

## I. A. LOUSINESS AND LICE CONTROL

## DISCUSSION

Jakob A. Gaon,<sup>1</sup> *Louse eradication programs in Yugoslavia.* Field studies carried out in a number of countries have shown the efficacy of insecticides against lice and typhus, but little has been said about the implementation of other control methods in this field (5, 6, 8, 9, 10, 15, 18, 22, 23, 24, 26). In this paper, then, we will draw on our long experience in the control of lice and typhus in Bosnia-Herzegovina as well as in various other parts of Yugoslavia to review Yugoslav approaches to the control of lice and louse-borne diseases. We are aware today that, unless we undertake broad action to put an end to lousiness or to achieve a very low louse infestation rate, it is impossible to attain complete eradication of louse-borne typhus, louse-borne relapsing fever, and trench fever.

Classical typhus creates the carrier state that may turn into recrudescing typhus. In a lousy environment, recrudescing typhus cases may infect lice and cause spread of the disease to an individual or a number of typhus patients. Trench fever also produces late recrudescing cases, making it possible for body lice to become infected (16, 17). While louse-borne relapsing fever has been present in some African countries in times of both peace and war, in the Eastern European countries such as the Soviet Union, Romania, Hungary, and Yugoslavia it has occurred during wartime and has usually

accompanied outbreaks of typhus. The latter occurs after wars as primary cases of classical typhus and as Brill-Zinsser disease cases. Louse-borne relapsing fever usually disappears suddenly and completely only several years afterwards (27).

Between 1946 and 1949 louse-borne relapsing fever in epidemic form predominated in some rural parts of Yugoslavia, along with outbreaks of classical typhus. There had been a steady incidence of Brill-Zinsser cases, together with sporadic cases and small epidemics of primary louse-borne typhus, up to 1966. Some of those cases were clearly related to a previous Brill-Zinsser case.

It is not known where the foci of louse-borne relapsing fever are located in the inter-epidemic period. This is the reason why we cannot expect to eradicate this disease without eradicating lousiness (13).

Our long efforts to control typhus in Bosnia-Herzegovina indicate that it is easy to control outbreaks of typhus and extirpate lice in infested areas with the help of insecticides and by applying other antiepidemic measures. Such is not the case with the eradication of typhus, however. To achieve that, it is necessary to decrease to a low rate or eradicate the lousiness in a larger area inhabited by people who have been affected by typhus and who are therefore candidates for Brill-Zinsser disease.

Lousiness is a sociobiologic phenomenon that decreases with improved economic and social conditions and ultimately disappears.

How long will it especially in the opening countries? of the major problem is overpopulation cities, along with incomes and a slip power of the population

These conditions lousiness, undernourishment, hygiene, and accompanied by a lack of general hygienic norms

Without a theoretical knowledge of social conditions it is impossible to program louse eradication has to be familiar with ways of life and to motivate them the eradication scheme

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In Serbia, Macedonia contrast, priority in lousiness and typhus was

<sup>1</sup> In this paper, "eradication" lousiness rate of the community's households. that small subpopulation drug addicts, or hippies.

How long will this process take, however, especially in the underdeveloped and developing countries? It is a known fact that one of the major problems facing those countries is overpopulation and large migration to cities, along with slow growth in national incomes and a slow rise in the purchasing power of the population (7).

These conditions may lead to increased lousiness, undernourishment, and neglect of hygiene, and quite frequently are accompanied by a lack of elementary personal and general hygienic measures.

Without a thorough investigation and knowledge of social and economic factors, it is impossible to plan a well-organized program of louse eradication. In addition, one has to be familiar with the conditions and ways of life and mentality of a people and to motivate them to active cooperation in the eradication scheme (2, 14, 25).

It is often very difficult to persuade responsible state officials to appropriate funds for the eradication of lousiness<sup>1</sup> and louse-borne diseases. As an added factor, there are a number of other severe health problems that have to be dealt with in developing countries.

