

Phlebotomus mascittii as Potential Vector of Human Pathogens in Southwest Germany

Sandra Oerther*

Institute of Global Health, Heidelberg University, Heidelberg, Germany

ABSTRACT

Knowledge on sand-fly activity is very limited but is urgently needed to continue with research in this field. Among the currently numerous incoming asylum seekers occasional it came already to occurrence of severe, rare disorders/diseases. Cases of parasitic diseases needs to be expected based on poor sanitary, though on the other hand by unintentional unwanted introduction of organisms such as Leishmania. When emerging pathogens are detected early enough and mode of transmission will be clearer, this can become an opportunity to implement effective preventive and active measures. Due to the current climate change subject debate in different areas, such as circulating emerging viruses and parasites, this research idea should gain should meet interest and promotion, as it touches us all in the mind and focus on public health. The management for individual responsibility should be considered, to increase interactive communications, cooperations to obtain important information on the subject for future research.

Keywords: Sand fly; Leishmania; Phlebotomus mascittii; Human pathogen

INTRODUCTION

Due to climatic factors and rising annual average temperatures it is accepted that more species will profit and the establishment and risk of spreading of sand flies is to be expected in Southwest Germany. Sand flies are world-wide known because of their meaning as vectors for a broad spectrum of viral and parasitic diseases [1]. Warmer climate promotes a surviving and the propagation of diseases. Increasing transnational journeys, migration and the transport of commodities regarding the globalization contributes to an increased risk of transferable diseases [2]. In 1999 the first four sandflies in Germany were trapped and in 2000 a female sandfly in the city of Neuenburg (federal state Baden-Württemberg) [3].

Sandflies are feared transmitters of leishmaniosis. By the bite of an infected female sandfly the protozoa invades into the body of vertebrates, including humans. The sandflies found in Germany are as well potential carriers of disease. The disease attacks the body, depending on the form either of mucous membranes (mucocutaneous), the skin (cutaneous) or internal organs (visceral). Patients suffering from anemia, weight loss, fevers, spleen and liver enlargement. Is the disease untreated, it leads to death [4].

Each year the WHO estimates new cases worldwide to at least 200,000 to 400,000 [5]. Also in the Mediterranean region, where often the dogs are carriers of the parasite, the visceral leishmaniasis is the predominant form of the disease [6]. The transport of dogs between Central Europe and countries where the sandflies are prevalent, paves the way for the dangerous protozoa in more

northerly regions, and thus provide a higher risk of transmission to humans [7]. Too little is known in general about the behavior of sandflies, therefore it needs to be examined to what extent the distribution limits (especially to the north) than currently known.

Phlebotomus mascittii, is proved in Baden-Württemberg for over 16 years, and strongly suspected to transmit the Tuscany virus to humans [8]. The transfer of phleboviruses (Tuscany virus) has been known since the beginning of the 21st century in Germany [9]. Moreover, sandflies could be found in the federal states Rhineland-Palatinate (RLP) at one place in 2001 [8].

More phleboviruses are endemic to the Mediterranean region and can spread through the Rhine Valley to Southwest Germany [10,11]. In 2015, Ph. mascittii could be found again at previous known habitats in BW. Thus, the known status from 10 years ago has been confirmed. In this study focus have been put to the state RLP on the occurrence of sand flies. Eleven new sites RLP were identified positive for sandfly presence during the whole study period [12].

To estimate the risk of vector-borne infections prospectively, it is crucial to capture the present distribution prioritized in sandflies, potential pathogens (viruses and possibly Leishmania) prospectively, and to show how the coexistence between humans and animals will develop further within the next years with regard

Correspondence to: Sandra Oerther, Institute of Global Health, Heidelberg University, Heidelberg, Germany, E-mail: Sandra.oerther@gmail.com

Received: October 17, 2020; **Accepted:** October 30, 2020; **Published:** November 6, 2020

Citation: Oerther S (2020) Phlebotomus mascittii as Potential Vector of Human Pathogens in Southwest Germany. Entomol Ornithol Herpetol.9:236. DOI: 10.35248/2161-0983.20.9.236.

Copyright: © 2020 Oerther S. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

to climate change and migration.

STUDY OBJECTIVES

- To assess the abundance of sandflies in Germany and to explore positive and negative trapping sites.
- Mapping of breeding areas examined and newly detected, where and what species occur and screening for possible pathogens they carry.

