

OBSERVATIONS ON SANDFLY FEVER IN MALTA AND REFERENCE
TO ITS CONTROL BY D.D.T.

(1) SCOPE OF THESIS.

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It is based on observations made from the Royal Naval

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by

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and also from the Army Medical Officer and also from the
Medical Officer who was quoted from contemporary literature (all of
which is referred to), otherwise all the clinical and theoretical
material given in the Thesis is the compilation of the Thesis
author and his clinical work.

Thesis Presented
for the Degree of M.D.



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I obtained some relevant statistics from the Naval Health Office and from the Army Senior Medical Officer and also from the Royal Air Force Meteorological Office. Several facts and theories have been quoted from contemporary literature (all of which is indicated), otherwise all the clinical and theoretical material prior to the Thesis and the compilation of the Thesis itself are my own unaided work.

(2) MALTA.

This Island forms the principal Naval Base in the Mediterranean and was of vital importance to Britain during the recent war. It has an area of 95 square miles and the highest point on the island is 845 feet above sea level. The climate is/

is mild and healthy in the winter, but in summer the prevailing wind, if any, is south easterly, and the heat is intense and can be damp and suffocating. Malta is 58 miles from Sicily to the north and about 180 miles from the nearest point on the African coast to the south. The following facts concerning Malta are considered relevant to the discussion on Sandfly Fever. The Island is densely populated containing approximately 2,700 people to the square mile - in comparison Isle of Wight has approximately 534 people per square mile. During the bombing in 1942 approximately 30,000 houses and buildings were knocked down or severely damaged and little effort had been made to clear up this damage or rubble by 1944. It is important to realise that in pre-war years a very small proportion of Naval Personnel lived ashore in Malta the large majority living in the Warships which lay anchored out in the harbours and creeks, but the war changed this and operational requirements necessitated (1) many thousands of sailors being accommodated ashore in old, ill ventilated, damaged buildings which were taken over and converted into Naval Barracks at short notice. (2) Large numbers of freshly "called up" sailors being constantly drafted out from the United Kingdom to these barracks.

(3) SANDFLY FEVER.

Facts and Theories concerning History and aetiology of the Disease.

Sandfly Fever has been recognised clinically for nearly 100 years, and although its transmitting agent was suspected in 1903 in/

in Chitral it was not confirmed until 1908 when Doerr published his observations on the infectivity of the blood and the role of the Sandfly as the Transmitter. (1). According to Whittingham and Rook (2) the disease has been known to affect British Forces serving in the Mediterranean since 1899. In view of this statement it is interesting to digress for a few moments and quote from a book published in 1830 by John Hennen M.D. (3) :-

....."Insects are abundant in Malta, most troublesome are the flea, mosquito, and above all that species of culex known here under the name of Sandfly. The bites of these troublesome insects often throw the delicate newcomer into a state of high fever The fine skin on each side of the Tendo Achilles is the part oftenest attacked by the Sandfly There are in this Island numerous beds or winter torrents which are retentive of underground moisture long after the surface is dry and are favourable to the emission of marsh miasmatae, malarisæ or exhalations quite sufficient for the production of fevers

I lament that I do not possess nor can I at present procure any official documents to show the nature of this fever but from the history of the Navy and Naval Hospital it appears that several ships which anchored in the neighbourhood of the Village at the head of a great harbour during the late war ("100 Years War") suffered from remittents in the months of August and September, and so purely were those fevers of local origin that they invariably ceased on moving the vessels from the Harbour to Bighi Bay Mr. Lightbody Surgeon of the 80th Regiment speaks of/

of fever as it occurs in July, August and September (quote) In most cases affectation was sudden. In the first instance the head was generally though not invariably principally complained of. Most frequently the forehead over one or both eyes. The eye frequently was suffused, the skin was hot and the tongue covered with a thin white slimy coat. The pulse generally increased but sometimes full, languid and slow. Pain in the back and limbs, in some cases severe pain in the back and top of the thighs was the usual complaint."

These observations written by Hennen in 1830 and supported by the following statistics of "admissions of fever into the Military Hospital in Malta taken over the years 1816 to 1823:-"

Jan:	217	Apl.	184.	July	498.	Oct.	322.
Feb:	207	May	189.	Aug.	487.	Nov.	194.
Mar:	158	June	272.	Sept.	540.	Dec.	156.

may well embrace an earlier description of Sandfly Fever - amongst other fevers than is generally accepted. The cessation of incidence of fever in the Navy on moving the ship clear of land, the increased incidence during July, August and September in the Army, the susceptibility to fever of what he terms the delicate newcomer, the sudden onset, the headache, the aching limbs, the suffused eyes and his perception of a slow and languid pulse can well make one conjecture whether Sandfly Fever was being unwittingly described.

In 1921 investigations were carried out by the Royal Airforce Sandfly Commission and Malta was chosen as the best locality/

locality to carry out their work presumably on account of its relatively isolated position and the fact that there was little or no malaria or relapsing fever or Dengue Fever on the Island. Many extremely valuable observations on Sandfly Fever as regards its aetiology and manifestations, and on the life history of the Phlebotomus were published by Whittingham & Rook (2), (4), as a result of this full and valuable investigation.

