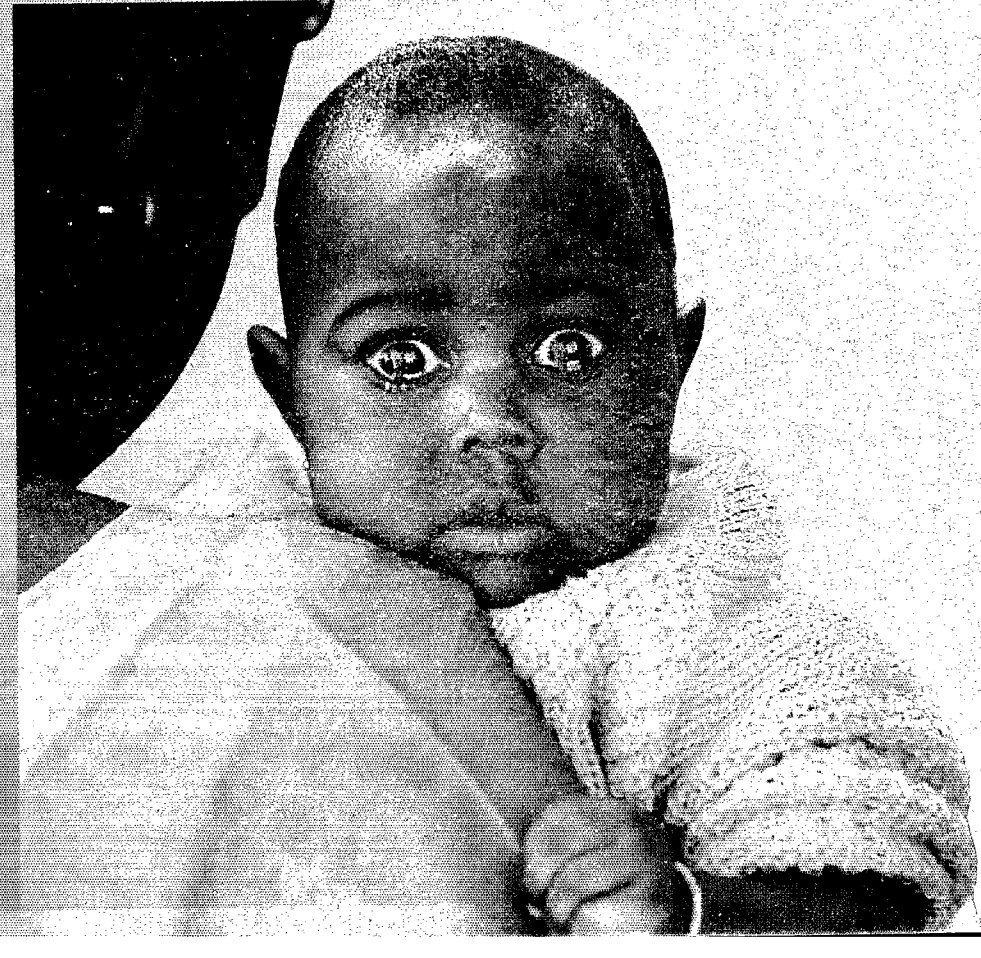
CONTROL OF TROPICAL DISEASES

MALARIA



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MALARIA

WORLD HEALTH ORGANIZATION
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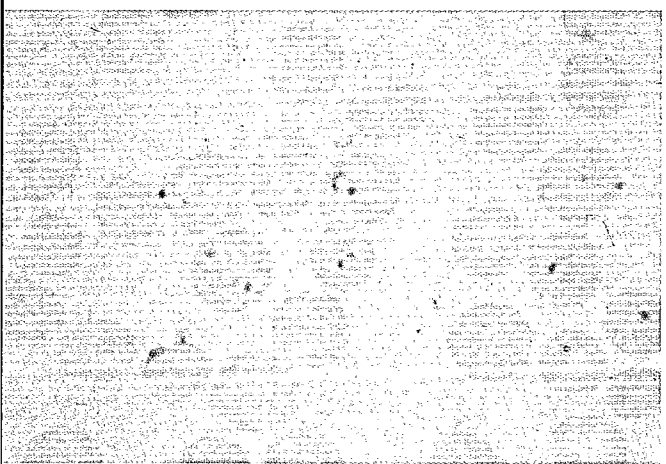

Blood smear showing ring-stages of *P. falciparum.*

MALARIA

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Malaria causes anaemia in children and pregnant women and increases their vulnerability to other diseases.

