An Annotated Bibliography of the Mosquitoes and Mosquito-Borne Diseases of Guam (Diptera: Culicidae)

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ABSTRACT. The literature concerning the mosquitoes and mosquito-transmitted diseases on Guam, Mariana Islands, is presented in the form of an annotated bibliography. It reflects the emphasis on mosquito surveys during World War II, and the continuing mosquito surveillance with new species collection records which has resulted from the island's current importance as a U.S. military center and port for both aerial and surface trans-Pacific commerce.

The earliest scientific references to mosquitoes on the island of Guam are comments by J.F. Leys (1905) and F.E. McCullough (1908), Surgeons, U.S. Naval Station, Guam. The initial entomological survey of the island was accomplished in 1911 by Mr. D.T. Fullaway (1912), and the first definitive study of the mosquito fauna of Guam made during 1936 was reported on by Mr. O.H. Swezey (1942). U.S. Navy activities on Guam dating from August 1899, combined with U.S. military actions during World War II, stimulated entomological surveys and produced numerous reviews of the local mosquitoes and the diseases they can transmit to man. The severe outbreaks of dengue fever in 1944 and Japanese B encephalitis in 1947-1948 made continued mosquito surveys on Guam desirable.

The post World War II buildup of U.S. military facilities, and the role of Guam as both an aerial and surface port for trans-Pacific traffic during the Korean and Vietnamese conflicts, sustained interest in the mosquito surveillance. Incidence of autochthonous malaria in 1966 initiated a series of surveys that resulted in the reporting of 9 species of Anopheles on Guam. It also redirected attention to the probability of introduction of new mosquito species into Guam via airplanes and ships.

The steady increase in the number of species of mosquitoes collected on Guam between 1948 and 1972 was documented by Nowell (1975) with the number rising from 12 to 37. Subsequent discoveries have brought this total to 40 species, including the two Toxorhynchites species purposely introduced during 1954 in an attempt to control the day-biting mosquito, Aedes albopictus.

The views expressed herein are those of the author and do not necessarily reflect the views of the United States Air Force or the Department of Defense.
The literature concerning the mosquitoes and mosquito-transmitted diseases on Guam, Mariana Islands, is presented in the form of an annotated bibliography. It reflects the emphasis on mosquito surveys during World War II, and the continuing mosquito surveillance with new species collection records which has resulted from the island’s current importance as a U.S. military center and port for both aerial and surface trans-Pacific commerce.
Grateful acknowledgment is given to Captain George K. Pratt, USAF, and the U.S. Military Entomology Information Service for assistance in the literature search.

The following bibliography is an annotated account of the studies and review of the collections and records that have been published on the mosquitoes and the diseases they can transmit to man on the Island of Guam. Those entries marked with an asterisk (*) were not seen by the author.

Bibliography


*Bailey, S.F. and R.M. Bohart. 1945. Unpublished survey for *Aedes aegypti* on Guam during February 1945. (mimeographed). Referenced by Bohart and Ingram (1946) and by Hull (1952). It was indicated that *Aedes aegypti* was the vector of the severe epidemic fever which occurred among the military personnel on Guam during 1944, and this survey was made to determine the abundance and distribution of mosquito vectors of dengue fever and other diseases.

Bailey, S.F. and R.M. Bohart. 1952. A mosquito survey and control program in Guam. J. Econ. Ent. 45(6):947-952. A mosquito survey was accomplished during February 1945 to gather epidemiological data concerning the severe epidemics of dengue fever on Guam, and establish preventive measures. Nine species of mosquitoes were collected. Control measures are described.

Basio, R.G. 1969-1973. Mosquito identification log, Guam. USAF 5th Epidemiological Flight, Pacific Air Forces. (unpublished records). Contains all of the identifications of mosquito specimens collected on Guam and sent to the 5th Epidemiological Flight in the Philippine Islands for identification. The identifications were made by Ruben G. Basio, mosquito identifier who was on contract to the 5th EF. The log covers the period 1 Oct 1969 to 30 Jun 1973, when Mr. Basio's contract was terminated. This period also spanned deactivation of the 5th EF (Aug 1970) in Manila and relocation of its Entomology Service to the USAF 1st Medical Service Wing at Clark Air Base.


