

R E P O R T

OF THE

INTERNATIONAL SCIENTIFIC COMMISSION

FOR THE

INVESTIGATION OF THE FACTS CONCERNING

BACTERIAL WARFARE IN KOREA AND CHINA

MEMBRES DE LA COMMISSION SCIENTIFIQUE INTERNATIONALE CHARGÉE D'EXAMINER LES FAITS CONCERNANT LA GUERRE BACTÉRIOLOGIQUE EN COREE ET EN CHINE

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Preamble

From the beginning of 1952, phenomena of a very unusual character occurring in the territories of Korea and China led to allegations by the peoples and governments of those countries that they had become the objective of bacteriological warfare.

Since the peoples of the world had long manifested their disapproval, and indeed detestation, of such methods of war, the gravity of the situation was well understood. This was the reason for the formation of an International Scientific Commission which should examine the evidence in the field.

The members of the Commission, who, conscious of their responsibility, made every effort to free themselves from preconceived ideas, have carried out their investigations according to the strictest scientific principles known to them. The details of this work, and the conclusions to which it has led, are placed before the reader in the present Report. In its composition eight languages have participated, and if it should be found lacking in elegance, the reader will remember that it had to be clear, unambiguous, and comprehensible in every continent.

Formation and Work of the Commission

On the 22nd Feb. 1952, Mr. Bak Hun-Yung, Foreign Minister of the Democratic People's Republic of Korea, and on the 8th March Mr. Chou En-Lai, Foreign Minister of the People's Republic of China, protested officially against the use of bacteriological warfare by the U.S.A. On the 25th Feb., Dr. Kuo Mo-Jo, President of the Chinese People's Committee for World Peace, addressed an appeal to the World Peace Council.

At the meeting of the Executive Committee of the World Peace Council held at Oslo on the 29th March, Dr. Kuo Mo-Jo, with the assistance of the Chinese delegates who accompanied him, and in the presence of the Korean representative, Mr. Li Ki-len, placed the members of the Committee, and other national delegates, in possession of much information concerning the phenomena in question. Dr. Kuo declared that the governments of China and (North) Korea did not consider the International Red Cross Committee sufficiently free from political influence to be capable of instituting an unbiased enquiry in the field. This objection was later extended to the World Health Organisation, as a specialised agency of the United Nations. However, the two governments were entirely desirous of inviting an international group of impartial and independent scientists to proceed to China and to investigate personally the facts on which the allegations were based. They might or might not be connected with organisations working for peace, but they would naturally be persons known for their devotion to humanitarian causes. The group would have the mission of verifying or invalidating the allegations. After thorough discussion, the Executive Committee adopted unanimously a resolution calling for the formation of such an International Scientific Commission.

Efforts were therefore made immediately after the Oslo meeting to obtain the acceptances of a considerable number of European, South American, and Indian scientists, as eminent as possible in the relevant fields. As soon as the provisional acceptances were known, Dr. Tsien San-Tsiang, Director of the Institute of Modern Physics of Academia Sinica (the Chinese National Academy), and a member of the Chinese Peace Committee, who had remained in Europe after the Oslo meeting charged with the work of organising the Commission, issued invitations in the name of Dr. Kuo Mo-Jo, President of Academia Sinica and of the Chinese Peace Committee. The indispensable minimum of members having been reached by mid-June, they duly proceeded to China.

The International Scientific Commission reached Peking on the 21st, and 28th June, where its members were warmly welcomed by representatives of Academia Sinica and the Chinese Peace Committee. The members were as follows:—

Dr. Andrea ANDREEN (Sweden), Director of the Central Clinical Laboratory of the Hospitals Board of the City of Stockholm.

Mons. Jean MALTERRE (France), Ingenieur-Agricole, Director of the Laboratory of Animal Physiology, National College of Agriculture Grignon; formerly Livestock Expert, UNRRA; Corresponding Member of the Italian and Spanish Societies of Animal Husbandry.

Dr. Joseph NÉEDHAM (U.K.), F.R.S., Sir William Dunn Reader in Biochemistry, University of Cambridge; formerly Counsellor (Science), H.B.M. Embassy, Chungking, and later Director of the Department of Natural Sciences, UNESCO.

Dr. Oliviero OLIVO (Italy), Professor of Human Anatomy in the Faculty of Medicine of the University of Bologna; formerly Lecturer in General Biology, University of Turin.

Dr. Samuel B. PESSOA (Brazil), Professor of Parasitology at the University of Sao Paulo; formerly Director of Public Health for the State of Sao Paulo; Hon. Professor in the Faculties of Medicine of the Universities of Recife and Paraiba.

Dr. N. N. ZHUKOV-VEREZHNIKOV (U.S.S.R.), Professor of Bacteriology at, and Vice-President of, the Soviet Academy of Medicine; formerly chief medical expert at the Khabarovsk Trial of Japanese ex-service men accused of participating in bacteriological warfare.

While greatly regretting that certain distinguished men of science whose participation had been expected, had not been able to come, the 15th July was fixed by the Commission as the last date for arrival. However, later on, a warm welcome was given to

Dr. Franco GRAZIOSI (Italy), Assistant in the Institute of Microbiology, University of Rome,

who arrived in Peking on the 6th Aug., just before the return of the Commission from Shenyang (Mukden). Since he was thus only able to be present during the last three weeks of the Commission's work, he was established in the status of Observer-Consultant, and in that capacity gave great help to the proceedings.

Finally, there participated:

Dr. TSIEN San-Tsiang (China), Director of the Institute of Modern Physics, Academia Sinica (Chinese National Academy),

who had accompanied the Commission from Europe to Peking as Dr. Kuo's representative. Upon the unanimous invitation of the Commission, he was attached by the Chinese authorities as Liaison-Member, a position which carried a voice in the deliberations of the Commission, but no vote. The group also included:

Mr. N. A. KOWALSKI; Secretary-Interpreter to Dr. Zhukov-Verezhnikov, and

Mrs. S. B. PESSOA; acting as Secretary-Interpreter to Dr. Pessoa.

The International Commission was assisted by a Committee of Reception which had been set up on the Chinese side. This was constituted as follows:

Chairman:

Mrs. J. I. Tê-Chuan President of the Chinese Red Cross Society and Member of the World Peace Council

Vice-Chairmen:

Mr. JIAO Ch'êng-Chih Member of the World Peace Council

Dr. HO Chêng Hon. President of the Chinese Medical Association

Secretary-General:

Dr. KUNG Nai-Ch'uan Director of Shanghai Medical College

Assistant Secretary-General:

Dr. CHI Su-Hua Secretary of the Chinese Medical Association

Specialist Liaison Officers:

Dr. CHUNG Hui-Ian Director of the People's Hospital, Peking, and Professor of Clinical Medicine, China Union Medical College

Dr. Wu Tsai-Tung Professor of Pathology, Nanking University Medical College

Dr. FANG Kang Associate Research Member, Central Biological Products Institution Peking;

Dr. CHU Hung-Fu Assistant Director Laboratory of Entomology, Academia Sinica

Dr. YEN Jen-Ying (Associate Professor of Obstetrics and Gynecology, Peking University Medical College)

Dr. YANG Chih-Ta (Professor of Public Health, Aurora University, Shanghai).

Most of the members of the Committee accompanied the Commission upon its travels, however hazardous or arduous, and were constantly ready to perform every conceivable liaison task which the situation might demand. From time to time some of them, together with many other Chinese scientists and medical men, attended the meetings of the Commission as observers or to give evidence before it. The Commission wishes to thank all these colleagues, for whose scientific attainments and probity it conceived a deep respect.

As regards the conduct of the meetings of the Commission, the Chairmanship rotated in an approximately consecutive manner among the members. M. Malterre was elected Scientific Secretary. The first meeting of the Commission took place in Peking on the 23rd June, and a brief chronological summary of all the meetings held will be found in App.

Of the general methods of the Commission it may be said that it worked in close contact with the Ministers and ministerial secretariats of the central and regional Ministries of Health at Peking, Shenyang (Mukden), and Pyongyang. It naturally had the help of all those scientists whose fields of work were relevant to the problem before it. Besides those already mentioned, the Commission wishes to thank Dr. WANG Pin and Dr. PAI Hsi-Ch'ing, Minister and Vice-Minister of Health respectively for the North-Eastern Region of China (Manchuria), who spared no pains to lay before the Commission all information that it was in their power to give. Its thanks are similarly due to Dr. KI Ping-Nam and Dr. LU Tchen-Han, Minister and Vice-Minister of Health respectively in (North) Korea, but these could not be offered without an expression of admiration for the cool manner in which these distinguished medical officials conducted all their business while suffering the constant inconveniences and dangers of heavy air bombardments.

In this connection, too, the Members of the Commission wish to voice their profound admiration for the devoted service to their country of all the Korean bacteriologists and other specialists whom they had the honour to meet during their visit. The Commission renders homage to three of the best Korean bacteriologists who have perished while carrying out their professional duties. It also wishes to place on record its admiration of the selfless service of the eminent Chinese specialists seconded to the Korean Epidemic Prevention Corps, such as Dr. CH'EN Wên-Kuei, Dr. WEI Hsi, and Dr. HO Ch'i, who thought fit to leave

the quiet amenities of their laboratories in far-away parts of China to share all the hardships and dangers of their Korean colleagues in the front line of anti-bacterial defence.

The meetings of the Commission varied in character. Sometimes the members discussed scientific problems for many hours in closed session, on other occasions Chinese scientific experts were present, and again at other times large rooms were required for the hearing of evidence of numerous eye-witnesses who came from all walks of life. Among the witnesses there figured a captured intelligence agent (App.) and four airmen (App.). From time to time specific sub-committees of two or three members were delegated to look into particular problems in conjunction with Chinese colleagues, and then to report back to the Commission. From time to time whole days were spent in laboratories, at Peking, Shenyang, and Pyongyang, where the Chinese and Korean scientists demonstrated in great detail the results of their investigations. As occasion demanded, too, members of the Commission made use of the very good library facilities available at Peking and Shenyang.

The material on the cases prepared by the Chinese and Korean specialists forms the bulk of the Appendices to the present Report. They will be found briefly described in the paragraphs which follow. It should be understood that they are not isolated cases, but represent a sampling from a larger mass of material. If the bulk of what is here presented is Chinese rather than Korean, this is because the Koreans were working under far more difficult conditions, and because the Commission was in Korea for a shorter time, and indeed at a particularly difficult moment.

At the same time the Commission felt that it must familiarise itself with the original scientific data which had formed the basis for the documentation issued from Prague during the earlier part of the year. It was necessary that these documents should be validated or otherwise, if possible, and it proved that clarifications were indeed necessary; misunderstanding, tentative identifications afterwards withdrawn, sheer mistakes of translation, etc. being found. After a great deal of work along these lines, the results of which may be seen in many of the Appendices, the general conclusion of the Commission was, in fact, to confirm the main statements of the Reports of earlier investigating groups which had been disseminated through Prague.

The main travels undertaken by the Commission were as follows: Having unravelled the main threads of the situation in Peking from the 23rd June to the 9th July, it proceeded to Shenyang (Mukden), where it worked from the 12th to the 25th. Accompanied by the members of the Reception Committee, it then passed across the Yalu River into North Korea and held meetings in Pyongyang (subject to interruptions by air-raids from July 28th to 31st). Then returning north, the Commis-

sion spent two days at a rendezvous with the captured airmen before re-crossing the frontier into Northeast China on Aug. 6th. It should be recorded that the technical organisation of this expedition was faultless.

An earlier one, which took a shorter time, had been undertaken on the 15th and 16th July, when the Commission went by special plane, train, and jeep, via Chichihar and Laha to visit the localities in the Kan-Nan district which had been the scene of the dissemination of plague-infected rodents (see App.). These places are located in Heilungchiang province on the border of Inner Mongolia. Other official journeys were of a minor character.

It is important to say something regarding the difficulties of language necessarily attendant upon any enterprise such as that of the present Commission. Within the Commission itself seven languages were represented, but it was found that French was the one spoken and understood by the majority of the members, and this therefore became the working language. Russian, English, and Italian, when spoken, were at once translated into French. On the Chinese side, the fact that so many Chinese scientists speak excellent English or French was of great value to the work, but during meetings, for protocol reasons, they spoke in Chinese, interpreted immediately, and often independently, into French, Russian, and English. This was effected by Dr. YANG Shih-Ta and Mr. TING Chi-Ch'ien for French, Dr. CH'EN Shu for Russian, and Dr. YEN Jen-Ying for English. At a later stage of the work, Dr. WU Huan-Hsing rendered valuable literary and linguistic assistance. The Commission had further the advantage that one of its European members spoke and understood the Chinese language, which was of particular value during the interviewing of witnesses, and could also read and write Chinese, which facilitated the consultation of literature and the examination of documents. Another member was able to maintain direct English-Russian linguistic contact. In Korea conditions were even more complicated, for very few Chinese scientists understand Korean, but the Commission had there the services of a remarkable linguist, Dr. OK Jen-Hsieh, who interpreted perfectly from Korean into French, English or Chinese at will. Other Korean-Chinese interpreters were also available. A parallel check was obtained by translation into one of the European languages through Chinese, and also simultaneously from Korean to Russian direct. Since frequent comparison of notes took place, it will be seen that there was not much likelihood of any mistake on points of substance. Lastly, the proceedings at some of the meetings were recorded by magnetophone for subsequent reference. For all these reasons, the Commission considers itself protected against any criticisms that it did not succeed in apprehending the full mind of Chinese and Korean specialists and witnesses.

The names of the members of the Commission signed below bear

appropriate indications as to the qualifications and fields of competence of the signatories. Their diverse experiences were pooled in laborious and extended discussions. Each contributed equally in all matters where a knowledge and understanding of the scientific method as such sufficed, and when the problem was remote from their own fields, the critical expositions of the better qualified members carried the conviction of the others. The present Report is thus a truly collective work.

