REGISTER OF MALARIA ERADICATION OF TRINIDAD AND TOBAGO

PAHO

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PAN AMERICAN HEALTH ORGANIZATION
Pan American Sanitary Bureau, Regional Office of the
WORLD HEALTH ORGANIZATION

MAR. 1965

Pan American Sanitary Bureau

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Introduction

Malaria had been one of the most important causes of illness and death in Trinidad and Tobago before the CURRENT malaria eradication program began. The epidemiology of the disease was well studied by local and foreign malariologists and entomologists, before and during World War II. In many areas in Trinidad and Tobago, a varying degree of malaria control had already been achieved by means of oiling, drainage, and removal of bromeliads before DDT became available. Residual house spraying with DDT was first tested in Trinidad in 1945 and subsequently was the principal measure used to eradicate Aedes aegypti and to control malaria until 1958.

From 1952 to 1957, an Expanded Program of Insect and Malaria Control was carried out by the Government with material assistance from UNICEF and technical assistance from PASB/WHO. Malaria incidence was dramatically reduced in Trinidad in the area where A. aquasalis was the principal vector. In Tobago, where A. aquasalis is the only vector, malaria transmission was completely interrupted and no autochthonous malaria case has been found after 1953. In some areas of Trinidad, however, the presence of Subgenus Kerteszia, A. bellator and A. homunculus, caused certain complications and the malaria control measures applied during this period did not succeed in interrupting malaria transmission completely.

In 1958, a full-scale malaria eradication program was launched in Trinidad. It was based on residual house spraying with dieldrin, 0.6 gm./m^2 once a year in the aquasalis areas and 0.5 gm./m^2 twice a year in the Kerteszia area. Although the coverage with dieldrin house spraying was island-wide, it was considered to be an experiment; for it was not certain that the insecticide alone would be fully effective against malaria transmitted by A. bellator and A. homunculus which, according to the previous studies, are very exophilic and exophagous. For this reason, the 1958 program was considered a "Pre-eradication Program". Malaria incidence was further reduced in 1958 except in the North-eastern region of Trinidad, where malaria transmission persisted in spite of the application of the insecticide.

In 1959, a Tripartite Plan of Operations was signed by the Government, UNICEF, and PASB/WHO for a malaria eradication program. It called for residual house spraying with insecticides in the aquasalis areas and mass drug treatment, since A. aquasalis was also present in the Kerteszia area. However, in most of the Kerteszia area, particularly in the northeastern region, the mass drug treatment was practically an additional measure to the residual house spraying. In Tobago, residual house spraying was carried out only in 1959 and, after that, the island was placed under malaria surveillance.

The results of the campaign were very satisfactory. Even with a well-developed malaria case-finding system, no autochthonous case has been found in Trinidad since September 1960. In view of the absence of autochthonous malaria for more than three years, Trinidad and Tobago are

considered to meet the criteria for malaria eradication established by the Expert Committee on Malaria in its Seventh and Eighth Reports. This report attempts to summarize the activities and the results of the malaria eradication campaign and to certify that malaria has been eradicated from Trinidad and Tobago.

BACKGROUND INFORMATION

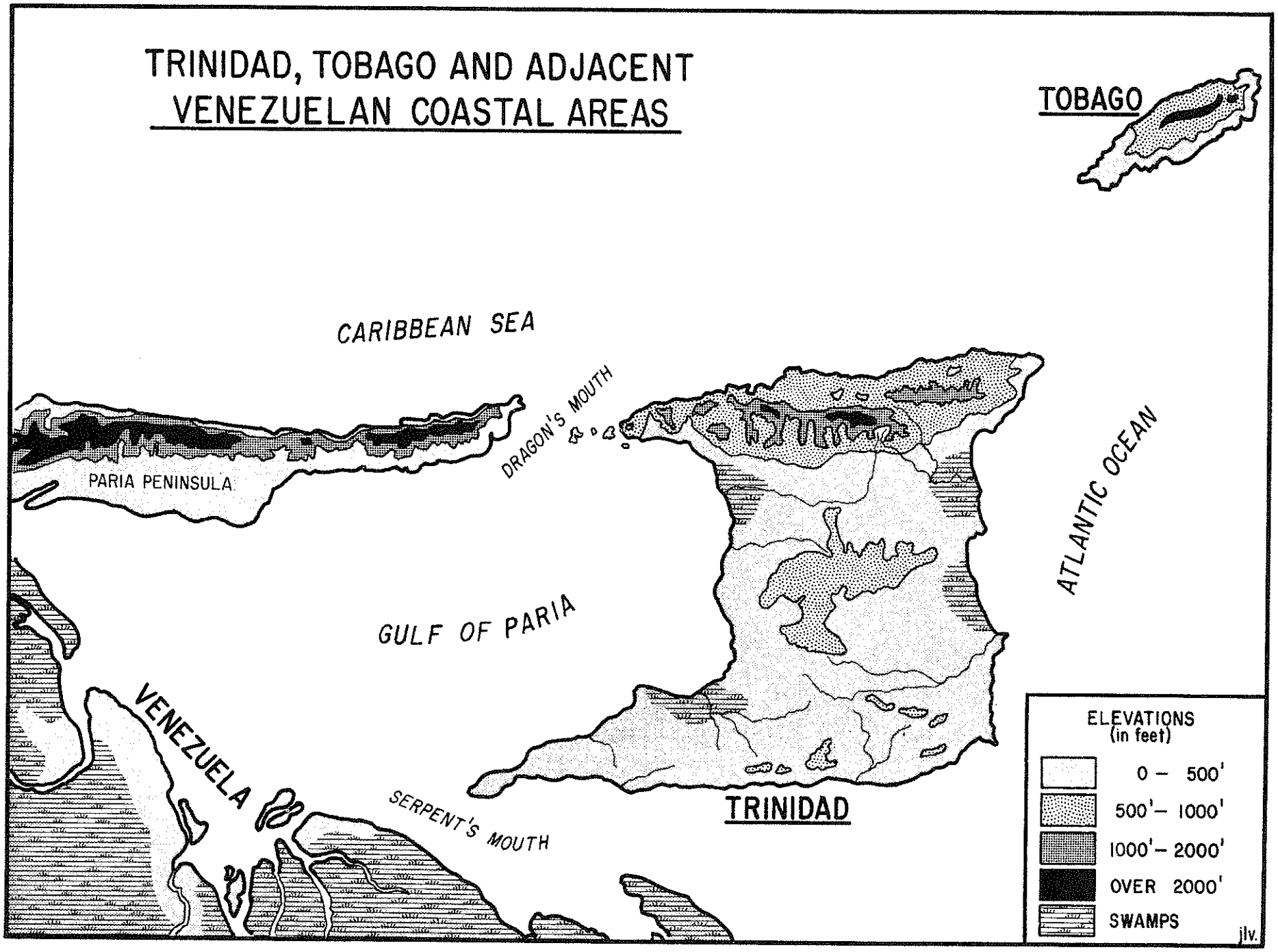
Trinidad and Tobago has been an independent country in the West Indies and a member of the Commonwealth of Nations since August, 1962. Trinidad is located between 60° 55' and 61° 44' W. longitude and between 10° 03' and 10° 51' N latitude. It lies 15 miles northeast of Venezuela. The island, which is roughly rectangular in shape, has an area of 1,863 square miles. The island of Tobago is situated between 60° 30' and 60° 50' W. longitude and 11° 08' and 11° 20' N. latitude 21 miles northeast of Trinidad. The island is 26 miles long and seven miles wide, and has an area of 116 square miles (see Map. 1).

