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MALARIA
MAY, JUN. 1944

HEADQUARTERS
ALLIED CONTROL COMMISSION
PUBLIC HEALTH SUB-COMMISSION
MALARIA CONTROL BRANCH
APO 394

16 June, 1944.

TECHNICAL MEMORANDUM)

NUMBER 4)

NOTE OF THE PREPARATION OF MALARIA WITH
ATABRINE-NEPACRINE

1. INTRODUCTION.

Although a fair amount of atabrine was used in Italy before the war, quinine was the drug most commonly employed for treatment of malaria. During the present season, practically no quinine will be available for treatment of civilians, except where local supplies remain from last year. Therefore, it seemed logical to prepare this memorandum on the subject of atabrine and its use in malaria therapy. The views presented are those of a majority of observers but in no sense whatever constitute a directive. Some of the information may be of use to Regional Public Health Officers for presentation to civilian doctors. Prophylaxis is not discussed because supplies of atabrine are not sufficient for suppressive treatment of civilians.

2. ATABRINE - NEPACRINE.

a. Atabrine is an acridin dye, a bright yellow, odorless, crystalline powder having a bitter taste. It was developed in Germany, first appeared during the years 1930-33, and since that time has come into world-wide use. According to the U. S. Pharmacopoeia, atabrine has the following formula: $C_{23}H_{30}ClN_3O \cdot 2HCl \cdot 2H_2O$

Atabrine and closely related compounds have appeared under a confusing variety of names, some of which are given in the following table:

<u>Acridin X:</u>	An Indian, atabrine-like compound;
<u>Acridiquine:</u>	Russian trade name;
<u>Atabrine:</u>	Winthrop trade name for atabrine hydrochloride for U.S.A. and possessions; (Other U.S.A. firms are now also making atabrine under the Winthrop patent);
<u>Atabrin:</u>	German trade name;

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<u>Acrifluine:</u>	Russian trade name;
<u>Atabrine:</u>	Winthrop trade name for atabrine hydrochloride for U.S.A. and possessions; (Other U.S.A. firms are now also making atabrine under the Winthrop patent);
<u>Atebrin:</u>	German trade name;
<u>Chemicochina:</u>	Italian product akin to atabrine;
<u>Chinacrin dihydrochloride:</u>	Former non-proprietary name used in New and Non-official Remedies, U.S.A.;
<u>Erion:</u>	Former German experimental name. Sometimes used as non-proprietary name in British colonies;
<u>Italichina:</u>	Italian atabrine;
<u>Mepacrine hydrochloride:</u>	Official British Pharmacopoeia name;
<u>Metocquine:</u>	Winthrop trade name in Latin America;
<u>Quinaorins:</u>	French trade name. Also used by English firm, May and Baker;
<u>Quinacrine hydrochloride:</u>	Official U.S.A. Pharmacopoeia name;
<u>Atebrin masonat:</u>	German trade name for dimethylsulphonate of atabrine, formerly used for parenteral injections;
<u>Atepe:</u>	German trade name for a combination tablet of atabrine 0.1 gram and plasmochin 0.01 gram;
<u>Metocquine compuesta:</u>	Winthrop trade name for atepere;

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b. Action on sporozoites.

There is no experimental proof that atabrine has any effect on sporozoites, hence the general belief that it will not prevent infection.

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c. Action on schizonts.

Atabrine is essentially a schizonticide, highly active against asexual forms of all species of the plasmodia of human malaria. Against some strains of P. falciparum, atabrine seems more effective than quinine. For instance, James found that he could control infections caused by an Italian strain of falciparum more readily with atabrine than with quinine. Ciucea and his colleagues had the same experience in Roumania. On the other hand, Field observed that Malayan strains of falciparum responded a little better to oral quinine than to oral atabrine.

Atabrine in 0.3 gram daily initial doses acts more slowly than the usual doses of quinine (10-15 grains) in cases of falciparum malaria, but somewhat more rapidly in vivax infections. With higher initial doses of atabrine the two drugs appear to be equally effective.

It is not known how atabrine acts to cure malaria but the experiments of James suggested a more direct attack on the parasite than is seen with quinine.

d. Action on gametocytes.

Atabrine, like quinine, does not destroy falciparum gametocytes nor have any apparent effect on their vitality. Of course, by its effective action on schizonts, it gradually causes the disappearance of falciparum gametocytes by bringing an end to schizogony. Vivax gametocytes usually disappear as rapidly under atabrine as under quinine treatment. Quartan gametocytes are generally more resistant.

e. Action as regards relapses.

When atabrine first appeared it was thought to have a higher sterilization value than quinine. But with wide-spread use during the past few years, early optimism has gone and it is generally believed that there is not much difference between short courses of quinine and the usual atabrine treatment in regard to the prevention of vivax relapses. It may be that the use of higher initial doses of atabrine will give better results. In general, atabrine seems more effective than quinine in preventing falciparum relapses.

f. Plasma concentration.

It is known that upon absorption, atabrine is taken up by many tissues of the body. As regards its action on malaria, the concentration of atabrine in blood plasma is of the greatest importance. Methods for determining plasma atabrine levels have been devised and are becoming available in Army hospitals.

g. Excretion of atabrine.

Atabrine is slowly excreted and has been found in the urine of patients as long as two months or more after treatment. This is in marked contrast to quinine.

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g. Excretion of atabrine.

Atabrine is slowly excreted and has been found in the urine of patients as long as two months or more after treatment. This is in marked contrast to quinine, which is generally not found in the urine for more than two days after treatment has been stopped.

3. TREATMENT.

a. General statement.

Treatment regimes for malaria have been more numerous than malaricologists. No series of cases has seemed too small, no bed-side experience too limited, for the addition of another item to the already mountainous accumulation of notes on ways to treat malaria.

The reasons are obvious. In the first place, malaria is probably the most important disease in the world today. Secondly, there has been no treatment devised thus far which will prevent malarial relapses in a considerable percentage of cases. Thirdly, many cases of malaria certainly will proceed to recovery on any medication or without medication. Finally, the term malaria refers to a complex of diseases, caused by one or more of four recognized species of plasmodia, each consisting of little known, but probably numerous strains which, even within the same species, vary widely in virulence and in response to therapy. In these circumstances, it is natural that search for a better anti-malarial continues. The clinician without sufficient experience or who is not statistically educated, frequently gives weight

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to results which have no real significance.

Although doubtless close at hand, the day is not yet here, when it is proper to advocate specific therapeutic regimens for individual species (and perhaps strains) of plasmodia. At present, despite the variety of types of clinical malaria, it is practical, for purposes of treatment, to consider each type under one or the other of two categories:

- (1) Malaria cases in which oral medication is possible;
 - (2) Malaria cases in which oral medication is not possible immediately.
- b. Malaria Treated by Oral Medication.

As a general rule, any patient with malaria who can swallow and retain an anti-malarial drug should be treated orally, not parenterally. The exceptions are:

- (1) Patients with cerebral or algid malaria;
 - (2) Patients suffering from hemorrhagic falciparum malaria, with epistaxis, rectal bleeding, or petechial hemorrhages;
 - (3) Patients with severe gastro-intestinal symptoms;
 - (4) Patients with *P. falciparum* infections, who have hyperpyrexia or whose blood smears show that five percent or more of the erythrocytes are parasitized;
 - (5) Patients who retain medication, but do not absorb it and who, therefore, do not respond to the anti-malarial therapy, but remain seriously ill.
- Only such patients, (provided diagnosis of malaria has been confirmed by positive blood smear) and those others who can not swallow or retain medication, should be treated parenterally.

The standard treatment of malaria with atabrine has usually consisted of three tablets a day for five days. These tablets are given, one after or during each meal, with a glass of water or fruit juice. Sometimes this regime is initiated by giving quinine sulfate, 10 grains, three times a day for two or three days before starting the course of atabrine. This is the treatment recommended for civilian use in Italy in 1944, using the preliminary quinine if local stocks are available. Children under 1 year will tolerate 0.05 gram of atabrine daily; 1-4 years of age, give 0.1 gram daily; 5-8 years of age, give 0.2 gram daily; over 8 years, give adult dose of 0.3 gram daily. Administer the fractional doses in milk if possible.

- (3) Patients with severe gastro-intestinal symptoms; epistaxis, rectal bleeding, or petechial hemorrhages;
 - (4) Patients with P. falciparum infections, who have hyperpyrexia or whose blood smears show that five percent or more of the erythrocytes are parasitized;
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It now appears that, analogous to sulfanamide therapy, it is desirable to obtain a relatively high plasma level of atabrine early in the treatment. The following regime has been adopted by the Surgeon General of the United States Army and has had the approval of the National Research Council:

1st day. - Atabrine hydrochloride 0.2 gram (3 grains) and sodium bicarbonate 1 gram (15 grains) by mouth, with 200 to 300 c.c. of water, sweetened tea, or fruit juice, every six hours for five doses. This is a total of 1 gram of atabrine (15 grains) during the first 24 hours.

