MALARIA IN INDIA.

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Part II.—Anti-malaria Work and a few Suggestions.

(*Continued from p.* 194.)

The final section is now reached, namely :—

(c) *The Protection of the Healthy Man.*

The most obvious procedure in this case is to remove him entirely out of reach of all possible vectors by sending him to some hill station, and keeping him there until all danger of infection is over. This "cold storage" system is now in vogue : Troops are sent to the hills during the hot weather, usually in two parties ; the first arrives about the middle of April and leaves in the middle of July, the second party then moves up to the hills, returning in October. Women and children move up in April and return in October. It is with the second party of troops and the women and children that we are concerned.

The highest incidence of malaria at Ferozepore is in November. Under existing conditions, with electric fans and a plentiful supply of ice, it should be possible to keep the families in the plains until the middle of May, especially if they can complete their train journey by night; they should then remain in the hills until the end of November. As far as possible the men should be kept in the hills until the end of November, but here the protests of the various district, brigade and regimental commanders can be imagined ; they will ask, "How can I complete my training if the men are kept in the hills?" A very reasonable question, but the "opposition" may ask, "Which is the better for your training, a healthy unit in December or a malarious unit in November?" If all the elementary stages of the men's training could be carried out in the hills, there should be ample time to complete intensive training in the plains between the beginning of December and the end of April. This would be one of the problems to be solved by the suggested central committee.

(Appendix VIII gives the incidence of cases of malaria at Ferozepore during the years 1926-30.)

The second most satisfactory method of protecting the uninfected men *en masse* is by mosquito-proofing their barracks. If this is properly done few, if any, mosquitoes should find their way into the buildings. The proofing of the old type of barracks, such as one finds in the Punjab, is both difficult and expensive; still it has been carried out at Lahore Cantonment with excellent results, and there is no reason why similar

results may not be anticipated at Ferozepore when funds for the purpose are provided.

The type of building which is needed in the plains is one in which the rooms are well ventilated and lighted, but the direct rays of the sun, hot winds and dust storms must be excluded; inner doors are therefore essential.

In cases of emergency there must be facilities for rapid egress and the method of proofing must be both efficient and fool-proof. Where fly-proof or mosquito-proof doors are provided it is a common practice to place stones or small pieces of wood in the hinges to keep the doors open; when anyone in authority is seen approaching efforts are made to close the doors, the result being sprung hinges. Therefore something more efficient than gauze-covered doors is needed.

All bungalows and barrack blocks in the plains have verandahs with openings for light and ventilation, and if these verandahs are made mosquito-proof it will be possible to close the inner doors during the heat of the day and at night should a dust storm arise. One double door at each end of the verandah should prove sufficient for the use of men entering or leaving the building. Windows, in addition to being covered with gauze, should also have a wooden or metal shutter. Chimneys and ventilators must also be made mosquito-proof.

Let us now consider what materials should be used for screening. Wire netting of such a mesh as to prevent all species of mosquito from entering must be used, but this mesh must be of the largest that can be used, otherwise air will also be excluded. A mesh of sixteen to the linear inch will keep out anophelines, and will prove sufficient as far as malaria is concerned; but to exclude the smaller species, such as *Aëdes calopus*, a mesh of eighteen to the linear inch will be found necessary.

Netting is obtainable of the above-sized meshes made of: (1) japanned iron which is painted while clean and hot; (2) galvanized iron; (3) bronze; (4) copper. The two last will stand the weather conditions better than the two first mentioned, but are more expensive; copper netting is, however, very soft and liable to stretch, even a moderate push being sufficient to open the meshes.

As regards the fitting of the netting on to the verandahs, this should be of a permanent nature but so fixed that in emergencies, such as fire, earthquake or an alarm of any kind, it can be easily pushed outwards. All windows should have permanent netting. Doors should have the netting fixed on to stout frames; these must fit tightly and be made of some material unlikely to warp.

Doors must open outwards, otherwise mosquitoes which have settled on them will enter the house when the doors are opened. Where there is any choice the door of the main entrance should face in the direction of the wind which prevails in the evening, as the mosquitoes congregate on the lee side of a building. Edge fitting doors are useless, if made of wood, since

during wet weather the doors will fit too tightly or will leave a gap at the edges when the weather is dry. The doors must shut against a broad surface (a batten at the top, bottom and both sides) so that, no matter whether the door shrinks or not, it will shut flat and tight, provided of course that it does not warp.

