

## OPEN DISCUSSION

Moderator: Dr. Elisberg

**Dr. Reeves:** There is one aspect of typhus control that no one has addressed himself to, although it was mentioned in the summary that was just given. That is, Have there been any advances in the methods available to control the rickettsiae found in louse feces or in dead lice where there is a great deal of typhus transmission? I do not have the least idea what materials would be effective for decontaminating such an environment other than heat, and the decontamination would be difficult. The people in such an area would obviously have to be vaccinated. I would like to see some consideration given to the problem of respiratory transmission of typhus. If there is nothing known, let us say so.

**Dr. Vinson:** There is a paradoxical situation with regard to the stability of typhus and trench fever rickettsiae. While rickettsiae are rather stable in louse feces or in lice, they are very susceptible to deleterious influences because they are easily killed by very mild antiseptics such as cold water and soap.

The simple washing of clothes would probably inactivate most of the rickettsiae. This probably could not occur in situations such as the one in Burundi, where people have only one change of clothing, but I am sure it happens in Mexico where the disease is more endemic and people in at least some villages do have laundry facilities.

**Dr. Wiseman:** In relation to louse feces, I have become more and more convinced since I have recently been in contact with heavily louse-infested populations that aerosol infection is a very real possibility in such populations.

Considerable attention should be paid to the louse species in clothes. Every time we

inoculate or accidentally infect a laboratory technician through the skin, we find a local lesion. Even the E strain, when inoculated intradermally, creates a lesion.

This is not something frequently described in reports about typhus epidemics, probably for many reasons. I suspect that it could easily be overlooked because the lesion is mild. On the other hand, the failure of so many observers to describe something like this might indicate that the airborne route is an important mode of infection in intense epidemic situations.

**Dr. Makara:** There is no doubt that we did not deal with the question of what to do at different epidemic levels. In an isolated, or medium-sized epidemic, such as is common in Central Europe, we have to deal not only with lice but also destroy the rickettsiae in louse excrement. Heat is not always practical for disinfection, especially because the environment may be dirty and everything should be disinfected. We need effective disinfectants other than heat. There are a number that kill rickettsiae, but no matter which we use, the phenolic compounds are just as good.

**Dr. Murray:** Dr. Gaon might have some information on this point, because the Yugoslavs have been extremely successful in holding to only one cycle of infection after the start of an epidemic. They carry out very active and energetic measures around a typhus focus. In the last 10 or 12 years, as far as I know, they have not had any secondary spread which would indicate that the feces of infected lice had not been adequately dealt with.

**Dr. Gaon:** I should emphasize that in many areas there are sick persons with un-

detected typhus. Such people do not see a doctor, and quite often they constitute an unbroken chain of typhus infection. The first thing to do in remote villages in countries such as mine is to search house to house for cases, or at least organize groups of laymen to do so.

Second, every fever of unknown origin has to be considered typhus so long as it has not been diagnosed. Patients with such fevers should be clinically examined and studied epidemiologically, and specimens from them sent not only to the local laboratory for Weil-Felix testing but also to a larger laboratory capable of testing with rickettsia-specific antigens.

In Yugoslavia, by law, the patient has to be isolated as early as possible in the course of his disease. Do not forget that lice are infected mostly on the patient. If the physician finds him during the first six days after the onset of the disease and isolates him after disinfection, all his infected lice will be killed and there will be no new cases.

Soviet health authorities tried experimentally to stop typhus epidemics by identifying and isolating new patients as early as possible, but without delousing them. Naturally, such patients remain infested. The isolation is not perfect since the patients see their families and, indeed, others in their village, and so the entire village becomes a focus.

We consider a focus alive during the life of patients' lice plus the 45-day incubation period after the last case of typhus. We use powder every week. The effect of the powder lasts about 15 days. For every case we find we dust the population three times each week every week until the last case has ended. We also disinfect clothing and bedding with ammonia-based disinfectants, which are excellent for killing rickettsiae.

As for health propaganda, we like to use prominent people in the village to get our message across. Pictures can also be very useful. Village teachers are very active, and

they used to send their pupils from house to house to see if there were any patients with fever. If they found one, we took blood and isolated him. This was just after World War II, when we did not have the medical personnel we have now.

**Dr. Makara:** We have practiced similar methods. It is now our practice in Hungary to remove a patient from his room and then fumigate it because otherwise we might get lousy ourselves. After six hours of fumigation, we can do other things. Second, we do not admit patients to the hospital without delousing them. Third, DDT can be used only in addition to the instantly effective delousing methods.

**Dr. Wisseman:** I want to stress the need to study the total biology of lice, which includes not only the propagation on an individual and the factors that influence such propagation, but also how lice get from person to person. This is the essence of typhus spread. We have to consider the influence of the behavioral and cultural patterns of the louse's host on the movement of lice in order to define the spread of typhus in different populations and in different countries. Such consideration has a bearing on how the vector is controlled because it might point out weak points in the cycle of louse transmission from human to human.

**Dr. Busvine:** I suppose a study could be made of the movements of lice among people, but much of that is mere common sense. During World War II, Mellanby studied scabies transference, and we looked at people living in common lodging houses who picked up lice. It was obvious that the quickest transfer of lice is among people sleeping in the same bed, either at the same time or one after the other. We found many lice in such beds. I remember that we even tried putting on different sorts of underwear and found that the more fleecy type proved more likely to pick up lice. It stands to reason that the more intimate the contact among people, the quicker lice will spread among them.