Bruce-Chwatt, L.J. 1970. Global review of malaria control and eradication by attack on the vector, *in* Conference on Anophelean Biology and Malaria Eradication. A Symposium of the Walter Reed Army Institute of Research, Washington, D.C. 21-23 May 1969, pp. 7-27. Ent. Soc. Am., Misc. Publ. 7. Malaria in the South Pacific is limited to the northwestern islands, via the Solomons and the Santa Cruz-New Hebrides. The remainder of this large area extending over 120° long. by 80° lat. is malaria-free. The northwestern limits are circumscribed by a line that starts from the Bonin Islands and then turns south and southwest to include the Marianas and Palau Islands, p. 21.

*Brumpt, E. 1936. Precis de Parasitologie. Masson et Cie, Paris. Guam is included in the map of the distribution of *Aedes aegypti* as known to date.


Clarke, D.H. and J. Casals. 1965. Arboviruses; Group B, in F.L. Horsfall, Jr., and I. Tamm (Eds.). Viral and Rickettsial Infections of Man, 4th Ed., pp. 606-658. J.B. Lippincott Co., Philadelphia. The outbreak of Japanese B encephalitis that occurred on Guam in 1947-1948 was the first recognized appearance of the disease there. It is believed that the disease was newly introduced to the island from an epidemic or endemic area, p. 626; the probable, but not proved, vector on Guam was Culex annulirostris, p. 630.


Crow, G.B. 1910. Filariasis on the Island of Guam. J. Am. Med. Assoc. 55(7):595-596. Filariae were found in the blood of 13 persons out of 224 natives tested in 1910 from various parts of the island. The infection focus was apparently limited to the region of Inarajan, a village on the southeast shore of the island. A brief history of filariasis on Guam is included, but no vector data are given.

Cruz, A. 1937. (Collection record for Aedes scutellaris pseudoscutellaris (Theobald) from Guam). Cited by O.H. Swezey (1942) and S.F. Bailey and R.M. Bohart (1952). Swezey: "In 1937, A. Cruz reared quite a lot of them from larvae in coconut hulls at Mogfog, Nov. 10." This species was probably the same one reported by Swezey and which was eventually described as Aedes (Stegomyia) guamensis by Farmer & Bohart in 1944.


Fullaway, D.T. 1912. Entomological notes, in Annual Report Guam Agricultural Experiment Station for 1911. pp. 26-35, U.S. Govt. Print. Off., Washington, D.C. Two species of mosquitoes are listed: a culicine (*Culex* sp. near *vishnui*) and *Stegomyia scutellaris*. Swezey (1942) states that the *Stegomyia scutellaris* reported by Fullaway was actually *Aedes pandani* and not *Aedes scutellaris pseudoscutellaris*. Also, the *Culex* sp. near *vishnui* is probably *Culex quinquefasciatus*.


*Fujii, T. 1939. [Species of mosquitoes distributed in the South Sea Islands]. Nanyo Igaku Ronbunshu [Coll. of South Sea Med. Publ.] 5:135-140. (in Japanese).*


Guam, Governor of. 1915-1940. Annual Reports of the Governor of Guam. Dengue fever is reported sporadically from Guam, including epidemics in 1932 (104 cases treated) and 1939 (40 cases treated).


Hammon, W. McD. 1973. Dengue hemorrhagic fever - do we know its cause? Am. J. Trop. Med. Hyg. 22(1):82-91. Both Dengue types 1 and 2 were suspected to be present on Guam during World War II from the results of antibody studies which should have differentiated had only one type been present, p. 86.


Holway, R.T. 1955. Mosquito survey for naval activities on Guam. U.S. Navy Preventive Medicine Unit No. 6. 22 pp. + 3 attach., 11 pp. (mimeographed). Report of an entomological survey of mosquito problems on Guam during July-August 1955, with emphasis on those species which are significant pests or potential disease vectors in the naval areas. 11 species are listed with bionomic data for the 6 major pest/vector species. Presents extensive collection data and control information.

Holway, R.T. 1964a. Disease vector and pest control technology; report of training and assistance in. U.S. Navy Preventive Medicine Unit No. 6. 15 pp. Lists the mosquito species collected on Guam since 1942, including results of a survey in 1964, with their importance as vectors. Culex tritaeniorhyncus as vector of JBE; Culex pipiens quinquefasciatus of Bancroft's filariasis; Mansonia uniformis as a known vector of Malayan filariasis; Aedes aegypti and A. albopictus previously important as vectors of dengue fever, all on Guam.