Besides those things which the members of the Commission themselves saw and heard, and for which therefore they take the responsibility of witnesses, the Commission necessarily depended on Korean and Chinese documentation. Although there was no reason to doubt the competence and probity of the medical men and other scientists in China and Korea, the Commission left no precaution untaken. It never wearied in analysing the cases, and took the greatest pains to enter into direct contact with the original facts whenever this was at all possible. Its members held themselves continually on guard against political, ethical or emotional influences, and its work was done in an atmosphere of calm and scientific objectivity. Its final convictions naturally rested to some extent upon the reliability of the hundreds of witnesses interviewed and interrogated. Their testimonies were too simple, too concordant, and too independent, to be subject to doubt.

In the descriptions which will be found in the body of the Report it was obviously impossible to incorporate in every sentence the Korean or Chinese authority upon which the statement is based. Personal tests, examinations, interrogations, etc., carried out by the members of the Commission, have generally been mentioned in the text. In all cases, full details will be found in the relevant documents and commentaries indicated by the references to the Appendices.

A final Appendix gives biographical details of all the Chinese and Korean scientists whose names are mentioned in the documents here published.

Documentation*

At the time when the members of the Commission first assembled, the only documents available to them were those which had been released by the Korean and Chinese Governments and disseminated in the western world from the secretariat of the World Peace Council at Prague or through the various Chinese official news agencies in the various countries.

The First Report of the Korean Medical Service (SIA/1)** dealt only with events of Jan. and Feb. 1952. The material contained in it was worked over again in the International Democratic Lawyers' Commission (Korea) Report (SIA/4), which added data on the appearance of plague cases in Korea, and of course the results of examination of eye-witnesses by international personnel.

The two most detailed reports were those of the Chinese Commission for Investigating the American Crime of Germ Warfare which carried out investigations both in Korea and in NE China (Manchuria) during the month of March. The main one of these was that of the sub-commission in Korea printed in Peking in April, given in full in NCNA/85 (Suppl.), and abridged in SIA/13. The report of the sub-commission, in Northeast China (Manchuria) was similarly printed in Peking and abridged in SIA/3. This report is that which contained the fullest entomological information. Nothing of strictly scientific significance was added by the International Democratic Lawyers' version of the same material, again printed in Peking, and fully reproduced in SIA/8.

A special report by certain European scientists consulted by the Secretariat of the World Peace Council confirmed the entomological identifications by photographs, and appeared as SIA/2; it covered both Korean and NE Chinese data. A further special report by four Chinese scientists, again based on the same material, appeared as SIA/12.

Those who wish to examine the earlier reports would be well advised to study them in the above order. By the time that the members of the Lawyers' Commission returned to Europe (mid-April), a considerable

* The references contained in the text relate to Appendices which will be published at a later date.

** The following document identifications will be used: Prague series, SIA/; New China News Agency, NCNA/; Documents furnished to the International Scientific Commission, in China, ISCC/; in Korea, ISCK/.

amount of new duplicated and typescript material was ready for them to take with them, especially a series of ten important, but at that time only partially analysed, incidents, which, as they carried numbers 00001 to 00010, are termed the "Four-Zero Series".

The remaining material, while by no means lacking in scientific significance, was predominantly legal and personal. Eye-witness depositions, some of which concerned cases also described elsewhere (e.g. 00005), were collected in SIA/6 and 10. Statements of various American prisoners of war and agents were collected in SIA/7, while many papers were devoted to the elaborate statements of captured American pilots (SIA/14, 15, 16, 17, 18), and these themselves were photolithographically reproduced in a document published by the World Peace Council probably in May. A collection of relevant press excerpts on bacteriological warfare was brought together in SIA/5.

The Relevance of Japanese Bacterial Warfare in World War II

No investigation of allegations of bacterial warfare in East Asia could fail to take cognisance of the fact that it was undoubtedly employed by the Japanese against China during the second world war. The Commission was relatively well informed on this subject since one of its members had been the chief expert at the Khabarovsk trial, and another had been one of the very few western scientists in an official position in China during the course of the events themselves. In 1944 it had been part of his duty to report to his own government that although he had begun with an attitude of great scepticism, the material collected by the Chinese Surgeon-General's Office seemed to show clearly that the Japanese were, and had been, disseminating plague-infected fleas in several districts. They were thus able to bring about a considerable number of cases of bubonic plague in areas where it was normally not endemic, but where conditions for its spread were fairly favourable. As is generally known, under normal circumstances, bubonic plague is endemic only in certain sharply circumscribed areas (e.g. Fukien province) out of which it does not spread.

From the archives of the Chinese Ministry of Health one of the original reports dealing with the artificial induction of plague at Changtê in Hunan province by the Japanese in 1941 was laid before the Commission (App. ISCC/1). This document is still today of considerable value and indeed historical interest. Official Chinese records give the number of hsien cities which were attacked in this way by the Japanese as eleven, 4 in Chekiang, 2 each in Hopei and Honan, and 1 each in Shansi, Hunan and Shantung. The total number of victims of artificially disseminated plague is now assessed by the Chinese as approximately 700 between 1940 and 1944.

The document reproduced below has, moreover, historical interest. It is known that the Chinese Surgeon-General at the time distributed ten copies among the Embassies in Chungking, and it may well be more than a coincidence that according to the well-known Merck Report of Jan. 1946, large-scale work in America on the methods of bacteriological warfare began in the very same year, 1941. The Commission was happy to have the opportunity, during its work in Korea, of meeting the distinguished plague specialist who wrote the original memorandum from Changtê, and of hearing his views on the failure of the Kuomintang

Government to follow up the evidence which was already in their hands by the end of the second world war (App.). As is generally known, his conclusions were subsequently fully confirmed by the admissions of the accused at the Khabarovsk trial.

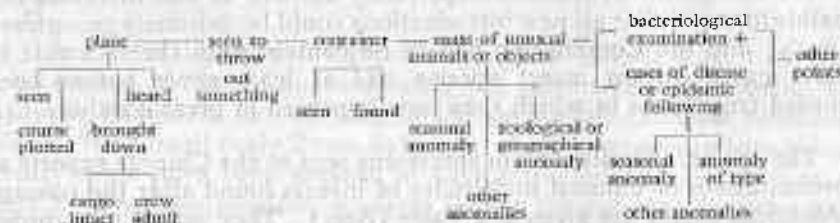
By the publication of the "Materials on the Trial of Former Servicemen of the Japanese Army charged with Manufacturing and Employing Bacteriological Weapons" (Moscow, 1950) a wealth of information about the practical work carried out under the direction of the Japanese bacteriologist Ishii Shiro (who was unfortunately not himself in the dock) was made available to the world. It was established beyond doubt that techniques had been employed for the mass-production of bacteria such as those of cholera, typhoid and plague, literally by hundreds of kilograms of the wet paste at a time. Techniques, quite simple in character, had also been used for the breeding of large numbers of rats and very large numbers of fleas, though in practice only the latter seem to have been disseminated. Moreover, the various witnesses were ready to give chapter and verse as to the dates upon which they had proceeded to various Japanese bases in China to superintend the methods of dissemination used. Abundant details were also forthcoming about the special secret detachments (such as the notorious "731") and their laboratories, pilot plants, and prisons in which Chinese and Russian patriots were made use of with perfect sangroid as experimental animals. In the course of its work, as will be mentioned below (p. 44) the Commission had the opportunity of examining some of the few remaining specimens of the earthenware "bombs" which were manufactured for Ishii in a special factory at Harbin.

It would seem that the Japanese militarists never abandoned their visions of world-conquest by the aid of biological weapons in general and the dissemination of insect weapons in particular. Before they departed from Dairen they systematically tore out from all volumes of journals in the university and departmental libraries articles which had any connection with bacterial warfare. It should not be forgotten that before the allegations of bacterial warfare in Korea and NE China (Manchuria) began to be made in the early months of 1952, newspaper items had reported two successive visits of Ishii Shiro to South Korea, and he was there again in March. Whether the occupation authorities in Japan had fostered his activities, and whether the American Far Eastern Command was engaged in making use of methods essentially Japanese, were questions which could hardly have been absent from the minds of members of the Commission.

Incident Analysis Adopted by the Commission

On account of its very nature, the use of biological weapons is an act exceptionally difficult to prove. Perfect proof might require, for example, that an airplane be forced down with its biological cargo intact and its crew prepared to admit their proceedings forthwith. Obviously this would be a very unlikely occurrence for many reasons. It is therefore necessary to envisage a manner of grouping events into a coherent pattern so that they can throw light upon each other and perhaps build up a circumstantial case. A first necessity, therefore, for the thought and work of the Commission was some kind of scheme which could serve as a framework for the facts which it would have to study in each particular investigation.

The simplest scheme, in which, under ideal conditions, every component would be present and positive, was the following:—



Naturally this complete pattern will rarely or never be encountered. There are, nevertheless, cases which come near enough to it to be decisive. In this way it is possible to reconstruct the activities of those who have utilised such methods, and to elucidate the effects which have been produced by them. The Commission paid particular attention to those assemblies of facts which attained most nearly the demonstrative character of the ideal pattern. When the general complex of facts resulting from the confrontation of numerous patterns is examined, the whole situation becomes clear, (cf. p. 51 below).

Entomological Data of the Prague Documents

One of the first tasks which presented itself to the Commission when it began its work in Peking was the systematic examination of the scientific material on which the Prague documents had been based, and one of the first aspects of this work was the tabulation of the entomological evidence in conjunction with the Chinese scientists of Academia Sinica and other learned bodies who had been responsible for the identifications. The opinion of the Commission was soon formed that there could be no doubts whatever as to their high competence (App.). They are, moreover, provided with very extensive library facilities including a rapid loan system between institutes, and the various collections of insects are maintained in excellent order. The only real difficulty, which remained insuperable, was the fact that even after the work of half a century, the systematic classification of many groups of insects in the Chinese sub-continent remains imperfectly known. It was therefore impossible to assert that all new introductions could be definitely recognised as such; and the Commission had to be content with the fact that in certain cases certain insect species had at least never before been recorded from areas in which they now appeared in great numbers.

The species identified from specimens sent to the Chinese experts as representatives of unusual multitudes of insects found after the passage of American planes, are given in a Table (App.). They include nine species of Diptera (six species of flies and three of mosquitoes and midges), one of Plecoptera, one of Collembola, one of Siphonaptera, and three of Orthoptera, as well as two spiders (Arachnida). In all, eighteen species including a beetle to be mentioned below.

One of the original impressions which the documentation (e.g. SIA/4) had given in Europe was that certain arthropods had been found which belonged, not only to species, but to genera, never known before in the relevant regions of continental Asia. This was not confirmed. Nevertheless, in three cases there were phenomena clearly anomalous in this respect. The species of *Hylemyia* (anthomyiid fly) identified repeatedly from numerous swarms collected, proved definitely not the same as any one of the four species common in Northeast China, nor with any one of the fifteen species previously recorded from all parts of China. The genus, however, has some 600 species, counting all parts of the world, and the true faunal areas of all of them are not yet perfectly known (App.). Similarly, the sun-flies found (*Helomyza modesta*; Meigen) were

certainly not identical with the single species of this genus previously recorded from China (App.). Exactly the same observation applies to the midge *Orthocladius*. These zoological and geographical discrepancies must be allotted due weight in the consideration of all the evidence.

In any case, the anomalies proved to be much more extraordinary on the oecological than on the zoological-geographical side. While the various species might or might not be strange to the region, it was certainly exceedingly strange to find them appearing in very large populations during the first three months of the year, when the snow is still on the ground in North and Northeast China and in Korea. The Commission found no difficulty in substantiating that these masses had been seen (and destroyed as quickly as possible) by very many ordinary men and women in all walks of life. Of the eighteen species so far referred to, no less than twelve exhibited marked seasonal anomalies of appearance. In other words they appeared in mass with a precocity varying from 6—14 weeks earlier than the time of year at which, according to the personal experience and published works of competent entomologists, they ought normally to be expected to appear. The average shift was one of 9 weeks; more than two months (App.).

Here several points of interest arise. The collection of many tens of thousands of flies of approximately the same size as house-flies can easily be imagined, but the size of the spring-tail (*Isotoma neigishina*; Börner) is so small (only 2 mm in length) that immense numbers in high density must have been present to have attracted any attention at all (App.). Wherever possible, concrete figures for assessed densities have been given in a Table (App.). An observation of importance made by one of the Chinese entomologists in SIA/12 was that certain masses of *Hylemyia* appearing when the temperature was -10°C . contained a high proportion of individuals ready to lay eggs, thus still further deepening the mystery of their origin. Similarly striking was the case of the field-cricket *Gryllus testaceus*, the life-history of which happened to have been the subject of an elaborate paper written in Peking in 1951 (App.). Thousands of adults of this species appeared in March near K'uan-Tien in Liaotung province, NE China (Manchuria), adjoining Korea, i.e. at a time when even in Peking, which has a warmer temperature than NE China, there should be present no individuals except those in the egg stage.

Now it may be granted that isolated and sporadic instances of the appearance of swarms of various kinds of insects in winter are to be found in entomological literature. But it is hardly conceivable that such phenomena could occur for so many species at once if its causes were

purely natural. The Commission ascertained that the meteorological conditions pertaining in the past winter in NE. China (Manchuria) and Korea were strictly normal (App.). It was therefore not at all surprising that the Chinese and the Koreans associated the unusual phenomena with the passage of American planes which on many occasions were seen by eye-witnesses to throw down non-explosive objects whence insects emerged. The Commission interviewed such eye-witnesses (App.), and assured itself of their good faith and rational credibility. As we shall see (pp. 39-45 below) containers of types both banal and highly peculiar were found and studied. Unfortunately in some of the documentation which reached Europe (such as the Four-Zero Series) the essential statements of the passage of the planes beforehand were not included, but the Commission was able to clear up this important point (App.).

