

LESSON ASSIGNMENT

LESSON 7

Arthropods and Diseases.

LESSON ASSIGNMENT

Paragraphs 7-1 through 7-5.

LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 7-1. Match a list of terms related to arthropods and diseases with a list of correspondence definitions
- 7-2. Identify and select the habitats for each of the six arthropods important to military operations.
- 7-3. Identify the ways arthropods affect human health.
- 7-4. Identify how arthropods spread diseases.
- 7-5. Name the arthropod-borne diseases and their vectors.

LESSON 7

ARTHROPODS AND DISEASES

7-1. TERMS AND DEFINITIONS

a. **Arthropods.** Includes ticks, spiders, mites and other insects as well as crustaceans such as shrimp, lobster and crabs.

b. **Vector.** A carrier. In this lesson, this term is used to describe an arthropod that transports a disease-causing organism, or pathogen, from one host to another.

7-2. ARTHROPODS IMPORTANT TO MILITARY OPERATIONS

To properly convey this information to your fellow soldiers, you need to be able to identify the six arthropods that have the greatest influence on military operations. In addition, knowing how and where arthropods live provides you with the key to protecting yourself and your fellow soldiers from getting ill. It will also help you to avoid or eliminate potential arthropod habitats and effectively control the arthropod population in your area of operations.

a. **Mosquitos.** Mosquitos have earned the honor of being labelled the most important arthropod for a number of reasons. First, you can find them practically everywhere. And where they are found they are usually in high numbers. Additionally, they are capable of transmitting a large number of diseases, some of which are war-stoppers. During WWII, Korea, and Viet Nam entire units were rendered combat ineffective by malaria.

(1) Life cycle. Mosquitos live short lives – about one month. They have four life stages; egg, larva, pupa, and adult. Mosquitos mature in about two weeks.

(2) Habitat. Mosquito larvae inhabit areas with standing water such as ponds, puddles, and ditches. Anything that can hold water provides a habitat for mosquito larvae; things like discarded cans, tires, and tree holes. Adult mosquitos continue to inhabit their larval habitats without venturing too far away.

b. **Filth flies.** The filth fly transmits many diseases. There have been situations in which filth flies have been allowed to breed unhampered. The resulting fly-borne disease outbreaks made hundreds of soldiers sick within a few days.

(1) Life cycle. Like the mosquito, flies do not generally live very long – usually about six weeks. They have four life stages: egg, larva, pupa, and adult. Filth flies mature in about two weeks, then live as adults for an additional three or four.



(2) Habitat. Flies are not too picky about their living quarters. They live in or near animal or human waste, garbage, decomposing plants and animals, or in mud with high organic content. A large population of flies is usually a good indicator of unsanitary conditions.

c. **Fleas**. Adult fleas are not only persistent and painful biters, but are efficient vectors of a number of diseases.

(1) Life cycle. The flea's life cycle has four stages; egg, larva, pupa, and adult. The flea matures in about one month and the adult flea can live for as long as one year.



(2) Habitat. Fleas are often associated with animals, although many humans are carriers, too. Large populations of fleas can usually be found around animal beds, burrows, and nests.

d. **Lice**. Head and body lice are considered external parasites of man. In other words, they live outside the human body and obtain nutrients from it. Both species bite causing an itching inflammation of the skin. However, only the body louse is a disease vector.

(1) Life cycle. The life cycle of the louse is somewhat different from the other arthropods we've discussed. Their life cycle has only three stages; egg, nymph, and adult. The louse matures from egg to adult in about sixteen days. The louse will live as an adult for another nine days, or so.



(2) Habitat. Lice normally inhabit the hairy parts of the body, along with clothing. They are often prevalent in crowded or unsanitary conditions. Soldiers who do not practice good personal hygiene can become infested with lice and pass them on to other soldiers when they come in contact with their hair, clothing, sleeping bags, or other linens.

e. **Cockroaches**. Cockroaches can carry a variety of disease-causing pathogens.

(1) Life cycle. Like the louse, the cockroach has three life stages; egg, nymph, and adult. They mature in about three months and live for adults for up to two hundred days.

(2) Habitat. Cockroaches prefer habitats with three criteria: water; shelter, such as cracks or crevices; and food, such as garbage or spillage. Anytime these three conditions exist, you should look for the existence of cockroaches. These three criteria usually exist together in kitchens and bath areas, especially when conditions are less than sanitary.

f. **Ticks and mites.** These two arthropods are very similar in biology, so are considered together. Ticks are the most efficient arthropod when it comes to disease transmission. This is because the female tick can pass the pathogen to the egg so that when the larva hatches it is already able to pass on the disease upon eating its first meal.

(1) Life cycle. Ticks and mites develop through four life stages; egg, larva, nymph, and adult. They live as adults for anywhere from one month to two years.

(2) Habitat. Ticks and mites are generally found in areas of tall grass or underbrush in close proximity to mammal resting places and watering holes.



7-3. HOW ARTHROPODS AFFECT HUMAN HEALTH

Now that you know the six arthropods most important to military operations, let's take a look at how they affect human health.

a. **Direct injury.** Direct injury results when the arthropod, itself, causes the disease or discomfort.

b. **Bites.** Bites are the most obvious mechanism for direct injury. Bites are not only annoying and painful, but can decrease a soldier's productivity level. It's not uncommon, in northern latitudes, for the bite counts of pests to reach twenty bites per minute. Can you imagine trying to be quiet while manning an LP/OP having to fight off this many insects?

c. **Envenomization.** This is the direct injection of venom into the body through a bite or sting. The damaging results of a bite or sting can range from dermatitis, or inflammation of the skin; (as seen with flea bites) to actual tissue damage (the result of the bite of the brown recluse spider).

d. **Entomophobia.** This condition is the irrational fear of real or imaginary insects.

