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MILITARY THOUGHT (USSR) : Biological Weapons and Some Problems of Antibiological Defense 50X1-HUM

Biological Weapons and Some Problems of Antibiological Defense

by
Colonel of Medical Service A. Vorobyev
Colonel of Medical Service A. Maslov

As is well known, despite the existing international agreements, research in the field of mass production of biological weapons continues to expand in the United States.

An analysis of materials published abroad indicates that the greatest attention at present is being given to the study of the pathogens causing such serious diseases as plague, tularemia, Siberian ulcer, smallpox, yellow fever, Japanese encephalitis, Q-fever, tsutsugamushi fever, typhus, botulism, and various fungous diseases. In addition, combined means of destruction are being tested which incorporate not one but several pathogenic microorganisms, since it is assumed that they may produce a stronger destructive effect and may create additional difficulties in determining the type of microorganisms used and in treating casualties.

In the opinion of the NATO leaders, biological weapons may be employed against enemy troops and against targets (areas) in the enemy's deep rear in order to wear down troops, wipe out reserves, disorganize the work of the interior of the country, and disrupt the control of industry, transportation, etc.

The principal method of employing biological warfare means is atomization in the air, that is, the creation of a biological aerosol (biological cloud). People and animals are infected through inhalation of aerosol particles containing disease pathogens. Data from field tests of biological weapons indicate their great effectiveness in the areas selected. Thus, the US Civil Defense Institute conducted a comparison of the capabilities for inflicting casualties on personnel from one aircraft carrying a nuclear warhead with a yield of 20 megatons, toxic agents, and bacterial means to be atomized in the air. Calculations have shown that 50X1-HUM the destruction rate achieved in the first and second variants was, respectively, approximately 98 percent and 30 percent of the unprotected personnel in an area of up to 260 square kilometers. If biological weapons are employed, possible enemy losses could reach from 25 to 75 percent over an area of 85 thousand square kilometers. According to an estimate made by

the chief of the directorate of chemical, biological, and radiological weapons of the staff of the US Army, General Stubbs, the method of atomizing biological means of destruction from the air is a very promising way of attacking a country which has a large army and substantial territory.

American military specialists are allotting considerable attention to organizing sabotage operations employing pathogens. In their opinion, such a method may also be effective, since it will be difficult for the enemy to detect biological warfare means, and it does not take a great amount of material to infect a target.

Thus, in organizing antibacteriological defense, we must proceed from the assumption that extensive areas may be subjected to biological warfare attack. Little known or completely unknown pathogens of infectious diseases can be used to infect people and animals. The most probable method of employing biological means will be to atomize them in the air. It follows from this that people and animals can be reliably protected from aerogenic infection, in an area in which biological weapons are employed, only if there is timely detection of the pathogenic microbes in the air. This can be done only by using automatic means of biological reconnaissance. Therefore, the timely development and putting into operation of these means in the armed forces and in the country as a whole must clearly be regarded as top priority tasks in providing for defense against biological attack.

As experience shows, the production of such means involves certain difficulties, since the casualty-producing doses of pathogenic microbes (which must be detected in the air) are very small, and the microbe cell comprises a large number of components. In developing automatic means of biological reconnaissance, the capitalist countries follow the principle of comparing a constant number of particles suspended in air with changes caused by the presence of an artificial aerosol, and they also recommend determining the quantitative proportion of various particle fractions or of the content of albumin per unit volume of surface air.

In order to measure the quantity of particles suspended in air, the US has designed an instrument called an "Aerosoloscope" and tested it under field conditions. This instrument operates by introducing the air to be tested into a special chamber which is illuminated by a narrow, directed beam of light. The aerosol particles, upon intersecting the light beam, scatter the light. The rays reflected off the particles are absorbed by a photoelectric cell and converted to electric impulses, which are recorded

by a counting mechanism. The instrument produces a count of aerosol particles ranging in size from a few tenths of a micron to 64 microns.

Some scientists consider, however, that a more reliable indicator of biological warfare attack consists of data concerning the variation of the quantitative proportion of particles suspended in the air, relative to the dimensions of different particle fractions. Thus it has been established that under natural conditions, the quantitative proportion of particles with dimensions of 0.5 to 0.6 micron and 1.0 to 1.5 microns will remain virtually constant at all times, except when the atmosphere is contaminated with dust at times of very strong wind. It is presumed that this balance will be sharply disrupted if biological weapons are employed. An instrument called a "Particle Proportion Analyzer" has been designed on this principle.

