

The prevention of malaria.

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NOT TO BE PUBLISHED

THE PREVENTION OF MALARIA

*This pamphlet is for the information
of all officers, who should convey the
information contained in it to the
non-commissioned officers and men
serving under them*

MALARIA IS A PREVENTABLE DISEASE

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THE PREVENTION OF MALARIA

1. THE IMPORTANCE OF MALARIA IN WAR

The effect of malaria upon armies operating in malarious areas cannot be exaggerated. The casualties caused by this *PREVENTABLE DISEASE* have invariably been higher than the battle casualties in every campaign conducted in a malarious country in this or any other war.

It is well known that malaria will attack newcomers from non-malarious countries much more severely than the local inhabitants of malarious countries, and that the very nature of military operations is often conducive to the creation of conditions favourable for the spread of the disease. Experience of military camps or cantonments in the tropics in peace time cannot be compared with active service conditions in malarious countries. The difference in degree is that between slight inconvenience and what may amount to total incapacitation.

Malaria is a preventable disease and, in view of the havoc which it may cause in a fighting force, it is obviously the duty of every officer and N.C.O. to do all in his power to safeguard the health and efficiency of the personnel under his command. The ways and means of preventing malaria are not difficult of comprehension, but if they are to be successful they must be carried out with extreme thoroughness. Fortunately, malaria is a seasonal disease in many countries and sustained effort is therefore necessary for only that part of the year when active transmission is going on—the "malaria season."

An intelligent understanding of the factors governing the transmission and spread of malaria, and of the principles underlying the preventive measures advocated, will facilitate the conduct of a successful anti-malaria campaign.

2. THE TRANSMISSION OF MALARIA

Malaria is a disease which is caused by a blood parasite and is transmitted from man to man by the bites of infected mosquitoes. If there were no infected mosquitoes malaria would die out. Not all mosquitoes are capable of transmitting

malaria, but only the females of some species of the genus *Anopheles*. Special training is required to distinguish the sex and the species of these mosquitoes; in the absence of this it is safer to consider them all as dangerous.

A mosquito becomes infected by taking the blood of an infected human and can then transmit the disease to healthy individuals after a period of at least ten days. Human beings harbouring malaria parasites in their blood are a source of danger to the healthy. For this reason the permanent residents ("natives") of a malarious locality are a source of infection to healthy troops and so, of course, are troops who have acquired malaria and who have not undergone an adequate course of treatment. Adequate courses are given under normal medical arrangements. (For any soldier to treat himself is contrary to M.E. Standing Orders for War, para. 1084, sub-para. 11).

Bearing these simple facts in mind, it will be clear that our efforts to prevent the incidence of malaria among troops must be directed upon the following lines:—

- (a) The selection of healthy sites for camps.
- (b) The protection of troops against the bites of adult mosquitoes.
- (c) The destruction of adult mosquitoes and control of their aquatic stages and breeding places.
- (d) Suppressive treatment.
- (e) Curative treatment of those suffering from malaria and their isolation.

Though special organisations exist for the more technical methods of attack directed against the transmission of malaria it will be realised that, under active service conditions, there will be difficulties in the way of employing elaborate control measures over extensive areas. It follows, therefore, that the nearer troops are to the front line the less work of this kind can be done for them and the more they must rely on measures of personal protection carried out by themselves.

3. THE MALARIA SEASON AND MALARIOUS AREAS IN THE MIDDLE EAST

(a) Malaria Season

In the Middle East this begins on April 1st and ends on November 30th, except in the Sudan and Eritrea, where it lasts the whole year.

(b) Malarious Areas

ALL the Middle East is malarious, with certain exceptions which are laid down either in Standing Orders for War, M.E.F., para. 1084, 6 (ii), or in Command Orders.

As these exceptions are liable to be changed they are not given here.

4. METHODS OF MALARIA PREVENTION TO BE CARRIED OUT BY UNIT COMMANDERS

(a) Selection of Healthy Sites for Camps

It is laid down that, before any camp is sited a reconnaissance must be made by a party which will include an officer of the medical services who will be detailed by the H.Q. of the Formation or Area concerned to advise on the site from the malaria point of view. If the recommendations of this officer, as detailed in his report, are not followed, the reasons for not doing so must be given.