Another argument would admit that there had indeed been a shift of the times of appearance of a considerable number of species of insects, but would urge that even if this could not have been due to abnormal meteorological conditions, some other natural factor had been at work, shifting systematically all the apparitions backwards by the same amount. A test of this was fortunately very easy. It was only necessary to arrange the various species in the order of their normal appearance, and then to plot on the same graph the order of their abnormal appearance. If a uniformly-acting natural factor had been at work, the two curves or lines should run parallel, but a glance at Fig. in (App.) is sufficient to show that they do not. The order of abnormal appearances is so haphazard as to indicate the intervention of an artificial factor.

One argument which had a certain success in various countries before the Commission began its work was that napalm bombing had notoriously been going on, and that this might well have led to intense and localised heating of the earth. Such an effect might have disorganised the normal life-cycles of various kinds of insects so as to lead to their appearance several weeks or even months before their proper time. The Commission therefore noted with interest the fact that many dozens of accounts of masses of insects including 33 principal incidents, some of which are given in Table, (App.) originated from places in NE. China, a region in which there has, of course, been no napalm bombing.

All the foregoing remarks apply to the species of insects mentioned in the SIA and parallel documents. A few species mentioned there by common names, such as "ants" and "horse-flies", could not be confirmed by the Chinese entomologists, and there may well have been some confusion due to terms used by non-scientific eye-witnesses. At a later stage the Commission examined new evidence concerning a coleopteron (beetle), *Ptinus*, (App.); this will be dealt with in its place. Both in this

and other cases of infected insects, the material assembled in the Appendices is available for the study of the connections between the vectors and the outbreaks of disease. Relevant also here is the question of the measures taken in China and Korea to control insect populations (see App.), and that of the occurrence of pathogens on random samples of normal insects (App.).

Medical Notes on the Insects Disseminated

The reader may encounter in the following paragraphs certain insects and spiders the names of which are likely to be unfamiliar to non-specialists. The following lines are intended to supply brief descriptions of them, and they are arranged in correspondence with the order adopted in Appendix.

The insect most frequently found to be disseminated is the anthomyid fly, *Hylemyia* sp. Flies of this genus are particularly common in North America, and there are in all more than 500 species, some of which frequent human habitations. Since they breed in human excrement they are naturally important as mechanical vectors of intestinal diseases. Many of the species pass the winter underground in the pupal stage, and in general their appearance in large numbers does not occur earlier than the month of May. Under natural conditions these flies can be infected by various bacteria pathogenic to plants (cf. p. 25 below, and App.).

Helomyza sp. (family Helomyzidae), the sun-fly, is an insect which frequents dungheaps. There are several dozen species most of which live on the excrement of man, bats, small mammals and birds; not only in the larval but also in the adult stages. Some species of these flies frequent human habitations, where they soil food and become the mechanical vectors of any human disease due to pathogenic bacteria.

The house-flies *Musca domestica* and its southern form *Musca vicina*, live invariably with man, and are well recognised as carriers of the agents of his diseases. More than sixty different species of pathogenic bacteria have been found on them.

The large house-flies, or stable-flies, *Musca stabulans*, are also recognised as insects associated with man, and mechanical vectors of human diseases.

All the above belong to the Diptera. The Plecoptera have been represented by *Nemoura* sp., one of the stone-flies. These multiply in streams and running water, their larvae feeding on the micro-organisms in the water. The adults do not like to stray far from this environment of their growth. Contact with man can occur through water and plants.

The Collembola, primitive wingless insects, have been represented by *Isotoma* sp. These develop in decomposing plant material and damp

soils rich in humus, and in the roots of vegetables. Some species develop on the surface of standing water.

In natural conditions, it has been proved that *Pulex irritans*, the flea parasitic on man, is capable of causing serious outbreaks of plague, (Blanc and Balthazar). It will later be seen that this vector has been utilised in bacteriological warfare.

The beetle *Ptinus fuscus* (Coleoptera) belongs to a genus comprising some 35 to 40 species most of which have the same habits, and some of which live in the neighbourhood of man. The species in question is most frequently found in human habitations, storehouses, stables, lofts and mills, libraries and factories. It lives on husked grain, cereals, cotton-seeds, stale bread or biscuits, flour, straw, furs, carpets, leather, etc. Among these things it lays its eggs. The process of metamorphosis lasts from 3 to 4 months, so that at least three generations can be produced in one year. The adult beetles can live for five years. They are to be met with in Europe, Asia, and North America, so that the species is widespread. Virulent anthrax bacilli have been isolated from *Ptinus* in the natural state (App.).

Among the spiders, the representatives are *Lycosa* sp. and *Tarentula* sp. of the family Lycosidae. They are carnivorous, feeding on mosquitoes, flies, ants, and other species among which there may be some which are vectors of human diseases. When such a spider attacks a man, the pathological phenomena seen are provoked not only by the venom of the bite, but also by the fact that pathogenic bacteria may be injected at the same time. The excreta of these spiders may also contain pathogenic bacteria. Their length of life is considerable, attaining several years. The adults are capable of living for two years without food, and several months without water; they can also withstand light frosts.

In the scientific literature there are descriptions of methods for the artificial production of insects and arachnids on a large scale. The most complete information on this subject will be found in a collective work prepared by American entomologists and entitled "Culture Methods for Invertebrate Animals" (New York, 1937).

As can be seen from the above commentary, some of the insects disseminated are known vectors of diseases, while others do not figure in the text-books as having anything to do with such transmissions. Thus the flies *Hylemyia* and *Helomyza* frequent human habitations from time to time, while other insects, such as the Collembolid *Isotoma* sp., have only remote contacts with man. It would therefore seem unlikely at first sight that such arthropods could have any importance in the transmission of human diseases. However, one must take into consideration not only

the great latitude of the so-called specificity of vectors, but also certain aspects of the vector-host relationship not yet clarified.

Thus the connection of man with the fowl mite *Dermanyssus gallinae* is possible only in peculiar and narrowly-defined conditions. Before 1944 nothing was known of the important part played by this ecto-parasite in the transmission and conservation of the virus of encephalitis. Before then it would have seemed absurd if anyone had made use of *Dermanyssus* to provoke artificially an epidemic of encephalitis.

It can not be accepted as a general rule that those species which are in intimate contact with man are necessarily more effective disease vectors than wild species. Thus among many examples one may take that of the mosquitoes *Aedes scapularis* and *Harmagopus spegazzini*. Under laboratory conditions these species transmit yellow fever. Now the first of these is very domestic and frequents human habitations located in forest regions, while the second one never enters them. Yet the human commensal has no important role in the transmission of yellow fever, while the wild species is well known as a vector.

As for the case of *Isotoma*, for example, various hypotheses may be formed, so long as one does not lose sight of the fact that they are only speculations about experiments of which we know nothing. For example:

- a) *Isotoma* → infection of lower mammal → ecto-parasites (fleas, mites, etc.) → infection of man.
- b) *Isotoma* → Contamination of food or water → infection of man.
- c) *Isotoma*, multiplication of the pathogen in, → *Isotoma*, congenital disease → infection of lower mammal → ecto-parasites → infection of man.
- d) *Isotoma* → infection of plants.

Many other hypotheses would also be plausible.

The same kind of suppositions apply also to the stonefly, *Nemoura*, but here there are probably yet other possibilities, hard to state precisely at present. There is no difficulty in understanding the role of the semi-domestic flies as vectors, especially when artificial laboratory conditions permit an augmentation of the percentage of infection, and an increased virulence of the pathogenic agent.

One further important point is worth emphasising. A single species can be semi-wild in one region and domesticated in another. As an example, one may cite the Anopheline mosquitoes of the genus *Kerteszia* which have no domestic habits north of the 24th degree of latitude in South America, and therefore play no part in the transmission of malaria.

But south of that line, on the contrary, they become very domestic, and consequently attain importance in the transmission of the disease.

Lastly, it is well known that prolonged researches were necessary before it became possible to establish definitely the role of arthropods as vectors in parasitic and bacterial diseases, such as the anopheline mosquitoes for malaria, fleas for plague, lice and ticks for Rickettsias, and so on. The part which arthropods play in the transmission of disease agents is something which requires continued study. Little known vectors may well have been employed in the hope that the methods of control of these unusual species of insects had not been worked out. Thus with regard to the methods of bacteriological warfare it can be seen that the artificial establishment of new biological inter-relations is quite possible, and though the researches required to elucidate them may be arduous, they are not likely to be unsuccessful.

Phytopathological Data

Several references were made in the earlier literature to the dropping of packets of plant material from American airplanes. They were usually seen by the eye-witnesses to burst at about 1000 ft. and scatter the leaves or other parts of plants over a wide area. Incidents of this kind occurred at Chang-Ju in Korea on 20th March (NCNA/85, p.9; SIA/13 p.4) and at more than ten other localities in Northeast China and North Korea. In one case the descent of the material was seen personally by a British war correspondent (SIA/6, p.2). Members of the Commission were able to discuss the botanical and mycological identifications with Chinese phytopathologists and botanists of international repute (App).

It was established that the stalks and pods of soya-beans were infected with purple spot fungus, *Cercospora sojini* Hara, (syn. *Cercosporium kibuchi*, Matsumoto and Tomoyasu). This fungus is a plant pathogen which has been reported from Korea and China, and which could cause serious damage and loss to soya-bean crops. As in the other cases here discussed, the pathogenic organisms were found inside the tissues of the plant material, showing that it was thoroughly and not merely superficially infected.

Among the fragments of leaves some were infected with anthracnose (*Glomerella*, sp., the asexual stage of which is called *Colletotrichum*). The organism found has a wide host range, attacking apple-trees, pear-trees, and cotton-plants, as experimental inoculation tests demonstrated. Ordinary cotton anthracnose (*Glomerella gossypii* (South) Edg.) only attacks cotton and related plants, while the apple bitter-rot fungus (*Glomerella cingulata* (Stoneman), S. & S.), though attacking more than thirty host plants, does not attack cotton. Both these have been reported from China. The fungus found, however, has morphological differences from them, as well as a much wider host range.

A third case of dissemination of a plant disease occurred as late as July, after the Commission had begun its work, near Hsiu-Yen in the south of Liaoning province. Peach-leaves, (not its natural host), were found to be infected with *Macrophoma karwinskii* Hara, the fungus causing apple and pear fruit rot (ring-spot) and also canker and twig blight of those trees. The fungus isolated proved to be highly infectious.

In the above three cases, precise eye-witness accounts of the dropping of the packets of plant material were available.

A further incident in this phytopathological warfare which came to the attention of the Commission, was the appearance of scattered corn (maize) grains (kernels) after one of the constant American air intrusions over Liaotung province in NE China (Manchuria), at the village of Sun-Chia-Pao-Tzu near Antung. These grains were found to be infected with a species of *Thecaphora* similar to, but not identical with, *Thecaphora deformans*, which is known as a pathogen of legumes in America and Europe. The plant pathogen here found had never previously been reported from China.

Although the leaves were sometimes in a fragmentary state, there was only one consignment (the anthracnose case) in which they could not be fully identified. In the first incident the material was *Glycine max*, in the third *Prunus perica*, and in the fourth *Zeamayt*. Other consignments frequently consisted of *Quercus* sp. (oaks) and *Sorghum vulgare* (kaoliang). Among them two are of particular interest (App). At Dai-Tek San in North Korea a mass of leaves was dropped which were identified as those of the deciduous oak *Quercus aliena*, Bl. var. *rubripes*, Nakai, a tree the distribution of which is strictly limited to regions south of the 38th parallel of latitude. At Hai-Loon hsien in NE China another mass of leaves was dropped on May 3rd, which were identified as those of *Lindera glauca* Bl., a tree only found in South Korea and quite unknown in Northeast China.

Allusion should be made to the possible use of insects as vectors of plant as well as human diseases. It is well known, for example, that the anthomyid fly *Hylemyia* spp. (cf. p. 20 above, and App.), carries fireblight of pear and apple (*Erwinia amylovora*), corn (maize) wilt (*Phytophthora stewartii*), and soft rot of vegetables (*Erwinia carotovora*)—three bacterial diseases—together with the fungal "black-leg" of cabbage (*Phoma lingam*). It is also well known that *Musca stabulans* (cf. p. 20 above, and App.), carries fireblight of pear and apple. Chinese phytopathologists have isolated strains of bacteria from the insects (and leaves) disseminated, and research is proceeding.

In general it may therefore be said that the dissemination of plant diseases has certainly played a part in the biological warfare which has been carried on in Korea and Northeast China (Manchuria).

Incidents in Korea (plague)

As has already been observed, the classical method of bacteriological warfare involving plague, that adopted by the Japanese during the second world war, consists in delivering, whether by container or spray, large numbers of fleas infected with plague bacteria. Since the beginning of 1952 numerous isolated foci of plague have appeared in North Korea, always associated with the sudden appearance of numbers of fleas and with the previous passage of American planes. Seven of these incidents, the earliest dating from 11th Feb., were reported in SIA/1, and in six of them the presence of the plague bacteria in the fleas was demonstrated. Document SIA/4 added the statement that after a delivery of fleas to the neighbourhood of An-Ju on the 18th Feb., fleas which were shown bacteriologically to contain *Pasteurella pestis*, a plague epidemic broke out at Bal-Nam-Ri in that district on the 25th. Out of a population of 600 in the village, 50 went down with plague and 36 died.

According to the best information which the Commission was able to obtain, for the past five centuries there has been no plague in Korea. The nearest endemic centres are three hundred miles away in NE China (Manchuria) and a thousand miles to the south in Fukien. Moreover, the month of February would be no less than three months too early for the normal appearance of human plague cases in this climate. Above all the fleas appearing were not the rat fleas which more usually carry plague bacteria in a state of nature, but human fleas (*Pulex irritans*). It was these which were used by the Japanese during the second world war, as we know from identifications on the Chinese side (App.) and from other indications (App.).