SANDFLY FEVER.

This disease is also known as Papataci Fever, Three Day Fever (now, I think, can be considered a misnomer) or Dog Disease - Hundfieher.

It is an acute fever of short duration caused by an unknown filter passing virus and transmitted by the bite of the Sandfly, Phlebotomus Papatasii. The disease occurs in tropical and subtropical countries stated to be where for eight consecutive weeks there is a mean daily temperature of between 65 and 90 degrees, and an earth temperature of over 65 degrees Fah. The Fever occurs mainly in the Mediterranean, Egypt, Palestine, Trans-jordania, Syria, Iraq, India and central and south America, but it is stated that it does not occur above a height of 7,000 feet. Whittingham (6) Anderson (5).

The Sandfly Phlebotomus Papatasii is a small delicate fly and is covered with fine hairs, it is not easy to see but has a distinctive short hopping flight.* It is only the female fly which bites the human being. Phlebotomi breed in rubble and in cracks, /

*x

Its limit of "flight" is said to be about 50 yards.

cracks, in walls and buildings and masonry and also in soil wherever suitable conditions of food, moisture and temperature exist. Anderson (5). The whole life cycle of the Phlebotomus covers a period of about 8 weeks dependant on its food and general environment. The larvae maybe found one foot down in the ground, they are mobile and can migrate to the level of optimal environment. Whittingham & Rooke (4).

(4) PREAMBLE.

The great bulk of the attached observations were made personally during the Summer of 1944 and 1945, and cover 600 cases personally treated. This work was carried out at Verdala Transit Camp, Malta, which was a wartime measure destined to act as a reservoir and drafting pool for a vast number of Sailors including periodic incoming drafts of "New" Sailors from the United Kingdom every few weeks. (During my time there, over 200,000 passed through its rather grim portals). Grim it was, for the Camp or Barracks was built around and inside an old disused Fort (built to repel the ravages of the Turks about 1552) which enclosed a long discarded Army Barracks which had been taken over faute de mieux by the Navy, and particularly during the summer its sanitation, water supply, and general amenities perforce left much to be desired, furthermore the conditions obtaining - crowded airless quarters, dust and rubble from bombing and decrepitude were most favourable for the prevalence and activity of the Phlebotomus.

A Sick Bay was organised with Three Wards taking up to Fifty Beds, and also a small laboratory in which Bloodcounts, Urines/

Urinés, Blood Sedimentation rates, and other straight forward tests could be carried out reasonably accurately. The Technical and Nursing Staff was small and inexperienced, but keen and reliable, and I had two young recently qualified Doctors working under me. This shortage of Staff, the fact that time was at a premium and service manpower shortage acute meant that investigations and experiments were not encouraged and had to be kept to a minimum compatible with accurate diagnosis, requisite treatment and rapid return to duty. This can well be understood by studying the figures for the incidence of Sandfly Fever during the Summer of 1944 (see page 8), when the numbers of men off duty with this disease caused interference with important operational commitments in the Navy.

In the height of the Summer of 1944 the ratings were living in stone rooms built prior to the first world war and originally intended, on the basis of space and cubic capacity of air, compatible with health and comfort, to accommodate 12 to 15 men, in these rooms from 22 to 25 sailors were living, eating and sleeping. The blackout imposed an added burden and cut down to an even smaller degree such slight currents of air as occasionally occurred. Fans at that time had not been or could not be supplied - they had been ordered and promised. Repeated representations were made regarding the potential dangers of such overcrowding and the close link between the epidemic of Sandfly Fever and the mens living conditions. Disgraceful though it seemed at the time surrounded with sick and complaining, and intolerable/

intolerable though it sounds now, it was I now know to a certain extent unavoidable, and to prevent it would have required two to three years unusual foresight and foreplanning. It had not been realised that the "seed" and the "soil" were going to be just right for epidemics of Sandfly Fever, and it was only when the numbers of men sick with this disease began to curtail operational requirements, that the Doctors were given those magical, but so necessary words - top priority - for their plans and requirements in their fight against the Sandfly.

Sandfly Fever was first mentioned by Naval Medical Officers in the Mediterranean several years ago (in 1921 it was first reported as an 'entity') but the disease had been of little importance or interest. The incidence during the pre-war years and then 1944 and 1945 will explain this and also indicate the subsequent importance of the disease:-

<u>Year</u>	<u>Number of Cases</u>	<u>Rate per 1,000</u>
1935	33	1.54
1936	158	6.32
1937	70	3.95
1938	47	2.60
1944	3505	349.50
1945	1457	145.70

In 1944 it became a vital factor in the prosecution of the War in the Mediterranean, and had wider repercussions as for example, when it necessitated the temporary closing of Malta Submarine Depot to Submarines on passage to the Far East to fight against Japan. The marked drop in 1945 is a corner stone of this Thesis, and as will be indicated the figures satisfactory though they were should have been even better if D.D.T. had been made/

made available earlier in the summer than June 22nd by which time 449 cases had already occurred.

(5) PROPHYLAXIS.

It would be as well at this stage to mention what steps were being taken to cope with the disease during its peak incidence in the Summer of 1944.

(a) Sandfly Nets.