It is obvious that camp sites must be selected with great care when operating in malarious areas. A unit camped on an unsuitable site may become severely infected with malaria, and even one night spent in such a place may give rise to a large amount of sickness.

Camps should be located as far as possible from villages or habitations, and from marshes and streams which are known or are suspected to be breeding places of mosquitoes. The fact that it may be necessary to transport water over increased distances should not over-ride the desirability of avoiding proximity to dangerous mosquito-breeding places. Where military considerations make it imperative to occupy unsuitable camp sites, preventive measures against malaria should be undertaken with special thoroughness. Attempts should be made to keep the main body of the troops in a healthy site at night, and to reduce the number present in an unhealthy one to an absolute minimum.

(b) Equipment of Troops Entering Malarious Areas

Units, parties or individuals proceeding into malarious areas during the malaria season should be fully supplied with all the necessary anti-malaria equipment and stores before going there.

(c) Personal Protection of Troops Against Mosquito-Bites

Personal protection against mosquito bites is the most important of all methods of malaria prevention under active service conditions and it should, therefore, be undertaken with special zeal by all ranks. Malaria-carrying mosquitoes attack man between sundown and sunrise, and it is only between these times that precaution need be taken. Some mosquitoes feed most actively at dusk, some during the night and some at or just before dawn. No relaxation of effort can therefore be permitted between dusk and dawn. The vicinity of all villages and all habitations used by local people, should be placed out of bounds between sunset and sunrise because infected mosquitoes abound in such places.

The methods of personal protection against mosquito bites most suited to active service conditions are: (i) The use of mosquito or sandfly curtains, or bush nets; (ii) the wearing of protective clothing; (iii) the use of mosquito repellents (anti-mosquito cream or liquid) applied to the exposed parts of the body. (See Appendix I.)

(i) *Nets or Curtains for Use against Mosquitoes or Sandflies*

If properly used, these are perhaps the most valuable single method of personal protection. There are no occasions on which their use can be dispensed with during the malaria season. Types suitable for service conditions are made available for issue to all troops. They must be carefully handled, and be inspected daily for the presence of tears and holes which, if found, must be repaired immediately. Owing to the difficulties in replacement of anti-malaria equipment it should be a matter of strict unit discipline that every effort is made to avoid damage to and loss of nets. If, for any reason, mosquito nets are not available, anti-mosquito face veils must be worn whilst sleeping at night.

(ii) *Personal Protective Clothing*

Mosquitoes will not bite through ordinary clothing unless it is thin and tightly stretched. They will, however, bite readily through ordinary socks or stockings but not through puttees. It is important that the body should be adequately protected against mosquito bites, not only while sleeping but also between sundown and bed time, and between reveille and sunrise. (It is often wise to postpone reveille, if possible, until after sunrise in highly malarious localities.)

Personal protective clothing consists of slacks and shirts, or jackets with long sleeves rolled down and buttoned at the wrist. This dress will be worn at all times between

sunset and sunrise except when the individual is under the protection of a mosquito net. Shirts or jackets with "cut-off" sleeves will *NEVER* be worn in the Middle East. Boots and anklets need only be worn as a malaria precaution when specially ordered. Anti-mosquito gauntlets are a D.M.S. controlled store and are only issued on the recommendation of the D.D.M.S., A.D.M.S., or S.M.O. (Independent Force), in special circumstances.

(iii) *Anti-mosquito Cream*

The cream should be smeared on and rubbed carefully into all exposed skin areas. Then a second layer should be smeared on over the first and allowed to dry on the skin. During the period of exposure to mosquito bites the smeared portions of the skin should be gently massaged for one minute every hour, without applying fresh cream. Fresh cream should be applied every four hours until sunrise or until protected by a mosquito net.

(iv) *Anti-mosquito Liquid (Insect Repellent)*

This is applied in the same way as cream, but the eyes and mouth should be avoided when using liquid. The hourly massage is omitted, but fresh liquid should be applied every four hours as in the case of cream.

Either anti-mosquito cream or liquid will be issued as a personal issue to all ranks, and are supplied in special containers. The omission of the use of either of these repellents can only be authorised by the G.O.C.