Although related geologically to South America, the island is classified as one of the West Indies. The island consists almost entirely of sedimentary rocks. A considerable area of Trinidad is covered by alluvial layers varying from mud flats with mangrove swamps in tidal areas to higher lands used for agriculture. Petroleum and asphalt are found in the sourthern part of the island. Tobago is formed mainly of metamorphic rocks of both sedimentary and igneous origin.

Topographically Trinidad can be divided in three ranges of mountains and hills and two intervening lowlands. The northern mountain range, a continuation of the mountains of the Paria Peninsula of Venezuela, stretches across the entire length of the north coast from west to east; the highest elevation is 3,085 feet. The central range of hills stretches across the island from southwest to northeast with the highest elevation of about 1,000 feet. The southern range runs along the southern coast of the island with an elevation of about 1,000 feet. Between the three mountain ranges, lie two plains with small rivers and swamps on both the east and the west coast. The river mouths and the mangrove swamps provide ideal breeding places for A. aquasalis (see Map. 1)

Another aspect of epidemiological importance in Trinidad is off-the-ground water collection, inside the base of epiphytic bromeliads. It forms a permanent "over-head lake" in the area where rainfall is sufficiently heavy and regular and where "immortelle" trees are used for shading cocoa trees. This over-head water collection provides the breeding places for A. bellator and A. homunculus.

Although tropical in location, Trinidad and Tobago has a comparatively temperate climate. The mean annual temperature at Port-of-Spain, the capital, is 77.6° F., with little variation during the year. Rainfall varies with location and elevation, averaging about 50 inches annually in the extreme west and about 150 inches in the extreme northeast, in the path of the trade winds. Normally, the rainy season begins in the middle of May and ends at the end of January. Usually a period of three to four weeks of less rainfall is seen in September or in October. Malaria transmission by A. bellator and A. homunculus is observed in the northeastern and eastern regions of the island where the annual rainfall is more than 90 inches. Humidity at mid-day in the western plain


TRINIDAD, TOBAGO AND ADJACENT
VENEZUELAN COASTAL AREAS
TOBAGO
CARIBBEAN SEA
DRAGON'S MOUTH
PARIA PENINSULA
ATLANTIC OCEAN
GULF OF PARIA
VENEZUELA
SERPENT'S MOUTH
TRINIDAD
ELEVATIONS
(in feet)
0 – 500'
500'– 1000'
1000'– 2000'
OVER 2000'
SWAMPS
jlv.

MAP I.

of Trinidad is between 50 and 72 per cent in the dry season and between 65 and 75 per cent in the rainy season. In the morning the humidity ranges between 80 and 88 per cent in the dry season and between 87 and 91 per cent in the rainy season (see Map 2).

The latest population census taken in Trinidad and Tobago on 7 April 1960, showed a total population of 827,957 of which 794,624 for Trinidad and 33,333 for Tobago. The racial composition of the population in the same year was: 43.3 per cent African, 36.5 per cent East Indian, 1.9 per cent white, 1.0 per cent Chinese, 16.3 per cent Mixed, 0.2 per cent Lebanese/Syrian and 0.8 per cent others.

Trinidad and Tobago is a self-supporting country with a favourable balance of payments, being its principal exports in order of importance, oil, sugar, asphalt, rum, cocoa, bitters, and coffee.

Port-of-Spain is an important port and airport for ships and aeroplanes coming from North, Central and South America, other Caribbean islands and Europe. There is an extensive network of roads both in Trinidad and in Tobago.

Administratively, the country is divided in eight counties, three boroughs and the island ward of Tobago. The Health Department is under the Ministry of Health and Housing. Each county and the island ward has a Medical Officer of Health, a number of district medical officers, public health nurses and public health inspectors. There are 98 (1958) Health Centers well distributed over Trinidad and Tobago, and they are periodically visited by district medical officers, public health nurses, and midwives. Trinidad has eleven government hospitals and Tobago has one. There are also specialized hospitals for tuberculosis, leprosy and mental diseases. In addition to the government health and medical services, some industrial firms have their own clinics and hospitals. There are also many private physicians in the cities and towns.

The malaria eradication program is carried out by the Malaria Division of the Department of Health. The Malaria Division which is now called "Insect Vector Control Division" has had a considerable degree of autonomy within the Department of Health. A malariologist (medical officer) was the Chief of the Malaria Division and he was assisted by three supervisor-inspectors, one being responsible for spraying operations, one for epidemiological evaluation and the other, for *Aedes aegypti* eradication up to 1959. There was also an entomologist.

