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**NOTES ON THE MOSQUITOS OF THE GILBERT, ELLICE
AND TOKELAU ISLANDS, AND ON FILARIASIS IN
THE LATTER GROUP.**

BY

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NOTES ON THE MOSQUITOS OF THE GILBERT, ELLICE AND
 TOKELAU ISLANDS, AND ON FILARIASIS IN THE
 LATTER GROUP.¹

By Marshall LAIRD.²

There are 25 islands, many of them atolls composed of a number of islets, in the Gilbert and Ellice Islands Colony—a Crown Colony under the administrative control of the High Commissioner for the Western Pacific. These islands lie between the parallels of 03°15'N. and 10°45'S. and the meridians of 172°30'E. and 179°52'E. The 16 northernmost ones, the Gilberts, form an arc across the Equator. They are, in effect, a bridge between Polynesia and Micronesia, the affinities of the Gilbertese themselves being largely Micronesian. The people of the nine southern islands, the Ellice Group, are Polynesians.

New Zealand administers the Tokelau Group, which is made up of three atolls inhabited by Polynesians. Lying out to the east of the Ellice Islands, these atolls are bounded by the latitudes of 08°30'S. and 09°28'S. and the longitudes of 171°12'W. and 172°32'W.

Filariasis occurs throughout the area in question, being of the non-periodic type in the Polynesian islands. There is a certain amount of evidence to suggest that in the Gilberts the nocturnally periodic type is present as well (Backhouse & Heydon, 1950). Elephantiasis is particularly prevalent in the northern Ellice Islands (O'Connor, 1923), but is rare elsewhere.

Only one species of mosquito, *Aedes (Stegomyia) pseudoscutellaris* (Theo.), has been reported from the Tokelau Group (O'Connor, 1923). O'Connor also found this mosquito to be widespread in the Ellice Islands, and demonstrated it to be the vector of *Wuchereria* both there and in the Tokelau Group. Buxton recorded "*Aedes variegatus* var. *pseudoscutellaris*" from all the islands of the Tokelau Group and from all those of the Ellice Group with the exception of Nurakita, which he did not visit; he thus felt, considering both the wide distribution and the limited flight-range of the species, that it was not a recent introduction (Buxton & Hopkins, 1927). Stating that "the eggs of this insect are resistant to drying, and that they are sometimes laid in canoes" Buxton thought it likely that Polynesians sailing up from Samoa had been responsible for the initial introduction, and that subsequent inter-island canoe voyagers had broadcast *pseudoscutellaris* within the two Groups. Davis (1949) suggested that the aquatic stages of this mosquito could have been carried in the drinking-water containers with which the former ocean-going canoes were equipped. It is worth noting that such hollowed-out wooden containers are still manufactured—although mostly for the tourist trade—by Ellice and Tokelau natives.

Young (1927) reported the prevalence of "*Stegomyia pseudoscutellaris*" in the Gilbert and Ellice Islands Colony. His record seems to have been intended to apply specifically to the Gilberts, as he had at that time visited all the Gilbert Islands although he had not been to the Ellice Group. Bohart & Ingram (1946) indicated that the representative of the *scutellaris* group occurring in the Gilberts is *Aedes (Stegomyia) marshallensis* Stone & Bohart, 1944, basing this conclusion on material from the atolls of Tarawa and Abemama.

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It was demonstrated by Marks (1951) that Theobald's *Aedes pseudoscutellaris* is actually confined to Fiji. She described the widely distributed vector of *Wuchereria* in Polynesia as a new species, *A. (Stegomyia) polynesiensis*. However, having no material from the Ellice and Tokelau Islands, she was unable to state definitely that the representative of the *scutellaris* group found there is in fact *A. polynesiensis*.

O'Connor (1923) found only one other species of mosquito in the Ellice Group. This, which he referred to as "*Culex jepsoni*", was subsequently recognised as *C. (Culex) annulirostris* Skuse by Edwards (1924). Although O'Connor reported this species from five of the Ellice Islands, Buxton found it at Funafuti only. The latter author was of the opinion that drought was the probable cause of his not securing *C. annulirostris* on other islands of the Group (Buxton & Hopkins, 1927).

