ACTA SCIENTIFIC AGRICULTURE (ISSN: 2581-365X)

Volume 2 Issue 10 October 2018

Review Article

Arthropods Vector in Disease Transmission

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Received: August 08, 2018; **Published:** September 28, 2018

Abstract

Arthropod vectors are mainly responsible for the disease transmission. Arthropods form a major group of pathogen vectors with mosquitoes, flies, sand flies, lice, fleas, ticks, and mites which transmit a huge number of bacteria, viruses, protozoa, etc. They transmit the disease by the mechanical method as well as biological method. Arthropod vector is transmitting disease world widely and now a day it has become the significance topic for pathogen in the animal. The newly emerging diseases of bacteria and virus are mainly carried out by arthropod. Some examples are Chagas, Borreliosis, etc. Thus, these diseases also play a significant role in economic importance and must be controlled by reducing contact, chemical and biological method. Due to its main role; all the authorities must have the special concern on vector disease transmission.

Keywords: Arthropod; Disease; Regurgitation; Myiasis

Introduction

Arthropods have exoskeleton, segmented body and appendages [1]. Arthropod is divided into class insects, arachnids, myriapods, and crustaceans [2]. Insects include about 80% of all known species of animal of all kinds [3]. In nature we get arthropod as parasitic form as well as freely living [4]. The main feed of the parasitic arthropod is the blood of animals and human which mainly act as vector in disease transmission [5]. Any agent that carries and transmits an infectious pathogen into another living organism is called disease vector [6,7].

History

From 1343 - 1351, several forms of plague caused by the bacterium *Yersinia pestis* were likely carried to humans by fleas on black rats [8]. The two third population of Asia and one third population of Middle East, and one third to two third population of Europe were killed. Hence known as black plague or black death [8].

Arthropod-borne diseases become more risky in developed countries. For example, West Nile virus, develops in birds and is transmitted to humans by mosquitoes, was emerged in US in 1999 but it is seen in many developing countries recently [8]. From 1999 to 2003, 9,000 cases were reported, in which more than 250 death. The spread of West Nile virus is suggested by reducing the mosquito population and using personal protective measures such as mosquito nets, repellents, etc [8].

Now a day, Arthropod borne diseases is becoming a major threat especially in developing countries. Malaria is well known arthropod-borne disease in this century which kills millions of life per year. Dengue fever is also transferred by mosquito which has increased prevalence in 21st century.

Transmission

Disease agents are transmitted by arthropods in two general methods.

Passive transmission

It is also called as Mechanical Transmission. It is the method in which the microorganism is transferred by arthropod from one living being to another which do not affect arthropod. They only act as transfer medium. For example: From infected human feces, Filth flies transfer bacteria on mouth part and legs. Hence it causes diarrhoea and dysentery contaminated by flies' legs when they stand on food. Cockroaches also act as same to carry disease in their mouth, legs, etc [9].

Active transmission

It is also called biological transmission. The microorganisms may change to be infectious in arthropod body. It consists various ways to transfer in healthy living beings.

Inoculation

Inoculation is the method in which the pathogen is inoculated or injected from the saliva of arthropod into the host. For example: Malaria is transmitted by inoculation.

Regurgitation

It is the method in which the arthropods spit or vomit pathogen in host body. For example: Bubonic plague transmitted by flea. Bubonic plague's bacterium multiplies in the gut of flea and blocks it which leads to the regurgitation into the host due to blockage.

Fecal contamination

In this method, the arthropod defecates into the host wound and the pathogen enters to the host while scratching and rubbing by the host when the wound itches. For example: Chagas' disease is transmitted by this method by Kissing bug.

Crushing the vector

In this method, the vector is bang up on skin of host. For example: Epidemic typhus is transmitted by this method by body louse [10].