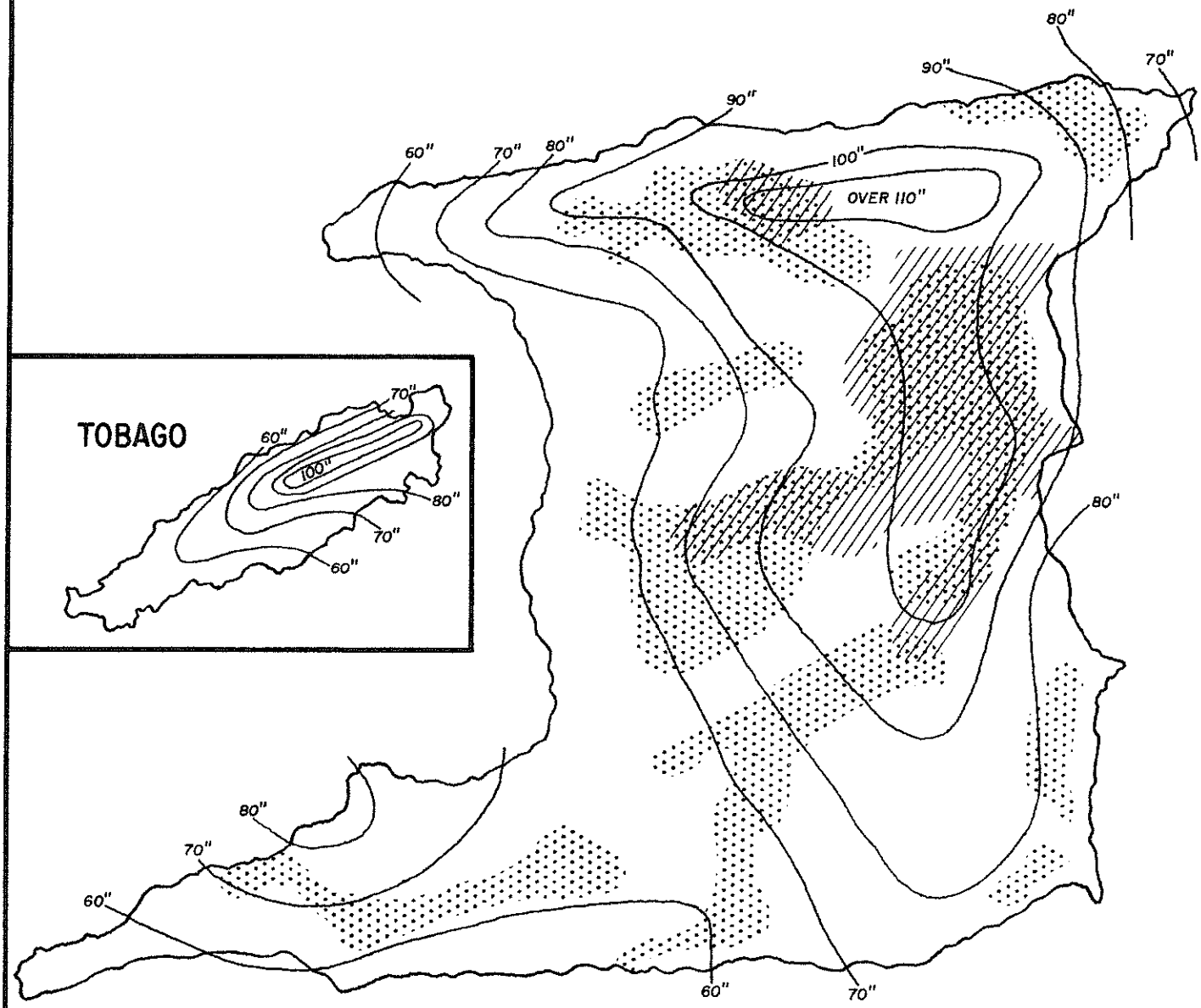
MALARIA HISTORY

The importance of malaria as a public health problem in Trinidad and Tobago was realized long ago. Early in the twentieth century, the disease was regarded as one of the main causes of death. According to the records of the Health Department, deaths from malaria constituted 10 per cent of the deaths from all causes during the period 1902-1912 and 7.6 per cent during 1928-1941. Between 1931 and 1942 the number of cases of malaria diagnosed annually by the district medical officers averaged 17,233.

Laboratory diagnosis for malaria cases was available at the Government Bacteriological Laboratory during 1932-1941. The majority of the samples were from persons coming to Port-of-

TRINIDAD AND TOBAGO

CORRELATION BETWEEN AVERAGE ANNUAL RAINFALL, MAIN COCOA GROWING AREAS AND AREAS OF TRANSMISSION BY KERTESZIA SPECIES



MAIN COCOA GROWING AREAS

AREAS IN WHICH MALARIA IS MAINLY OR ONLY TRANSMITTED BY KERTESZIA

60" 60" RAINFALL IN INCHES

jlv.

MAP 2.

Spain Colonial Hospital or from persons living in Port-of-Spain and its adjacent villages. In the 10 years, the laboratory examined 12,678 blood smears, of which 2,128 or 16.8 per cent were found to be positive; 1,769 cases or 83.1 per cent of the total positives were for P. falciparum, 345 cases or 16.2 per cent for P. vivax and 14 cases or 0.7 per cent for P. malariae.

In 1943, the Malaria Division was created and, since then, laboratory service has been made available to all the district medical officers in the two islands. Every year, a considerable number of blood smears were taken by the medical officers from suspected malaria cases at the district medical officers' offices and health centers. The results of the blood smear examinations are as follows:

NUMBER OF BLOOD SMEARS SUBMITTED BY PHYSICIANS AND RESULTS OF EXAMINATION APRIL 1943 - DECEMBER 1964

Year	Number examined	Number positive	% positive	Year	Number examined	Number positive	% positive
1943	14 117	5 823	41.25	1954	4 117	220	5.34
1944	20 504	7 115	34.70	1955	3 470	187	5.39
1945	18 899	5 235	27.70	1956	2 680	274	10.22
1946	10 422	2 772	26.60	1957	2 402	433	18.03
1947	17 919	2 523	14.08	1958	2 160	185	8.57
1948	10 713	943	8.80	1959	1 299	23	1.77
1949	10 424	959	9.20	1960	714	3	0.42
1950	6 685	308	4.60	1961	499	1*	0.20
1951	5 188	498	9.60	1962	293	1**	0.34
1952	4 008	778	19.40	1963	214	0	0
1953	3 492	400	11.45	1964	194	2***	1.03

* Imported P. vivax.
** Relapsing P. malariae.
*** One imported P. vivax and one relapsing P. malariae.