For determining the amount of albumin in the air, instruments are proposed which will operate on the principle of infrared spectrophotometry or the measurement of the products of the breakdown of albumin under the effect of temperature or chemical substances. In order to make a correct evaluation of the data obtained regarding the content of aerosol particles or albumin in the air, in determining the nature of a biological warfare attack, it is necessary to have information on the content of these substances in the atmosphere under conditions of nature, that is, to know the natural background. For these purposes, advance research will be conducted to determine the quantity of albumin in the air in different areas, and studies will be made of the dependence of this factor on geographical, weather, seasonal, and other conditions.

Another method which is of no small importance in detecting biological attack is to visually observe and identify the typical signs of the employment of biological weapons. These signs usually include the dropping, from enemy aircraft, of ammunition appropriate to biological weapons and the detection of substances resembling biological preparations on the ground, in water, or on combat equipment. It must be kept in mind, however, that data obtained through observations not using automatic biological reconnaissance equipment cannot be sufficiently efficacious and complete, that is, cannot provide for taking defensive measures in time. But they can serve as the first warning of an enemy biological warfare attack. Reports concerning the detection of signs that bacteriological weapons have been used, and reports of cases of infectious diseases amo50X1-HUM people, animals, and plants, must be reported immediately to special facilities (centers) capable of analyzing and evaluating them to determine the nature and scale of the biological warfare attack.

This is the current situation in our army: upon receipt of the first reports concerning enemy employment of bacterial means, units and large units which have been subjected to the effects of these means will, by order of the commanding officer, set up observation, which provides for carrying out a series of quarantine-restriction and treatment-prophylactic measures directed toward forestalling the outbreak and spread of infectious diseases.

Upon establishing the fact that an enemy has used pathogens of highly contagious infections (plague, cholera, etc.), a quarantine will be established by instructions of the commander of the army (front), providing for the implementation of a system of antiepidemic and routine measures directed toward the complete isolation of the center of infection and the elimination of infectious diseases. The procedure for subsequent employment of quarantined troops is determined depending on the situation. In many cases the affected units may be withdrawn from battle for the entire term of the quarantine.

Determining the limits of a center which has been affected, and thus identifying the affected units and large units, is an extremely difficult task. This is due first of all to the already noted complexity of determining casualty-producing concentrations of bacterial means both in the air and on objects in the environment after aerosols containing pathogens of infectious diseases have settled on them. Thus, for example, research shows that about 50 microorganisms are required to infect a human being with tularemia through the respiratory tract, and 10 microorganisms to infect through the skin. It is virtually impossible to determine such quantities of microbes by methods of non-specific analysis. Therefore the limits of a center will very often be established on the basis of data which are not directly pertinent, through calculations according to the laws of dispersion of a bacterial aerosol cloud.

The elimination of the aftereffects from the employment of biological weapons requires, along with confirmation that a biological attack has occurred, precise data on the types of disease pathogens used by the enemy. With the methods usually used in public health practice to identify microorganisms by testing contaminated material, it takes several days to obtain a definitive answer as to types of microorganisms used. This is a very long time period. It is therefore necessary to work out new methods for accelerated identification of microorganisms. The most progressive, in our view, are the methods for recognizing viruses by culturing them on tissue cells, the identification of microorganisms with the aid of the electron microscope, the application of fluorescent antibodies, and others.

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The last-named method is the most developed and has received wide recognition. However, in order to make it standard in the army and in civil defense establishments, it is necessary to make it specifically applicable to the identification of each of the pathogens which may be used in biological warfare, to initiate the mass production of fluorescent immune serums and equipment suitable for use under field conditions, and to instruct the personnel of field laboratories in the application of this method.