Details regarding the issue, use, maintenance and replacement of nets, veils and gauntlets, anti-mosquito cream and liquid, etc., are given in the Appendices.

(d) **Destruction of Adult Mosquitoes**

(i) *By Insecticidal Sprays*

The spraying of all occupied quarters, tents and bivouacs during the malaria season with Insecticide Spray ("flysol") at Reveille is now routine in malarious areas. The success, which has attended the use of this measure is attributable to the repeated opportunity afforded of killing mosquitoes which have fed on infected individuals before the mosquitoes actually become infective to man. As has been pointed out above, an interval of at least ten days must elapse to allow of the complete development of the parasite in the mosquito. Regular daily spraying greatly reduces the number of infected mosquitoes in barracks or camps, and this reduction

will be associated with a corresponding reduction in the number of malaria cases and in the severity of individual malaria attacks. When properly carried out, insecticidal spraying is a most valuable anti-malaria measure, and must be a carefully organised routine procedure during the malaria season. Details of the method of spraying and of the supplies and equipment necessary are given in Appendices II and IV.

(ii) *By Residual Spraying*

This consists of applying to walls and ceilings a solution containing a substance known as D.D.T. which is lethal to all insects. On drying, the solution leaves microscopic crystals of the above substance on the treated surfaces. Mosquitoes alighting even for a short period on a wall or ceiling which has been properly treated develop a progressive paralysis and die within a few hours.

If the directions given in Appendix II (f) are closely followed, one application should remain effective for several months.

(e) **Destruction of Mosquitoes in Their Aquatic Stages Within the Camp Area**

The egg, larval and pupal stages of mosquitoes develop in water. (These correspond to the egg, caterpillar and chrysalis stages of the butterfly). The time required for the completion of these three stages is over one week even under most favourable conditions. It follows that adult mosquitoes cannot emerge if water is not allowed to remain standing within camps for more than one week. Units are held responsible for ensuring that no water is left standing within camp limits for more than one week. The routine practice advocated is that a special inspection should be held between stated hours on a given day in each week during which all water containers are emptied and the absence of other standing water verified. In special circumstances it may be impossible to deal with *all* standing water in this way, and in such cases the advice of either the D.A.D.H. or O.C. Anti-Malaria Control Unit concerned may be obtained. In any case close liason must be maintained with the above officers and all possible assistance given in control work within the 3 km. range.

The technical methods of dealing with mosquito larvae cannot be dealt with in a pamphlet of this size.

(f) Suppressive Treatment

Suppressive treatment will prevent the development of Malignant Tertian Malaria altogether. Benign Tertian Malaria will not develop during its administration, nor will recipients become carriers of malaria and so a danger to other people.

The continued administration of a suppressive, such as mepacrine or atabrine, in the dosage ordered does not give rise to harmful effects, nor does it in any way affect the sexual functions. Its beneficial effects are not adversely affected by the rigours of a campaign.

Suppressive treatment saves much wastage of man-power by preventing not only illness from malaria, either permanently or temporarily, but also its spread. It will only be given when ordered by the D.D.M.S. and, once begun, will be maintained with the *utmost regularity* until the order to stop it has been given. It is pointed out that *irregularity* in the administration of suppressive treatment gives no protection.

Such treatment usually starts 14 days before exposure to risk of infection and continues for not less than one month after the risk has ceased, either because the malaria season has ended or because the formation concerned has moved permanently from the malarious area.

Mepacrine (or Atabrine, which is the American Army issue) is a medical supply, and the dose is *one tablet (0.1 gm.) daily (including Sundays) for all ranks*. It will be given on a parade supervised by an officer who should see that the tablets are actually swallowed. The best time for its administration is after the evening meal, i.e., on a full stomach and before rest. The tablet should be taken with water or tea, and the appropriate entry should then be made against each man's name in a register kept for the purpose. Any absentees should be traced and the fact that they have taken their daily tablet ensured. Officers and other ranks on detachment or on leave, even in non-malarious areas, must continue suppressive treatment. Small parties of men forward in battle areas will take their dose under the supervision of an N.C.O. or the senior soldier.