Importance

Arthropods form a major group of pathogen vectors with mosquitoes, flies, sand flies, lice, fleas, ticks, and mites which transmit a huge number of bacteria, viruses, protozoa, etc. The *Anopheles* mosquito, a vector for malaria, inserts its mouthpart under the skin and feeds on its host's blood. The parasites which mosquito carries are usually located in its salivary glands [11,12]. Therefore, the parasites are transmitted directly into the host's blood stream. Pool feeders such as the sand fly vectors for pathogens causing leishmaniasis, sand fly fever (phlebotomus fever) and black fly vector for onchocerciasis, will chew a well in the host's skin, forming a small pool of blood from which they feed [13,14]. *Leishmania* parasites infect the host through the saliva of the sand fly. Onchocerca force their own way out of the insect's head into the pool of blood. Crimean-Congo haemorrhagic fever, Lyme disease, Relapsing fever (borreliosis), Rickettsial diseases (spotted fever and Q fever), Tick-borne encephalitis, Tularaemia, etc. is caused by ticks [13]. Triatomine bugs are responsible for the transmission of a trypanosome, *Trypanosoma cruzi*, which causes Chagas Disease. The Triatomine bugs defecate during feeding and the excrement contains the parasites which are accidentally smeared into the open wound by the host responding to pain and irritation from the bite [14]. The biting of arthropod cause annoying, painful, direct injection of venom into the body through a bite or sting, dermatitis, or inflammation of the skin, tissue damage (the result of the bit of the brown recluse). Sensory damage can also be caused by arthropods by entering into the eye, ears, nose by severe irritation and allergies [15].

Myiasis

In this condition larvae of fly damage a host. It occurs in one of two ways: (i) a fly lays its eggs on an open wound, when the eggs hatch the larvae begin to feed on tissue. (ii) By eating larvae of fly on contaminated food. The food is usually passed through the digestive tract without any damage or illness. This process can also be used for medical treatment by intentionally placed the fly larvae into the wound which feed on dead tissue of wound and enhance the growth of living tissue.

Control measures

The major control methods of vectors are by eliminating the vector populations. Some preventative measures are:

- **Habitat and environmental control:** In this method, the areas where the vectors can breed are reduced or removed to limit the growth [7,16].
- **Reducing contact:** In this method, the contact between the host and arthropod is reduced. For example, nets, creams, window screens on homes, or protective clothing, etc [7,16].
- **Chemical control:** In this method, insecticides, larvicides, rodenticides, lethal ovitraps and repellents can be used. The use of pesticides for vector control is promoted by the World Health Organization (WHO) and has proven to be highly effective [7,16].
- **Biological control:** The use of natural vector predators, such as bacterial toxins or botanical compounds, can help control vector populations. Using fish that eat mosquito larvae or reducing breeding rates by introducing sterilized male tsetse flies have been shown to control vector populations and reduce infection risks [7,16].

Zoonotic importance

Diseases that are naturally transmitted from warm-blooded animals to humans are called zoonoses. Zoonotic diseases affect and are carried by domestic animals, farm animals, wild animals or rodents such as mice and rats. Humans are frequently exposed to zoonotic organisms since they can also spread into the environ-

ment, such as children's sandpits, water and food. Some diseases are transmitted by insect or tick bites. The insect or tick is then termed a 'vector' [17].

Zoonoses is major importance in a densely populated country with high numbers of livestock and pet animals and human activities which favors close contact with wildlife such as migrating waterfowl, deer and fox populations. Recent zoonotic outbreaks of importance are avian influenza in poultry in 2003 and Q fever epidemic in 2007 - 2010. Examples of vector-borne zoonotic diseases include: Dengue fever, Lyme disease, Plague, West Nile virus, etc [18].

Conclusion

Hence, Arthropod is very much important in disease transmission and it contributes many economic losses due to poor health condition. We must care about the control measures and help to prevent the diseases in animals as well as zoonosis.

Acknowledgement

I express my deepest thanks to Authors of different articles and books for making my study easier. I choose this moment to acknowledge his/her contribution gratefully. It is my radiant sentiment to place on record my best regards, deepest sense of gratitude to my friend Mr. Arun Chapain for his careful and precious guidance which were extremely valuable in every step of my study and review.

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