**Dr. Wisseman:** I think Dr. Busvine's comments represent a difference in view between a laboratory worker and one who has been immersed in the field aspects of typhus for some time. It is obvious, of course, that personal proximity furthers lousiness. My point is that one has to define the conditions and circumstances in which people get together in such a way that lice are exchanged. Those conditions and circumstances may vary from culture to culture and region to region.

**Dr. Reeves:** In three days of discussion of variations in louse populations, I have not heard any reference to variation in the competence of different louse populations to harbor rickettsiae and have the rickettsiae multiply in them. Field populations of lice may differ widely in their capacity to serve as hosts for these rickettsiae (actually, there is need to deal with field populations as much as possible, and not just with laboratory colonies). Wide variations in vector competence to harbor rickettsiae have been found in every other vector-borne disease in which this competence has been examined. I hope that in the future investigators will reexamine this question and not assume that all lice are equally susceptible to rickettsiae.

We should also realize our limited knowledge of the life-tables of lice and the interchange of lice in human populations. We now have fluorescent marker techniques with which we could study the dynamics of louse interchange in a human population very nicely, and if it was unsafe we would not have to use radioactively marked populations.

**Dr. Gaon:** We did not speak about murine typhus occurring in the same locality as louse-borne typhus. In Bosnia after World War II we examined hundreds of sera and never found any evidence of murine typhus, so we concluded it did not exist. Then, suddenly, I found two positive sera. Both were from an island off the town of Split in

Dalmatia. Though it was found on the islands, we did not find it on the mainland.

Dr. Gear has mentioned villages in South Africa in which murine typhus was found together with epidemics of louse-borne typhus. Can murine typhus become epidemic typhus?

**Dr. Gear:** The area in South Africa mainly affected by louse-borne typhus is the Transkei, which is about the size of Scotland and the homeland of the Xosa people. During the last big typhus epidemic, in 1942-43, we isolated a number of strains of typhus from the patients in this area and from their lice. All these strains had the characteristics of epidemic louse-borne typhus. Rat infestation of the huts was heavy and several batches of rats were collected. The results of the tests for murine typhus were negative except for one village, Lusikisiki, on the northern border of the Transkei. We did isolate a strain of murine typhus from the rats there. We were surprised to find that there was little overlap between the distribution of murine and louse typhus.

It is worthwhile to note that in Africa louse-borne typhus is essentially a rural disease and in South Africa is unknown in the main urban centers. Murine typhus, on the other hand, is essentially an urban disease, and most of the strains that we have isolated have been from rats caught in cities. Interestingly enough, several years after we had shown that the rats in Lusikisiki were infected, we did detect a human case—the first we identified in that area.

**Dr. Elisberg:** The Symposium's program committee considered Dr. Gaon's point about the possible acquisition of *Rickettsia typhi* infection by lice. There have been reports of this in obscure parts of the literature, but we felt that to address this subject in its entirety would require considerably more time than we were prepared to devote to it. It is important, however, to recognize that *R. typhi* infections may occur during louse-borne typhus epidemics.

**Dr. Fabrikant:** I should like to make one point in regard to DDVP strip use in the field. Each night in Burundi we routinely enclosed our clothing in a duffel bag containing a DDVP strip. The following morning when I would wash out my underclothes, I would often find dead fleas floating in the water. I did not find dead lice in my clothes after exposure to DDVP. I should also note that M-1960 impregnated clothing is impossible to wear because it is so uncomfortable.

**Dr. Wisseman:** There is no doubt that DDVP does not have the same attributes as methyl bromide or similar compounds as a one-shot insecticide to get rid of everything. We used DDVP in Burundi because we were surrounded by lousy people and had lice crawling all over us every day, and we had to find some practical way to keep the lice down. Even though a single exposure might not be 100 per cent effective, the repeated daily exposure of clothing to DDVP between launderings did seem to help because we got out without having an established infestation. DDVP is something convenient to take along on a trip for night use on one's clothing to prevent colonization and infestation in places of heavy exposure to lice.

**Dr. Busvine:** If someone sent me to a typhus zone and I wanted to protect my underclothing at night, I would take either a liter of ethyl formate or the mixture that Dr. Makara suggested. If this was considered a bit too inflammable, I would take a liter of chloroform, which would last me about 100 days and give 100 per cent protection, not

just 50 per cent protection. I would just put a spoonful in with my clothes in a plastic bag at night, and all parasites would be killed.

**Dr. Wisseman:** Dichlorvos is not a panacea, but for the traveler it is a great convenience because it is stable and easy to carry as a strip in baggage and can be used against many insects other than lice. We originally carried it along to decontaminate our baggage of bedbugs and other insects when we sent it home. By the time one's suitcase, trunk, or barrel reaches home most of the arthropods in them have been killed. During the daytime one can hang a dichlorvos strip up to kill off arthropods and vermin other than lice in one's quarters.

**Dr. Makara:** Someone commented that fumigation might be only 8 per cent effective. I disagree. Any properly practiced fumigation is 100 per cent effective. If we analyze the dose of DDVP sufficient to kill lice, we find that the  $0.2 \text{ mg/m}^3$  that kills mosquitoes has to be multiplied a hundredfold for lice. Thus, 100 per cent of lice will die within 30 minutes if the DDVP concentration is 25 to 50  $\text{mg/m}^3$ .

DDVP's penetration is fair, but the penetration of ethyl and methyl formate is excellent.

I would rather carry a bottle of DDVP than a strip, which does not produce enough concentration because it does not contain enough DDVP. I can measure the exact amount of DDVP fluid that I want and it will be present in the air, especially if I apply it by fogging.