

# REPORTS OF THE TWENTY-FIRST EXPEDITION OF THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE

JAMAICA, 1908-1909

SECTION I

## MEDICAL AND ECONOMIC ENTOMOLOGY

BY

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PART I

### TICKS AND OTHER BLOOD-SUCKING ARTHROPODA.

#### TICKS (*IXODOIDEA*)

One of the greatest problems which confronts the pen keepers of Jamaica is the eradication or control of those ticks which by their vast numbers have rendered nearly all the grazing districts of the Island insufferable to man and a veritable plague to his domesticated animals. For forty years or so, these pests seem to have been rapidly increasing, and to-day they swarm in incredible numbers and are a menace to the stock-raising industry of the country. The more serious nature of their presence is, however, the fact that at least one of the species is responsible for the transmission of disease from the sick to the healthy animal; and the losses already occasioned by the death of cattle from the disease transmitted by the so-called Texas-fever tick (*Margaropus annulatus australis*) justify the most energetic attempts towards the control if not the extermination of this pest, as well as those species which also cause serious loss by gross tick infestation.

The first investigation of the tick problem in Jamaica was conducted by the late Professor Williams, whose report is published

in the supplement to the Jamaica Gazette\* for October, 1896. This author claims that the disease as witnessed by him was a chronic form of 'Texan fever . . . conveyed from one animal to another through the intervention of the tick.' His recommendations for the control of the ticks will be considered later. Three different kinds of ticks are mentioned by him as affecting cattle:—(1) 'The large blue cow tick, also called the dog tick, *Ixodes ricinus*, the first known tick on this Island and not supposed to be injurious'; (2) 'the silver shield tick *Ixodes scapulatus*'; and (3) a tick 'similar to or identical with specimens of the Texan cattle tick *Ixodes bovis*.' Subsequent researches have shown that *Ixodes ricinus* does not occur in any of the West Indian Islands or in South America, so that it must have been a case of mistaken identity on the part of Professor Williams, and this species has therefore been eliminated from the list of Jamaican ticks. *Ixodes scapulatus* is synonymous with *Amblyomma cajanense* and *Ixodes bovis* = *Margaropus annulatus* var. *australis*.

During the years 1896-7 an endeavour was made by the Institute of Jamaica to secure a large and representative collection of ticks from all parts of the Island, with the view of obtaining the specific identifications, in the hope that such might throw some light upon the fever from which the cattle were then suffering. Many contributions were received at the Museum from various pen keepers, and the whole collection was subsequently forwarded to Professor G. Neumann, Ecole National Vétérinaire de Toulouse. About three years later a list of the ticks of Professor Neumann's identification appeared in the local press, together with the names of the hosts from which they were collected. The species therein recorded are:—(1) *Rhipicephalus annulatus* var. *microplus* from cattle. (This is evidently synonymous with var. *australis*). (2) *Rhipicephalus sanguineus* (from horses and cattle). (3) *Dermacentor nitens* (from horses and mules). (4) *Amblyomma cajanense* (from the horse). (5) *Amblyomma* (?) *coriaceum* (one engorged female only found on grass); this is a doubtful record and should be eliminated from the list of Jamaican species (6) *Argas americanus* (= *persicus*), from the domestic fowl. With the exception of the Argas, all the rest were

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\* N. S. Vol. XIX, No. 9, pp. 205-220.

found during the recent expedition, and besides these, three additional species were discovered, viz. :—*Amblyomma maculatum*, *A. dissimile* and *Aponomma* sp. Neumann in recent years has given a doubtful record of *Rhipicephalus bursa americana*, so that the total number of known species recorded from Jamaica is ten.

Some observations on the relative abundance of these ticks will be found under the respective species which are recorded in this memoir. But it may be well to state here that the most abundant kind is the Texas-fever tick (*M. annulatus australis*), and next to this in point of numbers is the silver tick (*Amblyomma cajanense*). The former is essentially a cattle tick, though it infests other animals also; while the latter is a more general feeder and although less abundant, is one of the greatest curses to the Island, owing to the fact that it occurs in all its stages among the grass and pastures, almost everywhere attacking man and beast with impunity. The almost total immunity of the Mysore cattle from the attacks of ticks of all kinds was most marked; this was particularly the case at Shettlewood and other places, where this breed of cattle was used for draft purposes. Crosses between the Mysore and other breeds were also much less subject to the attacks of these pests; while Shorthorns, Devons, Herefords, and Creoles suffered most. Indeed ticks show a decided preference for all cattle which have little or no Indian or Spanish strain in their blood; they have apparently a great dislike to animals with short fine hair; hence, probably, the immunity of the Indian and Spanish races.

It is claimed also that ticks show a decided preference for animals in bad or poor condition; and that a small percentage of animals of all breeds are much more susceptible to ticks than others of the same herd living under precisely the same conditions. Freshly imported European breeds suffer terribly, due, as one correspondent puts it, to the 'want of proper care and attention which their better breeding requires; consequently these animals are seldom in really good health, and so gradually become a special prey of ticks.' Horses with long heavy manes and excessively hairy fetlocks are particularly troubled by ticks, but there are instances recorded 'where there are now and always have been horses which never under any circumstances have ticks' (Clarendon district). Mules are particularly free, though, like horses, they are subject to the tropical horse tick (*Dermacentor*

*nitens*). Goats may be said to be practically immune; but pigs are much subject to them, and more especially are the ears of this animal infested by the 'grass lice' or larvae. Dogs also suffer, chiefly from the bites of *Rhipicephalus sanguineus*, though other kinds infest them.