2nd to 7th days. - Atabrine -(mepacrine) hydrochloride 0.1 gram (1½ grains) three times a day with or immediately after meals.

By this regime the patient receives a total of 2.8 grams of atabrine during one week's treatment. No plasmoquin (pamoquin) is given, as a rule. If a relapse occurs, it is treated as a new infection.

In the British Army, the standard treatment at present consists of quinine, Grains 10, in solution three times daily for three days, then mepacrine 0.1 gram three times daily for five days. The mepacrine is started on the third day of treatment and is given concurrently with the quinine on that day. Following the last day of atabrine, there are two days of rest from treatment.

Then pamoquin (plasmoquin) 0.01 gram is given three times daily for three days.

c. Malaria Requiring Initial Parenteral Treatment.

Whenever malaria is complicated by disorders such as intense nausea, petechial hemorrhages, severe intestinal colic, diarrhea, epistaxis, rectal bleeding, parenteral treatment is indicated. This also applies to patient whose blood smears show that five percent or more of the erythrocytes are infected with P. falciparum. Parenteral therapy should also be administered to those who have a positive blood smear but do not respond to oral therapy, remaining seriously ill at the end of the 3rd day of treatment.

Many observers believe that atabrine should not be given intravenously because sudden, and sometimes fatal, toxic reactions may occur. But atabrine functions well when given intramuscularly and is not toxic in the usual doses. The following procedure is recommended by the Surgeon General of the U.S. Army with concurrence by the National Research Council:

Atabrine (mepacrine) dihydrochloride 0.2 gram (3 grains) in sterile distilled water 5 c.c., is injected intramuscularly, with the usual precautions, into each buttock. (Total 0.4 gram or 6 grains). If necessary, one or two similar doses of 0.2 gram (3 grains), may be given at intervals of six to eight hours. As soon as oral administration is feasible, atabrine hydrochloride should be given by mouth, as described above, in such doses as to give a total by both routes together of 1.0 gram (15 grains) in the first 48 hours. This should be followed by 0.1 gram (1½ grains) three times a day with, or immediately after, meals for five days.

Some quinine dihydrochloride will be available for civilians requiring parenteral treatment. It should be given intravenously in doses of 0.6 gram (10 grains) in sterile physiological saline 300 to 400 c.c., injected slowly. This dose may be repeated in 12 hours. Then oral atabrine should be started.

4. TOXIC MANIFESTATIONS OF ATABRINE - MEPA CRINE.

Atabrine is capable of causing toxic reactions and is not tolerated by certain individuals, even in average therapeutic doses. The toxic symptoms of atabrine vary from mild gastric discomfort to severe vomiting and diarrhea, with abdominal cramps. Headache and fever may be present. Existing diarrhea and dysentery may be intensified. Mental symptoms, such as lightheadedness, mild excitement, and, rarely, transient psychoses, have been reported. In a percentage of cases there may appear a lemon-yellow tinting of the skin, because of the deposition of atabrine dye. It must be emphasized that this yellowing of the skin does not indicate a toxic reaction.

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5. TREATMENT OF CIVILIANS.

It will frequently not be possible to treat civilian malaria in hospitals or even in homes. Cases will come to ambulatory or dispensaries for treatment which they may or may not receive from skilled hands. Such cases, which may be a majority in some areas, will usually have to be treated from day to day as they apply at the dispensary. A complete course of atabrine tablets may not safely be given into the keeping of these cases at the first visit. For atabrine commands a high price in the black market, and, moreover, even those who would follow directions may not know how to do so. Therefore, almost all that can be done is to administer two tablets and give the patient one more with instructions to take it before going to bed, and to return for similar treatment each day for a week.

In most provinces patients will be treated free in their homes by a community doctor, engaged by the local anti-malaria committee, the Medico Provinciale, or by a bonification scheme. Each Regional Public Health Officer should attempt to have such a scheme functioning properly in malarious communes, and to see that adequate supplies of atabrine are available. As stated in Executive Memorandum No. 54, dated 25 April, 1944, paragraph 10, "Each Regional Health Officer, A.C.C., will requisition from the Medical Supply Branch, Public Health Sub-Commission, ACC, the amount of atabrine/mepacrine required by his regional provinces. The supply Branch will send the desired amount to the Regional Headquarters, from which provincial distributions will be made to the local malaria committees on requisition".

6. SUPERVISION.

Finally, it must be stressed that atabrine supplies are limited and if wasted or used for prophylaxis, they may be insufficient for therapeutic needs towards the end of the season. Therefore, careful supervision of the atabrine supplies is required. No civilian clinical case of malaria need go untreated this year if (a) suitable organization for treatment is set up in each malarious commune; (b) suitable requisitions are made for the required supplies; and (c) if the atabrine supply is properly used.

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Chief, Malaria Control Branch, ACC.

HEADQUARTERS
ALLIED CONTROL COMMISSION
PUBLIC HEALTH SUB-COMMISSION
MALARIA CONTROL BRANCH
APO 384

TECHNICAL MEMORANDUM)

NUMBER 3)

1 June 1944

SUBJECT: HAND-KILLING ADULT MOSQUITOES.

1. INTRODUCTION.

The Malaria Commission of the League of Nations in 1927 recommended that, "An active and energetic endeavor should be made, wherever possible, to induce householders, especially housewives, to make the killing of adult mosquitoes found within the house a part of the daily cleaning task". The Commission was convinced that, "this measure, if it could be effectively carried out, would have very remarkable results".

As a matter of fact, this measure was used effectively by Gorgas in the Panama Canal Zone, where systematic hand destruction of adult mosquitoes notably reduced malaria incidence in certain installations. Ross, in 1911, also emphasized the possibilities of this method and suggested that children should carry it out.

Certain popular malaria control bulletins published by the Italian Government, prior to the war, included hand-killing of adult anophelines among practical measures believed to be within the capabilities of average families.

But not much attention has been paid to these considerations because, normally, it has been easier to use other means of destroying mosquitoes or of screening them out. Even in countries like Italy, where malaria carrying anophelines usually spend their daylight hours resting on walls and ceilings of bedrooms and stables, easily accessible, very little hand-killing of these insects has been practiced.

Yet this measure of hand-killing adult anophelines in the daytime would seem to have potential value, especially during the present season in Italy, where little or no insecticide or screening will be available to civilians. Here the malaria-carrying mosquito is highly vulnerable in the daytime. If systematically and well done, hand-killing in a village would certainly reduce the transmission of malaria to a marked degree by destroying a high percentage of infected mosquitoes before they could bite.

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The purpose of this memorandum is (a) to suggest that attempts be made to get householders in malarious areas to destroy as many as possible of the mosquitoes which rest on the walls and ceilings of their bedrooms and stables in the daytime; and (b) to outline some details of this measure of hand-killing adult anophelines.

2. METHODS.

The simplest method of hand-killing mosquitoes resting on the walls and ceilings is to hit them with a fly-swatter. The swatter may be made in the usual way of a square of wire screen-cloth fastened to a handle, or it may be improvised from paper, cloth, leather, small twigs, rushes, or other material. A damp towel, half-folded lengthwise, makes a good mosquito swatter. It must be used in a slapping rather than a brushing manner.

Slapping mosquitoes with the hand is less satisfactory, but it may be done if the hand is kept as flat as possible and is pushed rather than waved against the insect. Mosquitoes on the wing are more easily hand-caught if palms and

fingers are wet, especially if the water is soapy.

Anopheles are sluggish in the daytime. Blooded individuals are easy prey, others require but little skill. Children soon become adept at destroying resting mosquitoes in houses and outbuildings.

Simple collecting cans may be made from small shallow tin containers holding cotton, paper, cloth, or matted hay soaked in kerosene, crude oil, soapy water, or soft mud. The tins are mounted on handles, one tin at the end for mosquitoes on the ceiling and one tin on the side for those on the walls. When disturbed, a resting mosquito will fly down into the moist mud, where it sticks long enough to be overcome by fumes or crushed by fingers. With a scarcity of almost everything but mosquitoes, some ingenuity may be required to make an effective collecting can. In some cases it might be possible to have a quantity of mosquito catchers manufactured locally and cheaply from salvage tins. The appended diagram illustrates a type of catcher used in Italy before the war.

