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DEPARTMENT OF THE ARMY
UNITED STATES ARMY INTELLIGENCE AND SECURITY COMMAND
FREEDOM OF INFORMATION AND PRIVACY ACT OFFICE
2600 ERNIE PYLE STREET
FORT MEADE, MD 20755-5995

May 19, 2023

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Sincerely,

HEATON.MICHAEL.TODD.1160922075 Digitally signed by HEATON.MICHAEL.TODD.1160922075 Date: 2023.05.19 07:12:59 -04'00'

Michael T. Heaton
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Enclosure

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BW-RELATED INSECT VECTOR RESEARCH IN THE SINO-SOVIET BLOC (U)

U S ARMY
FOREIGN SCIENCE
AND
TECHNOLOGY
CENTER

February 1965

AN ARMY INTELLIGENCE DOCUMENT

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U. S. Army Foreign Science and Technology Center
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DESCRIPTORS

Entomological BW weapons system; insect vectors; Sino-Soviet entomological research; tick-borne encephalitis; biological warfare.

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BW-RELATED INSECT VECTOR RESEARCH IN THE SINO-SOVIET BLOC (U)

February 1965

(Based on information available as of July 1964)

ABSTRACT

(U) This study discusses some significant Sino-Soviet Bloc entomological research and development. It compares entomological biological warfare (BW) with other weapons systems and lists activities which indicate or contribute to an entomological BW capability.

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COMPENDIUM

1. (U) PURPOSE

The purpose of this study is to point up, where possible, the capabilities of the Sino-Soviet Bloc to develop an entomological biological warfare (BW) weapons system. The study also presents some of the most important features and problems associated with an entomological BW effort.

2. (U) ~~(C)~~ SCOPE

This study covers the following points:

a. Significant Sino-Soviet Bloc research and development in entomology.

b. Advantages and disadvantages of entomological BW weapons systems.

c. Some of the factors that must be studied before selecting and developing such a system.

d. Research contributing to or indicating an entomological BW effort.

3. (U) ~~(C)~~ CONCLUSIONS

The Sino-Soviet Bloc countries, particularly the U. S. S. R., Czechoslovakia, and Communist China, have demonstrated excellent capabilities in the area of entomological research and development. They have highly competent investigators, with extensive knowledge of entomological research processes, and the technical facilities to develop an entomological BW weapons system. The Soviets have placed a great deal of emphasis on research on tick-borne encephalitis, and all of the data accumulated has direct application to the development of a tick vector-virus BW system.

DISCUSSION

4. (U) ~~(C)~~ SIGNIFICANT SINO-SOVIET BLOC ENTOMOLOGICAL RESEARCH AND DEVELOPMENT

a. Background.

(1) The Sino-Soviet Bloc has published considerable literature on insect vectors; the work reported clearly establishes that the Soviets are knowledgeable of and have the technology for developing an entomological weapons system. Soviet concern with insect vectors for BW application dates back to 1937, the time of Pavlovsky's now-famous expeditions to remote areas of Siberia to investigate the tick and the outbreaks of Russian spring-summer encephalitis. Members of his expeditions were reportedly enthused about their results in relation to possible application to BW.

(2) Soviet defense publications devote particular coverage to insect vectors. The following extract from the Czechoslovak monograph, "Biological Warfare," by Engineer Frantisek Konupka is typical treatment of the subject and sums up the Soviet thought about entomological BW.

(a) "Insects, even in peacetime, present one of the greatest banes to human health and economy. It is enough to name mosquitoes, ticks, flies, lice, potato bugs, moths, termites, and other sorts of parasitic insects. They exist in great numbers and are a bane in that they live their entire lives or a portion thereof on the body or within the body of other organisms (plants, animals, or humans). They live at host expense, during which period the host often dies or is caused serious illness. In addition to this direct harmful effect, insects can be the transmitters of detrimental infections.

(b) "Biological warfare is a reversal of the natural struggle of man to defend vitally important farming products and animals against insect damage. The use of insects in war is designed to damage man's food supply, especially products needed for his sustenance.

(c) "Damage by insects, in reference to human health, is diverse. A person is attacked by insects which suck blood from him, harm him, and interrupt him in his work.