It must be emphasised that the administration of suppressive treatment does not imply that other orders as to the prevention of malaria may be relaxed. On the contrary, the fact that suppressive treatment has been ordered carries the implication that the area is highly malarious, hence all precautions must be carried out even more strictly, if possible.

(g) Curative Treatment

Any individual who develops fever must report sick at once, because it is useless for him to try to cure malaria in the absence of a full course of treatment. It has already been stated that men suffering from malaria will infect mosquitoes, thus becoming a factor in the spread of this disease. This is avoided by proper treatment in hospital where the patient is isolated until he himself is cured and the parasites circulating in his blood are killed off.

5. ORGANISATION AND DISCIPLINE

The prevention of disease in the field involves more than administrative and executive control or the provision of suitable equipment and stores. It calls for individual effort and care on the part of each officer and other rank, and determination on the part of both the higher and the subordinate commands to enforce sanitary discipline. It is, in fact, the influence and example of the individual more than the system which can be responsible for the maintenance of a high standard of health and the resulting high standard of efficiency.

Officers should impress on their men the dangers to health and efficiency which arise from attacks of malaria, and should explain to them the reasons for the anti-malaria measures enforced. Strong disciplinary action should be taken against those who fail to carry out routine preventive measures during the malaria season. Failure to observe such precautionary measures is tantamount to self-inflicted injury, and on a large scale may endanger the success of the campaign.

The Unit Commander is responsible that the above measures are carried out within his camp area. Outside the camp and within the 3 km. range the responsibility for the control of malaria devolves on the Anti-Malaria Control Unit under the direction of the D.A.D.H. concerned.

(a) Control Within the Camp

The Medical Officer will give lectures and demonstrations to all ranks on these precautions before the beginning of the malaria season and also from time to time during it. This will be supplemented by further training in these methods each week during the malaria season.

The Unit Commander should appoint one officer as Unit Anti-malaria Officer during the malaria season. This Officer will ensure that all unit and personal precautions are carried out and that equipment is up to scale and serviceable. For

this it will be necessary that frequent inspections be made, day or night, of the state and use of nets, clothing, repellents, administration of suppressive treatment, etc.

The Unit Commander should also detail an Anti-Malaria Squad consisting of one N.C.O. and three other ranks per infantry battalion or similar unit, and a proportionate number for other units. This squad will be in addition to other sanitary personnel, and a trained reserve of 100 per cent. will be maintained. Such squads will be trained by Field Hygiene Sections or Anti-Malaria Control Units.

The measures advocated for use by units are not difficult, irksome, nor time-consuming if they are properly organised and carried out as part of the regular routine of camp life. In many places the enforcement of anti-malaria measures will be necessary for only a few months at a time, and on their careful execution will depend the health and efficiency of the unit for the entire year.

Defects in the working of routine anti-malaria measures in units will only be detected if frequent and thorough inspections are carried out. Officers on orderly duty should give special attention to this. The amount of malaria sickness which develops later may also be an indication of imperfect measures of personal prevention.

(b) Control Outside the Camp

The responsibility for the control of malaria outside the camp for an area which has a radius of 3 km. will be undertaken by special units formed and trained for the purpose—the Anti-Malaria Control Unit. The units are under the supervision of the D.A.Ds.H. and, as has already been mentioned, will help with advice and, in special cases, control within the camp. In such an event contact should be made with the D.A.D.H. concerned.

6. STANDING ORDERS FOR WAR, M.E.F.,

“PREVENTION OF MALARIA”

The orders and regulations on this subject are laid down in Standing Orders for War, M.E.F., para. 1084, and Appendices 48, 49 and 50, which must be read and understood by all officers.

It is further laid down that sub-paras. 8 (a) and (b) of this Order will be read out on a parade to all other ranks and will be published in unit orders monthly during the malaria season. These sub-paras. refer to Personal Precautions.

APPENDIX I

PERSONAL ANTI-MALARIA EQUIPMENT

In view of the great wastage of man-power that malaria may cause during the malaria season, every Officer, N.C.O. and man should be in possession of : (i) Personal protective clothing ; (ii) an appropriate mosquito or sandfly net ; and (iii) anti-mosquito cream or liquid in a proper container.

