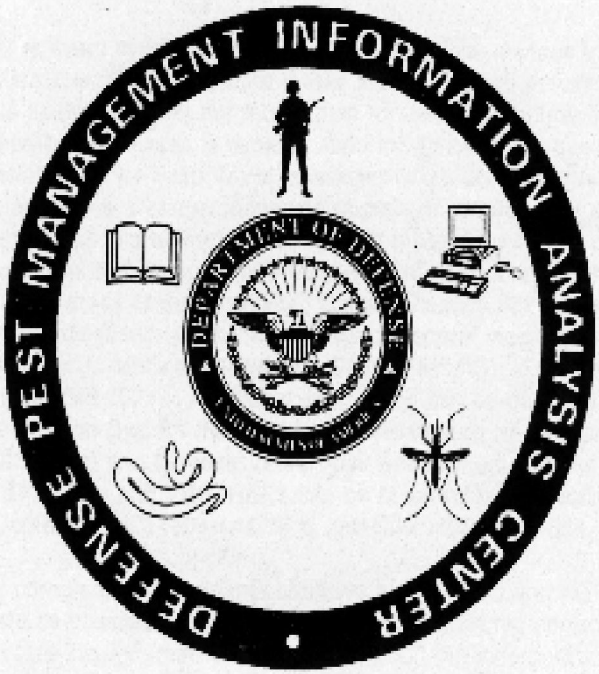
DISEASE VECTOR ECOLOGY PROFILE



YUGOSLAV REPUBLICS

Second Edition - 27 OCTOBER 93

Armed Forces Pest Management Board

DEFENSE PEST MANAGEMENT INFORMATION ANALYSIS CENTER

Forest Glen Section, WRAMC
Washington, D.C.
20307-5001

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
27 OCT 1993		**00-00-1993 to 00-00-1993**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Disease Vector Ecology Profile: Yugoslav Republics	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Defense Pest Management Information Analysis Center,Armed Forces Pest Management Board,Forest Glen Section - Walter Reed Army Medical Center,Washington,DC,20307-5001**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**40**	

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, behavior, and pesticide resistance. A selected bibliography of pertinent disease and disease vector literature is included.

DVEPs are synopses of relevant entomological and arthropod-borne disease information. They are compiled from unclassified scientific literature, and they are intended to provide a historical profile of arthropod-borne disease epidemiology in the recent past for selected geographical areas. The epidemiology of arthropod-borne disease is dynamic, and incidence and prevalence are constantly changing. This is especially true for Third World countries, which are undergoing rapid development and ecological change, and those areas experiencing migrations of large refugee populations as a result of civil 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 assessments, information on parasitic and communicable diseases, and other aspects of general medical intelligence can be obtained from the Armed Forces Medical Intelligence Center (AFMIC), Fort Detrick, Frederick, MD 21701 (301-619-7574, DSN 343-7574). Additional information can be obtained from the Navy Preventive Medicine Information System (NAPMIS), which maintains up-to-date Disease Risk Assessment Profiles (DISRAPs) and Disease Vector Risk Assessment Profiles (VECTRAPs) on most countries of the world. DISRAPs and VECTRAPs can be obtained by contacting the Navy Environmental Health Center (NEHC) (804-444-7575 extension 456, DSN 564-7575 ext 456).

DVEPs are designed to complement documents obtained from AFMIC and NEHC. Every effort is made to keep them as accurate as possible. Individuals possessing additions, corrections, or suggestions are encouraged to communicate this information to Chief, DPMIAC, for incorporation into future revisions. In addition to DVEPs, DPMIAC can provide bibliographic literature searches of its extensive database on pest management, medical entomology, pest identification and pesticides. DPMIAC (301 427-5365, DSN 291-5365).

Acknowledgements: Individuals who have made significant contributions to this DVEP include Dr. John F. Reinert (contractor), Dr. Milan Trpis (technical review), Dr. Richard G. Robbins (editorial and technical reviews), Mrs. Ola J. Tilghman (typing), Ms. Charlene A. Young (production), LTC John B. Gingrich (formatting and rewriting) and Capt Armando Rosales (final formating and rewriting).

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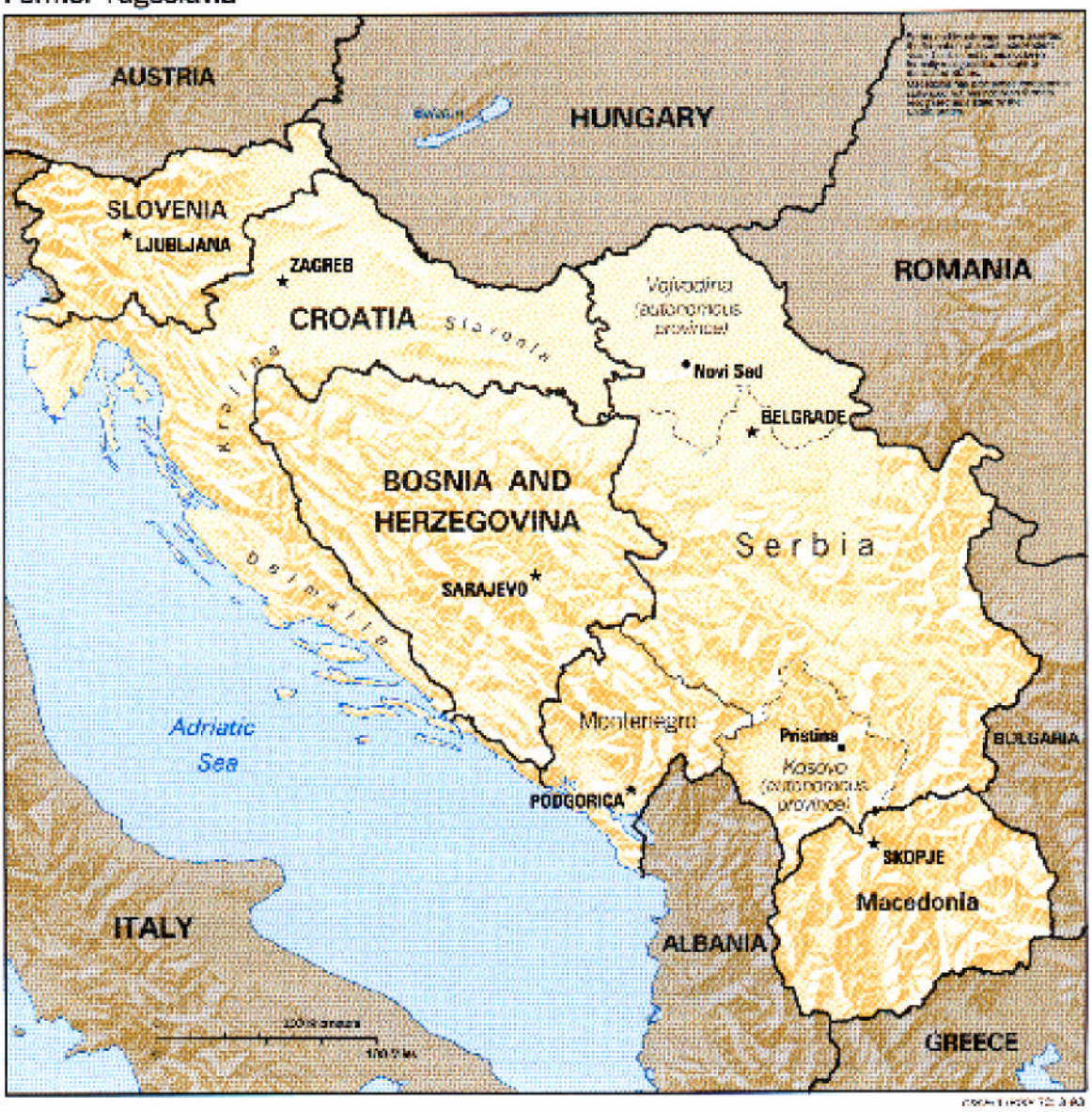