NOTE: While this condition is not usually prevalent among soldiers, it can occur so it needs to be mentioned.

e. **Accidental injury.** Insects can cause accidental injury to our sensory organs. Any insect that enters the ear, nose, or eye can cause severe irritation.

f. **Myiasis.** This is a condition in which fly larvae invade a human host. It occurs in one of two ways. First, a fly lays its eggs on an open wound. When the eggs hatch the larvae begin to feed on human tissue. Secondly, a person may eat fly larvae on contaminated food. However, when this happens, the food is usually passed

through the digestive tract without damage or illness. The process of myiasis may also be used as a medical treatment. In such cases, fly larvae are intentionally placed on wounds. The larvae feed on the dead tissue, which in turn, promotes the growth of living tissue.

g. **Allergies.** People who live in housing with a history of cockroach infestation could have a real problem with allergies as cockroach feces and the skins they shed when molting are potent allergens. Many people are also allergic to dust mites that are found in many buildings and in bedding materials such as mattresses and pillows. Allergies to the venom of some biting and stinging arthropods are also prevalent. While not often considered deadly, the nuisance caused by allergic reactions can, itself, be enough to reduce a soldier's productivity and effectiveness.

7-4. HOW DISEASE IS SPREAD

You're aware of how arthropods affect human health, but how are the diseases they carry actually passed to humans? Let's take a look at the ways in which vectors transmit disease-causing organisms.

a. **Passive or mechanical transmission.** This method of transmission occurs when the arthropod carries the pathogen from one host to another. During this transmission, the pathogen does nothing during the transfer except 'go along for the ride.'

(1) Example 1. Filth flies carry bacteria or other disease-causing organisms on their mouthparts and feet from infected human feces. If soldiers eat food that has been contaminated by a fly landing on it and depositing these pathogens, dysentery or other diarrheal disease may occur.

(2) Example 2. Cockroaches provide a similar 'taxi service' by carrying disease organisms on their legs, feet, and mouthparts. These pathogens can cause diarrheal diseases such as cholera.

b. **Active or biological transmission.** In this method of transmission the disease-causing agent undergoes some change in the body of the arthropod. The pathogen may multiply or simply develop into an infectious form. There are several ways a pathogen can be passed to humans via active transmission.

c. **Inoculation.** A vector injects the pathogen into the host with its saliva while it feeds on the host. Mosquitos transmit malaria by inoculation.

d. **Regurgitation.** The vector vomits the pathogen into the host while it feeds on the host. Fleas transmit bubonic plague by regurgitation.

NOTE: The bacteria that causes bubonic plague multiplies rapidly in the flea's gut and blocks it like stopping up a drain. When the flea attempts to eat, it can not ingest the

host's blood due to the blockage. The flea ends up regurgitating the bacteria into the host.

e. **Fecal contamination.** The vector defecates into a wound on the host. As the wound itches, scratching and rubbing by the host causes the pathogen to enter the host's body. Chagas' disease, also known as North American Sleeping Sickness, is transmitted in this way by the kissing bug.

NOTE: The kissing bug bites the host causing a wound. It then takes a few steps forward and defecates into the wound.

f. **Crushing the vector.** The vector is smashed onto the skin of the host. When the host wipes off the dead bug, the pathogen is rubbed into the skin. The body louse transmits epidemic typhus in this manner.

NOTE: The bacteria that cause epidemic typhus live and multiply in the body of the body louse.

7-5. ARTHROPOD-BORNE DISEASES AND THEIR VECTORS

There are several arthropod-borne illnesses that are significant to military operations. Now that you are familiar with how diseases are spread, we'll look at some of the diseases that are most significant to Army operations.

a. **Malaria.** This is the most important disease to the military. The Anopheles mosquito transmits this disease. Malaria is responsible for the death of over three million people each year. Think about it – that's about twelve times the number of people in the active duty army!

b. **Yellow fever.** The Aedes mosquito transmits this viral disease. Since we are now inoculated against this disease, it is no longer considered a real threat to soldiers in the army.

c. **Dengue fever.** The Aedes mosquito transmits this disease. It is most prevalent in the tropical and sub-tropical areas of Asia, Africa, and Central and South America. No vaccine has been developed for this disease.

NOTE: This disease is characterized by fever, headache, extreme pain in the joints and muscles, and a rash.

d. **Encephalitis.** The Aedes and Culex mosquitos carry several forms of this disease. (St. Louis encephalitis, Japanese B encephalitis, and California encephalitis.) Ticks carry another form of this disease known as Russian spring/summer encephalitis.

NOTE: Symptoms of this disease may include headache, fever, and extreme drowsiness. The disease may leave lasting effects such as deafness, epilepsy, or an altered mental capacity, known as dementia.

e. **Sand fly fever.** This disease is also known as phlebotomus fever. This viral disease is carried by the phlebotomine sand fly.

f. **Leishmaniasis.** The sand fly transmits this disease. It is transmitted to humans by the transfer of a single-celled animal known as a protozoa.

g. **Epidemic typhus.** The body louse is the vector for this disease. This disease has occurred in widespread epidemics during wartime or other periods when sanitation has not been strictly observed. It occurs in primarily temperate areas. During WWI, one hundred fifty thousand soldiers died of this disease.

h. **Bubonic plague.** Any one of the arthropods that are parasitic on rodents may transmit this disease. The most important of these is the rat flea. During the middle ages, bubonic plague occurred in huge outbreaks known as pandemics. These pandemics were known to wipe out the entire population of many cities.