

Armed Forces Pest Management Board
Disease Vector Ecology Profile

Iraq



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Preface

Disease Vector Ecology Profiles (DVEPs) are concise summaries of vector-borne and other militarily significant diseases that occur in specific countries. DVEPs focus on vector-borne diseases and emphasize essential epidemiology, vector bionomics, and behavior. A selected bibliography of pertinent disease and disease vector literature is included.

DVEPs are compiled from unclassified scientific literature, and are intended to provide a profile of arthropod-borne disease epidemiology in the recent past. The epidemiology of arthropod-borne disease is dynamic, and incidence and prevalence are constantly changing. This is especially true for countries undergoing rapid development and ecological change, and those areas experiencing migrations of large refugee populations as a result of strife. This document should be supplemented with recent information on foreign public health status and medical developments. Component medical department activities may have updated regional information for their areas of responsibility. Current disease risk assessment and additional information on parasitic and communicable diseases, and other aspects of medical intelligence can be obtained from the National Center for Medical Intelligence, Fort Detrick, Frederick, MD 21701, 301-619-7574, DSN 312-343-7574, ncmi_ops@dodiis.mil, <https://www.ncmi.dodiis.mil/>. Information about selected disease vectors may be obtainable from the Walter Reed Biosystematics Unit (WRBU), Museum Support Center, MRC-534, Smithsonian Institution, 4210 Silver Hill Road, Suitland, MD 20746-2863 USA, (301) 238-1123 or (301) 238-1069, nmnh-wrbu@si.edu.

Individuals having additions, corrections, or suggestions are encouraged to communicate them to Chief, Strategy and Information Division, AFPMB, for incorporation into future revisions. Contact information: The Armed Forces Pest Management Board, USAG Forest Glen, Silver Spring, MD 20910, 301-295-7476, DSN 295-7476, osd.pentagon.ousd-atl.mbx.afpmb@mail.mil, <https://www.acq.osd.mil/eie/afpmb/>.

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Introduction

Iraq is almost a landlocked country with only a small part in the southeast reaching the Persian Gulf. Iraq is bordered on the south by Saudi Arabia, the southeast by Kuwait, on the east by Iran, on the north by Turkey, and on the west by Syria and Jordan. The country can be divided into four major regions: desert in the west and southwest, rolling upland between the upper Euphrates and Tigris rivers; highlands in the north and northeast, with mountains of nearly 12,000 feet elevation along the border of Turkey and Iran; and the alluvial plain in central and southeast sections through which the Tigris and Euphrates rivers flow.

In the northeast highlands, the foothills and steppes have adequate soil and rainfall suitable for agriculture. This region also contains the oil fields near Mosul and Karkuk. The alluvial plain extending from north of Baghdad to the Persian Gulf is a delta interlaced by the channels of the Tigris and Euphrates rivers and irrigation canals.

The area of the country is 167,924 square miles (434,924 square kilometers), about the size of California. The climate is similar to that of Arizona. Annual rainfall in the south and southwest ranges from 4 to 7 inches and considerably more rainfall occurs in the foothills and steppes regions near the mountains. Approximately 90% of the rainfall occurs between November and April. The hottest months are June through August where temperatures may exceed 120°F with low humidity in some areas. In the winter, the temperatures may reach below freezing in the mountainous regions and western desert regions during January. The summer months are characterized by two kinds of wind phenomena. The southern and southeasterly sharqi winds, from April to early June and again from September to November, are dry with gusts up to 50 mph and are often accompanied by violent desert storms. The shamal winds, from the north and northwest occur from mid-June to mid-September, and are steady, being absent only occasionally during this period. The dry air from the shamal permits intensive sun-heating of the land surface and causes evaporation, making irrigation a necessity for vegetation survival.

The 2021 census reported a population of 39,650,145 million people with 75% of the people being Arabs; approximately 18% of the population are Kurds living mostly in Sulaymaniyah and the adjoining provinces of northeastern Iraq. Small communities of Christians, Jews Bahais, Mandaeans and Yezidis also exist. Between 93-95% of the population is Moslem of either Sunnite or Shiite sect, and about 3% of the population is Christian. Almost 75% of Iraq's population live in the flat alluvial plain stretching southeast toward Baghdad and Basra to the Persian Gulf. Arabic is the official language for the majority of the population and Kurdish is spoken and taught where the Kurdish population predominates. Turkish is spoken in some of the northern provinces. English is the most widely spoken foreign language. Spelling of Arabic proper names in English is somewhat fluid, so different but similar sounding spellings are encountered.



Source: WorldAtlas, <https://www.worldatlas.com/maps/iraq>

Disease Risk Summary

ENTERIC DISEASES: The greatest infectious disease risks in Iraq are the diarrheal diseases of several etiologies (e.g., enterotoxigenic *Entamoeba coli*, *Salmonella* spp., *Shigella* spp., *Campylobacter* spp., *Entamoeba histolytica*, *Giardia lamblia*, and viruses). The sanitation in most areas is very primitive and water purification in most cities is lacking. The dysenteries are endemic in most of the communities and cholera has been reported in some of the cities. Fly control measures, the sanitary disposal of wastes, and water purification and storage are strongly recommended as preventive measures, as well as thorough cooking of all food. The main causes of infant mortality are the diarrheas and dysenteries.

MALARIA: Malaria is transmitted by *Anopheles* sp. mosquitoes and is considered a low risk in Iraq. Endemic malaria transmission is confined almost exclusively to the northern region of Iraq and is limited primarily to *Plasmodium vivax*. Nearly all cases of *P. falciparum* are imported. Baghdad is considered risk free. In the mountainous north, the peak incidence occurs in July and August, but transmission occurs from May to October.

SCHISTOSOMIASIS: Schistosomiasis in Iraq comprises one of the two major foci of *Schistosoma haematobium* in the world, with an estimated 20% of the population infected. It occurs in the valleys of the Tigris and Euphrates rivers and their tributaries where the environment is suitable for the maintenance of the intermediate snail host, *Bulinus truncatus*. Humans acquire the infection when wading, swimming, or by drinking water containing the cercariae of the schistosome.

LEISHMANIASIS: Transmitted by sand flies. Both the cutaneous (oriental sore) and visceral (kala-azar) forms of leishmaniasis are prevalent in Iraq. In Iraq, 2/3 of the cases are the cutaneous form. Kala-azar disease is considered a significant Public Health disease in Iraq. Most cases occur in the late summer and early fall when the sand fly populations are at their peak.

SAND FLY FEVER: This sand fly-transmitted disease is endemic in many areas of Iraq and can appear in epidemic form among newcomers in an area. This viral flu-like disease is not serious, but its epidemic outbreaks can cause tactically significant morbidity in military personnel.

TRACHOMA: Trachoma is an eye infection caused by the bacterium *Chlamydia trachomatis*, that can cause blindness in severe or untreated cases. Approximately 140,000 people are treated each year for this disease. In the central provinces the situation is aggravated by the frequent wind and dust storms. In 2020, Iraq declared it had achieved its Trachoma elimination goals. It may still be endemic in some areas.