These articles should be a personal issue to all troops in malarious areas, and should be in their possession immediately *before* the malaria season starts or *before* troops enter a malarious country during that season. Their possession should be verified at every kit or equipment inspection made during that period.

1. PROTECTIVE CLOTHING

It is repeated that between dusk and dawn slacks and shirts or jackets with long sleeves rolled down and buttoned at the wrist **MUST** be worn. This order applies to **ALL** ranks stationed in malarious areas throughout the malaria season.

A watch should be kept for worn clothing through which a mosquito can bite and, for the same reason, men should be warned against allowing clothing to become tightly stretched, as at the knees when sitting.

2. MOSQUITO OR SANDFLY NETS OR CURTAINS

(a) Types of Nets

(i) *Curtain, Mosquito or Sandfly*

These nets are either bell-shaped or boot-shaped. The former requires an iron ring for its proper suspension and is most suitable for issue to hospital and base installations where beds are in use.

The boot-shaped net does not require a ring and its suspension is much more easy. It can be used for any type of bed or where troops sleep on the floor. It is intended for troops on L. of C.

(ii) *Bush Nets*

These are low rectangular nets provided with four supporting poles erected by means of guy ropes and pegs. They are intended for use when troops are operating in the open.

(iii) *Tents, Bivouac, Sandfly or Mosquito-proof*

The mosquito-net in this case forms a detachable lining of the tent which accommodates two men. They are issued to forward troops only.

Mosquito-nets are issued by the R.A.O.C. (see Appendix III), and are a personal issue. Under no circumstances should nets be withdrawn in malarious areas during the malaria season. They should be carried with unit equipment.

(b) **The Use of Mosquito-Nets**

Mosquito nets must be inspected daily to ensure that they are in good repair. All tears and holes should be repaired immediately. Mosquito nets must be put up and arranged so as to prevent the entry of mosquitoes. Those used with beds should be put down one hour before sundown and be carefully tucked under the mattress. Bush nets and tents, bivouac, are provided with pockets which should be filled with sand or stones to keep the lower edge of the net in close contact with the ground. Care should also be taken that the lower edges of the tents are pegged tightly against the ground. All troops should receive special instruction as to the proper method of using nets. Close contact of bare limbs with the nets should be avoided because it will allow the mosquito to bite through the net. The bed-roll should be made as wide as possible to minimise this risk.

3. ANTI-MOSQUITO CREAM OR LIQUID

This is issued by the R.A.S.C. (see Appendix IV). If anti-mosquito cream is issued each man is supplied with a dual container which holds the cream at one end and mepacrine tablets at the other. In the case of liquid the tablets are carried separately either in a small tin or in wax paper. Troops should be trained in distinguishing the ends of these containers in the dark.

APPENDIX II

ANTI-MOSQUITO SPRAYING

1. REQUIREMENTS

(a) **Spray Apparatus**

Pumps, spray, for use with Flysol are a R.A.O.C. supply, and are authorised for 10 per cent. of the strength for use against mosquitoes, *plus* 2 per cent. for anti-fly purposes.

These pumps are similar to the ordinary "flit gun." In addition, larger continuous sprayers known as the "Manney Hand Spray" are authorised on the scale of 1 per 150 men in certain areas.

(b) Spray Mixture

Insecticidal spray is used, and is a R.A.S.C. supply. The scale of issue is given in Appendix IV.

2. APPLICATION OF MOSQUITO SPRAYING

(a) The object to be attained is to produce a fine cloud of spray in the quarter to be treated. The cloud should permeate to all corners. The effect of the spray is independent of direct hits on mosquitoes and is analogous to fumigation. It is estimated that the amount of Flysol required to create an adequate cloud is 1 oz. per 3,000 cubic feet of space in the barrack, hut, tent or bivouac treated. The following information will serve as a guide to the amounts required.

- (i) Barrack Room 60 ft. \times 18 ft. \times 12 ft. requires $4\frac{1}{2}$ ozs. or about 400 full strokes of the pump of the Flit gun.
- (ii) Tents, I.P., Privates, require $\frac{3}{4}$ oz. or about 75 full strokes.
- (iii) Tents, I.P., S/Sgts., require $\frac{1}{4}$ oz. or about 25 full strokes.
- (iv) Tents, 180 lbs., require $\frac{1}{4}$ oz. or about 25 full strokes.
- (v) Tents, R.D., require $\frac{1}{3}$ oz. or about 35 full strokes.
- (vi) Tents, C.D., or C.S. require $\frac{1}{5}$ oz. or about 20 full strokes.