CONCEPT

In this study population density and distribution of sand flies were recorded and evaluated. Known habitats will be sampled and habitat characterization were established. The prospect for new breeding areas was carried out according to the conditions and the observations collected and received by the population. In cooperation with the BNI Hamburg, a Germany-wide map with known and potential new localities and possible found pathogens in sand flies were carried out. It was emphasized to inform the population nearby in relation to sand fly trapping activities based on newspaper advertisements, flyers, and personal discussion in person with the request to notify with possible matching habitats described in the info material. Furthermore, captured sand flies were analyzed with PCR techniques for viruses and Leishmania, as well they were morphological determined.

HOW MIGHT OUR RESEARCH 'ADD VALUE' TO THE SUBJECT?

My research project will contribute to discover causes and the multi-dimensional factors of the interplay between globalization and climate change and its biological effects on the development and increase of mosquito species, its disease transmission, transmission patterns and its control. This disease control shall contribute to the current public health concern in terms of according protection and awareness in human health affairs. Furthermore, it should serve to identify the unknown challenges in areas of the health systems. At the end of the study we expect to define the species composition and abundance of different hematophagous dipterans and their distribution in the Southwest region of Germany and the possible virus or parasite competence that they could carry. These data should be supplemented to obtain meaningful data for risk assessment on the occurrence of Phlebotominae sand flies and the likelihood of transmission of pathogens by these populations assessed.

This work should be carried out in cooperation with the Institute of Public Health in Heidelberg, the Bernhard Nocht Institute for Tropical Medicine in Hamburg, and the German Mosquito Control Association. Through the cooperation between the institutions, the respective areas of expertise could be ideal complements and manages an important step for monitoring mosquitoes in Germany, as well as to support future research and add with valuable data which might be able to bring benefits, and encouragement and enhancement in this research field.

FIELD OF ACTION-HEALTH

The more accurate a risk assessment can be done, the more accurate the impact on society can be foreseen. In terms of public health direct and indirect costs to society through medical visits, therapies and rehabilitations can be calculated. In addition an important topic will be costs for advanced training of doctors and medical staff of infectious diseases. Among the numerous incoming

asylum seekers occasional occurrence of severe, rare disorders were already present. Cases of parasitic diseases due to poor sanitary and unintentional unwanted introduction of organisms such as Leishmania are to be expected [13].

Education and sensitization of the population are important, such as information on sandfly behaviours (sandflies can enter a conventional mosquito net). Furthermore, the construction of a reporting system based on possible cooperation's from the population, doctors/veterinarians and scientists, institutions, and authorities, respectively in the State of Baden-Württemberg could be embedded in warning and control services. When emerging pathogens are detected early and the mode of transmission is known, this can lead to an opportunity to implement effective preventive and active measures.

To determine the status of Phlebotominae and their vector competence for Phleboviruses in Southern Germany this project will perform surveillance of sandflies and study their vector competence. Leishmaniasis is a dangerous disease even with a lack of available information on their vector competence. Leishmania can be transmitted to unborn children, and are dangerous during pregnancy. Actual statements about the expected population size and the resulting risk of infection by sandflies are currently not possible.

GAINS AND OBSTACLES

During the last 10 years little more than 350 specimen of *Ph. mascittii* could be caught in Germany. In neighbouring countries numbers of Sandflies is rising in addition. The results of the project will be published in peer-reviewed international journals. The interdisciplinary cooperation within the network will yield new useful findings on the relationship between sandfly populations and the transmission of phleboviruses to humans. The results will also extend the possibilities of prophylaxis of phlebovirus infections by means of controlling their insect vectors.

Further to optimize trapping time points for the field and time points for experimental procedures in the laboratory as well to optimize the laboratory methods for analysis. To learn more about the sand-fly behaviour and its life conditions. To show sand flies are present in direct environment to humans even they are difficult to detect and their recent rise northbound might have been underestimated.

GENERAL OBJECTIVES

- to build stable colony of *Ph. Mascittii* to further research on their vector competence.
- to analyze on influencing factors such as Sferics whether an influencing correlation exists between in sandfly activity (have been described as influencing factors in some biologic populations e.g. ants, bees, mosquitoes). If a correlation of sferics to sandfly activity can be shown, sferic measurements could be used for determining ideal time points for sandfly collection in the field. They could also be used to determine ideal time points for virus inoculation of active sandflies.
- to establish a cell line for *Ph. mascittii*. This serves to further examine infections with respect to the acceptance of different viruses and to gain more information about their ecology.

