

INSECTS AND OTHER ARTHROPODS CAPTURED BY THE
BRAZILIAN SANITARY SERVICE ON LANDPLANES OR
SEAPLANES ARRIVING IN BRAZIL BETWEEN JANUARY
1942 AND DECEMBER 1945*

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The work here reported represents the second phase of a campaign against *Anopheles gambiae* in Brazil. It involves the inspection and fumigation of all airplanes arriving in Brazil from Africa and is designed to prevent the entrance of live arthropods into the country on these planes.

The first phase of the campaign, extending from 1939 to 1941 and conducted by the Government of Brazil in collaboration with The Rockefeller Foundation, consisted of measures for the control of *A. gambiae* in the states of Ceara and Rio Grande do Norte in northeastern Brazil, where this dangerous malaria vector, brought by plane from Africa, had become entrenched and had caused an epidemic of malaria in which there were recorded more than 300,000 cases of the disease with 16,000 deaths. This memorable crusade, the work of the specially created Malaria Service of the Northeast under the direction of Dr. Fred L. Soper and Dr. D. Bruce Wilson, resulted in the complete eradication of *A. gambiae* from Brazil.

The second part of the campaign began in 1942, attained its maximum activity in 1943 and 1944, and is still continuing under the guidance of the Brazilian Quarantine Service, which took over from the Malaria Service of the Northeast, as of July 6, 1942, the responsibility for the inspection and fumigation of all airplanes from Africa, both civil and military. Although the official transfer of this responsibility took place on July 6, actually the remainder of that month was occupied in training personnel, and only on August 1, 1942, did the Quarantine Service really assume full charge of the program in all its details. Trained personnel from the Malaria Service of the Northeast together with their equipment and supplies were incorporated in the Quarantine Service.

A special government decree was passed prohibiting, under penalty of a heavy fine, the importation of live arthropods on planes coming from Africa, and requiring that all windows on incoming aircraft should be closed in order to prevent the escape of any insects which might not have died from the effects of fumigation. It was soon learned, however,

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that such legislation was inoperable under wartime conditions. And as the objective of this fumigation procedure was not to collect revenue but merely to protect the country from the importation of dangerous insects, Quarantine Service arranged that the Pan-American Airways, at that time the only commercial company operating between Africa and Brazil, should send to Natal, Brazil, for a period of training, their African personnel responsible for spraying planes.

In the beginning the Quarantine Service used a mixture of pyrethrum, carbon tetrachloride and kerosene for fumigating the planes. This was distributed under pressure by a De Vilbiss machine, a cloud of fine spray being delivered immediately as the inspectors entered the plane, so as to avoid the possibility of any live arthropods escaping when the door was first opened. After the plane had been sprayed throughout, a systematic search was made for all insects and other arthropods, which were subsequently sent for classification to the Yellow Fever Laboratory in Rio de Janeiro.

The Quarantine Service had hardly completed the instruction of the Pan-American Airways personnel, when it was confronted with a tremendously increased movement of military aircraft brought about by war activities on the African continent. Hundreds of army planes arrived day and night and were thoroughly sprayed, no longer with the old mixture of pyrethrum, carbon tetrachloride and kerosene but instead with aerosol bombs gratuitously furnished by the American Army. The De Vilbiss pressure sprayers were now only used at the moment when the doors of incoming planes were first opened by the inspectors.

The Brazilian Government decree soon became inoperable because pilots whose whole attention was focused on their wartime missions either misunderstood the need for this law or were actually opposed to the insistence of Brazilian personnel on a careful spraying of their craft. Because of these difficulties the American Army authorities suggested that they should assume the responsibility of fumigating their own planes.

Aware of the real danger threatening Brazil the Quarantine Service requested the assistance of the Secretary of State, Oswaldo Aranha, and as a result of that move the senior author went to Africa to study the sanitary conditions on that continent and to obtain first-hand information about the risks to which the Brazilian people were being exposed, as well as to observe the efficiency of control measures then in current use.