### SEASONAL PREVALENCE OF TICKS

During the writer's stay in the Island, from the end of November till the end of January, ticks of nearly all kinds were found breeding in profusion; and the commoner species were seen in all stages, including eggs, larvae ('grass lice'), nymphs and adults. The information supplied by the planters points very clearly to the fact that the season in which ticks are most prevalent is during the dry winter months, and that relatively few ticks are found during the rainy season. There is some indication, however, that the seasons may vary in certain parts of the Island, more especially so in the parish of St. Mary and Portland. It may be interesting, if not important from an economic point of view, therefore, to give a tabular statement of the returns which were made in regard to this question:—

PARISH	SEASON DURING WHICH TICKS ARE SAID TO BE MOST ABUNDANT	
	GRASS LICE OR LARVAE	STAGES NOT STATED
St. Ann ... ..	November-April	August-April
St. Andrew ... ..	Dry season	November-April
Clarendon ... ..	Not stated	November-April
St. Catherine ... ..	Dry season	November-May
St. Elizabeth ... ..	Dry season	December-May
St. James ... ..	Dry season	January and February
Manchester ... ..	Not stated	November-April
St. Mary ... ..	Dry season	March-September or during spring and hot weather
Portland ... ..	Not stated	April and May or 'early part of year'
St. Thomas ... ..	Not stated	'Spring months'
Trelawney ... ..	Not stated	August-April
Westmoreland ... ..	Dry season	Dry season

### EFFECT OF RAIN OR WATER ON TICKS AND THEIR EGGS

No experiments were made to determine the effect of submerging the eggs of ticks in water. But Hunter and Hooker,\* in their valuable

\* Bull. No. 72, U.S. Dept. Agr. Bur. of Ent., 1907, p. 22.

Report on the North American Fever-tick, have shown that eggs which were submerged for a period of from ten to twenty-four days nearly all hatched; and that 33 per cent. hatched after being submerged for twenty-five days. These experiments were conducted in order to ascertain what effect the flooding of pastures would have on 'the viability of ticks' eggs on the ground.' These authors also proved that grass lice have a remarkable resistance to water; and that 'flooding under some conditions, as, for instance, during a drought, might hasten incubation.'

That there is a diminution of ticks in Jamaica during the rainy season has already been pointed out; but it is clearly evident that this is not brought about altogether by excessive rains. In the light of our present knowledge of the habits of the Jamaican species, one can only conclude that the dry season is more suitable for the development of the ticks than other times.

#### DISSEMINATION OF CATTLE TICKS BY VARIOUS AGENCIES

The dispersal of ticks has been brought about almost entirely by the hosts to which the various species are peculiar; and the importation of infested cattle into various countries has been the sole means, practically, by which these pests have been disseminated over the larger portions of the tropical and sub-tropical parts of the world. Man alone is entirely responsible for this; and it is only during recent years that any steps have been taken to enforce quarantine or to control in any way the movement of live stock on their introduction into a new country. The question of rendering a tick-infested country free from these animals is an all-important one; and even if this were accomplished on a relatively small scale it remains to be seen how best such an area can be protected from re-invasion, as there are certain agencies by which this could be brought about in a small way other than by the careless introduction of tick-infested cattle. A small proportion may be wind borne, though it is doubtful if such an agency would carry 'grass lice' to any great distance from an infested area. Hosts unsuitable to the development of the Texas fever tick, such as dogs, horses, pigs, goats, or other domesticated animals, or even man, could bring this about in a small degree, so that the greatest possible care must be exercised in dealing with this problem. It has been assumed that the 'Bull Frog' (*Bufo marinus*)

may also be the means of disseminating cattle ticks. This supposition cannot, however, hold good, as the writer found no evidence in support of this theory. Not a single tick was found on this animal with the exception of the species (*Amblyomma dissimile*), which is peculiar to this Batrachian. Moreover, these animals do not wander far afield, so that it is positively certain that they are not and cannot have been responsible, in any degree, for the dissemination of cattle ticks. The mongoose has also been accused of carrying ticks from one district to another, and there may be some truth in this statement; but further proof is necessary, all the more so, seeing that this animal seems to be remarkably free from tick infestation. However, such an animal might easily carry a colony of 'grass lice,' in its coat of long hair, to a very great distance before the parasites relinquished their hold. It seems to the writer, however, that he is rather begging the question in discussing these apparently trivial points in regard to both the Bull-frog and the Mongoose. But these were matters to which his attention was frequently called during his stay in the Island; and the best interpretation, in the light of our present knowledge, has been given.

#### THE PREVAILING CONDITIONS UNDER WHICH PASTURES ARE EITHER MOST FREE OR MOST INFESTED WITH TICKS

One of the questions put to the Pen Keepers was: 'Have you made any observations as to the conditions under which pastures are (a) most free of ticks, (b) most infested with ticks?' There were twenty-six replies, of which a tabulated résumé is here appended:—

(a) MOST FREE FROM TICKS	(b) MOST INFESTED WITH TICKS
10. Pastures free from weeds and bush	5. Guinea grass and dirty pastures
1. Poor land and poor feeding	1. Guinea grass
1. Common grass	1. Rich glades with high guinea grass
1. Scarcity of green grass	1. An abundance of dry grass
1. Guinea grass not fed by stock	1. Heavily shaded and foul
1. Pastures under constant feeding	1. Pastures in which cattle are kept from January to May
1. Pastures in which cattle are kept from June to December	1. Periodically fed guinea grass
1. When stock are absent	1. Bushy and hard fed pastures
	1. Clumps of bamboos with trash beneath them
	1. Accumulations of trash in cool shady places

Judging by these statements it is clearly evident that ticks are most prevalent in dirty pastures with weeds, scrub and trash about them. On the other hand, there is abundant evidence that clean pastures are freer from these pests. We must not lose sight of the fact, however, that 'grass lice,' in particular, will always be less evident on clean ground than on weedy or scrubby ground, as under the former conditions they have less opportunity of clinging to the garments of any person who may pass over infested areas. With tall grass and scrub it is different, because the 'grass lice' climb to the higher stems and leaves, and in this way more readily attach themselves to man and thus render themselves more conspicuous.

Shade and a certain amount of moisture appear, however, to be highly essential to the development of cattle ticks, and as such conditions obtain to a greater extent in dirty pastures and among tall guinea grass, there can be little doubt that more 'grass lice' will hatch, and possibly survive for longer periods, under such conditions than in a clean open pasture exposed to the full blaze of a tropical sun.

#### LONGEVITY OF TICKS WITHOUT ACCESS TO A HOST

That various ticks are capable of fasting for very long periods has been proved repeatedly by many investigators in different parts of the world. In Jamaica, however, nothing has been done in regard to this subject, and it remains to be seen how long the two more abundant species may survive without access to a host. This is a most important matter, as it materially affects the methods of control when dealing with tick-infested land. For the Texas fever tick (*M. annulatus australis*) it is essential only to test the duration of life in the larva. The silver tick (*Amblyomma cajanense*), on the other hand, presents a more difficult problem, as the duration of life without access to a host must be determined in all three of its stages—larva, nymph and adult.