In addition to a broad board for a brace about the level of one's hand when opening the door, there should be, in addition, strips of wood about one or two inches wide, on the inner side of the door to protect the wire screening from the push of the hands, knees or feet of anyone trying to open it from the inside. Doors should be fitted with springs which will close them with certainty and quickly, even if they do bang. The use of hydraulic springs would be ideal but they are too costly for barracks; their use might, however, be considered in the case of hospitals where quiet is essential, provided some type that would give rapid action to the last could be procured. Springs on the hinges are fairly satisfactory if kept tight. A door fitted with a spring must also be fitted with a "stop" of some kind, else if the wind catches it, when partly open, it may blow back 180° from its position when shut, when the spring will have no power to close it. Automatic fastenings to the doors are also necessary so that when the door is shut it is secure against the wind.

All other openings, such as fireplaces, ventilators, key-holes, etc., must be protected, as anophelines are very persistent and will make every effort to find an opening through which they can enter a building, therefore a building with many small openings becomes not a protection but a mosquito trap. Frequently fully-fed mosquitos will remain in the places of feeding even when there is a clear way out, hiding in dark places, especially under the beds [9].

Having considered the mosquito-proofing of the whole building, one must now consider the protection of the individual occupants of barrack rooms by means of nets in those cases where mass protection is not possible.

Nets to be of any use must be made of a material the mesh of which will not allow mosquitoes to pass through; they must be light and easily removable and must be kept in a good state of repair.

There are three main circumstances in which nets may be used: (1) Outside in the open; (2) in buildings fitted with overhead electric fans; and (3) in buildings fitted with either electric or hand-pulled punkhas, or no punkhas at all.

In accordance with the calls for "military precision" the nets are now, in most cases, suspended from wires stretched along the barrack rooms, the issue of "poles, mosquito" having ceased. The use of mosquito poles certainly led to some untidiness; this was well described by "Mouse," one of the military correspondents of the *Lahore Civil and Military Gazette*, in the issue for September 22, 1930. On very hot nights it was possible for the men to take their beds out into the open, but now, being tied to

one long wire, individualism is destroyed and no matter how hot the night the man must remain inside the barrack room. That this "military precision" can be carried out to too great an extent was well shown when a medical officer whilst visiting a barrack room suggested that he would like to see the nicely "furled" nets lowered. This was done. There were no abnormal holes but he was surprised to see that some of the nets barely reached the beds and that it was impossible to tuck in the lower portions; he was then informed that this was due to the fact that the officer commanding the company had given orders that all nets were to be at the same level when raised during the day, and that as the tapes by which the nets were fixed to the wires were of different lengths the nets did not always allow for tucking in, hence the condition in which they were found.

With overhead electric fans nets should not be necessary providing that there is a fan for each bed or pair of beds. Fans if properly arranged should be sufficient protection against mosquitoes without the necessity for nets, but the number of fans provided in barrack rooms is quite insufficient.

There has been considerable controversy as to whether nets should be used in conjunction with punkhas; if nets are used in conjunction with punkhas, the latter have to be arranged at such a height that the man inside the net gets no benefit from them; the swing of the punkhas is very short, owing to the fringe being drawn up close to the frame, and the current of air so raised is not strong enough to drive mosquitoes away from the sides of the net at the level of the sleeper. The ordinary barrack bed is much too narrow, the result being that when a man is asleep some part of his body must be in contact with the net, and as the usual sleeping suit consists solely of a pair of short pants, mosquitoes can feed freely through the net. In a barrack room visited at night, thirty per cent of the men had some portion of the naked body touching the net, so probably during the night every man would lie in a similar condition.

If nets are not used the punkhas can be so arranged as to give a longer swing; they can be closer to the beds and, owing to the greater current of air so caused, mosquitoes will not be able to approach the men.

A solution of the problem "nets or no nets" might be possible by trying both methods in a unit, or better in one barrack room, men on one side of the room using their nets and those on the other being without nets.