The senior author was able to learn on that journey that the spraying of military aircraft when in flight was useless, because the insecticide escaped through the tail of the ship; and, in any event, the control of certain air bases near Dakar was impossible because of the nature of the terrain. This information was transmitted to the Brazilian Government and through the good offices of the Brazilian Secretary of State,

TABLE 1

Arthropods encountered on planes arriving at the airports at Belém, Fortaleza, Natal and Recife, Brazil October 1941–December 1945

Classification	Number of Arthropods		Classification	Number of Arthropods	
	Flying-boats	Land-planes		Flying-boats	Land-planes
HEXAPODA			HEXAPODA (Cont'd)		
THYSANURA.....	1	4	COLEOPTERA (Cont'd)		
COLLEMBOLA.....	1		Chrysomelidae.....	1	25
PLECOPTERA.....		1	Plastystomidae.....		2
EPHEMERIDA.....	102	758	Curculionidae.....		6
ODONATA.....	4	45	Scolytidae.....		3
Agrionidae.....		1	(Fam. indets.).....	237	3,206
ORTHOPTERA			HEMIPTERA		
Blattidae.....	62	45	Corixidae.....		1
Mantidae.....		5	Gerridae.....		10
Locustidae.....	1	6	Miridae.....		1
Acyridinae.....		2	Cimicidae.....	2	1
Tettigoniidae.....		4	Nabidae.....	1	36
Gryllidae.....	10	105	Phymatidae.....		1
Tridactylinae.....		10	Lygaeidae.....		3
(Fam. indets.).....	86	541	Aradidae.....		2
IZOPTERA.....	2	531	Coreidae.....		1
DERMAPTERA.....	19	146	Pentatomidae.....		19
COLEOPTERA			Cydnidae.....		10
Cicindellidae.....		5	(Fam. indets.).....	49	1,121
Carabidae.....		104	HOMOPTERA		
Omophronidae.....		10	Cicadidae.....		1
Dityscidae.....		6	Cercopidae.....		54
Hydrophilidae.....		24	Membracidae.....		3
Silphidae.....		1	Cicadellidae.....	8	1,040
Staphylinidae.....	6	4	Chermidae.....		1
Histeridae.....		4	Aphididae.....		2
Lampyridae.....		1	(Fam. indets.).....	24	10,492
Melyridae.....		1	NEUROPTERA.....		963
Cleridae.....		2	Chrysopidae.....		3
Meloidae.....		1	TRICHOPTERA.....	4	54
Ostomidae.....		7	LEPIDOPTERA		
Cucujidae.....		2	Nymphalidae.....		
Erotylidae.....		1	Libytheinae.....		1
Cryptophagidae.....		1	Pyralididae.....		4
Endomychidae.....		3	Tineidae.....	1	4
Tenebrionidae.....		2	(Fam. indets.).....	204	6,297
Lagriidae.....	2		DIPTERA		
Melandryiidae.....		3	Anisopodidae.....		2
Bostrichidae.....		12	Tipulidae.....	30	847
Cisidae.....		2	Simuliidae.....		18
Scarabeidae.....	2	37	Psychodidae.....	2	23
Passalidae.....		1	Chironomidae.....	155	3,952
Cerambycidae.....		8	Ceratopogonidae.....		3

TABLE 1—(Cont'd)