(d) "Insects, especially stinging insects, occupy a very well-known position in the carrying of infectious diseases. More than 20 percent of human infectious diseases are transmitted by insects. It was known by man from the first that insects damaged farming; on the other hand it was not known for a long time that insects were carriers of human sickness. During war campaigns, famines, and other catastrophies, tens of thousands of people perished from plague, various types of typhoid, cholera, and other diseases, without realizing that the carriers of these diseases were insects. Only gradually did man realize how insects can harm and only recently has he begun to examine how they can be used in war. Therefore, while one side leads a constant battle against insects, the other side is breeding them by tens of kilograms for use as allies in the event of war.

(e) "Insects carry infection mechanically or biologically. In reference to the mechanical transmission of infection, we refer to the passive carrying of the source of the infection by insects on the surface of their bodies (on feet, antennae, etc.). These sources of infection have been transmitted through contact with fruit, food, etc., by the insects. Another way infectious germs enter the body without injury is through the digestive tracts of insects, from excrement, and from direct or indirect contact with an infected person. The process whereby the source of the infection lives within the body of the insect, multiplies within it, reaches a certain stage of development, and is then transmitted to humans is referred to as biological transmission.

(f) "The danger of using insects as carriers of infection in biological warfare not only encompasses the malicious spreading of infection but in addition the artificial contamination of an area by infectious insects, whereby a lasting focus of infection can be effected if the insect adapts itself to the climate of the attacked area and is able to multiply.

(g) "During war insects and minute animals can be used as a cause of disruption to agricultural life and supplies of the attacked country and the spreading of infectious disease among people and agriculturally important animals. Fleas, mosquitoes, lice, ticks, spiders, mice, rats, and the rest of the scourges of man, animals, and plants are to be soldiers of biological warfare to rescue dying imperialism."

b. Recent Entomological Research and Development.

(1) Many Soviet institutes and personalities are involved in entomological research. Available evidence indicates that the Soviet Bloc nations do not have entomological BW research and development programs

but do conduct entomological research and development that is directly applicable to BW. Significant investigations are being conducted in the U.S.S.R., Czechoslovakia, and Communist China. Much of this research and the resultant data are those usually obtained at the screening or basic evaluation level for a particular agent. The Soviets and Czechoslovaks are recognized as worldwide authorities on tick-borne viruses, unexcelled anywhere. Communist China, according to the Soviet scientist Smorodintsev, has a highly developed research program on arthropod-borne viruses with special emphasis on Japanese B encephalitis.

(2) Soviet research on the transovarian passage of Russian spring-summer encephalitis (RSSE) in ticks clearly demonstrates a capability in insect research and development. Smorodintsev has emphasized that methodical conditions are necessary for this type of work. The percentage of infected larvae after transovarian passage varies according to the strain used. Fifty percent of the strains adapted in the laboratory to mice may lose infectivity for the mouse-tick transovarian passage. Smorodintsev successfully accomplished five cycles of transovarian passage of RSSE virus, each complete cycle taking about 1.5 years.

(3) Virus isolation from ticks is best in the larval stage because virus numbers are highest in the larvae. In one experiment, 2000 adults were infected but no virus could be isolated. Other females from the same lot were allowed to lay eggs. Virus was isolated from 5 to 25 percent of the larvae which hatched from the eggs.

(4) Soviet scientists claim that ticks are the principal stable reservoirs of RSSE virus. They have found that serum antibodies do not have any effect on the virus in the tick. When infected ticks are fed on only highly immunized animals, the ticks' virus titer is not changed detectably in subsequent titrations.

(5) The Soviets have described a technique for the infection of gamasid ticks with the tick-borne encephalitis virus. Techniques of this type are very important for mass feeding of insects. A container described by the Soviets as being made of a special cylindrical wire (17 cm in diameter and 17 to 18 cm long) was used to house 15 to 20 ticks. An alabaster plate (2 cm thick) formed the base of the cylinder. The top of the cylinder was covered with a cotton gauze plug. An oval hole covered with a caprone tissue is located about 1 to 2 cc from the bottom of the cylinder. The container is placed vertically on a wet tissue, which moistens the alabaster base plate and produces high humidity within the cylinder.

(6) Ticks are infected with virus as follows: Mix a 10-percent mouse brain suspension of the virus with defibrinated white mouse blood (50:50). Fill a capillary tube with the virus-feed mixture and suspend it into the container of ticks. (Hungry gamasid ticks will readily feed on this mixture.) Remove the capillaries after 24 hours. Finally, inoculate ground suspensions of ticks (groups of five ticks) into the brains of white mice every 2 days following the feeding period to prove infection of the ticks.