Culex (Culex) pipiens fatigans Wied. was collected by the District Officer, Tarawa, in 1925 (Buxton & Hopkins, 1927). These authors also identified examples of *Aedes (Stegomyia) aegypti* (L.) from Tarawa. Both domestic species were listed from the Gilberts by Young (1927) and in subsequent Annual Medical and Sanitary Reports of the Colony. Buxton & Hopkins considered that at the time of their researches both *C. p. fatigans* and *A. aegypti* were still absent from all the islands of the Ellice and Tokelau Groups. Twenty years later, however, the latter species had become established at Nanumea, the most northerly atoll of the Ellice Islands (Venner, 1944). Brygoo (1953) indicated the occurrence of *C. p. fatigans* as well as *A. aegypti* in the Ellice Group (his Tables "A" and "C"), but quoted no authority for his information. As he omitted to list "*pseudoscutellaris*" from the Ellice Group in his Table "A", and his paper contains other inaccuracies such as the statements that *C. annulirostris* is absent from New Caledonia (where this species is common—Perry, 1950; Laird, 1954) and that *Aedes (Stegomyia) tongae* Edw. is restricted to Tonga (it has been known from Sikaiana, Solomon Islands, for more than a quarter of a century—Edwards, 1926) Brygoo's record should be treated with reservation.

Finally, Buxton collected *Aedes (Aedimorphus) vexans* (Mg.) on the islands of Nui and Niutao in the Ellice Group (Buxton & Hopkins, 1927). It should be noted that Brygoo (1953) overlooked this record also. I cannot trace any record of *A. vexans* from the Gilberts, although Bohart & Ingram (1946) reported it from Ebon Atoll (Marshall Islands) to the north-west of the former Group.

It was stated in a U.S. Army Air Force wartime manual on tropical diseases (unpublished, 1944) that "*Aedes kochi* is not found in the Fiji, Ellice, Cook and Phoenix Islands. In the Gilbert (Tarawa), Tokelau and Society Islands it breeds in coconut husks and other small collections of water". This is inaccurate. Apart from the fact that a representative of the *kochi* group does occur in Fiji—*Aedes (Finlaya) fijiensis* Marks—*Finlaya* is unknown in the area under consideration (Stone & Bohart, 1944; Marks, 1947). The most easterly species of the *kochi* group is *A. (Finlaya) samoanus* (Grünb.), which occurs in Samoa and Tonga (Buxton & Hopkins, 1927). Larvae of *A. samoanus* are most frequently found in the water which collects in the leaf axils of certain species of taro (*Colocasia* and *Alocasia* spp.). Buxton & Hopkins drew particular attention to the absence of this species from the Ellice Islands, putting forward in explanation the facts that the brackish subsoil of these islands does not lend itself to the cultivation of the better types of taro and that the round-stem taro grown there does not hold water.

Discarding unsubstantiated records, then, the picture of mosquito distribution in the Gilbert, Ellice and Tokelau Islands presented by the literature is shown in Table I.

From time to time, flying boats of No. 5 Squadron, RNZAF, visit the Tokelau Group, Tarawa and Funafuti from Lauthala Bay, Fiji. The opportunity thus

presented itself to collect material at each of these places in the course of routine flights. Although all the calls were brief ones, only a day being spent at Nukunono (Tokelau Group) and a similar period at Tarawa and at Funafuti, it is considered that the results achieved warrant publication.

TABLE I.

Species	Occurrence		
	Gilbert Is.	Ellice Is.	Tokelau Is.
✓ <i>A. aegypti</i>	×	×	—
✓ <i>A. polynesiensis</i>	—	×	×
✓ <i>A. marshallensis</i>	×	—	—
✓ <i>A. vexans</i>	—	×	—
✓ <i>C. annulirostris</i>	—	×	—
✓ <i>C. pipiens fatigans</i>	×	—	—

TOKELAU GROUP.

A landing was made at Atafu on the afternoon of 15th June 1953, and a brief visit was paid to the village islet. Two collections of *scutellaris*-group larvae were made there, both of them from 44-gallon drums filled with rain-water of pH 7.0 and pH 6.4 at a temperature of 28°C. Ill-fitting wooden covers were present in both cases, and the drums were in the immediate vicinity of houses.