THE DISEASE

Malaria is one of the most serious and complex health problems facing humanity in the 20th century. Approximately 300 million of the world's people are infected by the disease and between 1 and 1.5 million people die from it every year.

Previously extremely widespread, the disease is now mainly confined to the poorer tropical areas of Africa, Asia and Latin America. The problems of controlling malaria in these countries are aggravated by inadequate health structures and poor socio-economic conditions. The situation has become even more complex over the last few years with the increase in resistance to the drugs normally used to combat the parasite that causes the disease.

Malaria is caused by protozoan parasites of the genus Plasmodium. Four species of *Plasmodium* can produce the disease in its various forms – *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale* and *Plasmodium malaria. P. falciparum* is the most widespread and dangerous of the four: untreated it can lead to fatal cerebral malaria.

Parasites are transmitted from one person to another by the female anopheline mosquito. The males do not transmit the disease as they feed only on plant juices. There are some 380 species of anopheline mosquito, but only 60 species are able to transmit the parasite. Like all other mosquitos, the anophelines breed in water, each species having its preferred breeding grounds, feeding patterns and resting place. Sensitivity to insecticides is also highly variable.

Severe malaria requires hospitalization.

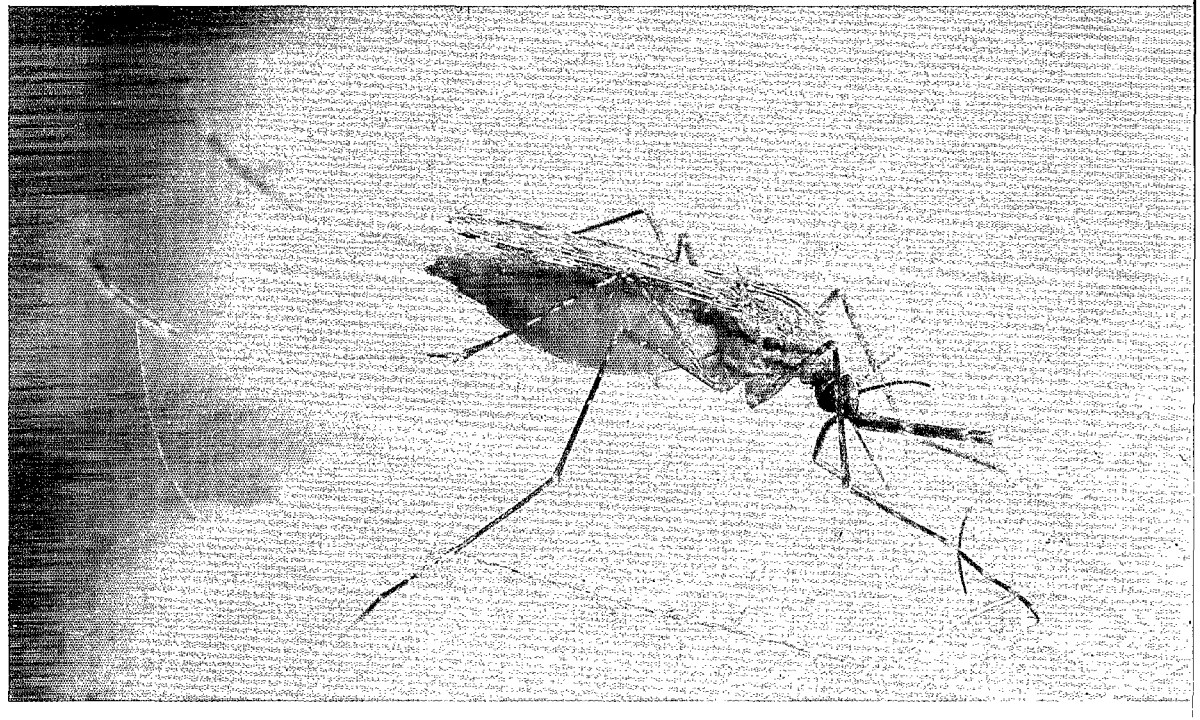
The parasites develop in the gut of the mosquito and are passed on in the saliva of an infective mosquito each time it takes a new blood meal. The parasites are then carried by the blood in the victim's liver where they invade the cells and multiply.

After 9-16 days they return to the blood and penetrate the red cells, where they multiply again, progressively breaking down the red cells. This induces bouts of fever and anaemia in the infected individual. In cerebral malaria, the infected red cells obstruct the blood vessels in the brain. Other vital organs can also be damaged often leading to the death of the patient.