(7) During May-July 1962, a scientific expedition, led by Prof. M. P. Chumakov and organized by the Institute of Poliomyelitis and Viral Encephalitides of the U. S. S. R. Academy of Medical Sciences, carried out investigations in natural foci of tick-borne encephalitis in the Kemerovo region. Members of the expedition included 37 workers from the Institute of Poliomyelitis and Viral Encephalitides, 11 from the Kemerovo Regional Sanitary-Epidemiological Station, and 6 from the Institute of Virology of the Czechoslovak Academy of Sciences in Bratislava (48 09 N-17 07 E) led by H. Libikova.

(8) One of the aims of this joint Soviet-Czechoslovak expedition was the virological investigation of Ixodid ticks, vectors of tick-borne encephalitis, as well as of blood specimens from patients suspected of being infected with tick-borne encephalitis virus and healthy persons bitten by ticks. The specimens were assayed in parallel at three laboratories of the expedition by inoculating newborn and adult white mice, chick embryos, and cultures of chick embryo and pig embryo kidney cells. Through the variety of simultaneously employed methods, the workers succeeded in inoculating not only a number of typical strains of tick-borne encephalitis but also several other virus strains differing substantially from the agent of tick-borne encephalitis.

(9) The first of these variant strains was isolated by the Czechoslovak group from a suspension of ground, hungry <u>Ixodes persulcatus</u> females collected in the Taiga Forest in the neighborhood of the village Romanovka (55 55 N-86 38 E), Kemerovo region, and from the spinal fluid of two patients hospitalized with a suspect febrile form of tick-borne encephalitis caused by previous tick bites. This virus strain produced a complete cytopathic effect in chick embryo cell cultures within 48 to 72 hours, multiplied well upon inoculation into the yolk sac of 7-day-old chick embryos, and caused a fatal illness after 2 to 5 days incubation in newborn white mice; as a rule, it was not pathogenic for adult white mice. The use of hyperimmune diagnostic sera in neutralization tests in chick embryo cell cultures ruled out any antigenic

relationship of the new strain with arboviruses of the tick-borne encephalitis, Western and Eastern equine encephalitis, and St. Louis and Japanese B encephalitis.

(10) Soon after these first findings, other laboratory groups of the expedition succeeded in isolating in Kemerovo and Novokuznetsk more than 20 similar strains of the virus from Ixodes persulcatus ticks, and from the blood and spinal fluid of patients suspected of tick-borne encephalitis and of healthy persons bitten by ticks. These strains easily passed through Seitz asbestos pads. Some of these isolates were sent to Moscow (55 45 N-37 35 E) where neutralization tests performed at the Institute of Poliomyelitis and Viral Encephalitides confirmed the antigenic differences of these viruses from the tick-borne encephalitis virus as well as from other types of Group A and B arboviruses.

(11) The new isolates are markedly pathogenic on intracerebral inoculation, not only for newborn white mice but also for newborn white and cotton rats and newborn Syrian hamsters. Adult hamsters and adult white mice developed disease and died in a few cases only. Intracerebral inoculation of rhesus (Macaca mulatta) monkeys resulted in short-lasting fever and viremia. The new isolates caused a cytopathic effect not only in chick embryo and pig embryo kidney cell cultures but also in human embryo fibroblast, primary and stable human amnion, and HeLa and primary monkey kidney cells. They formed large plaques in chick embryo cell cultures under agar overlay.

(12) The Chinese Communists, Ts'ai Shang-ta, Ko Hsiane-liu, Jung Kuan, and Li Tzu-i, have reported on the experimental infection of mosquitoes with Japanese B encephalitis. They have studied the seasonal distribution and influence of climatic conditions on the following mosquitoes, all of which are vectors of B-type encephalitis: Culex triaeniorhynchus, Aedes albopictus, Culex fatigans, and Anopheles hyrcanus sinesis. Experimental infection was accomplished by feeding the mosquitoes artificially and by allowing them to feed (bloodsuck) on infected mice. Experimentally infected A. albopictus were found to harbor the virus for as long as 19 days and to successfully transmit the disease up to 14 days. Experimentally infected C. fatigans could transmit the disease up to 27 days. Data of this type are significant in selection of BW vectors and in determination of their production potential and their effectiveness in a BW weapons system.