HOOKWORM AND OTHER HELMINTHIC INFECTIONS: These parasitic gastrointestinal worms are transmitted through fecal-oral contact. In northern Iraq 10-20% of the population is infected with hookworm, and in the irrigated areas of the south, nearly 40% of the population is infected. The most common nematode infections are: enterobiasis (pinworm), strongyloidiasis (threadworm), trichuriasis (whipworm), and ascariasis (roundworm). These infections are

common in areas of poor sanitation.

PLAGUE: The plague bacterium is spread between rodent host to humans by the bite of an infected flea. Plague still occurs in Iraq with small numbers of human cases, but the presence of a large rat population makes future outbreaks possible.

TYPHUS: Both the flea-borne murine typhus and the louse-borne epidemic typhus occur in Iraq. Most of the epidemic typhus occurs in the colder north and northeastern part of the country. Murine typhus is found wherever large rat populations exist.

DENGUE: Dengue is transmitted by mosquitoes and is considered a low risk in Iraq. The World Health Organization listed zero deaths due to dengue in 2018. However, the mosquito vector, *Aedes aegypti*, is widespread and the threat of an outbreak is always a possibility.

Q FEVER: This air- and animal product-borne rickettsial disease has been found in areas surrounding Baghdad and primarily affects persons in contact with livestock. Pasteurization of milk is recommended. Avoid inhalation of dry dust from places inhabited by infected livestock.

ANIMAL DISEASES TRANSMITTABLE TO HUMANS:

Rabies is an important disease in Iraq although poorly reported. Rabies is most commonly transmitted by the bite of an infected dog. In 2010, 24 deaths were reported and 9 deaths in 2017

Brucellosis is spread by contact with infected animals or animal products infected with the bacteria. It is widespread in cattle and sheep with the higher incidence in the northern semi-rural areas of northern Iraq.

Anthrax occurs in sheep and can be transmitted to humans, but is usually confined to shepherds and persons handling wool and sheep carcasses.

VENOMOUS FAUNA: Poisonous snakes, scorpions, and spiders are common. Bites from venomous snakes are potentially fatal. Stings from scorpions can be lethal to children but rarely to an adult. Spider and centipede bites can be extremely painful.

Diseases of HIGH risk in Iraq¹

According to NCMI's Infectious Disease Risk Assessment for Iraq, no direct arthropod-borne diseases are classified as High Risk in Iraq. Transmission of bacteria, protozoa, and viruses that cause diarrheal diseases can occur throughout Iraq. Most cases develop after consuming food or water tainted with fecal contaminants. Mechanical transmission is possible via filth flies and cockroaches. Service members should not consume food or water from unapproved sources, and should exercise good sanitation to limit contact with filth flies and cockroaches.

Arthropod-borne Diseases of INTERMEDIATE risk in Iraq²

Visceral Leishmaniasis

SYNONYMS: Kala-azar

INFECTIOUS AGENT: Protozoan, *Leishmania donovani*

RESERVOIR: Wild and domestic canines are important reservoir hosts.

MODE OF TRANSMISSION: Bite of infective sand flies of the genus *Phlebotomus*. *Phlebotomus papatasi* is the suspected vector.

CLINICAL FEATURES:

Incubation Period - Generally 2 to 4 months; range can be 10 days to 2 years.

Symptoms - Chronic systemic disease characterized by fever with 2 daily peaks, hepatosplenomegaly, lymphadenopathy, anemia with leukopenia, and progressive emaciation and weakness. Untreated cases can have as high as 95% mortality. Transmission from person to person, and by blood transfusion and sexual contact have been reported.

GEOGRAPHICAL DISTRIBUTION: In 2013, approximately 575 cases of Visceral Leishmaniasis were reported. Kala azar has reappeared in northern Iraq and has spread in central Iraq. Most cases occur in the Baghdad area and the remainder occur in the surrounding areas of Yusifiya, Falluja, Aboughraib, Dora, Mahmoodia, and Salman Pak.

VECTOR BIOLOGY: See Sand Fly Fever: VECTOR BIOLOGY

PREVENTION/CONTROL: Control of vector by eliminating natural breeding sites; area insecticide control; use of repellents, wearing of protective clothing after dark and use of fine

¹ Based on the National Center for Medical Intelligence's Infectious Disease Risk Assessment for Iraq, 2022.

² Based on the National Center for Medical Intelligence's Infectious Disease Risk Assessment for Iraq, 2022.

mesh sleeping nets; avoidance of sand fly areas especially after dark. Presently vaccines and chemical preventives are not available.

Cutaneous Leishmaniasis

SYNONYMS: Baghdad or Delhi boil, Oriental sore, Aleppo boil

INFECTIOUS AGENT: Protozoans *Leishmania tropica* and *L. major*

RESERVOIR: Canines are important reservoir hosts. Wild rodents may also serve as reservoirs. Principal rodent hosts in the Mideast for *L. major* are the great gerbil, *Rhombomys opimus*, the jird, *Meriones libycus*, and the fat sand rat, *Psammomys obesus*.

MODE OF TRANSMISSION: Bite of infective sand fly; also from direct human to human contact of abraded skin (urban leishmaniasis, *L. tropica*).

VECTOR BIOLOGY: See Sand Fly Fever: VECTOR BIOLOGY

CLINICAL FEATURES:

Incubation Period - at least a week to several months

Symptoms - A polymorphic disease of the skin and mucous membranes characterized by ulcerating lesions which may be single, multiple, or diffuse. The disease begins with a papule which enlarges to a painless ulcer. Lesions may heal spontaneously within weeks to months, or last for a year or more. Mucocutaneous lesions that involve the nasopharyngeal membranes may develop. Infection mainly involves the extremities. Most commonly, the disease is mild and self-limiting; moderate and severe disease resulting in major pain, disfigurement and fatalities may occur with diffuse and mucocutaneous forms of the disease.

GEOGRAPHICAL DISTRIBUTION: Baghdad occupies the approximate center of an extensive area of human infection which extends broadly from the northern boundaries of the alluvial plain southwards to southern Diwaniya in the north of Muntafiq and Amara Liwas. Other heavily infected villages are those along the Khorassan and Mahrat canals in Diyala Liwa and in the villages along the Tigris river. In southern Iraq, the disease occurs in the river-rain area of northern Amara.

PREVALENCE/INCIDENCE: Leishmaniasis has probably been underreported due to a lack of diagnostic capabilities. In 2020 approximately 8,691 cases were reported.

VECTORS: *Phlebotomus sergenti*, *P. alexanderi*, and *P. papatasi* are the main vectors of cutaneous leishmaniasis in Iraq. Most *Phlebotomus* species are active only when there is little or no wind and usually bite only at night. They seek protection in shelters by day, in dark corners of buildings or outdoors in caves, crevices, thick vegetation, or rodent burrows. The

peak adult vector populations occur in April through October and the main incidence of oriental sore is from October to March.

PREVENTION/CONTROL: Vector control with insecticides; eliminate sandfly breeding areas; repellents and the use of very fine mesh sleeping nets, protective clothing, and avoidance of sand fly areas, especially after dark. At present, vaccine and chemical preventives are not available.