If a room can be closed, a smoke smudge will paralyze all mosquitoes present so that they fall to the floor. Burning a little damp hay or green vegetation on a spade or sheet of metal will produce smoke generally dense enough to paralyze mosquitoes after 15 to 20 minutes exposure. Adding leaves of mint or eucalyptus to the fuel may increase the toxicity of the smoke. But smoke does not kill the insects, as a rule, so they must be swept up and burned or otherwise destroyed while temporarily paralyzed.

The best time of day for hand-killing anopheles is in the early forenoon. The insects are most apt to be found resting on walls and ceilings of bedrooms, stables, pig styres, and out-houses. Some will rest under culverts, but the majority are in buildings, especially in the darker corners. White-washing or calcimining walls and ceilings of bedrooms and stables not only drives general hygienic improvement, but makes it much easier to see resting mosquitoes. In some locations a good catching time is one hour after sunset, when the insects may collect at windows and screens.

3. CONCLUSIONS.

Naturally, this measure of hand-killing anopheles will not have much effect unless it is done systematically in a majority of the houses of a village. But in view of the increased malaria potential this season, with greatly reduced facilities for malaria control, it would seem logical to push hand-killing for all it is worth. In some areas it is perhaps the only measure of malaria control possible for the individual householder. Screens, bed nets, sprays, repellents, and prophylactic quinine or atabrine will generally not be available. The mosquito that spreads malaria will usually be found alighting on the walls and ceilings, easily accessible for hand-killing. The householder is not helpless against an insect which sleeps all day right under his hand.

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3. CONCLUSIONS.

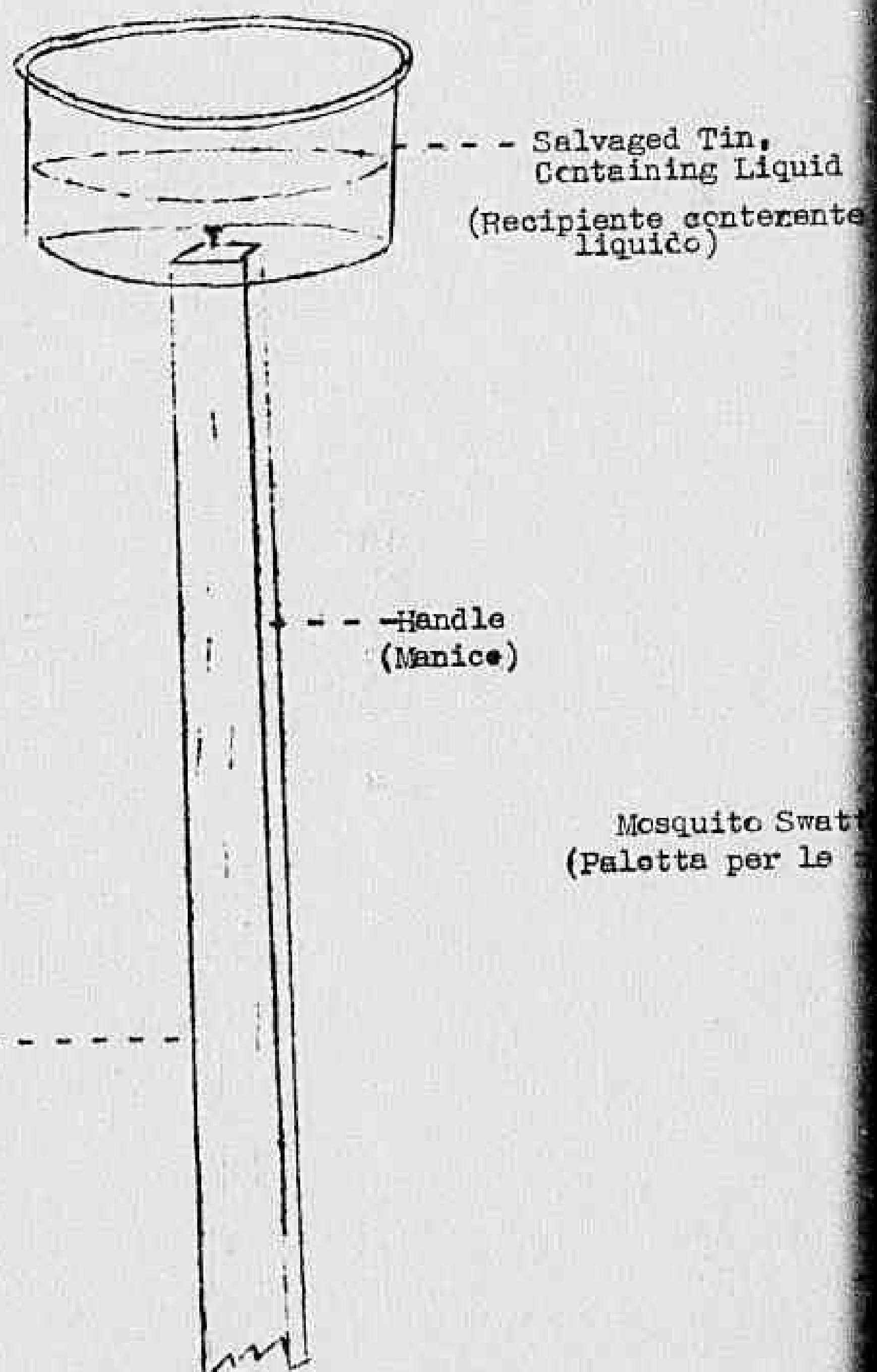
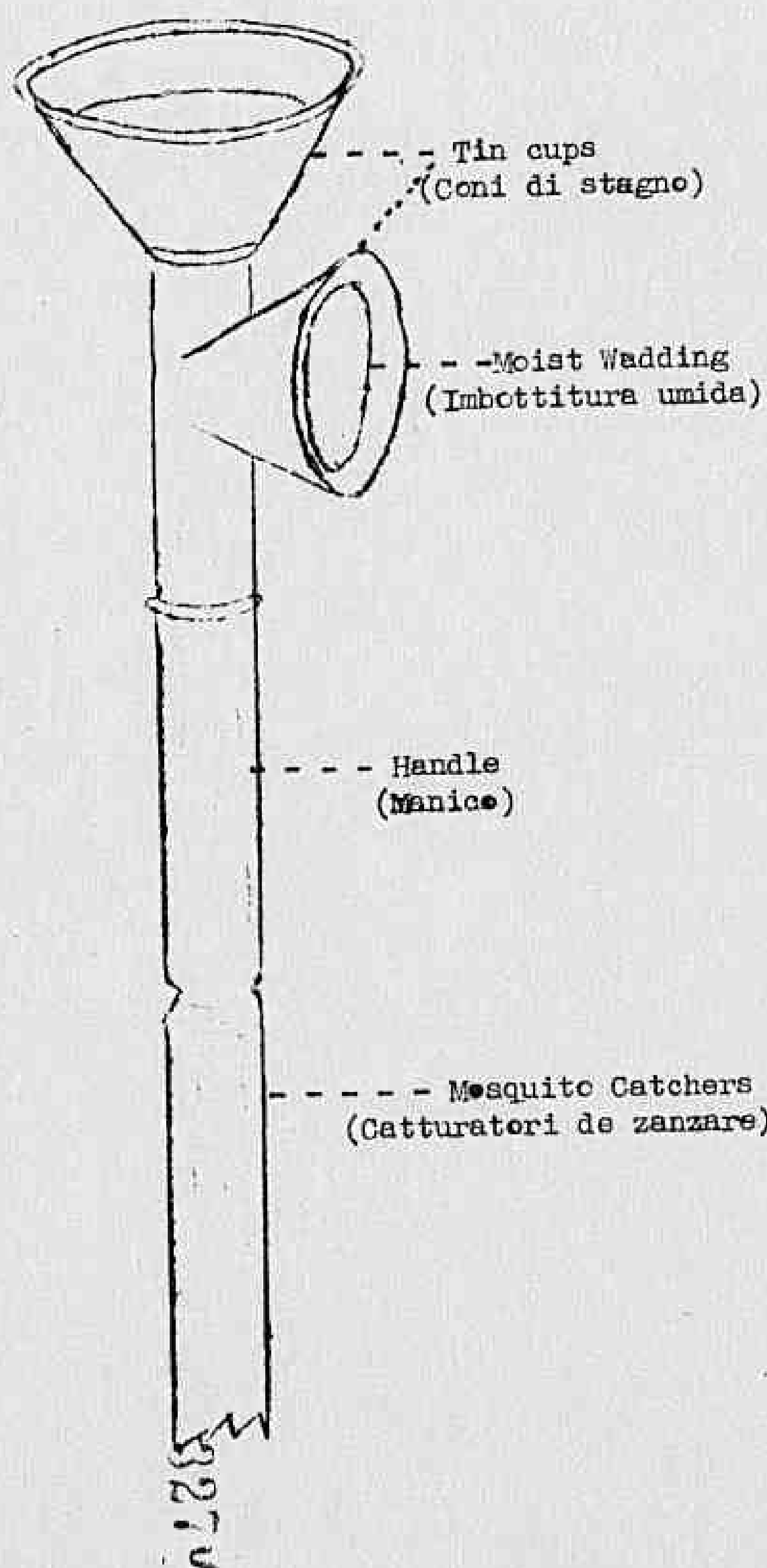
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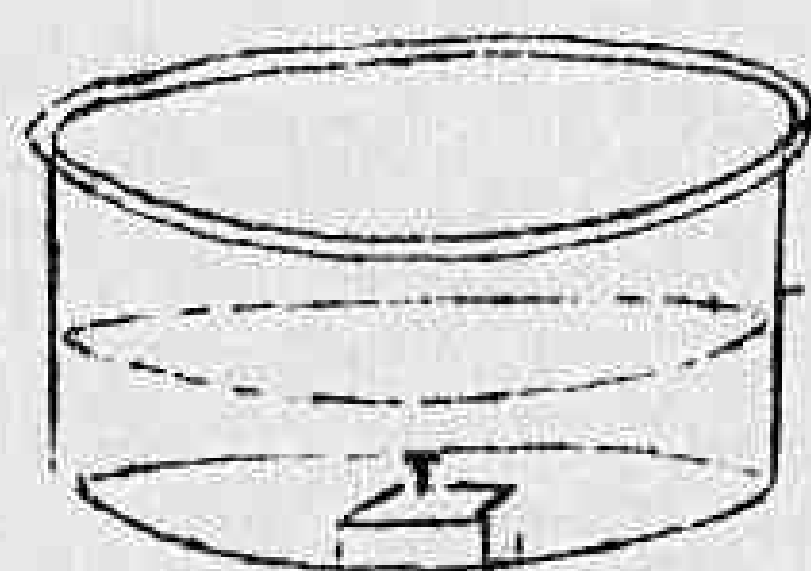
Attempts might well be made to institute effective local propaganda regarding this measure. Civil, school, and church authorities might be helpful. Locally prepared posters, handbills, and other publicity measures should be considered. Competition for prizes might be arranged for school children. At any rate the slogan should be, "Kill Anopheles Mosquitoes and Prevent Malaria".