Holway, R.T. 1964c. Mosquito abatement in Apra Harbor area, recommendations for. U.S. Navy Preventive Medicine Unit No. 6. 4 pp. (mimeographed). Mosquito collections of July 1964 are presented, and an alarming increase in population levels of *Culex tritaeniorhynchos* and *Mansonia uniformis* were noted. Control recommendations are offered.


Hu, S.M.K. 1953. Mosquito survey of Guam. Mosq. News 13(2):123-125. Seven of the 11 species which have been reported from Guam were collected; none was new to Guam. Previous epidemics of dengue fever and JBE on the island are reviewed.
Hu, S.M.K. 1955. Progress report on biological control of \textit{Aedes albopictus} Skuse in Hawaii. Proc. and Papers Twenty-Third Ann. Conf. Calif. Mosq. Cont. Assoc. 23:23. Colonies of \textit{Toxorhynchites brevipalpis} from South Africa and \textit{T. splendens} from the Philippines, two carnivorous species used in biological control, have been established in Hawaii. Requests for stock material were received, and living larvae have been sent to Guam.


Hull, W.B. 1952. Mosquito survey of Guam. U.S. Armed Forces Med. J. 3(9):1287-1295. Reviews early mosquito surveys on Guam. No \textit{Aedes aegypti} adults or larvae were found during this 1951 survey. A total of 9 species was collected and their distribution is reported.


Joyce, C.R. 1963a. Culex tritaeniorhynchus Giles on Guam. Notes and Exhibitions for June 13, 1962. Proc. Hawaiian Ent. Soc. 18(2):207-208. This species was recovered during a survey made during 20-27 May 1962. It was abundant, probably unrecognized since adults are very similar to Culex annulirostris mariana Bohart & Ingram. C. tritaeniorhynchus is an important vector of JBE in Japan and other parts of the Orient.


Kindleberger, C.P. 1912. Sanitary conditions in Guam. U.S. Navy Med. Bull. 6(3):464-472. Disease data reported on Guam prior to 1912 include 11 cases of *Filaria bancrofti*, 1 case of elephantiasis, with 83 Americans and 28 natives admitted during the year with dengue fever. No cases of malaria were known to have originated on the island, p. 472. Refers to the D.T. Fullaway collection of mosquitoes during 1911, p. 468.


Lauret, T. 1975a. Personal communication. Adult Culex fuscocephalus were collected in a light trap at Apra Harbor, Guam, by U.S. Navy Public Works Center personnel during Aug-Sep 1969. Larvae of this species were found at the same time breeding in a sewer break, 50 to 60 feet from where the light trap was set up. The larvae were feeding on Culex quinquefasciatus immatures. This was the initial collection record for this species on Guam. It was recorded on a local mosquito identification form, and the species was included by Holway and Bridges (1970) in their key to the mosquitoes of the Marianas.

Lauret, T. 1975b. Personal communication. One adult *Armigeres subalbatus* was reared in Sep-Oct 1969 from larvae found in a potato chip can which had been discarded behind the Orchid Restaurant and Bar in Apra Harbor, Guam. This is the first collection record for this genus on Guam. The specimen was not retained, and the collection record was neither published nor the species included in Holway and Bridges (1970) key to the mosquitoes of the Marianas.
Leach, P. 1900. Sanitary report on Guam, L.I. (Aug. 7, 1899 to Dec. 31, 1899), in (Annual) Report of the Surgeon General, U.S. Navy (for 1900), pp. 208-212. Bur. Med. & Surg., U.S. Navy Dept., Washington, D.C. Includes malarial fever in the list of more important individual diseases, p. 211, and refers to it as follows: "Manifestations presumed to be malarial are very rare, and it is not certain that malaria exists at all in the island."


Mumford, E.P. 1942b. Mosquitoes, malaria and the war in the Pacific. Science 96(2487):191-194. This is not a reprint of Mumford 1942a. Projects the possibility that the islands of the Central Pacific will lose their immunity from malaria and Anopheles before the end of World War II, p. 193.


Nakata, S. (for W.W. Cantelo). 1960. Aedimomyia ostedtia Knab on Guam. Notes and Exhibitions for January 12, 1959. Proc. Hawaiian Ent. Soc. 17(2):161-162. This species was first collected in a light trap near Apra Harbor in January, 1958, and has been taken frequently in the Apra Harbor area since that date. It may have been introduced into Guam from the Philippine Islands or the western Carolines.