In addition to laboratory services, malariometric and entomological surveys were made jointly by the Government and the Rockefeller Foundation during 1941-1942 (Dr. Horace Gillette, Mr. R. C. Shannon, Mr. Colin Pittendrigh, Dr. Mark Boys and Dr. Wilburn Downs). A total of 26,199 school children from all the counties and Tobago were examined for malaria parasites and spleen enlargement.

The parasite rate of this group was 10.5 per cent and spleen rate 8.5 per cent. An entomological survey was carried out during the same period. Thirteen species of anopheline mosquitoes were identified for Trinidad and three species for Tobago. Among the species in Trinidad, only five species were considered to be possible malaria vectors; i.e. A. aquasalis, A. oswaldoi, A. albitarsis, A. neomaculipalpus and A. bellator. However, only A. aquasalis and A. bellator were found to be naturally infected, and later only these two species were considered to be the principal

vectors in Trinidad and only A. aquasalis was the vector in Tobago. A. homunculus (Kerteszia) was added to the list of the principal vectors on the strength of epidemiological evidence. The studies made on the principal vector species in Trinidad and Tobago may be summarized as follows:

A. aquasalis: This species does not choose any specific breeding place, but it prefers brackish water along the fringes of mangrove swamps, water collection in the coconut estates along the coast, lagoons and swamps behind sand bars in river mouths, etc. Although the mosquito is found breeding many miles inland, it is much more abundant in coastal areas. The adults feed freely on animals and man and enter houses and stables readily. Its possible flight range extends to 3-5 miles, but, for practical purposes, control with anti-larval measures within a zone of one mile around human habitations gives good protection. The time of the greatest invasion of human dwelling for blood meals is from 6:30-8:00 p. m. and a second peak of lesser intensity is observed between 3-5 a. m. A. aquasalis is semi-wild and zoophilic; it does not like to remain indoors during the day-time, and it prefers animal blood wherever it is available. It is an important malaria vector owing to its very high density, and its readiness to enter houses and feed on man. After a blood meal, it rests on walls, furniture, bedspread, nets, etc. for a period of 30 minutes to several hours unless disturbed. After the post-biting rest, it tries to escape, especially on a clear, dry night. Its escape is guided by light, and as soon as the first daylight is perceptible, the mosquito is activated to leave the house or stable. A. aquasalis was found naturally infected in Trinidad. In 1928, De Vertenil dissected 200 A. aquasalis caught in habitations, and he found 3 positive for sporozoites in the salivary glands. Three years later, he dissected 80 specimens caught in houses and again he found 4 positive for oocysts. During the survey in 1941 and 1942, Shannon dissected 1,364 house-caught A. aquasalis and he found 46 positive for oocysts.

A. bellator and A. homunculus (Kerteszia): Both species breed in the water collection held by Bromeliads. Among many species of Bromeliads in Trinidad, these anophelines prefer a large, long-leaved species, such as Gravisia aquilega, Vriesia amazonica, Hohenbergia stellata and Wittmacklia lingulata. A.bellator breeds and lives in the drier and lighter upper level of the forest canopy, while A. homunculus prefers the forest floor where the microclimate is more humid. A. bellator is less restricted in its flight range and has more ability to leave the forest in search of human blood than A. homunculus. A. bellator is widely distributed over the eastern and northeastern part of Trinidad where bromeliads are abundant and where the rainfall averages between 90 and 110 inches a year. In the area with less than 90 inches annual rainfall, the density of A. bellator rapidly becomes less and so does its importance as a vector. The distribution of A. homunculus is limited to the area with more than 110 inches annual rainfall.

Both species are anthropophilic, exophagous, and exophilic. Although the biting peak is during the early hours of the evening, a small number of bites can be observed throughout the night and even during the daytime in the forest. These species have a great tendency to bite outdoors, but they also bite on the verandahs of the houses. They will

enter the house and bite when there is no blood meal available outside. They are rarely found resting indoors at any time of the day. They seem to fly away from the houses after biting, but on some occasions a small number of engorged mosquitoes were found resting on the walls and furnitures near the light, but the period of resting was a matter of a few minutes. A. homunculus seems to rest indoors more than A. bellator. A. bellator was a very efficient vector in Trinidad, and it was found naturally infected by Roseboom and Larid in 1941, 3 gland infections out of 725 specimens dissected. During 1941-1942, Shannon dissected 1,263 A. bellator and found 10 positive for oocysts. A. homunculus was not found to be naturally infected, but it was considered to be a vector on epidemiological evidence; malaria transmission was observed in some localities where A. homunculus was the only Anopheles found.

During the period 1941-1945, certain malaria control measures were undertaken by the Engineering Division of the Public Works Hydraulic Department, in close association with the Malaria Control Section (later Malaria Division) of the Health Department. The main activities were (a) construction of sea-heads at the mouths of rivers to prevent blockage, (b) construction of permanent, concrete drains, (c) building of an automatic flush in a river in Tobago, and (d) drainage, filling and oiling in the swampy area in both islands. These measures were applied in some limited areas were malaria incidence was very high owing to the enormous production of A. aquasalis. A great reduction of malaria incidence was obtained in the area where these measures were applied.

In the area where A. bellator and A. homunculus were the vectors, an attempt was made to remove bromeliads by hand, but it was found to be very costly and difficult to apply in an extensive area. Later in 1945, spraying with cooper-sulphate solution to kill the bromeliads was tested. 1.5 per cent copper-sulphate solution was sprayed on the bromeliads with a high pressure pump, rather like that of a fire engine. The results of this operation were very effective, but the coverage was rather limited. This measure was continued until 1963 as a supplement to residual house spraying, particularly in foci of transmission. During the period 1945-1963, an average of 600 acres were sprayed every year. One spraying was enough to kill all the bromeliads in the area for 8 years before reinfestation took place.

Early in 1944, a limited quantity of DDT was obtained and it was tested against the larvae and adults of A. aquasalis. In 1945, the insecticide was tested in a village, California, residual house spraying being the technique used. Because of the encouraging results obtained in this experiment, residual house spraying was gradually extended until the two islands were covered once a year. The number of houses sprayed during 1953-1957 was as follows:

NUMBER OF HOUSES SPRAYED IN TRINIDAD AND TOBAGO

1953-1957

Year	No. of houses sprayed		Population directly protected
	with DDT	with dieldrin	
1953	79 449	-	330 000
1954	81 816	-	335 000
1955	69 780	-	385 000
1956	83 255	-	430 000
1957	78 139	22 424	540 000

DDT residual house spraying during this period had a dual objective; to eradicate Aedes aegypti and to control malaria. For this reason, the coverage was not total as far as malaria was concerned, and, besides, the spraying cycle was never exactly annual. The Kerteszia area was sprayed only in 1953, 1955 and 1957.

