* spp. were found in 31% of all examined ticks by PCR, whereas no *Rickettsia*-infected rodents were detected. By sequencing of a part of the *rOmpA*-gene, we could identify *Rickettsia raoultii* in 30.3% and *Rickettsia slovaca* in 0.75% of ticks, respectively. The pathogenicity of *R. raoultii* is unknown so far; in contrast, *R. slovaca* is known to be the causative agent of tick-borne lymphadenopathy (TIBOLA), a usually mild human disease. Because of our detection of *R. slovaca* in *Dermacentor* ticks and its possible transmission to humans, TIBOLA should be considered in the differential diagnosis of tick-borne diseases. Our data show that more studies are necessary to elucidate the current distribution of *R. slovaca* and other tick-borne pathogens in Germany.

Invited lecture

THE MASS OCCURRENCE OF BLACK FLIES (DIPTERA: SIMULIIDAE) IN EUROPEAN LOWLAND RIVERS AND THEIR MANIPULATION BY CHEMICAL CONTROL AND THE RENATURALIZATION OF RIVERS

Doreen Werner[1,2]

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Biotic and abiotic factors determine the biodiversity within a given habitat. Changes in the species composition of individual animal groups may be the result of human influences on environmental factors, which may lead to a reduction in the species diversity of various groups on the one hand, and to increased possibilities for local and regional range expansion of the biota that remain on the other hand. This can be seen particularly clearly in aquatic habitats. One of the insect families that best demonstrates this situation in running water systems is the Simuliidae (black flies). This group of Diptera has important functions in the aquatic food chain and in the breakdown of organic substances. It is also a group of aggressive ectoparasites with some species being responsible for various veterinary, medical and economic problems, in particular when mass occurrence takes place. The presentation will discuss the re-naturalized courses of European lowland rivers, especially the River Oder, in relation to the species spectrum and abundance of the Simuliidae. The harmful effects that black flies may have will be demonstrated by means of examples. A review of the various control methods and their influence on the riverine environment in general will be given. The role of natural predators will also be discussed. Black flies are attacked in all their life stages by a wide variety of organisms, ranging from birds and fishes at one end of the scale to protozoans and nematodes at the other. Some act as internal parasites, attacking mainly the larval stages. Others are predators and scavengers – there is only a fine line between these feeding strategies – and attack egg, larval, pupal and adult stages.

Invited lecture

CLIMATIC AND ECOLOGICAL CHANGES AND MOVEMENT AND ESTABLISHMENT OF MEMBERS OF THE *SIMULIUM DAMNOSUM* COMPLEX IN WEST AFRICA.

Daniel Adjei Boakye

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Members of the *Simulium damnosum* complex in West Africa are the vectors of human onchocerciasis in the sub-region. The complex comprises nine described cytospecies generally classified into two groups; savannah and forest based on their preferred ecological habitat. The different species exhibit different vectorial capacities especially related to the transmission of the blinding and non-blinding strains of *Onchocerca volvulus*. Thus, the distribution of the various species, distances covered during migrations, establishment of viable colonies and infectivity of migrant blackflies are important factors for disease control and elimination. Larvae and adult samples were collected from various sites in West Africa and identified through cytotaxonomy and morphology respectively. The distribution of the various species was found to be influenced by seasonal climatic changes. In the rainy season most of the species migrated northwards thereby extending their distribution in that direction while in the dry season the movement and extension is towards the south. The establishment of each species was however not related only to fly movement during the seasonal changes but it is linked to the availability of suitable breeding sites. Human activities that lead to environmental changes such as deforestation were found to influence the establishment of permanent populations of savannah species in the forest zone and could become a source of blinding disease in the forest.