These were supplied to all Officers and men, but on account of the damage (tearing, cigarette burns and wanton mischief) done to them by the Sailors, the issue of Nets had to be stopped. In this respect it is interesting to note that the 27 Officers who did use Sandfly Nets regularly and intelligently all developed Sandfly Fever during the course of the Summer.

(b) The wearing of long Trousers and long sleeves after sunset.

(c) Various insect repellants according to personal choice, none appearing to be of much value.

In view of the necessity of reducing the incidence of Sandfly Fever to a minimum the policy in 1945 was to adopt all known means for the prevention of Sandfly Fever and to try experimentally the effect of insecticide liquids containing D.D.T. - this was applied for repeatedly and early, but owing to lack of transport and infuriating inter service difficulties it was not made available to the Navy till half way through June, by which time several hundred cases had already occurred in Malta, and the epidemic had every appearance of being, if anything, more severe than that of 1944.

The/

The Prophylactic measures for 1945 were:-

(a) D.D.T.

(b) The wearing of long trousers and long sleeves after sunset was ordered and enforced - it was observed and confirmed that the first two hours after sunrise provide a danger period that is apt to be overlooked. A particular example being a man standing shaving in little or no clothing.

(c) Immediate and strict segregation under a Sandfly Net of patients suffering from Sandfly Fever. This is an important factor in the treatment and one which is apt to be overlooked or omitted when there are many cases. There is some diversity of opinion on the duration of the infectivity of the blood, Manson Bahr (1) states the virus resides in the patients blood during the first two days of the fever. This opinion was also held by others. Anderson (5) however, states that it was shown (by Shortt, et al., 1940) that well defined lesions were produced on egg membrane by a considerable number of sera collected four to five weeks after the date of onset of Fever. This, he continues, would appear to indicate that virus is present in the blood of convalescents for a considerable time after recovery. It has not yet been shown that such convalescents act as reservoirs of infection, and can transmit the virus to Sandflies, but it is for consideration whether they should be subject to some form of isolation such as sleeping in separate buildings and being issued with an extra supply of repellants. Whittingham & Rook (2) stated that relapses could occur up to 46 days after the initial attack/

attack but in his later writing on the disease, Whittingham (6) says "In a few cases the fever recurs four to seven weeks after the primary attack, this is probably not a relapse but due to reinfection." This latter statement, although it could not be proved, seemed to me to be the more tenable and all of my cases were segregated under Sandfly Nets only while pyrexial. With the vast numbers of cases we had to deal with it would have been quite impracticable to attempt any degree of isolation for a prolonged period of convalescence, in fact the principal of rapid return to duty as described on page 7 will still further bear out these opinions of the infectivity period.

(d) The use of Dimethyl Phthalate as an insect repellent smeared liberally on the face, neck, arms and legs prior to sunset and again prior to going to bed.

(e) Short interesting talks on the increase in health and comfort (the latter often appealing more than the former) achieved by carrying out D.D.T. routine.

(f) Removal of rubble etc., where possible.

(g) Use of Electric Fans and the placing of Beds and Chairs as far from the walls as possible - taking full advantage of the Sandfly's weak and very limited powers of progression.

(h) Living and sleeping on upper floors where possible in view of the very limited flight of the Sandfly, and consequent predilection for low levels.

(i) Careful cleanliness and sanitation. Sandflies collect and hide themselves in dark dirty corners, cobwebs, and soiled clothing./

clothing.

Care should be taken not to throw slops, dirty water etc., on the ground surrounding living quarters.

(j) A further small point is to advise re personal cleanliness and the non scratching of Sandfly bites as secondary infection of these bites appears to occur very readily.

(6) D.D.T.

The full name of this organic chemical is Dichloro-Diphenyl-Trichloroethane. It has been stated that it was first discovered in 1874, but the insecticidal powers were discovered by the Swiss and it was first used to kill plant lice. It was patented by the Swiss firm Geigy early in 1940. It is a white crystalline powder with a melting point of 107 to 108 degrees C. It is stable under most conditions and is soluble in most organic solvents. Care should be taken in using D.D.T. as it is a mildly toxic substance (on prolonged exposure) and those who are applying it should be provided with protective goggles, protective clothing and gloves. It is highly inflammable and, therefore, the normal precautions should be taken as regards this factor. It is wise to cover up foodstuffs and cooking utensils when spraying is in progress.

D.D.T. appears to kill insects mainly by contact and possibly by ingestion. It has no repellent action. In the case of most insects it is absorbed through the pads of their feet and the reactions caused, in co-ordination and paralysis, indicate damage to the central nervous system.

Method/

Method of using D.D.T.

Two types of liquid D.D.T. were used.

(a) Five percent D.D.T. in Kerosene. The official name for this was insecticide liquid pattern 4294. This is a persistent spray and should be sprayed liberally over walls, doors and windows, and particularly in corners, cracks and crevices inside rooms and offices. It was found advisable to carry out this spraying at least once every six weeks. During spraying the room should be empty of people and left empty for at least an hour on completion of spraying.

(b) $\frac{1}{2}$ per cent D.D.T. solution with Pyrethrum in Kerosene (pattern 4292). This should be freely distributed with 'flit' guns to all Messes and Offices etc., and flitting should be carried out:-

- (1) On rising in the morning.
- (2) At sunset.
- (3) At 9 p.m.
- (4) On retiring.