A very widespread method of specific indication of bacteriological weapons is to use the reaction of passive hemagglutination. This is one of the most sensitive and specific reactions, making it possible to determine 1,000 to 10,000 microbe cells in one milliliter of the chosen sample. The technique of producing the reaction is very simple and does not require complicated equipment. This method of research can be used successfully under field conditions. Laboratories of medical-antiepidemic platoons of medical battalions of divisions, and mobile laboratories of separate medical-antiepidemic detachments of armies and fronts, will examine samples from objects in the environment for pathogens of plague, cholera, and Siberian ulcer and for botulotoxins, following an abbreviated plan. The base laboratories of separate medical-antiepidemic detachments in the army and the front will carry on full-scale bacteriological, virological, and rickettsiological research.

In order to forestall the outbreak and spreading of infectious diseases in the center of infection, it appears advisable and completely justified to issue antibiotics immediately after establishing the fact of enemy use of bacterial means. In this case, we should use preparations with a wide range of effects, consisting of a combination of several antibiotics. After determining the type of pathogen, it is advisable to carry out specifically directed preventive treatment using, in addition to antibiotics, other specific treatment means (gamma globulins, vaccines, sulfanilamides, bacteriophages, etc.).

The most important direction for defense against biological weapons is to immunize personnel and thus increase their resistance to infectious diseases. The leading role of specific prophylaxis in the system of antibacteriological defense is emphasized by many researchers and specialists.

However, despite the high evaluation of this method as the ideal means of defense against bacteriological weapons, from the practical standpoint the conduct of immunological countermeasures encounters serious

difficulties: the specific nature of the immunity imparted by vaccines, which is directed only against certain agents; and the difficulty of vaccinating hundreds of thousands, or possibly even tens of millions, of people against all of the anticipated agents of bacteriological warfare. These difficulties significantly lower the potential capabilities for prophylactic vaccination.

We cannot fail to mention also that conducting mass vaccination in the troops also has its particular difficulties. It is well known that combat actions in a modern war will be characterized by high mobility, maximum dispersal of troops both along the front and in depth, and the short amount of time which can be allotted for the concentration and reorganization of units and large units. Under these conditions, commanders of units and large units will be able to allot only minimal time for vaccination.

At the present time, methods of mass vaccination are being worked out and tested, including aerosol and peroral methods and the administration of vaccines with needleless injectors. The accumulated experience and data indicate that immunization by these methods will require a much smaller expenditure of forces, means, and time. In addition, aerosol immunization can be conducted in virtually any type of accommodations or in tents by atomizing dry or liquid (rehydrated) vaccines. An immunization session using dry (powdered) vaccines takes 15 minutes, and a session with liquid vaccines -- five to ten minutes. The number and location of sites for aerosol vaccination will be determined by the disposition of units and large units and by the amount of time allotted for inoculating. In a division, for example, it is advisable to set up the aerosol vaccination sites in regiments and certain separate units. For motorized rifle, tank, and artillery regiments, it appears that one site of 80 to 100 square meters, or two sites of 40 to 50 square meters each, will be adequate.

The technique of aerosol vaccination is in itself fairly simple, and, as experience shows, no special medical knowledge is required to conduct inhalation inoculations. However, this activity, like the large-scale introduction of any biological preparations into the body, requires medical supervision. When carrying out mass aerosol immunization of personnel, it is necessary to obtain methodological guidance from specialists from medical-antibacteriological platoons of medical battalions of divisions and from antiepidemic detachments of armies (fronts). The table shows a rough calculation of the time and forces needed to carry out prophylacti50X1-HUM vaccination in a motorized rifle division by various methods.

The method of administering vaccines by needleless injector and the enteric method require about as much labor as the aerosol method, but the effectiveness of the former for many vaccines must be verified, and the latter (as regards aerogenic infection) requires additional calculations and checking. In our view, research in this direction must continue, since the antiepidemic service must be provided with different methods of vaccination, to be applied depending on the conditions of troop activity. For example, if troops are very widely dispersed, so that immunization can be conducted only subunit by subunit, the enteric method proves much more effective than the aerosol method. In many cases, obviously, it will be logical to employ different methods of inoculation at the same time: aerosol for vaccinating large groups of people; and enteric for treating individuals or small groups not immunized by the aerosol method.

In taking these measures in the troops, we must each time take into consideration the reaction-producing qualities of the vaccines, because this is closely linked with maintaining the combat effectiveness of the personnel of units and large units. It is well known that most vaccine preparations are capable of evoking temperature and other clinical reactions, adversely affecting the health of military personnel and sometimes leading to the loss of combat effectiveness of entire subunits. Special care must therefore be taken in organizing and monitoring the immunization of personnel in the troops which are at the highest level of readiness (rocket forces, aviation, the navy, etc.).