Malaria is diagnosed by the clinical symptoms and microscopic examination of the blood. It can normally be cured by antimalarial drugs. The symptoms, fever, shivering, pain in the joints and headache, quickly disappear once the parasite is killed. In certain regions, however, the parasites have developed resistance to certain antimalarial drugs, particularly chloroquine. Patients in these areas require treatment with other more expensive drugs. Cases of severe disease including cerebral malaria require hospital care.

In endemic regions, where transmission is high, people are continuously infected so that they gradually develop immunity to the disease. Until they have acquired such immunity, children remain highly vulnerable. Pregnant women are also highly susceptible since the natural defence mechanisms are reduced during pregnancy.

A detailed knowledge of the ecology of the local insect vector and the behaviour of people in endemic areas is essential for determining the most effective methods to control the disease.



Female anopheline mosquitos transmit the parasite when they feed on the blood of humans.

IMPORTANT DATES

The symptoms of malaria have been known since time immemorial, although it was a long time before the actual causes were well understood. It was previously thought that "miasma" (bad air or "mal aria") emanating from swamps caused the disease. There is evidence that some ancient treatments were remarkably effective. The prescription of an infusion of qinghao *(Artemisia annua)* has been used in China for at least the last 2000 years, its active ingredient qinghaosu (artemisinin) having only recently been identified. In Peru, the antifebrile properties of the bitter bark of the cinchona tree *(Cinchona ledgeriana)* were known by local populations well before the 15th century. During the colonial period in the Americas, a Spanish physician who was well aware of the problems created by recurring fever among the people, advised his king, Charles III "to take the appropriate measures to supply all villages of the continent with this remarkable medicine at a moderate price to provide protection not only against fever, but also against the highly risky preparations of the apothecaries". Quinine, which has been used to treat and cure millions of malaria sufferers, was isolated in 1820 by the pharmacists Pelletier and Caventou and originates from this same cinchona.

Although in the past people were unaware of the origin of the recurring fevers and their mode of transmission, protective measures against the bite of the mosquito have been used for many hundreds of years. Herodotus (485-425 BC) noted that in the swampy region of Egypt, some people slept in tower-like structures out of the reach of the mosquitos, whereas others slept under nets.

Mass surveys to detect all parasite carriers were a feature of past control activities.

Systematic malaria control started after the discovery of the malaria parasite by Laveran in 1889 (for which he was awarded the Nobel Prize for medicine in 1907), and the demonstration by Ross in 1897 that the mosquito was the vector of malaria. These findings quickly led to control strategies and, with the discovery during the World War II of the powerful insecticidal effect of DDT, the notion of eradication. Effective and inexpensive antimalarial drugs of the chloroquine group were synthesized during this period.

Between 1955 and 1969, the WHO Global Malaria Eradication Programme launched a series of campaigns aimed at spraying the inside of homes with insecticide. The initiative proved successful in large areas of North America, Southern Europe, the former Soviet Union and some territories of Asia and South America. Transmission was halted and malaria was eradicated.

In Latin America and most Asian countries however, results varied and the disease persisted. The problems and logistics associated with malaria control were considered beyond the scope of the vast majority of African countries, and large scale eradication was never attempted. Epidemics frequently broke out in Central America and South East Asia – culminating in a massive epidemic in 1968 in Sri Lanka, where malaria was thought to have been eradicated. They also occured in some parts of Africa, where entire populations still suffer from the disease, as in 1988 in Madagascar when 25,000 people died from malaria.

The hope of global eradication of malaria was finally abandoned in 1969. Previous efforts had at least demonstrated that it was utopian to envisage eradication of the disease by campaigns based on a single strategy.

It is now clear that to be effective, control programmes be adapted to local conditions and involve the community at large, the general health services and those involved in development.

Provision of microscopical diagnosis and treatment is essential in the frontiers of development in Brazil where drug resistance is a problem

THE CURRENT SITUATION

Malaria is endemic in 91 countries with small pockets of transmission occuring in a further eight countries. *Plasmodium falciparum* is the predominant parasite. More than 120 million clinical cases and over 1 million deaths occur in the world each year.

Eighty per cent of the cases occur in tropical Africa. Malaria accounts for 10% to 30% of all hospital admissions and is responsible for 15% to 25% of all deaths of children under the age of five. Around 800,000 children under the age of five die from malaria every year. It is thus one of the major causes of infant and juvenile mortality. Pregnant women are also at risk since the disease is responsible for a substantial number of miscarriages and babies born underweight.