The American authors, Hunter and Hooker,\* proved experimentally that the North American fever tick (*Margaropus annulatus*), the typical form of the variety found in Jamaica, can survive, in its larval stage, without a host for a period varying from 49 to 159 days; and we shall probably find that the Jamaican

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\* *Loc. cit.*, p. 25.

variety is capable of surviving for a similar period. Assuming this to be the case, and we add to these data, the period from the time the female drops from the host to the hatching of the larvae or 'grass lice,' we find that the non-parasitic period may range from 93 to 200 days, approximately, so that these data give us important information on the question of tick eradication, in so far, at least, as the Texas fever tick is concerned. But we have little to guide us in regard to the other Jamaican species (*A. cajanense*), though we have ascertained the facts regarding the incubation period of the eggs and other matters relating to the earlier stages of this pest.

Many interesting details could be given here in relation to the longevity of various kinds of ticks found in other parts of the world, but such facts could have no practical bearing on the subjects under consideration.

One authority claims that 'young ticks or "*grass lice*" *suck the juice from the young blades of grass* and grow and thrive upon it until a better host comes along'; further that the 'young and tender shoots of the springing that follows burning affords an irresistible temptation to young ticks . . . so much so that they can be seen in millions going from adjoining pastures to a newly burnt one.' It is a commonly accepted theory among peasantry also that ticks can live and multiply without an animal host, becoming blood suckers when occasion serves, and though it may appear, in some cases, as if this were founded on fact, the inference is wrong. There is no evidence that ticks of any kind, can survive or mature on a vegetable diet.

#### LIFE CYCLE OF TICKS

Some details concerning the life histories of the Jamaican ticks are given in this Report (pp. 434-446), which, so far as they go, form a basis for economic procedure in dealing with tick-infested pastures.

All ticks undergo a metamorphosis which consists of the following stages:—1, the egg; 2, the larva or 'grass louse' stage; 3, the nymph; and 4, the sexually mature stage.

*Eggs.* These are laid upon the ground in masses, apparently in sheltered spots. At first they are pale brownish-yellow, but eventually change to translucent brown, resembling the colour



of common commercial glue. As incubation advances, a small whitish spot appears beneath the cuticle, evidently formed by the excreta of the embryo. The incubation period varies in the different species, and temperature has evidently a marked effect upon the development of the embryo. These produce:—

*Larvae*, 'grass lice' or 'seed ticks.' All larvae are six-legged; and the sexes are not distinguishable. On hatching from the egg they crawl up the stems of grasses and other plants, usually to the topmost leaf or stem, congregating together, sometimes in enormous numbers. The 'clusters' or 'nests' are as a rule the progeny of one parent. They remain in such situations for a host; meanwhile no kind of food is taken as a substitute for blood; and they are capable of fasting for very long periods, though it is highly probable that nature provides them with a store of food which may tide them over the first few weeks. When a host is secured they take a meal of blood, filling and distending their bodies considerably. The first moult takes place afterwards, and the eight-legged or nymphal stage is reached.

*Nymph* (Pl. XIII, figs. 1, 2). In this stage also there is no sexual distinction. The animal has now increased in size, though it may be, and often is, smaller than a fully engorged larva. Again the tick fills itself to repletion, the body becoming greatly distended during the process. Shortly after feeding, the nymphal skin is cast and the sexually mature stage is reached.

*Adult Tick* (Pl. XIII, figs. 1, 2). The sexually mature male and female are often identical in size immediately after the change from nymph to adult, and females of small size may frequently be found *in coitu* (*Margaropus annulatus australis*). Little change takes place in the male after feeding; but the female in filling her body to repletion becomes enormously distended, increasing in size from thirty to forty diameters. She falls from the host when fully engorged, and after the lapse of a few days begins to lay her eggs. This process is continued over several days; and in the end the female dies, leaving her body attached to the little mass of eggs. This is briefly the metamorphosis of the cattle ticks, and the cycle is practically the same in all other known species of this division of the Ixodoidea. In habits, however, they vary considerably: some species require but one host, such, for instance, as the cattle tick of Jamaica

(*Margaropus annulatus australis*); others have two hosts; and, like the silver tick (*Amblyomma cajanense*), others again require three hosts. With the first named, all the meals and both moults are effected on the same animal. The second kind moults on the first host as a larva, and leaves the host as a fully engorged nymph, moults for the second time on the ground, and when sexually mature seeks another host. The last named undergoes both moults upon the ground; the first as a larva, the second as a nymph, so that in this way three different hosts are required. With such ticks as these, there are three non-parasitic periods, and for this reason the complete life-cycle must often be greatly prolonged in the absence of a host, and the probabilities are that large numbers perish for the want of food. With the fowl tick (*Argas persicus*) the parasitic periods, with the exception of that of the larva, are all of short duration, and the female may live for a very long period producing many batches of eggs at irregular intervals.

#### STRUCTURAL CHARACTERS OF TICKS

These animals are divided into two families: 1, the Argasidae; 2, the Ixodidae. There are representatives of both groups in Jamaica, though the prevailing forms belong to the second division. It is not intended to enter fully into the structural details, but to point out some of their more salient characteristics.

*Argasidae.* Distinguished chiefly by the absence of a scutum or shield on the upper surface of the body. The fowl tick (*Argas persicus*) is the only representative of this group hitherto found in Jamaica.

*Ixodidae.* All the members of this family are provided with a shield or scutum (fig. 1) and the mouth parts (capitulum, figs. 1, 2) project in front of the body. The males differ from the females in having nearly the whole of the upper parts of the body covered with a shield; in the females this is not so; in some species the shield is extremely small, especially so in the genus *Margaropus*, in which it is scarcely visible in the engorged female. With the exception of *Argas persicus* all the other known species found in Jamaica belong to this group. The structural details of one of the members of this family (*Amblyomma cajanense*) are shown in the accompanying

figures (1 and 2), but these can be seen only by the aid of a microscope. The various phases in the development of the Texas fever tick and the silver tick are illustrated on the accompanying Plate XIII, figs. 1, 2.