The two methods (a) and (b) were used concurrently.

(c) Pressure 'Bombs' of D.D.T. can be used. They give a fine spray, but of a more transient nature. They are more suitable for use in private houses, as they are cleaner, easier to use, but naturally much more expensive.

The residual spraying of 5 per cent D.D.T. should be carried out by a regular 'team' who understand what they are doing and are supplied with compression sprays. (A photograph of one in use is enclosed).



Sprayer in use. 5% D.D.T. in Kerosene.



Sprayer used for 5% D.D.T. Solution.

Stirrup pump sprays were the only type available for the first part of the Summer and proved inadequate and wasteful. As stated the 'team' using the sprays must be provided with protective water-proofs and goggles.

Ill effect of D.D.T. on human beings.

- (a) Headache and slight giddiness. These symptoms were reported quite frequently by members of the spraying team after a prolonged exposure to fumes (usually of over an hour). The headache was very temporary and cleared up with rest and fresh air.
- (b) Erythema and slight vesication of the skin from repeated contact with the fluid (see enclosed photograph).



Erythema and vesication of forearms following prolonged exposure to D.D.T.

(c) Conjunctivitis. Also a temporary manifestation due to exposure on removing the goggles during or immediately following spraying.

No further investigations were carried out regarding these complaints. They all appeared to be slight and transitory. Those members of the team who carried out spraying in the morning were given a rest in the afternoon and vice versa.

(7) GENERAL OBSERVATIONS.

The diagnosis of Sandfly Fever is much simplified in Malta by the fortunate fact that there is no Malaria and no Dengue Fever, and in the 600 cases reviewed no man with a past history of Malaria was included, thus further removing the possibility of error in differential diagnosis of these selected cases. It must be appreciated as explained previously that it was impossible to carry out repeated laboratory tests, (for example, e.g. full differential blood counts daily) and diagnosis came to be based on a definite clinical picture built up of signs and symptoms and previous history. The confirmatory Leucopenia was also of value, (See remarks on blood picture).

In a series of 600 cases the following observations were made.-

Sex. All patients were Male, but cases of Sandfly Fever occurred amongst white women on the Island.

Age. The average age of 1,000 Sailors that passed through Verdala Barracks was 20.6, but rather curiously the average age of the Sandfly patients works out at 23.7. There was no difference in the type of attack noticed in young as compared with older patients.

Race/

Race. All the patients reviewed were white and were from the British Isles. In this respect it is interesting to note the relative immunity acquired by the Maltese. For the following figures I am indebted to the Senior Medical Officer, R.A.M.C., Malta.

I have selected the incidence figures from four different summer months of 1944 and 1945. They will suffice for my purpose of demonstrating the relative incidence of Sandfly Fever in English and Maltese Army Troops:-

<u>BRITISH:</u>	1st Month	2nd Month	3rd Month	4th Month	Incidence per 1000
No. of Troops	5411	14512	5986	12856	1st Month- 10.3
					2nd Month- 20.5
					3rd Month- 8.3
No. of cases	76	298	50	119	4th Month- 9.3
<u>MALTESE:</u>					
No. of Troops	11063	10633	11056	11140	1st Month- 4.6
					2nd Month- 8.0
					3rd Month- 3.8
No. of cases	52	86	41	58	4th Month- 5.2

Whittingham (6) states natives contract the disease in childhood and thereafter by frequent sub-minimal infections maintain a complete immunity. Fleming (8) quotes a report of a high degree of

of immunity in persons resident in endemic areas, and suggests this as an explanation of the absence of Sandfly Fever among the native population in Rome and Naples during the outbreak in 1944 and 1945 among British and American Troops. Manson Bahr (1) also states that natives of endemic areas appear to be immune from Sandfly Fever.

From the figures I have quoted it would appear that the incidence of Sandfly Fever amongst so-called natives is considerably higher than previous reports would suggest. It is, of course, possible that communal living with "non-natives" as in the Forces during wartime maybe a definite factor in the lowered immunity, or increased susceptibility of the natives.

As regards immunity amongst troops from the British Isles it does seem extremely likely that there are people who have a natural immunity to this disease - this fact can, I think, be deduced from the discrepancy between the very large numbers resident in the barracks and the numbers affected by the disease.

TIME SPENT ABROAD.

Of the 600 cases reviewed 54% occurred within one month of arrival in Malta. A further 24% occurred from one month to two months, 11% from two months to six months, and the rest from six months onwards. 11% stated that they had not had an attack of Sandfly Fever or any illness that might have been Sandfly Fever during a previous Summer in the Mediterranean.

Whittingham (6) found 75% of newcomers to Sandfly regions fall victim to Phlebotomus Fever during their first summer.

Anderson/

Anderson (5) states the general trend of evidence suggests that the Fever is most likely to occur among comparatively new arrivals, and in his series of 78 cases he found that 80% were men with less than two years service in the Sandfly Fever area.

SECOND AND THIRD ATTACKS IN ONE YEAR.