There is, of course, the possibility of the punkhas stopping when the men are all asleep, with immediate mass attacks by the mosquitoes; the fitting of an automatic alarm which would rouse the men at once should the punkhas stop would overcome this danger, repellants being used until the punkhas were again in action.

Having considered the man in the barrack room one must now consider the man on duty.

Police and sentries, whose duties necessitate their being out at night, should be provided with mosquito-proof veils and gauntlets and should,

prior to going on duty, apply some form of repellant. The wearing of these veils is unpleasant, owing to the heat, but infection is most certainly prevented if they are properly put on.

The wearing of "shorts" and kilts is forbidden during the malaria season in the plains after sunset. Yet one frequently sees men wearing shirts with short sleeves; this should also be forbidden, and in those units in which the sleeves are cut off the shirts, the wearing of jackets after dusk should be enforced.

Cinemas, restaurants and dancing halls have all been blamed at various times of being danger spots where the men may become infected with malaria; while not denying this, it should be obvious to even the most rabid anti-malariologist that if, as has been frequently suggested, these places of amusement are closed or placed out of bounds, there would be a large increase in the number of cases of drunkenness and also in venereal diseases.

The question of the value of a prophylactic issue of quinine to all ranks was again raised, during 1930, at Ferozepore. As was expected, the results were of little value; the "controls," who took no part in the test, in most cases showed a lower admission rate than those who were taking quinine (Appendix IX).

Reference to the 1930 edition of the "Commentary on the Health of British Troops in India during the year 1929," page 9, shows that the proportion of cases of malaria diagnosed clinically is nine per cent, and disappointment is expressed that this has not been reduced. A comparative table is also given which shows "what can be done" in some stations. The issue of such tables is, in my humble opinion, unjust and liable to lead to just the opposite result to that which is desired. Peshawar heads the list of stations which do not return many cases of clinical malaria, but it is not mentioned that at this station there is a medical officer who does little else than anti-malaria work. So long as honest returns are sent in there is bound to be a certain proportion of cases of clinical malaria, but in those hospitals in which the commanding officer decrees that these cases are to be shown as "constipation, or something like that" there will be no cases of clinical malaria shown.

Summary.

Before any general work can be undertaken in India, it is essential that there should be a Central Department of Malariology at New Delhi and Simla. The members of the head committee should include a high official of the Civil and one of the Military branches of the Government; these would have as expert advisers, a trained malariologist, an entomologist, specially trained in mosquito work, who need not necessarily be a medical officer, and an officer of the civil or military engineering services who has been specially trained in anti-malaria work. An ample staff of clerks should also be provided.

These advisers should be available at all times in case any of the district committees need their expert opinion on any matter which could not be worked out locally.

Local committees and sub-committees should be formed; these would be responsible for the carrying out of local malaria surveys and for submitting maps and reports to the central body. It is suggested that these local bodies should control areas similar to those at present administered by the Commissioners and Deputy-Commissioners.

There would be a staff of experts on each of these local bodies, similar to that at headquarters. The sub-committees would be in charge of the various gangs which are employed in the actual anti-malaria works.

The strength proposed for each gang is one overseer, who has been specially trained in the work, with three coolies to do the work; each gang would comprise one "unit," and would deal with approximately one square mile of the area to which it belonged. The area would, however, vary to a certain degree according to the type of country under consideration; desert land would require little or no attention, whereas highly cultivated land, towns and cantonments would need a higher concentration of labour, as it is not anticipated that the average town or cantonment dweller will ever work up much energy as regards anti-malaria work, even if penalties for non-observance are imposed.

Each unit should be kept as much as possible to the same area, and should only be moved in cases of emergency, returning to its own area as soon as the emergency is over.

Five units should comprise a "squad"; this should be directed by a subordinate, corresponding in rank to an Assistant or Sub-Assistant Surgeon.

Two squads should form a "section," under the control of an expert with the rank of Lieutenant or Captain. In order to provide these officers, who must have undergone special training, applicants should be drawn from the R.A.M.C. and I.M.S., or from civil practitioners engaged either in England, India, or any of the Colonies. It is essential that these should be qualified men, as they would also be concerned in treating any cases of malaria with which they might come in contact.

These sections would all be under the local sub-committee, this being controlled by the committee of the district, which in its turn would be directly ruled by the Headquarter Committee.