The aircraft reached Nukunono (09°10'S., 171°47'W.) later that afternoon. The population of this atoll at the last census was 452—226 males and 226 females. Thanks to the good offices of Father A. MacDonald and Sister Kasarina, who are stationed at Nukunono, 97 of these people, their ages ranging from 5 to 78, presented themselves for blood sampling. A single thick film was taken from the tip of the index finger of each individual, the survey being made between 1910 hr. and 2025 hr. on the evening of 15th June. The films were subsequently dehaemoglobinised and stained with Giemsa in the usual fashion. All those concerned had dwelt on the atoll for all, or for the greater part of, their lives.

The data obtained were inadequate for the estimation of any relationship between age and microfilaria concentration. Ten or more microfilariae were counted in the thick films from six individuals whose ages were 22, 25, 32, 34, 39 and 42 years. The heaviest concentration was noted for a man 34 years old, 30 microfilariae being present in his film.

In 1920, O'Connor examined 27 males, all over 16 years of age, at Nukunono. Four of these had microfilariae without clinical filariasis, one had both clinical filariasis and microfilariae and one had clinical filariasis alone. The microfilaria rate for this group was thus 18.5 per cent., while the overall percentage of infection was 22.2 per cent.

During the present survey, 28 males of over 16 years of age were examined (no notes on clinical filariasis being taken). Twelve of these exhibited microfilariae, the microfilaria rate thus being 42.9 per cent. The rates for 10-year age groups ranged from 28.6 per cent. for the 20–29 group to a maximum of

66.7 per cent. for the 50-59 group (Table II). In this connection, it is worth noting that Murray (1948) recorded the maximum percentage of microfilaria carriers in the 50-54 age group in American Samoa.

The total number of males above 16 years of age was only one more than that dealt with by O'Connor, but the microfilaria rates for each 10-year age group, as

TABLE II.
Microfilaria rate, Nukunono.

Age of persons (years)	Males			Females		
	Number examined	Positive		Number examined	Positive	
		No.	%		No.	%
1 — 9	7	0	0	5	0	0
10 — 19	8	0	0	11	0	0
20 — 29	7	2	28.6	14	2	14.3
30 — 39	6	2	33.3	7	1	14.3
40 — 49	5	2	40.0	10	1	10.0
50 — 59	6	4	66.7	5	1	20.0
60 plus	4	2	50.0	2	0	0
Total	43	12	27.9	54	5	9.3

well as the overall rate, materially exceed the figure of 18.5 per cent. computed from the latter author's data. This might be due, at least in part, to a difference in techniques, for O'Connor based his conclusions on the examination of 20 cu. mm. of blood from each subject, and the volume of blood in the average thick drop is in excess of 20 cu. mm. Six of those examined in the present instance had relatively light infections, only one or two parasites being present in their films. Some or all of these infections might well have been overlooked had a smaller sample of blood been taken. Four of those concerned being men, the resultant microfilaria rate for males above 16 years of age could thus have been computed at 18.6 per cent.—a figure almost exactly comparable with O'Connor's. It cannot, therefore, be claimed that the microfilaria rate at Nukunono has increased since 1920, although the evidence now available indicates that this rate is higher than O'Connor estimated it to be.

Dr. J. S. Armstrong (Acting Director of Medical Services for Western Samoa at the time of this survey) informed me that two or three years ago he took 50 thick smears in the Tokelau Group, but that these, the only ones taken since O'Connor's visit, so deteriorated before staining as to be unsuitable for examination.

O'Connor examined more people at the other two atolls, Fakaofu and Atafu, than he did at Nukunono. Of a total of 330 individuals from all three atolls, 12 (of 85) under 16 years old and 90 (of 245) above that age showed evidence of infection. Only seven of those under 16 had microfilariae in their blood, the other five being what O'Connor called "doubtful cases of clinical filariasis". Of

the 90 above that age who showed signs of infection, 52 (of 145) were male and 38 (of 120) were female. However, 13 of the former and 22 of the latter were recorded as positive for filariasis on clinical grounds alone. Microfilariae were demonstrated for only 39 (26.9 per cent.) of the males and 16 (13.3 per cent.) of the females.