Sand Fly Fever

SYNONYMS: Pappataci fever, Phlebotomus fever, three-day fever

INFECTIOUS AGENT: Bunyaviruses (at least 7 related immunological types)

RESERVOIR: Humans; an animal reservoir is suspected

MODE OF TRANSMISSION: By bite of an infected sand fly, usually of the species *Phlebotomus papatasi*. Sand flies become infective about 7 days after biting an infected person and are capable of transmission for their normal lifespan of about one month.

CLINICAL FEATURES:

Incubation period- 3 to 6 days

Symptoms - Similar to influenza but without inflammation of respiratory tract. Frontal headache, fever of 38-39.5°C, photophobia, sore throat, nausea, pain of limbs, neck and back. Leukopenia on 4th -5th day after onset of fever. This is a serious, debilitating disease but it is non-fatal.

EFFECTS - This disease is most likely to appear in personnel from nonendemic areas. Local populations generally become immune during childhood. This disease is of great military significance because of its epidemic nature, causing self-limiting but debilitating flu-like febrile illness. The epidemics occurring during military operations in the two World Wars make Sand fly fever of major concern to deployments in the Mideast.

GEOGRAPHICAL DISTRIBUTION: This disease is endemic in Iraq in widely distributed areas. Its peak incidence occurs in August.

VECTOR BIOLOGY: Sand flies of the genus *Phlebotomus*.

Habits - Most sand fly species are nocturnal, seeking shelter from the sun during the day by retreating deep into cracks in soil and in loose-rock or masonry construction, crevices in cliffs and rock outcroppings, caves, trees holes, animal burrows, etc. Virtually any protected microhabitat that offers shelter, temperatures between 70-80°F and 70-80% relative humidity will serve well as a resting site for sand flies. In hot desert environments sand flies disperse

from resting and breeding sites after sunset to find sugar (from plants), a blood meal, and/or mate. While male sand flies require only plant sugars, females also require a blood meal from a vertebrate host for their eggs to develop. Usual feeding times, on both plant sugar and blood, are from dusk to dawn. Sand flies are rather weak, noiseless fliers, and where vegetation is lacking, usually travel close to the ground (within 1 meter), in short hops, a few inches to a few feet a time. This hopping behavior is a useful field characteristic for identifying sand flies. Their range of movement is usually limited to about 300 m, but in some desert or savanna situations they have been known to fly up to 2300 m (1.5 miles). They bite on exposed parts of the body such as the face, ears, neck, arms, chest, and lower legs. After blood feeding, engorged females move to a resting site and later to an oviposition site. They deposit their eggs on damp soil that is rich in organic matter. Unlike mosquito larvae, the almost microscopic, caterpillar-like sand fly larvae do not live in standing water, but in rodent burrows, cracks and crevices in soil, rocks, loose masonry, piles of rubble, etc. Sand flies are tiny insects and can easily pass through ordinary mosquito netting.

PREVENTION/CONTROL: Use of repellents and protective clothing; avoid sandfly breeding areas after dark; control vector by eliminating breeding sites around dwellings, rubbish heaps and rock piles, area control by way of insecticide spraying. Mosquito bed nets can provide protection if treated with permethrin repellent.

Crimean-Congo Hemorrhagic Fever

SYNONYMS: Central Asian Hemorrhagic Fever

INFECTIOUS AGENT: A virus of the genus *Nairovirus* (family Bunyaviridae)

RESERVOIR: Small wild mammals and the tick vectors (*Hyalomma* spp.). Ticks acquire infection from the animal hosts and through transovarian infection within the tick hosts.

MODE OF TRANSMISSION: Bite of infected adult tick of species *Hyalomma marginatum* and *H. anatolicum*. Nosocomial transmission from patients to medical workers after exposure to blood and secretions has been important in many outbreaks. Infection is also associated with the butchering of infected animals.

CLINICAL FEATURES:

Incubation Period - 7 to 12 days

Symptoms - Abrupt onset with fever, malaise, weakness, headache, irritability, severe pain in limbs and loins, and marked anorexia. Vomiting, abdominal pain, and diarrhea occur occasionally. Hemorrhagic enanthema of soft palate, uvula and pharynx and a fine petechial rash spreading from the chest and abdomen to the body are generally associated with the disease; occasionally large purpuric areas are observed. There may be some bleeding from

gums, nose, lungs, uterus and intestines, but mostly in serious or fatal cases. Mortality rate may vary from 5-65%.

GEOGRAPHIC DISTRIBUTION: In Iraq, Crimean-Congo Hemorrhagic Fever has been observed in the Baghdad area and localities along the Tigris and Euphrates rivers where people have frequent close association with sheep, goats or cattle.

INCIDENCE/PREVALENCE: Crimean-Congo Hemorrhagic Fever is considered endemic in Iraq. Sporadic cases have occurred, most recently in 2021 with 45 cases and 7 confirmed deaths. The cases occurred in agricultural and related workers. The seasonal occurrence is from June to September which is the period of adult vector activity.

VECTOR BIOLOGY: Members of this genus are extremely difficult to identify. *Hyalomma* are hardy ticks adapted for survival in desert regions where climatic conditions are extreme, hosts rare and hiding places sparse. Immature stages commonly feed on birds, rodents and hares. Adults feed on ungulates such as cattle and camels. Many *Hyalomma* species will readily feed on man. They exhibit an unusual host-seeking behavior of rapidly moving across the ground in pursuit of a host. Many species in this genus are highly efficient vectors of a wide variety of disease-causing organisms.

PREVENTION/CONTROL: Immunization is not currently available for this disease. Prevention includes avoiding tick habitats, use of repellents, blousing of boots, and prompt removal of ticks from the body. Area control includes clearing of brush, insecticide spraying to eliminate ticks, reservoir (small mammals) control, and limiting contact with domestic animals.

Schistosomiasis

SYNONYMS: Bilharziasis, snail fever, blood fluke

INFECTIOUS AGENT: Blood flukes (trematodes); *Schistosoma mansoni*, *S. haematobium*, and *S. japonicum* are the major species causing human disease. *S. haematobium* is the only species found in Iraq.

RESERVOIR: Humans are the principal reservoir.

MODE OF TRANSMISSION: Contact with water infected with schistosome cercariae (the motile stage) which have developed in snails (the intermediate host).

CLINICAL FEATURES:

Incubation Period - Most major symptoms occur 2-6 weeks after exposure.

Symptoms - Late afternoon fever, night sweats, prodromal diarrhea, enlarged tender liver,

epigastric distress, pain in the back, groin, and/or legs, and urticaria. Mortality is unusual, but can occur in extreme infections in children.

INCIDENCE/PREVALENCE: Schistosomiasis in Iraq comprises one of the major foci in the world, with an estimated 20% of the population infected. Rates are highest where the environment is suitable for the maintenance of the intermediate snail host. It is endemic in the valleys of the Euphrates and Tigris rivers and along the marshlands of central and southern Mesopotamia. A successful snail eradication effort in Iraq has reduced prevalence rates to 0.1% reported since 2013.

VECTOR: The intermediate host for *S. haematobium* is the snail *Bulinus truncatus*. It has not been reported in the beds of the great rivers: Euphrates, Tigris, Diyala, Zen Badinan and Zei Koya, Karun. These rivers generally carry clay particles from the mountains in which they arise, and the waters of the two main rivers (Euphrates and Tigris) have high concentrations of mineral salts, especially during the summer low waters, which inhibit the establishment of *B. truncatus*. Snail habitats are found in the vast marshlands of central and southern Mesopotamia. The courses of the rivers have been altered over many decades by the construction of numerous dams and dikes and an extensive drainage network of canals which have provided ideal snail habitats and sites for schistosomiasis transmission. Over 35,000 km² are under irrigation in Iraq.