When it was proposed that any anti-malaria work should be carried out, a full report would be submitted to the headquarters of the department, together with the estimated cost. The matter would be thoroughly examined and the necessary funds allotted if the scheme was sanctioned.

The local bodies would have no funds at all; all pay, cost of larvicides, and such charges being met monthly by cheques sent out from the headquarter office, on receipt of the usual claims.

It is realized that many of the suggestions made in this article are

utopian and cannot possibly be carried out, even should the millennium be reached, but they may put some ideas into minds more worthy than mine, so it is hoped that "out of evil may come forth, even the slightest, good."

Ferozepore has been taken as the basis of this article, as I have a greater knowledge of this station than of the others in the Lahore District, but the remarks contained herein could equally apply to several others in the plains.

It is hoped that this article may lead to a strong offensive on the part of other members of the Corps. Criticism will be gladly received, provided that it leads to action which will be beneficial to those suffering from, or likely to suffer from, "malaria in India."

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APPENDICES.

I. Distribution List of the Anopheline Mosquitoes found in the Lahore District.
II. Extract from a Report on "Malaria at Delhi," by R. Senior White.
III. Resolutions Passed by the Malaria Section of the Seventh Congress of the Far Eastern Association of Tropical Medicine, held in Calcutta in December, 1927.
IV. Copy of a Letter from the Senior Medical Officer, Ferozepore, to the Executive Officer, concerning action to be taken regarding wells in the cantonment area.

V. Table showing the Strata pierced by a Tube Well, at the Power Station, Ferozepore Cantonments.
VI. Some Natural Enemies of the Mosquito Family.
VII. An Experimental Mosquito Trap.
VIII. Table showing the Number of Fresh and Relapse Cases of Malaria amongst British Troops at Ferozepore, 1926 to 1930.
IX. Table of the Results of Prophylactic Quinine Issue, Ferozepore, 1930.

APPENDIX I.

Distribution List of Anopheline Mosquitoes in the Lahore District.

	A. pulcherrimus	*A. plumbeus* var. *barianensis*	*A. hyrcanus* var. *nigerrimus*	*A. barbirostris*	*A. listonii*	*A. jeyporiensis* var. *moghulensis*	*A. subpictus*	*A. fuliginosus*	*A. maculatus* var.	*A. willmori*	*A. maculipalpis* var. *indiensis*	*A. culiciformis*	*A. turkhudi*	*A. stephensi*	*A. pallidus*	*A. theobaldi*	*A. lindesayi*	*A. gigas* and var. *simlensis*	*A. culicifacies*	
A. Plains Stations—																				
Ambala ..							+					+		+					+	4
Amritsar ..	+		+	+	+		+	+			+	+	+	+	+				+	12
Ferozepore ..	+		+*	+			+*	+*			+	+	+	+*					+*	10
Jullundur ..							+				+			+						3
Lahore ..	+		+		+		+*	+	+	+		+	+	+		+			+	12
Lahore Cantt.	+		+	+			+*	+				+	+	+*					+*	8
Multan ..	+						+							+						3
B. Sub.-Montane—																				
Kalka					+		+			+		+					+		+	6
Pathankot ..									+	+	+						+			4
Sialkot ..	+						+					+		+					+	5
C. Hill Stations—																				
Bakloh ..										+			+	+			+	+		5
Dagshai ..													+							1
Dalhousie ..																		+		1
Dharamsala ..					+			+		+	+	+	+				+			7
Kasauli ..		+			+	+	+		+	+	+		+				+	+		10
Simla ..		+					+			+							+	+		5
Subathu ..										+										1

* Captured by the author.

APPENDIX II.

Extract from a Report on "Malaria at Delhi," by R. Senior White.

A. rossii.—Hodgson records finding this species as early as April; I did not take a single specimen until after the onset of the monsoon in July. Thereafter it was certainly the most common anopheline present. Though Gill (1925) records successful laboratory infections with it, with B.T., it has never been found naturally infected anywhere but in the Dutch East Indies, never in India. In this respect it may be mentioned that Gill bred his specimens, and it has been suggested by Williamson (1928) that there

may be a factor inhibitory to parasite development in foul water feeders, such as *rossii* in nature. The underlying reasons for this are now being investigated, by Williamson and Rosedale, at Singapore. Meanwhile I propose to follow all previous workers and my own practical results both in India and Ceylon, and completely ignore this species as a factor in malaria causation.