The microfilaria rate among Tokelau males is thus much higher than that among females, O'Connor's figures indicating a ratio of 2:1 and mine (Table II) one of 3:1. This is in accord with data available from American Samoa, where Murray (1948) found microfilariae in the blood of twice as many men as women above 20 years of age. It seems likely that this state of affairs is related, as previous authors have suggested, to the much greater amount of time which men spend working in the coconut plantations where the population of vector mosquitos of the *scutellaris* group is usually much greater than in the cleared ground about the villages where the women spend most of their time. Tokelau boys go regularly to the plantations (which are located on other islets than the village ones) from an early age. MacGregor (1937) stated: "Every family has a plantation of coconut trees on the atoll and usually some trees near the village. It is part of the young boys' work to keep the household supplied from these trees and to go with their fathers to the plantations two or three times a week and pick nuts."

Twelve larval habitats of mosquitos of the *scutellaris* group were located on 16th June. Seven of these were at Motusanga, a small islet covered with coconut palms at the southern end of the village islet, to which it is connected by a footbridge. The other five were on the village islet itself, this islet bearing the name of the atoll, Nukunono. Nine collections, five on Motusanga and four on Nukunono, were made at small reservoirs hollowed into the trunks of growing coconut palms (see O'Connor, 1923, Pl. IV, fig. 10; Buxton & Hopkins, 1927, Pl. XII, fig. A). Such tree reservoirs were formerly used to obtain drinking water, most of which is now stored in large concrete tanks. Thus the water in these cavities—at all events in those of them handy to the villages—is often allowed to lie untouched or is used by men returning from the lagoon, who dash it over themselves to wash away the salt. While six of the reservoirs examined teemed with larvae, three others, located near to the beach and thus in constant use, contained fewer larvae and many dead adults. Some of the latter were not fully free from the pupal pelt, and had apparently been knocked over in the act of emergence by mechanical disturbance of the water.

Two of the larval collections were made from rot-holes in a Puka tree (*Hernandia ovigera*) on Motusanga, while the remaining one was from water in the bottom of a beached canoe in the heart of Nukunono village. Adult males and females of the *scutellaris* group were found resting in the shaded upper parts of two of the tree reservoirs. A few females also emerged from some of the pupae collected. All the larvae collected at the atoll were typical of the *scutellaris* group, while the adults corresponded with the description of *Aedes* (*Stegomyia*) *polynesiensis* Marks. Specimens were duly forwarded to Dr. Marks who confirmed my tentative identification (private communication, 1953).

The only other aquatic arthropods present in any of the mosquito breeding places were Ostracoda, discounting a crab, found at the bottom of one of the holes in the Puka tree, and identified as *Sesarma* sp., probably *rotundata* Hess, by Dr. C. H. Edmondson of the Bernice P. Bishop Museum, Honolulu. There were also a few Collembola on the surface film of some of the palm reservoirs. The hydrogen-ion content of the water in the last-named larval habitats ranged from 6.0 to 7.6 pH (av., 7.1), while that of the water in the Puka rot-holes was 6.8. In all cases the water temperature was much the same, varying from 26.25°C. to 27°C. The water in the beached canoe being very murky and of a deep yellow colour, a pH reading could not be taken by the only means

available, a Lovibond comparator. All the breeding places were shaded from sunlight, the tree cavities by the part of the trunk above them and the canoe by a pile of palm fronds.

Two hours were spent in a fruitless search for mosquito larvae along the rubbish-strewn edges of a seepage pond some 50 yards in length and 20 yards in width, on Motusanga (fig. 1). The water there was brackish to the taste, with a pH content of 8.4. It is considered that this pond could support such



Fig. 1.—Brackish seepage pond, Motusanga.

a brackish-water breeder as *Culex (Culex) sitiens* Wied. should an introduction ever take place—as well it might, *C. sitiens* being common in Samoa, whence comes most of the (sporadic) shipping which visits the Tokelau Group.

No coconut shells holding water and suitable as breeding places could be found on Nukunono, a tribute to the state of cleanliness in which the village and its surroundings are maintained. No larvae of *A. polynesiensis* were found in 44-gallon drums as at Atafu, and an examination of the water held in 50 leaf axils of *Pandanus* disclosed no aquatic arthropods whatsoever. Night-biting mosquitos were conspicuous by their absence, although *A. polynesiensis* was troublesome in shady places both at Motusanga and on the village islet during the day.

TARAWA, GILBERT ISLANDS.

Mosquito collections were made at this atoll (01°30'N., 173°00'E.) on 27th January 1954. It was not practicable to undertake a blood-smear survey during the visit.