Invited lecture

DEVELOPMENT OF VEGETABLE FARMING: A CAUSE OF THE EMERGENCE OF INSECTICIDE RESISTANCE IN POPULATIONS OF *ANOPHELES GAMBIAE* IN URBAN AREAS OF BENIN

Anges William M Yadouleton,[1,2] Alex Asidi,[1] Rousseau F Djouaka,[3] James Braïma,[3] Christian D Agossou,[1] Martin C. Akogbeto [1]

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A fast development of urban agriculture has recently taken place in many areas in the Republic of Benin. This study aims to assess the rapid expansion of urban agriculture especially, its contribution to the emergence of insecticide resistance in populations of *Anopheles gambiae*. The protocol was based on the collection of sociological data by interviewing vegetable farmers regarding various agricultural practices and the types of pesticides used. Bioassay tests were performed to assess the susceptibility of malaria vectors to various agricultural insecticides and biochemical analysis were done to characterize molecular status of population of *An. gambiae*. This research showed that: (1) The rapid development of urban agriculture is related to unemployment observed in cities, rural exodus and the search for a balanced diet by urban populations; (2) Urban agriculture increases the farmers' household income and their living standard; (3) At a molecular level, PCR revealed the presence of three sub-species of *An. gambiae* (*An. gambiae s.s., Anopheles melas and Anopheles arabiensis)* and two molecular forms (M and S). The *kdr* west mutation recorded in samples from the three sites and more specifically on the M forms seems to be one of the major resistance mechanisms found in *An. gambiae* from agricultural areas. Insecticide susceptibility tests conducted during this research revealed a clear pattern of resistance to permethrin (76 % mortality rate at Parakou; 23.5% at Porto-Novo and 17% at Cotonou). This study confirmed an increase activity of the vegetable farming in urban areas of Benin.This has led to the use of insecticide in an improper manner to control vegetable pests, thus exerting a huge selection pressure on mosquito larval population, which resulted to the emergence of insecticide resistance in malaria vectors.

Contributed talk

CONTROL OF MOSQUITOES BY MASS TRAPPING: FIELD STUDIES IN ITALY AND BRAZIL WITH BG-SENTINEL TRAPS

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BG-Sentinel traps were shown to be excellent traps for mosquitoes of the subgenus *Stegomyia*, specifically *Aedes aegypti* and *Aedes albopictus*. Besides their use as highly efficient surveillance tools for these species in monitoring programs and risk assessments, this trap type may also have a role as a control tool. Data from field studies performed in Italy (on *Ae. albopictus*) and in Brazil (on *Ae. aegypti*) show that the continuous use of traps resulted in reduced population sizes of these species when compared to control areas without mass trapping. In the study in Italy, three clusters received treatment with eight BG-Sentinel traps each (intervention) and three clusters served as a control without traps. The mosquito population density was determined by measuring the human landing rate (biting rate), which was reduced by up to 80%, compared to control areas. The number of eggs in the ovitraps (a measurement of the density of oviposition-site seeking mosquitoes) was reduced by up to 60%. The study in Brazil was performed in the city of Manaus and involved six clusters with a total of 734 households, 444 households of which were using one BG-Sentinel trap each. Six clusters with a total of 753 households served as a control. Due to the risk of dengue fever, no human landing collections were performed, but additional BG-Sentinel traps were used to monitor the population sizes of host-seeking female *Ae. aegypti* mosquitoes. Oviposition-site seeking females were additionally monitored by capturing them with sticky ovitraps (MosquiTRAPs). Compared to the control areas without BG-Sentinel traps, the catching rates of the monitoring traps decreased by up to 59%. Sticky traps for oviposition-site seeking females captured up to 51% fewer mosquitoes in the intervention areas than in the control areas.

Contributed talk

NETWORK "RODENT-BORNE PATHOGENS" IN GERMANY: MOLECULAR EPIDEMIOLOGY OF HANTAVIRUS AND *LEPTOSPIRA* INFECTIONS IN RODENT HOSTS

Rainer G. Ulrich,[1] Mathias Schlegel,[1] Gerald Heckel,[2] Jens Jacob,[3] Jonas Schmidt-Chanasit,[4] Boris Klempa,[5,6] Martin H. Groschup,[1] Detlev H. Krüger,[6] Martin Pfeffer,[7] Holger C. Scholz,[8] Angelika Draeger,[9] Sandra S. Essbauer,[7] Karsten Nöckler [9]