PREVENTION/CONTROL: Wearing of uniform properly to block penetration of cercariae; avoidance of contact with suspect bodies of water whenever possible; avoidance of recreational swimming; sanitary disposal of human feces and urine to prevent viable eggs from reaching bodies of fresh water containing the snail intermediate host; use of molluscicides; use of hexachlorophene on exposed skin areas.

Arthropod-borne Diseases of LOW risk in Iraq³

Murine Typhus

SYNONYMS: Flea-borne typhus, endemic typhus fever

INFECTIOUS AGENT: *Rickettsia typhi* (*Rickettsia mooseri*)

RESERVOIR: Primarily rats. In nature, infection is maintained by a rat-flea-rat cycle. Mice and other small mammals may be involved.

MODE OF TRANSMISSION: Infected rat fleas pass fecal material containing rickettsiae while sucking blood, thus contaminating the bite site and other fresh skin wounds. Once infected, fleas remain infected for life (up to 1 year). Murine typhus is not transmitted directly from

³ Based on the National Center for Medical Intelligence's Infectious Disease Risk Assessment for Iraq, 2022.

person to person.

OCCURRENCE: Large rat populations exist in many of the urban areas of the country making murine typhus a threat in any of these areas where substandard living conditions favor the transmission of the disease.

CLINICAL FEATURES:

Incubation Period - 1 to 2 weeks, commonly 12 days

Symptoms - Sudden onset of headache, chills, prostration, fever and general pain. Macular eruptions generally appear on 5th or 6th day after onset of symptoms. The rash and other skin involvement is less severe than in the louse-borne form. Mortality is low (1% to 5%), less than 2% if treated. Infection confers immunity to future infection.

VECTOR: *Xenopsylla cheopis* the oriental rat flea is the primary vector.

PREVENTION/CONTROL: Residual insecticides effective against the fleas, repellents, rodent control through poisoned baits and elimination of their breeding places, and improvement of the sanitation and standards of human habitation.

West Nile Virus

INFECTIOUS AGENTS: West Nile virus is the infectious agent for West Nile.

RESERVOIR: Various species of birds.

MODE OF TRANSMISSION: From the bite of an infected *Culex* sp mosquito.

CLINICAL FEATURES: Most are asymptomatic. Severe cases include high fever, disorientation, coma, tremors, vision loss, paralysis. Less than 1% of cases are fatal.

INCIDENCE: West Nile Virus occurs rarely in Iraq.

Zika Virus: There have been no reports of Zika Virus in Iraq

Malaria

INFECTIOUS AGENTS: *Plasmodium falciparum* and *P. vivax* are the most common but *P. malariae* is also present.

RESERVOIR: Humans are the only important reservoir of human malaria.

MODE OF TRANSMISSION: From bite of infective female *Anopheles* mosquito, or from blood transfusion from an infected person

CLINICAL FEATURES:

Incubation Period - Usually 12 to 30 days; in some cases of *P. vivax* there may be a protracted incubation period up to 10 months.

Symptoms - Acute febrile illness characterized by chills, fever, headache, sweating, muscular ache, and general malaise. Symptoms of *P. falciparum* malaria may include severe anemia, jaundice, renal failure, shock, loss of orientation, convulsions and coma. Symptoms are most severe in *P. falciparum* malaria. Case fatality rates among nonimmune adults and children considerably exceeds 10%. Relapses are common with improperly treated *P. vivax* and may occur irregularly for years.

Resistance of *P. falciparum* and *P. vivax* to antimalarials is becoming an increasing concern in Iraq because most cases are imported from workers coming in from other countries where chloroquine resistance may occur. According to the US Centers for Disease Control and Prevention, as of 2021 there have been no cases of chloroquine- or paludrine-resistant strains that were native to the area.

SEASONAL INCIDENCE: In the mountainous north, the peak malarial season is in July and August with the season running from May to October.

GEOGRAPHIC DISTRIBUTION: Malaria Transmission is confined almost exclusively to the northern region of Iraq including the cities of Dahok, Irbil, Kirkuk, Mawsil (Mosul), Ninawa, and Sulaymaniyah. Baghdad is considered risk free. Risk is also present in rural areas in the eastern half of the country along the border with Iran.

PREVALENCE/INCIDENCE: Iraq implemented a successful malaria control program in 1957. In 1999, 4,134 cases were noted. Since 2007, the incidence of malaria has been reduced to less than 0.001 cases per 1000 population.

PRIMARY VECTORS:

Anopheles sacharovi is the main vector in the northern regions at altitudes up to 3,000 feet. The period of transmission by this species is from May to November. This mosquito breeds in large and small collections of water that contain aquatic vegetation. It is frequently found in inland and coastal swamps, but also breeds in the boggy ground in bends of rivers, neglected storage areas, and in water from leakage and seepage areas. Adults feed indoors on humans and livestock, and rest in houses and animal shelters.

Anopheles superpictus occurs in the riverine and irrigated areas of the plateau, escarpment and foothill regions of Northern and Central Iraq. It is found in permanent rivers and streams

that are exposed to sunlight, with little or no vegetation, wells dug in dry river beds, and irrigation tanks. It has been reported in low numbers in border villages in Diala province and in Haklaniya/Huditha in Al-Anbar province. Adults feed at night, indoors on humans and livestock and rest in houses and shelters.

Anopheles stephensi is restricted to the central and southern regions, to the south of a line which runs between Khanaquin and Ramadi passing through Ba'aquba, westward to Baghdad and Falluja. This is commonly a domestic mosquito which breeds in man-made containers, water collections near human habitations, footprints, puddles and lake margins. Adults feed indoors on humans and live-stock and rest in houses and shelters.

SECONDARY VECTORS:

Anopheles pulcherrimus is found in high densities in the provinces of the Central Euphrates region; moderate densities are found in the southern region of Basrah, Thequar and Misan provinces. This species has been noted to readily feed on humans and rest outdoors. Other potential vectors of malaria in Iraq are *An. algeriensis*, *An. claviger*, *An. maculipennis*, and *An. hyrcanus*.

PREVENTION/CONTROL: Vector control is through elimination of mosquito breeding places and/or appropriate larviciding or adulticiding measures. Personal protective measures to include proper wearing of clothing, and use of netting and repellent in sleeping areas are effective, especially where mosquito control is difficult. Chemoprophylaxis may be recommended prior to and during deployment in endemic malarious areas where resistant strains aren't prevalent.

Dengue

INFECTIOUS AGENT: Group B arbovirus of the family Flaviviridae. Four serotypes have been identified.

