

a 62466

15 October 1962

ORIGINAL: ENGLISH



Supplement to WHO/Mal/362

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1. IN MEMORIAM: PROFESSOR V. N. BEKLEMISHEV

Professor Vladimir Nikolaievitch Beklemishev, Head of the Division of Entomology of the Martsinovskiy Institute of Medical Parasitology and Tropical Medicine of the USSR Ministry of Health, member of the USSR Academy of Medical Sciences, died in Moscow on 4 September 1962 at the age of 72 years.

Professor Beklemishev's death will leave in the field of medical entomology a gap that will not be easy to fill. His contribution to basic science was immense and linked with his interest in applied research and particularly related to problems of public health and to malaria eradication. Thirty years ago, while still on the staff of the University of Perm, Professor Beklemishev became interested in the biology of impounded waters giving rise to large-scale breeding of Anopheles. This work led to the study of epidemiology of malaria to which Professor Beklemishev devoted most of his work since 1932, when he was appointed as Head of the Entomology Division of the Malaria Institute in Moscow (now the Martsinovskiy Institute of Medical Parasitology and Tropical Medicine).

In his new post, Professor Beklemishev devoted all his knowledge, energy and experience to the organization of country-wide control of malaria, tick encephalitis and other arthropod-borne diseases.

Beklemishev's outstanding book on the comparative anatomy of invertebrates, first published in 1944, saw a second edition in 1952 and was translated into many languages. His book on the ecology of A. maculipennis published in 1948 was equally successful. Beklemishev's main achievement was the thorough planning and organization of collective research work on the bionomics of arthropod vectors of communicable diseases in the Soviet Union. One of the results of this work was a recent book on seasonal changes in the biology of A. atroparvus over the whole vast territory of the USSR - a unique achievement in the field of entomological science.

He wrote a foreword to the monograph on age-grouping methods in Diptera of medical importance (prepared by one of his pupils, Dr T. S. Detinova), which was recently published by the World Health Organization.

Beklemishev greatly increased our understanding of ecological and phenological factors in the distribution of malaria and introduced new notions of "landscape malariology" as a basis for planning malaria control and eradication. The study of the physiology of malaria vectors led Beklemishev and his collaborators to the introduction of new methods of age-grading of female anopheles. The importance of this in the epidemiological follow-up of malaria eradication was fully realized in the Soviet Union and is now increasingly appreciated in other parts of the world. The age-grading methods developed by the school created by Beklemishev are now being used for the study of the biology of house-flies, tsetse flies, black flies and midges in other countries. Beklemishev's wide interests and keen intellect contributed greatly in the study of population biology of arthropods, to the study of the evaluation of parasitism in blood-sucking vectors of human and animal diseases, to the development of nosogeography of communicable diseases and to the analysis of general and specific aspects of natural foci of infection.

He was the author of a series of handbooks on medical entomology and taught this subject to thousands of students at the Lomonosov University, at the Martsinovsky Institute and at the Central Post-Graduate Medical School in Moscow. Beklemishev's brilliant teaching always emphasized the link between basic research and practical problems of public health.

The highest USSR State prize for scientific work was given to Beklemishev twice: the first time for his study of comparative anatomy of invertebrates; the second time for his entomological work in the field of malaria eradication in the USSR, so ably led by Professor Sergiev, his friend and colleague. He was a consultant on entomology and vector control to the Ministry of Health, USSR and co-editor of the journal Meditinskaya parazitologiya i parazitarnye bolezni. He was also a member of the WHO Expert Advisory Panel on Malaria.

Beklemishev had an immense fund of knowledge in the field of entomology, hydrobiology, geomorphology and biostatistics and was always ready and eager to place his experience at the disposal of those who consulted him. His lectures were a model of clarity in presentation and often enlivened by delightful humorous asides. His main outside interest was the history of art and he was a keen student of painting and sculpture.

He was a kind and wise man and his absence will be sadly felt by his many friends and admirers everywhere.