Classification	Number of Arthropods		Classification	Number of Arthropods	
	Flying-boats	Land-planes		Flying-boats	Land-planes
HEXAPODA (Cont'd)			HEXAPODA (Cont'd)		
DIPTERA (Cont'd)			DIPTERA (Cont'd)		
Culicoides.....		28	africanus....	23	54
Culicidae.....			Aedeomyia....		1
Dixinae.....		4	squamipennis.....		6
Dixa.....	2	2	Psorophora.....		10
Chaoborinae.....	116	868	Psorophora.....		2
Corethrela.....		2	ciliata.....		188
Chaoborus.....	1		Grabhamia....		25
Culicinae.....		9	confinnis....		14
Anopheles.....	3	51	Aedes.....	3	9
Anopheles.....	5	39	Ochlerotatus..	15	3
spicimacula..		1	dorsalis.....	6	105
concolor.....		2	sollicitans...	2	1
coustani.....		1	taeniorhynchus.....	53	1
var. zeimanni...	3		Stegomyia....	2	4
crucians.....		5	aegypti.....		2
intermedius		1	Aedimorphus..		1
maculipennis.....	3	3	punctothoracis.....		1
Nyssorhynchus.....	4	1	Banksinella...		1
albitarsis....		17	lineatopennis.....		1
tarsimaculatus.....		1	Eretmapodites..		1
Myzomyia.....		31	chryso-gaster	1	
demeilloni...		8	Armigeres.....		9
pretoriensis..		5	Armigeres.....		9
funestus.....		32	obturbans...		9
gambiae.....	17	335	Culex.....	77	951
pharoensis...		5	Lutzia.....		1
Culicini.....			Culex.....	83	49
Uranotaenia....	1	17	fatigans.....	16	24
Theobaldia.....			Melanconion...	5	1
Allotheobaldia.		3	Mochlostyrax...	1	74
longiareolata		1	(Indets.).....	101	124
Theobaldia....		9	Mycetophilidae.....	15	66
incidens.....		14	Cecidomyiidae.....	9	130
Taeniorhynchus.			Bibionidae.....		3
Taeniorhynchus.....	4	6	Scatopsidae.....		452
indubitans..	1		Tabanidae.....	43	1
titillans.....		2	Chrysops.....		102
Mansonioides..	4	2	Stratiomyidae.....	2	4
uniformis....	1	1	Rhagionidae.....		1
			Xylomyiidae.....		1

TABLE 1—(Cont'd)

Classification	Number of Arthropods		Classification	Number of Arthropods	
	Flying-boats	Land-planes		Flying-boats	Land-planes
HEXAPODA (Cont'd)			HEXAPODA (Cont'd)		
DIPTERA (Cont'd)			DIPTERA (Cont'd)		
Bombyliidae.....		6	Glossina.....	1	
Therevidae.....	1		palpalis.....	4	
Scenopinidae.....		3	Hippoboscidae.....		16
Asilidae.....		23	(Fam. indets.).....	11	2
Dolichopodidae.....	36	133	SIPHONAPTERA.....	1	
Empididae.....		32	HYMENOPTERA		
Phoridae.....	1	15	Braconidae.....		4
Pipunculidae.....		7	Ichneumonidae.....		3
Syrphidae.....	6	337	Ophoninae.....		2
Cordyluridae.....	2		Chrysididae.....		4
Helomyzidae.....	1	4	Formicidae.....	84	202
Sciomyzidae.....		2	Mutillidae.....		7
Trypetidae.....	6	491	Vespidae.....		2
Micropezidae.....	1	9	Sphecidae.....		4
Piophilidae.....		1	Megachilidae.....		3
Diopsidae.....	4	3	Bombidae.....		2
Ephydriidae.....	1		Apidae.....	1	5
Drosophilidae.....	248	2,328	(Fam. indets.).....	815	3,566
Ochthiphilidae.....		83	ARACHNIDA		
Anthomyiidae.....	9	1	ARANEIDA.....	27	126
Calliphoridae.....	16	111	DIPLOPODA.....		1
Sarcophagidae.....	1	5	CHILOPODA.....		3
Tachinidae.....	1	77	CRUSTACEA.....	1	1
Muscidae.....	11,533	25,895	ISOPODA.....	1	

the American Government sent a special Medical Commission from the War Department to discuss with Quarantine Service, in detail, what protective measures would guarantee the safety not only of Brazil but also of the other theatres of war.

In November 1943 an agreement was signed by which the American Government promised to sanitize all its African bases that had direct communication with Brazil. The Brazilian Quarantine Service arranged to send two public health officials to Accra and Dakar to work in cooperation with the American sanitary authorities, just as those authorities in their turn were working with the Quarantine Service at the Brazilian air bases. The spraying of planes upon their arrival in Brazil would continue as a responsibility of the Brazilian Quarantine Service. Subsequently, without any request on the part of this Service, the American authorities in Brazil graciously incorporated some of Brazil's protective legislation as part of their own sanitary codes for this country.