Reeves, W.C. and A. Rudnick. 1949. Unpublished survey of mosquitoes of Guam during November and December 1948 and January 1949. Referred to by Hull (1952): "out of 2,189 larval collections and 250 adult collections, no Aedes aegypti were found. A. albopictus was found in 119 collections and was rather widespread from Talofofo north. Anopheles mosquitoes were found throughout the southern end of Guam. These workers also collected all other species known from Guam except Culex sitiens."

Reeves, W.C. and A. Rudnick. 1951. A survey of the mosquitoes of Guam in two periods in 1948 and 1949 and its epidemiological implications. Am. J. Trop. Med. 31(5):633-658. Surveys were made in Feb-Mar 1948, and Nov 1948-Jan 1949, following the epidemic of JBE in Guam in December 1947. This report is based on the findings of an intensive survey of the mosquito fauna of Guam, in an attempt to determine if mosquitoes were the vectors of JBE. Includes the first record of adult Aedes albopictus (Skuse) from Guam, p. 648.


Reinert, J.F. 1973. Contributions to the mosquito fauna of Southeast Asia. XVI. Genus Aedes Meigen, subgenus Aedimorphus Theobald in Southeast Asia. Cont. Am. Ent. Inst. 9(5):1-218. Reviews the taxonomy and collection records, including those on Guam, for Aedes vexans nocturnus (Theobald), p. 74, and states: "In the absence of sufficient biological, behavioral and genetical data on the Pacific Island populations of vexans, and since specimens from these populations fall within the variable range of morphological characters of other populations within the distribution of the species, I am hereby synonymizing nocturnus with vexans vexans," p. 77.
Reisen, W.K. and R.G. Basio. 1971. Oviposition trap surveys conducted on four USAF installations in the Western Pacific. Philipp. Ent. 2(1):62-66. *Aedes albopictus*, *A. burnsi* and *A. pandani* were recovered from NCDC "black jar" oviposition traps on Guam. This was the first record for recovery of the latter species from an oviposition trap, p. 64.


Reisen, W.K., J.P. Burns and R.G. Basio. 1971b. A mosquito survey of Guam, Marianas Islands. U.S. Air Force 1st Medical Service Wing (PACAF). 30 pp. (mimeographed). Guam was surveyed for adult and immature mosquitoes during Feb 1971; adult mosquito light trap collection data compiled by the Preventive Medicine Section, USAF Hospital, Andersen AFB, during 1970 are included. A list of the species captured at various points around the island using ovitraps, light traps, man-biting surveys, and larval sampling is given. 18 different species, including 8 new distribution records are listed.


Rosen, L. 1971. Infectious disease research activities of the National Institutes of Health in the Pacific, in Proc. Commander in Chief Pacific First Conference on Preventive Medicine, Oahu, Hawaii, 18-22 January 1971, pp. 14-17. Notes that after *Aedes albopictus* was introduced accidentally on the island of Guam during World War II, it eventually displaced the endemic *soumellaria* species from the peridomestic habitat, p. 16.

Rozeboom, L.E. and J.R. Bridges. 1972. Relative population densities of *Aedes albopictus* and *A. guamensis* on Guam. Bull. Wld. Hlth. Org. 46(4):477-483. A 1970 survey showed that since a similar survey in 1948-49, the population density of *A. albopictus* increased while that of *A. guamensis* decreased in both artificial and natural breeding sites. *A. guamensis* is indigenous to Guam, and *A. albopictus* was not discovered there until 1944. Competition between the two populations is suggested.


Sabin, A.B. 1964. Dengue: research activities, in Preventive Medicine in World War II. Vol. VII. Communicable Diseases: Arthropodborne diseases other than malaria, pp. 40-62. Off. Surg. General, Dept. of the Army, Washington, D.C. Neutralization tests on sera from people with a diagnosis of dengue fever during the Hawaii epidemic of 1943-44, or the Japanese epidemics of 1944-45, revealed that the Hawaii type of virus was probably predominant in those outbreaks, while similar tests on the sera of Americans who had had the disease on Guam in 1944-45 indicated that another type or types of dengue fever were probably more prevalent there, p. 59.


Satterlee, R.C. 1928a. Sanitary survey of the Island of Guam, 1928. Forwarded by the Governor Commandant of Guam, 28 August 1928, to the U.S. Navy Dept., Washington, D.C. Reports the presence of Anopheles in Micronesia (Guam), but according to D.S. Farner (1944b, p. 38), "it seemed to be unfounded."