Paul F. Russell
PAUL F. RUSSELL

Colonel, A. C.

Chief, Malaria Control Branch, ACC

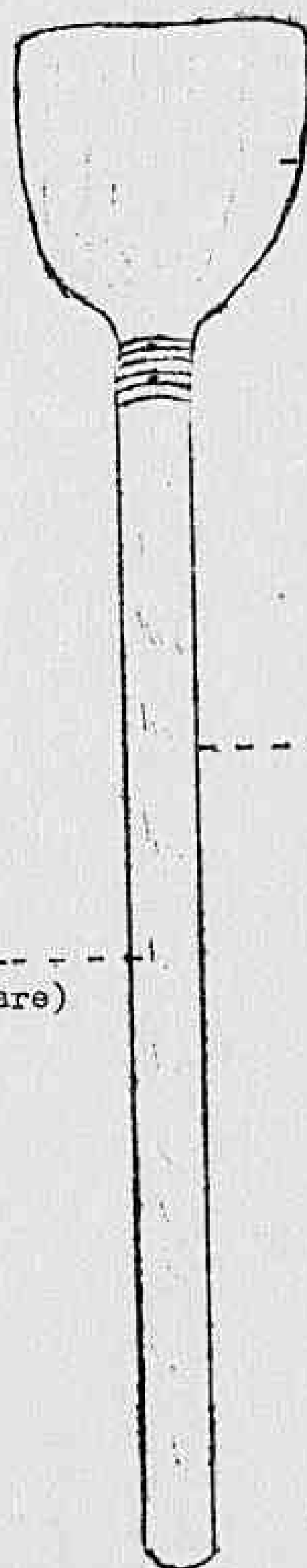




Salvaged Tin,
Containing Liquid
(Recipiente conterente
liquido)

Handle
(Manice)

Mosquito Swatter
(Paletta per le zanzare)



Swatter
(Paletta)

Handle
(Manice)

HEADQUARTERS
ALLIED CONTROL COMMISSION
PUBLIC HEALTH SUB-COMMISSION
MALARIA CONTROL BRANCH
APO 394

MEMORANDUM TECNICO)

NUMERO 3)

1 June 1944.

SOGGETTO: UCCISIONE A MANO DELLE ZANZARE ADULTE.

1. INTRODUZIONE. La Commissione Anti-Malaria della Lega delle Nazioni raccomandava, nel 1927, che "uno sforzo attivo ed energico si sarebbe dovuto fare, che l'uccisione delle zanzare adulte, specialmente le donne di casa, a far sì, pulizia quotidiana. La Commissione era convinta che, se questa misura si fosse potuta mandare ad effetto, avrebbe avuto risultati notevolissimi". Infatti, questa misura fu usata effettivamente da Gorgas nella zona del Canale di Panama, dove, la distruzione a mano delle zanzare adulte, ridusse notevolmente l'incidenza della malaria in certe località. Ross, nel 1911, illustrò ampiamente le possibilità di questo metodo, e, suggerì che i ragazzi non mettessero in pratica.

Certe istruzioni popolari di propaganda sulla lotta anti-malarica pubblicati dal Governo Italiano prima della guerra, includevano l'uccisione a mano degli anofelini adulti fra le misure pratiche che rientrano nelle capacità di tutte le famiglie.

Ma non molta attenzione è stata fatta a queste considerazioni, per le zanzare e mantenerle al di fuori per mezzo di reti metalliche. Pure nei paesi come l'Italia, dove gli anofelini malarigeni, durante le ore del giorno si possono sui muri e sui soffitti delle camere da letto e stallo, e dove quindi, sono facilmente catturabili, l'uccisione a mano di questi insetti è stata praticata molto relativamente.

Ancora, questa misura di uccisione degli anofelini adulti durante il giorno, sembrerebbe che avesse un valore potenziale, specialmente durante la corrente stagione in Italia, dove poco o niente insetticida e reti metalliche saranno disponibili per i civili.

In questo paese, la zanzara malarigena è molto vulnerabile durante il giorno. Se questa misura sarà sistematicamente praticata e ben fatta, l'uccisione a mano in un villaggio, certamente ridurrà notevolmente il contagio della malaria, mediante la distruzione di un'alta percentuale di zanzare infette, prima che possano divenire infettanti. È noto che il plasmodio richiede da 10 a 14 giorni, per maturare allo stadio infettivo di sporozoito.

Il compito di questo memorandum è (a), di suggerire tentativi per indurre i...

mettessero in pratica.

tutte le famiglie.

molto relativamente.

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che possano divenire iniettabili. L'idea era che si potesse passare dallo stadio infettivo di sporozoito,

dettagli circa questa misura di uccisione a mano degli americani contro

2. METHOD I.

mente catturabili se le mani sono bagnate, e specialmente con acqua tiepida. Gli insetti che hanno fatto il bagno il giorno prima sono più facili da catturare.

stanno nelle case ed in altri fabbricati.

Semplici scatoline catturatrici possono essere fatte con piccoli e bassi recipienti di latta contenenti cotone, carta, tessuto e fieno, imbevuti di nafta, petrolio, acqua sapinata o fango poco denso. Le scatoline sono montate su bastoni, una scatola all'estremità per la zanzara sul soffitto ed una sul fianco per quelle sulle pareti. Quando è disturbata all'improvviso, la zanzara che riposava velera nel materiale bagnato dove aderirà abbastanza a lungo per essere uccisa dai vapori o schiacciata dalle dita.

È chiaro, quindi, che con mezzi non molto difficili a procurarsi, e poca abilità si può fare una scatola catturatrice molto efficace.

In alcune località ci sarebbe la possibilità di avere una considerevole quantità di catturatrici di zanzare, manifatturate localmente e a poco prezzo, ottenute con scatoline di rifiuto.

Se una camera può essere chiusa, una fumigazione paralizzerebbe tutte le zanzare presenti, cosicché esse cadranno sul pavimento. Bruciando un po' di fieno umido o erba, su di una paletta o un pezzo di metallo, si otterrà un fumo generalmente abbastanza denso, tale da paralizzare le zanzare dopo 15-20 minuti di trattamento. Ma il fumo, di regola, non uccide; e perciò esse devono essere spazzate via e bruciate o altrimenti distrutte durante la temporanea paralizzazione. Aggiungendo foglie di menta o di eucalipto al combustibile, si può aumentare la tossicità del fumo.