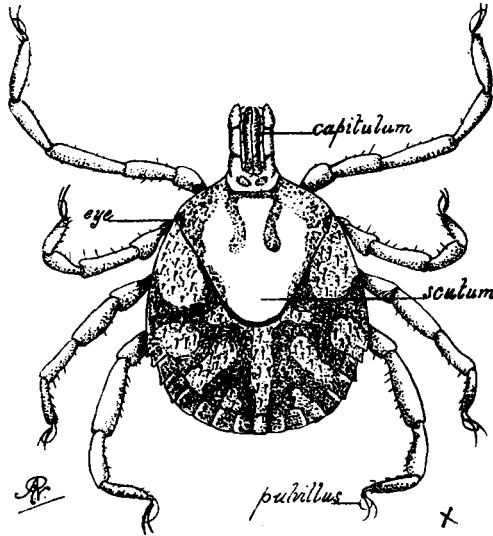


FIG 1. Silver Tick (*Amblyomma cajanense*). Unfed female. Enlarged ten diameters, about.

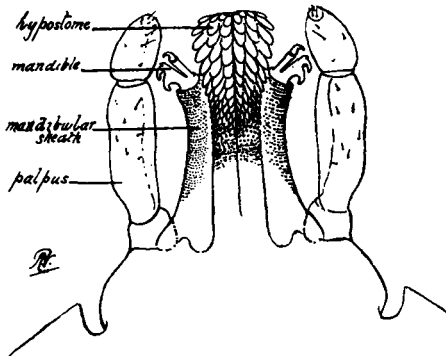


FIG. 2. Mouth parts (capitulum) of Silver Tick (*Amblyomma cajanense*). Ventral aspect. Greatly enlarged.

#### ARTIFICIAL KEY TO THE JAMAICA TICKS

The subjoined key to the ticks found in Jamaica is decidedly artificial in its arrangement. It has been devised as a ready means of assisting in the identification of ticks without recourse to a micro-

scope, though a pocket lens will be needed in order to determine the sculpturing of the integument and those other characters which are embodied in the synopsis. It has not been possible to devise a key for the identification of the various stages in the development of the young adult females, as these vary so greatly in size and shape that it would be impossible to do so with any degree of accuracy or without entering into minute microscopical characters which for the most part are visible only after careful and somewhat tedious preparation. The exact determination of the closely allied species of *Rhipicephalus* cannot, however, be made without a very careful study of the minute anatomical characters by an expert.

KEY TO THE NINE SPECIES OF TICKS FOUND IN JAMAICA.

- A. Scutum or shield absent. Sexes similar. Distension after feeding slight in both sexes.
1. Colour chocolate brown; body flat; skin with numerous oval and round discs - - *Argas persicus* (p. 434).
- B. Scutum present. Sexes dissimilar. Distension after feeding great in female, very slight in male.

MALE

*Upper surface yellowish brown, reddish brown or pitchy brown.*

2. Mouth parts angulate at sides; ventral surface behind the anus without a median furrow - -  
*Margaropus annulatus australis* (p. 435).
3. Mouth parts similar to 2; ventral surface behind anus with a well-defined median furrow; scutum covered with fine but well separated punctations - -  
*Rhipicephalus bursa*.
4. Mouth parts similar to 2; ventral furrow as in 3, scutum with large and small punctations distributed regularly over the whole surface - -  
*Rhipicephalus sanguineus* (p. 437).
5. Mouth parts *not angulate* at sides; scutum pitchy black, with a median row of punctations on posterior half -  
*Dermacentor nitens* (p. 439).

*Upper surface variegated.*

6. Dark rich red-brown markings on a paler ground forming a mask-like pattern - *Amblyomma maculatum* (p. 443).
7. Pale brownish yellow with silvery white markings - -  
*Amblyomma cajanense* (p. 440).
8. Yellowish with yellow-brown spots and radiating lines -  
*Amblyomma dissimile* (p. 445).

## REPLETE OR ENGORGED FEMALE

- B. I. *Scutum very small, uniformly red-brown; body greenish or leaden-grey.*
  1. Mouth parts angulate; body slightly glossy; pale to dark olive green, sometimes yellowish - -  
*Margaropus annulatus* var. *australis* (p. 435).
  2. Similar to 1. Scutum covered with fine but distinct punctations - - - *Rhipicephalus bursa*.
  3. Mouth parts and colour similar to 1. Scutum distinctly emarginate in front. with large and small punctations. Generally smaller than 1 - - -  
*Rhipicephalus sanguineus* (p. 437).
- B. II. *Scutum uniformly black-brown or pitchy; body uniformly dull yellow or drab yellow.*
  4. Integument of body with minute obscure spots - -  
*Dermacentor nitens* (p. 439).
- B. III. *Scutum with large coppery spot at apex.*
  5. Colour of body similar to 4. Spots on integument generally visible to naked eye - - -  
*Amblyomma dissimile* (p. 445).
- B. IV. *Scutum variegated.*
  6. Scutum with silvery grey markings; colour of body resembling 1, but with distinct though somewhat suffused purple-brown reticulations - -  
*Amblyomma cajanense* (p. 440).
  7. Scutum with dark red net-like pattern; body leaden grey.  
*Amblyomma maculatum* (p. 443).
  8. Adult *Aponomma* sp. Not discovered (p. 447.)

All these show conspicuous bright yellow markings after leaving the host and during the period of egg laying.

**CHICKEN-FEVER TICK***Argas persicus* (Oken).

The larval stages of this Argasid were found 'adhering to the skin of the common fowl' at Kingston, by Dr. J. W. Plaxton, in or about the year 1896. These examples were identified by Neumann, and subsequently recorded in the local press, as then forming part of the local collection in the Museum of the Institute of Jamaica (No. 4,165). A thorough search for this tick was made in several localities without discovering any trace of it—neither were specimens received from any part of the country, though one frequently heard of a 'fowl-tick,' but whether it was of this kind or one of the common cattle ticks of the country is not clear; but seeing that it has already been recorded, the probabilities are that it will be found in many localities, though it may prove to be somewhat local in its distribution.