While in Korea the Commission was invited to study two special cases (App.). In the first of these, at Kang-Sou towards the end of March, a farmer went to a jar near his well one morning after a plane had circled over his village the previous night. He found that numerous fleas were floating on the surface of the water in the jar. He was probably bitten by other fleas of the same sending, for he died of bubonic plague a few days later, the diagnosis being abundantly confirmed by pathological and bacteriological tests, carried out by Korean and Chinese experts. The fleas also were demonstrated to be infected with plague bacteria. Members of the Commission inspected the cultures of microorganisms isolated from the body of the patient by the above-mentioned specialists, and convinced themselves

that these cultures were really of *Pasteurella pestis*. Pathological and histological preparations were also examined. Prompt sanitary measures at Kang-Sou had prevented further cases.

In the second of the studies, two lieutenants of the Chinese Volunteer Forces in Korea, found a very dense mass of fleas on a bare hillside near Hoi-Yang. The zoning was so distributed as to indicate that they had been delivered by a container which came down rather slowly in a NNE direction, but no trace of any container could be found. Somewhat astonished at the density of the population, which darkened the ground and blackened their trousers, the two young men, who were afterwards questioned by the Commission personally, returned to their quarters and brought reinforcements which destroyed the fleas with a fire of petrol and pine branches. In this case the soldiers were protected in a number of ways (App.) and their prompt counter-measures took effect before any appreciable number of the fleas could find their way to routes of transit frequented by human beings. Tests carried out by the Korean-Chinese services showed that these fleas were infected with plague bacteria, and that they were human fleas,

The fact that they were fleas (*P. irritans*) parasitic on man must be emphasised. According to what is known of the oecology of this insect, it would be impossible to find large numbers away from the houses of man. What, then, is to be said of the occurrence of a number of these insects estimated at many tens of thousands, at one time, on bare waste land remote from any human habitation? Such a witches' sabbath was certainly not called together by any natural means. More relevant was the plane which members of the CPVT billeted in the neighbourhood had heard circling over the place at about 4 a. m. on the day the discovery

Analysis shows that in these circumstances some of the normal links in the epidemiological chain of plague, in which *Pulex irritans* participates, are missing. Normally the epizootic disease manifests itself first among rodents, and this is followed by an outbreak of human cases, from which *P. irritans* is secondarily infected. Only then is this parasite of man capable of giving rise to further cases.

In the light of all these and other similar facts, the Commission had no option but to conclude that the American air force was employing in Korea methods very similar to, if not exactly identical with, those employed to spread plague by the Japanese during the second world war.

During the discussions of these cases at Pyongyang the Commission had the help of one of the foremost Chinese experts on plague, the author, indeed, of the 1941 report (App.). He gave evidence to the effect that he had urged the Kuomintang government to make known to the world the

facts concerning Japanese bacterial warfare, but without success; partly, he thought, as the result of American dissuasion (App.). He also drew attention to the high virulence of the strains of plague bacteria now being used in Korea.

The delivery of plague-infected fleas is of course not the only way in which it might be hoped to induce an epidemic. Other methods can be used and we shall now see that this has indeed been done.

The Kan-Nan Incident (plague)

Another case with a relatively complete sequence of component elements which the Commission was invited to consider in great detail was one involving the sudden appearance of a population of voles infected with, and suffering from, plague. On the morning of the 5th April, 1952, the countryfolk of four villages situated within the area administered from the town of Kan-Nan (Kan-Nan hsien), awoke to find themselves surrounded by large numbers of a rat-like animal (App.). This town lies on the western border of the province of Heilungchiang in NE China (Manchuria), and its district is thus just on the edge of Inner Mongolia.

During the previous night many of the villagers had heard a plane pass overhead, and information provided by the Chinese Air Observer Corps shows that after having crossed the Yalu River just before 10 p. m., it was over Kan-Nan district about 11:30; it then retraced its course as if its mission had been accomplished (App.). It was identified by the Corps as an American F-82 double-fuselage night-fighter plane. In the morning, the villagers found many of the voles dying or dead in their houses and courtyards, on their roofs, and even on their beds, while others were scattered around the outskirts of the settlements. The total number collected and destroyed in and near the inhabited places of an area measuring roughly 3×9 miles was 717 (App.). There was an anomaly of season, for small rodents do not usually begin to show themselves in this region until a month later, and then in nothing approaching such numbers (App.). The location was also anomalous, for voles are not frequenters of human settlements.

The species concerned also seemed to be regionally anomalous. It had never before been seen by the local people. It was possible to identify it as belonging to the genus *Microtus*, and morphologically similar to *Microtus (Sivocranius) gregalis gregalis*. This species had previously been reported by Tokuda (1941) from parts of Northeast China (Manchuria) northwest of Kan-Nan, and by others from points still more to the west. Further taxonomic study by Chinese Scientists is in progress. Moreover, this genus is not among those three which are normally carriers of plague (*Pasteurella pestis*) in those parts of Northeast China where the disease is endemic (App.). Analysis of the evidence by the Commission, both at Shenyang (Mukden) and at the villages, showed that a certain rôle in concentrating the animals must have been played by the cats of the farmers, but it also

became clear that the members of the intrusive species were uniformly diseased or dying before the cats found them. Some died in circumstances which excluded the action of cats.

The Kan-Nan area has never known any form of plague so far as records are available, and reasons more than adequate were presented to show that a migration of the voles from the nearest endemic areas must be regarded, in view of the distances and obstacles involved, as highly unlikely (App.). Furthermore the season was at least a month too early for the normal occurrence of epizootics of plague among rodents in the endemic areas (App.). Only one individual was preserved sufficiently for bacteriological test, but the evidence of virulent infection with *P. pestis* obtained from this specimen, together with the eye-witness accounts mentioned above, pointed unmistakably to a collection of animals in the full grip of the plague (App.). This evidence was confirmed in personal experiments carried out by those members of the Commission competent to do so, in collaboration with the Chinese scientists, and demonstrated to the whole Commission in the Bacteriological Laboratories of the National Medical College at Mukden.

The principal gap in the chain of evidence consists in the fact that no container or "bomb" of any kind was discovered. However, in view of the fact that in Jan. 1952 there was described in a Japanese journal (*Mainichi*) a container and parachute made of strong paper in such a manner that it would burn away, leaving no trace, after depositing its cargo of infected rats (App.); this missing link can hardly be considered sufficient to render nugatory the mass of circumstantial evidence already outlined. Other Japanese press reports (*Korea Shinbun*, Aug. 1952) revealed the existence of a breeding Institute directed by Ojawa, a former assistant of Ishii Shiro, which produces a large number of rodents, (App.).

It only remains to add that the Commission heard evidence at Shenyang (Mukden) from ten farmers, who, with others, were visited also individually in their homes. It also heard evidence from the epidemiologist who took charge of the local sanitation arrangements after the incident, from the bacteriologists who investigated and isolated the plague bacteria, and from the zoologist responsible for the specialised study of the rodents. The Commission considers that the countryfolk owed their escape from plague in this case to the sanitary precautions which they took from the moment of first discovery of the unusual rodents, and to the remarkable promptitude with which they destroyed the whole population of cats and dogs at noon on the same day. Among the precautions taken was a very effective method in common use in NE China for destroying fleas in human habitations; a thin layer of dry hay and straw is thrown over the earthen floors and kang, after all household goods have been removed, and then set on fire. For

these reasons plague-infected fleas were unable to transmit the pathogenic agents to the human beings.

In the opinion of the Commission, therefore, there remains no doubt that a large number of voles suffering from plague were delivered to the district of Kan-Nan during the night of the 4th/5th April, 1952, by the aircraft which the villagers heard. This was identified as an American F-82 double-fuselage night-fighter.

The K'uan-Tien Incident (anthrax)

The Commission studied in detail a case which involved the abnormal and simultaneous appearance of anthomyiid flies and spiders (App.). On the 12th March, 1952, inhabitants of the town of K'uan-Tien, which lies in the southeastern part of Liaotung province near the Yalu River, saw eight American fighter planes pass over the city about half-an-hour after noon. They recognised them without difficulty for such intrusions were a common, almost daily, occurrence. The Chinese Air Observer Corps identified them as F-86 planes and spotted their courses. From one of them there was distinctly seen to drop a bright cylindrical object. Immediately afterwards, and during the following days, the people of the town, including school-boys, organised searches in the region beyond the east gate where the object appeared to have fallen, and collected many anthomyiid flies (*Hylemyia*, sp.) and spiders (*Tarentula*, sp.).

Nine days after the original incident, one of the schoolboys was so fortunate as to discover fragments of a container in and around a shallow crater at the point of impact of the object (App.). The location was a maize field constituted by a small island surrounded by the beds of rivers dry at this time of year. The largest "bomb" fragment was of metal, but the most numerous were of a thin porous calcareous substance the nature of which was not immediately obvious. This was later identified and will be discussed separately (p. 44). The site of the incident was visited on the following day by two well-qualified entomologists, who had already searched in the immediate neighbourhood four days earlier; they collected a further supply of flies, and carefully assembled as many container-fragments as possible, melting the snow with the help of hot water.

The presence of snow, at least in drifts between the furrows explains how it was possible for the insects (sluggish at the low environmental temperature) to remain for more than a week in the close neighbourhood of the point of impact. It also explains the similar continued presence of considerable numbers of fowl feathers (also delivered at the same time) in the same zone. The insects and arachnids showed an anomaly of seasonal appearance (see p. 20 above) and the former also a regional anomaly as to zoological species (see p. 16 above).

Competent bacteriological examination by the Chinese demonstrated the presence of the pathogenic organism causing anthrax (*Bacillus anthracis*) both on insects, spiders and feathers (App.). The occurrence

of this in or on the arthropods must be considered a highly extraordinary phenomenon. While its occurrence on the fowl feathers is not quite so remarkable, bacteriological examination by the Chinese services of control specimens of feathers collected at random in N. China and NE China (Manchuria) yielded negative results. Moreover, the feathers may perhaps have been simply packed to ensure the safe passage of the insects, though it must be remembered that in other cases anthrax-infected feathers have been delivered alone. No cases of anthrax in or around the town were reported as a result of this intervention.

In view of the above facts the Commission had no option but to conclude that insects and spiders carrying anthrax had been delivered by means of at least one container of special type from at least one American plane in the neighbourhood of this small town in Liaotung province on March 12th.

Incidents in Liaotung and Liaohsi (respiratory anthrax)

The Commission gave exhaustive study to a group of cases in which American planes coming from across the Yalu River and returning thither were actually seen to drop objects of various kinds (App.). Though no containers could be found at the presumed points of impact when local eye-witnesses immediately went to search for them, other things were found, notably large numbers of beetles of the species *Ptinus faw* (normally a pest of stored grain and other dry stuffs), or alternatively masses of downy feathers of fowls. In some cases large numbers of the house fly *Musca vicina* unexpectedly appeared, with the anomaly of season so often noted, snow being still on the ground. Though the beetle was not seasonally anomalous, its appearance in the open air and in daylight in great numbers was oecologically extraordinary. All three of these biological objects were found by the Chinese bacteriologists to be contaminated with anthrax bacilli. And the strains of bacilli isolated, in spite of the diversity of the objects, all had exactly the same behaviour in fermentation tests,—an unusual and suspicious circumstance.

Thorough examination of 24 eye-witnesses was carried out, some of whom had been among those who saw the objects descending from the planes. Spotting records from the Chinese Air Observer Corps were available in all cases (Figs.) and this information showed that the intruding planes were in general F-86 fighters, with the exception of a B-26 bomber on one occasion. In one case several people saw an object like a large red thermos flask thrown down, which seemed to burst with an explosive puff and a disagreeable smell like burning skin or horn when about 30 ft. from the ground (cf. the paragraph on Containers). In another case valuable testimony, admitting the absence of any material container at the presumed point of impact, described the slow dispersion by the wind of a large quantity of feathers from just that point, with the formation of a triangular area slowly extending and broadening. In this instance the description of the container was such as to recall strongly the self-destroying "egg-shell" type used at K'uan Tien, (App. and p. 44 below).

The evidence concerning aircraft, containers, biological objects appearing, and bacteriological tests, was now amplified, for a number of localities in the provinces of Liaotung and Liaohsi, by concrete and well-analysed data concerning fatal human cases of respiratory anthrax and

haemorrhagic anthrax meningitis (App.). Five of these were examined, that of a railwayman, a tricycle-rickshaw driver, a housewife, a school-teacher, and a farmer. All of these fell sick of a disease which ran a similar rapid course, and all of them presented the same picture to the pathologists on autopsy and subsequent histological analysis. The Commission satisfied itself that none of the cases had the customary occupational history connected with anthrax. The beetles appear to have been responsible for two of the deaths, while the flies and the feathers would have accounted for another two. The Commission was fully satisfied with the diagnoses made and the proofs demonstrated by Chinese scientific colleagues. Furthermore, the examination of witnesses brought out (App.) what was missing from the document itself (App.), namely that four out of the five victims had not only collected the insects and feathers in the general course of such organised hunts, but were known to have dispensed with the recognised precautions followed by most people; that is to say, he or she had failed to protect the respiratory passages by a mask, or had handled the biological objects without gloves or forceps. Under the dissecting microscope it was clear that the beetle *Ptinus* would be well adapted for disseminating anthrax by this route, for it has an abundance of brittle chitinous spines on its elytrae which could be inhaled, a fact which the document apparently overlooked.

It is not to be supposed that these were the only deaths caused by the anthrax-infected objects; the five cases, with their precise pathological analysis, were presented as samples. Nor can the five cases be placed in their proper setting unless the full rarity of this kind of disease in the region previously, is clearly understood. Statistical evidence is presented (App.) which shows that not only was the classical cutaneous or pustular anthrax exceedingly rare in NE China in recent times, but respiratory anthrax leading to haemorrhagic meningitis was completely unknown.