(13) Insect vector studies in Communist China, as in the U.S.S.R., are not restricted to vector-virus studies but also include vector-bacteria and vector-rickettsia investigations. Li Chao-hsi of the

Department of Veterinary Medicine, Peiping Agricultural University, collected ticks, Dermacentor nuttalli and Dermacentor sinicus, during an outbreak of brucellosis in sheep and goats in Chieh Ming. His research proved that tick-borne brucellosis exists in China and, as a consequence, the following investigations, all important in entomological BW research and development, were generated: studies on the life cycle of brucella in various tick species, site of parasitism, transformation of brucella as a result of parasitism in ticks, effect of transformation on virulence, and artificial infection of healthy ticks.

5. (C) COMPARISON OF ENTOMOLOGICAL BW WITH OTHER BW WEAPONS

Use of entomological BW has certain advantages and disadvantages when compared to the standard concept of BW weapons such as line source release of aerosols and multiple-point source (i.e. bomblets).

a. Advantages.

(1) Insects and other arthropods offer the unique advantage of seeking out the target. Because of this built-in homing mechanism, an entomological munition does not have to score a direct hit. Insects also offer the advantage of injecting the agent directly into the blood stream, thereby reducing the time required to produce the desired effect.

(2) An agent, because it is carried within the body of the vector, is not subject to rapid decay or deterioration as a result of unfavorable conditions of moisture, light, or temperature. Further, depending on the length of time between infection of the vector and its delivery on the target, an increase or multiplication of the agent within the vector occurs. Finally, barring catastrophic weather conditions, such as strong winds which would also disperse aerosolized agents, the vector could remain in the target area from several days to a week or more.

(3) Protective masks would not prevent infection. In addition, the combat uniform would afford little protection because arthropod vectors would normally be used during warm weather (50° to 90° F.) and because some vectors, for instance, mosquitoes, have the ability to infect through summer clothing.

(4) Introduction of infected vectors on a large or small scale offers the possibility of initiating an epidemic which is developed and sustained by indigenous species.

(5) Small numbers of an infected exotic species could be used to start an epidemic -- which would in turn be developed and sustained by indigenous species -- or large or small numbers of a species native to the area could be covertly introduced to produce the same effect.

(6) Certain vectors, for instance, ticks, which normally do not move about much under their own power, could be dispersed over critical terrain so as to deny its use to any enemy. This information could then be leaked out to the hostile forces. Uninfected vectors, or common pests not known to be natural carriers or vectors of an agent (such as roaches), may be used for the creation of psychological effects, panic, and harrassment. (For example, several billion mosquito eggs could be covertly or overtly introduced into a water resevoir near a large populated area. In 10 days to 2 weeks, millions of uninfected mosquitoes would emerge to converge upon and bite the people. Scientists would assay the vector and not find an agent; they would not know whether the vectors were actually uninfected, whether current techniques were not revealing the presence of the agent, or whether the agent was so novel that known techniques could not identify it. Because of the uncertainty, authorities might initiate a useless mass immunization with considerable waste of effort and vaccine.)

(7) Insect pests are capable of reducing the yield of nearly every crop produced by man, by outright destruction. In addition, a dozen or more insect pests feed upon and contaminate stored grains and cereal and foul milling plants.

(8) The equipment required in entomological BW research and development is more often not as expensive, complicated, or intricate as that required for other types of BW effort. For economically depressed countries, this savings factor could be a major importance in a BW program.

b. <u>Disadvantages</u>.

(1) Most insect vectors would have to be employed during warm weather in temperate climates or in tropical or subtropical climates. Generally, they would be ineffective below 45° to 50° F. and often become inactive at the upper extremes, around 100° F.

(2) The size of both larvae and adults of the insect vectors in comparison with the organisms of the other BW systems necessitates larger rearing, handling, and holding facilities. The increased space requirements might partially offset the advantage of less expensive research and development equipment.

(3) Although insect vectors can seek out and home-in on their target, personnel in properly screened buildings and enclosures would be protected. On the other hand, aerosolized microorganisms can penetrate through very minute openings.

(4) Once the insect or arthropod vectors are infected, they can be stored or maintained in the infected stage for only a limited time; after a 2- to 3-week storage period the number of vectors would decrease daily as a result of normal mortality.

(5) Unlike some other types of BW weapons, most arthropod vectors or economic pests are large enough to be visible to the unaided eye.

(6) The effective and immediate application of repellents and insecticides would sharply reduce the damage inflicted on the enemy by an entomological BW weapon.

6. (C) FACTORS TO BE CONSIDERED IN THE SELECTION OF AN ENTOMOLOGICAL BW WEAPON FOR USE AGAINST MAN OR ANIMALS

a. Purpose. In selecting the vector or vector-agent combination, attention should be given to what effect is desired -- whether lethal, debilitating, psychological, or harassing.

b. The Arthropod Vector.