RESERVOIR: Man

MODE OF TRANSMISSION: Bite of infected mosquito, *Aedes aegypti*

CLINICAL FEATURES:

Incubation Period - 4 to 6 days

Symptoms - Include sudden fever of 3-5 days (rarely more than 7), intense headache, pain behind the eyes, severe muscle and joint pain, prostration, gastrointestinal disturbances, and a rash from 3-4 days after onset of fever. In some outbreaks dengue progresses to a severe hemorrhagic form with shock, which can be fatal. Mortality is generally low (less than 2%) except for the hemorrhagic form. Recovery from infection provides homologous immunity of

long duration, but does not provide protection against another serotype. Dengue is not transmitted from person to person. Patients are usually infective for mosquitoes from the day before to the end of the febrile period. The mosquito becomes infective 8-12 days after the blood meal and remains infective for life.

GEOGRAPHIC DISTRIBUTION: Dengue has been reported in Iraq, although no recent epidemics have occurred. Outbreaks among nonimmune populations introduced into Iraq are possible.

PREVALENCE/INCIDENCE: In 2018 there were no deaths due to dengue. Cases have been rare.

VECTOR: *Aedes aegypti* is the primary vector of dengue due to its domesticated habitats and close association with man. This mosquito species is closely associated with human habitats and breeds in fresh water in artificial containers such as tires, cans, rain barrels, or cisterns. Adults prefer to feed on humans during the day and will also feed on cats, dogs, or other domestic animals. Biting activity is increased for 2 hours after sunrise and 2 hours before sunset. The entire life cycle usually takes place near or in human dwellings. The adult flight range is frequently no more than 100 meters from the breeding site.

Louse-Borne Typhus Fever

SYNONYMS: Epidemic louse-borne typhus, classical typhus, typhus exanthematicus

INFECTIOUS AGENT: *Rickettsia prowazekii*

RESERVOIR: Humans

MODE OF TRANSMISSION: The human body louse, *Pediculus humanus*, becomes infected by feeding on the blood of a person with acute typhus fever. Infected lice usually defecate at time of feeding and excrete rickettsiae in their feces. Man is infected by rubbing feces or crushed lice into the bite or into superficial abrasions. Head lice are believed not to be involved in the transmission of any pathogen. Inhalation of infective louse feces as dust may account for some infections.

CLINICAL FEATURES:

Incubation Period - 1 to 2 weeks; commonly 12 days

Symptoms - Onset is variable, commonly characterized by sudden onset with headache, chills, prostration, fever, and general pains. A macular eruption appears on the 5th-6th day, initially on the upper trunk followed by spread to entire body. Mortality is less than 10% if properly treated. The mortality rate varies from 10-40% if untreated.

GEOGRAPHIC DISTRIBUTION: Epidemic typhus occurs mostly in the colder north and northeastern part of Iraq.

VECTOR BIOLOGY: Body lice spend their entire life cycle on the human host. Eggs are usually cemented to the fibers of the underclothing and hatch in about one week. The louse nymph molts three times before becoming a sexually mature adult. The total life cycle is completed in about three weeks. If the clothes are not worn for several days, all of the lice usually die within a few days. Eggs hatch over the temperature range of 24-37⁰ C. Eggs may survive unhatched for 3-4 weeks which is important when considering the survival of lice in infested clothing.

PREVENTION/CONTROL: Improve general sanitation and living conditions, personal hygiene, frequent and thorough washing of all clothing, dusting of clothes and persons with appropriate insecticidal powders, insecticide impregnated clothing, and immunization of susceptible persons entering endemic areas.

Plague

SYNONYMS: Bubonic plague, oriental plague, black death, sylvatic plague

INFECTIOUS AGENT: *Yersinia pestis*, the plague bacillus

RESERVOIR: Wild rodents are the reservoir of plague in rural areas. Commensal rodents, especially *Rattus* species may become involved in urban outbreaks of plague.

MODE OF TRANSMISSION: Bite of infected flea; handling infected animals; inhalation of exhaled droplets from patients with pneumonic form of the disease. Pneumonic plague is highly contagious, especially under conditions of overcrowding. Plague in military personnel may occur as a result of human intrusion into the zoonotic cycle in rural areas.

CLINICAL FEATURES:

Incubation Period - 2 to 6 days; may be slightly longer in vaccinated individuals.

Symptoms - High fever, inflamed and painful swelling in lymph nodes, restlessness, prostration, delirium and coma. May get secondary involvement in the lungs resulting in severe pneumonia. Patients with plague pneumonia (pneumonic plague) are highly communicable and direct person-to-person transfer may result in epidemics in crowded areas. Mortality is high in untreated cases, 50% for bubonic plague and usually 100% in pneumonic plague.

GEOGRAPHIC DISTRIBUTION: Plague still occurs sporadically in Iraq, but there have been no reported epidemics since World War II. However, the presence of a large rat population makes the possibility of future outbreaks likely.

VECTOR: The most frequent source of exposure resulting in human disease worldwide has been from bites of infected *Xenopsylla cheopis*, the oriental rat flea. It is a common ectoparasite of commensal rodents. A secondary vector in this area is the human flea, *Pulex irritans*.

Zoonotic Diseases and Hazardous/Venomous Animals

Rabies

IMPORTANCE: Rabies is considered of INTERMEDIATE importance in Iraq, according to the NCMi Infectious Disease Risk Assessment. Rabies is found all year and has a higher prevalence than the United States.

INFECTIOUS AGENT: *Rabies lyssavirus*

RESERVOIR: Infected mammals.

MODE OF TRANSMISSION: The Rabies virus is transmitted through contact with saliva or brain tissue of the infected animal.

CLINICAL FEATURES: The rabies virus must travel to the brain before symptoms occur. Initial symptoms are flu-like to include fever, weakness and headache. Symptoms progress to delirium, hallucinations and insomnia. The disease period ends after 2 to 10 days. After reaching the clinical phase the disease is usually fatal.

PREVALENCE: In 2010, 24 Rabies deaths were reported. In 2017 there were 9 deaths. Rabies may be under-reported in Iraq.

Leeches

Internal hirudiniasis is caused by leeches of the species *Limnatis nilotica*, found in abundance in northern Iraq. Leech endoparasitism may cause epistaxis or hemoptysis. Occasionally the leeches occlude the respiratory tract leading to severe dyspnea, cyanosis, and suffocation, which may necessitate tracheostomy.

Leech ectoparasitism presents an annoyance for man and domestic animals. Their effects on man are both physical and psychological. They may cause extensive blood loss and the lesions produced from their feeding are susceptible to infection.

Scorpions

Scorpions are nocturnal animals. During the daytime they remain hidden and emerge at night to feed. Some scorpions live in burrows, others hide under rocks, logs, or in crevices. The last mentioned are probably responsible for most cases of scorpion sting in man, for as they seek refuge when daylight comes, they hide in shoes, blankets or in clothing which has been left upon the floor. This is a problem of particular importance in areas where housing construction is

poor, screens are lacking, and cracks in the walls or floor offer many hiding places for scorpions. Food consists of insects and other arthropods.

