The Incidence and Effect of Insect Bites on Servicemen in Belize

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SUMMARY: In the climate and terrain of Belize the incidence of insect bites and the risk of secondary infection are considerable. This is demonstrated by the large number of medical first attendances, attributed to infected bites, at Medical Centres in four Army locations, Airport Camp, Holdfast, Rideau and Salamanca. A breakdown of these figures, taken from the Monthly Minor Morbidity Return (AF W3181) and treatment books, shows that for three months (November and December 1981 and January 1982), 17% of the total of 1825 first attendances were due to the effects of insect bites.

Introduction

Belize lies on the east coast of Central America between Mexico and Honduras and is bounded to the west by Guatemala. Its total area including the offshore islands (cayes) is just under 9,000 square miles, and the country measures a maximum of about 175 miles N-S and 70 miles E-W, thus being about the size of Wales.

A low coastal plain, covered mainly in mangrove swamps, runs N-S. The interior of the northern third of the country is hilly, up to 1000ft with areas of low tableland. To the south of this is the E-W valley of the Belize River, providing the main line of communication between Belize City on the coast, Belmopan, the capital, and eastern Guatemala. The central third of the country is made up of the limestone massif of the Maya and Cockscomb Mountains and Mountain Pine Ridge, rising in places to nearly 4,000 ft and running NE to SW. The southern third of the country between the mountains in the extreme W and the coast consists of a low lying forested area cut by a number of slow-moving rivers. The coastal waters are shallow for about 20 miles to the east, dotted with small islands and bounded by a coral reef second only in size to the Australian Great Barrier Reef. The climate is sub-tropical, damp and warm, and tempered by sea breezes along the coast. The temperature averages 75-80°F throughout the year. Annual rainfall ranges from 55 inches in the north to 175 inches in the south. More rain falls between June and January when it may be frequent and intense with as much as 8-10 inches in 24 hours and 100% relative humidity. In the drier months of February to May, both temperature and humidity are slightly

lower. Hurricanes may occur in the summer months.

The population of the country is nearly 150,000, increasing by about 4% annually. The main racial groups are Creoles who make up 50% of the population (for example, mulattos of mixed European and negro descent, and mestizos, of mixed Spanish Portuguese and Amerindian descent), 10% Caribs (native West Indian descent), 25% Amerindians (both Mayan and Ketchi), and 10% Europeans.

Insect Problems

The incidence of bloodsucking flies in Belize is high. Probably the most common is the very small midge *Culicoides* known locally as a 'sand fly' (Fig. 1), no more than 2mm in length but with a most irritating bite. *Culicoides* is found in most parts of the country, breeding in wet decomposing organic

Fig. 1 Biting midge, *Culicoides*

matter in such diverse environments as inland marshes, mangrove swamps and seaweed gathered on beaches. The midge bites mainly during the hours of daylight or into the evening.

In the forest areas, especially near rivers and streams the biting black fly *Simulium* (Fig. 2) is common and bites savagely during the day but not at night, prodding the skin with its short mouthparts until a small pool of blood is formed from which it feeds. This results in a tiny black scab at the site of attack. The fly is known locally as the 'Botlass fly', a name derived from the shape of its abdomen which resembles in miniature the bottle of a local brand of beer, hence 'bottle-arsed'.

Fig. 2 Black-fly, *Simulium*

In certain parts of the country the true sandfly *Phlebotomus* (Fig 3) is locally common, though it is rarely found in camp areas. It will bite at dusk and dawn and throughout the night, and may also attack during the day in places such as caves or dark jungle. Its bite is sharp and irritating.

Fig. 3 Sandfly, *Phlebotomus*

Some 40 species of mosquitoes (Fig 4) are found throughout Belize. Most will typically bite at night, but a few will also feed during the hours of daylight.

Fig. 4 Culicine and Anopheline mosquitoes

Several species of *Chrysops* (Fig 5) inflict painful bites with their scalpel-like mouthparts, giving the insect its local name of 'doctor fly'. Infestation by the larval stages of the bot-fly *Dermatobia hominis* (Fig 6) known locally as the 'beef worm', is a common cause of specific myiasis in Servicemen. Attack by several species of hard tick (Fig 7) is likely in infested vegetation.

Insect-borne diseases are common in many parts of Belize. Malaria is endemic and is transmitted by several species of *Anopheles* mosquito including the

Fig. 5 Deer Fly, *Chrysops*

Fig. 6 Egg and larval stages of *Dermatobia hominis* (Reproduced from JRAMC 113 by kind permission of the Editor)

Fig. 7 Hard Ticks, Ixodidae

daytime biting *Anopheles albimanus*. Mosquito-borne viruses, particularly dengue fever, are common, and a number of as yet unidentified arboviruses occur, probably transmitted by both Anopheline and Culicine mosquitoes and perhaps by other blood-sucking flies as well as hard ticks. Filarial worms of dubious pathogenicity are transmitted by *Culicoides*, but onchocerciasis, carried by *Simulium* in many parts of Central America, has not been reported from Belize. In the hot humid conditions of Belize, secondary infection of bites from all these arthropods is a frequent occurrence (Figs 8 and 9).

Method and Results

The incidence of insect bites among British Servicemen in Belize during November and December 1981 and January 1982 was investigated by abstracting those first attendances due to skin conditions from Army Forms W3181 (A) for Belize as a whole, and AFs W3181 for the Station Hospital at Airport Camp (Army and RAF personnel), and medical centres at Holdfast and Rideau Camp (Army, mainly British infantry personnel) and Salamanca Camp (Gurkha personnel). These figures for skin infections were then investigated in treatment books and those due to insect bites were isolated. The results are shown in Tables 1, 2 and 3 as incidence per 1000 personnel, the total number of Servicemen in Belize being 1413 in November 1981, 1439 in December and 1418 in January 1982. These figures show that insect bites and the resulting secondary infection are the largest single specific cause of morbidity in Services personnel in Belize.