It is well known that the literature contains proposals for the use of anthrax bacilli in bacteriological warfare. Although, under natural conditions, transmission from man to man occurs only rarely, so that a spontaneous epidemic could not easily be set on foot, the bacillus has the "advantages" of a wide host range, a high infectivity if virulent, and an extreme resistance to environmental conditions so that it is capable of poisoning a locality for a long time. To these must be added the very insidious character of the disease when the infection occurs by the respiratory route, for all the victims here mentioned remained comparatively normal until they suddenly collapsed, after which death ensued in 48 hrs. or less.

Anthrax infection by the respiratory route is significant in connection with the work on bacteriological warfare carried out in the United States. Researches from Camp Detrick, published in 1946 and 1947 (see

App.), showed that it had been possible to obtain new strains of anthrax bacilli cultured on synthetic media which not only possessed unusually high virulence, but which were especially adapted to the respiratory route of infection.

On the basis of the evidence presented, and on their own searching and prolonged interrogation of a considerable number of witnesses, both medical and lay, the Commission was compelled to conclude that the delivery of various biological objects contaminated with anthrax bacilli to many places in the two Chinese provinces had taken place, and that this had given rise to a number of cases of a mortal infection hitherto unknown in the region, namely pulmonary anthrax and ensuing haemorrhagic meningitis. Eye-witness statements impossible to doubt indicated American airplanes as the vehicles of delivery of the infected objects.

The Dai-Dong Incident (cholera)

One of the incidents to which the Commission was invited by the (North) Korean Minister of Health to devote detailed attention concerned certain fatal cases of cholera illustrative of those which have been occurring in rural areas since May, 1952 (App.). Early in the morning after a night (16th May) during which a plane had been heard circling round for an hour or more as if its pilot were trying to find something, a country girl picking herbs on the hillsides found a straw package containing a certain kind of clam. She took some of the clams home and she and her husband made a meal of them raw; on the evening of the same day both fell suddenly ill and by the evening of the following day both were dead. Medical evidence showed that the cause of death was cholera (App.). Further packages of clams were found on the hillsides by the local Home Guard, and bacteriological examination by the Korean and Chinese specialists proved that the clams were heavily infected with the cholera vibrio (App.).

The whole sequence of events becomes more and more extraordinary the more closely it is examined. In the first place, the appearance of marine molluscs (*Meretrix meretrix*), contaminated in this way, on a hill in the middle of the countryside, can only be regarded as a highly unnatural phenomenon. The human fatalities, moreover, were epidemiologically very abnormal. Evidence presented convinced the Commission that cholera has never been an endemic disease in Korea; for while there have been a number of outbreaks during the past forty years it was always possible to trace them to a maritime point of entry. Yet here was a purely rural focus. Furthermore, there had only been one previous instance during this century of any cholera in Korea in May; seldom did it appear before the month of August. Then there were several peculiarities about the clams as found. In Korea they are not usually wrapped in straw for sale, they appeared here a month before their usual season (indeed since the beginning of the war they have not been reaching the markets at all), and if anyone had gone to the trouble of laying the packages down at various places on the hillside it was hard to explain why many of the thick calcareous shells of the clams should have been broken.

Light was thrown on the sequence of events, however, when the nature of the locality was examined. The clams were found in a zone some 400 yds. from a pumping-station at the top of the hill, and some 1,000 yds. from a series of reservoirs or spring-fed ponds the water of

which is drawn up by the pumping-station and distributed, partly for drinking, to several coastal settlements and port towns. On the night previous to that during which the clams made their appearance, the purification-plant adjacent to this pumping-station had been accurately destroyed by American planes using small bombs, the pumps themselves being undamaged. Further statements of local residents examined personally by the Commission (App.) revealed that the weather on the night of the second raid when the clams appeared had been dark and windy. All these facts pointed unmistakably to a deliberate and carefully-planned attempt to contaminate drinking-water reservoirs, the scheme having failed in its main purpose because the weather conditions on the night of the delivery of the clams did not permit the pilot to locate the reservoirs. On the night in question they would not have presented a mirror-like surface.

It might still, however, be thought bizarre, that a marine or at least estuarine variety of lamellibranch mollusc should have been thought suitable for depositing in fresh-water sources for their pollution. Evidence of much interest, however, not only reminded the Commission that the cholera vibrio is a halophilic organism, but revealed the existence in the Japanese literature of researches which had shown the marine lamellibranch molluscs to be well suited as media for its growth (App.). This provided the last link in the reconstruction of the plan for this kind of bacteriological warfare. During their slow osmotic death in fresh-water the molluscs would serve as natural culture-vessels for the cholera vibrios, liberating them at their death to contaminate the drinking-water for a period likely to be of the order of thirty days (App.).

Thus the Commission could only conclude that American air force units, following a careful plan previously established, first destroyed the Dai-Dong purification plant without damaging the pumps, and then attempted to contaminate the drinking-water reservoirs with cholera. The young couple who died, impoverished by war devastation, had the imprudence to eat some of the clams which had been intended as the vehicles of contamination.

This case should be studied in connection with evidence mentioned elsewhere (p. 58) concerning flies as artificial carriers of cholera.

Types of Containers or "Bombs"

The time has now come to devote some attention to the types of containers, or "bombs", if the term is appropriate for engines of war which may contain little or no explosive material. At various times and places, particularly at Shenyang (Mukden) and in the neighbourhood of Pyongyang, the Commission had the opportunity of examining at leisure a variety of the containers in which biological objects had been delivered from the air. Its members were thus able to verify a number of the statements made in the Prague documentation, and to investigate in considerable detail newer methods more refined than any which had been described therein. As will be better appreciated shortly the task of the Commission was not rendered easier by a circumstance which soon became apparent, namely that some of these newer methods comprise "self-destroying containers", that is to say, containers which either break into pieces so small that their discovery is unlikely, or containers which set fire to themselves and disappear after delivering their cargo. Moreover, throughout the Prague documents, and even in subsequent depositions collected by the Commission, there runs a streak of unavoidable confusion, due to the fact that even when eye-witnesses were on the spot when a container was delivered, they did not always succeed in finding it, partly because naturally they did not quite know what to look for, and when they did find it their descriptions were sometimes not as detailed as they might have been. This confusion was unfortunately not cleared up by the testimonies of the captured air force officers, whose status as pilots and navigators did not seem to have entitled them to very precise and detailed information on bombs and containers. It must be remembered that in one of the lectures which the pilots attended (Quinn/Ashfork; see below, p. 51 & App.) it was distinctly stated that "our bombs are still in the experimental stage, and there are various types of them". The contents of this paragraph must therefore be accepted with all due reservations.

The containers present a variety of forms and systems probably adapted to a variety of different cases. It seems also that pathogenic agents can be spread directly over the target area. In what follows it will be convenient to begin with this method, namely spraying, which involves no container at all, and to end with the self-destroying recept-

acles. Intermediate positions will be occupied by the less specialised devices whether parachuted or not.

(1) **Spraying.** In NCNA/85, p. 4, (Report of the Chinese Scientific Commission in Korea) the claim was made that a Chinese volunteer soldier actually saw an American plane spraying insects at Chor-Won from a height of about 900 ft. on Feb. 11th. It seems unlikely that this could have been anything else than a deduction from the fact that large numbers of insects were found anomalously on the snow over an oblong area 6×3 miles after its passage. Nevertheless the statements of all four American pilots are quite specific and concordant that in five separate lectures they were told that spraying could and would be done. One of these statements (O'Neal, ISCK/4, App.) includes a diagram of the equipment installed in the plane, and another (Kniss, ISCK/5, App.) says that its writer was informed that spraying would start in June. However, the former witness states his reasons for believing that spraying was going on from at least Feb. 18th, so the Chinese volunteer may have been right in his deduction.

As to the kinds of insects which could be so distributed, it seems certain that the method would be unsuitable for delicate creatures such as mosquitoes, but other discussions (App.) indicated that it would not be unreasonable for fleas. It would of course be the way in which bacteria, viruses or toxins, would be disseminated in aerosol form.

(2) **Non-exploding Objects and Paper Packets.** Several of the Prague documents have descriptions of the finding of paper packages of various colours from which insects were emerging. Again on the 11th Feb., Chinese volunteers at Chor-Won saw three American planes throw down such non-explosive objects, which turned out to be cylindrical yellow paper packets 8 inches high and 4 inches diameter (SIA/1, p.6; SIA/4, p.5). Elsewhere in the vicinity there were rectangular grey paper packets, $4 \times 4 \times 1\frac{1}{4}$ inches containing insects. White paper packets are spoken of as having been delivered at Pyongyang on 4th Mar. (NCNA/85, p.8) and brown ones at Chang-Do on 10th Mar. (NCNA/85, p.6). Two of the lectures attended by the captured pilots (Enoch/Wilson and Quinn/Ashfork, see below, p. 51) described the use of paper as a packing for infected insects. While it seems conceivable that hardy insects might be dropped from a low height simply wrapped in this way, it seems more probable that in all cases the packets originated from the interior of metal leaflet-containers or "bombs" which had exploded and opened in mid-air. To these we now turn.

(3) **Air-Bursting Variable-Time Fuse Leaflet Bomb.** This type of container is the one which has figured most in all accounts hitherto published on bacteriological warfare in Korea and China, and it is certainly the commonest type in the collections which the authorities of those two countries have made. Members of the Commission saw many examples of it. This bomb is of approximately the same size and shape as the ordinary American 500 lb. HE bomb, but it weighs only about 150 lbs. and can therefore be loaded on to the planes by hand (App.). It consists of a conical nose-piece at the tip of which is the time-fuse. This nose-piece forms a small empty compartment, and below it the cylindrical body of the bomb is divided by three steel diaphragms into four separate compartments. The casing is divided longitudinally so that half of it, being mounted on hinges, can swing open and release its contents at any moment desired. Below the floor of the lowest compartment the casing narrows again to form a conical empty space from the sides of which spring the four tail-fins, and in the bottom of which is a hole sufficiently large to permit of the escape of a parachute if it should be desired to equip the bomb with such a device. There has been some divergence in the published measurements of the bomb (NCNA/85, SIA/13, ISCK/4, etc.) but the specimens seen by the Commission and described by the captured pilots have a total length of approximately 4 ft. and a diameter of 1 ft. 2 in. The casing is made of $\frac{5}{8}$ in. steel, and the total capacity of the 4 compartments is of the order of $14\frac{1}{4}$ gallons. The length of the time-fuse is a little more than 3 in. Markings seen were "Leaflet Bomb—500 lb.—M 105 Lot—U.S. Time (-fuse)-Empty". According to the descriptions given by the captured airmen (App.) the doors of the bomb are supposed to open at a height of about 100 ft., distributing the contents over an area likely to be about 300 ft. in diameter.

The classical eye-witness description (App.) is that of an army doctor who on Mar. 26th saw an American plane, circling over Yong-Won, drop two bombs in a power dive. Both split into two on exploding and gave rise to an insect-congested zone some 200 yards long and 100 yards broad, with a maximum density of 100 insects per sq. yard, centering on the craters (5 in. deep) made by the bomb halves (NCNA/85, p. 5). The Commission had the opportunity of personal interrogation of eyewitnesses, mostly peasant farmers, who had found three such leaflet-bombs surrounded by insects after they had been dropped by planes on Mar. 27th and 31st at Ch'ang-Pai in Liaotung Province (ISCK/4; SIA/10). Again, while at Pyongyang, the Commission inspected a collection of these containers, and here reproduces a table of details concerning them (c.f. App.).

Serial	No.	Date	Time	Place	Province	Remarks
	208	26/2	night	Pyong-Won	Pyong-An-Nam	flies temp. — 4°
	209	28/2	dawn	Kim-Hua	Kang-Won	flies 300 X 300 ft. temp. — 7°
	205	28/2	8 p.m.	Pyong-Won	Pyong-An-Nam	flies
	210	1/3	morning	Shin-Chun	Huang-He	flies in discoidal zone centering on point of impact, 2,700 sq. ft. temp. — 7°
	201	5/3	midnight	Min-Chun	Kang-Won	flies, 600 X 300 ft., lethargic
	207	10/3	4 a.m.	Sitog-Chun	Pyong-An-Nam	flies in discoidal zone centering on point of impact, 150 ft. diam.; greatest density 20-30 sq. yd.
	204	21/3	night	Mun-Chyn	Kang-Won	flies
	206	26/3	9 a.m.	Myong-Wou	--	flies in discoidal zone centering on point of impact, area 100 sq. yds.

It only remains to add to the above that this type of container was described in more or less detail in every one of the nine lectures attended by the four captured airmen who gave evidence before the Commission. In all four cases, too, the airmen believed that the bacteriological bombs which had been loaded on to their planes and which they duly dropped, were of this type (App.).

As is well-known, public disputes have arisen in the international press about the use of leaflet containers, but the chief of the American Army Chemical Corps is on record for the statement that they are well suited for the delivery of biological objects (SIA/9, p.1; NCNA/85, p.5; ISCC/4).

(4) **Air-Bursting Propeller-Armed Leaflet Bomb.** This container would appear to be a variation of that just described. The fuse in the nose would be armed by a small passive airscrew or propeller which would bring about detonation after a certain number of revolutions. There is hardly any mention of this type in the documentation issued before the Commission began its work, nor was any evidence found of its use. However, it was described in one of the lectures which the captured airmen had received (O'Neal/McLaughlin, see below, p. 51).

(5) **Leaflet Bomb with Doors opened by a Propeller.** In this type, which would be similar in external appearance to both those just described, the passive propeller or airscrew in the nose would actuate a mechanism, to open a series of doors along the length of the bomb after it had carried out a predetermined number of revolutions. The packets are then blown out by the wind. Again there is no mention of this in the Prague documentation, nor did the Commission find direct evidence of its existence or use. But nevertheless it was described in one of the lectures which the captured airmen had received (Quinn/Ashfork, see below, p. 51).