Scorpions can inflict extremely painful stings which are usually not fatal. Scorpions are plentiful in Iraq. Known species are:

Androctonus crassicauda

Buthacus leptochelys

Buthotus saulcyi

B. scaber

B. schach

Buthus pietschmanni

Compsobuthus acutecarinatus

C. judaicus

C. matthiesseni

Hemiscorpion lepturus

Mesobuthus caucasicus

M. eupeus mesopatamicus

Orthochirus persa

O. scrobiculosus mesopatamicus

Scorpio maurus kruglovi

Flies

Myiasis is the invasion of a host's body parts by fly larvae. Several cases have occurred in Iraq where people have had infections of fly larvae in the eyes. Most cases occurred in the Ranya area of Iraq. Nasal myiasis in sheep and goats is caused by the species *Oestrus ovis*. Accidental myiasis in humans may be caused by this fly. Although the larvae don't grow to maturity in humans, they can cause acute symptoms during their 3- to 10-day period of development.

Venomous Spiders

Latrodectus tredecimguttatus resembles the common black widow spider and has red, orange, or yellow spots on the back of the abdomen. This spider builds a web in dark corners and seeks shelter in rubble or debris.

Lycosa tarantula is a large spider that is active at night and does not build a web.

Venomous Snakes

Elapid (family Elapidae) snakes are characterized by their permanently erect fangs and their threat displays.

Walterinnesia aegypti (Desert black snake or Innes' Cobra) - Adults are uniformly black with iridescent bluish black ventral parts and obtain a length of 1.2 meters. They inhabit arid desert lands. They are nocturnal and spend much of their existence underground, rarely coming to the surface. Toxicity of the venom is about the same as the Indian Cobra, but the quantity is considerably less. It can strike more than half its length.

Viperid (family Viperidae) snakes have long, hinged fangs.

Cerastes cerastes gasperettii (Arabian horned or sand viper). Adults obtain a length of 75 cm and have the basic color of the sand that is the habitat (for example, pale gray on the coral beach sands near the Arabian Gulf, a tan or reddish color further inland). Always with darker irregular bars on the back and two small dark streaks on the sides of the head running back from each eye. Pure white belly. A common snake in arid, sandy desert areas of the central plains. It is nocturnal and moves with a sidewinder motion. It feeds on small rodents, lizards and birds. It will travel long distances in search of prey, travelling a kilometer or more a night. Its bite is painful but usually not life threatening.

Echis carinatus pyramidium (saw-scaled or carpet viper). Obtains a length of 75 cm. Coloration is variable, but the color pattern has 40-50 spots on the back. This snake is very adaptable and may be found from barren rocky or sandy desert to dry scrub forest and gardens. It feeds on a wide variety of small animals and insects. It moves rapidly with a sidewinder motion and is active mainly during the night. Echis snakes are very aggressive, very dangerous, and abundant over much of their range. The venom is extremely toxic and is responsible for most of the human fatalities over their range.

Pseudocerastes persicus (Persian horned viper). Adult obtains a maximum length of slightly less than one meter. *P. persicus persicus* is found in northern Iraq and *P. persicus fieldi* is found in southern Iraq. They inhabit rocky and sandy country to elevations of 6000 feet. They can be morphologically distinguished by the scale rows which are all strongly keeled in *P. persicus persicus* but in *P. persicus fieldi* several lateral rows are nearly smooth and the outer rows are entirely without keels. The venom of the two subspecies differs greatly in its composition.

Vipera lebetina (Levant viper). Maximum length 1.5 meters. This species frequents barren rocky hills and mountains of northeastern Iraq. It is nocturnal and feeds largely on small mammals. It may occur in two color phases, one light-gray or buff with rectangular dark cross-blotches; the other reddish brown or rust without blotches. It is very slow to move, especially when encountered during the day. The Levantine viper is important as a cause of snakebite in the Mideast.

Venomous Snake Bite Symptoms and First Aid Information from US CDC

Symptoms

Signs or symptoms of snake bite vary depending on the type of snake, but may include:

- Puncture marks at the wound
- Redness, swelling, bruising, bleeding, or blistering around the bite
- Severe pain and tenderness at the site of the bite
- Nausea, vomiting, or diarrhea
- Labored breathing (in extreme cases, breathing may stop altogether)
- Rapid heart rate, weak pulse, low blood pressure
- Disturbed vision
- Metallic, mint or rubber taste in the mouth
- Increased salivation and sweating
- Numbness or tingling around your face and/or limbs
- Muscle twitching

First Aid

Do the following if bitten by a snake:

- Seek medical attention as soon as possible—antivenom is the best treatment for serious snake envenomation, the sooner antivenom can be started, the sooner irreversible damage from venom can be stopped.
- Note the appearance of the snake, and take a photograph of it from a safe distance if possible. Identification of the snake can help with treatment of the snakebite.
- Keep calm.
- Inform someone who can help.

Do the following while waiting for medical attention:

- Lie or sit down with the bite in a neutral position of comfort.
- Remove rings and watches in anticipation of swelling.
- Wash the bite with soap and water.
- Cover the bite with a clean, dry dressing.
- Mark the leading edge of tenderness/swelling on the skin and write the time alongside it.

Do **NOT** do any of the following:

- Do **not** pick up the snake or try to trap it—**NEVER** handle a venomous snake, not even a dead one or a decapitated head, they are still capable of envenomation.
- Do **not** wait for symptoms to appear if bitten, seek immediate medical attention.
- Do **not** apply a tourniquet.
- Do **not** slash the wound with a knife or cut it in any way.
- Do **not** try to suck out the venom.

- Do **not** apply ice or immerse the wound in water.
- Do **not** drink alcohol as a painkiller.
- Do **not** take pain relievers (aspirin, ibuprofen, naproxen, etc.).
- Do **not** apply electric shock or try any "folk therapies."

Source: US CDC, VENOMOUS SNAKES, Symptoms and First Aid, last reviewed: May 31, 2018, <https://www.cdc.gov/niosh/topics/snakes/symptoms.html>, accessed 7 May 2021.

Venomous Animals in Desert Operations

Awareness and preventive measures are by far the most important in avoiding a bite or sting from snakes, scorpions or other desert creatures. Remember that these animals are adapted to being relatively inactive during the heat of the day, so the greater exposure hazard is at twilight or at night. Many of these animals are protectively colored, often closely matching their environment. Therefore, they may be hard to spot during the day or night. Avoidance is your best technique. Shake out your boots and clothes before putting them on. Wear your boots day or night when active -- do not go barefooted. Do not sleep on the ground. Don't put your hand in crevices or holes, where you cannot see. Old buildings, caves and mines are places where snakes live. Cool dark places should be avoided. Be careful when picking plants, turning over rocks, moving piles of material, gathering wood, etc. Keep surroundings clean. Refuse attracts bugs that attract lizards and small rodents which snakes feed on. Do not keep snakes, scorpions, spiders or other native creatures as "pets". Following this advice will minimize the likelihood of contact with these animals.