INTRODUCTION

In this document, Yugoslavia is treated with its early 1992 political configuration. It's a southeastern European country about the size of Wyoming and comprises 6 republics (Serbia, including the 2 autonomous provinces of Vojvodina and Kosovo; Croatia; Bosnia and Hercegovina; Slovenia; Macedonia; and Montenegro). A number of republics have declared independence and their ultimate configuration is uncertain. The west coast region includes the Dinaric Alps and the Velebit Range with a number of islands in the Adriatic Sea. The Karawanken and the Julian Alps are in the northwest and the North Albanian Alps are in the south. The Danube River meanders through the fertile farmlands and industrialized cities of the northeast. Italy is to the northwest, Austria and Hungary to the north, Romania and Bulgaria to the east, Greece and Albania to the south, and the Adriatic Sea is to the west.

The climate is extremely varied because of differences in elevation. In Slovenia and the mountains of the Dinaric system, the climate is alpine; in the central part of the country, the climate is similar to that of central Europe; in the southern part, in the Vardar Valley and along the southern portion of the Adriatic coast, it's Mediterranean. The continental region has cold winters (avg. temp. 30°F) and hot summers (75-80°F), with seasonal extremes of -13 to 91°F. The coast has warm winters (January avg. 45°F) and hot summers (July avg. 75°F). Temperatures become lower in the mountains, and the alpine regions have cold winters and short, cool summers. Coastal rainfall averages 25-35 in. annually; totals increase inland to more than 100 in., with heavy mountain snowfall, and decline to 25-40 in the northeastern plains.

The Republics' economic and social situation has deteriorated dramatically during the last few years due to deepening and renewed conflict among ethnic and religious groups of the 6 republics and 2 autonomous provinces. These differences have led to armed conflict in many areas. The population of 23,591,000 (1988) has an ethnic composition (1981) of: Serb 36.3%, Croat 19.7%, Bosnian Muslim 8.9%, Slovenian 7.8%, Albanian 7.7%, Macedonian 6.0%, Montenegrin 2.6%, and other 11.0%. Religious affiliation in 1980 was: Serbian Orthodox 34.6%, Roman Catholic 26.0%, Crypto-Christian 11.3%, Muslim 10.4%, and other 17.7%. The government is a single-party federal socialist republic with two legislative houses, i.e. Chamber of Republics and Provinces (88) and Federal Chamber (220). Official languages are Slovenian, Serbo-Croatian, and Macedonian.

Health resources for the country (1986) include 40,329 physicians (1/ 577 persons) and 141,039 hospital beds (1/165 persons). The major causes of death per 100,000 people (1984) include: circulatory disease 470.6, neoplasia 138.0, respiratory disease 55.7, digestive system disease 40.5.

The economy is 50% agricultural (corn, beets, wheat, potatoes, grapes, barley, hogs, sheep, cattle, poultry). Mineral resources include: copper, iron, lead, zinc, bauxite, antimony, and manganese. Primary manufacturing includes: cement, steel, pulp and paper, sulfuric acid, tires, leather, and cotton fabrics. The land (1986) is 36.6% forested, 25.0% meadows and pastures, 30.6% agricultural cultivation, and 7.8% other. Transportation for the country (1987) includes: 9,246 km of railroads, 119,401 km of roads (59% paved), 17 airports, and 498 merchant marine vessels (>100 gross tons).

There are more than 5,000 plant species in the country. Evergreen species dominate the Mediterranean coast, subtropical plants (cotton, rice, poppies) are found in Macedonia, and deciduous trees (beech, oak, and hornbeam) cover the rest of the country. Animal life in the interior plains is characterized by central and eastern European influences. In the Karst region, many rare species are found and also venomous snakes. Mediterranean species influence the fauna along the coastal belt.

The scarcity of published data on certain diseases of military importance leaves gaps in our understanding of their true incidence, vectors, reservoirs, and dynamics. Many of the diseases are vectored by ticks.

DISEASE RISK SUMMARY

Section omitted from documents placed on the World Web Server.

MILITARILY IMPORTANT DISEASES

SAND FLY FEVER

SYNONYMS: Phlebotomus Fever, Pappataci Fever, Three-Day Fever.

INFECTIOUS AGENTS: Arbovirus, *Phlebovirus*, family Bunyaviridae, serotypes Naples and Sicilian.

RESERVOIRS: Principal reservoirs are humans and the sand fly vectors. Transovarial transmission has been demonstrated. Phleboviruses have been isolated from wild and domestic animals, but natural infection of these animals has not been associated with any disease; therefore, their importance in the maintenance cycle of these agents is uncertain.

MODE OF TRANSMISSION: Through the bite of an infective sand fly, *Phlebotomus* spp.

CLINICAL FEATURES:

(1) Incubation Period - Up to 6 days, usually 3 to 4 days, rarely less.

(2) Symptoms - The disease usually lasts 2 to 5 days and begins suddenly with fever, severe frontal headache, lower back pain, generalized myalgia, retro-orbital pain, photophobia, conjunctival injection, and malaise. Other symptoms may include nausea, dizziness, vomiting, and a stiff neck. Rash is uncommon. No deaths have been associated with this disease, and recovery is complete; however, weakness and depression may persist for a week or more.

GEOGRAPHICAL DISTRIBUTION: There is considerable overlap between the Naples and Sicilian serotypes found in the Yugoslav Republics (Naples predominates). Sand fly fever reportedly occurs along the Adriatic coast from Istria to Dubrovnik and throughout the coastal islands from Mali Losinj to Korcula.

SEASONAL DISTRIBUTION: The sand fly fever season occurs from about May to September, which coincides with sand fly activity and abundance.

INCIDENCE/PREVALENCE: Data from 1975 indicate that both viral serotypes have occurred in the Kosovo area. However, recent seroprevalence rates vary from 23 percent along the Croatian Littoral and in the northern Dalmatian Islands to 51 percent on Mijet. Naples serotype continues to predominate.

VECTORS AND VECTOR BIOLOGY: Antibodies to the 2 sand fly fever serotypes have been detected only in areas where *Phlebotomus papatasi* occurs. A suspected secondary vector is *P. perfiliewi*.

Phlebotomus papatasi - Breeding places are in moist, loose soil in dark, humid, sheltered places such as beneath stones, in masonry crevices, in deep soil cracks, or in animal burrows. Several days after a blood meal the female lays one or more batches of eggs. Eggs hatch in about 10 days and the larvae feed on insect or animal feces, decaying vegetation, or other organic debris. Larval development is completed in 2 to 4 weeks and that of the pupa in about 7 to 10 days. Fourth instar larvae overwinter. The life cycle is completed within 6 to 8 weeks. Adults begin to emerge around May and disappear by the end of September. They become active at dusk and feed throughout the night. Flight range is usually within 100 meters of the breeding site. This feature often leads to a highly circumscribed distribution, so that only certain sections of a town, groups of houses, or even rooms within a house are heavily infested, while few sand flies are found in the immediate surroundings. Peculiarities of local sand fly distribution depend on the availability of breeding sites and daytime shelters, and to some extent on the prevailing winds.