A. fuliginosus.—A proved carrier in India, but I fully concur with Hodgson that this species has not the slightest importance in malaria causation. Hodgson showed it to be essentially a cold weather species, though present throughout the year, and my findings agree with this. It has its minimum prevalence during the fever season. . . . That this is not a temperature effect alone, however, is indicated by heavy catches having been made both at 25° C. and at 32° C. Hibernating larvæ were numerous in a canal in Delhi Waterworks settling bed in January and February, but hereafter disappeared, showing that the species must have been prevalent at the end of the 1926 season. I have given reasons for neglecting it elsewhere. (S.W. 1928.)

A. stephensi.—This species apparently hibernates in wells and is found as a larva in natural waters with the first warm weather in February to March. Primarily a well-breeder, it is in reality extremely catholic in its tastes and, especially in spring, invades outside bodies of water, but after the onset of the monsoon it seems largely confined to wells, in which it is then extremely common. Whether there are any seasonal fluctuations in the numbers I have no data to go on. Hodgson seems to be of the opinion that there are, with a maximum during the rains. Sinton (1917) shows that at Kohat the curve of its prevalence follows rather closely that of B.T., and in view of the extreme rarity of the next species, before the onset of the rains, I think that there can be no doubt that *A. stephensi* is responsible for all the spring malaria in Delhi. Like its congeners of the *rossii* group it can unfortunately tolerate foul water. Whether specimens so bred can successfully carry malaria is another question.

A. culicifacies.—Found commonly as a fourth stage hibernating larva at the end of the very cold weather, but by the end of the third week in February the larvæ have pupated and emerged. Young larvæ were found in April, but the species was rare until after the onset of the rains; it was then common and continued so until the end of October. I fully agree with Hodgson's remarks about its breeding requirements, "The water must be fresh, not too deep, and if possible changed slowly but regularly. This is especially the case if pools are to continue to afford breeding grounds for a large number of the species."

Recent research has shown the reason underlying the last statement; it is that unless the water is changed, ammonia accumulates in the temporary pools that form so much of the breeding area of this species to an extent inhibitory to its development, when the anopheles present changes from *culicifacies* to *rossii*. On the other hand, if these pools are continuously

diluted by fresh rainfall the water remains suitable for *culicifacies*, which then breeds in increasing numbers.

This, in my opinion, is the true relationship between the rainfall and epidemic malaria. I am further of the opinion that *culicifacies* alone is concerned in the causation of epidemic malaria in the Punjab.

APPENDIX III.

Resolutions Passed by the Malaria Section of the Seventh Congress of the Far Eastern Association of Tropical Medicine, held in Calcutta in December, 1927.

(1) The Malaria Section of the Seventh Congress of the Far Eastern Association of Tropical Medicine are aware of many instances of a great increase in the incidence of malaria caused by the facilities given to mosquito reproduction by engineering works, either during construction or afterwards, due to the different conditions brought about.

This Congress is of opinion that plans for railways, canals, harbours, and all similar engineering works likely to affect the conditions producing malaria should be submitted to the proper Public Health Authorities and their Sanitary Engineers before being sanctioned by the Governments.

(2) As it has been represented that difference of opinion regarding the best method of controlling malaria sometimes causes doubt in the public mind and so may hamper the progress of anti-malarial work, this Congress takes the present opportunity to emphasize the fact that there is no single method of malaria control applicable to all conditions and all countries.

Nevertheless, they consider that for towns, mines, plantations, large public works and similar aggregations of people, the control of the breeding places of the malaria-carrying species of mosquito is a method which should be employed whatever other anti-malarial measures are put into force. Whenever possible, this control should be effected by permanent works which eliminate entirely the sources of mosquito breeding.

For wide rural areas, especially those with scanty, poverty-stricken populations, the first step in the control of malaria is adequate research, so that conditions present may be ascertained and the best methods of control under the particular circumstances ascertained as a result of such research. Methods of prevention may here be of great variety and include drainage, flooding, jungle-clearing, jungle-preservation, bonification, the promotion of agriculture, improvement of housing, and the general economic conditions, education, etc., of the people.