Historical Lists of Species Reported from Iraq

Mosquitoes

[ca. 1991)

<i>Aedes aegypti</i> ^{2,3}	<i>Culex hortensis</i>
<i>Ae. caspius</i> ³	<i>Cx. laticinctus</i>
<i>Ae. communis</i>	<i>Cx. mimeticus</i>
<i>Ae. detritus</i> ³	<i>Cx. perexiguus</i> ²
<i>Ae. echinus</i>	<i>Cx. pipiens</i> ^{2,3}
<i>Ae. flavescens</i> ³	<i>Cx. pusillus</i>
<i>Ae. gemiculatus</i>	<i>Cx. quinquefasciatus</i> ^{2,3}
<i>Ae. lepidonotus</i>	<i>Cx. theileri</i> ²
<i>Ae. mariae</i>	<i>Cx. torrentium</i>
<i>Ae. refiki</i>	<i>Cx. tritaeniorhynchus</i> ^{2,3}
<i>Ae. vexans</i> ³	
<i>Anopheles algeriensis</i> ¹	<i>Culiseta annulata</i> ²
<i>An. apoci</i>	<i>Cu. longiareolata</i> ²
<i>An. claviger</i> ¹	<i>Cu. subochrea</i> ²
<i>An. dthali</i>	
<i>An. fluviatilis</i>	<i>Uranotaenia unguiculata</i>
<i>An. hyrcanus</i> ¹	
<i>An. maculipennis</i> ¹	
<i>An. marteri</i>	
<i>An. melannoon</i>	
<i>An. multicolor</i>	
<i>An. pucherrimus</i>	
<i>An. sacharovi</i> ¹	
<i>An. sergenti</i> ¹	
<i>An. stephensi</i> ¹	
<i>An. superpictus</i> ¹	
<i>An. turkhudi</i>	

¹ Potential malaria vector

² Potential arbovirus vector

³ Significant human pest species

Most Useful Keys for Identifying the Mosquitoes of Iraq

Abdel-Malek, A. A. 1958. The anopheline mosquitoes of northern Syria. Bull. Soc. Entomol. Egypte 42: 519-535 (Old, but useful for the *Anopheles* of Iraq.)

Harbach, R. E. 1985. Pictorial keys to the genera of mosquitoes, subgenera of *Culex* and the

species of *Culex* (*Culex*) occurring southwestern Asia and Egypt, with a note on the subgeneric placement of *Culex deserticola* (Diptera: Culicidae). *Mosq. Syst.* 17: 83-107. **(Best key for *Culex* arbovirus vectors in the Middle East.)**

Harbach, R. E. 1988. The mosquitoes of the subgenus *Culex* in southwestern Asia and Egypt (Diptera: Culicidae). *Contr. Am. Entomol. Inst. (Ann Arbor)* 24(1): 1-240. **(Most up-to-date key to *Culex*, not pictorial.)**

Hudson, J. E. and J. Abul-hab. 1987. Key to the species of adult female culicine (Diptera, Culicidae) mosquitoes of Iraq. *Bull. End. Dis. (Baghdad)* 28: 53-59. **(Somewhat outdated, but useful adult keys to the culicine mosquitoes of Kuwait.)**

Parr, H. C. M. 1943. The culicine mosquitoes of Syria and the Lebanon. *Bull. Entomol. Res.* 34: 245-251. **(Outdated, but fairly good adult and larval keys of some use in Iraq.)**

Postiglione, M., B. Tabanli and C. D. Ransdale. 1973. The *Anopheles* of Turkey. *Riv. Parassitol.* 34: 127-159. **(Adult and larval pictorial keys for *Anopheles* of Turkey, but of use for much of Iraq.)**

Pringle, G. 1951. The identification of the adult anopheline mosquitoes of Iraq and neighboring territories. *Bull. End. Dis. (Baghdad)* 1: 53-76. **(Old and outdated, but very useful because of the many illustrations. Also has adult keys.)**

Zaim, M. and P. S. Cranston. 1986. Checklist and keys to the Culicinae of Iran. *Mosq. Syst.* 18: 233-245. **(Recent, fairly good, and useful for Iraq. Keys adults and larvae, no *Anopheles*.)**

Note: The Walter Reed Biosystematics Unit can provide an illustrated key to the *Anopheles* of the Middle East.

Sand Flies

[ca. 1991]

*Phlebotomus alexandri**
*chinensis**
dentata mediensis
kandelakii
mervynae
*palestinensis**
papatasi
*sergenti**
*tobbi**
*wenyoni**

Sergentomyia *babylonica*
baghdadis
hodgsoni
sintoni
squamipleuris

* Known vectors of *Leishmania tropica*

Fleas

[ca. 1991]

Chiropteropsylla brockmani johnsoni

Ctenocephalides canis
felis

Ctenophthalmus congener allousei

Nosopsylla bunnii
durii
pringlei

*Pulex irritans**

Rhinolophopsylla unipunctinata unipunctinata

Stenoponia tripectinata irakae

Synosternus cleopatrae
pallidus

Xenopsylla astia
*cheopis**
conformis
nubica

* Important vector of plague to man

Ticks

ARGASIDAE

Argas confusus
persicus
vespertilionis

Ornithodoros asperus
erraticus
lahorensis
*savignyi*²
tholozani

IXODIDAE³

Amblyomma lepidum

*Boophilus*⁴*annulatus*
kohlsi
microplus

*Haemaphysalis*⁵*adleri*
erinacei
parva
sulcata

*Hyalomma*⁶*anatolicum anatolicum*
anatolicum excavatum
asiaticum
detritum
dromedarii
impeltatum
marginatum marginatum
rufipes
marginatum turanicum
schulzei

*Ixodes*⁷*eldaricus*

*Rhipicephalus*⁸*bursa*
leporis
sanguineus
turanicus

1. This is the most medically important genus of this family.
2. Has a painful bite.
3. Almost any southwest Asian ixodid is capable of transmitting *Rickettsia conori* the cause of boutonneuse fever.
4. This genus parasitizes ungulates and is unlikely to bite humans.
5. This genus feeds on small mammals and birds and is unlikely to bite humans.
6. Medically important genus that transmits Crimean-Congo hemorrhagic fever.
7. Unlikely to bite humans.
8. Common and widespread genus capable of transmitting disease and feeding on humans.

Pesticide Resistance Data for Iraq

Note: These historical data taken from the World Health Organization's pesticide testing database are retained for informational and planning purposes. R = Resistant, S = Susceptible.

Iraq was one of the first countries in the Middle East to use the new synthetic organic insecticides to control malaria after World War II. After a successful pilot project, the government began a country-wide eradication program in 1957 with the residual treatment of indoor wall surfaces with DDT. When resistance appeared in *Anopheles stephensi* in the southern region, a switch was made to dieldrin. In 1961, a high level of resistance to dieldrin was detected. DDT was reintroduced until due to resistance it was replaced with malathion. Resistance of the other vectors of malaria to DDT has been recorded. The Malaria Eradication Program in Iraq has been plagued with technical, organizational and operational difficulties.