CURRENT MALARIA ERADICATION PROGRAM

Various malaria control measures applied during 1943 and 1957, especially DDT residual house spraying carried out during 1953-1957, resulted in a great reduction in malaria incidence in Trinidad and even interrupted malaria transmission in Tobago where no autochthonous case of malaria has been found since 1953. However, a low malaria transmission continued in the Kerteszia area, especially in the northeastern region of the island where the rainfall is heavy and the density of A. bellator is high.

Epidemiological evaluation before 1957 was limited to school surveys and blood smears taken by the district medical officers and therefore it was not quite sufficient to indicate the exact status of malaria transmission. Nevertheless, it appears that malaria transmission in the A. aquasalis area was interrupted, but persisted at a low level in the Kerteszia area.

In 1958, the Government of Trinidad and Tobago decided to undertake a malaria eradication program in conjunction with the Aedes aegypti eradication. As Aedes aegypti had already developed resistance to DDT, it was agreed to use dieldrin in order to achieve the two objectives at the same time. The Government requested increased material assistance from UNICEF and technical assistance from PASB/WHO. The plan of operations provided for the spraying of all the houses in the A. aquasalis area with dieldrin at 0.6 gm. /m^2 once a year and with the same insecticide at 0.5 gm. /m^2 twice a year in the Kerteszia area. It was also agreed to organize a systematic epidemiological evaluation scheme in order to assess the results of the campaign.

The program in 1958 was regarded as an experiment, because it was not 100 per cent sure that house spraying alone would be sufficient to interrupt malaria transmission in the Kerteszia area, in view of the exophilic and exophagous habits of the vectors. Nevertheless, the results of

school surveys indicated a marked reduction in the parasite rate after sprayings in 1953 and in 1955 and for this reason it was considered worthwhile to experiment with total coverage with insecticides. The plan was to spray all the surfaces in the houses, including inside and outside walls, verandahs, and underside of floor if the house is built on stilts. Since this was an experiment, the 1958 program was called "Pre-eradication". During the year, more studies were to be made on the habits of A. bellator and A. homunculus and then a definite plan of operations was to be based on the results of this experiment.

The plan of the "Pre-eradication Program" was carried out under rigid supervision. The results obtained in this year were highly satisfactory in reducing the global parasite rates from 6.5 per cent in 1957 to 0.7 per cent in 1958. However, malaria transmission in the northeastern region of Trinidad seemed to continue at a low intensity. It was also found that A. aquasalis had developed a certain degree of resistance to dieldrin, but it was still susceptible to DDT. Entomological studies gave very interesting results. A. bellator is very exophagous and it prefers to bite man outside and on the verandahs. However, if there is no blood meal available outside, it enters the house. The biting peak is between 6:00 and 8:00 p. m. and after that the number of bites falls sharply. During these hours, many inhabitants in this area stay outside, or on the verandahs. After the biting hours, some specimens were found resting on walls and surfaces of the furniture near the light. But the resting period was a matter of a few minutes. On other occasions, the engorged specimens were found resting on the outside surfaces of walls and objects on the verandahs. The number of resting mosquitoes was negligible compared with the large number of bites. A. homunculus seems to have more of a tendency to rest inside the house. In fact, in the villages where A. homunculus was the only vector, malaria disappeared with house spraying alone.

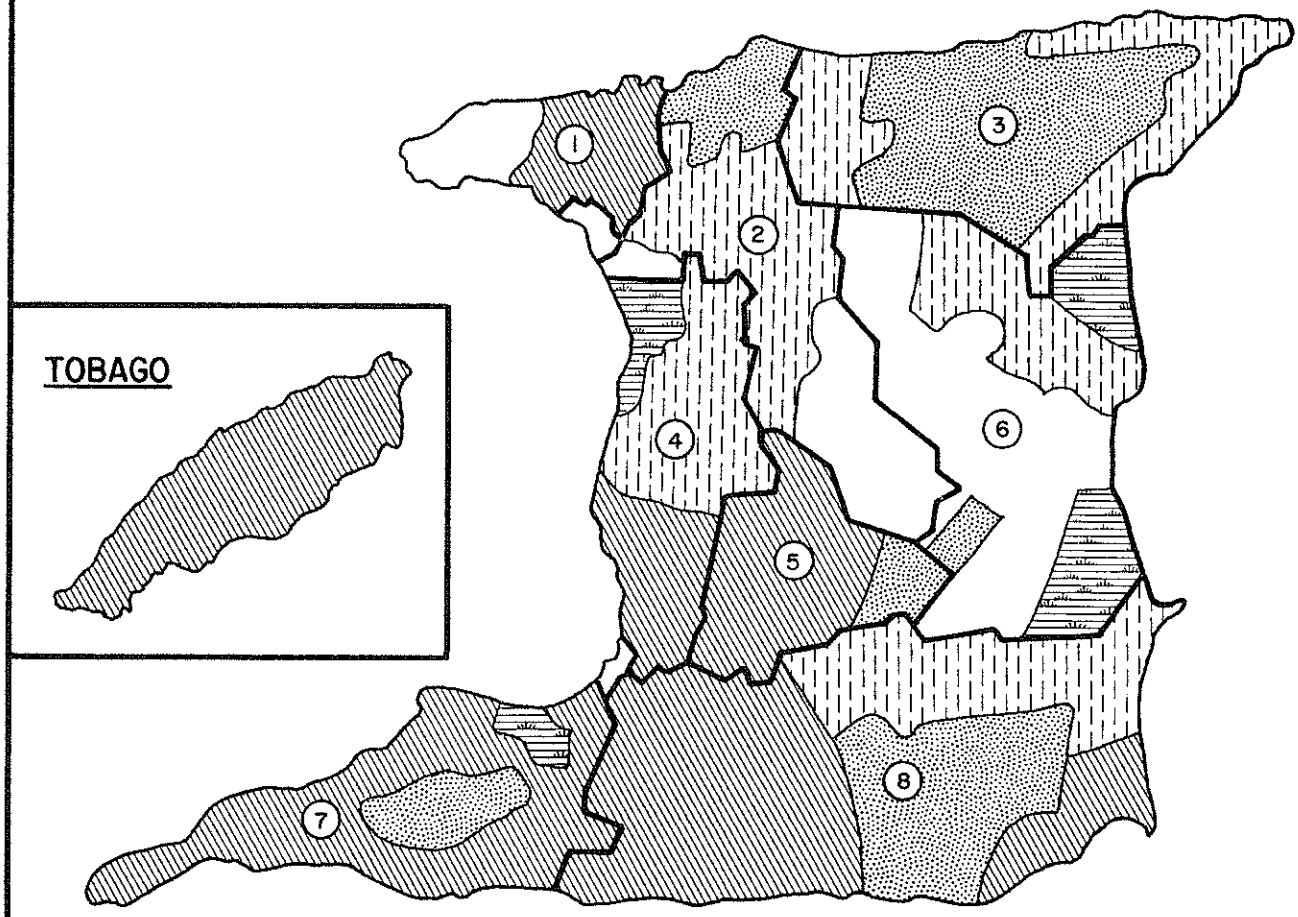
On the basis of the knowledge obtained in 1958, a new plan of operations was made and it was signed by the three parties in June 1959. This plan included:(1) residual house spraying in all the malarious areas in Trinidad where A. aquasalis is the vector, (2) Mass Drug treatment of the entire population in the area where A. bellator is the vector, and discontinuation of residual house spraying except in the area where A. aquasalis is also a vector; (3) Further development of evaluation networks.