(1) The vector must have a proclivity for biting the desired host. For instance, if man were the intended target, man has to be the primary host of this vector in nature or the primary host under the special conditions prevailing at the time of intended use.

(2) In regard to infectivity, several questions arise. What is the desired effect? What agent will give that effect? Can the vector be infected with this agent? Does the agent have any detrimental effect on the vector?

(3) If the vector can be infected with the desired agent, will it transmit the agent or can the titer be raised to the point that the desired effect is achieved? Will the vector live long enough to transmit the agent?

(4) If the vector will attack by preference the desired host, if it can be infected without detriment to itself, and if it transmits the

agent, then the next problem that arises is that of mass-producing the vector. If the vector is holometabolous, the mass-production process must consider the production of all four of the biological or developmental stages: egg, larva, pupa, and adult. This often requires ingenious and original fabrication of certain devices, such as those required in the separation and enumeration of the various biological stages.

c. The Agent.

(1) Can the agent be mass produced and what problems are associated with its mass production?

(2) What are its storage limitations?

(3) What is the level of natural immunity, if any, among potential target populations?

(4) Is there an effective antidote for this agent?

d. Geographic Area.

(1) Are climatic and topographic conditions such that the vector can survive long enough to transmit the agent?

(2) What are the possibilities of the vector becoming permanently established and denying the area to friendly use without an expensive and time-consuming control or eradication program?

(3) Would any nearby neutral or allied nations be affected by the migration of this species across their geographic boundaries?

e. Other Factors.

(1) A factor to be considered, especially by an economically depressed nation, might be the amount of research data and knowledge currently available on a particular vector. For instance, an Englishman, Sir S. Rickard Christophers, has written a book of some 700 pages on the yellow fever mosquito. Probably more is known on the morphology, biology, physiology, and distribution of this insect than any other known to man. Other insect vectors about which considerable literature has been written are the Lone Star tick, the American dog tick or wood tick, the mosquito Anopheles quadrimaculatus (the principal vector of malaria

in the United States), and the rat flea. In the Soviet Union, much has been published on the mosquito Anopheles maculipennis messae, the primary vector for malaria in that nation, and the rat flea Xenopsulla cheopis, vector of the plague pathogen Pasteurella pestis.

(2) The ease with which a species or group of vectors can be colonized and reared may also be a contributing factor in the selection of an arthropod vector.

(3) The geographical distribution of a vector becomes important when methods of controlling the vector are being developed or when a decision is made to covertly introduce the vector. A tropical species introduced during the summer in a temperate or northern climate could be assumed not to survive the winter. On the other hand, if covert use were involved, a species native to the area of intended use is indicated. In either case a knowledge of the geographical area of distribution is important.

(4) A long life span, a high bite rate, a high oviposition rate, and speed and range of flight are only a few of the obvious favorable biological characteristics of a vector which might influence its selection as a candidate for an entomological BW system.

7. (C) ACTIVITIES AND RESEARCH WHICH COULD MAKE A POSITIVE CONTRIBUTION TOWARD AN ENTOMOLOGICAL BW CAPABILITY

a. The first step in developing the vector system after selection of the candidate is laboratory colonization of the arthropod. The remaining steps are all dependent on this initial accomplishment.

b. The second step in the vector system is the mass-rearing process. This entails mass production and enumeration techniques for the eggs, larvae, pupae, and adults. The mass-rearing process requires attention to such things as type, amount, and schedule of food, nutritional requirements and their relationship to biological development, energy components, and nutritive reserves. It necessitates the development of techniques and equipment for rearing, handling, counting, and storing, as well as quality control methods.

c. Colonization and mass-rearing techniques can be modified to increase the production of vectors. Modifications could include the following:

(1) Optimizing environmental conditions such as temperature, moisture, light, and ratio of vector to unit area of rearing space or media.

(2) Reduction of the time required for development by the nondestructive biological stages of the vector.

(3) Improvement of diet and dietary regimes.

(4) Improvement of biological characteristics such as increasing:

(a) Fecundity.

(b) Resistance to insecticides, repellents, and extremes of temperature and moisture.

(c) Flight range.

(d) Longevity.

(e) Bite rate.

(f) Egg storage time.