PREVENTION/CONTROL: Human-vector contact can be reduced by use of DEET repellent on exposed skin, permethrin impregnation of uniforms, and sleeping in permethrin treated bednets. Insecticide treatment of window screens provides some protection. Residual insecticides applied to building interiors and adult resting sites can be effective in controlling sand flies.

TICK-BORNE ENCEPHALITIS

SYNONYMS: Central European Tick-Borne Encephalitis, Viral Meningo-Encephalitis, Czechoslovak Tick-Borne Encephalitis, Biphasic Meningoencephalitis, Diphasic Milk Fever, (abbreviation TBE).

INFECTIOUS AGENT: Arbovirus, *Flavivirus*, family *Flaviviridae*, Russian Spring-Summer Encephalitis Complex.

RESERVOIRS: Small mammals (rodents and insectivores) and ticks through transstadial and transovarial transmission.

MODE OF TRANSMISSION: Occurs through the bite of an infective tick or through the consumption of raw and unpasteurized milk and milk products (e.g. goat, sheep, cow).

CLINICAL FEATURES:

(1) Incubation Period - Averages 7 to 14 days.

(2) Symptoms - The course of disease is mono- or biphasic with initial symptoms of headache, nausea, vomiting, weakness, loss of appetite, photophobia, hyperesthesia, and fever averaging 101ºF. Acute phase sometimes includes signs of neurological disorders (e.g. blurred vision, diplopia). The first phase of illness lasts 4 to 6 days and is accompanied by viremia. In biphasic cases, a brief remission occurs, followed by return of fever and then signs of meningeal irritation. Abortive, meningeal, encephalitic, and encephalomyelitic types of TBE have been distinguished. In Europe, TBE is a relatively mild clinical disease with a low case-fatality rate.

GEOGRAPHICAL DISTRIBUTION: The TBE virus was initially isolated in 1953 during an epidemic in Slovenia. Isolates were first reported in other areas as follows: Croatia (1953), Bosnia and Hercegovina (1962), Serbia (1969), Kosovo (1972), and Montenegro (1973). Most recent analyses indicate that the disease occurs in widely distributed foci of northern Slovenia and Croatia, although some risk occurs countrywide.

SEASONAL DISTRIBUTION: Cases may occur from spring until autumn, but approximately 95% occur during May to September. The seasonal peak is in July, when about 33% of the cases occur.

INCIDENCE/PREVALENCE: Of 304 cases (age 11-30 years) admitted to hospitals in Slovenia in a 1953 epidemic, 208 were analyzed by profession as follows: peasants, woodworkers, and their families (111); industrial workers (54); state employees (21); craftsmen (16); and others (6). Residents of small villages made up 90.9% of the cases, with the remainder from larger towns. Patients 11-30 years old constituted 56.2% of the total cases. Recent data from Bosnia-Hercegovina and the Adriatic Littoral areas indicated seroprevalences of 1.5 and 2.6 percent , respectively.

VECTORS AND VECTOR BIOLOGY: The generally incriminated vectors in Yugoslavia are the ticks *Ixodes ricinus* and *Ix*. *trianguliceps* (family Ixodidae). Human cases of TBE are closely associated with woodlands and these tick species. One isolate of TBE virus was made from *Dermacentor reticulatus* (= *pictus*) in Croatia.

Ixodes ricinus - In Croatia, this tick has been observed between March and July, with a population peak in April-May; no ticks were found in November and December. Ticks can be collected when temperatures reach 43°F, and numbers increase proportionately with increased air temperature. This species occurs in high densities along deciduous forest edges and in supplementary shrub communities. The tick's developmental cycle requires 3 to 4 years. Intervals between successive feedings of individual ticks vary from 4 to 22 months, often depending on the availability of hosts. Ticks parasitize wandering and migrating birds, usually during the summer and autumn when the activity of the birds increases, resulting in the spread of ticks to both neighboring and distant biotopes. Flocks of sheep infected with TBE migrating from one area to another may also facilitate the spread of the disease and infected ticks.

Ixodes trianguliceps - The burrow tick primarily parasitizes shrews, voles and field mice, in that order. Although it may be found in surface leaf litter and in the underground nests of its hosts, most often it is found in burrows. The preferred habitats are deciduous or coniferous forests or wooded plantations below 900 meters in elevation. It exhibits two seasonal abundance peaks per year, usually in July and October. Developmental time is generally one to two years (sometimes longer). Since *Ix. trianguliceps* is a highly zoophilic species, its major role is probably in zoonosis maintenance.

PREVENTION/CONTROL: Proper wearing of clothing (tops of socks pulled over bottoms of trousers; trouser bottoms tucked into boot tops), impregnation of outer clothing with permethrin, and use of DEET repellent on exposed skin provide personal protection in infested areas. A TBE vaccine is available in Europe (this would be used only after U.S. military medical department recommendation). Personnel should be advised to avoid unpasteurized milk and milk products. Elimination of ticks can be accomplished by application of acaricides to ground and vegetation in highly infested areas and bivouac sites.

CRIMEAN-CONGO HEMORRHAGIC FEVER

SYNONYMS: Crimean Hemorrhagic Fever, Central Asian Hemorrhagic Fever, (abbreviation CCHF).

INFECTIOUS AGENT: Arbovirus, *Nairovirus*, family Bunyaviridae

RESERVOIRS: The virus survives in the vector tick for at least one year, transstadially during the tick's postembryonic developmental stages, and is transovarially transmitted to the F_2 generation. Hare, hedgehog and cow hosts may serve as virus amplifiers.

MODE OF TRANSMISSION: To humans through the bite of an infective adult tick, *Hyalomma marginatum marginatum.* Nosocomial transmission from patients to medical personnel can occur after exposure to blood and secretions, and infection has been associated with butchering infected animals. Immature ticks are presumed to acquire infection from animal hosts.

CLINICAL FEATURES:

(1) Incubation Period - 3 to 12 days.

(2) Symptoms - Illness begins abruptly with fever, chills, malaise, irritability, headache, weakness, and severe pains in the limbs and loins followed by anorexia, nausea, vomiting, abdominal pain, and occasionally diarrhea. Fever is continuous but may remit, usually resolving after 8 days. Patients are depressed and somnolent. In most cases a fine petechial rash begins on the trunk and then covers the entire body. The liver is enlarged in about 50% of cases. Bleeding occurs, in descending order of frequency, from the nose, gums, buccal mucosa, stomach, uterus, intestines, and lungs. Involvement of the central nervous system is seen in 10-25% of cases and usually indicates a poor prognosis; it includes

neck rigidity, excitation, and coma. The mortality rate may reach 30-50%, usually due to shock, secondary blood loss, or intercurrent infection. Convalescence is prolonged.

GEOGRAPHICAL DISTRIBUTION: Cases of CCHF have been diagnosed clinically from rural inhabitants of Kosovo and Metokhiya. A serologically confirmed CCHF epidemic occurred near Tetovo, Macedonia. The disease also is reportedly enzootic in discrete foci in unspecified northern areas.

SEASONAL DISTRIBUTION: CCHF cases have occurred during the summer following the build-up of infected tick populations. Cases can occur from early spring to late autumn. As expected, the most important epidemics in neighboring Bulgaria have been associated with increased tick abundance.