In view of the fact that A. aquasalis had developed resistance to dieldrin it was necessary to change from dieldrin to DDT. On the other hand, Aedes aegypti, which was resistant to DDT, was close to eradication as a result of the dieldrin house spraying in 1958, and it was considered necessary to continue the use of dieldrin in order to complete eradication. In fact, malaria transmission in A. aquasalis was practically interrupted at that time, and it was therefore decided to use dieldrin in 1959 in the area where Aedes aegypti was still present. In the area where Aedes aegypti had been eradicated, DDT was used. After 1959, DDT was the only insecticide used in the area where A. aquasalis was the vector, and it was applied twice a year at 2 gr. DDT tech. /m^2. House spraying was completely discontinued in December 1959 in Tobago and in December 1961 in Trinidad. (See Map 3).

In Trinidad, the entire island, except for the Cities of Port-of-Spain and San Fernando, was considered to be malarious. The population in the malarious area totaled 622,487 (1960 census).

TRINIDAD AND TOBAGO

SPRAYING OPERATIONS DURING 1959



OPERATIONAL DISTRICT

RESERVE FOREST

SWAMPS

AREAS SPRAYED WITH DIELDRIN

AREAS SPRAYED WITH DDT

1.– NORTH WEST
2.– ARIMA LAVENTILLE
3.– MATURA MATELOT
4.– CHAGUANAS S. FERNANDO
5.– SOUTH CENTRAL
6.– NORTH CENTRAL
7.– SIPARIA CEDROS
8.– PRINCES TOWN MAYARO

jlv.

MAP 3.

In Tobago, the entire island with 33,333 inhabitants was considered malarious, although the last case of autochthonous malaria was found in 1953. The results of the spraying operations are as follows:

NUMBER OF HOUSES SPRAYED IN TRINIDAD AND TOBAGO

1958 - 1961

Cycle	Period	Insecticide used	Houses to be sprayed	Houses sprayed	Coverage %	Population directly protected
I	Jan-Dec. 58	dieldrin	136 824	135 269	98.9	648 605 *
II	Jan-Dec. 59	dieldrin	110 582	110 116	99.6	553 883 *
	" "	DDT	19 432	19 393	99.8	96 965 *
III	Jan-June 60	DDT	120 715	119 700	99.2	582 516
IV	Jul.-Dec. 60	DDT	122 304	121 985	99.7	594 391
V	Jan-June 61	DDT	123 615	123 058	99.5	601 222
VI	Jul.-Dec. 61	DDT	125 075	123 737	98.9	591 767

* Estimated

In the bellator area, anti-malarial drugs were distributed to the population monthly, the adult dose being 450 mg. of chloroquine plus 45 mg. of primaquine. About 40,000 inhabitants were to be treated monthly. Residual house spraying was discontinued in the area where A. bellator was the only vector; however, it was continued in the area where both A. bellator and A. aquasalis were present. In most of the area where A. bellator transmitted malaria, A. aquasalis also existed and therefore, in practice, mass treatment was additional to house spraying, particularly in the northeastern region of the island where malaria transmission had been persistent. In the area where A. bellator was the only vector, malaria transmission was already very low in 1959. It seemed that malaria transmission persisted in the area where the density of both A. bellator and A. aquasalis was high.

The percentage of the population treated with anti-malarial drugs was very low each month, ranging from 22 to 37 per cent with an average of 29.0 per cent. However, considerable differences in coverage were noticed among various localities and areas. In Sangre Grande, an urban area, the coverage was about 10 per cent while among the charcoal burners in the forest it was more than 70 per cent monthly. The charcoal burners were actually the most important population exposed to malaria transmission and they were living in the northeastern region of the island where bromeliad spraying and house spraying were also carried out. The mass treatment was started in November 1959 and completed in December 1961.

Between 1943 and 1957, epidemiological information was obtained from the blood smears submitted by medical practitioners and district medical officers. Occasionally, the malariologists, of the Malaria Division made malariometric surveys in schools, but as the malaria transmission tapered off, the results could not provide sufficient information and therefore they were discontinued after 1956.