Malaria thus has disastrous social consequences and is a heavy burden on economic development. It is estimated that a single bout of malaria costs a sum equivalent to over 10 working days in Africa. The cost of treatment is between $US 0.08 and $US 5.3 according to the type of drugs prescribed as determined by local drug resistance. In 1987, the total "cost" of malaria – health care, treatment, lost production, etc. was estimated to be $US 800 million for tropical Africa and this figure is expected to be more than $US 1,800 million by 1995.

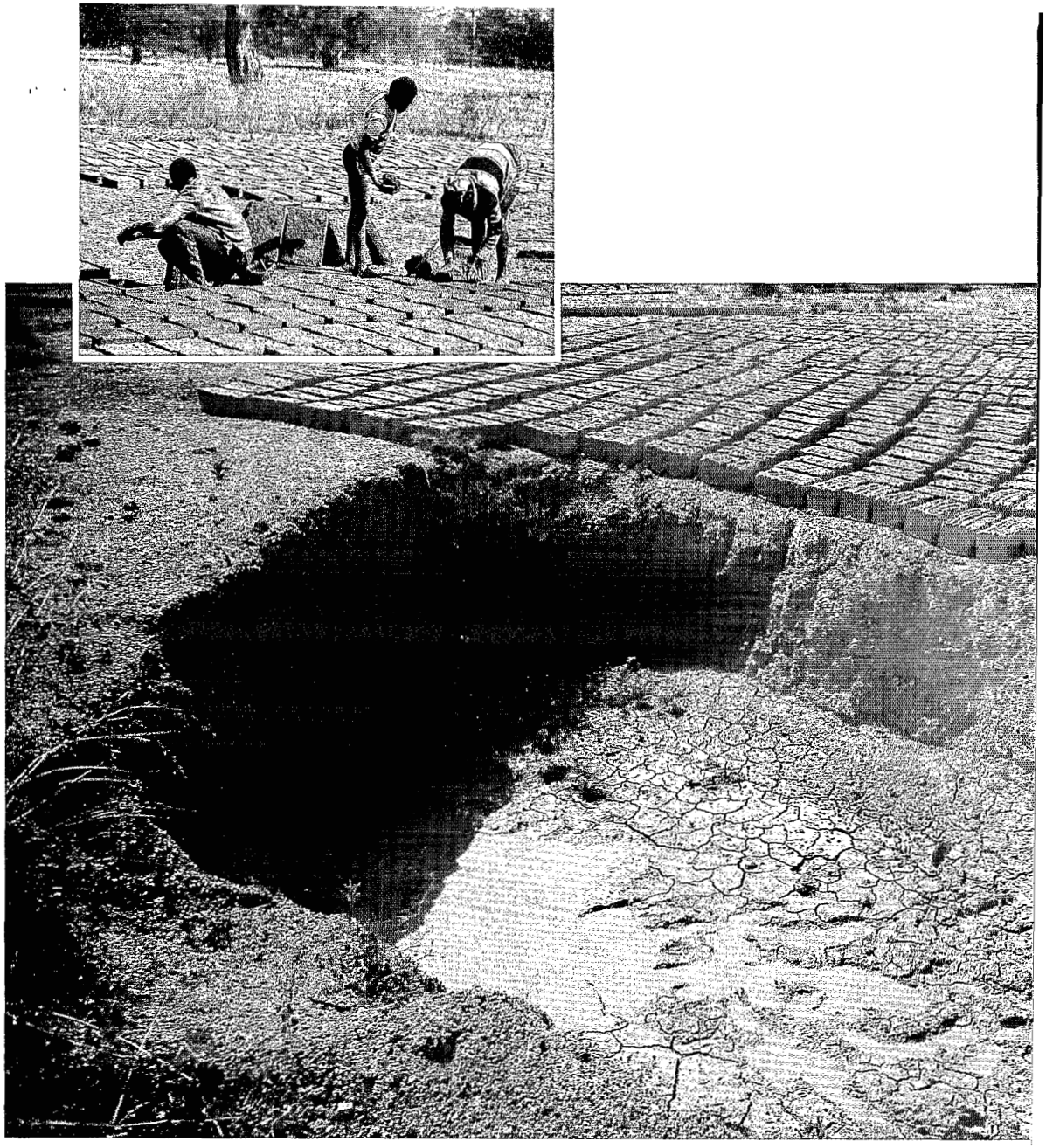
In other parts of the world, the distribution of malaria varies greatly from country to country and within the countries themselves. In 1990, 75% of all recorded cases outside of Africa

Open-cast mining in South-East Asia creates mosquito breeding sites.

were concentrated in only nine countries: India and Brazil (50%), Afghanistan, Sri Lanka, Thailand, Indonesia, Viet Nam, Cambodia and China. There are also marked differences in the distribution of the disease from one area to another. In India, the majority of reported cases occur in only a handful of states. In Brazil, close to 80% of all cases occur in three states of the Amazonian Basin representing a mere 6.1% of the country's overall population.