2. ANTIMALARIA MEASURES IN THE USSR

At the WHO Inter-Regional Technical Meeting on Malaria Eradication held at Teheran, Iran, 1-6 May 1962, Professor S. N. Pokrovsky, Director of the Institute of Medical Parasitology, Rostov-on-Don, USSR, reported on the malaria situation in his country. The following note is a synopsis of his report.

In 1960 malaria was practically eradicated in the USSR. In 1961 360 new cases and 138 relapses were reported from a population of 216 151 000.

MALARIA INCIDENCE IN THE USSR, 1961, COMPARED TO THAT IN 1960

(based on the data of the Statistical Department of the Public Health Ministry of the USSR)

Republics	Total number of patients in 1960			Total number of patients in 1961		
	New cases	Relapse cases	Total	New cases	Relapse cases	Total
1. RSFSR	122	14	136	148	19	167
2. Ukraine	17	-	17	9	1	10
3. Byelorussia	1	-	1	1	-	1
4. Uzbekistan	12	-	12	10	-	10
5. Kazakh	44	10	54	14	7	21
6. Georgia	15	-	15	21	3	24
7. Azerbaijan	85	33	118	53	108	161
8. Lithuania	-	-	-	-	-	-
9. Moldavia	1	-	1	1	-	1
10. Latvia	-	-	-	2	-	2
11. Kirghizia	-	-	-	-	-	-
12. Tajik	61	-	61	93	-	93
13. Armenia	4	-	4	5	-	5
14. Turkmenia	6	-	6	3	-	3
15. Estonia	-	-	-	-	-	-
Total for the USSR	368	57	425	360	138	498

Of the total number of cases, in 96 instances the infection had been contracted outside the territory of the USSR and was observed in Soviet people coming back from abroad and in foreigners coming to the USSR. Local cases of malaria in the USSR were reported in 123 communities. Among the imported cases, 67 cases were reported in Moscow in the complete absence of cases among the local population. Falciparum malaria was observed in 47 patients, of which 44 were visitors from abroad, and quartan malaria was found in 17 patients, six of which were observed after blood transfusion.

In 1961 antimalarial measures were carried out along two lines: first, detection of the source of infection with subsequent treatment of patients and, secondly, control of the vector in certain communities and certain areas. Reinforced supervision was executed on the implementation of antimalarial control measures carried out both by the staff of the parasitology service and by general medical staff. Particular attention was paid to epidemiological surveillance and measures for active detection of patients were broadened. Mass blood survey examination of 5 536 800 persons has been carried out in 1961 and 138 cases were found. Blood examination of patients with fever was widely done. Treatment of patients and treatment of premises were done free of charge. It has become a routine practice to give an additional course of quinocide treatment after the attack treatment. In areas not completely freed of malaria, as well as in areas where there was a danger of introduction of malaria in 1961, treatment of premises with residual insecticides was continued. In a number of instances, when a malaria patient appeared in an area where malaria had been eradicated, treatment of premises was resumed. Though the amount of treatment in 1961 was considerably reduced compared to previous years, 166 041 258 square metres were treated during the season.

Much attention in the USSR is paid to public health in rural areas. The initial section of the public health system in rural areas is represented by feldscher's units, feldscher midwife's units and local rural hospitals. These medical institutions ensure the fulfilment of the whole complex system of both therapeutic and prophylactic measures, including those for malaria control. The

system of malaria control measures adopted in the Soviet Union combines measures for the detection, registration (compulsory registration of malaria patients was introduced in 1920) and treatment of malaria patients with malaria mosquito control measures since the very first years of malaria control.

The rural medical institutions participate in this control programme by carrying out surveys of the population, treatment of the patients detected with malaria, and follow-up. All rural hospitals include clinical laboratories which carry out blood examination for malaria of all persons suspected and all patients with fever, thereby securing timely detection of the disease, hospitalization and treatment. The existing network of hospital beds in the USSR provides for a 100 per cent. hospitalization of all detected malaria patients for the whole period of treatment. The success achieved in the field of malaria control in the USSR is due to a considerable extent to the fact that all medical workers in 1960 numbering 401 612 physicians and 1 388 300 paramedical personnel, were enlisted for malaria control work.

