

PUBLICise HEALTH

Public Health Telegram on Vector-borne Diseases

Issue No. 4 – CuliBo

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Welcome to the fourth issue of the EDENext Public Health Telegram, the newsletter from the EDENext project focusing on our vector-borne disease research results with direct or indirect impacts on Public Health issues.

EDENext is investigating the biological, ecological and epidemiological components of vector-borne disease introduction, emergence and spread, and creating new tools to control them.

EDENext comprises five specialised vector groups. In this issue we concentrate on the work of the group on *Culicoides*-borne diseases (Diptera, Ceratopogonidae).

EDENext is seeking to make research more visible, comprehensible and applicable to the public and policy makers, embedding the research results from each vector group in the context of Public Health and vector-borne disease control in Europe. The EDENext Public Health Telegram was established to inform interested individuals and institutions about research results on vector-borne diseases with direct or indirect impact on Public Health issues.

For more details about the project, visit www.edenext.eu



Culicoides nubeculosus female, feeding on human arm
(The Pirbright institute, UK)

In this issue, research results from the EDENext

***Culicoides*-borne disease (CuliBo)** group (01/2012 – 03/2014) include:

1. The impact of biting midges on human Public Health in Europe
2. Lack of *Leishmania* vector competence of biting midges
3. The role of *Culicoides* in the transmission networks of blood parasites in south-west Spain
4. Insecticide treated nets as cost-effective preventive measures against *Culicoides*
5. The role of wind and midge flight activity in spreading disease
6. Updates from *Culicoides*-borne disease research in Denmark



EDENext
Biology and control of vector-borne
infections in Europe



CuliBo research results & Public Health

1. The impact of biting midges on human Public Health in Europe

The EDENext study by **Carpenter et al (2013)** considers the impact of biting midges of the genus *Culicoides* on human health in Europe. Special focus is put on their potential for transmitting human pathogenic arboviruses. So far, the only arboviruses identified as being primarily transmitted by *Culicoides* among humans are the Oropouche virus (OROV) and the Iquitos virus (IQTV). These two members of the family *Orthobunyaviridae* cause major epidemics of febrile illness in human populations of South and Central America and the Caribbean. The authors describe factors promoting sustained outbreaks of OROV in Brazil from an entomological perspective and assess areas of the epidemiology of this arbovirus that are currently poorly understood but may influence the risk of incursion into Europe. Additionally, the role of *Culicoides* in the transmission of other zoonotic infections is examined and placed in context with the presence of other potential vector groups in Europe.

Carpenter S., Groschup MH., Garros C., Felipe-Bauer ML., Purse BV.:
Culicoides biting midges, arboviruses and public health in Europe.
Antiviral Res. 2013 Oct;100(1):102-13. doi: 10.1016/j.antiviral.2013.07.020. Epub 2013 Aug 8.

2. Lack of *Leishmania* vector competence of biting midges

Leishmaniasis are diseases caused by various species of the trypanosomatid protozoa genus *Leishmania*. They can cause various symptoms, ranging from a cutaneous form that leads to cutaneous ulcers at the bite site to a highly pathogenic visceral form. Millions of human cases are reported from Asia, Africa, South and Central America as well southern Europe every year. Female biting sand flies of the genus *Phlebotomus* in the Old World or *Lutzomyia* in the New World are currently the only known vectors of *Leishmania* sp. Recent observations of Australian midges transmitting *Leishmania* may indicate that biting midges might also play a role as potential *Leishmania* vectors. To investigate this theory, **Seblova et al (2012)** experimentally infected the colonized biting midge species *Culicoides nubeculosus* with two human pathogenic *Leishmania*



species (*L. infantum* and *major*). An early stage of *Leishmania* development was demonstrated in the midgut until two days after feeding, but a subsequent loss of parasites occurred. The authors hypothesise that a lack of midgut attachment in the midgut is the major refractory barrier that prevents *Culicoides nubeculosus* from becoming a successful *Leishmania* vector. Additionally, they illustrate that PCR positivity alone, especially when non-quantified, is misleading in the implication of arthropods other than sand flies as vectors of *Leishmania*. Direct microscopical observation of massive parasite infection in the anterior midgut remains a crucial method for any conclusions about the competence of the putative vector.

Seblova V., Sadlova J., Carpenter S., Volf P.:
Development of *Leishmania* parasites in *Culicoides nubeculosus* (Diptera: Ceratopogonidae) and implications for screening vector competence.
J Med Entomol. 2012 Sep;49(5):967-70.