Today malaria is becoming an even greater health problem than before in many parts of the world; epidemics are even occuring around traditionally endemic zones in areas where transmission had been eliminated. These outbreaks are generally associated with deteriorating social and economic conditions, and main victims are underprivileged rural populations. Demographic, economic and political pressures compel entire populations (seasonal workers, nomadic tribes and farmers migrating to newly-developed urban areas or new agricultural and economic developments) to leave malaria free areas and move into endemic zones. These people are often non-immune and at high risk of severe disease. Unfortunately, these population movements and the intensive urbanization are not always accompanied by adequate development of sanitation and health care.

Moreover, in many areas conflict, economic crises and administrative disorganization result in the disruption of health services. As a result, control efforts are interrupted and more people are put at risk. The absence of adequate health services frequently results in a recourse to self-administration of drugs often with incomplete treatment. This is a major factor in the increase in resistance of the parasites to drugs.



House building in Africa also creates situations for malaria transmission.

Malaria is complex but it is a curable and preventable disease. Lives can be saved if the disease is detected early and adequately treated. It is known what action is necessary to prevent the disease and to avoid or contain epidemics and other critical situations. The technology to prevent, monitor, diagnose and treat malaria exists. It needs to be adapted to local conditions and to be applied through local and national malaria control programmes.

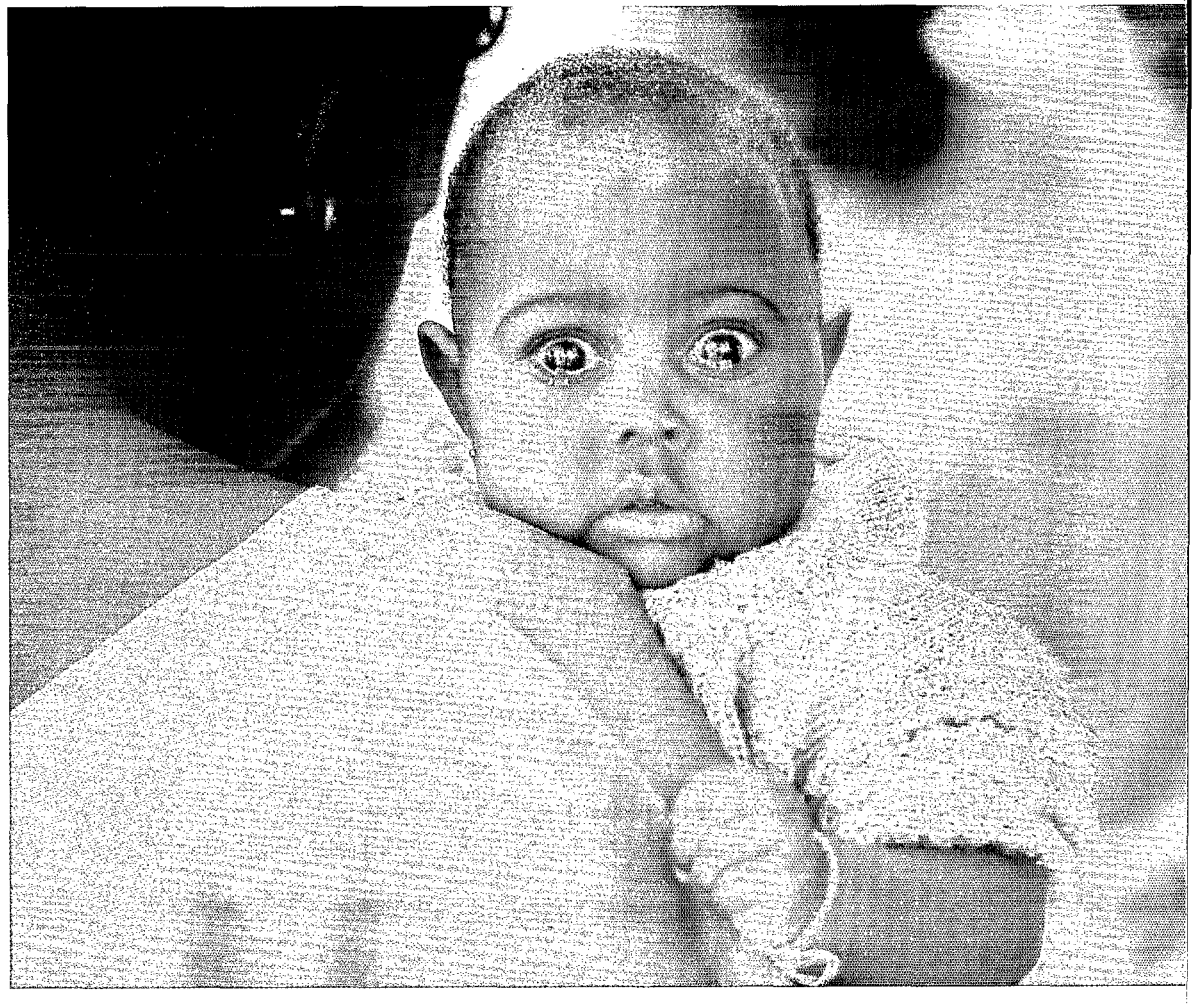
Two-thirds of the malaria cases in the Americas occur in the Amazonian basin as a result of colonization and mining.