INCIDENCE/PREVALENCE: Eight CCHF cases occurred in 21- to 54-year-old people in Kosovo and Metokhiya in the summers of 1954 to 1967. In 1970 near Tetovo, Macedonia, a family of 13 members became ill with CCHF and 2 died. In 1988, an outbreak near Dubrovnik affected 200 persons (10 fatal). The most recent data indicate that human seroprevalence rates up to 12 percent may be found in endemic areas, with higher rates in domestic livestock.

VECTORS AND VECTOR BIOLOGY: The tick *Hyalomma marginatum marginatum* is the primary reservoir/vector of CCHF virus in the Yugoslav Republics. Other species of *Hyalomma*, *Dermacentor*, and *Rhipicephalus* may be involved in zoonotic CCHF virus circulation during nonepidemic periods; these ticks also bite people. As well, the virus has been isolated from *Ixodes ricinus* in this country. A combination of mild winter and spring weather and ecological changes stemming from war, flood control, or land conversion may trigger an explosion of CCHF virus in rapidly increasing tick populations. *Hyalomma marginatum marginatum* - This 2-host tick characteristically occurs in steppe, savanna, and lightly wooded hill and valley biotopes with fairly low relative humidity, but not in deep forests or high mountains. The larval and nymphal stages chiefly parasitize ground-feeding birds, hares or hedgehogs. Burrowing rodents are seldom parasitized. Infested birds are important in dispersing immature ticks during postbreeding and migratory flights. Adults feed on all domestic mammals, are especially common on cattle and horses, and eagerly attack humans.

PREVENTION/CONTROL: See appropriate personal protective and control measures listed for tick-borne encephalitis. Persons caring for and treating CCHF patients need to take strict precautions against contamination by bloody discharges and possibly by aerosols. At the first sign of an outbreak, a vigorous awareness and education program should be initiated.

LYME DISEASE

SYNONYMS: Erythema Chronicum Migrans, Tick-Borne Meningopolyneuritis, Lyme Borreliosis, Acrodermatitis Chronica Atrophicans.

INFECTIOUS AGENT: A spirochete, *Borrelia burgdorferi* (heterogeneity in isolates from Europe).

RESERVOIRS: Feral animals of forests (especially rodents, other small mammals and deer) and domestic animals (e.g. dogs, cattle, sheep) on which ticks feed are considered the major reservoirs.

MODE OF TRANSMISSION: To humans through the bite of an infective tick (*Ixodes ricinus*).

CLINICAL FEATURES:

(1) Incubation Period - 3 to 50 days (median of 22) for early and usually self-limiting ECM, and 1 to 100 days (median of 40) for neuroborreliosis.

(2) Symptoms - The disease symptom spectrum includes skin manifestations (erythema chronicum migrans [ECM], acrodermatitis chronica atrophicans [ACA], and lymphadenosis cutis benigna [LCB]), neurological manifestations (meningopolyneuritis [MPN], cranial neuritis, lymphocytic meningitis, encephalitis, and myelitis), joint manifestations (mono- or oligoarthritis), and cardiac involvement (various disorders of the conduction system to frank myocarditis). Elderly people frequently exhibit the ACA condition. Skin manifestations (ECM, ACA, LCB) and systemic symptoms are more frequently observed in females than in males, but neurological manifestations predominate in males. Of 250 cases in Yugoslavia, the clinical diagnosis provided was: ECM = 60.0%; ACA = 0.8%; LCB = 0.8%; MPN = 36.0%; and systemic symptoms = 2.4%.

GEOGRAPHICAL DISTRIBUTION: Lyme disease is presumed to occur throughout most of the Yugoslav Republics with the possible exception of southern Macedonia; this corresponds closely with the distribution of the tick vector.

SEASONAL DISTRIBUTION: Transmission occurs from spring through early fall, with peaks in April and May, periods of high tick activity and abundance.

INCIDENCE/PREVALENCE: Lyme disease occurs in all age groups and in both sexes. Antibody prevalences of up to 11.3 percent have been found in inhabitants of rural forested areas.

VECTORS AND VECTOR BIOLOGY: The vector throughout Europe, including Yugoslavia, is the sheep tick, *Ixodes ricinus* (family Ixodidae). Larvae and nymphs can transmit the rickettsiae transstadially and the females transovarially.

Ixodes ricinus - For bionomics, see tick-borne encephalitis.

PREVENTION/CONTROL: See appropriate personal protective and control measures listed for tick-borne encephalitis.

BOUTONNEUSE FEVER

SYNONYMS: Mediterranean Tick Fever, Marseilles Fever, Tick-borne Typhus.

INFECTIOUS AGENT: Rickettsiae, *Rickettsia conorii*.

RESERVOIRS: Dogs and small wild animals maintain the rickettsiae in nature; vector ticks are also reservoirs.

MODE OF TRANSMISSION: To humans through the bite of an infective ixodid tick, especially *Rhipicephalus sanguineus*. Humans are also infected by contamination of the eyes, nasal mucosa or skin lesions by contents of crushed, infected ticks.

CLINICAL FEATURES:

(1) Incubation Period - Usually 5 to 7 days.

(2) Symptoms - This mild to moderately severe disease is characterized by a primary button-like lesion, a fever lasting a few days to 2 weeks, and a maculopapular rash (usually on palms and/or soles of feet) appearing 3 to 5 days after onset. Other symptoms include headache, malaise, myalgia, and conjunctival injection. Complications and sequelae are unusual and recovery is complete. Fatality rate is less than 3%, even in untreated cases.

GEOGRAPHICAL DISTRIBUTION: This disease has been reported from most of the area around the Mediterranean Sea. Specific distribution data within Yugoslavia are lacking.

SEASONAL DISTRIBUTION: Highest incidence in the Mediterranean area is during the warmer months of the year. Presumably this is also true in the Yugoslav Republics.

INCIDENCE/PREVALENCE: In the Mediterranean area the highest incidence of disease occurs during the spring and summer months when ticks are numerous. However, specific incidence/prevalence data are lacking.

VECTORS AND VECTOR BIOLOGY: Vectors are ixodid ticks. People visiting the Mediterranean coast expose their dogs to attack by infective dog ticks (*Rhipicephalus sanguineus*). The dogs then carry the ticks home where they become a source of infection for humans and other small mammals in the area.

Rhipicephalus sanguineus - This tick's principal host is the dog. It also feeds on numerous other animals, but rarely on humans. Adult ticks are often found in the ears and between the toes of dogs, larvae and nymphs in the long hair at the back of the neck. Eggs are deposited in cracks/crevices of the kennel or other areas frequented by dogs. Eggs hatch in 20 to 30 days. Ticks tend to crawl upwards and are often found in cracks in the roofs of kennels. Larvae and nymphs can transmit the rickettsiae transstadially and the females transovarially.

PREVENTION/CONTROL: See appropriate personal protective and control measures listed for tick-borne encephalitis.

LEISHMANIASIS

SYNONYMS: Kala-Azar, Visceral Leishmaniasis (VL), Cutaneous Leishmaniasis (CL), Oriental Sore.

INFECTIOUS AGENTS: Protozoan, *Leishmania infantum* (previously reported as *L. donovani infantum*) for VL and *L. tropica* or *L. major* for CL.

RESERVOIRS: For VL, humans and dogs are the proven reservoirs; suspected reservoirs are rats (*Rattus rattus*, *R. norvegicus*), from which isolates have been made. Humans are reservoirs for CL. Wild reservoirs are uncertain in the Yugoslav Republics.