The bites of this tick are dangerous, and are said to cause prolonged sickness in man in Persia. It is also the cause of *Spirochaetosis* in fowls, acting as the intermediary host of *Spirochaeta marchouxi*, Nuttall. Like the other members of the sub-family to which it is related, it is not a permanent parasite, though it remains on the host for a few days when in its larval or young stage, in which it is generally known as a 'seed tick.' It is strictly nocturnal in its habits, and after casting its larval skin feeds only at night, leaving the host immediately after taking a meal of blood, seeking shelter in any hole or crevice in the fowl-roost into which it can wedge itself. In these respects therefore it very closely resembles the common bed-bug (*Cimex lectularius*). Unlike the cattle ticks, the female does not die after laying her first batch of eggs, but often survives for long periods, taking frequent meals of blood when the host is available, and laying eggs at irregular intervals throughout life. They can be reared in this country (England) if placed in a suitable temperature; but great numbers die off in the dry atmosphere of the incubator.

Hunter and Hooker\* give a great many interesting details regarding the life-history and habits of this species. Full tables are given by these authors on the oviposition as observed at Dallas in Texas, and the figures given show that the number of eggs laid by

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\* *Ibid.*, pp. 45-46.

the females after the first engorgement varied from 32 to 247; after the second engorgement 55 to 199, and after the third engorgement 32 to 454. The incubation period varied from fourteen to sixteen days. Lounsbury\* has given a very full account of the life-cycle and habits of this tick, which should be read by all who are interested in this subject.

#### TEXAS-FEVER TICK

*Margaropus annulatus*, var. *australis*† (Fuller).

*Male.* Dorsum bright red-brown to castaneous or chestnut brown, with more or less regular, branched, black markings. Legs pale yellowish-brown. Venter, in the space between the legs, brown to pale brown or almost colourless. Ventral shields and caudal process, bright chestnut brown. Length 2·25 mm.

*Unengorged female (i.e. at period of fecundation).* Dorsum with three well-defined grooves; pale ochreous brown clouded with smoky brown. Scutum bright chestnut brown; eyes darker, tinged with dull crimson. Legs ochreous brown to red-brown. Ventral surface pale leaden grey with irregular pale ochreous blotches or markings. Length 2·50 to 3 mm.

*Engorged female, immediately after removal from host.* Dull olivaceous to leaden grey, sometimes with a faint greenish-yellow tinge; yellowish markings not nearly as pronounced as in females at the period of parturition, being almost obscure in some individuals. Ventral surface, paler, especially so on the anterior half, which is usually of a leaden grey colour. Small area surrounding the anus, whitish. Length 10 to 11 mm.

*Engorged female, four days after removal from host.* Body, slightly glossy; pale to dark olive green, often with distinct yellow markings; scutum small, dark red-brown to chestnut brown; legs very pale brown, faintly yellowish beneath towards the tips.

*Habits.* This tick requires but one host during its developmental cycle; though, as in the case of all other known ticks, the female lays her eggs upon the ground and the larvae or 'grass lice' which they give rise to, crawl up the stems and leaves of various plants, &c., congregating together precisely in the same way that other larval

\* Agric. Journ., Cape of Good Hope, Vol. XXIII. No. 3, pp. 261-273. (Illustrated.)

† Professor G. Neumann has kindly confirmed the Author's identification of this species.

ticks do, and in such elevated positions await some passing host. When once the larva has secured a host, it feeds, and after repletion casts its skin and becomes a nymph. In this latter stage it takes another meal of blood, afterwards casting its skin, and this brings it to the sexually mature stage. So that all its meals and both its moults are effected on one host. Pairing also takes place on the host; and in a very large percentage of cases the male takes up a position close to the nymphal female, considerably in advance of the time when the latter undergoes her last moult and becomes sexually mature. This habit seems to be quite general, though almost any number of adult couples may also occur on the same host. As in the case of the 'silver tick' (*Amblyomma cajanense*), no observations were made as to the parasitic period. But it was found that egg laying takes place in from seven to fourteen days after the replete female is removed from the host, and that the larvae or grass lice begin to hatch on the thirty-fifth day and continue to do so till the forty-second day. So that the length of the non-parasitic stage may be given as fifty-six days during the dry season. The number of eggs laid by the female varies from 1,000 to 2,000 approximately.

It is by far the most abundant tick in the Island; and from 90 to 95 per cent. of the species found on cattle were of this kind.

*Hosts.* The ox is the principal host of this tick, both in Jamaica and elsewhere outside the Island. In three instances, mature examples of both sexes were found on the dog, associated with *Rhipicephalus sanguineus*; several adults and nymphs were also found on the horse, but the females from this host were much smaller than those taken either from cattle or dogs. It is generally believed that the larval or 'grass lice' stage will attack any vertebrate animal that comes in its way. It is in this stage that it is such a great pest to man.

*Distribution.* Occurs everywhere in the grazing district throughout the Island. Specimens were obtained in all the parishes; the only locality from which specimens were not received, was Water Valley, a banana property in the Parish of St. Mary, though it was swarming elsewhere in the district a few miles away. So far as one could ascertain it did not occur at a greater altitude than 2,000 to 3,000 feet, but this requires confirmation.



*Distribution outside the Island of Jamaica.* Australia, South America, and several of the West Indian Islands. Very closely allied forms occur also in South Africa and Japan.

### LARGE RED TICK

*Rhipicephalus sanguineus*,\* Latr.

*Unengorged female.* Dark red-brown; scutum of the same colour with dark red-black or pitchy markings, especially towards the margins. Length 4 to 5 mm.

*Engorged or replete female.* Resembling very closely small specimens of the Texas-fever tick (*B. annulatus australis*). Length 5.50 to 6 mm.

*Male.* Dark red-brown; scutum of the same colour, with intense black or pitchy markings visible under a pocket lens. Length 2 to 3 mm.