(6) **Leaflet Bomb with Doors or Sides opening after Impact.** Here the half-side of the bomb, or a series of doors in it, would be opened by mechanism driven by electric battery activated only by the shock of

impact. Breakage of a plastic partition would permit access of the acid to the plates. This was not mentioned in the Prague documents, nor was direct evidence of its existence found. But it was described in one of the lectures attended by the captured airmen (Quinn/Ashfork, see below, p. 51) who was afterwards able to make a sketch of it in his deposition (App.). From the descriptions it would follow that this type of bomb must be equipped with a parachute, and it is possible that this was the container referred to in their lectures as delivering infected insects by parachute (O'Neal/McLaughlin; Kniss/Holleman; Kniss/McLaughlin). One of them (App.) was able afterwards to make a sketch of what he conceived such parachute containers to look like.

(7) **Paper or Carton Cylinder with Silk Parachute.** The only type of parachute container which the Commission actually saw was one which is said to be similar to those used for flares. It is a carton cylinder with walls about $\frac{3}{8}$ inch thick, some 1 ft. 2 inches long and 5 inches diameter. The examples seen were marked "USC 5/1-1-1952-Lot 100-F-6". The silk parachute attached had a diameter of only 2 ft. $3\frac{1}{2}$ inches. As has been pointed out, (NCNA/85, p.5) this size is only one thirtieth of the ordinary flare parachute, so that presumably it would not be likely to float for a long time in the air. It was also pointed out that there was no trace of burning on the carton, and this was certainly true of the examples which the Commission examined. It may well be significant that on one of the occasions when such a receptacle was found, it appeared to have delivered midges (Kang-Dong, 26th March, NSNA/85; SIA/13). Delicate insects such as these (*Orthocladus*), or mosquitoes, would doubtless conveniently be delivered by such a method.

(8) **Paper container with Paper Parachute (Self-Destroying).** Of this interesting type no example was seen by the Commission nor had the captured airmen any information to give about it. But such a device was described in some detail in the article by Maj. R. Sakaki in *Mainichi* for January, 1952 (App.). According to this account, the container would be of strong paper and would include several compartments, it would be weighted, and it would carry a fuse so arranged as to be able to ignite both the container and the paper (or impregnated silk) parachute when the proper moment arrived. In Sakaki's description the biological objects (plague-infected rats) would be gently liberated after the container had opened on touching the ground, and then after a sufficient latent period the ignition would occur and no trace would be left. But the machine could easily be so arranged as to deliver its load some 20 or 30 ft. above the ground, after which, becoming lighter, it could drift further away before ignition and disappearance. The circumstance that Sakaki specifically refers to the use of these containers for plague-infected rats made it tempting to suppose that a battery of them had been used in the Kan-Nan incident (p. 29 above), but for this there is no specific evidence. One corollary of paper containers for rodents would be that

the animals might have to be kept in at least a semi-anaesthetised condition during the flight, to prevent them from gnawing their way out. The Commission places these points on record only for the purpose of drawing attention to possibilities.

(9) **Bomb-shaped Containers of Earthenware or Porcelain.** During the second world war, the Japanese bacteriological warfare organisation manufactured "porcelain" (actually earthenware) bomb-shaped containers, of at least two different sizes, in a special plant near Harbin. Specimens of these (the larger about 2 ft. 6 inches and the smaller about 1 ft. 6 inches long) were examined by the Commission at Shenyang (Mukden). Although this kind of container is still recommended in Japan, as by Sakaki in the article already mentioned (App.), for bacterial cultures, the Commission did not find any evidence for its use in 1952 in Korea or China. Here it takes its place rather as the precursor of the most ingenious of all the types in question, namely the "egg-shell" container which breaks up on impact, but into a great number of small and thin pieces easily overlooked.

(10) **The Artificial Egg-Shell Container.** On March 21st, more than two hundred fragments of a container made of some calcareous material, together with a cap-shaped steel plate and metal rod attached to the centre of the concave surface, were found outside the city of K'uan-Tien in Liaotung province. Circumstances (reported in ISCC/3, App.) showed that these things must have been the remains of a container which had fallen from an American plane on the 12th, and in which there was reason to think that anthomyiid flies, spiders, and fowl feathers, bearing anthrax bacilli, had been delivered. The metal pieces and calcareous fragments were subjected to an exhaustive analysis by the Institutes of Modern, and of Applied, Physics of Academia Sinica (the Chinese National Academy), with a view to reconstruction of the original form of the device (App.).

It was thus possible to deduce that the intact container must have been cylindrical, and domed at least at one end. The total length would have been more than 1 ft. 3½ inches, and the length of the rod 11 inches (Fig.). The radius of curvature of the steel cap plate is just under 5 inches, and its diameter 6¾ inches; the radius of the calcareous body of the container 5¼ inches. The thickness of the calcareous walls would have been just over 1/16 inch, and the whole had been painted on the outside with aluminium paint. X-ray examination demonstrated that the material of the walls was chiefly calcium carbonate. While mainly calcite, the substance contained, as was shown spectroscopically, some magnesium. By some means or other, then, a fragile calcite box had been fashioned, and chemical evidence was obtained of the presence of organic matter, which had served perhaps as a cement for the calcite particles. Something is still lacking in our understanding of the facts

since it is not yet clear how so fragile a container can stand the shock of departure from the plane.

The incident at K'uan-Tien (ISCC/3) had already been partially reported in SIA/3, p. 2 and SIA/8, p. 6, and the Commission was able to examine the calcareous fragments preserved from it. But it did not represent the only incident of the kind which came to the notice of the Commission. As late as June 6th, the delivery of insects to the neighbourhood of Pi-Tung (N. Korea) had been accompanied by what was described as the rather slow slanting fall of silvery globes about twice as big as footballs (App.). There can be little doubt that this was the same device again. Moreover, one of the eye-witness accounts of the Pai-Ch'ing-Tzu cases (ISCC/5; SIA/6, p. 1) mentioned shining objects dropped by American planes. Here, too, masses of feathers infected with anthrax were delivered. Other descriptions (e.g. SIA/10, p. 1) might refer to this type, but it is not possible to be sure. In any case, the Commission considers that there can be no doubt that such containers were used by the Americans on both sides of the Yalu River in March and in June.

(11) **Miscellaneous Containers.** It only remains to add that evidence has been produced of the use of several other kinds of receptacles besides those already mentioned. For rodents there has been mention of cylindrical cages of wire-netting (NCNA/85, p. 5) and of wooden boxes (NCNA/85, p. 6). If these indeed descended from the sky, it was more probably as part of the cargo of some kind of parachute bomb. Packages of straw were used for the cholera clams of Dai-Dong (App.). A hand-grenade type of bomb has also been mentioned (NCNA/85, p. 6; SIA/13); the Commission did not see this. Members did however have the opportunity of examining near Pyongyang fragments of a green translucent insect container which, it was stated, had been fired as a shell (NCNA/85, p. 5, 6; SIA/13). Artillery participation in bacteriological warfare was referred to in at least two of the lectures attended by captured American airmen (Enoch/Wilson and O'Neal/Williams, see below, p. 51); but the Commission found no evidence of the practical use of the method of warfare described by Sakaki, namely of covering pieces of shrapnel with jelly containing *B. welchii* (gas gangrene) or tetanus (App.). Cotton filling for padded winter clothing, however, which appeared at one time conveniently near the Chinese trenches, was found to be contaminated with paratyphoid B (comm. from DGMS, CPVF).

(12) **Ground Distributions of Biological Objects Delivered.** Those who read the appendices to this Report as well as the earlier documents issued from Prague will find eye-witnesses constantly speaking of discoidal insect-congested zones, centered on the remains, generally quite uncrumpled, of the leaflet-container "bomb". This presumably means

that there was a fairly regular concentric distribution around the spot immediately beneath which the opening of the container had taken place.

Apart from these cases, the Commission noted two interesting examples of ground distribution of delivered objects. In one case (ISCC/5) (App.) feathers were found being blown away slowly by the wind from their point of arrival, so as to form a triangular area $\frac{1}{2}$ mile long and rather less than $\frac{1}{4}$ mile broad at the base. This was gradually lengthening and broadening. Though no container or its fragments were found, the bomb in this case was probably of the egg-shell type. In another instance, that of the great numbers of human fleas found on a bare hillside (ISCK/3; App.), it was seen that the insects covered an ellipsoidal area about 30 yds. \times 10 yds. with a zone of maximum density at approximately one of the centres or foci of the ellipse. This would presumably suggest that the fleas were delivered by some object, perhaps a parachute container, which travelled along the long axis of the ellipse.

Testimonies of Captured Intelligence Agents

The Korean authorities informed the Commission that since the beginning of the war agents had been sent into North Korea with the precise objective of obtaining and sending back epidemiological information related to bacterial warfare. Many of these agents had been captured, and their admissions had thrown considerable light on the organisation of the American intelligence service and the work which had been entrusted to them. Already in SIA/7 detailed information had been published concerning some of the agents, for example one Chinese and one Korean.

Members of the Commission had the opportunity at Pyongyang of interviewing at length one of these agents, (App.). The young man, whose schooling had been cut short, belonged in 1945 to the "Youth Organisation" of the South Korean Government, and when the American troops finally retreated he had gone with them. Minor personal interest, rather than political conviction, had apparently been the dominant motive in his antagonism to the North.

Unable to make a living, the witness joined the American auxiliary intelligence forces. He described the political, military, and hygienic training which he had received in a organisation entitled "K.L.O." at Seoul between December, 1951 and March, 1952, (App.). Here he was taught the techniques for obtaining the information desired. It was during this period that the bacterial warfare developed. Numerous inoculations were given to him about the beginning of February, though he was not informed of their nature. Until the eve of his departure he had no contact with foreign military officers, but his final instructions were then delivered to him by an American major through an interpreter. These comprised a specific area for his operations, and gave exact details of the diseases about which the Americans wanted to know (typhoid, plague, cholera, encephalitis, dysentery, and smallpox). The witness was informed as to the systems on which North Korean statistical information was drawn up, and his instructions were to obtain it if possible by means of contacts in the health and other governmental services, or if need be, to steal it. He was also told to be extremely careful of what he ate, not to pass the night in places infected with insects, and not to drink un-boiled water. North Korea was full of illness, it was said, but his inoculations would give him great protection.

The witness accordingly passed into North Korea on the 29 March,

and worked there with an accompanying radio-telegraphist until he was arrested on the 20th May. In replying to questions, he was rather reticent, perhaps to shield collaborators. He said that he had very little success in contacting North Korean health personnel, and had been able to transmit little or no information to American headquarters.

The witness made it clear that before his illicit entry into North Korea, he had been given no indication that bacterial warfare was being carried on. He had only heard that there were numerous epidemics in the North, and that the armies of the South "were employing the most modern scientific weapons with good results." He learnt of bacterial warfare only from reading public notices.

The Commission was unanimously of the opinion that the bearing of this witness and his evidence about his mission and instructions bore the stamp of truth, and that any pressure, physical or mental, could be excluded. For the rest, he seemed to be a rather mercenary personality. The Commission found no improbability in the sending of epidemiological intelligence agents across the lines. It was satisfied that the task of the agent had been to provide information about the effectiveness of bacteriological warfare; a conclusion which could only add to the cumulative mass of evidential material inculcating the American armed forces.

Testimonies of Captured Airmen

On Jan. 13th, 1952, a B-26 bomber of the American Air Force was shot down over An-Ju in Korea. By May 5th statements of considerable length admitting their participation in bacteriological warfare had been made by the navigator Lt. K. L. Enoch, and by the pilot, Lt. John Quinn, and issued to the world through Peking. As has already been stated, these documents will be found in SIA/14 and 15 respectively, and together with lithograph reproductions of the original manuscripts, in the printed brochure issued from Prague. The relevant parts are here reproduced in App. Documents SIA/17 and 18 should also be consulted, though the later interviews recounted in them did not add much to the technical and scientific evidence.

What were the essential points in the principal declarations of these airmen? First of all, both officers had had to attend, in Japan and in Korea, secret lectures on the methods of bacteriological warfare. These expositions, which it was impressed on them contained highly confidential information, described the use of bacteria directly as cultures deposited or sprayed, of insects transmitting diseases biologically or mechanically, of rodents in parachute-containers, of poisoned foods, and of bacteria-containing artillery shells. Various kinds of containers or "bombs" were described and sketched. Correct altitudes and air-speeds for delivery were given. Particularly significant statements made in the lecture attended by Lt. Quinn were (a) that "almost any insect could be used for spreading diseases", (b) that "rats could be dropped, though this might not be necessary", and (c) that there was an intention to use encephalitis, "for which no positive cure is known."

Secondly, both officers had received orders to carry out bacteriological warfare missions, and had duly flown them, though with the greatest inner reluctance. There were various peculiarities about the special bombs used, and in some cases these were under special guard so that the pilots could not examine them too closely. In one of the reports information was given as to the various types of planes most suitable for delivering various kinds of containers. From the personal knowledge of the two airmen many their fellow service-men had also engaged in such missions, and later conversations brought out well the large number of Air Force personnel who had been instructed on bacteriological warfare, (SIA/17). Lt. Enoch was briefed "germ bombs" while Lt. Quinn was briefed "duds", but both were told that in debriefing (i.e. reporting the results of the flight) "duds" was to be the term used.

There can be no doubt that these admissions had considerable influence on the western world. But those who did not wish to be convinced tended to brush them aside as confessions obtained under physical or mental duress, saying that after all, only two young men had come forward, and suggesting indeed they did not really exist at all, and that the whole declarations were forged. Attempts, however, to demonstrate inconsistencies in Lt. Quinn's story, failed (SIA/16).