MODE OF TRANSMISSION: To humans through the bite of an infective phlebotomine sand fly.

CLINICAL FEATURES:

(1) Incubation Period - For VL generally 2 to 4 months (range 10 days to 2 years); for CL at least 7 days to many months.

(2) Symptoms - VL is a chronic systemic disease characterized by fever, hepatosplenomegaly, lymphadenopathy, anemia with leukopenia, and progressive emaciation and weakness. Fever can be either gradual or of sudden onset, continued and irregular, often with 2 daily peaks, and is followed by alternating periods of apyrexia and low grade fever. CL is a polymorphic disease of the skin and mucous membranes that begins with a nodular lesion, which may be painless or become painful and ulcerate. Lesions may be single, multiple or diffuse and may be chronic or self-limiting.

GEOGRAPHICAL DISTRIBUTION: Historically, a few cases of VL have been reported each year from Croatia, Serbia, Macedonia, Montenegro, and Dalmatia. However, the most recent information indicates

that it is focally distributed in southeastern Serbia and among the Dalmatian coastal islands. CL occurs in some coastal areas and on islands of the Dalmatian Sea. Historically, it has been extremely rare in Serbia.

SEASONAL DISTRIBUTION: Transmission of the disease is centered around the population dynamics of the adult sand fly vectors and occurs from May through October, peaking from July through September.

INCIDENCE/PREVALENCE: During 1968 there were 8 cases from 7 localities in Nis. In Macedonia, there were 105 VL cases in 1942-1947 and 15 VL cases in 1960-1969. Five VL cases were reported from Montenegro in 1967 and 8 from Dalmatia in 1968. Sporadic cases of CL occurred in Serbia and the Dalmatian coastal islands during the 1960s. Currently, all active foci of VL have decreased and few cases are reported.

VECTORS AND VECTOR BIOLOGY: The primary vector of VL is the sand fly *Phlebotomus major*. Other reported secondary vectors of VL are *P*. *perfiliewi*, *P*. *simici*, and *P*. *tobbi*. The primary vector of CL is *P*. *papatasi* and the secondary vector is *P*. *perfiliewi* (and possibly *P*. *sergenti*).

Phlebotomus major and *P*. *perfiliewi* - Adults have been found resting in bee-eater burrow-nests and sleeping places, rodent holes, animal burrows, small recesses under tufted grass, soil cracks and crevices, and other suitable shelters; these areas are probable sand fly breeding places. Both species are well-known human-biters and are found in village houses; however, the latter species occurs in greater abundance. Flies also have been commonly collected in stables. Two generations a year are found in the Dobric area from the end of July to the third week of September. Flies feed on humans, dogs, rats and other animals. Adults are most active during hot, still nights; activity is diminished by strong wind or rain and much reduced at a temperature of 66^{o}F (activity stops at 61^{o}F). *Phlebotomus perfiliewi* adults are attracted to artificial light sources and immatures are found in cow manure.

Phlebotomus papatasi - For bionomics see sand fly fever.

Phlebotomus tobbi and *P*. *simici* - Biology is similar to the first 2 species except that they exhibit low abundance in natural habitats and are uncommon in village houses. Immatures of *P*. *tobbi* have been collected from cow manure in the region of Dobric.

PREVENTION/CONTROL: Currently, special protective and control measures for this disease are not warranted, although they would be similar to those listed for sand fly fever. In 1953, a marked reduction in sand fly abundance occurred following house spraying with DDT for malaria control and a similar specific VL control program.

OTHER VECTOR-BORNE DISEASES OF POTENTIAL IMPORTANCE

LOUSE-BORNE RELAPSING FEVER: Humans acquire this disease when an infective body louse (*Pediculus humanus humanus*) is crushed over the bite wound or an abrasion of the skin. The head louse *(Pediculus humanus capitis*) may be an occasional vector. Infection is caused by *Borrelia recurrentis* in a person-louse-person cycle. The disease currently is endemic in the southeastern 60% of the Yugoslav Republics, and during a major epidemic between 1946-1949 it predominated in rural areas. Seasonally increased incidence occurs during the winter, especially where poor hygienic conditions prevail. In the past, this disease occurred during wartime in Yugoslavia and usually accompanied outbreaks of louse-borne typhus. Currently, the disease has a low endemicity. The incubation period is usually about 8 days (5-15 day range), and onset of illness begins abruptly with chills, fever, headache and fatigue, which usually occur continuously throughout the day. Other symptoms include myalgias, arthralgias, anorexia, dry cough, and abdominal pains. Elevated temperatures of 101-104ºF last 2 to 9 days and alternate with afebrile periods of 2 to 4 days; the number of relapses varies from 1 to 10 or more. Fatalities in untreated cases are 2-10% but have exceeded 50% in epidemics. Personal preventive measures include wearing permethrin impregnated uniforms, good hygiene, and avoidance of close contact with louse-infested people. Treatment with insecticidal powder is effective for individual or mass delousing.

LOUSE-BORNE TYPHUS: This disease (also known as epidemic typhus, classical typhus fever, Brill-Zinsser disease, and recrudescent typhus) is caused by *Rickettsia prowazeki* and is transmitted to humans when an infected body louse (*Pediculus humanus humanus*) or its contaminated feces are crushed/rubbed into the bite wound or another skin abrasion or when contaminated feces come in contact with conjunctivae and mucous membranes. Head lice *(Pediculus humanus capitis*) may be occasional vectors. Humans are the reservoir of the disease and are responsible for infection maintenance during inter-epidemic periods. Widespread epidemics of louse-borne typhus occurred in Yugoslavia during and after World War II. Currently, endemic foci exist primarily in the form of Brill-Zinsser disease cases and some secondary cases. Incidence is chiefly during the winter, especially where poor hygienic conditions prevail. Between 1964 and 1975 there were 803 reported cases of Brill-Zinsser disease (623 of these were from Bosnia and 107 were from Serbia). An interval of 30-39 years between the first attack and relapse occurred in 26% of these cases. The usual incubation period is 8 to 12 days, followed by an abrupt onset with unremitting headache, chills, fever (persisting at 102-104ºF), and myalgia of the back and legs. A rash covers the upper trunk and spreads. Persistent subclinical infections result in Brill-Zinsser disease with potential recrudescence years later. See personal protective and control measures listed for louse-borne relapsing fever.

MURINE TYPHUS: This rickettsial disease, caused by *Rickettsia typhi* (= *R. mooseri*), is also known as flea-borne, endemic, or shop typhus. Transmission of rickettsiae to humans occurs when the infectious feces of rat fleas, especially *Xenopsylla cheopis*, contaminate the bite wound or fresh skin abrasions, or when dried airborne feces are inhaled. Rats of the genus *Rattus* (e.g. *R. rattus, R. norvegicus*) are the primary reservoirs and infection is maintained in nature by a rat-flea-rat cycle. Some authors believe the disease is often unrecognized (or under reported) because it occurs sporadically, frequently without distinguishing clinical manifestations. The incubation period in humans is 6 to 14 days. Illness is characterized by headache, myalgia, and fever; its onset is variable but not often sudden. A rash on the upper thorax and abdomen occurs in 60-80% of cases. In untreated adults, temperatures of 102-104ºF usually last for 12 to 16 days, convalescence is rapid, and the fatality rate for all ages is about 2% but increases with age. Individual protective measures include avoidance of endemic foci and using repellents (permethrin impregnation of uniforms and DEET on skin). During rodent control operations, insecticide dusting of rodent harborages to kill their fleas should precede rodent poisoning/trapping.