Thirty-nine patients (6.5%) had a second attack. Four patients (.7%) had a third attack. Ninety-three patients (15.5%) had one or more attacks during the previous Summer. It must be pointed out that there was a large floating population, and that these figures, therefore, cannot be accurately representative, and are almost certainly on the low side. They do, however, prove the occurrence of second and third attacks in one year. Livshitz (8) concluded that a single infection gave protection for one to three months. One case of mine showed completely typical manifestations of Sandfly Fever eleven days after the commencement of a previous typical attack which had cleared up. Another case had a further attack of Sandfly Fever thirteen days after an earlier attack. I had no means of discovering whether these two isolated cases were relapse of re-infection - the former seems more probable. No other case had a second attack with less than thirty-four days interval.

Whittingham (6) states that probably a high proportion of Europeans suffer from second or third attacks so slight that they are mistaken for a chill or over exertion in the heat.

INCUBATION PERIOD.

It was not possible to fix an incubation period accurately, but there was much conclusive evidence that in these epidemics under review it was never less than six days (132 cases developed/

developed signs and symptoms of Sandfly Fever six days after arrival in Malta by ship from the United Kingdom - no case developed signs and symptoms earlier than six days after arrival). Anderson (5) states "amongst five artificially infected volunteers, the days of onset were as follows:- two on the 6th day and one on each of the 7th, 8th and 10th days. This incubation period is rather longer than that mentioned in many textbooks." - however, Fleming (7) on the contrary found that artificial inoculation produced typical symptoms of Sandfly Fever two-and-a-half days after the injection. Whittingham (6) says in non-immunes the Fever usually follows (the bite) within to five to seven days. Manson Bahr (1) gives four to seven days as the incubation period.

ONSET.

In 357 cases (59.5%) the onset was sudden in that the patient reported with acute symptoms and signs inside six hours of their initial appearance. In 243 cases (40.5%) there was a protracted onset with premonitory vague malaise varying from 6 hours to 48 hours, of these from 6 hours to 12 hours comprise 45%, from 12 hours to 24 hours comprised 47%, and 8% had complained of malaise of 24 to 48 hours duration. This onset differs markedly from Fleming's (7) review of cases in Italy where over 93% had a sudden onset. Anderson (5) however, found a vague "off colour" period in 50% of his cases, which he states when present lasted for one to two days and was succeeded by the true initial phase consisting of severe frontal headache and marked malaise. His report also states that 75% of his patients stated/

stated that they first felt really ill on waking in the morning or after the afternoon siesta. A few of his cases reported the onset of symptoms after strenuous exercise, such as Football or Hockey.

In the cases under review 35% of patients first reported sick in the afternoon, but as the Sailor gets his daily ration of Rum at midday, then has his lunch followed by a quick sleep, it is considered that these factors may be contributory to the timing. It was, however, found that in 11% of cases the onset followed directly after physical exercise.

SANDFLY BITES.

The majority of bites were found on the legs, particularly around the ankles and tendo achilles. They were not noticed at the time of biting. In the case of new-comers particularly subsequent itching was marked, and frequently one found secondary infection as the result of scratching. It was usually only in these cases that bites were found on examining patients reporting sick with Sandfly Fever. Weals were rarely complained of or noticed.

CLINICAL MANIFESTATIONS.

Headache - This was present in 100% of cases. It was usually severe and in 73% of cases was frontal and supra-orbital. In 17% of cases there was generalised headache, and in 10% it was occipital.

Conjunctivitis - Usually generalised but most severe around the outer Canthus.

MENTAL/

- Mental Apathy - In severe cases this was always well marked and usually persisted for the first 24 hours.
- Vomiting - This occurred comparatively rarely, and usually in cases complaining of particularly severe headache.
- Photophobia - A fairly prominent symptom for the first 24 hours.
- Rash - No definite rashes were seen. The patient was invariably flushed and quite frequently there was prickly heat or intercurrent dermatitis.
- Muscular Tenderness- This was a very persistent symptom and in 80% of cases was referred to the legs (calves) and lumbar region.
- Tongue - Invariably furred, but usually presenting a clean margin.
- Pharyngitis - With faucial injection and small vesicles was present in about 25% of the cases.
- Neck Rigidity - This was occasionally present, but was a stiffness rather than the rigidity seen in meningitis, and usually appeared in apprehensive patients with severe headache.
- Kernig Sign - This was not found in any case.
- Papilloedema - This was not found in any of 200 cases.
- Spleen - Not enlarged in any case.
- Gastro enteritis - Rather vague diarrhoea and vague abdominal discomfort occurred during the course of the/

HEADACHE. 100%

73% of these headaches were frontal and/or supraorbital.

RUFFED TONGUE 100%

69% had well marked clear red edges.

BRADYCARDIA 100%

This slow pulse rate is relative to temperature.

PAINFUL EYES 96%

Either pain on eye movements or "pain at back of eyeballs"

CONJUNCTIVITIS 95%

ACHING EYES 81%

HEAD IN THE BACK 79%

PHOTOPHOBIA 70%

INSOMNIA 67%

This symptom might well be secondary to the general discomfort and summer heat.

GASTRO-ENTERITIS 32%

Diarrhoea and abdominal discomfort. It could be secondary to a general lowered resistance.