In organizing the treatment of casualties from biological weapons, we must consider first of all the extent of casualties inflicted, the number requiring medical aid, and how widely they are dispersed. If the center of infection is small and the number of casualties inconsiderable, the sequence and volume of medical aid activities will to a great extent parallel the measures taken to eliminate outbreaks of infectious diseases under peacetime conditions. If troops and populace are affected over vast areas, it will be difficult in many instances to consider evacuating casualties from the center of infection and hospitalizing all of them. Obviously, in providing aid, local resources will be utilized extensively and all persons fit for work will be enlisted to look after the sick.

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Treatment must be based mainly on the use of broad spectrum antibiotics. It is very important to begin treatment in time and to choose the correct medicinal preparation. At the present time, methods have been worked out for choosing an effective medicinal preparation for treating diseases which have not yet been precisely diagnosed. The essence of these methods, which are applied in different modifications, is that the material

serving as the source of infection, or the clinical samples taken from an infected person, are planted in culture mediums containing different medicinal substances. The preparation which more than others inhibits the growth of pathogens, is regarded as the most acceptable for treating casualties. The indicated methods of choosing an effective medicine or preparation can be very useful for early treatment of casualties before one has succeeded in identifying the pathogens used by an enemy.

In connection with the possibility of disseminating biological warfare means over large areas there arises the problem of decontaminating affected targets. Chemical and engineer troops and rear services subunits are responsible for carrying out the main biological warfare decontamination measures in the troops. Chemical subunits and units will set up stations for the decontamination treatment of personnel and decontamination of clothing, equipment, weapons, combat equipment, and transport, and will also decontaminate the terrain. Engineer subunits will procure and purify water. The rations supply service of the rear will be responsible for the decontamination of food products. The medical service will monitor the quality and completeness of decontamination activities and will conduct medical treatment of the wounded and the sick in the stages of medical evacuation.

A great many chlorine-containing substances are used as biological warfare decontamination means in the armed forces, being employed also for chemical warfare decontamination of targets. An innovation in this field is the wide introduction into practice of gaseous biological warfare decontamination means -- ethylene oxide and its compound, methyl bromide, and beta-propiolactone. The use of gaseous decontaminants makes it possible to accelerate activities for the decontamination of targets (weapons, combat equipment, transport means, accommodations). In application to the conditions of civil defense, it is recommended that along with the indicated means we adopt the simplest decontamination methods, based on the use of physical methods of microbe decontamination (boiling, airing in sunlight) and improvised means of decontamination.

In view of the possibility that infected insects may be used in a biological warfare attack, the armed forces and the civil defense system must provide for appropriate measures and means to combat carriers of infectious diseases. And to do this we must, first of all, develop and adopt new insecticides effective against insects with a heightened resistance to preparations which have been widely distributed and in use for a long time.

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The success of measures for defense against biological weapons at the beginning of combat actions will depend largely on the establishment during peacetime of the necessary mobilization reserves of medical means, on the quality of training received by armed forces personnel and the populace of the country in methods of defense against biological weapons, and on the working out of a series of theoretical problems connected with prophylaxis and with the treatment of casualties.

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Expenditure of Time and Forces for Prophylactic Inoculation in a Motorized Rifle Division, Using Different Methods of Applying Preparations

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Method of vaccination	Sites (tents) for vaccination		Number of vaccinators		Time spent vaccinating a motorized rifle division, hours
	Dimensions, square meters	Number	Doctors or medical assistants	Medical instructors	
Hypodermic	--	19	19	38	20-24
Aerosol (dry)*	80	6	6	6	2-3
	40	12	12	12	2-3
	22 (Standard Medical-Technical Tent-41)	24	12	24	2-2.5
Aerosol (liquid)*	80	6	6	6	1.2-2
	40	12	12	12	1.2-2
	22 (Tent-41)	24	12	24	1-1.5
Needleless injection	--	12	12	12	2-3

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* The calculations take into account preparatory measures lasting seven to ten minutes before each vaccination session. With this exception, these data are valid only for uninterrupted (undelayed) arrival of personnel at inoculating points.