TAHYNA VIRUS INFECTION: This arbovirus (*Bunyavirus*, family Bunyaviridae) is transmitted by mosquitoes (e.g. *Aedes vexans*) and produces an influenza-like febrile disease with headache, nausea, pharyngitis, hyperemia of the conjunctivae and, in some patients, myalgia, central nervous system involvement, or bronchopneumonia. Wild mammals (e.g. hares, rabbits, hedgehogs) are the principal reservoir hosts and under natural conditions show no clinical manifestations. One survey of sera in the Republics indicated that 8% of 50 people tested were positive for Tahyna virus antibodies. Humans readily enter the transmission cycle of Tahyna virus but are considered aberrant hosts because viremic levels sufficient to infect the mosquito vector have not been recorded. Personal protective measures are not warranted at present.

BHANJA VIRUS: In 1977, this Bunyavirus-like virus (family Bunyaviridae) was isolated from the tick *Haemaphysalis punctata*, collected from sheep on the island of Brac on the Adriatic coast of Yugoslavia. Antibody prevalence rates averaged from 35.8% (high of 61.3%) for humans to 100% for sheep. Evidence suggests a natural cycle involving ticks and sheep. Serological surveys in other areas of the country showed positive results in humans as follows: Hvar, 1.0% of 512; Zadar, 2.2% of 90; northern Croatia, 7.1% of 645; and Kosovo, 4.8% of 104 and 0.9% of 628. The virus generally produces mild or inapparent infections in humans. Personal protective measures are not warranted at present.

SCABIES: This infectious disease of the skin in caused by a mite, *Sarcoptes scabiei*, that lives in tiny linear burrows just beneath the skin surface. Eggs are laid in the burrows. Lesions are often pronounced around finger webs, ventral surfaces of elbows and wrists, the belt line, thighs, anterior axillary folds, and genitalia. Itching can be intense, especially at night. Transmission of mites is by direct skin-to-skin contact. Itching in persons without previous exposure begins in 2 to 6 weeks. In Skopje, Yugoslavia, a survey during 1969-1971 of 2,481 soldiers with scabies showed that 15% had been infected during the first month of military service, 42.4% during the first 2 months, and 72.5% during the first 6 months. Personnel should practice good hygiene and avoid close contact with mite-infested people.

MALARIA: Yugoslavia previously was endemic for this protozoan disease (*Plasmodium* species) that is vectored through the infective bite of *Anopheles* mosquitoes (e.g. the *maculipennis* complex or *An. superpictus*). The incubation period for the disease is about 12 to 14 days. In 1960, malaria was reported to have been eradicated from the country. Despite eradication, the combination of abundant vectors and regular occurrence of imported cases make reintroduction a real possibility, especially under unsettled economic, political or environmental conditions. If autochthonous transmission resumes, personal protective and control measures listed for sand fly vectors would be recommended, as well as drug prophylaxis.

POISONOUS SNAKES

FAMILY VIPERIDAE: Viper, Asp, Adder.

Genus *Vipera* - The viper, asp, and adder are the only poisonous snakes in Yugoslavia. Eight species and subspecies are known (see Appendix I). Characteristics common to all species are the following: head distinct from neck, covered with small scales with or without small frontal and parietal shields; eyes moderate or small, with vertical pupil, separated from labials by scales; nostrils lateral; nasal in contact with rostral or separated by a nasorostral shield; body cylindrical; scales keeled, with apical pits, in 19-31 rows; ventrals rounded, tail short, anal entire, subcaudals in 2 rows; typical solenoglyphic fangs in tissue sheath; and no sensory pit between nostril and eyes. These snakes generally are found in wilder areas, particularly in rocky places, such as mountains, where they may occur at elevations up to 5,000 feet. Mountain slopes, moors, grain fields and trash piles are favored habitats. Some species are aggressive and, at times, savage. They hibernate during the winter months and are active from March through

October. Venom is moderately potent. Over a 12 year study period (split area), most snake bites were inflicted by the horned viper and the common adder.

SNAKE BITE: Reported cases of snake bite in military personnel conducting operations are small; however, the fear of being bitten by a poisonous snake can be a degrading morale factor.

Laboratory experiments show that snake venoms contain a complex mixture of toxic factors, but the clinical signs of snakebite poisoning in humans are usually distinctive because viper venom is mainly vasculotoxic. Venomous snakes inflict two types of bite: (1) a bite inflicted when the snake is seeking prey, in which a victim dies rapidly following injection of a large quantity of venom, and (2) a defensive bite, with little or no venom injected, the snake's object being to escape. Studies of snakebite patients confirm that when venomous snakes bite humans, the bites nearly always are of the second type. More than half the victims have minimal or no poisoning. Only about a quarter will develop serious systemic poisoning.

The commonest reaction following snakebite, whether or not the snake is poisonous, is fright. Fear, to some degree, is present in all snakebite victims and often dominates the clinical picture. Emotional symptoms emerge rapidly, within minutes of the injury, while symptoms of systemic poisoning rarely appear until a half hour or more after the bite. The frightened victim may appear semiconscious, with cold, clammy skin, feeble pulse, and rapid, shallow breathing. These symptoms resolve quickly after a placebo injection.

FIRST AID: The following steps should be followed if snakebite occurs.

(1) Get the victim away from the snake. Keep victim calm and quiet. Do not handle the snake or put yourself at risk of being bitten. Identify the snake if possible. If it has been killed, keep it.

(2) Immobilize the site of the bite and, if possible, keep the site below the level of the victim's heart.

(3) Do not give the victim anything to eat or drink.

(4) If the bite is on one of the victim's upper limbs, remove any rings or jewelry from that limb.

(5) Arrange immediate evacuation of the victim. If there is no evidence of venom, keep the victim quiet and under observation.

(6) If there is evidence of venom (swelling, spreading pain, bruising, symptoms remote from the bite area) and LESS than 30 minutes have passed since the bite, place a band about 4 inches above the bite. Tighten it just to the point that you can only get one finger beneath the band. Do not remove the band, but if swelling develops, be prepared to adjust it so that it gets no tighter.

(7) An ice pack can be used intermittently to reduce pain. DO NOT pack a limb in ice or immerse it in ice water.

For information on snakebite, including sources of antivenins worldwide, contact the Arizona Poison and Drug Information Center, phone number (602) 626-6016.

Appendix* A. Mosquitoes** Reported from the Yugoslav Republics

Aedes (*Aedes*)
Anopheles (*Anopheles*)
cinereus

Aedes (*Aedimorphus*)
vexans

Aedes (*Finlaya*)
echinus
geniculatus

Aedes (Ochlerotatus)
annulipes
cantans
caspius
communis
detritus
dorsalis
excrucians
flavescens
pulchritarsis
pullatus
punctor
sticticus

Aedes (Rusticoidus)
refiki
rusticus

Aedes (Stegomyia)
aegypti

Culiseta (*Allotheobaldia*)
longiareolata

Culiseta (Culiseta)
annulata annulata
annulata subochrea
fumipennis
glaphyroptera
morsitans
algeriensis
atroparvus
bifurcatus
hyrcanus
labranchiae
maculipennis
melanoon
messeae
plumbeus
sacharovi

Anopheles (Cellia)
superpictus

Coquillettidia
richiardii

Culex (Culex)
laticinctus
mimeticus
pipiens
quinquefasciatus
theileri

Culex (Maillotia)
hortensis

Culex (Neoculex)
martinii
territans

Orthopodomyia

pulchripalpis

Uranotaenia (*Pseudoficalbia*)
unguiculata

* Appendices herein list species as "known" or "reported." Known species are those whose presence has been confirmed by an expert; reported species are reported in the literature but without confirmation.