Il miglior tempo del giorno per uccidere con le mani gli anofelini, è il primo mattino, o il tramonto, (circa un'ora dopo di esso). È questo il momento in cui essi escono dai nascondigli dove si sono riparati durante il giorno, e cercano di uscire all'aperto per l'accoppiamento e la deposizione delle uova.

Se si attenderanno una mezz'ora presso i vetri delle finestre, specialmente di quelle che guardano a ponente, si potranno facilmente uccidere tutte le zanzare che si trovano nel locale. Gli insetti, molto facilmente si trovano, mentre riposano sui muri e soffitti delle camere da letto, stalle, porcili ed altri fabbricati. Alcuni si fermano sotto i ponti, ma la maggior parte nei fabbricati è specialmente negli angoli più oscuri. Mettendo il bianco di calce sui muri ed i soffitti delle stanze da letto e stalle, non si ottiene solamente un generale provvedimento igienico, ma più facilmente si potranno vedere le zanzare, quando si posano sui muri e soffitti.

3. CONCLUSIONE.

Naturalmente, questa misura dell'uccisione a mano degli anofelini, non avrà grandi effetti a meno che non sia praticata sistematicamente nella maggior parte delle case e dei villaggi. In visione dell'aumentare di potenzialità malarica in questa stagione, e di conseguenza, con facilità grandemente ridotta, per il controllo della malaria, è logico stimolare l'uccisione a mano per i vantaggi che darà. In alcune località sarà forse l'unica misura possibile per la lotta contro la malaria, a disposizione dei padroni di casa. Reti metalliche, reticelle, spruzzatori, repellenti, mezzi ereditari, quali chinino e atabrina, non saranno

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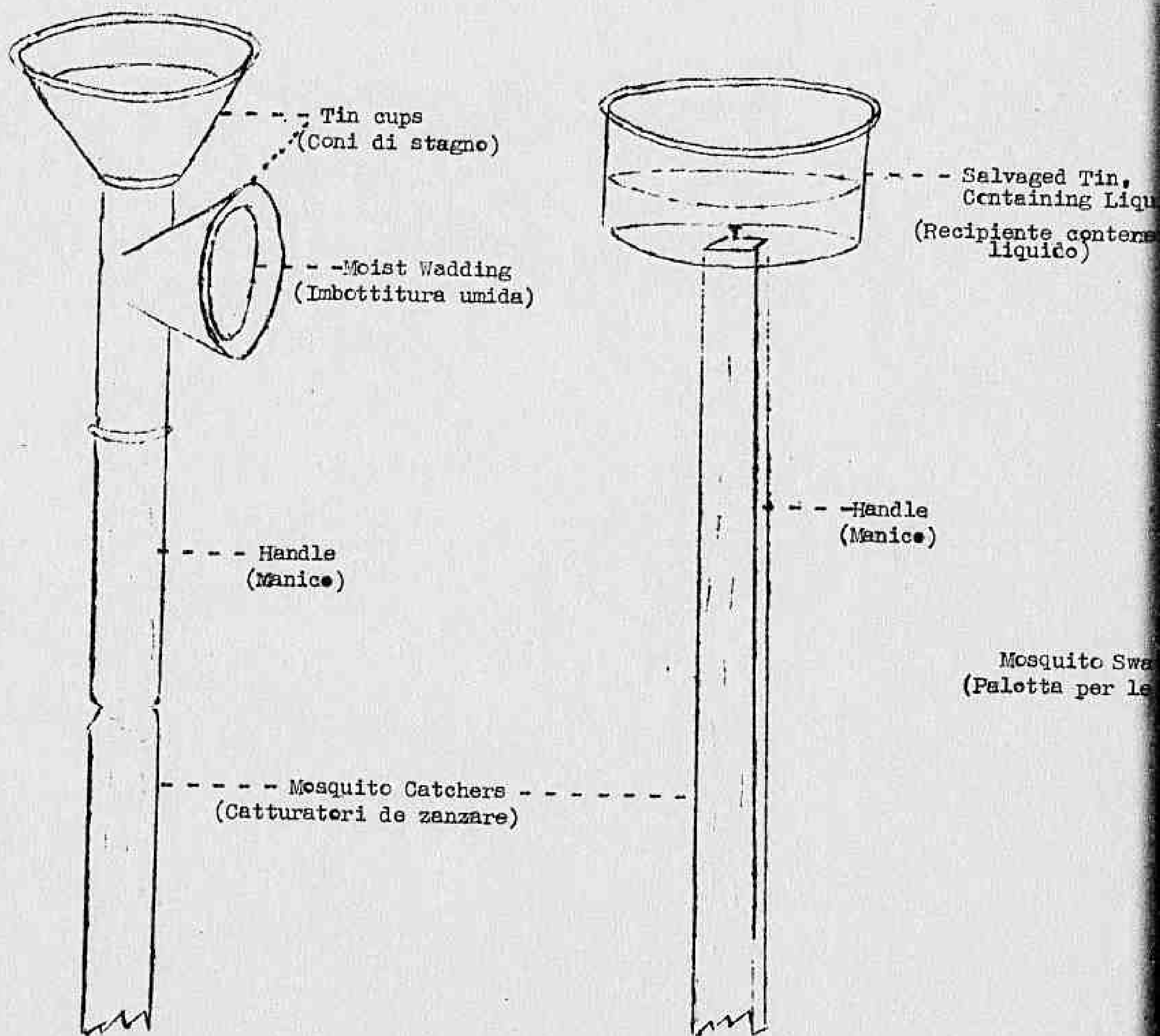
Autorita' civili, scolastiche ed ecclesiastiche, potrebbero essere di grande aiuto. Affissioni localmente preparate, manifesti ed altre misure di pubblicita' dovrebbero essere adottate. Competizioni per i premi potrebbero essere fatte per i ragazzi di scuola. In ogni modo il monito dovrebbe essere: -

"Uccidere la Zanzara Anophele e Prevenire la Malaria."

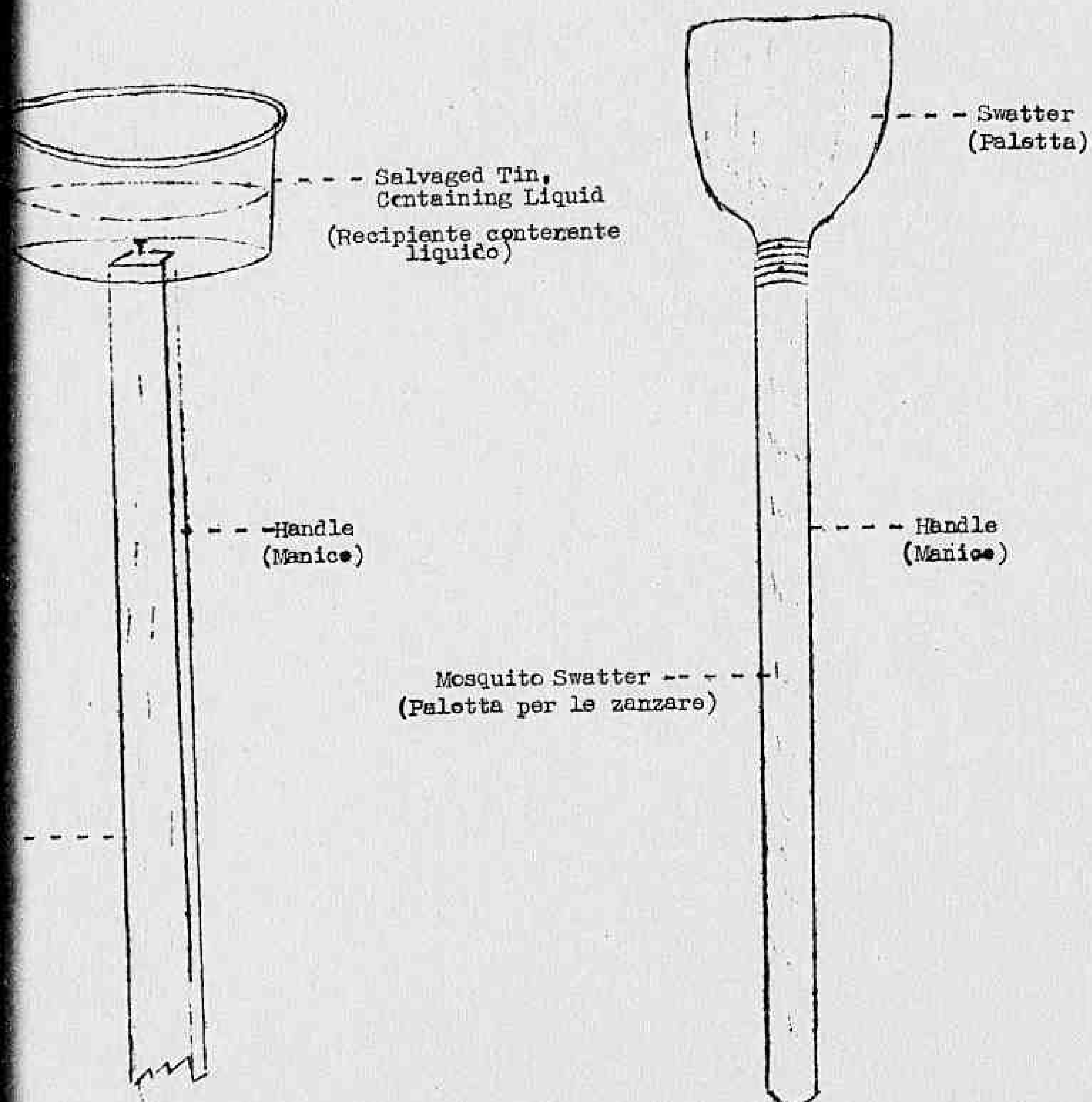
PAUL F. RUSSELL,

Colonel, M.C.,

Chief, Malaria Control Branch.