Up to 1970, two concepts prevailed in regard to the control of lice and typhus in Yugoslavia. In Bosnia and Herzegovina the control of lice consisted primarily of hygiene and education measures, and insecticides were used only in exceptional cases. To carry out this program rural school teachers, Red Cross, and representatives of other public organizations were recruited to help and the area's health service provided professional guidance and advice.

In Serbia, Macedonia, and Montenegro, in contrast, priority in the eradication of lousiness and typhus was given to the use of DDT

<sup>1</sup>In this paper, "eradication" is considered a body lousiness rate of under 2 per cent in a community's households. It is also possible to expect that small subpopulations such as vagabonds, drug addicts, or hippies will have head and body lice.

powder and emulsion. Intensive hygienic and education measures were also undertaken.

In any locality in Yugoslavia where one or more primary cases of typhus or its recrudescent forms were detected, lousiness was controlled by DDT powder or, more often, by DDT emulsion.

None of these preventive actions continued for more than one to three years, however. The programs were not implemented at the same time, nor in all the areas where lousiness and typhus were prevalent. This is why the decline in the number of typhus patients and the considerable decrease in the lousiness rate were temporary (11, 19, 25).

The interruption of these programs or their inadequate coverage was usually caused by difficulty in securing the necessary funds to purchase DDT and cover other costs.

To the authorities who had to approve the necessary funds, the occurrence of 100 or 200 cases of typhus per year seemed a small problem compared to treating thousands of other patients with more common illnesses. Only in Macedonia were DDT emulsions applied for four years in succession, and then to control malaria outbreaks from 1955 to 1958. Clothing, underwear, and fabrics were sprayed at the same time to control lousiness. The campaign eradicated both malaria and typhus, and never since has a case of primary typhus been reported in that part of Yugoslavia.

#### Eradicating lousiness

Lousiness may be eradicated in one of two ways: by using hygienic and education measures to make the population aware that they themselves must fight lousiness, as was done in some areas of Bosnia (1, 3), or by applying DDT emulsion to households and spraying or impregnating underwear, clothing, and other fabrics. The purpose of the second method is to use insecticides for several years in succession to eradicate lousiness

breaks of typhus. The latter is primary cases of classical Brill-Zinsser disease cases. Typhus usually disappears completely only several (27).

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where the foci of louse-borne typhus are located in the inter-urban areas. This is the reason why we find it difficult to eradicate this disease with- out insecticides (13).

to control typhus in the inter-urban areas, it is easy to eradicate typhus and extirpate it with the help of insecticides. In the case of other antiepidemic measures, however, the case with the help of insecticides, however. To achieve a decrease to a low rate of lousiness in a larger area, it is necessary to have been affected by lousiness; therefore candidates for eradication

biologic phenomenon. Improved economic and social conditions ultimately disappears.

in a broad area and thus prevent louse-borne diseases (25), and it should result in more rapid eradication of lousiness than the first method. The second method calls for more funds than the first, especially for DDT and other insecticides, over a period of years. It also requires that a special field staff outside the health service be recruited to spray DDT emulsion and impregnate underwear in rural areas.

The local health service is responsible for the execution of either method in its own jurisdiction, and is assisted by the regional hygiene and preventive medicine agencies as well as a central institute (in Yugoslavia, the Republic Institute of Public Health) in the form of professional and technical guidance. To motivate the population to active participation in such efforts, well-defined duties are assigned to school systems, the Red Cross, the military health service, and other public organizations.

Either method is successful only if planned and implemented as a long-term program to eradicate lousiness. Any temporary interruption will result in failure, and after several months to one year of cessation the situation that had prevailed before the program was started will again obtain.

Short-term programs are carried out to eradicate typhus epidemics with the help of DDT powder or through a single application of DDT emulsion, along with other epidemic control measures, which continue until the focus is declared extinguished.

To carry out various financial, administrative, hygienic, educational, and other tasks on a national level, as well as at the community level, commissions to eradicate lousiness and typhus are set up. They are composed of the representatives of the health institutions, the Red Cross, the sanitary inspection service, the army health service, and various other public organizations. These commissions must consider, approve, monitor, and evaluate field activities carried

out under the louse eradication programs under way. They also have fiscal responsibilities.