** **Family Culicidae, Order Diptera. References**: Anonymous 1942 (key), Danilov 1987 (key), DuBose and Curtin 1965 (key), Macan 1942 (key), Mattingly 1971 (key), Russell, Rozeboom and Stone 1943 (key).

Appendix B. Biting Midges* Reported from the Yugoslav Republics

Culicoides
- *alazanicus*
- *cataneii*
- *chiopterus*
- *circumscriptus*
- *clastrieri*
- *dzhafarovi*
- *fascipennis*
- festivipennis
- *gejgelensis*
- *grisescens*
- *impunctatus*
- *kibunensis*
- *longipennis*
- *maritimus*
- *newsteadi*
- *obsoletus*
- *pallidicornis*
- *parroti*
- *pictipennis*
- *pulicaris*
- *puncticollis*
- *sejfadinei*
- *vidourlensis*

Leptoconops
- *aviarum*
- *bezzii*
- *bidentatus*
- *camelorum*
- caucasicus
- *flaviventris*
- *irritans*
- *lisbonnei*
- *lucidus*
- *mesopotamiensis*
- *minutus*
- *nigripes*
- *nipponensis*
- *noei*

Appendix C. Phlebotomines** Reported from the Yugoslav Republics

Phlebotomus
- *balcanicus*
- *major*
- *mascittii mascittii*
- *papatasi*
- *pedifer*
- *perfiliewi*
- *perniciosus*
- *sergenti*
- *simici*
- *tobbi*

Sergentomyia
- *dentata*
- *minuta*

***Family Ceratopogonidae, Order Diptera. Reference:** Remm 1982.

****Family Psychodidae, Order Diptera. Reference:** Lewis 1982 (key).

Appendix D. Simuliids* Reported from the Yugoslav Republics

Metacnephia
- *blanci*
- *danubica*

Prosimulium (*Prosimulium*)
- *fulvipes*
- *latimucro*
- *rufipes*
- *tomosvaryi*

Simulium (*Boophthora*)
- *erythrocephalum*

Simulium (*Byssodon*)
- *maculatum echinatum*
- *trifasciatum*

Simulium (*Eusimulium*)
- *krymense*
- *silvaticum*
- *velutinum*

Simulium (*Nevermannia*)
- *angustitarse*
- *bertrandi*
- *brevidens*
- *carpathicum*
- *carthusiense*
- *codreanui*
- *costatum*
- *crenobium*
- *cryophilum*
- *lundstromi*

Simulium (*Obuchovia*)
- *auricoma*

Simulium (*Psilozia*)
- *vittatum*

Simulium (*Simulium*)
- *argenteostriatum*
- *baracorne*
- *colombaschense*
- *croaticum*
- *degrangei*
- *ibariense*
- *maximum*
- *monticola*
- *noelleri*
- *ornatum*
- *paramorsitans*
- *reptans*
- *savici*
- *variegatum*

Simulium (*Tetisimulium*)
- *bezzii*

Simulium (*Wilhelmia*)
- *balcanicum*
- *equinum*
- *lineatum*
- *pseudequinum*

Twinnia
- *hydroides*

***Family Simuliidae, Order Diptera. References**: Kim and Merrit 1987 (checklist), Rubtsov 1959-1964 (key).

Appendix E. Tabanids* Reported from the Yugoslav Republics

Atylotus
- *fulvus*
- *latistriatus*
- *loewianus*
- *sublunaticornis*
- *usticus*

Chrysops
- *caecutiens*
- *flavipes*
- *italicus*
- *melicharii*
- *parallelogrammus*
- *rufipes*
- *sepulcralis*
- *viduatus*

Dasyrhamphis
- *ater*
- *umbrimus*

Haematopota
- *crassicornis*
- *gallica*
- *grandis*
- *pandazisi*
- *pluvialis*
- *subcylindrica*

Heptatoma
- *pellucens*

Hybomitra
- *acuminata*
- *aterrima*
- *auripila*
- *bimaculata*
- *ciureai*
- *kaurii*
- *lundbecki*
- *lurida*
- *micans*
- *montana*
- *muehlfeldi*
- *pilosa*
- *tropica*

Nemorius
- *vitripennis*

Pangonius
- *fulvipes*
- *funebris*
- *haustellatus*
- *micans*
- *pyritosus*

Philipomyia
- *aprica*
- *graeca*

Silvius
- *algirus*
- *alpinus*

Appendix E. Tabanids* Reported from the Yugoslav Republics (Continued)

Tabanus
- *autumnalis*
- *bifarius*
- *bovinus*
- *briani*
- *bromius*
- *cordiger*
- *cuculus*
- *eggeri*
- *exclusus*
- *glancopia*
- *indrae*
- *lunatus*
- *maculicornis*
- *miki*

Therioplectes
- *gigas*
- *tunicatus*

Tabanus
- *nemoralis*
- *paradoxus*
- *quatuornotatus*
- *rectus*
- *regularis*
- *rupium*
- *shannonellus*
- *spectabilis*
- *spodopterus*
- *sudeticus*
- *tergestinus*
- *tinctus*
- *unifasciatus*

***Family Tabanidae, Order Diptera. Reference:** Leclercq 1960, 1966 (key).

Appendix F. Fleas* Reported from the Yugoslav Republics

Amphipsylla
- *rossica rossica*

Archaeopsylla
- *rothschildi*
- *erinacei erinacei*

Atyphloceras
- *nuperus nuperus*
- *nuperus palinus*

Ceratophyllus
- *farreni farreni*
- *fringillae*
- *rusticus*
- *sciurorum*

Ctenophthalmus
- *agyrtes bosnicus*
- *agyrtes graecus*
- *agyrtes ohridanus*
- *agyrtes serbicus*
- *bisoctodentatus*
- *capriciosus capriciosus*
- *caucasicus*
- *congener*
- *dolomydis*
- *monticola*
- *nifetodes brelihi*
- *nifetodes eugeniae*
- *nifetodes martinorum*
- *nifetodes nifetodes*
- *nivalis cervinus*
- *nivalis helvetius*
- *nivalis ianlinni*
- *nivalis nivalis*
- *nivalis rhaeticus*
- *nivalis ubayensis*
- *orientalis*
- *orphilus dolomiticus*
- *orphilus orphilus*
- *ruris*
- *uncinatus*
- *integella*

Doratopsylla

Chaetopsylla
- *globiceps*
- *homoea*
- *trichosa*

Citellophilus
- *martinoi*

Ctenocephalides
- *canis*
- *felis felis*

Nosopsyllus
- *fasciatus*
- *londiniensis*
- *mokrzeckyi*

Nycteridopsylla
- *dictena*
- *eusarca eusarca*
- *trigona balcanica*

Palaeopsylla
- *kohauti*
- *oxygonia*
- *similis peusi*
- *similis similis*
- *soricis*

Peromyscopsylla
- *fallax*

Pulex
- *irritans*

Rhadinopsylla
- *dolomydis*
- *isacantha continentalis*
- *pentacantha*

dasycnema cuspis

Hystrichopsylla
talpae

Rhinolophopsylla
unipectinata unipectinata

Appendix F. Fleas* Reported from the Yugoslav Republics (Continued)

Ischnopsyllus
elongatus
hexactenus hexactenus
octactenus
variabilis

Leptopsylla
sciurobia
segnis
taschenbergi

Myoxopsylla
laverani

Neopsylla
setosa

Spilopsyllus
cuniculi

Stenoponia
tripectinata

Tarsopsylla
octodecimdentata

Typhloceras
poppei

Xenopsylla
cheopis
nesiotes

***Order Siphonaptera, Families Pulicidae, Ceratophyllidae, Ctenophthalmidae. Hystrichopsyllidae, Ischnopsyllidae, Vermipsyllidae. References:** Hopkins and Rothschild 1953, 1956, 1962, 1966, 1971 (key), Mardon 1981 (key), Smit 1973 (key).