Savage, E.P. 1966. Mosquitoes, in Report of Vector and Related Sanitation Problems on Guam, Part III, 10 pp. U.S. Public Health Service, National Communicable Disease Center, Atlanta, Georgia. An in-depth review of the 14 species of mosquitoes recorded from the Island of Guam to date: 6 species of Aedes, 5 species of Culex, and 1 species each of Aedemoyna, Anopheles and Mansonia. A summary of mosquito biting collections and a key to identify Guam mosquitoes are included, in addition to bionomics and public health data.

Schliessmann, D.J. 1968. Aedes aegypti eradication in a developed country. WHO Chron. 22(4):146-149. The measures taken by the United States of America are discussed. Guam is included as an American yellow fever receptive area as of 1960, p. 147.


Stone, A. and D.S. Farner. 1945. Further notes on the *Aedes scutellaris* group (Diptera, Culicidae). Proc. Biol. Soc. Wash. 58:155-162. The known range of *Aedes guamensis*, known herefore from the Island of Guam, has been extended to Saipan on the basis of a male collected at Marpi Point, p. 158. *A. guamensis* is included in a key to the adults of the *scutellaris* group, p. 159.


Travis, B.V. 1947a. Relative efficiency of six species of mosquitoes from Guam, M.I., as developmental hosts for *Dirofilaria immitis*. J. Parasit. 33(2):142-145. Data are presented to show which species of mosquitoes are most likely to be transmitters of dog heartworm on Guam.


U.S. Air Force. 1944. Notes on tropical diseases for Air Forces medical officers (127 pp.); Regional medical studies (118 pp.); and General medical bulletins (35 pp.). Army Air Forces School of Aviation Medicine Manual 25-200-5, Randolph Field, Texas. Designates the Pacific a malaria-free zone, p. 01-1; No reports of filarial disease cases in the Mariana Islands, p. 06-2; Regional medical studies 6: Health and disease in the Japanese Mandated Islands and Guam, 8 pp. - Dengue fever is endemic, p. 5; Filariasis has been reported, p. 5.

U.S. Air Force. Consultative and technical reports published by the Fifth Epidemiological Flight and the First Medical Service Wing. See individual authors.


U.S. Dept. Health, Education, and Welfare. 1975. Health status of Vietnamese refugees. Morbidity and Mortality Wkly Rept. 24(18):157-158, 163. Public Health Service, Center for Disease Control, Atlanta, Georgia. Hospitalization rates for refugees arriving on Guam are listed. Only 2 cases of malaria (1 Plasmodium vivax, 1 P. falciparum) have been reported. 5 cases of a syndrome clinically compatible with dengue fever have been diagnosed in arriving refugees. Comprehensive malaria assessment, including transmission potential and case occurrence, is given, p. 158.

U.S. Dept. Health, Education, and Welfare. 1975. Update on Vietnamese refugee health status. Morbidity and Mortality Wkly Rept. 24(19):172. Public Health Service, Center for Disease Control, Atlanta, Georgia. 20 cases of malaria have been reported for a total of 22; no additional cases of dengue fever, leaving the total at 5.

U.S. Dept. Health, Education, and Welfare. 1975. Update on Vietnamese refugee health status. Morbidity and Mortality Wkly Rept. 24(21):188. Public Health Service, Center for Disease Control, Atlanta, Georgia. 5 additional cases of malaria reported from Guam and Wake islands for a total of 30. 2 additional cases of dengue fever reported from Guam.

U.S. Dept. Health, Education, and Welfare. 1975. Update on Vietnamese refugee health status. Morbidity and Mortality Wkly Rept. 24(22):189-190. Public Health Service, Center for Disease Control, Atlanta, Georgia. No new cases of dengue fever. Vector control activities included aerial ultra-low volume spraying with malathion. No transmission of the infection on Guam has been verified. A total of 90 cases of malaria has been reported to date from all refugees. 50 of these cases were reported from Guam and Wake islands. No transmission of malaria has been reported on Guam since the arrival of the refugees.


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These cases may have been acquired outside or on the island. There is no distinction in the reported cases. The disease data from Guam were not published each year. Since the years and numbers of cases of malaria reported do not include the 1966 and 1969 outbreaks on Guam, it is likely that they represent those cases diagnosed, treated or hospitalized in military personnel returning from assignments in the Far East or in Southeast Asia.