Both types of louse eradication were carried out in Yugoslavia before 1970, but nowhere did such a program last more than three years. Since 1971 only the second type of program has been carried out. Both kinds of program have also aimed at the eradication of typhus, which means that under one and the same program active case-finding, epidemiologic inquiries, laboratory diagnosis, hospitalization of the ill, and execution of necessary sanitary and epidemic control measures are planned.

These two methods are described in detail because they might be useful in the preparation of similar programs in other countries, where they might have to be modified to a greater or lesser extent to suit local conditions.

#### Hygiene and education method of louse eradication

This method embraces the use of hygiene and education measures, and does not rely on the use of insecticides.

#### Indications

This approach is indicated if there is no immediate risk of a typhus outbreak and therefore enough time is available to carry out the program for several years, if there is a shortage of qualified health personnel, or if existing health workers must attend to other, more urgent problems, or if there are not enough funds to pay for insecticides and the necessary spraymen.

#### Personnel

If this method is used, the population is expected to participate in the eradication of lousiness after appropriate training and without too great effort on their part. The eradication team consists of the village school teacher and a representative of local public

organizations in villages. The coordinator gives advice and guidance and supervises the field work.

#### Means and methods

Locally available insecticides are used in occasional cases. Conventional methods include: (1) laundry boiling with soap and water; (2) examination of underwear made from wool; (3) regular combing of hair close together; (4) use of bed nets; (5) use of separate beds instead of communal beds; (6) use of night shirts or nightgowns; (7) use of separate beds instead of communal beds; (8) instructing the members of a family to wash their bodies the same day and change their underwear, as well as to separate from domestic animals against superstitions that favor lousiness.

#### Implementation

**Phase 1.** The health service prepares a plan for lousiness and typhus eradication, determining how to carry out the program, how and how detailed the program should be imparted to the population, regional, community, and village level, dealing with the population before the school year begins, their respective part in all communes. The health workers in all communes and members of public organizations in the program's technique means can be used. Instructors and supervisors are prepared and provided.

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organizations in three or four neighboring villages. The communal physician provides advice and guidance and from time to time supervises the field team's activities.

Means and methods

Locally available methods are used and insecticiding is carried out only in exceptional cases. Commonly taken measures are: (1) laundry boiling or washing in lukewarm water with soap or with a detergent if underwear is made from certain synthetic fibers; (2) examination of the hair for lice and regular combing with combs whose teeth are close together; (3) education about the factors that allow lice to exist, with special warnings that people should bathe regularly, use night shirts or pyjamas, and sleep in individual beds instead of together on the floor; (4) instructing the population that all members of a family should take a bath on the same day and at that time change their underwear, as well as keep clean underwear separate from dirty; and (5) propaganda against superstitions, customs, and habits that favor lousiness.

Implementation stages

Phase 1. The Republic Institute of Public Health prepares a program to eradicate lousiness and typhus for the entire country, determining how to carry out periodic and final evaluations, how to finance the program, and how detailed information about it will be imparted to the public. The national, regional, communal, and local commissions dealing with the program are organized before the school year starts and draw up their respective plans. Seminars are arranged in all communes and larger localities at which health workers instruct teachers and active members of public organizations in the program's techniques and explain what local means can be used to achieve eradication. Instructors and printed materials are prepared and provided.

When the school year starts in September, teachers inspect their children and enter their findings on forms entitled "Record of Pupils Having Lice," specifying whether head or body lice are found. The so-called "Cleanliness Week" takes place at the end of that month. In all villages, underwear is washed, people take baths, houses are cleaned, and other measures of personal and household sanitation are taken. Thereafter the two-person village teams inspect each household for lice monthly and teachers inspect their pupils weekly. The teams notify the teachers of their findings and vice versa, and then try to reeducate the heads of households in which lice were detected.

If at the end of the program's first year more than 20 per cent of families are found to have lice, the phase must be repeated. If not, the second phase may begin.