Appendix G. Ticks* Known from the Yugoslav Republics

Argas
- *persicus*

Boophilus
- *annulatus*

Dermacentor
- *impressum*
- *marginatus*
- *niveus*
- *reticulatus*
- *silvarum*

Haemaphysalis
- *concinna*
- *erinacei*
- *inermis*
- *leachi*
- *punctata*
- *sulcata*

Hyalomma
- *aegyptium*
- *anatolicum anatolicum*
- *anatolicum excavatum*
- *detritum*
- *dromedarii*
- *marginatum marginatum*
- *rufipes*

Ixodes
- *caledonicus*
- *canisuga*
- *frontalis*
- *gibbosus*
- *hexagonus*
- *ricinus*
- *trianguliceps*
- *vespertilionis*

Ornithodoros
- *lahorensis*

Rhipicephalus
- *bursa*
- *sanguineus*

***Order Parasitiformes, Families Argasidae, Ixodidae. Reference**: Sheals 1973 (key).

Appendix H. Other Selected Arthropods from the Yugoslav Republics

SUCKING LICE

Pediculus
- *humanus humanus*
- *humanus capitis*

Pthirus
- *pubis*

MITES

Neotrombicula
- *autumnalis inopinatum*
- *moesica*

Pediculoides
- *ventricosus*

Sarcoptes
- *scabiei*

FLIES

Fannia
- *canicularis*
- *scalaris*

Gasterophilus
- *flavipes*

Hypoderma
- *bovis*

Lucilia
- *sericata*

Musca
- *domestica*

Sarcophaga
- *haemorrhoidalis*

Wohlfahrtia
- *magnifica*

SCORPIONS

Euscorpius species

SPIDERS

Aranea
- *sexpunctata*

Latrodectus
- *erebus*
- *tredecimguttatus*

References: Oldroyd and Smith 1973 (fly larvae, key), Pont 1973 (Muscidae, key), Smith 1973 (Calliphoridae, Sarcophagidae, key).

Appendix I. Poisonous Snakes Reported from the Yugoslav Republics

*Vipera**

ammodytes ammodytes
ammodytes meridionalis
aspis aspis
berus berus
berus bosniensis
ursinii macrops
ursinii rakosiensis
ursinii ursinii

Appendix J. Personal Protective Measures

Personal protective measures are the first line of defense against arthropod-borne disease and may be the only protection for military personnel deployed in the field. Proper wearing of the uniform and appropriate use of repellents can provide high levels of protection against blood-sucking arthropods. The uniform fabric is a significant mechanical barrier to mosquitoes and other blood-sucking insects. The uniform should be worn to cover as much skin as possible if weather and physical activity permit.

When operating in tick-infested areas, pants should be bloused into boots to prevent access to the skin by crawling arthropods. Check yourself frequently when walking through tick-infested areas. Upon returning from tick-infested areas, remove all clothing and examine yourself for ticks. Infected ticks may require several hours of feeding before pathogens are transmitted. Therefore, personnel in tick-infested areas should check themselves frequently and remove ticks as soon as possible.

If ticks become attached, the simplest and best method of removal is a slow, steady pull with a pair of tweezers. Don't squeeze the body but grasp the tick where the mouthparts enter the skin and pull firmly until the tick is extracted. Be careful not to break off the mouthparts and leave them in the skin. Wipe the bite area with an antiseptic. If hands have touched the tick during removal, wash them thoroughly with soap and water or an antiseptic, since tick secretions may contain pathogens.

Newly developed repellents provide personnel with unprecedented levels of protection. An aerosol formulation of permethrin (NSN 6840-01-278-1336) can be applied to the uniform according to label directions but not to the skin. This will provide the uniform material with both repellent and insecticidal properties that will be retained through five washings. A new extended-duration repellent lotion of DEET (N, N-diethyl-3-methylbenzamide, formerly N, N-diethyl-m-toluamide) (NSN 6840-01-284-3982) has been developed to replace the 2 oz. bottles of 70% DEET in alcohol. The new formulation contains 34% active ingredient. It's less irritating to skin, has less odor, and is generally more acceptable to the user.

Properly wearing the uniform, use of extended duration DEET on exposed skin and permethrin on uniform items has been demonstrated in laboratory and field studies to provide nearly 100% protection against a variety of blood-sucking arthropods. In addition, permethrin should be used to treat bednets, tentage, and other field items as appropriate. Detailed instructions on the proper use of personal protective items, with training slides, are provided in Army Environmental Hygiene Agency Technical Guide No. 174: Personal Protective Techniques Against Insects and Other Arthropods of Military Significance. Order this publication from DPMIAC.

***Family Viperidae. References: Anonymous 1962 (key), Anonymous 1986a, Harding and Welch 1980 (checklist).**

Appendix K. Chemical Control of Vectors and Pests

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 Information Memorandum (TIM) No. 24, "Contingency Pest Management Pocket Guide." This guide is a concise reference to National Stock Number (NSN)- listed pesticides and equipment available through military supply channels for contingency use. It covers intended uses, dosages, and application methods, pesticide dilution and dosage formulas, and pesticide dispersal equipment. TIM 24 also provides information on surveillance, trapping, and safety equipment, personal protective equipment against disease vectors, air-transport of pesticides that don't meet transportation requirements, and US military points of contact overseas who can provide information on vector-borne disease control in their respective areas of the world.

Copies of TIM-24, Contingency Pest Management Pocket Guide, can be obtained free of charge from:

Defense Pest Management Information Analysis Center
Armed Forces Pest Management Board
Forest Glen Section, WRAMC
Washington, DC 20307-5001

Appendix L. Insecticide Resistance

SPECIES	AREA/LOCALITY	INSECTICIDE	DATE	STATUS
Musca domestica	Yugoslavia	DDT	1986	R*
Aedes aegypti	Yugoslavia	DDT	1986	R
Pediculus humanus	Yugoslavia	DDT	1986	R
Pediculus humanus	Yugoslavia	gamma HCH	1973	R
An. maculipennis	Croatia (Zagreb)	Propoxur	1973	S
An. maculipennis	Croatia (Zagreb)	DDT	1972	S
An. maculipennis	Croatia (Zagreb)	Malathion	1972	S
An. maculipennis	Croatia (Zagreb)	Fenitrothion	1974	R
An. maculipennis	Croatia (Zagreb)	Fenitrothion	1974	R
An. maculipennis	Croatia (Zagreb)	Fenitrothion	1974	R

*R = Resistant; S = Susceptible.

References: Anonymous 1986b, 1987.

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