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Introductory Chapter: Vectors and Vector-Borne Pathogens around Us

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1. Introduction

The book “Vectors and Vector-Borne Zoonotic Diseases” is about the vectors of diseases and the pathogens they can carry and transmit. The topic of vector-borne diseases is of high interest among many researchers around the world. There are more and more pathogens discovered or they are discovered in locations where they were not found before. There are also more and more hosts where the pathogens are discovered in, and there are several reasons for that.

2. The factors of the discovery of new and old vector-borne diseases

In our modern times, it is possible to travel across the world in a day. Today one can reach a destination in less than 36 or even 24 h, for which in the past several days or a week was needed. Also, people travel more because of the globalization of business or different vacation options and very often they take their pets with them—again, across the globe.

Besides that, today there are many highly developed diagnostic laboratory methods which are:

- sensitive and can detect a very small part of the pathogens (DNA);
- specific for a certain pathogen; and
- available to most of the laboratories in the world.

These methods are based on molecular diagnostic procedures and have a possibility to detect new pathogens in different kind of samples and to detect different strains of the same pathogen.

There is also a factor of global warming and the adjustment of vectors to the climate changes. Some vectors in order to complete their life cycle need a certain temperature of the environment. Over a decade ago, some vectors could be found only in the Mediterranean region and now they can be found all the way in the Balkans. There was also seasonality in the appearance of some vectors, like ticks were not to be found from November until March in the countries with continental climate. Nowadays, in some countries, ticks can be found all around the year and they can also be found in north European countries. It seems like the vectors have a fantastic ability to adjust to climate changes, new locations, new hosts, and new pathogens, which all together makes them perfect organisms for spreading the disease.

3. The terms vector and vector-borne disease

The subject of the book Vectors and Vector-Borne Pathogens is not only both vectors and pathogens that can be found in them but also the diseases that they can cause in animals or humans.

Vector is an invertebrate animal (most usually an arthropod) that transmits infectious agents to vertebrates. In infectious disease epidemiology, vector is an insect or any living carrier that transports an infectious agent from an infected individual, or its wastes to a susceptible individual or its food or immediate surroundings [1]. In short, it is an organism that transmits a pathogen from one host to another.

Vector-borne disease can be transmitted differently:

1. Mechanical way of pathogen transmission—includes just mechanical transmission of the pathogen by a crawling or flying insects, on their legs, feet or wings, or proboscis, or by passage of the pathogens through their gastrointestinal tract. There is no multiplication or development of the pathogen within the mechanical vector, so no part of the pathogens life cycle occurs in the mechanical vector.
2. Biological way of pathogen transmission—involves part of the pathogens life cycle to occur within the vector: propagation (multiplication), stage development, or some combination of them is needed to occur in the vector, before it can transmit the infective form of the pathogen to the host (an animal or human). The incubation period is therefore needed after the infection so that this process can occur, before the vector becomes infectious and is able to transmit the infection. The pathogen within the vector can also be transmitted vertically to the next generation of the vector (transovarian transmission). Also, a trans-stadial transmission can occur, meaning that the pathogen can be transmitted from one stage of the life cycle to another, like for example, from the nymph to the adult. When the pathogen is “ready” within the vector, the transmission of the pathogen from vector to host can be done in different ways. The pathogen can be injected from a salivary gland with the fluid during the blood meal of the vector. Or, it can be transmitted by the regurgitation process, or deposition on the skin of feces or other material that can penetrate through a bite wound or an area of traumatized skin from scratching or rubbing [1]. Transmission like this usually occurs by an infected non-vertebrate host and it is not a simple mechanical carriage by a vector. Whichever role the arthropod takes, it is labeled as a vector.

In order to transmit the disease, a vector has to be competent for it. Vector competence is the ability of a vector to acquire, maintain, and transmit microbial agents. Not all blood-sucking arthropods are vectors (transmitters) of disease agents [1].

One same vector-borne disease can be seen as a neglected or endemic one, or an emerging or a reemerging one. It all depends on the geographic appearance of the disease (country or a region) and the relation of the countries public health toward that disease.

Neglected diseases are the ones that there is at least an evidence of the pathogen present in the environment, but there is no official acknowledgment of the threat from the disease. On the other hand, once the pathogen is in the environment, with appropriate vectors, hosts, and climatic conditions, the disease can develop to its full capacity causing clinical symptoms in animals and humans and then the disease becomes endemic for a certain region/country. Endemic diseases are maintained

in a population without the need of external outputs. Emerging disease is either a newly recognized, clinically distinct disease or a known infectious disease whose reported incidence is increasing in a given place or among a specific population. They are rapidly increasing in incidence or geographic range.

4. The origin, purpose, and significance of the book

This book is a product of scientific and research work of many authors. The data presented are mostly from the original work done by the authors. But, it is presented in the way to be available not only to the scientific audience, but also for education and information. It is a collection of different experiences, cases, and studies with a same general topic on vector-borne diseases. The purpose of the book is to show how much public health can be endangered by the pathogens in vectors which can cause a disease and how much are vector-borne diseases present in our everyday life. It can also be used for education of students in order to show which vector-borne diseases represent a major public health threat in different parts of the world.

The book “Vectors and Vector-Borne Zoonotic Diseases” should point the readers to comprehend the One Health approach or aspect when thinking about vectors and vector-borne diseases. One Health concept recognizes the optimal health of people as being connected to the health of animals and the environment. It unites the collaborative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals, and our environment. One Health approach considers the role of changing environments with regard to infectious and chronic disease risks affecting humans and nonhuman animals. The book is indicating a One Health point of view to be adopted by the reader. All the experiences shown in the book are somehow related intentionally or non-intentionally to One Health approach in the work of authors. The authors in the book represent multidisciplinary and transdisciplinarity in work with vector-borne diseases.

The nature of the book is transdisciplinary, but united around one topic—vector-borne diseases. It shows the research work of different groups of experts, like entomologists, virologists, medical doctors, veterinarians, epidemiologists, microbiologists, and others, and all of them working and serving in the protection of Public Health. They all contributed to the book with a purpose for the readers to acknowledge the existence of different vector-borne diseases in different parts of the world and how people cope with them worldwide.

This book should be considered as very important book of experience because of its practical use in situations when public health has been endangered by vector-borne diseases. It also shows the reality and significance of transdisciplinary and multidisciplinary research groups with the same interest and passion that they all share for vectors or vector-borne diseases. There is also the educational role of the book, with a purpose to teach the young researchers about vectors and vector borne zoonotic pathogens and their significance within the public health.

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