Phase 2. The village teams make monthly founds of households, inspecting those previously found lousy twice a month. Through the pupil hygienist teachers detect those pupils who have lice and inform their parents and the village team accordingly. Before the school year is over, the teacher and the village representative on the team evaluate the lousiness situation on the basis of school and household inspection records.

If more than 10 per cent of the households are found to have lice the second phase is repeated; otherwise the third phase starts.

Phase 3. The methods of the third phase are the same as those of the second. Any house not freed from lice is subjected to insecticide treatment. If the lousiness rate within a commune is less than 2 per cent of its households for two years, the regional and republic commissions declare that lousiness has been eradicated (4, 21).

It is very important to clearly designate the health institution or some other organization that will undertake the overall responsibility for the execution of the program. It is equally important to determine in advance

the mechanism of financing, solve personnel problems, and coordinate the effort with other public health programs being carried on in the commune.

The program's duration until the eradication of lousiness is completed cannot be predicted. It depends on the availability of resources, the population's response, health, and cultural awareness, and sometimes on other factors that cannot be foreseen.

When this approach is used, the teacher notifies the local health service of all febrile persons. In turn, the health service is to undertake urgent clinical and laboratory diagnosis of their conditions to determine whether they have a louse-borne disease; if they do, it must also undertake appropriate epidemic control measures.

### Insecticidal method of louse eradication

#### Indications

This approach is indicated when old endemic foci of typhus exist and there is risk of outbreak; if there are recrudescence forms of typhus (Brill-Zinsser disease) and primary cases of typhus; if there is a dynamic process of migration of the population to and from lousy environments that may favor the spread of lousiness; or if there is a risk of a noticeable increase of lousiness during disturbances such as earthquakes or war.

The insecticidal approach may be contemplated when it is possible to recruit a larger nonmedical field and administrative staff than for the education and hygiene approach, when it is possible to finance the cost of insecticides and other necessities for at least five years to ensure continuity, and when laboratory findings indicate that local body and head lice are not resistant to the insecticides to be used.

#### Personnel.

An unskilled sprayman must be recruited for every 150 households. An administrative

person is taught to take care of administrative matters and inspect for lice. A sanitary technician is needed for every five to 10 spraymen, and a physician is required for a commune territory embracing between 10,000 and 12,000 persons.

At least three physicians should be recruited at the regional level, and at least five more at the republic level. One each of the regional and republic physicians must be a specialist in epidemiology. They work periodically, at least two months a year before, during, and after the spraymen carry out their field tasks.

#### Means and methods

DDT emulsion, lindane, or another insecticide that is nontoxic to humans is used. The same insecticide must be used in all areas undergoing spraying. Spraying of underwear, clothing, and fabrics with insecticide is carried out only in those houses in which some member of the family is found to have lice. Domestic measures are applied as in the hygiene and education method of eradication.

#### Implementation stages

*Phase 1 (preparatory phase).* The republic, regional, and communal commissions for eradication of lousiness and typhus are organized and operating plans are drawn up at each level. The material necessary to the execution of the program is secured and administrative and so-called sanitation personnel (spraymen) are recruited. Staff seminars are held at the republic center or in the regions as well as in each commune and qualified instructors to give them are designated. Early in September the sprayman and sanitary technician inspect schools and households for lice, entering their findings on specially prepared forms. This phase runs from January to the end of September.

*Phase 2 (attack phase).* In the spring and autumn all school children and members of rural households are inspected for lice, and

records of the finding for each village and to where any case of Brill-Zinsser disease in a few years are also made.

In lousy households, bed sheets, and 1 or impregnated when 1 cent DDT emulsion; and is used for hair. This the moment of the year when infestation is sprayings are during ber (autumn-winter during February and ing), and are performed where there are carried out simultaneously in a given area and at the same time, DDT workers in large communities, and others

Professional education of the Red Cross launch active field projects to get the population and household hygiene patients are actively households are being responsible communities urgently notified of winter and winter households found taken in each of the

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care of administration for lice. A sanitary officer every five to 10 days is required for a village embracing between 50 and 100 households. Sanitarians should be recruited, and at least five should be employed. One each of the sanitarians must be a physician. They work 10 months a year because the spraymen carry

or another insecticide if humans is used. The insecticide used in all areas spraying of underclothes with insecticide is done in houses in which lice is found to have been applied as in the method of eradication.