The domestic mosquitos, *Aedes aegypti* and *Culex pipiens fatigans*, having already been recorded from Tarawa (p. 293), these were not searched for. Particular attention was paid to accumulations of surface water on the islets of Bairiki, Teoraereke and Eita. The deep pits which the Gilbertese dig down to intersect the water table for the cultivation of their coarse taro or "babai" (*Cyrtosperma chamissonis*) proved of particular interest as larval habitats.

Larvae of *C. annulirostris* were found to be abundant on all three islets, being particularly common in the "babai" pits on Eita. There are some extensive pits on the latter islet, one of those examined measuring about 150 yd. by 100 yd.

and appearing to be an adapted natural swamp. During times of drought the seepage water in the "babai" pits is more or less brackish, but in the wet season—which was at its height at the time of this visit—so much rain-water is stored up that the resultant pools are all but fresh. The pH content of the water was found to vary between 7.2 and 8.0 (av., 7.4) at a temperature of 28°C. Larval Chironomids (identified by Dr. W. W. Wirth of the U.S. National Museum as *Tendipes* sp.) were usually present together with *C. annulirostris*, and the nymphs of Odonata (Anisoptera and Zygoptera) were always common. Great numbers of Collembola were noticed on the surface film of some small marginal pools. Other aquatic arthropods, notably Coleoptera and Hemiptera, appeared to be altogether lacking.

A brackish pond (pH 8.0 at 28°C.) near the beach at the eastern end of Teaoraereke supported huge numbers of the developmental stages of *C. annulirostris*. The entire surface of this pond, which measured 20 ft. by 15 ft., was literally black with larvae, despite the presence of large numbers of predators (dragonfly and damselfly nymphs). The species was also collected from flooded crab burrows. Adults of *C. annulirostris* were troublesome by night in the European houses on Bairiki.

One of the shallow pools in a rather dry "babai" pit on Bairiki proved to contain a few fully developed larvae of *Aedes* (*Aëdimorphus*) *vexans nocturnus* (Theo.). Bohart & Ingram (1946) stated that larvae of the typical *A. vexans* (Mg.) have head hair B with two branches and C with three to five branches, whereas larvae from Australasia and the Philippines have B single and C single or double. On these grounds the Pacific representative of *A. vexans* was distinguished as *A. vexans nocturnus*. All the Tarawa examples seen have head hairs B and C both single, and are thus referred to this subspecies. No adults were collected.

A. marshallensis was common everywhere. Larvae abounded in the husks which littered the plantations, and imagines were a pest during the day-time in any shady patches of vegetation, particularly on Teaoraereke. The small pockets of water in 20 leaf axils of *Pandanus* were carefully searched for mosquito larvae, but as at Nukunono no arthropods of any kind were found.

FUNAFUTI, ELLICE ISLANDS.

The afternoon of 29th January and the morning of the 30th were spent at Funafuti (08°28'S., 179°08'E.) on the way back to Fiji from Tarawa. As in the case of the latter atoll no blood-smears were made.

Collecting was confined to the largest islet, which bears the name of the atoll. The sandy soil of Funafuti is of much better quality than that of Tarawa. Pits, similar to those of the Gilbertese, are dug through the water table to make sunken gardens, some of which are of considerable size. The true taro (*Colocasia antiquorum* var. *esculenta*) is grown in addition to *Cyrtosperma chamissonis*. The Funafuti gardens were found to be much drier than those of Tarawa. Shallow pools in most of those examined held the aquatic stages of *A. vexans nocturnus* in association with larval Tipulids and Anisoptera, and amphipods, ostracods and freshwater snails. The pH content of the pools, like that of those at Tarawa, averaged 7.4 (range, 7.0 to 8.2). Water temperatures were higher than those recorded at the latter atoll, and in one instance that of a pool supporting a very heavy population of *A. vexans nocturnus* (up to 300-400 second-instar larvae per dip with a 200 cc. dipper) was as high as 37°C. (pH 8.2). Adults of this species were very troublesome at night-time.

A few adults of *C. annulirostris* were found resting in dark corners of a bedroom on the morning of the 30th. The only other record of this species at Funafuti was from the last-mentioned pool, and concerned an egg raft, from which larvae were just beginning to hatch.