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Rodents are important reservoirs for a large number of zoonotic pathogens with direct or vector-mediated transmission to humans (e.g. hantaviruses, *Leptospira* spp., and Tick-borne encephalitis virus, *Borrelia* spp.). The knowledge of the geographical distribution, molecular evolution of rodent-borne pathogens and of reasons for clusters of human infections in Germany is limited. Therefore the network "Rodent-borne pathogens" was initiated for a synergistic collaboration on rodents and pathogens. Embedded in the network, a total of about 7,400 wild and commensal rodents were collected in 15 federal states of Germany since 2001. In bank voles (*Myodes glareolus*) trapped in regions in southern and western Germany with previous hantavirus cases a high prevalence (up to 60%) of *Puumala virus* (PUUV) was observed. Initial longitudinal studies in Cologne and a rural region close to Osnabrück demonstrated a continuing PUUV prevalence in the bank vole populations. The striped field mouse (*Apodemus agrarius*) was identified as reservoir host of *Dobrava-Belgrade virus* in northeastern Germany. *Tula virus* (TULV) was for the first time demonstrated to be present in two *Microtus* species (*Microtus arvalis*, *M. agrestis*) in Brandenburg and Lower Saxony. *Leptospira*-PCR analysis of 332 rodent kidney samples resulted in the detection of 67 positive samples originating from seven federal states and six rodent species (average prevalence 24% with a range of 3.2% and 64.7%). In conclusion, our investigations revealed an unexpected broad geographical distribution of different hantavirus and *Leptospira* species in rodents in Germany. The initiated studies will set the basis for understanding the molecular evolution and changes in the distribution of rodent-borne pathogens. This may become very important for setting up a risk assessment for human infections especially with the changes in the epidemiology of rodent-borne pathogens expected in the light of climate changes in the future.

Contributed talk

VARIATION IN *ANOPHELES GAMBIAE* S. L. EXHIBITING DIFFERENT VECTORIAL CAPACITIES FOR LYMPHATIC FILARIASIS TRANSMISSION IN COASTAL GHANA

Hilaria Amuzu, Michael Wilson, Daniel Boakye

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Anopheles species are considered to possess well developed cibarial armature which make them less efficient vectors of *Wuchereria bancrofti* at low level microfilaraemia. The higher the number of teeth, the more efficient it is at lacerating the parasite at low level microfilaraemia thereby facilitating elimination of the disease. Two endemic communities in Central Region of Ghana which have undergone six rounds of mass drug administration (MDA) with different level of annual transmission potentials (ATP) were studied to determine the sibling species of *An. gambiae* s.l, molecular forms of *An. gambiae* s.s and the number of teeth. Human landing catches of mosquitoes was done from 1800 to 0600 GMT. *Anopheles gambiae* s.l was identified morphologically and by PCR-RFLP. The heads were cleared, mounted and the number of teeth counted. The community with lower ATP had only *An. gambiae* s.s while *An. melas* and *An. gambiae* s.s were found at the site with high ATP. One mosquito which was identified as *An*. *gambiae* s.l but could not be identified using PCR had 8 teeth which is very different from those of *An. gambiae* s.s and *An. melas*. There was a significant difference (p=0.014) in the number of teeth among *An. melas, An. gambiae* ss M and S molecular forms. The mean number of teeth in *An. melas* was 14 (range= 12-15) which was significantly less than those of *An. gambiae* M form (mean=15.45; range=13-19; p= 0.032) and S form (mean=16; range= 15-17; p=0.002). No significant difference (p= 0.503) was found in the number of teeth of the M and S forms. The lower number of teeth makes *An. melas* more efficient at picking *W. bancrofti* at low level microfilaraemia than *An. gambiae* ss. It may be necessary to augment MDA with vector control in areas where *An. melas* is the main vector. There is the need to identify the *Anopheles* species with the 8 teeth since its lower number potentially makes it a more efficient vector than both *An. gambiae* s.s and *An. melas*.