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HEADQUARTERS
ALLIED CONTROL COMMISSION
PUBLIC HEALTH SUB-COMMISSION
MALARIA CONTROL BRANCH

APR 29, 1944

24 May 1944

TECHNICAL MEMORANDUM)

NUMBER 2)

SUBJECT: LARVICIDAL OILING

1. INTRODUCTION.

Due to world-wide military requirements, no supplies of Paris green have been allocated to the Allied Control Commission for use by civilian anti-malaria agencies in Italy during 1944. Limited amounts are available in some provinces from the 1943 allowances or from military sources for an extra-cantonment control program. For general use, it has been possible for the Allied Control Commission to make Diesel oil available to Regional Public Health Officers for provincial anti-malaria committees. The oil is being distributed, on the basis of monthly requirements, to local depots by CIP. (See Executive Memorandum No. 54; dated 25 April 1944; RC & MG Section; A.C.C.). The purpose of this memorandum is to discuss certain phases of larvicidal oiling for the information of those concerned. It may be useful for the guidance of local officials, many of whom have been trained in the use of Paris green, but not of oil as a larvicide.

It may be recalled that in Italy, until after 1925, malaria control consisted largely in the distribution of quinine for prophylactic and therapeutic use. Cooperative experiments by the Rockefeller Foundation and Italian malariologists then demonstrated the value of Anopheles control, especially by drainage and by the use of Paris green. Provincial anti-malaria committees for nearly a decade before the war carried out malaria control programs, in which Paris green larviciding was an important part. Oil has always been relatively expensive in Italy and has not been used to any great extent in Italian malaria control programs. Hence, the need for special emphasis on the technique of larvicidal oiling during the present season.

2. GENERAL PRINCIPLES.

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2. GENERAL PRINCIPLES.

In 1812, Robert Southey in London suggested the use of oil as a larvicide, and in 1846, an Italian observer also called attention to the fact that, when oil is spread on water, it forms a film which kills mosquito larvae. But not until the work of Howard in the United States in 1892, Rees in Sierra Leone in 1899, and Gorgas in Panama in 1904, was the value of oil as a larvicide widely recognized. It is today probably used more extensively than any other anti-mosquito agent.

There have been many studies to determine exactly how oil destroys mosquito larvae. It is now generally agreed that several factors are involved. The oil may enter the breathing tubes and either poison or suffocate the larvae, or it may cause a matting of their feeding brushes or destruction of their food supply so that they starve. The old idea that it is necessary to have such a thick film of oil that larvae are unable to penetrate it to obtain air has been disproved. With a toxic oil, such as the Diesel grade supplied by A.C.C., a thin film is sufficient. But it should be an unbroken film which will persist for a day or two in quiet water.

3. ADVANTAGES OF OIL.

The chief advantages of oil as a larvicide are the following:

- a. Oil is readily obtainable and easily applied.
- b. Oil kills eggs, larvae, and pupae of all species of mosquitoes (Paris green destroys anopheline larvae, but not culicine as a rule. It has no effect on eggs or pupae of any mosquito species).
- c. Oil can be seen clearly after application so that inspections are readily made.

4. PRECAUTIONS.

Oil has disadvantages, some of which may be outlined as follows:

- a. Oil has common uses which make it liable to theft.
- b. Oil is more expensive than Paris green and is less easily transported.
- c. Recently oiled water may be unfit for bathing or drinking.
- d. Oil does not penetrate well among grasses or into floatage where larvae may be sheltered.

5. APPLICATION.

In mid-summer, it is usually necessary to oil a mosquito-breeding place each week. The intervals may be greater in cooler weather. The quantity of oil required will vary from 10 to 25 gallons per acre, (One acre equals approximately 0.4 hectare); increasing with the amount of vegetation or floatage. (One gallon, U.S.A. equals 231 cubic inches, or 3785 cubic centimeters and is approximately 0.8 of an Imperial gallon). A gallon of oil should cover some 250 linear yards (Approximately 230 meters) with a spray about 12 inches wide (Approximately 30.5 centimeters). The amount of oil that one laborer can spread properly in a day will vary, of course, with the nature of the breeding place and its distance from headquarters. With a knapsack sprayer, one man can cover about five acres (approximately 2 hectares) a day, if the going is good.

6. KNAPSACK SPRAYING.

There are many ways of spreading oil for larvicidal effect, and they vary from simple hand spraying to the use of knapsack sprayers.

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6. KNAPSACK SPRAYING.

There are many ways of spreading oil for larvicidal effect, and they vary from simple hand-pouring to distribution from airplanes. The most common method, and the one of choice for provincial anti-malaria programs, is the use of a knapsack sprayer. This oiler consists of a tank holding three to five gallons of oil. The tank fits on the back of the laborer where it is held by straps, which should be padded. The tank is equipped with a rubber hose and a nozzle, which should deliver a conical spray of oil about 18 inches (approximately 45 cm.) in diameter for a distance of about four feet (approximately 122 cm.).

Oil may be forced out by a pump inside the tank, activated by an overhead handle, worked continuously by the laborer as he sprays. In another type of sprayer a hand pump is located between the tank and the nozzle. This is worked back and forth by the laborer as he spreads the oil. A third type is the so-called pressure tank. The laborer, from time to time, unmounts the tank and pumps up air pressure. He then refastens the tank to his back and sprays until the pressure is exhausted.

Whatever the type of knapsack sprayer, certain principles should be noted. In the first place, it is necessary to protect the laborer's skin from excess

or spilled oil. Most tanks have a high rim around the top to trap spilled oil. A piece of sacking between the tank and the laborer's shirt is advisable. Laborers should be instructed to bathe completely when the day's ciling is finished.

The care of equipment is very important. Each day, after use, the knapsack sprayer should be dismantled and cleaned by repeated flushing with water. This will greatly prolong the usefulness of the rubber hose and washers, and will tend to keep the nozzle from becoming blocked. The laborer should be taught that this is a routine phase of the day's ciling.

7. OTHER OILING DEVICES.

There are various other devices for spreading oil. Drip cans, for instance, have some value over narrow, sluggish streams or canals. Such cans may be made from kerosene or petrol tins by putting a nail-hole in the bottom and leaving the nail in the hole with some string packed around and under the nail-head to retard the flow of oil. The length of stream or canal effectively treated by a drip can will vary with conditions and must be ascertained by observation in each case. There is, of course, danger of theft from such cans in some areas.

In some places, oil-sacked sawdust may be hand-cast on the water of breeding places and will produce an effective film.

Although a fair number of knapsack sprayers are being distributed through A.C.C. for civilian anti-malaria agencies, there will be some shortages. Where no sprayers are available, brush or "dip-stick" ciling may be done. It is slow, but is economical and effective. In this method, some sacking or waste cloth or twigs or rushes are tied firmly to the end of a stick of convenient length. The mop of the "dip-stick" is immersed in a pail of oil and then rubbed along the edge of the stream, canal, or pond where larva control is required. If breeding is occurring out beyond the edge of the spread, oil may be splashed on the water by suitably flicking the mop.

8. PREVENTION OF THEFT.

In order to minimize the chances of larvicidal oil being used for purposes other than malaria control, it is possible, in some areas, to add 10 percent waste engine oil. It should be strained when added. Sometimes arrangements may be made with military motor pools, Navy Yards, or airfields for a supply of waste oil. Care must be used to avoid adding anything to the Diesel oil which will clog the spray nozzles or damage the moving parts.

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P. F. Russell

PAUL F. RUSSELL

Colonel, M. C.

Chief, Malaria Control Branch.