In the second half of 1957, four evaluators were appointed to start an acting case finding in the Kerteszia area. In 1958, the number of evaluators was increased to 28 to cover the island and it was further increased to 73 when mass treatment was started. In Tobago, 10 evaluators have been provided since 1959. The island of Trinidad was divided into six "projects" and Tobago was the seventh project for the convenience of evaluation operations (See Map 4). The number of evaluators assigned to each project varied considerably according to the importance of malaria transmission and the necessity for mass treatment. In the Kerteszia area, sufficient number of evaluators was assigned to make a monthly visit of all houses in the projects, during which they took blood smears from current and recent fever cases and at the same time gave mass drug treatment to the population. In other projects, the frequency of house-to-house visits was reduced from 2 to 4 visits a year, depending on the importance of malaria transmission in each project. After the discontinuation of house spraying and mass treatment at the end of December 1961, the evaluators were instructed to visit all the health centers on the day when a district medical officer held his clinics, usually two to four times a month, and to take blood smears from current and recent fever cases who came for consultation. As Trinidad and Tobago are well provided with health and medical facilities, it was considered to be the most efficient way to find malaria cases. Besides the visits to the health centers the evaluator had to visit schools and to make house-to-house visits once in every three months within the project in which he was assigned. The results of the epidemiological evaluation during 1956 to 1964 are as follows:

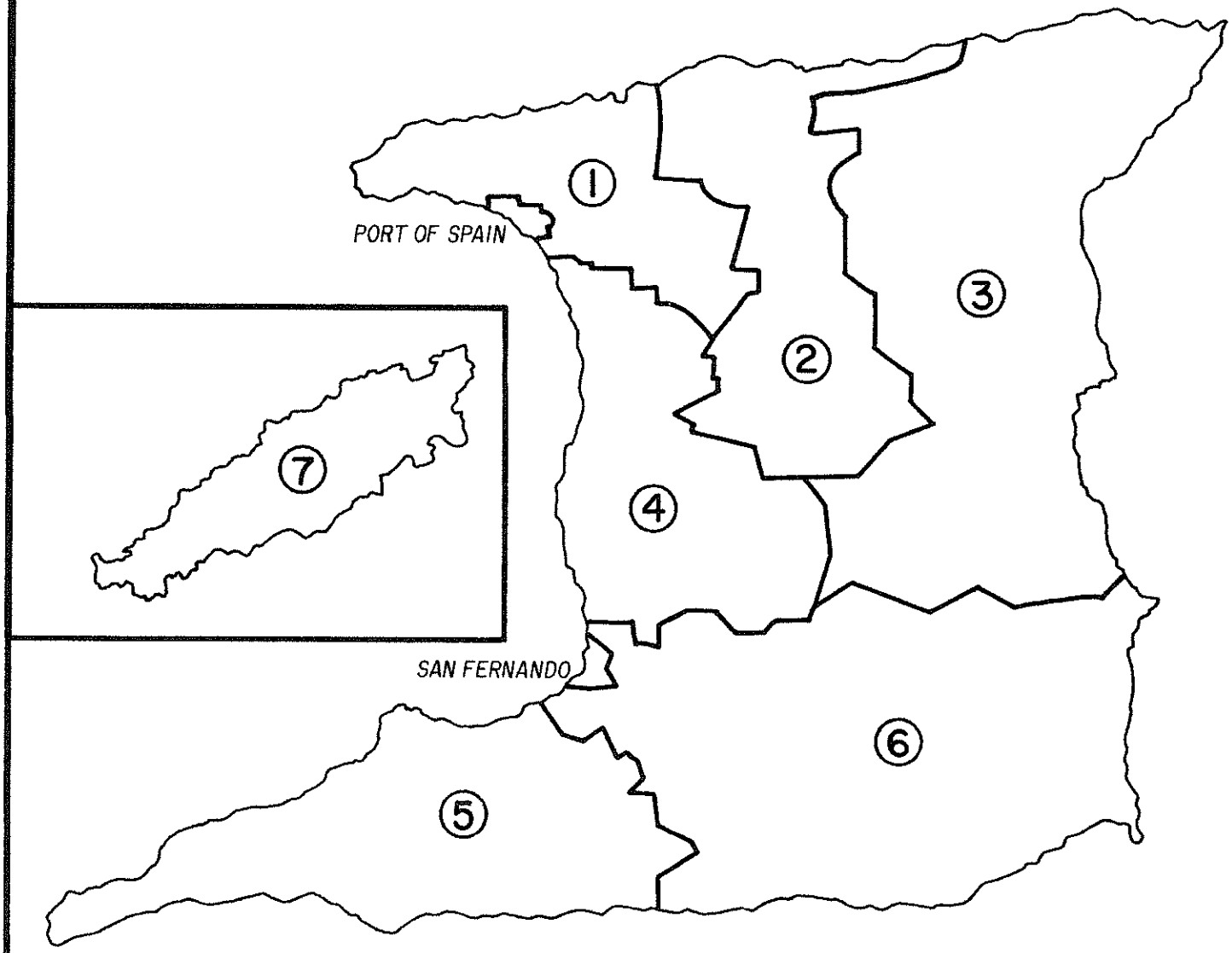
NUMBER OF BLOOD SMEARS EXAMINED AND THEIR NUMBER AS A PERCENTAGE OF THE POPULATION IN THE MALARIOUS AREAS OF TRINIDAD AND TOBAGO

Year	Estimated total population [a]	Population in malarious areas a	Number of blood smears examined	Blood smears examined as % population in malarious areas	
1956	739 657	583 758	2 680	0.5	0.4 [b]
1957	760 806	600 993	10 427	1.7	1.6 [b]
1958	782 560	618 736	52 159	8.4	8.4 [b]
1959	804 937	637 022	85 864	13.5	13.5 [b]
1960	827 957 [c]	655 820 [c]	101 968	15.6	15.6 [b]
1961	851 637	695 759	86 592	12.4	13.2 [b]
1962	875 994	738 131	123 092	16.7	18.8 [b]
1963	901 047	783 083	108 928	13.9	16.7 [b]
1964	926 817	830 747	82 332	9.9	12.6 [b]

a) Estimated by PAHO/ME
b) Percentage based on 1960 census of population.
c) Population census on April 7th, 1960.

TRINIDAD AND TOBAGO

SURVEILLANCE PROJECTS 1962 - 1964



1.- ST. GEORGE WEST
2.- ARIMA
3.- NORTH CENTRAL MATURA
4.- CHAGUANAS SOUTH CENTRAL
5.- ST. PATRICK
6.- PRINCES TOWN MAYARO
7.- TOBAGO

jlv.

MAP 4.