RESULTS

In this study, sand flies were trapped at 37 out of the 176 sites

in Southwest Germany. This shows that these potential vectors are more widespread than previously known. A number of 149 confirmed sand flies of the species *Ph. Mascittii* could be collected during the study period from the years 2015-2020 [12].

However, non-detection of sand flies at a trap site should be interpreted with caution and not taken immediately as evidence of a lack of a population there. Sites which had regularly been positive in previous studies were positive for sand flies again, demonstrating stable populations at these sites. The number of trapped sand flies was always very small, usually only 1 or 2 specimens. In most studies, *Ph. mascittii* is rather found in low population densities [14]. The low density may be due to the specific ecological niche they are adapted to (caves, tunnels and natural barns) and therefore *Ph. mascittii* is supposed to be a temperature adapted sandfly species. Global warming might lead to an extension of the distributional area of sand flies and therefore an increase in the risk for sand fly-borne infections in Southwest Germany [15].

CONCLUSION

The study results reveal that sand flies occur in different areas where they have not been detected before. During the study, 15 new sites in Southwest Germany were identified as positive. The most common biotopes were old barns, especially with non-concrete ground, and close to humans and animals. Generally, it appears that these sand flies are associated with a relatively stable and calm environment. The occurrence of phlebotomine sand flies in Southwest Germany is expected to be larger than the number of collected specimens suggests. This reinforces the need for further surveillance in suitable regions in Germany. Furthermore, there is an urgent need to clarify the vector competence and capacity of *Ph. mascittii*.

REFERENCES

1. Koch LK, Kochmann J, Klimpel S, Cunze S. Modeling the climatic suitability of leishmaniasis vector species in Europe. *Scientific Rep.* 2017;7:13325.

2. Fischer D, Thomas S, Beierkuhnlein C. Climate change effects on vectorborne diseases in Europe. *Nova Acta Leopoldina.* 2010;384:99-107.
3. Naucke T, Menn B, Massberg D, Lorentz S. Sandflies and leishmaniasis in Germany. *Parasitol Res.* 2008;103:65-68.
4. ECFDPAC. 2020. Phlebotomine sand flies-factsheet for experts [online].
5. World Health Organization. Leishmaniasis-key facts. 2020.
6. World Health Organization. Leishmaniasis. 2020.
7. Naucke T. 2016. Leishmaniose-infektionen in Deutschland-gefahr geht nicht nur von sandmücken aus.
8. Steinhausen I. Untersuchung zur verbreitung von sandmücken (phlebotomen) in deutschland mit hilfe geographischer informationssysteme (gis). 2005;91.
9. Charrel RN, Gallian P, Navarro-mari JM, Nicoletti L, Papa A, Sánchez-seco MP, et al. Emergence of toscana virus in Europe. *Emerg Infect Dis.* 2005;11:1657.
10. Amaro F, Zé-zé L, Alves MJ, Börstler J, Clos J, Lorenzen S, et al. Co-circulation of a novel phlebovirus and massilia virus in sandflies, Portugal. *Virology J.* 2015;12:174.
11. Stark K, Niedrig M, Biederbick W, Merkert H, Hacker J. Die auswirkungen des klimawandels. *Bundesgesundheitsblatt-gesundheitsforschung-gesundheitsschutz.* 2009;52:699-714.
12. Oerther S, Jöst H, Heitmann A, Lühken R, Krüger A, Steinhausen I, et al. Phlebotomine sand flies in southwest Germany: An update with records in new locations. *Parasit Vect.* 2020;13:173.
13. World Health Organization. Vernachlässigte tropenkrankheiten: rasch gemeinsam bekämpfen [online]. 2017.
14. Obwaller AG, Karakus M, Poepl W, Töz S, Özbek Y, Aspöck H, et al. Could phlebotomus mascittii play a role as a natural vector for leishmania infantum New data. *Parasit Vect.* 2016;9:458.
15. Maroli M, Khoury C, Bianchi R, Ferroglio E, Natale A. Recent findings of phlebotomus neglectus tonnoir, 1921 in Italy and its western limit of distribution. *Parassitologia.* 2002;44:103-109.