Allied Control Commission

HEADQUARTERS
ALLIED CONTROL COMMISSION
PUBLIC HEALTH SUB-COMMISSION
MALARIA CONTROL BRANCH
APO 394

24 Maggio 1944

MEMORANDUM TECNICO)

NUMERO 2)

SOGGETTO: L'USO DEL PETROLIO NELLA LOTTA ANTI-LARVALE.

1. INTRODUZIONE.

A causa dei bisogni militari dappertutto il mondo, il verde di Parigi non e' stato allocato alla Commissione Allicata di Controllo per l'uso delle agenzie civili anti-malariche in Italia per l'anno 1944. Quantita' limitata sono rimaste dall'anno 1943 o rilasciate da stabilimenti militari per un progetto anti-malarico fuori degli accantonamenti. Per uso generale, e' stato possibile per l'A.C.C. di fornire il petrolio Diesel agli Ufficiali Sanitari Regionali per i comitati Provinciali anti-malarici. Il petrolio si distribuisce, a base di bisogni mensili, ai magazzini locali del CIP. Il compito di questo memorandum e' di discutere certe fasi dell'uso del petrolio contro le larve per l'informazione degli interessati. Sarebbe utile come guida per ufficiali locali, molti dei quali sono stati istruiti nell'uso del verde di Parigi, ma non del petrolio come larvicida.

Si fa notare che in Italia, fin dopo l'anno 1925, la lotta contro la malaria consisteva largamente nella distribuzione di chinino per uso profilattico e curativo. Esperimenti cooperativi della Fondazione Rockefeller e malaricologi italiani allora hanno dimostrato il valore della lotta contro gli anofeli, specialmente con il drenaggio e l'uso del verde di Parigi. Per questi (10) dieci anni prima della guerra i comitati provinciali anti-malarici hanno eseguito dei programmi in cui il verde di Parigi come larvicida prese una parte importante. Il costo del petrolio e' stato sempre relativamente alto in Italia e non e' stato utilizzato molto nei programmi anti-malarici italiani. Allora, vi e' bisogno di uno stimolo speciale per quanto riguarda la tecnica dell'uso del petrolio come larvicida durante questa stagione.

2. PRINCIPI GENERALI.

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2. PRINCIPII GENERALI.

Vi sono stati numerosi studi per determinare esattamente come il petrolio distrugge le larve delle zanzare. Tutti sono generalmente d'accordo che vi entrino molti fattori. Il petrolio entrerebbe nei sifoni respiratori ed avvelenerebbe o causerebbe asfissia delle larve, o causerebbe adesioni delle setole, o noccali o distruzione del loro alimento. La vecchia idea che bisognerebbe avere una patina di petrolio cotti, spesso che le larve non potrebbero penetrarla e' stata disapprovata. Con un olio tossico, come il grado Diesel fornito dall'A. C.C., una patina sottile e' sufficiente. Ma deve essere una patina continua che persiste per un giorno o due in acqua quieta.

3. VANTAGGI DEL PETROLIO

I vantaggi principali del petrolio come larvicida sono i seguenti:

- a. Il petrolio e' prontamente ottenibile, ed e' facilmente applicato.
- b. Il petrolio uccide le uova, le larve e le pupe di tutte le specie di zanzare.
(Il verde di Parigi distrugge le larve anopheline ma non culicine di regola. Non ha effetto sulle uova o pupe di qualunque specie di zanzare).
- c. Il petrolio puo' essere visto chiaramente e le ispezioni sono fatte facilmente.

4. PRECAUZIONI.

Il petrolio ha degli svantaggi, alcuni dei quali sono i seguenti:

- a. Il petrolio ha degli usi comuni per cui e' soggetto al furto.
- b. Il prezzo del petrolio e' di piu' del verde di Parigi ed il suo trasporto e' meno facile.
- c. L'acqua recentemente trattata col petrolio non e' adatta per bere o per i bagni.
- d. Il petrolio non penetra facilmente fra l'erba o materiale galleggiante dove si trovano le larve.

5. APPLICAZIONE.

Durante la stagione estiva, e' necessario applicare il petrolio ogni settimana nelle acque dove si sviluppano le zanzare. Gli intervalli possono essere piu' grandi quando il tempo e' piu' fresco. La quantita' di petrolio varia fra 10 a 25 galloni per acro, (un acro e' uguale a 0.4 ettari), secondo la vegetazione o il materiale galleggiante. (Un gallone, U.S.A. e' uguale a 3.785 c.c. e 0.8 galloni imperiali). Un gallone di petrolio dovrebbe coprire almeno 230 metri con uno spruzzo di 30.5 centimetri. La quantita' di petrolio che un operaio puo' spandere in un giorno varia, naturalmente, con la natura della superficie e la sua distanza dalla stazione anti-malarica. Con uno spruzzatore, un uomo puo' trattare circa cinque acri (circa 2 ettari) in un giorno, se le condizioni permettono.

c. L'acqua penetra facilmente fra l'erba o materiale galleggiante per i begni.

d. Il petrolio non penetra facilmente fra l'erba o materiale galleggiante, dove si trovano le larve.

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6. SPRUZZAMENTO.

Vi sono molti metodi di spandere il petrolio per il suo effetto contro le larve, e variano dallo spandimento a mano alla distribuzione con aeroplani. Il metodo piu' comune, e quello di scelta per i programmi provinciali anti-malariici, e' l'uso dello spruzzatore portatile a zaino. Quest'apparecchio consiste in un serbatoio con una capacita' di tre o cinque galloni. Il serbatoio si adatta sul dorso dell'operaio dove e' mantenuto da cinghie che dovrebbero essere ovattate. Il serbatoio e' fornito di un tubo di gomma ed un becco che deve produrre uno spruzzo conico di petrolio di circa 45 cm. di diametro per una portata di circa 122 centimetri. Il petrolio puo' essere fuori emesso per mezzo di una valvola all'interno del serbatoio, attivato da un manico, azionato continuamente dalla mano mentre si fa lo spruzzamento. In un altro tipo di spruzzatore, una pompa a mano e' situata fra il serbatoio ed il becco. Questa e' messa orizzontalmente dall'operaio mentre spande il petrolio. Un terzo tipo e' il serbatoio con pressione. L'operaio di quando in quando, smonta il serbatoio e pompa dell'aria per aumentare la pressione. Poi rimonta il serbatoio sul dorso ed esegue lo spruzzamento finche' la pressione non sia finita.

Qualunque sia il tipo dello spruzzatore portatile a zaino, certi principi devono esseri notati. Prima di tutto, e' necessario proteggere la pelle dell'operaio dal petrolio. La maggior parte dei serbatoi hanno un orlo alto intorno al bordo superiore per impedire l'eccesso del petrolio. Un pezzo di sacco tra il serbatoio e la camicia dell'operaio e' consigliabile. Gli operai devono essere avvisati di farsi un bagno completo quando il lavoro del giorno e' finito.

La cura dell'allestimento e' molto importante. Ogni giorno, dopo l'uso, il serbatoio a zaino deve essere smontato e pulito con dell'acqua. Questo produrra' di molto l'utilita' del tubo di gomma, e tentera' di impedire che il becco sia sbarrato. L'operaio deve essere avvisato che questa e' una fase pratica del lavoro del giorno.

7. ALTRI METODI DI SPANDIMENTO DEL PETROLIO.

Vi sono altri vari metodi per applicare il petrolio. Lasciando gocciolare l'olio nell'acqua, per esempio, ha qualche vantaggio nelle correnti strette e lente. Tale metodo puo' essere impiegato usando recipienti di benzina, facendo un buco con un chiodo nel fondo, e lasciando il chiodo nel buco impiccato con della stringa o sotto il capo del chiodo per ritardare il flusso del petrolio. La lunghezza della corrente o del canale effettivamente trattato cosi' variera' con le condizioni, e deve essere accertata con l'osservazione in ogni caso. In qualche caso, le segature imbevute di petrolio possono essere gettate a mano sull'acqua e questo metodo produrra' una patina effettiva.

Sebbene un numero discreto di spruzzatori a zaino si stiano distribuendo da parte dell'A.C.C., per le agenzie civili anti-malariche, vi sara' qualche scarsenza. Dove gli spruzzatori non sono disponibili, si puo' adoperare il metodo della spazzola. E' lento, ma economico ed e' efficace. In questo metodo, della tele di sacco o degli stracci o della paglia si lega all'estremita' di una mazza di lunghezza conveniente, questa si immerge in una secchia di petrolio e la si strofina lungo l'orlo della corrente del canale, o dello stagno dove vi e' bisogno della lotta anti-larvale. Se lo sviluppo avviene al di la' dell'orlo dell'acqua, il petrolio puo' essere spruzzato sull'acqua.

