

BAT TRANSMITTED PARALYTIC RABIES IN TRINIDAD

(Concluded)

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Bat Destruction

The destruction of vampires has been a major and brave undertaking over the years, the effect of which is difficult to estimate. Vampire bats have been destroyed at the average rate of 1,350 per annum (calculated for the period 1950–May, 1959) with not the slightest indication of a fall in the population. In support of the last remark, 900 vampires have been destroyed during the period January to May of this year. In more recent times, the destruction of bats, other than vampires, has also been practised.

Over the years, scores of vampire roosts have been located throughout the island and these are visited periodically by the bat destruction groups. The intensive search for roosts which follows an outbreak invariably yields a number of new roosts. Roosts are never destroyed and the bats therein are caught or killed in a manner which will not prejudice the return of bats at a future time. The methods used are mainly shooting, with a shot that will not disintegrate the specimens, and netting. The job of the bat destruction squads is tedious, hazardous, and frustrating. A great deal of their search is conducted in rain forest areas or in abandoned cacao cultivation where one must brave mosquitoes, sandflies, snakes, heat and tropical downpours. Having located a roost, say in a hollow tree, the entrance is widened and netted to allow 2 or 3 persons to work under the net. Someone enters the trunk with a bamboo pole and flushes the bats. Down rains the dust, up comes the stench of bat excreta. More bamboo poles are lashed end to end to reach the bats which have gone further up and, if they do not escape through an unseen upper opening, they swoop past the worker in the trunk, through the exit, and into the net. With thick leather gloves the bats are snatched up and put into cages.

As the vampire not infrequently re-opens its recent bite by dislodging the scab, the poisoning of bats by applying a strychnine syrup to fresh scabs has been practised with some measure of success. From 4,288 animals painted with strychnine in 1950, 1951, and 1955, 661 poisoned bats were recovered. Malaga-Alba (12) has used poisoning effectively as a control measure in certain parts of Mexico, especially within forest areas, and has pointed out that the criterion for assessing the treatment should be based on a fall in bites as opposed to the recovery of poisoned bats, as it is probable that many bats succumb to the poison away from the host and are not recovered.

The burning of lights in stables is widely practised and is fairly effective in protecting livestock from being bitten. Bat-proofing of animal accommodation with wire mesh is also effective but in certain circumstances is attended by grave danger where the vampire, forced to secure food elsewhere, may be compelled to enter human dwellings.

The examination of vampire bats for Negri bodies and/or for the virus of

TABLE II
A SUMMARY OF BATS DESTROYED AND FOUND TO BE RABID, JANUARY, 1950 TO MAY, 1959

	Departments of Health and Agriculture						Trinidad Regional Virus Laboratory						
	Vampire bats			Bats other than vampires			Vampire bats			Bats other than vampires			
	No. destroyed	No. examined	No. rabid	No. destroyed	No. examined	No. rabid	No. examined	No. rabid	No. examined	No. rabid	No. examined	No. rabid	Estimated no. of rabid livestock
1950	1,400	550	Nil	263	—*	—	—	—	—	—	—	—	Nil
1951	1,779	877	2	Nil	—	—	—	—	—	—	—	—	74
1952	1,888	1,201	1	—	—	—	—	—	—	—	—	—	99
1953	1,153	—	—	—	—	—	—	—	—	—	—	—	42
1954	2,073	915	6	—	263	1	—	—	—	—	—	—	270
1955	1,188	798	13	—	502	3	—	—	—	—	—	—	22
1956	823	384	2	1,933	630	3	—	—	—	—	—	—	3
1957	610	146	1 pool (6 bats)	1,947	375	1 pool (2 bats)	96	568	1	1	3	3	3
1958	1,216	274† (+202 S.G.)	Nil	3,289	454 (+246 S.G.)	2	—	—	—	—	—	—	14
1959	896	468 (+3 S.G.)	1 pool (3 bats)	465	78	1 and 1 pool (3 bats)	—	—	—	—	—	—	16
Jan.-May													
Total	13,026	5,613	24 and 2 pools (9 bats)	7,997	2,302	10 and 2 pools (5 bats)	96	568	1	1	543	1	543

*Not done or result not available.