TABLE 2

Anopheles gambiae encountered on landplanes and seaplanes arriving in Brazil from Africa, classified by months

MONTHS AND YEARS	FLYING-BOATS			LANDPLANES		
	Number of planes which arrived	Number of planes with <i>A. gambiae</i>	Total number of <i>A. gambiae</i>	Number of planes which arrived	Number of planes with <i>A. gambiae</i>	Total number of <i>A. gambiae</i>
<i>1942</i>						
January.....	14	2	2	4		
February.....	17			1		
March.....	17			3		
April.....	22			4		
May.....	14	2	2	4		
June.....	19	2	2	6		
July.....	28	1	1			
August.....	29					
September.....	23					
October.....	32			22		
November.....	30			36		
December.....	40			34		
Totals.....	285	7	7	114		
<i>1943</i>						
January.....	27			19		
February.....	16			66		
March.....	36			71		
April.....	29			102		
May.....	16			140	1	1
June.....	2	1	1	156	3	3
July.....	5			139	6	10
August.....	7			153	10	21
September.....	12	3	3	147	27	72
October.....	15			148	36	163
November.....	23	1	1	205	6	6
December.....	21			211	1	1
Totals.....	209	5	5	1,557	90	277
<i>1944</i>						
January.....	29			245	1	1
February.....	33			252		
March.....	39	1	1	230		
April.....	31			218		
May.....	25			244	1	17
June.....	8			261	3	3
July.....	8			269	2	2
August.....	6			165		
September.....	7			162		
October.....	11			172		
November.....	16			210	1	1
December.....	13	1	1	200	3	4
Totals.....	226	2	2	2,628	11	28

TABLE 2—Concluded

MONTHS AND YEARS	FLYING-BOATS			LANDPLANES		
	Number of planes which arrived	Number of planes with <i>A. gambiae</i>	Total number of <i>A. gambiae</i>	Number of planes which arrived	Number of planes with <i>A. gambiae</i>	Total number of <i>A. gambiae</i>
1945						
January.....	12	1	1	255	3	4
February.....	10			208		
March.....	20			301	1	1
April.....	11	1	1	189		
May.....	12			461		
June.....	11			1,036	2	2
July.....	2			1,021	6	8
August.....	4			553		
September.....	2			350		
October.....	4			442	11	12
November.....	10			76	2	3
December.....	13			38		
Totals.....	111	2	2	4,930	25	30

In December 1944 the Brazilian public health officials who had been sent to Africa returned to Brazil because of the high grade of efficiency of the fumigation procedures in use in Africa and because the air bases near Dakar had all been transferred to the well-sanitized zone surrounding Mallard Field. It was suggested to the American authorities that a higher degree of efficiency could be obtained, if the final authority were vested in a single malariologist who was responsible for all the sanitized areas on the west coast of Africa.

With the cessation of hostilities the needs for military aviation were greatly reduced. But experience in Brazil has amply demonstrated the grave peril from aerial navigation across Africa. We should like to recommend, therefore, that all interested nations reach an agreement which would protect them against the perils of commercial air-traffic, which is bound to develop on an ever-increasing scale in the very near future. We are concerned not only about the danger of the reintroduction into South America of *Anopheles gambiae* and other important disease vectors, such as the tsetse fly, but also about the numerous agricultural pests of Africa which might readily become established here.

Three tables are appended to this report. The first gives the total numbers of all arthropods arriving on land- and seaplanes at the airports at Belem, Fortaleza, Natal and Recife. Many of the arthropods were classified as to family or order only, but the majority of the mosquitoes were classified by genus and by species. Not all the mosquitoes taken came from Africa, for such species as *Anopheles apicimacula*, *A. crucians*,

A. intermedius and *A. albitarsis* were obviously of American origin. The total of 352 *A. gambiae* identified from all types of planes is noteworthy. Also we wish to call attention to the presence of four *Glossina palpalis* on flying-boats.