Phase). The republic health commissions for typhus and Brill-Zinsser disease are drawn up at the beginning of the year. It is necessary to the health and sanitation personnel. Staff seminars are held in the centers or in the communes and quaileries are designated. A sanitary officer and sanitary workers and households are designated on specially selected phase runs from September. In the spring and summer and members of the village are selected for lice, and

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records of the findings are made separately for each village and town. Lists of localities where any case of primary classic typhus or Brill-Zinsser disease has occurred in the past few years are also made.

In lousy households the underwear, clothing, bed sheets, and bed covers are sprayed or impregnated whenever possible with 2 per cent DDT emulsion; and 0.5 per cent emulsion is used for hair. This is done twice a year, at the moment of the yearly increase and again when infestation is at its peak. The two sprayings are during November and December (autumn-winter spraying) and again during February and March (winter-spring spraying), and are performed only in those households where there are lice. Each spraying is carried out simultaneously by all spraymen in a given area and lasts at most 20 days. At the same time, DDT emulsion is sprayed on workers in large companies or plants, forest workers, and others.

Professional educators and representatives of the Red Cross and other organizations launch active field propaganda campaigns to get the population to take needed personal and household hygienic measures. Febrile patients are actively sought at the same time households are being sprayed, and the responsible communal health institution is urgently notified of patients found. Autumn-winter and winter-spring sprayings of all households found to have lice are undertaken in each of the two following years.

This phase covers three years, in each of which two sprayings are performed.

Phase 3 (consolidation phase). All schools and households are to be inspected for lice before the autumn-winter and winter-spring sprayings start; this is also true of the following year. DDT emulsion is sprayed in lousy households and on school children, factory workers, and the like. Active field search is carried out for febrile patients suspected of having typhus or Brill-Zinsser disease ("active surveillance"). All febrile cases must be considered as possibly typhus or

Brill-Zinsser disease until clinical or laboratory proof is obtained that it is some other disease ("passive surveillance"). This phase lasts two years.

Phase 4 (final phase). At the beginning of this stage the health service takes over the task of eradicating lousiness and typhus, which is now regarded as an infectious disease—the reason why the health service undertakes the task of disinfection by applying insecticides in any household, factory, or enterprise where anyone is found to have lice. If in both years of Phase 3 lousiness continued below 2 per cent of households,<sup>1</sup> and if during that time no case of typhus was found, the relevant regional and republic commissions declare that lousiness and typhus have been eradicated (12, 20).

In addition to surveillance in the field during a program based on this insecticidal approach, the communal health unit keeps the regional health service informed of the activities it carries out in the field and the regional health service similarly reports to the Republic Institute of Public Health. During each of the program's phases the representatives of public organizations engage in intensive health propaganda.

These are some statistical data on the results obtained from experimental pilot investigations carried out of the two methods of lice eradication described above.

In Bosnia in the period 1955-57, experimental investigations were conducted to test the possibility of eradicating lousiness primarily through health education methods, using DDT powder or emulsions only in exceptional cases. Rural school teachers and representatives of public organizations inspected pupils every seven days and households once a month, and they advised parents whose children had been found lousy how to disinfect them.

<sup>1</sup> A family is considered infested if any of its members is found to have two or more body lice or any live eggs of body lice.

When the program was begun in one Bosnian village in 1955, the infestation rate was 9 per cent; in July 1957, it was 3 per cent. In another village it was 59.0 per cent at the start of the campaign and 3.4 per cent at its end in July 1957. In still another village in the same area the underwear and clothing of all inhabitants were impregnated with 2 per cent DDT emulsion. At the time no health education measures were undertaken. Before impregnation lousiness amounted to 87.50 per cent, but two weeks later it was 3.89 per cent. It increased each month thereafter to 72.43 per cent of the population when the year ended. The second impregnation was followed by a rapid decline and subsequent gradual increase in lousiness, exactly as after the first, but with a lower rate of infestation at the end of the second year. The investigators concluded that continuous hygiene and education measures, with occasional exceptional use of DDT, yields more lasting results than mere impregnation when eradication is the aim. In contrast, the short-term use of insecticides without health education cannot have any lasting effect (1).