Poster presentation

SYNANTHROPIC FLIES AS POTENTIAL VECTORS OF PATHOGENIC AGENTS

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The order Diptera outranks other insect orders in terms of medical and veterinary significance. They are responsible for the transmission of a wide variety of pathogens such as bacteria, fungi, protozoan and metazoan parasites to animals and humans. Among them a few hundreds of fly species are common pests in and around human homes and farms. Therefore the study of these synanthropic flies as possible carriers and transmitters of frequent pathogenic agents and their potential involvement in the spreading of diseases is of essential importance. In the present study we investigated the pathogenic burden of 486 wild flies caught at different animal related places in Dormagen (NRW, Germany). Most of the caught species belong to muscoid flies (e.g. *Musca domestica*, (I: 62%), followed by blow flies and flesh flies. The flies were examined for the pathogenic agents they carried with standard microbiological and parasitological methods. We could detect a large diversity of different bacterial and fungal species, protozoan and even metazoan species on the exoskeletons and in the intestines of the flies. Among them we could prove life threatening bacteria species such as enteropathogenic *Escherichia coli*-strains (EAEC, EHEC, ETEC, EPEC), potential pathogenic fungi (e.g. *Candida albicans*, *C. tropicalis*), eggs and larvae of animal helminths (e.g. *Ascaris suum*) as well as the hog louse *Haematopinus suis*. The present study emphasizes the potential of synanthropic flies (especially the house fly *M. domestica*) as a crucial vector of multiple pathogenic agents.

Poster presentation

TIGER MOSQUITOES: THE INVASION OF EUROPE

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Following its introduction into Albania in 1979 and into Italy in 1990, the Asian Tiger Mosquito (*Aedes albopictus*) has colonised large areas of southern Europe and is now a common pest in the Mediterranean. *Aedes albopictus* is an important vector of chikungunya and dengue viruses and has caused an outbreak of chikungunya fever in Italy in 2007. It has also become a major vector of canine heartworm disease in Italy. Although there are conflicting prognoses regarding the future spread of this species under climate change scenarios, there is a broad consensus that its range in Europe, if not controlled, is poised to expand significantly. This project seeks to reconstruct the history of Europe's invasion by Tiger Mosquitoes based on DNA evidence. Using multiple genetic markers and new statistical methods, we test several hypotheses concerning the introduction and spread of this species in Europe, e.g., the number of times it was introduced and the geographic origin of its source population(s). This has great applied significance for projections of future range expansions and for planning control measures. So far, we collected 390 mosquitoes from 15 sampling sites in southern Europe. For a first estimation of genetic diversity, a 480 bp fragment from the barcode region of the mitochondrial cytochrome oxidase subunit I (COI) gene from 145 specimens was sequenced and analyzed together with sequences from outside Europe obtained from the EMBL/DDBJ/GenBank database. As expected, overall CO I diversity was very low. Outside the original species distribution in Asia we found only a limited number of haplotypes pointing to a restricted area of origin, for example in Vietnam or Thailand. At the moment the minimum estimate of females introduced into Europe is five, as it equals the number of CO I haplotypes. Further analyses will be conducted with high resolution microsatellite markers.

Poster presentation

DIVERSITY AND POPULATION STRUCTURE OF *CULEX PIPIENS* COMPLEX MOSQUITOES IN BANGLADESH: PRELIMINARY RESULTS FROM MITOCHONDRIAL DNA SEQUENCE ANALYSIS

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The genus *Culex* comprises a large number of mosquito species with a global distribution. In Bangladesh, members of the *Culex pipiens* complex are important vectors of lymphatic filariasis. Morphologically, members of this complex are often hard, or even impossible to distinguish. In the context of a diversity-oriented pilot study of mosquitoes in Bangladesh we carried out a preliminary survey of geographical variation and molecular diversity of morphologically identified *Culex quinquefascaitus*. Mosquitoes were collected in December 2008 and February 2009 from 12 populations in various different eco-regions across the national territory of Bangladesh using BG-Sentinel traps and hand-held aspirators. Approximately 650 base pairs from the barcode region of the mitochondrial cytochrome oxidase subunit I gene (CO I) was sequenced for at least ten morphologically identified adult mosquitoes from each locality. These sequences were analyzed together with other *Culex* sequences from the EMBL/DDJB/GenBank database, and clustered by neighbor-joining. The DNA evidence revealed a much greater diversity of *Culex pipiens* complex mosquitoes than was expected based on the morphological identification. In addition to a few highly divergent sequences that might respresent rare sorting errors, there were three major and geographically largely co-distributed clusters of haplotypes, some of them with larger sequence divergences than between other recognized *Culex* species. These findings are important from the perspective of both vector and disease control: As the different mitochondrial genetic lineages might also differ in biting habits, vector competences, vector capacities, insecticide resistance and other features, further studies on their genetic cohesiveness and ecology are indicated.