PHARYNGITIS 25%

Pharyngitis with small Vesicles present.

"STIFF NECK" 10%

No true case of neck rigidity occurred.

VOMITING. 10%

SPLENOMEGALY. Nil.

PAPILLOEDEMA. Nil.

Refers to 200 cases only.

RASH. Nil.

- the illness in 32% of cases. It was considered to be a natural sequence in hot weather of a generally lowered resistance.
- Bradycardia - Slow pulse rate relative to the temperature is a constant sign of this disease.
- Chest signs - In 83 cases there were signs of acute or chronic bronchitis but 68 of these gave previous "chest" history.
- Central Nervous System - Reflexes were equivocal. In some cases they were increased and in others they appeared to be diminished. In the majority they were unaltered. The pupil reactions were unaffected in any case.
- Insomnia - This was found to be definite symptom during the first three or four nights of the illness. 38% of cases volunteered the complaint. 23% admitted it on questioning.

9. CLINICAL INVESTIGATIONS.

- Blood - Repeated facilities for this were limited. Three hundred cases had differential counts done on the first and second day of the Fever. 81% of them showed a definite Leucopenia (4,000 white cells or under) The second day was found to be a lower count in 79% of cases. A relative Lymphocytosis was found in 64% of cases.
- Urine - Occasional albuminuria was found, but not to

a marked extent, and in no case did it persist. No other abnormality was found.

Blood Sedimentation rate - This test was carried out in 100 cases on the second day of the illness, in some cases it was found to be raised, in the majority of cases it was within normal limits. 32% of cases showed a count of over 15 mm per hour (Wintrobe) No case showed a higher B.S.R. than 24 mm per hour.

Cerebro Spinal Fluid- Lumbar puncture was carried out in 11 cases only, two of these showed increased cell content and protein content to a slight extent only. The rest were within normal limits.

10 DIFFERENTIAL DIAGNOSIS.

When Sandfly Fever is ushered in by vague premonitory signs, almost any acute febrile illness can be simulated. Under more usual circumstances and in regions where Sandfly Fever is occurring I venture to assert that the differential diagnosis is not as difficult as frequently stated to be. The two main conditions likely to cause trouble in my opinion are Malaria and "Effects of heat", and in Malta, Undulant Fever. Dengue Fever, is, of course, very similar but has well marked features of its own, and in any case its differential diagnosis is not of any great import. Typhoid and Paratyphoid must be well remembered and then excluded. Relapsing Fever, Yellow Fever, Weils Disease, Cerebros/

Cerebrospinal Meningitis, Influenza, E. coli infections, Pre-icteric stage of Jaundice, typical Pneumonia and after effects of T.A.B. Inoculation all deserve consideration and subsequent exemption. Briefly they can be differentiated as follows:-

- Malaria - History, Rigor, Periodicity of Fever, Blood Film, Full Rapid Pulse, Splenic enlargement.
- Heat Exhaustion - History of undue exposure, Pale Face, Shallow respirations, sub-normal temperature.
- Heat Stroke - The prodromal stage is very similar to Sandfly, and requires close observation, but later you get hyperpyrexia, contracted pupils, and absence of deep reflexes. The history will usually also help.
- Undulant Fever - Marked increase in sweating, rapid pulse, afternoon pyrexia. Splenomegaly.
- Relapsing Fever - Leucocytosis, rapid pulse, enlarged Spleen and presence of Spirochaeta.
- Typhus Fever - Patient is usually very ill. Leucocytosis is present. Albuminuria present.
- Enteric Fever - The slow pulse and Leucopenia with headache and vague malaise are apt here to confuse the issue, but it is usually found that in Typhoid there has been a prolonged onset. The Spleen is usually enlarged and Marris's Atropine Test may be of assistance. The temperature too may present a typical feature. Blood culture can be carried out during/

- during the first week.
- Weils disease - Severe onset often with rigor or vomiting.
Leucocytosis. Blood culture may help.
- Yellow Fever - Frequently starts with a rigor, pulse usually full and bounding. Jaundice appears early. Albuminuria marked.
- Cerebro Spinal Meningitis - Lumbar puncture is diagnostic.
- Early stage of infective Hepatitis - Anorexia and dyspepsia are marked symptoms. A histamine test introduced by Klein is said to be useful for diagnosing latent Jaundice in the pre-icteric stage (an intradermal injection of .25 cc of histamine is given into the inner aspect of the forearm. Normally a white weal is produced. In a pre-icteric stage the weal is yellow in one minute). As regards infective hepatitis Cameron (11) in a review of cases of this disease in Palestine suggested that Sandfly Fever was a pre-disposing factor in rendering the Liver susceptible to catarrhal Jaundice. There was no evidence of this sequel in 280 cases which were observed for 8 weeks following Sandfly Fever, in Malta.
- Influenza - Usually occurs in epidemic form, almost invariably there is tracheitis and a troublesome cough.

Post T.A.B. -

An error in this diagnosis can, but should not be made, if the patient is properly examined and questioned.

11. TREATMENT.

(a) Prophylaxis. -

This is fully described in paragraph 5, page 9.

(b) Symptomatic relief.