†Salivary glands.

rabies has been routine for several years. In 1954, largely at the suggestion of Dr. Malaga-Alba, W.H.O. Rabies Consultant, the scope of examination was widened to investigate the epidemiology of rabies in the Trinidad bat population. Table II presents the results of bat examination for rabies. Since 1950, 13,026 vampire bats have been destroyed and of 5,613 examined by the Departments of Health and Agriculture, 24 bats and 2 pools of a total of 9 bats have been found infected with rabies. Assuming that each pool contained a single infected bat, the incidence of rabies in vampire bats was 4.5 per 1,000 or about 60 for the total number destroyed since 1950. During the same period it is estimated that 543 head of livestock were lost through rabies, representing a ratio of 1 rabid vampire per 9 fatalities. Of 2,302 bats, other than vampires, 10 bats and 2 pools of a total of 5 bats were rabid; on the same basis the rate of infection was 4.1 per 1,000. There was no apparent correlation between the disease in vampires and in other bat species. Shown separately are the results of examinations carried out by the Trinidad Regional Virus Laboratory (21). Of 96 vampires and 568 other bats, most of which were inoculated into mice as individual brains, one isolation of rabies was made from an *Artibeus* bat. However, several isolations were made of an inclusion-producing viral agent which may be confused with rabies. The agent, which was recovered from brain and salivary gland of *Artibeus*, readily killed mice (5).

Since August of 1958, 2 foci of infection have occurred. In the Siparia area where 8 animals were lost, no rabid bats were found amongst 123 vampires and 53 other bats destroyed in the area and examined. In the Manzanilla area, where 19 animals died of rabies, 1 pool of 3 vampires was positive out of 230 *Desmodus* and 2 other bats destroyed and examined. Most of the bat collections in these 2 foci were made during or after the outbreaks. The low incidence of rabies in the bats in such areas may stem from the fact that outbreaks in livestock occur one to 5 months post infection by which time many of the rabid vampires have no doubt succumbed to the disease or have resisted infection and may no longer be harbouring the virus.

DISCUSSION

Vampire bats have been known in Trinidad for over 100 years, but it is uncertain for how long they have been infected with rabies. Although the first outbreak of paralytic rabies in Trinidad livestock is officially recorded as having occurred in 1925, de Verteuil (3), in his history of Trinidad, presents information which strongly suggests that the disease was present before that. In his section on Chiroptera he states: "The loss of blood from numerous or repeated bitings is, at times, so great, that large animals, such as oxen, become immediately enfeebled, and may die within two to three weeks; this, however, happens only at intervals of several years, when great loss in livestock is occasioned to proprietors of estates."

Trinidad is sufficiently close to the Spanish Main to make the introduction of rabies by bats on the wing a distinct possibility. The white spotted vampire *Dioemus* first came to light in 1954 after over 20 years of sustained vampire bat control and the possibility exists that it represents a recent introduction from the Mainland.

A striking feature of the outbreaks which took place in the twenties was the

abnormal behaviour of bats in the epidemic regions. Authentic accounts were given of bats attacking man, livestock, and each other during the day and in brilliant sunshine. After the mid-thirties, reports of "furious" bats ceased. Pawan (16) pointed out that such phenomena may represent a virulent disease attacking a susceptible population of bats followed in later years by the development of mild subclinical infections and natural immunes. If such be the case, then the disease was not indigenous in Trinidad or had died out for a period prior to the mid-twenties. Equally strange has been the abrupt appearance and disappearance of paralytic rabies in man, who continues to be bitten to the present time. Has the virus undergone some degree of modification in the vampire? In 1955, the Health Department reported 82 humans bitten while last year our zoologist uncovered 4 people in one family bitten 11 times in about 3 weeks. These reports are felt to represent only a portion of the humans actually bitten. Since the human fatalities in Trinidad, others caused by vampire bats have occurred in Mexico [Landa cited in (11)] and in British Guiana (14).