Poster presentation

HEAT TOLERANCE OF THE BED BUG *CIMEX LECTULARIUS*

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The use of high temperatures is a physical method to provide a non-chemical alternative to chemical control of bed bugs. As exact data on thermal tolerance of bed bugs are lacking, we present data for lethal temperatures, necessary exposure times and the influence of temperature on bed bug metabolism. Groups of adults, juveniles and eggs (group size = 20 individuals) were exposed to ambient temperatures T_A of 45 °C and 50 °C at exposure times of 10, 15, 20, 25 and 30 min (n = 4 for each temperature/exposure time). Bed bugs were transferred to small wooden tubes in a water bath and T_A was directly recorded in the wooden tubes. We used wooden tubes (L 50 mm, Ø 15 mm, wall 2 mm) in order to simulate practical thermal treatment situations, where bed bugs are aggregated in crevices and other small hideouts and T_A at the aggregation sites increase more slowly than at exposed places during heat treatments. After treatment, the adults and juveniles were kept at 25 °C and eggs at 31 °C. Bug activity was controlled following heat exposure after 1 h, 6 h, 24 h, 48 h, 72 h, 96h and 7 d. All bed bugs (adults, juveniles and eggs) were dead after an exposure time of 10 min at T_A 50°C and after 30 min at T_A 45 °C. At T_A 45 °C, adults were less heat resistant (97.5 % survivors after 15 min treatment, no survivors at 20 min) compared to eggs (still 17.5 % hatchlings after 25 min, no hatchlings after 30 min). In addition to our thermal tolerance experiments, we determined metabolic rates of adult bed bug groups (group size 20 individuals) at different T_A (30 °C to 45 °C) in an isoperibolic batch microcalorimeter (Biocalorimeter B.C.P.; Electronique Arion, Orsay, France). The calorimeter contained a measuring and a reference vessel with volumes of 15 ml each. At T_A 42 °C, bed bugs died after 90 min. Shortly before death, the metabolic rates of bed bugs showed a sudden increase, followed by a drop. Data from our experiments will be useful for a better understanding of heat treatment of bed bugs.

Poster presentation

LANDSCAPE ATTRIBUTES INFLUENCE ECTOPARASITE INFESTATIONS OF HEDGEHOGS (*ERINACEUS EUROPAEUS*) IN AN URBAN - SUBURBAN ENVIRONMENT

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Environmental conditions influence animal occurrences and behaviour in various ways, most likely influencing interactions between animal hosts and their ectoparasites with changing environmental conditions and across habitat types. Therefore, host individuals that exploit heterogeneous and patchy environments may by at varying risk of ectoparasite and disease acquisition. How and at which scales interaction processes between parasites, hosts, and the environment are realized remains largely unknown. We examined the infestation patterns of 56 hedgehogs (*Erinaceus europaeus*) with fleas and ticks at a relatively small spatial scale within a 12 km^2 area along a suburban - urban gradient in southwestern Germany. Landscape composition and configuration surrounding hedgehog locations were estimated from digital land cover data within radii of 20, 50, and 100 meters. These were assumed to match the ranging area and underlying heterogeneous environmental matrix in which host - parasite interactions take place. Landscape-based models suggested that flea burdens were most meaningfully associated with the overall diversity of land cover types, as well as with the number and areal coverage of roads within radii of 50 and 100 meters. Tick infestation levels were mostly explained by the areal coverage of built-up areas within 100 m radius, the number of forest patches and roads within 50 m radius, as well as time of capture. Our results suggest that heterogeneous landscape matrices affect host-parasite interactions in urban environments, with clear differences at the individual level.

Poster presentation