When an adequate cloud has been produced the eyes begin to smart ; this is a reliable guide that the proper dose has been given.

(b) Spraying is most efficacious when carried out as soon as possible after dawn in order to catch mosquitoes before they are disturbed and leave the quarters.

(c) Thus it is laid down that all occupied quarters, tents and bivouacs will be closed immediately after Reveille. They will then be sprayed with Flysol and left closed for 30 minutes.

(d) Under special conditions spraying may be necessary in the evening as well as at Reveille, when extra issues of Flysol may be authorised.

(e) Units must arrange the details of spraying operations to suit their circumstances. Unit anti-malaria

squads may be employed for this work in the case of barracks or huts, but in the case of tents it may be more convenient to detail one man to take charge of spraying each tent. Constant change of personnel engaged in spraying is not desirable.

(f) *Residual Spray.*

(i) This is applied by special sprayers, on loan from authorised sources or, in urgent cases, distemper brushes may be used.

(ii) The walls and the ceilings must be treated.

(iii) The solution of 5 per cent. D.D.T. in kerosene is supplied already mixed. 1 gallon of this solution is required for 1,000 sq. ft. of surface and *not less must be used.*

(iv) This solution is unsuitable and dangerous for ordinary spraying with flit and similar guns.

(v) Food and utensils must not be exposed during the application of this solution, and men working with it must be protected by anti-gas gloves, capes and eye-shields. They must wash well with soap and water when the work is finished.

APPENDIX III

(STANDING ORDERS FOR WAR, M.E.F. PARA. 1084,
APPENDIX 49)

SCALE OF UNIT ANTI-MALARIA EQUIPMENT

	<i>Scale of Issue</i>	
	FIELD UNITS (regardless of location)	BASE and L. of C. UNITS on Scale A tentage in standing camps or bar- racks in mala- rious areas.
Dual anti-mosquito cream/ mepacrine containers	1 per man	1 per man
Bush nets	1 per man	— —
Tents, bivouac, sandfly-proof ...	1 per 2 men	— —
Curtains, mosquito or sandfly	— —	1 per man
Fillers, anti-mosquito cream ...	1 per unit under 400	1 per unit under 400
	2 per unit over 400	2 per unit over 400

In addition to the above equipment, a small quantity of veils and gauntlets, anti-mosquito, will be held by Ordnance as a D.M.S. controlled store for issue on the recommendation of D.D.M.S. (or senior administrative medical officer).

APPENDIX IV

(STANDING ORDERS FOR WAR, M.E.F. PARA. 1084, APPENDIX 50 AS MODIFIED BY M.E.G.O. 1185 of 1944)

SCALE OF R.A.S.C. SUPPLIES—ANTI-MALARIA MEASURES

<i>Item.</i>	<i>Scale of Issue.</i>
Anti-Mosquito Cream ... 185 lbs. per 1,000 men per month. (or)	
Insect Repellent (Anti-Mosquito Liquid) ... 25 galls. per 1,000 men per month.	
Insecticide Spray (Flysol) ... 50 galls. per 1,000 men per month.	
For use with each power-driven sprayer ... 150 galls. per sprayer per month.	

APPENDIX V

(STANDING ORDERS FOR WAR, M.E.F. PARA. 1084, APPENDIX 51)

SCALE OF ANTI-MALARIA EQUIPMENT FOR REGIMENTAL UNITS, PER COMPANY OF 150 OR EQUIVALENT UNIT

<i>Scale of Issue</i>	
Pumps, spray, (guns Flit), for use with insecticide spray (anti-mosquito only) 10% Strength	
Hand sprayers, Manney or Mysto * ...	1
Ladles, white ...	1
Shovels, G.S. ...	1

* To be issued only for the use of troops in barracks, huts, billets and houses, or when recommended by the D.D.M.S. for special conditions.