The standard remedy of Aspirin, Phen acetin and Caffeine, was almost invariably found to give most relief, but in severe and intractable cases of pain and headache Aspirin, Phenacetin and Codeine (in tablet form, acetylsalicylic acid 0.25 gm., phenacetin 0.25 gm., and codeine phosphate 0.01 gm.) was used with benefit.

For the Insomnia chloral hydrate gr 20 was found to be useful. A phenol gargle and mouthwash is much appreciated.

As regards the muscular aches and pains in the back and legs these were markedly relieved by massage with Linament Methyl Salicylate. If this massage can be given at about nine o'clock at night it will often ensure a much better night's rest for the patient.

As stated above the patient, should be nursed in bed and under a Sandfly Net whilst pyrexial. He should be given a light diet with a plentiful supply of Fluid, particularly fruit juices or barley water and lemon.

(c) Specific Cure. - There does not appear to be any.

Thirty cases were treated with sulphonamides (sulphathiazole 16 gms. in 48 hrs.) without any apparent relief or benefit as compared with the treatment given above.

Thirty cases were treated with a mixture containing quinine Sulphate/

Sulphate and these also showed no improvement as compared with the routine treatment above.

(d) Complications.

In the series of cases under review no complication occurred. The headache and general malaise usually cleared within 96 hours, and in over 50% of cases the myalgia was the most troublesome and persistent symptom. Most of the literature on this disease mentions a prolonged convalescence with apathy and depression and Whittingham (6) states that nervous symptoms may appear and persist for weeks and months after the Fever has gone. In this series of 600 cases, this was not the case. During 1944 in view of the possibility of these complications I recommended that all Sandfly cases should have one week's leave following their discharge from Hospital. When the incidence of the disease increased greatly it was decided - reluctantly - that the leave period should be cut down to three days. This was explained to the Patients who were advised that anyone who suffered from the after effects of Sandfly Fever should report back to the Sick Bay with a view to an extension of his sick leave. Out of the next two hundred cases of Sandfly Fever (all of whom were given only three days sick leave prior to their return to duty) twenty-seven reported back with complaints, eleven of whom were given a further seven days sick leave and then returned to work. At a later period that Summer the manpower shortage became so acute (as described earlier in this Thesis) that it became expedient to try out the effect of returning men direct to some form of light duty immediately following their discharge from Hospital, after an attack/

attack of Sandfly Fever. This procedure was carried out for the remainder of that Summer and for the early part of the Summer of 1945. There was no apparent ill effects and no complaints amongst a population that was, alas' only too ready to complain on the slightest provocation. Speaking from personal experience of two attacks of Sandfly Fever there did not appear to be mental depression or prolonged convalescence. These facts are considered interesting in that they do refute a much publicised complication of Sandfly Fever - certainly of Sandfly Fever as it occurs in Malta.

12. PROGNOSIS.

No case was fatal and I have not read of any such occurrence. Whittingham (6) has suggested that should Phlebotomus Fever, which is a leucopenic disease, occur in an individual already suffering from a disease accompanied by leucopenia, then it is possible that death might supervene. This unfortunate combination of circumstances did not occur in any of my cases.

SUMMARY AND CONCLUSION.

1. Two Sandfly Fever epidemics are reviewed by a Naval Medical Officer whilst working ashore in a temporary barracks under wartime conditions.
2. Sandfly Fever is not a dangerous disease, but under such conditions as occurred in Malta - in overcrowded dilapidated barracks - it may assume epidemic form which apart from purely medical and health considerations may cause a huge loss in man hours.
3. It can be most effectively controlled by Dichloro-Diphenyl-Trichlorethane. A method of using this is described. This insecticide used along with other prophylactic methods should prevent such epidemics occurring again.
4. In comparing reports on Sandfly Fever one finds diversity of opinion on the aetiology of the disease, on its incubation period, on the period of infectivity in the blood, on the incidence amongst 'natives' and on the relative incidence of its clinical manifestations.
5. Observations on 600 cases of Sandfly Fever in Malta are given, from these and from other reports it appears that Sandfly Fever varies in different areas, this makes one wonder whether those differences are due to different types of viruses causing the disease, or to different vectors (is *Phlebotomus Papatacii* the only vector or not).
6. An early or even immediate return to duty does not precipitate depression or mental distress, as is suggested in most of the relevant literature.

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Infective Hepatitis.
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CHART 1