<u>SPECIES</u>	<u>AREA</u>	<u>LOCALITY</u>	<u>INSECTICIDE</u>	<u>STATUS</u>	<u>STAGE</u>	<u>DATE OF TEST</u>
<i>An. stephensi</i>	Resistance to DDT and dieldrin is widespread					
<i>An. stephensi</i>	Basrah Siwa	Aku-Ghareeb	DDT	R	Adult	05/68
<i>An. stephensi</i>	Nassiryah	Akaika	DDT	R	Adult	05/68
<i>An. stephensi</i>	Basrah	Abu-Gharib	DDT	R	Adult	05/67
<i>An. stephensi</i>	Basrah	Geyria	DDT	R	Adult	05/67
<i>An. stephensi</i>	Basrah	Al Brathiya	Fenitrothion	S	Adult	11/80
<i>An. stephensi</i>	Basrah	Al Lateef	Fenitrothion	S	Adult	11/80
<i>An. stephensi</i>	Basrah	Jazerah Owla	Fenitrothion	S	Adult	12/80
<i>An. stephensi</i>	Basrah	Al Brathiya	Malathion	S	Adult	11/80
<i>An. stephensi</i>	Basrah	Al Lateef	Malathion	S	Adult	11/80
<i>An. stephensi</i>	Basrah	Garmat Ali	Malathion	S	Adult	10/79
<i>An. stephensi</i>	Basrah	Abu Hilwa	Malathion	S	Adult	11/79
<i>An. stephensi</i>	Basrah	Al Baradhiya	Malathion	S	Adult	10/79
<i>An. stephensi</i>	Basrah	Moaviyah	Malathion	R	Adult	03/78
<i>An. sacharovi</i>	Sulaimaniya	Tibagolai	DDT	R	Adult	06/73
<i>An. sacharovi</i>	Sulaimaniya	Sayedsadegh	DDT	R	Adult	05/78
<i>An. sacharovi</i>	Ebril	Tawka	DDT	R	Adult	08/73
<i>An. sacharovi</i>	Sulaimaniya	Sayedsadegh	Malathion	S	Adult	05/78
<i>An. sacharovi</i>	Ninewa	Hazar Jut	Malathion	S	Adult	10/79
<i>An. sacharovi</i>	Ninewa	Mulla Barwan	Malathion	S	Adult	10/79
<i>An. superpictus</i>	Dehok	Cani-Bibad	DDT	S	Adult	08/73
<i>An. superpictus</i>	Ebril	Tawka	DDT	S	Adult	08/73
<i>An. superpictus</i>	Basrah	Al Tahsiniya	Malathion	S	Adult	11/79
<i>An. superpictus</i>	Erbil	Sesawah	Malathion	S	Adult	07/80
<i>An. pulcherrimus</i>	Baghdad	Alwan Saji	DDT	R	Adult	09/74
<i>An. pulcherrimus</i>	Salahuddin	Ashegh	DDT	R	Adult	05/78
<i>An. pulcherrimus</i>	Missan	Omalthawa	Malathion	S	Adult	03/78
<i>An. pulcherrimus</i>	Salahuddin	Ashegh	Malathion	S	Adult	05/78
<i>An. pulcherrimus</i>	Basrah	Moaviyah	Malathion	S	Adult	03/78
<i>An. pulcherrimus</i>	Theqar	Al Deen	Malathion	S	Adult	04/81

- *Musca domestica* - Resistance of adult houseflies has been recorded in Iraq to the following insecticides: DDT, malathion, iodofenphos, fenchlorphos, bromophos, benzene hexachloride.
- *Culex pipiens* - Resistance to DDT of adult mosquitoes has been recorded from several localities.

Personal Protective Measures

Personal protective measures are the first line of defense against arthropod-borne disease and may at times be the only protection for military personnel deployed in the field. Proper wear of the uniform and use of repellents can provide high levels of protection. Uniform fabric can provide a significant mechanical barrier to mosquitoes and other blood-sucking and biting arthropods, so the uniform should be worn to cover as much skin as possible if weather and task permit. When operating in tick- and chigger-infested areas the pants should be bloused inside the boots to prevent arthropods from entering. Personnel should check themselves frequently when walking through tick-infested areas. If ticks become attached, the best method of removal is to grasp the tick with tweezers where the mouthparts enter the skin and pull gently but firmly until the mouthparts are extracted. Wipe the bite area with an antiseptic. If hands touch the tick during the removal, wash them thoroughly with soap and water or an antiseptic because tick secretions may contain pathogens.

For the most current and complete personal protective information, see AFPMB TG 36, [Personal Protective Measures against Insects and Other Arthropods of Military Significance](#).

Several types of personal repellent are available in the National Stock System:

NSN	Repellent
3740-01-284-3982	Insect Repellent, personal application, Ultrathon (3M/EPA 58007-1)
3740-01-584-8393	Insect Repellent, personal application, 30% DEET (SP532-Ultra30/LipoDEET)
3740-01-584-8598	Insect Repellent, personal application, 25% DEET, pump spray bottles (Cutter Backwoods DEET Insect Repellent)
3740-01-619-4795	Insect Repellent, personal application, 20% Picaridin, pump spray bottle (NATRAPEL Insect Repellent)
3740-01-656-7707	Insect Repellent, IR3535 pump spray bottle (Bullseye Bug Repellent)
3740-01-137-8456	Insect Repellent, personal application, 5% benzocaine, 10% precipitated sulfur (Chigg-Away)

Before deploying, approved repellent products should be applied to uniforms, bed nets, and tentage that have not been factory treated.

****Important Note: Permethrin products are not for use on the skin****

NSN	Product
3740-01-334-2666	Insect repellent, clothing application, 40% permethrin, liquid (for application with a 2-gallon sprayer)
3740-01-278-1336	Insect repellent, clothing application, 0.5% aerosol (Sawyer Permethrin)

	Arthropod Repellent)
6840-01-692-7397	Insect repellent, clothing application, 0.5% permethrin, in trigger spray dispenser (Sawyer Premium Insect Repellent)
6840-01-345-0237	Insect repellent, clothing application, 40% (pre-dilution) permethrin, individual dynamic absorption application (IDAA) kit ("IDA Kit")

Chemical Control of Pests and Vectors

More detailed recommendations for the selection, application and use of pesticides in field situations worldwide, during contingency operations or military exercises can be found in [AFPMB Technical Guide #24, Contingency Pesticide Usage Guide](#). This guide is a concise reference on: National Stock Number (NSN)-listed pesticides available through military supply channels and designated for contingency use by one or more of the Armed Services; their uses, dosages, and application methods; pesticide dispersal equipment; information on surveillance, trapping, and safety equipment; personal protective equipment against disease vectors; air-transport of pesticides that do not meet transportation requirements; pesticide dilution and dosage formulas; and U. S. military points of contact overseas who can provide information on vector-borne disease control in their respective areas of the world.

Copies of Technical Guide #24, Contingency Pesticide Usage Guide, can be downloaded at <https://extranet.acq.osd.mil/eie/afpmb/cac/techguides/tg24.pdf> .

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Links to Additional Information

AFPMB Technical Guide 24, Contingency Pesticide Use Guide:

<https://extranet.acq.osd.mil/eie/afpmb/cac/techguides/tg24.pdf>

Other AFPMB Technical Guides, and Pesticide and Equipment lists:

<https://www.acq.osd.mil/eie/afpmb/>

American Mosquito Control Association – Mosquitoes and mosquito-borne diseases:

<http://www.mosquito.org/>

Army Public Health Command Entomology and Pest Management – Technical assistance:

<https://phc.amedd.army.mil/topics/envirohealth/epm/Pages/default.aspx>

IR Mapper – Insecticide resistance mapping worldwide:

<http://www.irmapper.com/>

National Center for Medical Intelligence – Current information about diseases:

<https://www.ncmi.dodiis.mil/>

VectorMap – Vector and vector-borne disease distribution maps:

<http://vectormap.si.edu/>

WRBU arthropod keys and identification services:

<http://www.wrbu.org/index.html>