*Habits.* The life-cycle of this species has not apparently been studied, but the probabilities are that both moults are passed off the host, so that in this respect it would resemble the silver tick (*A. cajanense*) in its habits. Structurally the members of this genus closely resemble the Texas fever tick (*Margaropus annulatus*), and it is comparatively recently that they have been separated from *Margaropus*. Miss C. Nuttall, Stony Hill, St. Andrew, who kindly forwarded a number of specimens which were taken from her mastiffs, says that 'these ticks are a source of serious annoyance, as they necessitate the grooming of the dogs twice daily. The small flat brown ones attach themselves between the toes, and are generally found in clusters of three or four. Their bite does not seem to cause the dogs much pain, nor do they trouble us and I have never been bitten by them. The grey specimens (nymphs) get into the hair of the dogs and bite chiefly about the neck. They fall off when fed to repletion, but the result to the dog is a lump about the size of a grain of barley with a blood scab at the top, and quite denuded of hair. You may imagine the misery to the dog when it has chanced into a nest of twenty or thirty of this variety, and the appearance of the animal is that of a badly "surfeited" horse. It is some weeks before the hair grows again. The dogs do not appear to have fever, but are

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\* Determined by Professor G. Neumann, to whom the Author extends sincere thanks.

off condition for some days after being bitten. These ticks crawl about and lay their eggs anywhere, if the dogs are not kept well groomed. We have no cattle, and our pigs and fowls and mules and horses do not seem to get bitten.

'I have tried every kind of wash for the mastiffs that could be used on house dogs, and the water for their rubbing down every morning has a small quantity of kerosene oil in it, but this does not seem deterrent.

'A run of land adjoining ours is simply infested with ticks, grass lice chiefly, and to my almost certain knowledge the cattle belonging to the property have not been allowed into that particular place for over eighteen months—the spot being now a complete rinate: not even goats wander there. . . . Between us and the aforesaid land is a stone wall, but the ticks are in our pasture, which for years has not carried stock of any kind.'

*Hosts.* This tick does not seem at all particular in its choice of hosts; many and widely separated groups of the Vertebrata being attacked. It is common on the ox and dog, and was found also on the horse (at Vale Royal); but outside Jamaica other animals seem equally suitable, as the appended list will show:—Cat, fox and other canines, hare, dromedary, camel, sheep, goat, birds, and also one or two species of the Reptilia.

*Distribution.* In addition to the records from Stony Hill, this species was also found at Albany, from whence twenty-seven adults (mostly males) and eight nymphs were collected from cattle, and one from the horse; both kinds of animals were also infested with silver ticks (*A. cajanense*). It will in all probability be found in other parts of the Island; but as it bears a striking resemblance to the Texas-fever tick it may be easily overlooked. Neumann has previously recorded it (1897) as occurring on the horse and on cattle at Hopewell, Highgate, S. Mary.

*Distribution outside the Island of Jamaica.* In Europe it has been recorded from France, Austria and Italy. It is widely distributed over the whole of the African continent—Algeria, Tunis, Egypt, Abyssinia, Zanzibar, Cape Colony, Congo Free State, Cameroons, Togoland, &c. It has been found also in Madagascar; Persia, India and China in Asia; Antigua and Colombia in America; and also from Queensland in Australia; so that it occurs in all the four continents.

## TROPICAL HORSE TICK

*Dermacentor nitens*, Neum.

*Unengorged female.* Slightly larger than the male. Dark red-brown or orange brown. Scutum or shield, reddish yellow with irregular blackish markings. Length 3 mm.

*Engorged or replete female.* Uniformly dull yellow or yellowish drab. The integument as seen under a lens uniformly covered with minute black specks, rather widely separated. Ventral surface bluish, paler anteriorly. Scutum or shield, mouth parts and legs dark red-brown. Dorsal half of body, with three more or less well defined and equidistant grooves, two of which have origin at the lateral margins of the scutum; besides these there are sometimes present other short and well-defined grooves, but these are more or less irregular. Length 10 to 12 mm.

*Male.* To the unaided eye appears of a uniform dark red-brown (piceous). Scutum, shining dark red-brown to red-brown, with irregular, and somewhat inconstant, intense, broad, black markings forming a coarse reticulation which almost obscures the paler ground colour. Legs red-brown. Length 2.50 to 3 mm.

*Nymph.* Uniformly pale ochreous with dusky suffused markings. Length 1 mm.

*Distribution.* Found somewhat sparingly at Kew Park, Westmoreland; Friendship and Pepper, St. Elizabeth; Kendal and Quebec Park, St. Mary; Stony Hill and Constant Spring, St. Andrew; Great Valley, Manchester; and Halberstadt, St. Andrew. It has been previously recorded also from several other localities, so that it is fairly widely distributed over the Island, though not an abundant species anywhere.

*Distribution outside the Island of Jamaica.* It is rare apparently in the United States; but is common on horses at San Domingo; and Neumann records it from Guatemala, Venezuela, and Porto Rico and Hayti.

*Habits.* Little or nothing apparently is known of the bionomics of this common and widely distributed species.

*Hosts.* Almost exclusively confined to horses and mules, chiefly the former. It usually occurs in little colonies inside the ears, though

it is found also in other natural cavities of these animals. Colonies of this tick were found altogether on eighteen horses; and two or three isolated examples occurred also on the ox and dog.

### SILVER TICK

*Amblyomma cajanense* (Fab.).

*Engorged or replete female.* Surface of skin not highly polished. Dull bluish grey, with dark purplish brown reticulations. The ground colour appearing as pale round spots on the lower half of the body where the brown colour predominates; excretory system showing through the cuticle as pale dull yellow markings; but there is usually a more or less well-defined patch of yellow, often somewhat rectangular in form just behind the scutum from which the branched markings diverge. Ventral surface pale bluish grey with irregular whitish markings. Mouth parts (*capitulum*) pale brown, usually with two minute dark spots at the posterior lateral angles. Scutum, faintly metallic, with two dark brown submedian curved lines; lateral margin, dark brown behind the eyes, terminating before the apex, the latter pale golden-yellow. Eyes pale, almost colourless. Legs pale brown; segmentation paler, appearing as very faint rings. Length 10 to 12·25 mm.

*Unengorged female.* Similar in size to the male but is easily recognised by the small shield (scutum) on the back. It is also less brilliantly coloured than the male; and the marginal festoons are either entirely absent or scarcely visible to the unaided eye. Length 5 to 6 mm.

*Male.* Pale dull yellow or brownish yellow, with irregular silvery white markings or streaks and brown or red-brown spots, forming a definite but complex pattern which gives the dorsal surface (scutum) a somewhat reticulated appearance, though when seen under a lens the spots and streaks do not coalesce. Length 4 mm.