The systematic killing of infected adult mosquitoes, screening, the use of anti-malarial drugs and a host of special methods, have each also to be considered in their proper application.

The Congress desires to stress the need, not only of thoroughly trained Malarial Research Officers, but of expert Malarial Engineers in whichever type of malaria prevention is at stake.

APPENDIX IV.

Subject : MALARIA. No. 9/M/29.

Office of the Senior Medical Officer, Ferozepore,
July 26, 1929.

To the Anti-malaria Officer,
Ferozepore Cantonments.

The following anti-malaria works are recommended and should, I think, be met from cantonment funds, except in those cases where landlords can be made to pay :—

(1) All wells worked by charsa to be done away with, iron Persian wheels being substituted.

(2) Wooden Persian wheels to be replaced by iron wheels. The well tops to be covered in, only an opening for the wheel remaining. The M.E.S. might evolve a mosquito-proof cover for the wheel, removable when repairs are needed ; the water exit to be protected by a flap valve.

(3) Drinking and bath water to be obtained from tube wells in each compound.

(4) All disused wells to be covered in.

(5) "Sumps," in gardens, to have movable mosquito-proof lids.

(6) A considerable amount of the anti-malaria grant appears to be expended on the repairing of existing drains ; it is very doubtful whether this is a legitimate charge against the grant. The only drains that should be charged for are those specially constructed for draining "diggies" and other collections of water, which are in evidence in the malarial season.

The reason for my suggesting (1) is that every well worked by charsa has a bullock run which invariably acts as a breeding place for anophelines during the rains. Bullock runs should be filled in.

J. E. M. BOYD,
Major, R.A.M.C., Senior Medical Officer, Ferozepore Bde. Area.

Copies to :—

The Headquarters, Ferozepore Brigade Area.
The Executive Officer, Ferozepore Cantonments.

APPENDIX V.

TABLE SHOWING THE STRATA PIERCED BY A TUBE WELL, AT THE POWER STATION, FEROZEPORE CANTONMENTS.

	At feet
Ground level	0
Excavation, earth	16
Sand	16— 31
Fine sand with nodules of clay	31— 33
Sand, coarse	33— 38
Sand interspersed with nodules of kunkur.. ..	38— 56
Pure sand	56— 59
Sand with small kunkur	59— 64

	At feet.
Large lumps of kunkur	64— 66
Sand, with very little mixture of clay	66— 84
Stiff clay	84—108
Fine sand with slight clay	108—111
Slight course of sand	111—121
Sand with fine kunkur	121—123
Sand with trace of small nodules of clay	123—134
Sand with small kunkur	134—138
Kunkur	138—140
Sand, gravel and clay	140—144
Clay	144—158
Sand and stiff clay	158—169
Clay	169—178
Sand	178—192
Nodules of clay	192—203
Sand	203—210
Fine sand	210—218
Clay	218—221
Fine sand with nodules of clay	221—235
Fine pure sand	235—240
Sand	240—243
Sand with nodules of clay and kunkur	243—244
Sand	244—250
Stiff clay	250—256
Hard clay with nodules of kunkur	256—263

APPENDIX VI.

Some Natural Enemies of the Mosquito Family.

Plants of the bladderwort group.

Fungi and bacteria, the empusas and yeasts.

Protozoa, gregarines, flagellates, spirochætes.

Other lower animals, as Hydra.

Vermes, trematodes, nematodes.

Water beetles, Dytiscidæ, Hydrophilidæ, Gyrinidæ, Nepa, and other arthropods.

Dragon flies, adults feed on adult mosquito and the larvæ on mosquito larvæ.

Culicidæ, Psorophora, Megharinus, Lutzia, are voraciously carnivorous and even cannibalistic, as larvæ.

Corethrinæ, sp.

Chironomidæ, sp.

Empididæ, sp.

Scatophagidæ, sp.

Simulium.

Wasps, sp.

Arachnidæ, mites of the Hydrachnidæ, spiders.

Other arthropods, as small crayfish, fresh and salt water shrimps.

Batrachians, frogs and toads eat the adult mosquito, tritons.

Reptiles, gecko lizard in India.