Although over-all, for every 9 animals killed by rabies 1 rabid vampire bat was accounted for, the ratio was particularly wide in the years where heavy losses in livestock occurred. In 1952, for example, 1 rabid vampire was found amongst 1,201 examined (about 66 per cent of the total destroyed) whereas 99 head of livestock died of rabies. Failure to disclose more rabid vampires is probably due to the increasing destruction of bats, primarily of vampires, over the entire island. The high proportion of bats which either succumb to the disease or recover, four to five weeks post infection and may no longer be harbouring the virus adds to the difficulty of detection. Serological techniques may reveal the presence of recovered virus-free bats. Results in vampires and in other species have not so far permitted the prediction of outbreaks of rabies in the livestock population, but any marked increase in bat control might serve to shed light on this aspect, particularly if accompanied by expansion of the diagnostic facilities. If a greater proportion of the livestock population can be adequately protected by vaccination the entire policy in regard to bat control will need to be reviewed. Bat control, as carried out with the means presently available, and the current rate of immunization, appear to be inadequate. In so far as the hazard to human health exists, the value of bat control appears questionable and there seems to be little to recommend it other than the false sense of security it engenders in some quarters.

The question of biological control and wholesale slaughter of the bat population requires careful consideration because of the beneficial activities of many species of bats (7).

The isolation in baby mice of an inclusion-forming viral agent from several *Artibeus* bats (5) is causing some concern to those surveying bats for rabies. The agent, which immunologically does not resemble any known virus, has been isolated from both brain and salivary gland of these bats. It readily kills adult mice. Its ability to kill mice and to produce an inclusion body has already caused the unnecessary treatment of a technical officer for exposure to rabies. It will undoubtedly result in some confusion in the identification of rabies in Chiroptera.

In the final analysis one is forced to conclude that, at present, the most promising avenue for the improved control of paralytic rabies lies in intensifying and improving the coverage derived from livestock vaccination.

SUMMARY

1. Rabies, transmitted by haematophagous (vampire) bats and characterised by paralysis, may be responsible for deaths in man, cattle and other livestock in certain parts of South and Central America and in Trinidad.

2. Vampire bats as well as *Artibeus*, a fruit-eater, may resist infection with rabies and become symptomless carriers with infected saliva; they may live in this state for several months.

3. In Trinidad, over a period of about 20 years the destruction of vampire bats does not appear to have lowered their numbers.

4. Although the over-all ratio of rabid animals to rabid vampires is 9 to 1, this figure may be grossly inaccurate, especially during years of heavy losses.

5. To date the examination of vampires and other bats for rabies has not yielded information which permits prediction of rabies outbreaks in livestock or elucidates the inter-relationship of the disease in vampires and other bats.

6. Anti-rabies vaccination remains the primary mode of control at present.

RÉSUMÉ

1. La rage transmise par les vampires hématophages et caractérisée par une paralysie peut causer la mort des humains et des animaux domestiques dans certaines parties de l'Amérique du Sud, de l'Amérique Centrale et dans l'île de la Trinité.

2. La salive des vampires et d'*Artibeus* un frugivore peut transmettre la rage; souvent l'animal ne présente aucun symptôme et ce pour une période de plusieurs mois.

3. Dans l'île de la Trinité en 20 ans, la destruction systématique des vampires ne semble pas avoir réduit leur nombre.

4. Bien que la proportion entre les animaux et les vampires atteints de rage soit de 9 à 1, ces chiffres peuvent être inexacts surtout durant les années où les pertes sont nombreuses.

5. A date, l'examen des vampires et des chauves-souris n'a pas donné d'information qui laisse prévoir une épidémie de rage chez les animaux domestiques.

6. La vaccination demeure encore le principal moyen de contrôle contre cette infection.

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THREE ATTRACTIVE LADIES. This picture taken at the New Brunswick Annual meeting is further proof to the fact that Association meetings are not for men only. *Left to right:* Mrs. Murray Mutrie, Woodstock, N.B., 3rd vice-president of the Ladies' Auxiliary to the C.V.M.A.; Mrs. Donald Butterwick, Fredericton, N. B., President of the New Brunswick Ladies' Auxiliary, and Mrs. George C. Fisher, Charlottetown, Past President of the Ladies' Auxiliary to the C.V.M.A.