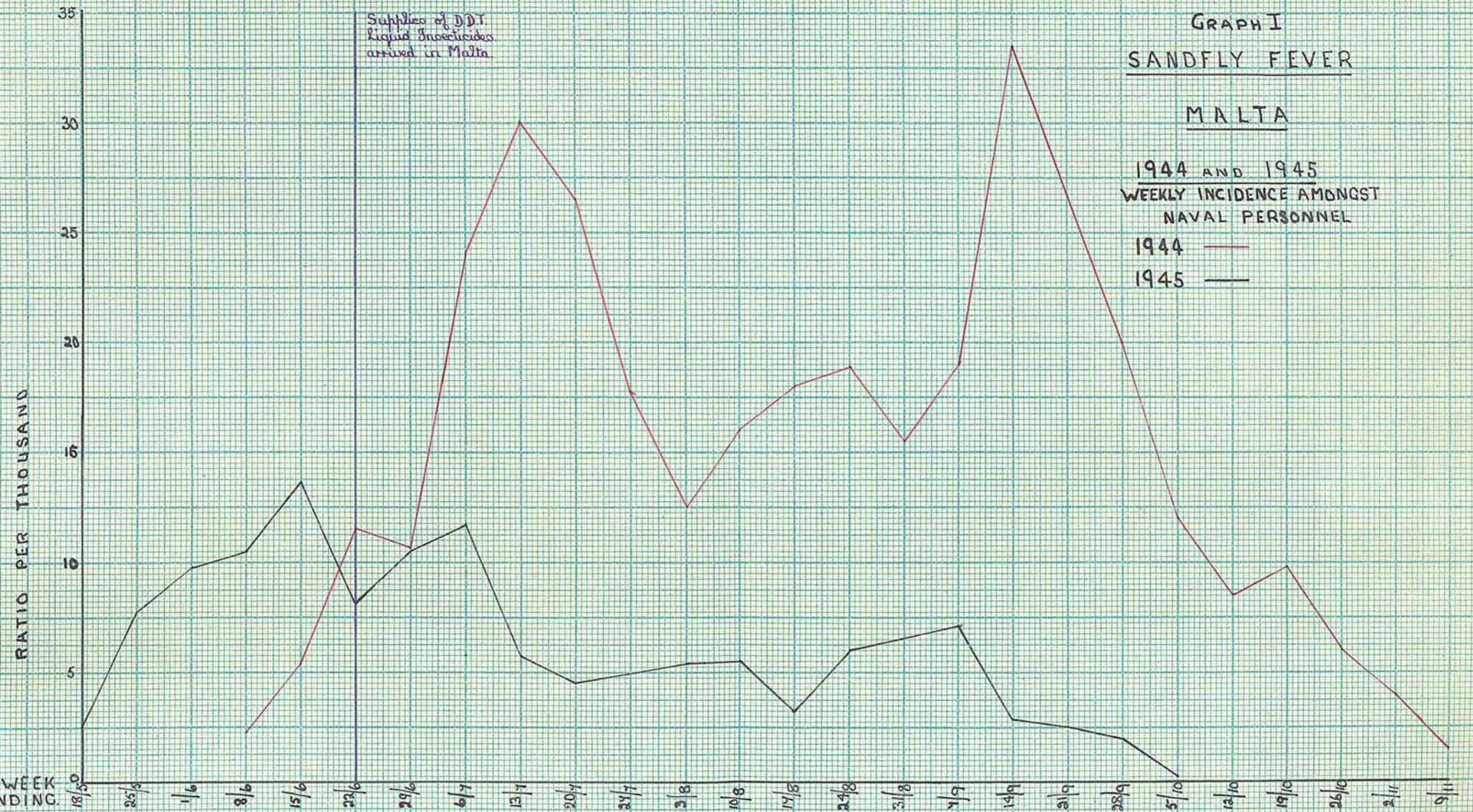
This chart illustrates clearly the very beneficial effect in modifying an epidemic of Sandfly Fever achieved by the use of D.D.T. It can be seen that the epidemic in 1945 started three weeks earlier than in 1944. The D.D.T. arrived in the Island on June 22nd/45 and had been distributed and used in all Naval establishments by June 29th/45.

GRAPH I
SANDFLY FEVER

MALTA

1944 AND 1945
WEEKLY INCIDENCE AMONGST
NAVAL PERSONNEL

1944 — (red line)
1945 — (black line)



Supplies of DDT
Liquid Insecticides
arrived in Malta

1944	MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER						
TOTAL WEEKLY RAINFALL.	0.3mm.	0.5mm.	TRACE	NIL	NIL	NIL	NIL	TRACE	6.8mm.	NIL	TRACE	0.3mm.	TRACE	25.4mm.	4.5mm.	11.3mm.	13mm.	4.9mm.	
WEEKLY MEAN MAX. TEMP.	75°	77°	83°	80°	82°	86°	84°	84°	83°	86°	84°	84°	83°	80°	79°	74°	75°	71°	70°
	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	TRACE	NIL	TRACE	NIL	TRACE	NIL	TOTAL WEEKLY RAINFALL.		
	78°	88°	79°	81°	81°	84°	87°	83°	83°	87°	83°	83°	83°	83°	83°	83°	83°	83°	83°
																	WEEKLY MEAN MAX. TEMP.		

CHART 2.

This interesting chart illustrates the surprising difference in the incidence of Sandfly Fever in the Royal Navy on the one hand, and in the Army and the Royal Airforce on the other.

It was undoubtedly due to the fact that the Navy which was not normally based ashore in large numbers in peace time had perforce to accept dilapidated, crowded and generally unsatisfactory accommodation ashore at short notice during wartime. The Army and the Royal Airforce, however, normally have properly planned barracks for their personnel in peace time, and therefore, apart from a few minor discomforts are not subject to any undue alterations in circumstances during wartime conditions.

GRAPH II
SANDFLY FEVER

MALTA 1945

WEEKLY INCIDENCE IN THE:-
 ROYAL NAVY. —
 ARMY. —
 ROYAL AIR FORCE. —