ACTION

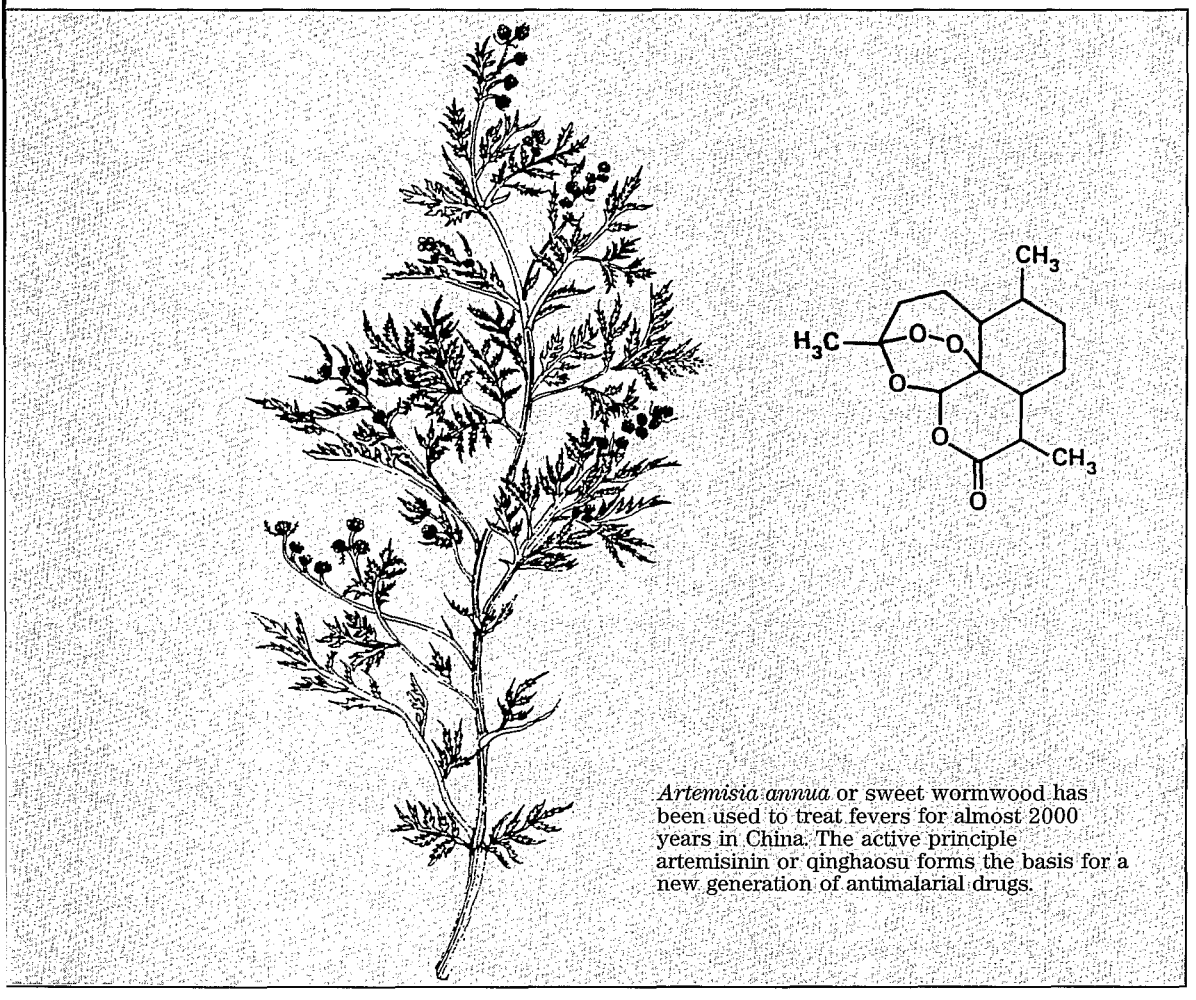
The goal of malaria control is to prevent death and suffering from the disease. The key is local action and the progressive strengthening of local and national capabilities for planning, implementation and evaluation. Community partnership, political determination and provision of sufficient funds and people are essential. Malaria control must be an integral part of health development and health must be a part of national development. In all situations, control programmes should be based on four main principles:

- Provision of early diagnosis and prompt treatment to all people at risk. This should be considered a basic right of all affected populations;
- Selective application of sustainable preventive measures, including vector control adapted to the local situations;
- An immediate, vigorous and wide-scale response to epidemics;
- The development of reliable information on infection risk, living conditions of concerned populations, and vectors.

In most countries, particularly in tropical Africa, the major task is to ensure that exposed populations are provided with early diagnosis and effective treatment. In Asia, Oceania and the Americas, most malaria eradication programmes and, theoretically their activities, have been integrated with the general health services. In reality, many of these programmes still adhere to an approach inherited from the eradication concept and have little contact with the general health services. Thus, in many cases, control



Children are at great risk from malaria. One child in 20 dies in Africa before the age of five years.



Artemisia annua or sweet wormwood has been used to treat fevers for almost 2000 years in China. The active principle artemisinin or qinghaosu forms the basis for a new generation of antimalarial drugs.

programmes need to be reoriented. The changes will mainly stem from new training and information programmes and the sustained motivation of the decision makers.

It is in this context that WHO is working alongside governments, international authorities and NGOs. Five types of activities are being developed and reinforced:

- support for national control programmes;
- training, information and education;
- prevention and control of epidemics;
- promotion and coordination of research;
- worldwide surveillance of the risks associated with malaria and antimalarial drugs.

WHO support for national control programmes is mainly in the form of technical collaboration aimed at reinforcing and reorienting the programme with emphasis on planning, management human resources development, information systems and operational research. Collaboration between countries and between regions is promoted through exchange of technical and epidemiological information. Links are established between the most underprivileged endemic countries and international cooperation agencies with a view to obtaining funds for control programmes.