BLOOD SMEARS EXAMINED BY SOURCES IN
TRINIDAD AND TOBAGO

Total	By Evaluators		By Physicians		Total					
	Number Exam.	Positive	Number Exam.	Positive	Number Exam.	P. fal.	P. vivax	P. malar.	Total	%
1956	0	0	2 680	274	2 680	220	52	2	274	10.2
1957	8 025	244	2 402	433	10 427	575	98	4	677	6.5
1958	49 999	191	2 160	185	52 159	318	58	0	376	0.7
1959	84 565	74	1 299	23	85 864	67	29	1	97	0.1
1960	101 254	10	714	3	101 968	10	3	0	13[a]	0.01
1961	86 093	0	499	2	86 592	1	1	0	2[b]	0
1962	122 799	1	293	1	123 092	0	1	1	2[c]	0
1963	108 714	0	214	0	108 928	0	0	0	0	0
1964	82 138	2	194	2	82 332	0	2	2	4[d]	0

a) One P. falciparum and one P. vivax both imported.
b) Imported cases.
c) One P. vivax imported, and one P. malariae relapsing.
d) Two P. vivax imported, and two P. malariae relapsing.
% Positivity is calculated for autochthonous cases only for the years, 1960, 1961, 1962 and 1964.

As mentioned previously, the last autochthonous case of malaria was recorded in 1953 for Tobago and in September 1960, for Trinidad. In 1961, two cases of malaria were found in Trinidad, but they were imported cases, one being P. falciparum and the other P. vivax. In 1962, two cases of malaria were found in Trinidad, but one was imported P. vivax and the other relapsing P. malariae. In 1964, another four cases were found in Trinidad, two were imported P. vivax and two relapsing P. malariae. The malaria surveillance networks have been well developed since 1959 and the number of blood smears examined has been satisfactory. Furthermore, the blood smears obtained, particularly at the health centers since January 1962, were very regular in their frequency and fairly even in their geographical distribution, (see Table "Blood smears examined by sources in Trinidad and Tobago").

Since the establishment of the Malaria Division in Trinidad, all the malaria blood smears have been examined by the microscopists in the laboratory of the Malaria Division. The laboratory service has been very efficient, and it usually gives the results of the blood smears submitted by physicians and district medical officers within 24 hours by telephone or telegram. The work of the microscopists has been supervised by the chief microscopist who rechecks the positive blood smears and a number of negative blood smears. Occasionally, the PAHO Laboratory Adviser also rechecks the positive and negative blood smears sampled at random. The number of blood smears rechecked during 1961-1964 is summarized as follows:

NUMBER OF BLOOD SMEARS RECHECKED BY CHIEF MICROSCOPIST AND THE PAHO LABORATORY ADVISER

Year	Number of blood smears rechecked				
	Number of blood smears examined	By chief Microscopist	By PAHO Lab. Adviser	Total rechecked	Percentage
1961	86 592	-	-	-	-
1962	122 892	2 157	3 543	5 700	4.64
1963	108 923	4 594	1 188	5 782	5.38
1964	82 332	1 801	7 386	9 187	11.2

PLANS FOR THE MAINTENANCE PHASE

The Government of Trinidad and Tobago is aware that conditions for malaria transmission in the country after the termination of the attack and consolidation phases have remained much the same as before the beginning of the program and that transmission could be re-established, in particular in the previously most endemic areas, if the importation of malaria cases is not prevented or a residual or new focus not discovered in time.

The Government is making provision for an adequate malaria vigilance system in the Insect Vector Control Division into which the Malaria Division was converted in 1962. The system will consist of active and passive case finding operations. Efforts to integrate the case-finding system into the central and county health departments are being made and will continue. Both Trinidad and Tobago are well provided with a network of Governmental and private medical facilities.

The following organization of malaria vigilance will exist as soon as the malaria eradication program enters the maintenance phase:

1. An active case-finding system consisting of a network of evaluators covering each of the islands, Trinidad and Tobago, and provided with adequate transportation. There will be at least three evaluators in each county and in the island ward of Tobago. The evaluators will visit hospitals, health centers, clinics, dispensaries, etc., and take blood smears from febrile persons and from persons with a recent history of fever. Special attention will be given to the Kerteszia areas in Northeastern and North-Central Trinidad and to airports and port areas.

2. Efforts will be made to develop the existing passive case-finding system which is composed by medical and para-medical personnel of the Government and of private institutions.

3. A malaria laboratory and sufficient staff to examine up to 80,000 blood smears a year.

4. Staff and facilities for supervising field personnel and carrying out epidemiological investigations.

5. A system to prevent malaria parasite carriers from entering the islands undetected as well as the corresponding legislation is under study.

CONCLUSIONS

The Islands of Trinidad and Tobago have met all the criteria for malaria eradication established by the WHO Expert Committee on Malaria in its Seventh and Eighth Reports. The Pan American Health Organization hereby certifies MALARIA ERADICATION has been achieved in Trinidad and Tobago.

BLOOD SMEARS EXAMINED BY PROJECTS IN TRINIDAD AND TOBAGO, 1961-1964

Project	Population in original malarious areas[a]	Number of Blood Smears examined				Blood smears examined as percentage of population in malarious areas [a]				
		1961	1962	1963	1964	1961	1962	1963	1964	1964[b]
I. St. George West	217 974	13 958	36 726	31 231	17 424	6.4	16.8	14.3	8.0	6.3
II. Arima [c]	35 485	31 982	16 608	7 719	8 191	90.1	46.8	21.8	23.1	18.0
III. North C. Matura [c] ...	37 013	12 230	8 315	3 356	12 370	33.0	22.5	9.1	33.4	26.0
IV. S. C. Chaguanas	114 003	11 149	19 669	15 649	9 468	9.8	17.3	13.7	8.3	6.5
V. St. Patrick.....	107 525	3 923	20 926	34 306	21 112	3.6	19.5	31.9	19.6	14.9
VI. Princes Town M	110 487	13 350	16 317	15 517	12 826	12.1	14.8	14.0	11.6	9.2
VII. Tobago	33 333 [d]	(e)	4 531	1 150	941	-	13.6	3.4	2.8	2.9
Total	655 820	86 592	123 092	108 928	82 332	13.2	18.8	16.6	12.6	9.9

a) Based on population census in April, 1960. The total population of the Islands was 827 957 of which 172 137 were excluded from the program because they were residing in non-malarious areas or U. S. leased territory. (b) Based on 1964 estimated population. (c) Kerteszia area. (d) Tobago was considered as malarious area, although the last case of autochthonous malaria was recorded in 1953. (e) 13 787 blood smears were taken, but they were not examined.