(g) Hatch rate and percent hatch of eggs.

d. Data on the flight range, dispersion, and distributional characteristics of laboratory mass-produced species would be an important contribution towards an entomological BW capability.

e. In order to properly control and manipulate a species in the laboratory, and to lay the groundwork for estimating the behavior in the field, the following types of studies and information would be of value:

(1) Responses to environmental factors.

(a) Light, temperature, and moisture.

(b) Sound.

(c) Color.

(d) Movement.

(2) Laboratory mechanics of mass-rearing.

(a) Texture, form, and size of rearing or holding containers.

(b) Equipment and processes used in handling and enumeration.

(3) Biting characteristics.

(a) Type of host(s).

(b) Preferred host(s).

(c) Bite rate, and cycle if any.

(d) Periodicity (bites when? daylight hours only? darkness? daybreak? dusk?).

(e) Preferred site on host for biting (head, chest, abdomen, arms, legs).

(4) Oviposition characteristics.

(a) Type of site.

(b) Time(s) of oviposition (cycle).

(c) Numbers of eggs produced under various conditions.

(d) Method(s) of collecting eggs.

(5) Flight characteristics. Much can be learned about the flight characteristics in the laboratory before mass-rearing techniques are developed. Some information, such as speed, duration, time(s) of flight, and energy requirements, can be determined best, and sometimes only, in the laboratory.

f. Important contributions pertaining to agents and vector-agent combinations would include the following:

(1) Method(s) of production or culture of the agent.

(2) Virulence and stability of the agent; i.e., titers obtained and effects of:

(a) Passage.

(b) Temperature, moisture, and light.

(c) pH.

(d) Storage (age, carrier or media, physical conditions).

(3) Methods of detection and assay.

(4) Techniques used in handling agent and vector-agent combinations to include safety precautions.

(5) Number and kinds of susceptible hosts.

(6) Infection and transmission studies (techniques, vectors, and hosts used; effectiveness).

(7) Immunological studies.

8. (U) ~~(C)~~ ACTIVITIES AND RESEARCH WHICH SHOULD BE VIEWED AS POSITIVE INDICATIONS OF AN ENTOMOLOGICAL BW-RELATED EFFORT

a. Mass Rearing. The production of large numbers of medically or economically important pest species should be considered a suspect activity, especially when the pests are produced in the laboratory; public health-related activities seldom engage in such production. Mass-rearing of beneficial insects, on the other hand, is a legitimate operation.

b. Mass Infection. The only time that mass infection of a species might not be considered incriminating would be if the preferred host of the vector were definitely established not to be man and/or any of his domestic animals and/or if the agent used were definitely not effective against man or any of his domestic animals. The remote possibility does exist that masses of infected arthropod vectors might be released to control a pestiferous species of wild animal.

c. Mass Releases. Except as noted in paragraph b above, mass releases of arthropod vectors (or plant pests) seldom occur in a public health or agricultural research program. Such operations would be of primary importance in BW research.

d. Vector Munitions. The BW-related effort here would be self-evident. However, the mere fact that a system had been developed for the transportation of the various biological stages of arthropod vectors would not necessarily constitute a vector munitions system. Eggs, larvae, pupae, and adults of many species of arthropods are continually being shipped all over the world in various types of specially designed containers adapted to the requirements of the organism being shipped.

e. Concurrent Research. Research on a given species or vector-agent combination which is underway concurrently at several institutions of a nation, when the species, vector, or agent is not a current or immediate future public health or economically important problem of that country, should be construed as BW research.

f. Exotic Species. BW research is indicated when a nation conducts research on medically or economically important arthropods which are not endemic to that country and which are not likely to be accidentally introduced into that country.

g. Machines, Equipment, Methods, and Processes. Perhaps the most concrete evidence of BW research would be the detection of the development and testing by a nation of hardware and techniques that could be used in the mass production or infection of arthropods, as follows:

(1) Machines and equipment for

(a) Collection and counting of eggs, larvae, pupae, and adults.

(b) Separation of one developmental stage from another, such as larvae from egg shells, pupae from larvae, and adults from pupae.

(2) Methods and processes that could be used in

(a) Mass feeding or infection of vectors.

(b) Handling, transfer, or munition loading of any of the biological stages of an arthropod in large numbers.

9. (U) ~~(C)~~ SINO-SOVIET CAPABILITY FOR ENTOMOLOGICAL BW

The Sino-Soviet Bloc countries, particularly the U.S.S.R., Czechoslovakia, and Communist China, are conducting entomological research and development which could lead to the development of an entomological BW weapons system.

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