The following table shows the numbers of physicians and paramedical personnel in six southern Union Republics as of 1960.

THE NUMBER OF PHYSICIANS AND AUXILIARY PERSONNEL  
IN SIX UNION REPUBLICS

Republic	Number of Physicians	Number of Auxiliary Personnel
The Uzbek SSR	11 255	38 500
The Tadjik SSR	2 440	8 400
The Turkmen SSR	7 816	10 600
The Azerbaijan SSR	8 737	26 100
The Armenian SSR	4 204	11 300
The Georgian SSR	13 453	30 700

Collective farms, state farms and public organizations render great help to local public health institutions enlisting the active participation of the population. Public sanitary commissioners, active workers of the Red Cross and Red Crescent assist in carrying out all kinds of sanitary measures.

In order to prevent the development of conditions conducive to contraction of malaria infection, and taking into account the existence of epidemiological prerequisites both in the territory of the frontier areas of the USSR and abroad, treatment of communities with residual insecticides is widely carried out in these areas, and in some places, according to epidemiological indications, chemoprophylaxis is done. In a number of areas larviciding is conducted as well as regular house-spraying and blood examination of the population.

Among the republics of the USSR, six southern Union Republics have frontiers with countries participating at the Teheran Meeting: the Uzbek SSR, the Tajik SSR, the Turkmen SSR, the Azerbaijan SSR, the Armenian SSR, the Georgian SSR. Malaria incidence in these Union Republics, the population of which had been severely affected by malaria in the past, has been practically eradicated now. In the overwhelming majority of places malaria has been completely absent for a number of years, and only in some communities occasional cases are reported.

INCIDENCE OF MALARIA IN SIX SOUTHERN UNION REPUBLICS

Republics	Incidence of malaria cases						Neighbouring countries
	1934	1940	1956	1959	1960	1961	
The Georgian SSR	494 976	102 818	808	67	15	2	Turkey
The Armenian SSR	188 591	53 897	68	7	4	5	Turkey, Iran
The Azerbaijan SSR	531 299	238 145	3 071	890	85	161	Turkey, Iran
The Turkmen SSR	107 664	27 237	58	12	6	3	Iran
The Uzbek SSR	323 005	203 567	645	45	12	10	Afghanistan
The Tajik SSR	104 226	72 224	1 305	68	61	93	Afghanistan, China

In 1961 only two frontier areas of the Tajik SSR, Shaartuz and Kalay-Khumb, had a slightly increased incidence of malaria, that is, in eight communities of Kalay-Khumb area 29 patients were reported and in Shaartuz area in seven communities 31 patients were reported.

The peculiarities of the epidemiology of malaria in areas near the border of Afghanistan, Iran and Turkey include the duration of the season of transmission (May-October), high temperatures allowing for rapid completion of sporogony in the vector, the presence of a significant number of anopheles breeding places, a high density of local vectors (A. superpictus and A. pulcherrimus) (mainly in the republics of Central Asia) and A. sacharovi and other sub-species of A. maculipennis (mainly in the Transcaucasian Republics). In the past falciparum malaria was rather widely spread here, whereas at present only occasional cases are found - only three cases in the Tajik SSR.

In order to secure stable well-being with regard to malaria in communities in the frontier areas, it was considered expedient to co-ordinate measures of control on the basis of mutual rapid and effective information, strengthening of the local sanitary-epidemiological service and general network of medical institutions in the frontier area villages.

### 3. PERSISTENT MALARIA TRANSMISSION

The following paper on persistent malaria transmission due to operational and entomological factors was presented by Dr A. P. Ray, Director, National Malaria Eradication Programme, Ministry of Health, Government of India at the WHO Inter-Regional Technical Meeting on Malaria Eradication held at Teheran, Iran, 1-6 May 1962.