Typhus used to occur now and then in the area of Sandžak, Serbia, during the years after World War II. All households in the area, which had a population of 55,000, were sprayed with DDT emulsion; the spraying included underwear, clothing, and other fabrics. This was first done in 1951 and was repeated the following year, usually in December when lousiness tended to increase, under the local school teacher's supervision. The same experiment was repeated in 1957 in three villages with 65,000 inhabitants in the Autonomous Province of Kosovo.

In both these experiments a rapid decline in lousiness followed the spraying, only to increase again and reach 23 per cent of the baseline infestation within two months and 50 per cent within four months. In one sprayed area (Gnjilane) where before the campaign at least one case of typhus was

found every year, not a single typhus case was reported during the following three years. Similar measures were taken in still another district (Istok), and within four years there was not a single case of typhus after spraying.

Based on this and findings elsewhere in Serbia, the investigators concluded that it is not possible to eradicate lousiness with two or three sprayings, but that it is possible to achieve such a low infestation rate that the transmission of typhus is blocked. The authors are of the opinion that it is most important to undertake another spraying four months after the first so that lousiness can reach a still lower level.

The four-year (1955-58) DDT spraying campaign in Macedonia to control malaria, which included household spraying, reduced lousiness to below 2 per cent and eradicated typhus. The investigators thus recommend that spraying should last at least a few years (five years) and be done twice a year. They also hold that the same results can be obtained in Bosnia-Herzegovina, Kosovo, and Sandžak, all previously endemic typhus areas, provided that the same methods are applied (12, 20, 25).

#### Discussion

The investigations of the infestation rate in Bosnia have shown that body lice have never been at a lower level. Similarly, the prevalence rate of residual titers for typhus has never been lower, particularly in children and younger populations in remote areas that used to be endemic typhus foci (6).

The number of typhus cases has fallen to its lowest level. In 1960, 130 cases were reported in Yugoslavia; in 1965, 61, and in 1970, 12. Later laboratory tests showed that a good number of reported typhus cases were cases of Brill-Zinsser disease. All of the dozen cases reported in 1970 were in Bosnia-Herzegovina.

At a meeting of Yugoslavia in 1968 it was decided to take an insecticidal approach rather than the hygiene and education approach after a thorough discussion of the results obtained with each approach.

The following arguments are advanced against the long-term use of DDT: (1) resistance to DDT; (2) the population will use hygienic measures if the large-scale spraying is expensive; (3) the large-scale spraying is expensive; (4) the Zinsser disease cases invalidate the insecticidal approach; (5) the approach reaches the original level after DDT spraying.

To each of these counterarguments (1) not been established; (2) other methods can be used; (3) along with hygiene and education the population should be stimulated to change their minds that the lice are not so popular among our people; (4) the use of DDT in the fight against typhus is not so expensive; (5) the annual cost per inhabitant is not so high (3.5 dinars, or U.S. \$0.15); (6) if lousiness constantly remains at a low level, it is necessary to spray at least five years, and after that time the lousiness will tend to the baseline; (6) the cost of spraying is shown that by spraying every year the lousiness falls to a low level, typhus transmission is stopped, and there are no more cases of Brill-Zinsser disease. The long-term use of DDT to eradicate lousiness is recommended.

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At a meeting of Yugoslav epidemiologists in 1968 it was decided to undertake the insecticidal approach to eradication, rather than the hygiene and education approach, after a thorough discussion of the results obtained with each approach.

The following arguments were made against the long-term use of DDT emulsions: (1) resistance to DDT will build up (6, 7); (2) the population will be discouraged from using hygienic measures against lice and typhus; (3) the large-scale use of insecticides is expensive; (4) the insecticide tactic is a war method; (5) the existence of Brill-Zinsser disease cases as the reservoir of rickettsiae invalidates all the value of the insecticidal approach; and (6) lousiness reaches the original level six to eight months after DDT spraying.