*Habits.* As already stated this tick requires three hosts during its developmental cycle. The first host in its larval or 'grass louse' stage, the second in its nymphal or second stage, and the third and last host in its adult stages. The replete or fully engorged female (Pl. XIII, fig. 1) lays her eggs on the ground; these produce larvae or 'grass lice,' which congregate together at the tips of grass and leaves, or

the flowering stems or leaves of any other kind of plant or other suitable object, usually something which stands out prominently above the denser vegetation. One enormous colony of 'grass lice' was found clustered together on the flowering stem of a plant locally known as the 'devil's riding whip.' In cattle pens where there is little vegetation they congregate on the exposed roots of trees or swarm up the tree trunks and fix themselves upon any little prominence they may find. Sometimes, also, they occur on stone walls or on angular fragments of rock, or even dead leaves and bits of sticks lying upon the ground. In such situations they await a passing host. When once the young tick has secured a host, it fills itself to repletion, afterwards leaving the host and undergoing the first moult on the ground, becoming a nymph or 'Redback.' In this stage it seeks a second host, usually from the top of some prominent grass stem or other plant, and after taking a meal of blood falls to the ground, moults, and becomes sexually mature. The males and females ascend the taller plants and for the third time seek a host. Both sexes take a meal of blood, and the female after repletion falls from the host, lays her eggs and dies. What eventually becomes of the male is not known. Neither was it ascertained if coition takes place on the host as in other allied species of *Amblyomma*. The females invariably preponderated, and, although enormous numbers of males were seen, in no instances were they found in coitu. The male is extremely active throughout life—mealtime excepted—and so also is the female while seeking a host, but after feeding to repletion, like all her congeners, becomes an almost helpless creature and is capable only of moving her body very slowly.

Little can be said with regard to the period occupied by this tick in the duration of its life cycle. The females are most prolific; the number of eggs laid by the female, according to Williams (*loc. cit.*), is 2,000, but Mr. Wortley makes the figures 7,240, and these may be taken as nearer the average than those of Professor Williams. Egg laying occupies from seven to ten days; and the period of incubation, in an average temperature of 75° F., varied from forty-three to fifty days. The eggs were kept in the shade, and whether the more or less direct rays of the sun would hasten the hatching of the larvae was not ascertained. Beyond this stage nothing can be said at present; neither is it known for how long this tick can survive

in each of the three stages without access to a host. On man the larva fills its body to repletion in from two to four days. At this stage it looks very like a No. 10 gunshot, and is then easily removed. In several instances one or two nymphs were found associated with the colonies of larvae on plant stems; but both nymphs and adults are, relatively speaking, much scarcer than the 'grass lice' or larvae.

*Hosts.* This species is a very general feeder and is not at all particular in its selection of hosts. It occurs most freely on 'horse-kind' and cattle; but is, generally speaking, most abundant on the former. With the horse or mule it confines its attacks chiefly to the head, though it is often found inside the ears, and sometimes also in other natural cavities, as well as on the flanks, withers, mane and tail; while with the ox (cattle) it may be found attached to any part of the body, generally in company with its more abundant relative, the Texas Fever Tick (*M. annulatus australis*). It may be interesting to add, also, that there are several authentic records of its occurrence on the tongues of young calves, though no specimens were secured from such situations. It is common on the pig especially in the larval or 'grass lice' stage, sometimes completely covering the ears of the animal; but it occurs also on this animal in both the nymphal and adult stages. It is apparently not so common on the dog, though specimens in all stages were taken from this animal. To man it is the greatest pest of the Island, attacking him in all its stages from the larval to the sexually mature males and females. It is a most vicious biter, and when it has gained access to the skin inserts its mouth parts (capitulum), the adults producing an irritating wound followed often by intense itching. As showing the extent to which this tick infests man in Jamaica, no less than twenty-seven adults of both sexes, and swarms of larvae, were taken from the writer after walking through a small native settlement which was surrounded by trees and an undergrowth of scrub and long grass. No stock had been turned into this enclosure, neither was it accessible to them; but numbers of pigs were running about the place in a semi-wild condition, and it was evident, therefore, that these animals were acting as the hosts for this tick. On reaching the unclothed portions of the body they bit freely, and so firmly did they attach themselves that several had to be removed with forceps.

From the Portland district comes the note that 'these insects (*sic*)

are a great pest to horses and mules . . . in fact, they attach themselves to every animal that walks in the pasture—birds, fowls and man. To the latter they cause great irritation to the skin, and if the wounds are scratched they are followed by painful sores.’ In this instance the writer refers chiefly to the ‘red grass lice,’ which, so far as one could gather, consisted almost entirely of larvae and nymphs. The same authority says that the young stages of the tick ‘are found mostly on the foreheads of horses and mules; also on fowls and pigs.’

As far as could be ascertained, the goat is almost free from this species; and the Batrachians and lizards were not found acting as hosts.

*Distribution.* Generally distributed throughout the Island in all localities where any of the domesticated animals are kept. It occurs in great numbers up to an altitude of 1,500 feet; but no examples were collected from a greater elevation than 3,000 feet.

*Distribution outside the Island of Jamaica.* Mexico, Central and South America are given as the range for this pest.

#### PIMENTO OR NETTED TICK

*Amblyomma maculatum*, Koch.

*Unengorged female.* Uniformly dark brown; legs slightly paler; scutum whitish with one median and two lateral slightly divergent interrupted stripes. In the middle of the space between these and the angles, are two distinct elongated spots, the markings collectively forming a mask-like pattern. Capitulum, dull red-brown; legs of the same colour, with pale articulations. Scutum, pale bronzy pink; anterior portion, pale red-brown merging into a broad median stripe of darker brown terminating considerably within the apex. On either side of this are two divergent and curved lines of the same colour; these extend to the margin, but the apices are considerably interrupted, forming small confluent spots, especially at the extreme margin; the large angular areas enclosed by these lines have each a large sub-central elongated and clearly defined spot; anterior to these spots are several smaller spots; all the dark spots and lines have their margins suffused with pale bronze-green. Abdomen, above, dark brown with obscure blackish markings; margin distinctly festooned; the festoons and the median dorsal area are deeply and coarsely

punctated. Ventral surface ochreous to pale brown; dark brown posteriorly; area of crescentic groove below anus, paler. Stigmata, pale with a broad median dark brown band.