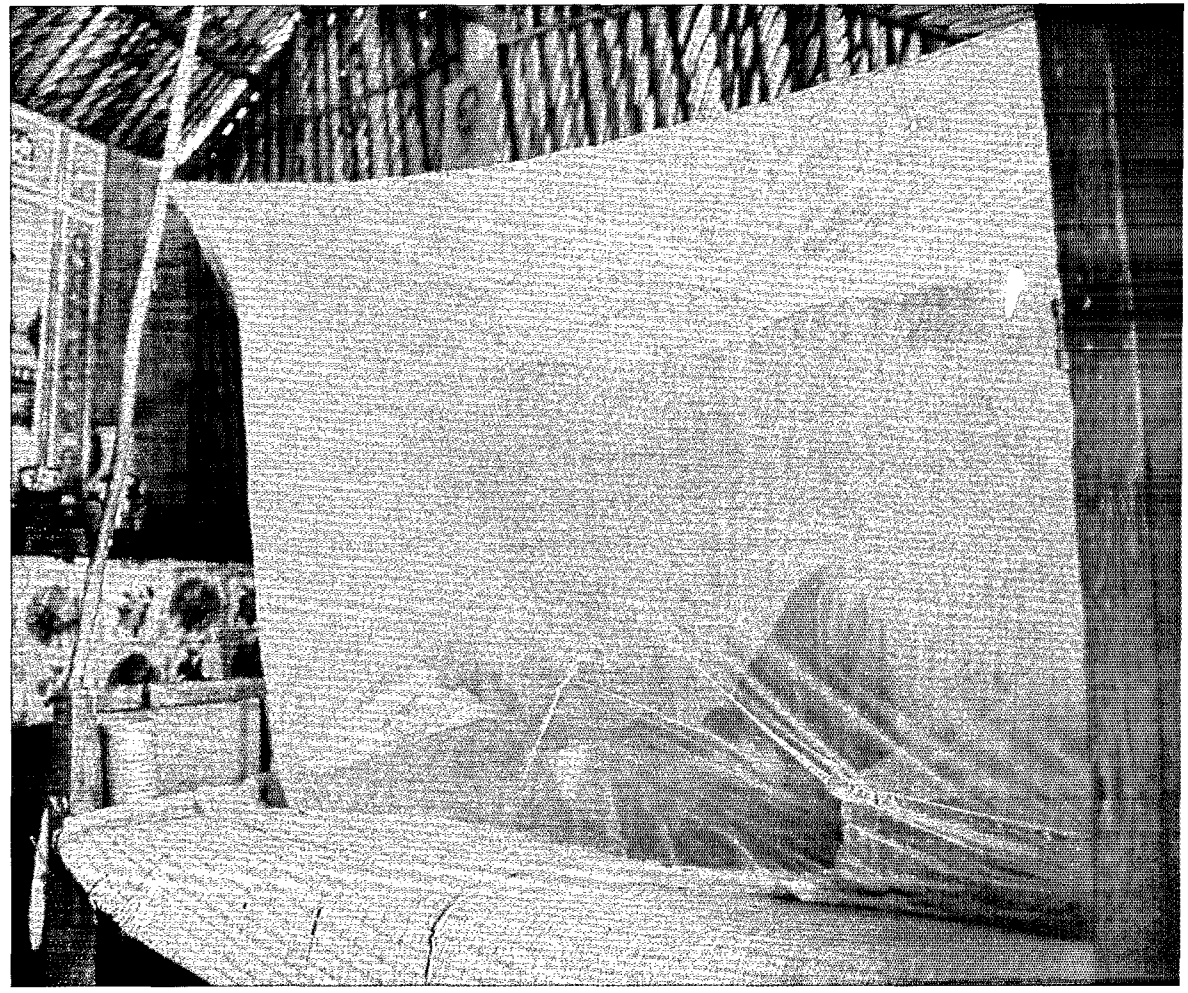
In the endemic countries, WHO actively develops courses and workshops on malaria control intended to back up training and to improve technical skills.

In relation to the control and prevention of epidemics, WHO should be in a position to respond to requests from countries in which the situation has seriously worsened by making a rapid

assessment of the situation, supporting the implementation of emergency measures and the planning of long-term programmes.

WHO plays a major role in research. Its programme, the World Bank/UNDP/WHO Special Programme on Research and Training in Tropical Diseases, supports research on new malaria control tools, attempts to upgrade existing tools and studies their application in different social and ecological situations. WHO is also fostering dialogue between operational research specialists and control programmes in order to ensure that useful research results are applied to control initiatives and that research meets programme requirements.

WHO coordinates worldwide surveillance of risks linked to malaria by collecting epidemiological data from affected countries and identifying trends. WHO also carried out investigations on specific drugs intended for the payment or cure of malaria. Computerized databanks are maintained on side effects of drugs, on the epidemiological situation in exposed areas, on the resistance of parasite to different drugs, and on control activities. The publication "International Traval and Health" is available for travellers and provides information on exposed areas, levels of parasite chemoresistance, recommendations for prevention and cure, etc.



More and more people are turning to bed-nets to protect themselves from mosquito bites and other nuisance insects.

CONCLUSION

The aims of malaria control programmes are simple – to prevent people from dying from the disease, to reduce the suffering it causes and to reduce the socio-economic cost. Effective tools to attain these objectives exist. Their application demands intersectoral collaboration and the political determination to mobilize all available human and financial resources in each country. Community partnership is necessary for responding to the needs of the affected populations, and in particular for successful long-term vector control, local environmental measures and acquisition and use of insecticide-impregnated bednets.

The time has come to reaffirm commitments and to step up control initiatives. It is up to the governments of endemic countries to show the way. Malaria is a disease closely linked with poverty; in order to combat disease and misery, the populations of endemic countries need ongoing support from the international community. The suffering and deaths of millions due to malaria can be avoided. A new wave of solidarity is essential for each country to develop its health structures as an integral aspect of social and economic progress.

◄ Impregnation of bed-nets with insecticide can improve protection and be carried out by community workers.

► Malaria can be cured and populations protected. This is fundamental right to everyone at risk. If action is taken now, there is a future for this baby.

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