In these circumstances it was of great importance that the Commission was able to meet, at a rendezvous in Korea, not only the two officers so far mentioned, but two more, Lt. F. B. O'Neal and Lt. Paul Kniss, whose accounts are even more lengthy and detailed (App.). With those four American airmen, the Commission found itself in presence of a good cross-section of American life—a cool-headed electrical engineer; a middle-class business man; a young research chemist, and a solid steel-mill worker of agricultural origins. The Commission had the opportunity of extended conversations with these men under conditions of free discourse. Its members unanimously formed the opinion that no pressure, physical or mental, had been brought to bear upon these prisoners of war in order to induce them to make the declarations which they made. These declarations were made of their own free will, after long experience of the friendliness and kindness of their Chinese and Korean captors had brought to them the realisation that their duty to all races and peoples must outweigh their natural scruples at revealing what might be considered the military secrets of their own government. The greater part of the conversations consisted in question and answer among the airmen and the members of the Commission, but each airman prefaced his interview with a statement along the lines of his written document, and concluded it with a solemn affirmation of the convictions to which his conscience had brought him.

Since the statements of the witnesses (ISCK/4 & 5), and the commentaries containing the substance of the interviews, are reproduced below as App., there is no necessity to elaborate them further here. But from the written statements and answers to questions it seems already possible to reconstruct what was going on in the American air force during the last months of 1951 and the early months of 1952. This may be appreciated by means of the following table:

- | | |
|---------------|---|
| 1951 June | —Kniss attends lecture by Laurie in U.S. Information given because the enemy might use bacteriological warfare. |
| Aug. 25th | —Enoch attends lecture by Wilson in Japan. The U.S. has no plans for bacteriological warfare, but the enemy might use it. |
| Oct. | —Enoch attends lecture by Browning in Korea. Same statement. |
| Dec. 1st | —O'Neal attends lecture by Williams in U.S. Non-committal attitude on intention to use bacteriological warfare. |
| Dec. | —Enoch attends another lecture by Browning in Korea. Same statement as in Oct. |
| Dec. 18th | —Quinn attends lecture by Ashfork in Korea. Necessity of preparing for bacteriological warfare which the enemy might use. |
| 1952 Jan. 3rd | —Quinn's first mission with bacteriological bombs. Briefed and debriefed as "duds", but from other circumstances he knew what they were. |
| Jan. 6th | —Enoch's first mission with bacteriological bombs. Briefed as "germ bombs", to be debriefed as "duds". |
| Jan. 22nd | —O'Neal attends lecture by McLaughlin in Korea. Bacteriological warfare stated definitely to be in use. |
| Feb. 15th | —O'Neal's first mission with bacteriological bombs. Briefed as "germ bombs", to be debriefed as "air-burst VT". |
| Feb. 18th | —O'Neal sees evidence of the use of spraying technique, from specially adapted planes. |
| Feb. 22nd | —Kniss attends lecture by Holleman in U.S. Use of bacteriological warfare definitely denied, but possession of weapons by the U.S. admitted. |
| Mar. 21st | —Kniss attends lecture by McLaughlin in Korea. Bacteriological warfare stated definitely to have been in operation since 1st Jan. Clear statement that the U.S. Government would continue to deny it as long as possible. |
| 27th | —Kniss' first mission with bacteriological bombs. Briefed as "flack-suppressor", to be debriefed as "results of mission unobserved". |

From the above facts the conclusion can hardly be avoided that the order to begin bacteriological warfare upon the people of North Korea and China must have been given late in 1951, air personnel having previously been prepared for the work by cautious informatory lectures, and not apprised of what they were expected to do, even after Jan. 1952, until their actual arrival in Korea. At American and Japanese bases, bacterial warfare was said to be a theoretical and purely defensive matter; but at Korean bases pilots were surprised to find that it had already been started weeks or months before their arrival. The fact that the general order must have been given during the period of the Kaesong peace talks was not overlooked by the pilots.

For the rest, the independently heard testimonies of the airmen contained several points of interest. It was noteworthy that they did not remember ever having received any instruction on the recognised customs and usages of war, such as the prohibition of the shooting of prisoners, nor of having seen any regulations relating thereto in American manuals of procedure; still less had they heard of the outlawing of certain forms of war, at least by certain nations. Then the testimony of the witnesses was unanimous as to the disastrous effects on the

morale of their fellow service-men of the orders to carry out bacteriological bombing. It was the last straw for many of them already disgusted by the ferocity with which they were being hounded on to slaughter the civilian population of North Korea (App.). The revulsion of feeling which the witnesses then underwent, when after their capture they were treated in such a friendly way by the Koreans and Chinese, who evidently no longer regarded as enemies those who had laid down their arms, can well be imagined.

The officers interviewed did not seem very well-informed on the variety of types of containers being used, but this was doubtless because as pilots and navigators they were not supplied with the information which armament officers would have had. They were also able only to speculate as to the place of origin of the biological material used, but significantly some of them thought that it might be in Japan.

In sum, the Commission, as the result of exhaustive conversations and direct personal contact, saw every reason to accept the veracity and to uphold the integrity of the officers who gave evidence before it. They appeared fully normal and in perfect health, they spoke in a natural way and seemed fully at their ease. The Commission once more affirms its belief that the airmen were not subjected to any physical or mental pressure, and that their treatment was worthy of the best traditions of Chinese humanism. The Commission therefore accepted as true and faithful the evidence of the airmen, which complemented indeed in many ways the strictly scientific and observational evidence already accumulated from the field.

Hygiene in New China

The Commission was deeply impressed by the present hygienic conditions of the Chinese people and by the measures which are being taken to raise the hygienic standard and to combat the spread of epidemic diseases. These measures are effective and thorough. The idea that the Chinese people live in very unsatisfactory hygienic conditions is widespread in the West, but even a superficial first-hand acquaintance with the conditions now prevailing, and with the enthusiasm shown by the Chinese population in carrying out the health directives of their government, is sufficient to dispel it.

A few figures may be given to indicate the extraordinary progress which has been brought about in a few years. In Northeast China 35 million rats were killed in 1951, and 10 million in the spring of 1952—a war against rodents unparalleled in any other part of the world. The fight against flies and other insects capable of acting as vectors of disease has assumed a universal character, and Peking has become a city almost devoid of flies and mosquitoes. Before the liberation, vaccination against smallpox was sparse and inefficient, the largest number of persons vaccinated in one year (1946) being no more than 7.3 million. But in three years since the liberation 307 million people have been vaccinated, and the disease has been almost entirely eliminated. Re-education of midwives has lowered the infant mortality rate from Tetanus neonatorum, by one third between 1949 and 1951. Infantile mortality as a whole, and maternal mortality, were reduced by one half in the same period. The numerous practitioners who follow the system of traditional Chinese medicine have been mobilised as auxiliaries in the great campaign for health, and have proved both able and willing to receive such instruction in modern medicine as equips them to play a useful part. In Peking and other great cities there has been a complete elimination of stray dogs, which were suspected of being reservoirs of encephalitis virus and vectors of many infections.

Besides all this, there has been great progress in the organisation and productive capacity of the laboratories producing vaccines and sera. The Commission visited the relevant Institute in Peking, and was impressed by its efficiency, high production, and excellent scientific research quality.

The health movement is not confined only to Peking or a few other "model" cities. Reliable informants asserted that it reaches far into the remotest corners of the sub-continent. The Commission as a body had the opportunity of seeing this for themselves during their travels in the Northeast, which included a visit to remote places in the north of Heilungchiang province,

on the borders of Inner Mongolia. The members were much impressed by the cleanliness of the villages.

Since the liberation, indeed, there has been a health education campaign in China of a breadth and scope probably hitherto unattained elsewhere. The whole-hearted cooperation of every member of the population, man, woman and child, has been necessary for the results which have been achieved. The clearing away of accumulated rubbish, the scrupulous cleaning of courtyards and waste-land, the screening of windows, the fight against all kinds of noxious insects, the production and use of insecticides and vaccines—every possible aspect of a constantly and rapidly rising general level of public health has been thought of and executed with verve and thoroughness. The fundamental education has been carried out by every available means of instruction, by large meetings, by posters, picture-books and wall-newspapers, by the press, from the stage, and on the screen.

When confronted with bacteriological warfare, or even the suspicion of it, the peasant masses of China knew exactly what to do, and did it without the least confusion or panic. The Commission was able to visualise, through personal contact with a large number of witnesses from many parts of the Chinese countryside, the disciplined action of hundreds, indeed thousands, of ordinary folk, guided by instructions from the central and regional Ministries of Health, combing their fields and streets to collect and destroy everything which issued from containers arriving from the air.

The hygienic progress in China today constitutes the active execution of measures more or less vainly urged by successive international health organisations. The achievement of so much progress in so short a time would not have been possible if the Chinese government had not been able to count upon the unconditional support of all classes of the population. Peasants and factory workers, scholars and religious groups, have approved its aims and done their best to achieve them.

General Considerations

It will now be useful to assemble certain facts in tabular form, not only those which were summarily set forth in the Prague documents, but also those which were brought before the Commission during June, July and August for examination. A certain number of the clearer incidents will be found in the folding table (App.). For each case there is recorded the reference number, date, place and circumstances, whether the passage of a plane was noted, and whether any object was seen to fall, whether a container was found, and what areas unusually congested with insects or other biological objects were observed, together with notes on the density of the animals, where possible. There follows the entomological or zoological identification, the results of bacteriological tests, and any epidemiological remarks. It must be understood that only a small number of the known incidents is included in the Table.

It will be clear from this summary tabulation that the appearance of biological material found to be infected with pathogenic micro-organisms was not always followed by human cases of disease. This must be in great part attributed to the speed with which the country and townspeople throughout the districts affected have searched for and destroyed any unusual animals and objects which there was reason to think might have been disseminated from the air. So effective have these operations been that in many cases no samples were saved for bacteriological analysis, as the Table shows. In other cases, bacteriological analysis gave negative results for those types of pathogenic organisms for which tests were made.

Here it is worth noting that the incursions of planes over Northeast China have been numerous during the year, and that for the most part they have not been accompanied by bombardment with explosives. Between the 29th Feb. and the 21st Mar., American planes made 955 sorties in 175 groups over NE China (Manchuria), covering 70 hsien districts in the provinces of Liaotung, Liaohsi, Chilin, Sungchiang and Heilungchiang (SLA/3). Other similar figures have also been given (NCNA/85; SLA/13), and the air intrusions over China have recently intensified rather than decreased. In the eight days ending 7th Aug., for instance, American planes made 398 sorties in 79 groups over Chinese territory.

The geographical distribution of the incidents in NE China is also interesting (see Map.) Down to the end of April, taking well-analysed incidents only, the greatest number (18) had occurred in Liaotung province, which borders most of the Korean frontier. Here the fact was striking that

almost always the incidents were reported from the immediate neighbourhood of railways and main roads. The same peculiarity was noteworthy in the 8 incidents which occurred in the remotest province, Heilungchiang. Here one of the railway lines north of Chichihar and Harbin describes a vast S-shaped bend, with sides of a hundred miles or more—all along this line the incidents were dotted.

Documents previously published gave on the one hand some of the bacteriological and epidemiological details relating the infected insects with cases of human disease; and on the other hand evidence relating the insects to the passage of planes. Sometimes the data furnished in those documents were incomplete. This was one of the reasons for the exhaustive enquiries which the Commission made, in collaboration with the Chinese and Korean scientists, with regard to the incidents at Hoi-Yang, Kan-Nan, K'uan-Tien, Liaotung and Liaohsi, Dai-Dong, etc., recounted in the preceding paragraphs. From all these investigations it will be seen that the connection between the planes, the vectors, and the cases of human disease, can no longer be contested.

At an earlier point, the method of incident analysis was explained. The moment has now come to assemble the data from the most fully analysed cases in the form of a synoptic Table. From this confrontation of patterns, an organic plan clearly emerges. Planes were always seen or heard, and their course often plotted; and the statement of captured pilots later added supplementary detail. There follow in the Table the necessary data on the fall of containers, the vectors employed and their anomalies, the bacteriological tests, and the clinical cases following.

In connection with all these facts, the Commission heard and interrogated a large number of ordinary Chinese country-folk. Its members were convinced of the integrity and stolid honesty of these witnesses; whose depositions were marked by plainness and clarity.

Turning to specific questions, the Commission considered the possibility that the plague in Korea might have been transported by incoming traffic from those areas in Northeast China (Manchuria) where it still remains endemic. There are several reasons why this possibility must be ruled out. First, no case of plague has at any time been reported from the regions which separate the new Korean foci from the above-mentioned endemic areas. Secondly, there were very serious seasonal anomalies in the occurrence of the plague (see App.). Third, in the Korean foci the characteristic appearance of dead rodents, denoting an epizootic, before the human epidemic begins, was entirely absent. Fourthly, the clinical effects were often demonstrably connected with the previous passage of planes and the dissemination of suitable vectors. Finally, the most stringent sanitary precautions are, and were from the beginning, taken both by the Chinese and the North Koreans at the frontier between the countries.

Planes: seen or heard
 course plotted
 crew interrogated
 Delivery: objects seen to fall
 Containers: found
 Spraying suspected
 Animals or other Vectors:
 Anomaly of high concentration
 Anomaly of season
 Anomaly of locality
 Anomaly of species
 Animal or other Vectors:
 Bacteriological examination
 Disease, human, cases following
 Anomaly of season
 Anomaly of locality
 Anomaly of type of disease
 Disease, vectorial
 Anomaly of season
 Anomaly of locality
 Anomaly of type of disease

	+	+	+	+	+	An-Ju (K, plague) SIA/1, 4
		+	+	+	+	Cheum-Dom (K, plague) SIA/1
		+	+	+	+	Kan-Nan (C, plague) ISCK/2
++++	++++	+	+	+	+	Kang-Sou (K, plague) ISCK/2
		+	+	+	+	Hoi-Yang (K, plague) ISCK/3
	+	+	+	+	++	K'uan-Tien (C, anthrax) ISCC/3
	++++	+	+	+	+++ +++ ++	Liaotung (C, resp anthrax) ISCC/5
	+	+	+	+	+	Pi-Tung (K) App. S
		+	+	+	+	Ch'ang-Pai (C) ISCC/4
	++++				+	An-Shan (C, encephalitis) ISCC/6
	++++	++++			+	Dai-Dong (K, cholera) ISCK/1
	+	+	+	+	+++	Airmen (ISCK/4, 5; App. CC, DD)

Several of the diseases used are connected with domestic animals as well as man for example anthrax (NCNA/85; App.). When the discovery of *Pasteurella multocida* (*septica*) on certain disseminated vectors (App., Table) was confirmed, it seemed at first to have little importance since it is so common an infection of laboratory animals. There are reasons, however, for supposing that it might be used as a weapon against domestic stock (App.).