From experience gathered for over a decade during malaria control and eradication campaign in the country, it is generally agreed that operational failure contributes largely towards continuation of transmission, though under certain circumstances entomological factors may also be responsible for persistent transmission.

1. Some of the major operational factors which may militate against prompt interception of transmission are grouped as follows:

- 1.1 Terrain, topography and communication difficulties.
- 1.2 Emergency conditions
- 1.3 Lack of suitable training of spray crew as well as the supervisory staff.
- 1.4 Defective logistics.
- 1.5 Failure to maintain the correct time schedule of spray operation.
- 1.6 Inadequate supervision.
- 1.7 Aggregation of labour and moving population.
- 1.8 Resistance from the people.

1.1 Terrain, topography and communication difficulties

As to the terrain, topography and communication difficulties etc. it should be borne in mind that inadequate or defective planning and failure to provide adequate staff are primarily responsible for incomplete coverage during spraying operations. Normally every country is able to draw up estimates for the normal output per pump per day in a short period. In the plains areas and where population live in compact areas the output in India per pump per day is in the region of 40 to 50 houses or about 80 to 100 houses for a five man team working with two pumps. However, in hill sectors or in forest areas as well as during heavy monsoon when movement is slow, obviously the output will be considerably reduced. Of necessity, therefore, suitable provision of staff should be made in respect of all such areas after taking into consideration the expected output of work. It would also be necessary to look into the accommodation facilities for the team for night halts, or else there will always be the tendency of the staff to return to base even without completing the assigned task. Although it is true everywhere it is much more important in operationally difficult areas. For instance, the fear of wild animals in forest areas may goad the crew to return early before nightfall. Incomplete coverage is the inevitable result. Difficulties of communication should not be contributory factors for operational failure provided necessary provision is made.

## 1.2 Emergency conditions

Normally during emergency conditions like floods, the spray schedule is disrupted. If immediate provision is not made for application of spraying soon after the flood recedes transmission cannot be intercepted. In many parts of India there are areas which are affected by periodic floods and therefore suitable provision has been made to meet such emergency. All areas affected by floods are sprayed again (irrespective of the height of the water) even though the houses may have been sprayed only recently. In other words the flood affected areas are sprayed all over again. Suitable provision should, therefore, be made in the plan of operation to meet such contingencies.

## 1.3 Lack of suitable training of spray crew as well as the supervisory staff

It is the general experience that unless the spray crew are fully conversant with the spraying technique, proper formulations and the necessity of spraying operations in every sprayable surface, the performance is generally sub-standard. Therefore, sufficient stress should be given for adequate training and programme at the time the calendar of activities is prepared. Normally a period of one week should be sufficient for such training. The malaria inspectors would also require intensive training for one week prior to the actual spraying operation.

## 1.4 Defective logistics

It is not enough to procure adequate quantities of insecticides, material and equipment but what is more important is to ensure that these are delivered to the periphery well ahead of time. Quite often breakdown of supply of insecticide or equipment, particularly during the heavy monsoon period, may militate against complete coverage. Therefore, all aspects of logistics, including maintenance of vehicles, should be ensured prior to the commencement of spray operations.

## 1.5 Failure to maintain the correct time schedule of spray operation

Even though all requirements have been met with and the spraying operations have attained the desired standard both in quantity and quality, transmission may still continue if the proper time schedule is not maintained. Initiation or continuation of spraying operations beyond the peak transmission period could not possibly serve the purpose as the people remain unprotected during the main transmission season.

It is, therefore, highly essential that the transmission period for each area should be worked out in detail and spraying time schedule be so strategically adjusted that all structures receive the number of rounds of spraying required prior to the peak transmission season. Under the Indian programme, the programme is so adjusted that the first round is usually completed before the beginning of the transmission season, and the second round before the peak transmission so that a total of 200 mg DDT per square foot has been applied before this period.

Where transmission is prolonged the necessity of an additional round of spraying will have to be considered. But this will depend on the sprayable surface, the temperature and humidity factors and the duration of the biological effectiveness of insecticide applied under such conditions.