Larvae and adults of a *Stegomyia* of the *scutellaris* group were common everywhere. Coconut husks lying about in the underbrush of the plantations often teemed with aquatic stages of this mosquito, which were also found in a small pool in a hollow on top of a knob of coral deeply shaded by overhanging vegetation. The pH content of the water in this larval habitat was 7.6 at 27.5°C. (the shade air temperature at the time was 28.5°C., while nearby pools in taro pits exposed to full sunlight averaged 33°C.; members of the *scutellaris* group are seldom found in water subject to marked temperature fluctuations, and the temperature of their larval habitats at the height of the day is usually less than the shade air temperature). Other larvae were found in a 44-gallon drum positioned so as to catch rain-water directed into it by means of a spout from the trunk of a coconut palm (pH 6.6 at 30°C.).

Imagines were extremely troublesome in the shade of the plantations. At one stage as many as 40 were present on my arms, and it was not possible to continue working without applying repellent. This is in marked contrast to the experience of O'Connor (1923), who declared that "I found only four or five specimens of *Stegomyia pseudoscutellaris* on this islet [*i.e.*, Funafuti.—M.L.], though *Culex jepsoni* [= *C. annulirostris*, see p. 292], which is absent from the other islets, is common". Perhaps the underlying reason is seasonal—O'Connor spent the driest months of the year (April–June) at Funafuti, and at that time a minimum of suitable mosquito breeding places would be available. As at Nukunono, the *scutellaris*-group mosquitos proved in every way comparable with the description of *A. polynesiensis*. Dr. Marks was sent material for checking, and once again she confirmed the identification (private communication, 1954).

The 44-gallon drum already mentioned contained numerous larvae of *A. aegypti* in addition to those of *A. polynesiensis*. No adults of *A. aegypti* were seen at Funafuti.

Many leaf axils of *Colocasia* and *Pandanus* were searched for mosquito larvae, once again with complete lack of success. Two to three hours were also spent in searching for mosquitos at the margins of two extensive brackish swamps (connected with the sea by underground channels, and thus subject to tidal action). Small pools in waterlogged ground at the edge of these swamps had a pH content of 10.0 at 32.5°C. Although outwardly suited to such brackish-water mosquitos as *C. sitiens*, these were quite without larvae.

Discussion.

The incidence of filariasis at Nukunono, as judged from the microfilaria rate, is appreciably higher than is apparent from O'Connor's (1923) results, and a much higher percentage of men than women exhibit *Wuchereria* there. Otherwise, the picture is substantially unchanged since 1920, no new mosquitos having made their appearance, although potential larval habitats for two Samoan species, *A. samoanus* and *C. sitiens*, are available at the atoll.

Tarawa and Funafuti have been the ports of entry to their respective Groups for many years. They are consequently the atolls most likely to be initially overrun by introduced mosquitos. On the available evidence it would seem that both *A. vexans nocturnus* and *C. annulirostris* have become established at Tarawa over the last quarter of a century. These species might well be very recent introductions, for in view of the military activity at Tarawa during World War II it is surprising that no mention of their presence was made in official survey reports. Both mosquitos could have been brought by sea or air from the Ellice Group, if not from further afield. *C. annulirostris* had become widely distributed in that Group by 1920 (O'Connor, 1923), while *A. vexans nocturnus* was present on at least two of the islands in 1924 (Buxton & Hopkins, 1927, as *A. vexans*). Although neither O'Connor nor Buxton found the latter insect on Funafuti it would have been an easy matter for them to have overlooked it, as

their visits both took place during the dry season. *A. vexans nocturnus* is of sporadic occurrence throughout its area of distribution, typically appearing in huge numbers (often to the temporary exclusion of *C. annulirostris*) in temporary surface pools formed as a result of heavy rains. Finally, it is highly unlikely that the two authors in question, interested as they were in mosquitos utilising small natural and artificial containers as larval habitats, would have overlooked the presence of so important a domestic mosquito as *A. aegypti* at Funafuti.

Certain ecological niches suitable as mosquito larval habitats, although not as yet utilised by these insects, are available in the Gilbert and Ellice Islands. Conspicuous among these are the brackish swamps of Funafuti and leaf axils of *Pandanus* and *Colocasia*. As the lack of water-retaining taros in the Ellice Group was proposed by Buxton as a reason for the absence of *A. samoanus*, it can only be concluded that crop changes in recent years have laid the Group open to the possibility of a successful introduction of this annoying pest species.