As for the *Vibrio cholerae*, though in the detailed case studied above (Dai-Dong) it appeared in contaminated molluscs, there have also been not a few cases (App.) in which it has been found on insects, especially flies. The same has also been true for *Salmonella typhosi* and *paratyphosi*, and for *Shigella dysenteriae*. These pathogens have been found on populations of flies appearing in areas where no cases of these diseases had been known. This raises the question of the possible existence of pathogenic micro-organisms in or upon normal flies collected at random. The Chinese medical literature contains studies (App.), published many years before the present hostilities, in which exactly these controls were made. They showed that in non-epidemic periods, normal flies did not carry the bacteria of typhoid or paratyphoid fever, or the cholera vibrio. The relevant appendix adds a further note on certain similar studies made this year in Shenyang (Mukden).

A question related to this is the use of quantitative methods of investigation in the study of the carriage of bacteria by insects; it is treated of in a special Appendix.

A few words should be added concerning the part played by insect vectors, to complete what has already been said in the Prague documentation and elsewhere. One Appendix is devoted to the zoological identification of the insects disseminated; another will help the reader in the general study of problems of medical entomology relating to bacteriological warfare.

In the earlier reports there were a certain number of questions, especially as regards events in Korea, which still remained open. During its stay in Pyongyang, therefore, the Commission submitted to the Minister of Health, Dr. Ri, a series of questions (App.), to which answers were in due course received (App.). It thus appeared that some translations had been faulty. The word "tick" used in the first Korean report (SLA/1) had in fact been a reference to the red mite, *Trombicula akamushi*. As for the nycteribiid flies, parasitic on bats, also mentioned in the same document, the Commission was informed by the competent Korean authorities that it could not now be considered demonstrable that these insects had been connected with the bacteriological warfare.

Confirmation, however, was obtained for the statement that dead fishes

contaminated with *Salmonella* and *Shigella* had on more than one occasion been found lying on hillsides. It was emphasised that these phenomena had always occurred in the neighbourhood of drinking-water sources. (This recalls the Dai-Dong incident investigated in detail by the Commission (P., 37 and App.) where the purpose of spreading cholera clearly appeared.)

A question which had particularly aroused the curiosity of western scientists, and about which the Commission was seriously concerned, was that of the "lyophilised proteinaceous material" discovered after the passage of planes (NCNA/85). This substance, found in separate masses, was sticky and hygroscopic, absorbing water as it lay on the surface of the snow. Chemical analysis showed that it was composed of protein breakdown products; proteoses, peptones and polypeptides. The bacteriologists were able to isolate from it mannitol-fermenting dysentery bacilli. No incident of this kind took place during the period of the Commission's work in Korea, and it had therefore to rely upon the reports of the Korean services, but it found entirely probable the hypothesis accepted by the Minister himself, namely that the material represented the delivery of freeze-dried bacterial cultures as such.

As for the question of the dissemination of insects under conditions of very low environmental temperatures, the Commission points out (though not itself prepared to subscribe necessarily to such affirmations) that in their evidence the captured airmen alluded to methods directed to the production of insect populations specially endowed with cold-resistance (App.).

In a preceding paragraph (p. 16), eighteen species of insects and arachnids disseminated from airplanes were described. Of these, nine have been definitely incriminated by bacteriological tests as infected with pathogenic micro-organisms. What is to be said of the others? The Commission could not conclude that they were perfectly clear from infection. It is a difficult matter to isolate pathogenic micro-organisms from such material when no one knows exactly what should be looked for, all the more so when artificially selected bacteria and viruses are in question. The possibilities are far from having been exhausted.

In the American literature on bacteriological warfare there are some contradictions with what has been seen in Korea. Certain judgments expressed in works not yet superseded are hardly in accordance with the observations of the Commission. It seems likely that in some important cases technical advances have rendered these opinions obsolete. The case of plague is typical. Ten years ago Rosebury cautiously expressed the view that it might be possible to spread this effectively for warlike purposes, but only in areas remote from the front lines owing to the great danger of the infection of friendly territory. In Korea the Commission's work has revealed repeated attempts to diffuse plague at places not far

removed from the front lines contrary to the opinion of so experienced a bacteriologist as the former Director of Camp Detrick. But the contradiction is only apparent. The last ten years have seen enormous progress in techniques of disinfection; on the one hand new and ever more potent insecticides, combined in various mixtures, and on the other hand machines of high efficiency for the dissemination of clouds of these substances in large amounts and minimum time, sufficiently simple to be operated by any ordinary person. These machines derive from smoke-screen apparatus developed during the second world war.

Practical experience has shown that such methods can be used for the eradication of diseases caused by insect vectors from whole territories. Recent published information shows that the American forces in Korea are in possession of such machines, and emphasises their significance since "in any future hostilities ordinary measures and normal methods may well prove insufficient to cope with the situation." (App.)

These data are sufficient to clear up the apparent contradiction between the literature and the facts found in the field. They apply, at any rate partly, to all other insect-carried diseases, and help to explain the general tendency seen in Korea towards the use of insect vectors. The example taken is typical; we cannot limit the possibilities of bacteriological warfare to what has classically been observed in natural conditions; technical and scientific advances extend the range of what may be done, and throw light, as here, on apparent contradictions. An almost perfect control of insect vectors on the American side in Korea would invalidate the reservations found in the literature. For the same reasons the Commission cannot share the opinion of those who would assume that the diffusion of bacteria, viruses and toxins, in aerosols is the only effective method of bacteriological warfare. Thus Japanese experience (cf. pp. 13/14 above) can now be utilised on a new level.

However, one of the cases examined by the Commission, that of the epidemic of encephalitis (SIA/3;8;00010) occurring in the cities of Shenyang (Mukden) and Anshan in Liaotung province, Northeast China (Manchuria), raised the possibility that a virus had been disseminated directly by the aerosol method. The Commission was unable to reach a firm conclusion on the matter, since it could not establish a definite relationship between the disease and the air incursions. Nevertheless the evidence is indeed disturbing and full documentation concerning it is therefore placed among the Appendices (ISCC/6).

The Commission is not in a position to give to the world concrete figures concerning the total number of Korean and Chinese civilians killed, nor the total morbidity, nor the mortality rate. It is not desirable that this should be done, since it would provide the last essential data for those upon whom the responsibility lies. The information is not neces-

sary for the proof of the case upon which the Commission was invited to express an expert opinion. All that is necessary is to know what the Commission confirmed, namely that many human fatalities have occurred in isolated foci and in epidemics, under highly abnormal circumstances in which the trail always leads back to American air activity. It is essential that the world should take warning from what has happened and is still happening. All people should be aware of the potentialities of this kind of warfare, with its incalculable dangers.

Conclusion

Since the beginning of 1952, phenomena of a very unusual character occurring in Korea and China, led to allegations by the peoples and governments of those countries that U.S.A. forces were waging bacteriological warfare. The International Scientific Commission which was formed to investigate the relevant facts has now brought its work to a conclusion after more than two months in the field.

It found itself in the presence of a mass of facts, some of which formed coherent patterns which turned out to be highly demonstrative. It therefore concentrated its efforts especially upon these.

The Commission has come to the following conclusions. The peoples of Korea and China have indeed been the objective of bacteriological weapons. These have been employed by units of the U.S.A. armed forces, using a great variety of different methods for the purpose, some of which seem to be developments of those applied by the Japanese army during the second world war.

The Commission reached these conclusions, passing from one logical step to another. It did so reluctantly because its members had not been disposed to believe that such an inhuman technique could have been put into execution in the face of its universal condemnation by the peoples of the nations.

It is now for all peoples to redouble their efforts to preserve the world from war and prevent the discoveries of science being used for the destruction of humanity.

The List of the 46 Appendices is as follows:

- A. Chronological summary of the meetings of the commission.
- B. General survey of the principles of transmission of diseases by insect vectors, etc.
- C. Memorandum on the quantitative investigation of bacteria carried by insects.
- D. Memorandum on the mechanical transmission of bacteria by normal flies in China; analysis of studies on random samples.
- E. An investigation to determine whether the flies naturally occurring in the city of Shenyang (Mukden) carry intestinal pathogenic bacteria or *Bacillus anthracis* (ISCC8).
- F. An investigation on the bacteriology of local specimens of chicken feathers collected from the cities of Shenyang and Kuan-Tien to determine if they carry *Bacillus anthracis* (ISCC9).
- G. General table of incidents in North Korea and Northeast China (Manchuria); including some of the more important of those mentioned in the Prague documents.
- H. Entomological data on the insects disseminated (ISCC 10); table of species identified; graph showing the anomalies in the appearances of the unusual insect populations; graph comparing the winter temperatures of 1951 to 1952 with earlier figures.
- I. Questions addressed to the (North) Korean Minister of Health (Pyongyang, 30 July, 1952), and replies received (Peking, 21 August).
- J. a. Report on fungus-laden plant materials dispersed by U.S. planes in Northeast China and in North Korea (ISCC7).
- J. b. Report on two kinds of leaves of South Korean plants disseminated by U.S. planes in North Korea and Northeast China.
- K. Report on plague in Changteh, Hunan (12 December 1941) (ISCC1).
- L. Memorandum on certain aspects of Japanese bacterial warfare (ISCK6).
- M. Report on voles infected with *Pasteurella pestis* dropped by U.S. plane at Kan-Nan Hsien, Heilungchiang Province (ISCC2).
- N. Hearings on the Kan-Nan incident; depositions of eyewitnesses and others; observations of the commission made on the spot, etc.
- O. Memorandum on the comparison between the voles collected at Kan-Nan with *Microtus gregalis* Pallas (ISCC2a).
- P. Commentary on the comparison of the Kan-Nan voles with *Microtus gregalis* (O.O.).
- Q. Article: "Bacteriological Warfare", by Sakaki Ryohei, formerly major, Epidemic Prevention Service, Japanese Kwantung Army, translated from Sunday Mainichi (weekly), N° 1,682, 27 January, 1952.
- R. Report on a case of plague in Kang-Sou Goon Pyong-An Nam Do, caused by contact with fleas infected with plague, dropped by U.S. planes on March 25th, 1952 (ISCK2).
- S. Hearings on the Kang-Sou incident (plague); replies of eyewitnesses and statements of scientific experts.
- T. Report on the spreading of human flea infected with plague bacteria, by U.S. planes (ISCK3).
- U. Hearings on the Hoi Yang incident—plague; eyewitness statements, etc.

V. Report on the calcareous-bacteriological bomb dropped by U.S. plane at Kuan-Tien district, Liaotung Province (ISCC3).

W. Commentary on the case of "eggshell" container used at Kuan-Tien.

X. Notes on the incident of June 6th.

Y. Report on four-compartment insect bombs dropped by U.S. planes at Chang-Pai Hsien, Liaotung Province (ISCC4).

Z. Notes on exhibits of containers in the Central Laboratories of the Korean Epidemic Prevention Service, Pyongyang (ISCK7).

II

A. a. Report on the occurrence of respiratory anthrax and haemorrhagic anthrax meningitis following the intrusion of U.S. planes over Northeast China (ISCC5).

B. b. Hearings on the incidents in Liaotung and Lishai Provinces connected with the dissemination of anthrax and fatalities arising therefrom.

C. c. Report on a case of cholera in Dai-Dong Goon caused by eating raw clams contaminated with *Vibrio cholerae* and dropped by U.S. planes during the night of May 16th, 1952 (ISCK1).

D. d. Hearing on the Dai-Dong incident (cholera), statements of scientific experts and depositions of eyewitnesses.

E. e. Memorandum on the mollusc *Meretrix* as an agent for carrying *Vibrio cholerae* (ISCC11).

F. f. Memorandum on acute encephalitis—a new disease in Shenyang (Mukden) and its neighbourhood produced by the intrusions of U.S. planes (ISCC6).

G. g. Hearings on the cases of a new form of encephalitis occurring at Shenyang (Mukden) after U.S. air intrusions.

H. h. Information on arthropod-borne diseases of the encephalitis type in man.

I. i. Commentary on the incidents at Shenyang (Mukden) (encephalitis).

J. j. Notes on the case of the South Korean agent sent to North Korea to collect and transmit to U.S. headquarters epidemiological intelligence.

K. k. Testimony of Lieutenant K. L. Enoch concerning his participation in bacterial warfare waged by the U.S. forces in Korea (SIA14).

L. l. Testimony of Lieutenant J. Quinn concerning his participation in bacterial warfare waged by the U.S. forces in Korea (SIA15).

M. m. Testimony of Lieutenant P. B. O'Neal concerning his participation in bacterial warfare waged by the U.S. forces in Korea (ISCK4).

N. n. Testimony of Lieutenant P. R. Kniss concerning his participation in bacterial warfare waged by the U.S. forces in Korea (ISCK5).

O. o. Notes on interviews with four captured U.S. airmen.

P. p. Memorandum on the public health and hygiene movement in New China.

Q. q. Report on the occurrence of epizootics of septichemia among fowls following the dissemination of spiders carrying *Pasteurella multocida* by U.S. planes (ISCC12).

R. r. Declaration by Dr. Franco Graziosi.

S. s. Excerpt from medical literature presented as a reference concerning the use of exploding projectiles for the dissemination of pathogenic organisms.

T. t. Biographical register of Chinese and Korean scientists and medical men.