To each of those arguments there was a counterargument: (1) resistance to DDT has not been established in Yugoslavia, and if it comes there are other insecticides that could be used; (2) along with the use of DDT, the population should be more actively educated and stimulated to be clean, impressing on their minds that the insecticides only speed up their getting lice-free; (3) DDT is very popular among our peasants and that should be used in the fight against lousiness; (4) using DDT emulsion is not expensive since the annual cost per inhabitant in Bosnia amounts to 3.5 dinars, or U.S. \$0.25; (5) to decrease lousiness constantly and ultimately eradicate it, it is necessary to use insecticides for at least five years, and any temporary interruption will send the lousiness level back to its baseline; (6) the experiments in Serbia have shown that by spraying all households twice yearly lousiness, falls to a level that blocks typhus transmission; and (7) if within a few years there are no primary typhus cases following the eradication of lousiness, there is no risk of Brill-Zinsser disease, which will disappear as a disease in the near future.

The long-term insecticidal program to eradicate lousiness and typhus started in

1971 in the Sandžak area of Serbia and in Bosnia-Herzegovina, but it is still too early to gauge its definitive results. The lousiness rate in the program areas has suddenly decreased, however. Only 2 to 5 per cent of the population of some mountain villages were infested by early 1972. There was one suspect typhus patient in Bosnia-Herzegovina after three sprayings in 1971, and none in the first eight months of 1972. No typhus cases were reported in Serbia during that time.

Conclusions

By applying classical epidemic control measures in the fight against typhus, trench fever, and louse-borne relapsing fever, i.e., through controlling lousiness in the foci of those diseases, it is impossible to eradicate them. Because of the possible occurrence of Brill-Zinsser disease and the late recrudescence forms of Wolhynian fever, and because the location of the reservoir of louse-borne relapsing fever is unknown in the interepidemic period, the eradication of these diseases will only be possible after lousiness has been eradicated in the areas in which the diseases occur and in areas in which former patients are living.

There is a direct correlation of lousiness with the illiteracy rate and an indirect one with the amount of national income. This sociobiologic phenomenon, which positively declines with growth of the economy and culture, depends on a number of factors, habits, and customs. The author has listed the most important socioeconomic factors that have played or are still playing a major role in the maintenance and spread of lousiness in remote rural areas. Lousiness control cannot be achieved if these factors remain unknown.

Before 1971, two distinct schools of thought prevailed in Yugoslavia about louse control. One held that control could be achieved through hygiene and education



measures, with only exceptional use of insecticides; the other emphasized DDT use from the start of a control campaign and placed hygiene and education measures in a secondary role. Through the first approach lousiness is eradicated over the course of several years. Through the second, lousiness rapidly decreases after DDT spraying of underwear, clothing, and fabrics, only to increase again within four months to 50 per

cent of the baseline rate. Because of that increase all households with lice are sprayed twice a year, in early winter and again four months later, in the spring.

If there is enough money and medical personnel, the author recommends the program involving the long-term application of insecticides. It should last for at least five years, and any interruption will doom the program.

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J. H. S. Gear.<sup>1</sup> *R southern Africa, with their control.* Four ri known to infect man They are: (1) epidem caused by *Rickettsia* mitted by the hum *humanus*; (2) murir caused by *R. moose* many by rat fleas, *p cheopsis*; (3) tick-bite typhus that occurs in caused by *R. conori* v various species of ixo transmitted to man, u Q fever, caused by *R* parasite of ticks usu: by the inhalation of rarely by the ingestio tick bite.

## Epidemic louse-bore

In the past, before years of World Wa regions of southern relatively temperate the highveld of the C Transvaal, favored typhus. The disease It does not occur i living conditions a water is freely ava commonly used. 7 seen in the cities h where the disease o occasion, would b customs, many i were sometimes to countryside. A tr and spent the nig happened to be p he was convalescu ing infected lice,

<sup>1</sup> South African In Johannesburg, Sou