Granted a suitable means of transportation, it is felt that the possibility of such an Anopheline as *Anopheles (Myzomyia) farauti* Lav. being introduced should not be overlooked. There is no reason why this dangerous mosquito should not be able to establish itself in the taro gardens of either Group.

Representative adults of *Aedes polynesiensis* from Nukunono and Funafuti and of *A. marshallensis* from Tarawa have been deposited in the collection of the University of Queensland.

Summary.

It is confirmed that the *scutellaris*-group mosquito of the Tokelau and Ellice Islands is *Aedes (Stegomyia) polynesiensis* Marks. No other mosquitos are known from the former Group, but *Culex (Culex) annulirostris* Skuse, *A. (Aedimorphus) vexans nocturnus* (Theo.) and *A. (Stegomyia) aegypti* (L.) are also recorded from Funafuti, Ellice Islands. *C. annulirostris* and *A. vexans nocturnus* are listed—apparently for the first time—from Tarawa, Gilbert Islands. Reference is made to the microfilaria rate at Nukunono in the Tokelau Group, and to some potential mosquito larval habitats, as yet unutilised, in all three Groups.

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References.

- BACKHOUSE, T. C. & HEYDON, G. A. M. (1950). Filariasis in Melanesia: observations at Rabaul relating to incidence and vectors.—*Trans. R. Soc. trop. Med. Hyg.*, **44**, pp. 291–306.
- BOHART, R. M. & INGRAM, R. L. (1946). Mosquitoes of Okinawa and islands in the central Pacific.—*NAV MED*, no. 1055, 110 pp. Washington, D.C., Bur. Med. Surg., Navy Dep.

- BRYGOO, E. R. (1953). Epidemiology of filariasis in the South Pacific.—Filar. S. Pacif. Proc. Conf. Papeete, 1951, pp. 17-47. Nouméa, S. Pacif. Comm.
- BUXTON, P. A. & HOPKINS, G. H. E. (1927). Researches in Polynesia and Melanesia . . . Parts I-IV.—Mem. Lond. Sch. Hyg. trop. Med., no. 1, 260 pp.
- DAVIS, T. R. A. (1949). Filariasis control in the Cook Islands.—N.Z. med. J., **48**, pp. 362-370.
- EDWARDS, F. W. (1924). A synopsis of the adult mosquitos of the Australasian Region.—Bull. ent. Res., **14**, pp. 351-401.
- EDWARDS, F. W. (1926). Mosquito notes. VI.—Bull. ent. Res., **17**, pp. 101-131.
- LAIRD, M. (1954). A mosquito survey in New Caledonia and the Belep Islands, with new locality records for two species of *Culex*.—Bull. ent. Res., **45**, pp. 285-293.
- MACGREGOR, G. (1937). Ethnology of Tokelau Islands.—Bull. Bishop Mus., no. 146, 183 pp.
- MARKS, E. N. (1947). Studies of Queensland mosquitos. Part I.—Pap. Dep. Biol. Univ. Qd, **2**, no. 5, 66 pp.
- MARKS, E. N. (1951). The vector of filariasis in Polynesia: a change in nomenclature.—Ann. trop. Med. Parasit., **45**, pp. 137-140.
- MURRAY, W. D. (1948). Filariasis studies in American Samoa.—Nav. med. Bull., **48**, pp. 327-341.
- O'CONNOR, F. W. (1923). Researches in the western Pacific.—Res. Mem. Lond. Sch. trop. Med., no. 4, 59 pp.
- PERRY, W. J. (1950). The mosquitoes and mosquito-borne diseases on New Caledonia, an historic account: 1885-1946.—Amer. J. trop. Med., **30**, pp. 103-114.
- STONE, A. & BOHART, R. M. (1944). Studies on mosquitoes from the Philippine Islands and Australasia (Diptera: Culicidae).—Proc. ent. Soc. Wash., **46**, pp. 205-225.
- VENNER, R. B. (1944). Filarial problem on Nanumea.—Nav. med. Bull., **43**, pp. 955-963.
- YOUNG, D. M. (1927). Gilbert and Ellice Islands Colony. Medical and Sanitary Report for the year 1925-26.—7 pp. Suva.