8. LA PREVENZIONE DEL FURTO.

Per diminuire l'opportunita' di impiegare il petrolio larvicida per altri scopi oltre che quello delle lotta anti-malarica, e' possibile in certi locali aggiungere il 10% di olio esausto. Deve essere filtrato prima di essere aggiunto. Dalle volte, si possono fare degli accomodamenti con i posteggi militari, cantieri navali, o degli aeroporti per un rifornimento di olio esausto. Si deve avere cura di evitare di aggiungere qualunque cosa che sbarreri il becco del tubo della pompa o danneggi le parti che si muovono.

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Colonel, M.C.

Chief Malaria Control Branch, A.C.C.

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HEADQUARTERS
ALLIED CONTROL COMMISSION
Public Safety Subcommittee

Folio for action/information

C.P.S.....

D.C.P.S..... *As*

Ex. Officer..... *WJ*

Police..... *WJ*

Prisons..... *H.Y. SR*

Fire & C.D..... *WJ*

Regn. & Licensing..... *WCA*

Adm. Officer..... *WJ*

REMARKS.....

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HEADQUARTERS
ALLIED CONTROL COMMISSION
PUBLIC HEALTH SUB-COMMISSION
MALARIA CONTROL BRANCH
APO 394

RM
15 May 1944

TECHNICAL MEMORANDUM)

NUMBER 1)

SUBJECT: A NOTE ON THE EPIDEMIOLOGY OF MALARIA IN ITALY.

1. GENERAL DISTRIBUTION.

No large region in Italy is free from malaria but, as always, this mosquito-borne infection is unevenly distributed geographically, seasonally, and from year to year. Malaria throughout the theater is generally found below 2000 feet altitude and in rural rather than urban conditions. Such cities as Naples, Rome, Palermo, Ajaccio, and Bastia are not malarious, although the disease may approach the municipal limits and occasionally penetrate them. Rural towns on the plains of South Italy are apt to be foci of the disease. It is generally correct to assume that communities of Italians farming the plains, river tracts, or marsh areas south of Pisa or Ancona, and that rural Sicilians or Sards, in the valleys and low coastal areas of their islands, will be reservoirs of malaria. For the most part, these indigenes accept an annual series of chills and fever as a normal experience. As a rule the clinical incidence of malaria begins to increase slightly in April due, it is believed, mostly to relapsing cases. In 1944 such a rise has been seen in curves of both civilian and military malaria. The seasonal upswing due to new infections makes its appearance in May and the curve climbs steeply in June and July, reaching a peak in late July or in August. Thereafter it declines in September. In some areas shows a modest secondary peak in October (following September rains) and then falls sharply, coming to its lowest point in March.

2. MALARIA MOSQUITOES

Generally under military conditions it is a rule to combat all nearby mosquitoes whether disease-bearing or merely annoying. But in civilian communities it is often necessary to concentrate on malaria vectors, consequently some knowledge of these species is useful. Sicily, Sardinia, and South Italy will be considered

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Although there are several Anopheles in Sicily, only one is an important carrier of malaria. This one is named Anopheles labranchiae labranchiae Falleroni, 1926. It is one of several morphologically similar species which comprise the so-called maculipennis complex. These species can be differentiated by characteristic egg patterns, but not by larval or adult anatomical features.

labranchiae

The anopheles is found in its aquatic stages chiefly in small indentations and pools of rivers, streams, canals, and irrigations channels, not often above an elevation of 2000 feet. It is also taken in ponds, marshes, and shallow agricultural wells, or water points. It will tolerate brackish water with salt content up to 1.9 percent. This mosquito in some situations will travel from a breeding place as far distant as two miles, in numbers sufficient to propagate malaria. labranchiae adults habitually rest in houses, huts, animal sheds, and outbuildings in the daytime, feeding almost exclusively after sunset and having a strong preference for human blood.

Sardinia is blighted by two important malaria carriers and has thereby become notorious for intense paludism. One of the two vectors is Anopheles labranchiae, with much the same habits as in Sicily. The other is Anopheles sacharovi Favr., 1902, once named elutus and sometimes still so called.

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The aquatic stages of sacharovi are often found associated with labbranchiae. But sacharovi will tolerate a greater degree of salinity, with content up to 2.2 percent. Hence it is apt to be more prevalent closer to the sea. Both labbranchiae and sacharovi will breed in either still or slowly moving water, both feed by preference on man, both habitually rest in the daytime in man-made structures. Sacharovi is somewhat harderier, flying a two-mile radius more often and in greater numbers, and more effectively withstanding hot-dry and cold-wet seasons. Both species undergo a semi-hibernation and it is believed that occasionally either one may cause a winter infection. Both species begin to breed in April and have greatest prevalence in May and June. Larvae become scarce by the end of September and the density of adults is soon markedly reduced.

In Italy itself there are several malarial vectors. South of Naples, both east and west, the chief vector is sacharovi, assisted in the southeast by Anopheles superpictus Grassi, 1899. North of Naples, in the west, labbranchiae is the carrier, while sacharovi extends up the east coast, with labbranchiae assisting. In the delta region of the river Po, sacharovi is assisted by Anopheles labbranchiae atroparvus van Thiel, 1927, another member of the maculipennis complex and closely similar to labbranchiae labbranchiae. The habits of sacharovi and labbranchiae in Italy are much the same as already described. Superpictus is usually found in small streams in hill or mountain country. Shallow residual pools, sometimes beneath the stream-bed stones and thus hidden from casual view, are typical breeding places. This species is a strong flier, feeds on man, and rests in man-made structures. It does not tolerate brackish water. Atroparvus is similar to labbranchiae in its habits, but possibly a little more tolerant to salinity and somewhat less particular as to its blood meals, feeding on animals almost as readily as on man.

There are other species of the maculipennis complex in Italy. For example, Anopheles messeae Falleroni, 1926 and Anopheles melancon melancon Hackett, 1934 are found in the marshes, rice fields, and inland lakes of South Italy. But ordinarily these two Anopheles do not feed on man and hence are not vectors. Whether the animal population has been sufficiently reduced so that these species will feed frequently enough on man to become war-time carriers of malaria is a question which must be kept in mind.

3. PLASMODIA.

The following statements represent a consensus of opinion:

- a. P. vivax, P. falciparum, and P. malariae all occur in Italy.
- b. P. vivax in the overall picture is most common and P. malariae least prevalent.

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- a. P. vivax, P. falciparum, and P. malariae all occur in Italy.
- b. P. vivax in the overall picture is most common and P. malariae least prevalent.
- c. In some areas P. falciparum is more common than P. vivax and there are a few small foci of predominant P. malariae malaria.
- d. There is usually a seasonal swing, with P. vivax most prominent in spring and early summer, while P. falciparum takes the lead in late summer and autumn.
- e. Mixed infections are fairly common.
- f. The majority of relapses are due to P. vivax.
- g. Some strains of P. falciparum in Italy are more virulent than average.

4. MALARIA CYCLE.

Under usual summer conditions malaria mosquitoes in Italy will develop through egg, larva, and pupa stages in 10 - 12 days. Adult females will feed the second or third night after emergence. If a mosquito ingests suitable gametocytes these will undergo development and become infective sporozoites in about 12 days. Of course, temperature and species as well as other factors will

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modify these periods. When an individual is infected with sporozoites, he will usually develop clinical malaria in about 14 days, depending on species of parasite. The minimum incubation period for vivax is 8 days and the maximum for malariae may exceed a month. Under suppressive medication the onset of symptoms may be postponed until some weeks or even months after the drug has been withheld.

These figures are averages, but it is apparent that the first new infections each season will appear clinically not sooner than 5 to 6 weeks after the vector mosquito begins actively to oviposit. As the weather becomes warmer, the cycle becomes shorter, but probably in this theater it is rarely less than 30 days. With each cycle the numbers of gametocyte carriers increase and a seasonal epidemic takes shape. It is important to remember these time relationships and to realize, for example, that the mosquito breeding observed in an area today may be reflected clinically in malaria next month.

5. MALARIA INCIDENCE.

Statistics of malaria morbidity and even mortality are seldom satisfactory in regard to civilian cases. But some idea of trends and potentialities may be obtained from a table of malaria mortality in Italy (Petragnani, 1941). This table indicates that malaria deaths in Italy declined from 490 per million in 1900 to 57 in 1914. During the first World War the curve began to rise and came to a peak of 324 in 1918. Then there was a steady fall to a low of 14 in 1939. Conditions in 1944 are potentially as bad if not worse than they were in 1918. Unless strenuous control efforts are made during the coming season, there is every reason to believe that malaria will be widely and intensely prevalent.

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