TABLE 3

Number of landplanes or seaplanes arriving in Brazil from which arthropods, either alive or dead, were secured

MONTHS	FLYING-BOATS WITH ARTEROPODS							
	1942		1943		1944		1945	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
January.....	No search made for living arthropods	14	1	26	5	24	5	7
February.....		15	1	15	2	30	3	5
March.....		15	5	31	8	28	4	10
April.....		19	2	27	10	20		10
May.....		12	3	13	4	21	2	9
June.....		19		2	2	6	1	3
July.....		27	1	4	1	7	1	1
August.....		29		7	3	3	2	2
September.....		22	1	11	2	4		2
October.....		32	2	13	6	4	1	3
November.....		30	3	20	7	9	3	7
December.....		39	9	12	6	7	7	5
Totals.....		273	28	181	56	163	29	64

MONTHS	LAND PLANES WITH ARTEROPODS							
	1942		1943		1944		1945	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
January.....	No search made for living arthropods	4		19	38	152	83	126
February.....		1	6	60	24	120	74	100
March.....		2	16	55	32	123	106	135
April.....			28	74	19	137	70	74
May.....			55	85	37	119	51	312
June.....			43	113	59	146	90	795
July.....			31	108	53	177	31	712
August.....			42	110	42	92	42	290
September.....			13	133	50	88	63	211
October.....		22	25	121	56	91	174	262
November.....		36	41	155	83	87	17	54
December.....		34	23	151	61	94	9	16
Totals.....		99	323	1,184	554	1,426	810	3,087

Table 2 summarizes the number of land- and seaplanes arriving from Africa each month, the number of planes with *A. gambiae* and the total

number of specimens of that species identified during the past four years. The greatest numbers arrived in the months of August, September and October 1943.

Table 3 indicates the number of land- or seaplanes that arrived each month in Brazil with arthropods of any kind, either dead or alive. It brings out perhaps more clearly than the preceding tables the importance of the program for preventing the introduction of insect pests. All insect identifications were made under the supervision of the junior author and his assistants to whom much credit is due.

INSECTOS Y OTROS ARTROPODOS EN LOS AVIONES LLEGADOS AL BRASIL (Sumario)

Los estudios aquí comunicados representan la segunda fase de la campaña librada en el Brasil contra el *Anopheles gambiae*, comprendiendo la inspección y fumigación de todos los aviones que llegan del Africa, a fin de impedir la entrada de artrópodos vivos. El resultado aparece expuesto en tres tablas. La primera contiene el total de artrópodos encontrados en los aviones de llegada en los aeropuertos de Belem, Fortaleza, Natal y Recife. Es digno de nota el total de 352 *A. gambiae* identificados e igualmente la presencia de cuatro *Glossina palpalis*. En la tabla 2 aparece el número de aviones con *A. gambiae* a bordo y el total de ejemplares de esa especie identificados en el cuatrienio 1942-45. La tabla 3 indica el número de aviones que llegaron cada mes al Brasil con artrópodos ya vivos o muertos, recalcando de paso la importancia de los planes puestos en práctica para impedir la entrada de insectos en el Brasil.

Educación y propaganda.—Nos creemos obligados a hacer, en primer lugar, una aclaración necesaria. Y es la de la diferencia que existe entre los vocablos educación y propaganda, especialmente referidos a la cuestión de la salud. Educar, no es hacer reclame. Aunque educador y vendedor coinciden en la necesidad de ganar la atención del público sus propósitos y finalidades son bien distintas. El propagandista, el vendedor, trata de motivar las reacciones humanas para conducir las al logro de su particular y egoísta interés. El educador, en cambio, presenta hechos, disemina información y trata de ayudar al individuo a pensar correctamente y deducir sus propias conclusiones lógicas.—ANGEL REAUD: "Educ. y Propag. Sanit.," Habana, 1946.

Individuo y estado.—Para el desenvolvimiento de los servicios sanitarios y para mantenimiento de la salud pública es indispensable que la acción individual del pueblo corresponda, con igual intensidad, a la acción del Estado. Es sorprendente todo lo que se puede obtener, para la colectividad, por la acción individual de sus miembros. Sin embargo, hay funciones que requieren indispensablemente la acción oficial, o por lo menos una acción, de carácter colectivo, a cargo de instituciones que estén apoyadas en un mandato social para realizar determinados propósitos de bien público.—LUIS F. THOMEN: Primer Instituto de Salud Pública, Ciudad Trujillo, Santo Domingo, 1946.