U.S. Navy. 1945. Tropical and exotic diseases of naval importance. U.S. Naval Medical School, Bethesda, Maryland. 107 pp. Guam is included in a malaria-free zone (map and island list), p. 2; dengue fever distribution map, p. 42; filariasis distribution map, p. 66.


U.S. Navy. 1971. Guam, in PACOM Intelligence, Proc. Commander in Chief Pacific First Conference on Preventive Medicine, Oahu, Hawaii, 18-22 January 1971, p. 28. States the intelligence for this area of study (Marianas) is minimal. The possibility of a major vector-borne disease outbreak such as dengue fever, encephalitis, malaria or plague exists and constitutes an area of major concern to preventive medicine officials.

U.S. Navy. Consultant and other reports published by the Preventive Medicine Unit No. 6. See individual authors.

U.S. War Dept. 1944a. Medical and sanitary data on Guam. War Dept. Tech. Bull. (TB MED) 57:1-16. No *Anopheles* mosquitoes or malaria in Guam. *Aedes aegypti*, *A. oakleyi*, *A. pandani*, *A. scutellaris pseudoscutellaris*, and *Culex fatigans* are reported, with notes on vector abilities. Dengue fever and endemic filariasis are reported as occurring.


Ward, R.A. 1975. Two new anopheline vectors reported on Guam. September 1975 Minutes of the Global Epidemiology Working Group, U.S. Army Medical Intelligence and Information Agency, Washington, D.C. 1 p. (mimeographed). Reports the presence of 2 previously unrecorded anopheline species on Guam: Anopheles barbirostris and A. litoralis. The mosquitoes were collected in light traps which indicates that the species were established and breeding. Guam was sprayed in June 1975; these mosquitoes were collected in July. It is felt that Anopheles litoralis was introduced into Guam via the Philippines, probably with cargo.


World Health Organization. 1955. Control of insect vectors in international air traffic. WHO Int. Dig. Hlth. Leg. 6(3):379-435. Cites three species of mosquitoes brought into Guam since World War II which have acclimatized themselves there, p. 388. Refers to the introduction of Anopheles subpictus into Guam, probably by insufficiently disinfected aircraft coming from the Celebes, p. 391, and Aedes albopictus, by aircraft from the Philippines, p. 392.

World Health Organization. 1969. Japanese encephalitis, in Report on the Second Regional Seminar on Virus Diseases: Mosquito-Borne Virus Diseases (Arboviruses). WHO Regional Off. for the Western Pacific, Manila, Philippines, 6-11 October 1969. WPR/416/69, 58 pp. A single epidemic of Japanese encephalitis occurred in Guam in 1947. The virus was apparently introduced, was not reported previously, and has not reappeared since, p. 2. Culex annulirostris mariana was considered to be the vector, p. 6.


World Health Organization. 1972. Vector control in international health. Wld. Hlth. Org., Geneva. 144 pp. Anopheles subpictus indefinitus was first reported on Guam in 1948; until that time the island was believed to be free from anophelines. In 1969, 6 cases of malaria were reported from Guam, and at least one of these cases was transmitted locally on this previously malaria-free island, p. 32.

World Health Organization. 1975. Dengue fever surveillance in some countries of Asia and the South-west Pacific. WHO Wkly. Epidem. Rec. 50(30):269-272. Aedes aegypti was detected during a survey carried out on Guam in 1971. A. scuteZtaris and A. albopictus were also identified, p. 271.


ADDENDUM


Guam, Government of. 1975. Environment impact assessment for aerial ULV application of malathion at three ounces per acre in Guam. Pp. 42 + Tabs A-E. (mimeographed). Examines the impact, on man and his environment, of the administration of 95% Malathion at the rate of 3 ounces per acre by aerial application to prevent an outbreak of dengue fever among the civilian community following the influx of Vietnamese refugees during "Operation New Life."

Velimirovic, B. 1969. Japanese Encephalitis history and geographical distribution, in Report on the Second Regional Seminar on Virus Diseases: Mosquito-Borne Virus Diseases (Arboviruses), p. 2. WHO Regional Office for the Western Pacific, Manila, Philippines, 6-11 October 1969, WPR/416/69, 58 pp. A single epidemic of JE occurred in Guam in 1947. The virus was apparently introduced, was not reported previously, and has not reappeared since, p. 2. *Aedes annulirostris mariana* was considered to be the vector, p. 6. Dengue fever virus on Guam, p. 49/50; JE virus on Guam, p. 51/52; Arbovirus disease map, showing Guam, p. 57/58. (see W.H.O., 1969)