Birds, goat suckers, including night hawks, American swift, the true swallows, flycatchers. Aquatic birds are also useful in destroying eggs and larvæ, as the spoonbill duck and the mallard. Shore birds which eat the larvæ include the phalaropes, sandpipers and small plover. (Fifty-three per cent of the food of twenty-eight northern phalaropes from one locality consisted of mosquito larvæ.)

Bats, all species.

Fish, all surface feeders of the minnow class, also roach, goldfish, perch, and others.

(Further information on this subject can be obtained by referring to "The Mosquitoes of North and Central America and the West Indies," by Howard, Dyar and Knab, from which many of the above statements have been extracted.)

APPENDIX VII.

An Experimental Mosquito Trap.

When stationed in India some few years ago I was trying to evolve a method for destroying sandflies and mosquitoes, and the idea of some form of mechanical trap, similar to the one described below, seemed feasible. Unfortunately, I have so far been unable to test the value of the trap.

The idea first occurred to me when I was visiting a large electric light station during the hot weather. I was surprised at the coolness of the place, and on looking round found that on either side of the door were kuskus screens, with several electric fans behind each. The fans were so arranged that when in motion they sucked air through the wetted screens, the air being cooled in transit.

It has been proved by many observers that many insects are attracted by light; one has only to place a lamp over a bath containing water during the swarming of white ants to demonstrate this, or to rub a little vaseline or such like substance on to the globe of a hand lamp, when in a very short time many small insects will be seen to be adhering to the glass.

So it occurred to me that if a combination of some such apparatus could be arranged a useful insect trap would result; it would be easy to make and could be assembled as follows :—

The first requirement would be a small wooden box, from which the front and back portions had been removed.

In place of the front of the box would be placed a cone-shaped structure, made of cardboard, the apex being inwards and having at the apex a small hole. The back of the box would be replaced by wire gauze, with a mesh sufficiently small to prevent the passage of any insects. In front of the large end of the cone would be placed an electric light, and behind the gauze an electric fan, so made as to cause a strong suction action.

When the light is turned on insects will be attracted by the light and

will be drawn into the box through the cone by the electric fan, remaining in the box until they are needed for examination.

APPENDIX VIII.

TABLE SHOWING THE NUMBER OF FRESH AND RELAPSE CASES OF MALARIA, AMONGST BRITISH TROOPS, AT FEROZEPORE, 1926 TO 1930.

Months	1926		1927		1928		1929		1930	
	Fresh	Relapse	Fresh	Relapse	Fresh	Relapse	Fresh	Relapse	Fresh	Relapse
January ..	1	9	2	8	—	7	2	3	—	5
February ..	—	14	—	4	3	2	—	3	—	1
March ..	—	7	—	2	1	4	—	4	—	2
April ..	—	15	—	9	7	5	2	3	—	3
May ..	4	7	—	18	3	8	1	1	—	9
June ..	3	8	4	10	—	4	—	2	6	15
July ..	—	10	1	13	1	9	—	5	18	18
August ..	7	18	3	11	4	8	13	6	57	26
September	11	33	12	3	14	4	30	11	33	16
October ..	10	8	6	15	22	18	24	13	41	24
November..	17	14	17	13	63	23	58	34	32	21
December	6	8	8	14	8	9	8	14	6	6
Totals ..	59	151	53	120	126	101	138	99	193	146

APPENDIX IX.

RESULTS OF PROPHYLACTIC QUININE, FEROZEPORE, 1930.

Units	Strength	(A) Number taking prophylactic quinine	Percentage of malaria admissions from (A)	(B) Controls	Percentage of malaria admissions from (B)	Actual admissions from (A)	Actual admissions from (B)
SEPTEMBER, 1930.							
2nd R.S. Fus.	233	180	13·89	53	5·66	25	3
91st Field Battery R.A.	114	94	11·70	20	5·00	11	1
20th Med. Battery R.A.	80	60	11·67	20	*Nil*	7	—
Staff and Depts.	73	26	3·85	3	*Nil*	1	—
						44	4
OCTOBER, 1930.							
2nd R.S. Fus.	292	222	15·32	70	15·71	34	11
91st Field Battery R.A.	111	81	9·88	20	10·00	8	2
20th Med. Battery R.A.	80	60	8·33	20	5·00	5	1
Staff and Depts.	79	25	4·00	3	*Nil*	1	—
						48	14