3. The role of *Culicoides* in the transmission networks of blood parasites in south-west Spain

In comparison to vector species such as mosquitoes and black flies, only limited research has so far been conducted on the role of *Culicoides* in the transmission of blood parasites. **Ferraguti et al (2013)** examine the transmission networks of blood parasites from south-west Spain, with special focus on the role of *Culicoides* transmitting *Haemoproteus* and *Plasmodium* between wild birds. The results could be considered in regard to the potential role of *Culicoides* in the transmission of human pathogenic blood parasites.

Ferraguti M., Martínez-de la Puente J., Ruiz S., Soriguer R., Figuerola J.:
On the study of the transmission networks of blood parasites from SW Spain: diversity of avian haemosporidians in the biting midge *Culicoides circumscriptus* and wild birds.
Parasit Vectors. 2013 Jul 15;6:208. doi: 10.1186/1756-3305-6-208.



4. Insecticide treated nets as cost-effective preventive means against *Culicoides*

The EDENext studies by **Del Río (2014)** give attention to the use of nets treated with cypermethrin and deltamethrin as preventive measures against biting midges. While cypermethrin-treated nets did not show an insecticide or repellent effect (potentially also due to not choosing finer netting), deltamethrin-treated nets showed good results regarding the toxic effects on the observed *Culicoides* populations, although to a lesser extent under field conditions than in the laboratory. Therefore, the authors recommend the latter method in combination with other procedures for the control of biting midges and the diseases associated with them.

Del Río R, Barceló C, Lucientes J, Miranda MA.:

Detrimental effect of cypermethrin treated nets on *Culicoides* populations (Diptera; Ceratopogonidae) and non-targeted fauna in livestock farms.

Vet Parasitol. 2014 Jan 31;199(3-4):230-4. doi: 10.1016/j.vetpar.2013.10.014. Epub 2013 Oct 26.

Del Río R, Barceló C, Paredes-Esquivel C, Lucientes J, Miranda MA.

Susceptibility of *Culicoides* species biting midges to deltamethrin-treated nets as determined under laboratory and field conditions in the Balearic Islands, Spain.

Med Vet Entomol. 2014 May 29. doi: 10.1111/mve.12072. [Epub ahead of print]

5. The role of wind and midge flight activity in spreading disease

The EDENext study by **Sedda et al (2013)** examines the role of wind and midge flight activity in disease spread using the example of biting midges and Bluetongue disease (BTD), a viral disease of ruminants. The described framework of a novel model involving both mechanistic and stochastic steps might be useful for future Bluetongue disease outbreaks as well as other vector-borne diseases.

Sedda L., Brown HE., Purse BV., Burgin L., Gloster J., Rogers DJ. :

A new algorithm quantifies the roles of wind and midge flight activity in the bluetongue epizootic in northwest Europe.

Proc Biol Sci. 2012 Jun 22;279(1737):2354-62. doi: 10.1098/rspb.2011.2555. Epub 2012 Feb 8.



6. Updates from *Culicoides*-borne disease research in Denmark

The study by **Græsboøll et al (2012)** presents a process-based stochastic simulation model of a Bluetongue disease (BTD) epidemic outbreak in Denmark that can be implemented on other vector-borne diseases of grazing animals.

Kirkeby et al (2013) describe various models of light traps and the importance of these trapping systems for epidemiological research on vector-borne diseases with light sensitive insect vectors. In another paper, **Kirkeby et al (2013)** present a novel mark-release-recapture method for *Culicoides* in the field that allows a direct quantification of the exchange of such disease vectors between locations. Both present practical solutions to be implemented on vector-borne diseases.

Graesboøll K., Bødker R., Enøe C., Christiansen LE.:

Simulating spread of Bluetongue Virus by flying vectors between hosts on pasture.

Sci Rep. 2012;2:863. doi: 10.1038/srep00863. Epub 2012 Nov 16.

Kirkeby C., Græsboøll K., Stockmarr A., Christiansen LE., Bødker R.:

The range of attraction for light traps catching *Culicoides* biting midges (Diptera: Ceratopogonidae).

Parasit Vectors. 2013 Mar 15;6:67. doi: 10.1186/1756-3305-6-67.

Kirkeby C., Bødker R., Stockmarr A., Lind P., Heegaard PM. :

Quantifying dispersal of european culicoides (Diptera: Ceratopogonidae) vectors between farms using a novel mark-release-recapture technique.

PLoS One. 2013 Apr 22;8(4):e61269. doi: 10.1371/journal.pone.0061269. Print 2013.



Imprint

The Public Health Telegram on published vector-borne research results by the EDENext project partners is compiled by the EDENext Public Health group and is published at regular intervals.

For more details about the project, visit www.edenext.eu

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Contributions

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