#### 1.6 Inadequate supervision

It is needless to mention that in a programme of this nature the most important factor is supervision at all times and at all levels. Inadequate or defective supervision is the single most important factor for continued malaria transmission in an area where spraying operations have been in progress for several years. Further, it may also be stressed that, unless supervision is both consecutive and concurrent, the performance cannot reach the desired standard. It is the universal experience that, during concurrent supervision, the squads put up the best show possible, as is natural. Therefore, concurrent supervision by itself could rarely ensure the desired coverage and quality of spraying operations. Further, it is the general experience that the standard of coverage in areas which are generally approachable on foot are generally far below the standard observed in roadside villages or those easily accessible. These therefore emphasize the need for consecutive supervision more than concurrent supervision, particularly in areas which are not approachable by motor transport. Under the Indian programme, therefore, the main emphasis has been given to consecutive supervision, though concurrent supervision is necessary to ensure that the personnel are fully conversant with the proper method of spraying and with the formulations.

It is also essential that supervision be ensured from the highest level through all echelons.

### 1.7 Aggregation of labour and moving population

In construction, engineering and power projects labour is drawn from various parts of the country and it is likely that some of them may already be infected. Furthermore, in many areas lack of suitable building materials for huts and shanties make spraying operations difficult.

In the absence of adequate coverage transmission can continue unabated. Suitable provision should, therefore, exist to establish static squads in such areas, not only to spray such structures at periodic intervals but also institute spraying operations as soon as the new structures are built. These steps as well as chemotherapeutic measures often meet the desired results.

### 1.8 Resistance from the people

Resistance to accepting spraying operations in many areas has posed a serious challenge to the success of the programme. The factors responsible are the mental attitude of the people in areas where incidence of malaria has gone down very considerably. In such areas people are generally reluctant to be disturbed by spraying squads. Other factors responsible are bed-bugs nuisance, religious belief, etc. Added to this, the problem becomes more formidable when people resort to frequent mud plastering immediately after spraying operations. Need for health education and mass contact could not be over-emphasized under such circumstances, particularly in areas where bed-bug nuisance is acute. Occasionally judicious use of a mixture of DDT and diazinon may help in areas where refusal rate is extremely high.

## 2. Entomological factors

The more common factors involved for persistence of malaria transmission are:

### 2.1 Development of resistance in vectors to the insecticides in use

However, it should be borne in mind that this need not necessarily be responsible for persistent transmission. In this connexion it may be mentioned that a focus had been located in India in 1959 where the local vector, A. culicifacies, had developed a high degree of resistance. But, as transmission

continued to be interrupted, spraying operations were carried out up to 1961 and there had been no interference so far with the success of the programme. On the other hand, in a few other foci in other parts of the country the phenomenon of resistance had been attributed as responsible for the continuation of transmission. In such areas switching over of insecticides from DDT to BHC had considerably eased the programme. If such foci are small, judicious chemotherapeutic measures and use of sporontocidal drugs should help considerably.

It should, however, be borne in mind that before one attributes continued transmission to the phenomenon of resistance in any particular area, repeated trials would be necessary before one should give credence to such factors,

## 2.2 Secondary vectors

There has been some controversy regarding the importance of this factor. However, it is essential to know in all areas the role played by different vectors and the time of transmission. It should also be determined as to the part played by each during the main transmission season and the subsidiary seasons. Unless the bionomics of the vectors are different and vectors have developed resistance, judicious timing of spray operations should meet the problem.

## 2.3 Feeding and resting habits

Where the vector is both exophilic and exophagic, like A. nuneztovari in Venezuela, insecticide spray would be of little help. Special measures would have to be adopted under such circumstances.

In India, A. leucosphyrus plays secondary role in certain parts of the country. Although the vector is exophilic, it is usually endophagic and therefore this should not pose any serious challenge. However, a special WHO team has been established in this sector for detailed investigations.