Discussions and Conclusions

People respond in different ways to the effects of insect bites, the variation depending upon the type of bite and the degree of immunity of the individual.

Figs. 8 & 9 Secondarily infected mosquito bites in Belize

Table 1
Monthly rate per 1,000 personnel for November 1981

	Airport Camp	Holdfast	Rideau	Salamanca	Belize Garrison
Number reporting sick per 1000 in location	240	450	970	220	430
Cause per 1000 reporting sick					
Insect bites	116	110	202	0	145
Other skin conditions	169	110	156	75	144
Respiratory	84	36	32	570	93
Alimentary	84	51	140	25	98
Injuries	253	360	284	175	286
Other causes	294	334	188	155	234

Table II
Monthly rate per 1,000 personnel for December 1981

	Airport Camp	Holdfast	Rideau	Salamanca	Belize Garrison
Number reporting sick per 1000 in location	600	450	820	260	410
Cause per 1000 reporting sick					
Insect bites	67	115	207	0	160
Other skin conditions	307	274	195	102	198
Respiratory	53	87	32	480	92
Alimentary	94	40	109	146	84
Injuries	241	255	280	170	240
Other causes	238	229	177	102	226

Table III
Monthly rate per 1,000 personnel for January 1982

	Airport Camp	Holdfast	Rideau	Salamanca 300	Belize Garrison
Number reporting sick per 1000 in location	320	550	700		450
Cause per 1000 reporting sick					
Insect bites	79	334	281	0	205
Other skin conditions	242	155	117	200	175
Respiratory	103	107	33	254	95
Alimentary	49	11	135	72	69
Injuries	212	255	208	345	234
Other causes	311	136	223	127	220

Having inserted its mouthparts to bite, an insect typically injects a small quantity of anticoagulant saliva to prevent the blood of its victim from clotting. This saliva has antigenic components and contains pharmacologically active substances such as histamines, haemolysins, hyaluronidase and toxic polypeptides. Some biting insects may also cause significant traumatic and chemical tissue damage. This together with antibody-antigen reactions, and the effects of proteolytic enzymes and irritants in-

jected by the insect, stimulate the release of histamine and other tissue reaction mediators. This release may in turn cause local oedema, papules, vasodilation, vaso-permeability and smooth muscle contraction.

The immunology of insect bites is complex. Non-sensitised individuals bitten by insects will not respond, others may not respond because of tolerance, or may experience an immediate or delayed hypersensitivity reaction. The immediate reaction, a

rapid antibody mediated response, can present as an extreme localised cutaneous reaction or rarely as generalised anaphylaxis. Delayed hypersensitivity is a cell mediated response occurring some 48 hours after the bite and typically presents as a papule with marked pruritis, considerable erythema, oedema and induration. Hypersensitivity, perhaps due to a genetic factor, varies greatly from person to person, and may be attributed to a specific allergy, imbalance or lack of pharmacological mediators.

Analysis of Belize Results

Results indicate that in the four locations in Belize nearly one in five personnel reporting sick do so because of insect bites, with as many as one in three in the month of January at Holdfast. At Rideau nearly a fifth of all personnel reported sick due to bites in each of the three months under investigation. It is interesting to note that at Salamanca, a camp occupied at that time by Gurkhas, not one soldier reported sick because of bites during the period, and but for this the total proportion for Belize as a whole would have been considerably greater.

Personnel reporting sick with bites were invariably affected on legs and feet which often rendered them unable to wear boots, thus decreasing their usefulness even more. From these results it is very apparent that insect bites are the cause of considerable loss of manpower and efficiency, and that every step should be taken to protect Services personnel from the attack of biting insects.

Protective Measures

Personal protection from bites is afforded by correct anti-mosquito drill (long sleeves and trousers, closed neck etc at dusk and during the hours of darkness) and the use of netted windows or mosquito nets at night. Insect repellent is effective if used regularly and if all exposed parts of the skin are treated. However the Army issue repellent (DET) is a strong (75%) concentrate of the active ingredient diethyl toluamide in isopropyl alcohol, and stings if it comes into contact with mucous membranes. This is sometimes difficult to avoid in the climate of Belize where sweat runs into the eyes, nose and mouth, washing the repellent with it. Cream-based repellents are often more effective and more cosmetically acceptable, but apart from the combined sunscreen-insect repellent which is not easily available, these are not on issue. Servicemen invariably purchase proprietary brands of cream or aerosol insecticides from local stores, or simply prefer to be bitten, rather than use the crude Army issue repellent. Mosquito bed-nets impregnated with a 1% solution of permethrin deter sandflies and *Culicoides* from crawling through the mesh to bite.

It is often difficult, especially when asleep, to avoid scratching a bite, but if this can be prevented for 5-10 minutes after attack the reaction will often be minimal since the irritant saliva remains very much more localised.

More general methods of pest control can be satisfactorily adopted to reduce the number of biting flies. The most effective of these is the use of a space-spray concentrate insecticide dispensed through a swingfog in the form of an aerosol mist which has a knockdown and kill effect on any insect coming into contact with it. The fog should be applied during the flight period of the majority of biting flies, for example at dawn and dusk when sandflies, midges and most mosquitoes will be affected.

These basic and readily available preventive measures, combined with active and efficient health education, will considerably alleviate the incidence of insect bites which in Belize are the cause of a major and unnecessarily high morbidity among Servicemen.

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Fig. 10 Map of Belize