*Engorged female.* Leaden grey with paler irregular markings; integument without spots.

*Male.* Rich dark brown, shining with a very clearly defined reticulated or net-like pattern produced by the paler ground colour. To the unaided eye the animals appear both striped and spotted.

Mouth parts and legs, dark red-brown; articulations of legs not quite so clearly defined as in the female. Scutum, rich dark castaneous, paler towards the margins, especially posteriorly. The bronzy silvery reticulations being clearly defined, but rather thickly studded with black spots and suffused with coppery green reflections; the reticulations of the remaining portions of the dorsum enclosing well-defined areas; each of the festoons with a pale bronzy silvery spot, some of which are nearly equal to the length of the festoon, others small and scarcely visible; these merge into large dark castaneous areas, giving each festoon an ocellated appearance. Ventral surface pale leaden grey; margins, pale red-brown; the intestinal tract showing through the cuticle as pale greyish and blackish blotches.

*Habits.* Little is apparently known of the life-cycle; but Hunter and Hooker,\* who attempted to rear this species on dogs, say that the larvae matured in six to seven days, and then left the host; that the incubation period of the eggs varied from twenty-six to thirty-one days; and that the larvae which hatched from these eggs in the beginning of September were still living on 1st of March following.

*Hosts.* Found upon 'horsekind' and cattle, and, according to Mr. Harry Jackson, is most plentiful 'between the months of June and October. They attack the ears, tails and manes of the animals; and are worse than the ordinary silver tick, as very often they cause sores in the ears and tail.' In addition to the inside of the ear, other natural cavities are also selected; and it bites man almost immediately after gaining access to the skin, inflicting a painful wound, resembling the pain produced by salt when rubbed into a freshly-cut wound, as the writer can testify from experience.

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\* U.S. Dept. Agriculture, Bureau of Entomology, Bull. No. 72, p. 64.



*Distribution.* The only examples of this rather handsome species were captured by Mr. H. Jackson at Waltham, in the Mandeville district of Manchester, on the 18th January, 1909. Several examples of both sexes were forwarded under the name 'Pimento Tick.' No other examples were seen, though carefully searched for in other districts. This is the first recorded occurrence of this species in Jamaica.

*Distribution outside the Island of Jamaica.* North America, especially near the Gulf Coast; Neumann also gives Mexico, Peru, Brazil, Paraguay, Uruguay, Chili and the Argentine Republic.

### BULL FROG TICK

*Amblyomma dissimile*,\* Koch.

*Engorged or replete female.* Dull ochreous to yellowish grey; excretory system scarcely showing through the integument in pale yellow but irregular lines. Scutum, chocolate-brown with dull coppery markings, forming a distinct spot at the apex. Integument, with numerous well-defined black spots, which in some individuals are surrounded with pale brownish yellow. Length, 17 to 17.50 mm. Greatest width, 11.50 to 12 mm. Height, 6.50 to 17.50 mm.

*Nymphs.* Scutum, deeply but widely punctate with two sub-median grooves; dull ochreous yellow; posterior margin, as far as the eyes, dark brown; eyes, red-brown. Capitulum and legs red-brown. Body, leaden-grey dorsally, with the diverticula showing through the cuticle as two irregular branching lines, slightly diverging from the median line a little above the centre; venter, paler at the margins (almost white), especially in front, and there is a large irregular patch of the same colour surrounding the anal orifice. Ventrally a deep, narrow, and well-defined groove extends from the anal orifice to the margin, and there are also two broad deep divergent grooves on either side; dorsum, with a broad median groove terminating near the middle of the back; and there are two irregular depressions on both sides of this.

*Habits.* The replete or fully engorged female is slightly larger than any other species of tick found in the Island, the length of this tick being equal to one-seventh or one-eighth of the total length of its host (see Pl. XIII, fig. 3). No males were found, though very careful

\* Determined by Professor G. Neumann.

search was made for them. Both the nymphs and the females mature very slowly; and it is evident that all three stages (larva, nymph and adult) are passed upon one host; so that in this respect it differs markedly from its congeneric representative, *Amblyomma cajanense*, which requires three hosts and effects its two moults upon the ground. The life-cycle of *A. dissimile*, therefore, resembles that of the common cattle tick (*Margaropus annulatus australis*). Two apparently freshly attached larvae filled themselves to repletion in about one week; but the nymphal stage occupied from four to seven weeks; and three females were fourteen, seventeen and twenty-three days respectively in maturing. When fully engorged they left the host and in all cases buried themselves among the loose damp grass forming the bed at the bottom of the cage in which the toads were kept. Egg laying, commencing on the seventh day, and was continued for seventeen days. The number of eggs laid by one female was 1,784. These unfortunately did not hatch before the members of the expedition left the Island; but they survived the low temperature of the voyage to England, and, although they were not placed in the incubator until some time after arrival, several larvae hatched out in a temperature of 23° C. during the second week in May; so that it is evident that the eggs of this species are exceedingly resistant to cold. The replete female feigns death when disturbed, but crawls about, when left undisturbed, in a fairly active manner.

*Host.* Apparently confined to the common toad or so-called 'Bull-frog' of the Island (*Bufo marinus*, Gravenh.). This tick often occurred singly; but occasionally four or five examples, in various stages of development, were found upon a single host. It has not hitherto been recorded from Jamaica.

*Distribution.* Sparingly in the Montpellier district in the parishes of St. James and Hanover; Vere District, Clarendon; and at Mona, Bertaville, and Constant Spring in the parish of St. Andrew. It may also occur in all districts where the host is found.

*Distribution outside the Island of Jamaica.* Neumann gives Mexico, Guatemala, Nicaragua, Barbados, Columbia, Venezuela, Brazil, Paraguay and the Philippines; and *Bufo marinus* as the only host.

## LIZARD TICK

*Aponomma* sp.

*Nymph.* Bluish grey with the anterior fourth, both dorsally and ventrally, and also a large patch immediately behind the anus, pale yellowish white; the pale colour also extends along the lateral margins on both sides. Legs, pale brown; capitulum, slightly paler. Scutum, slightly darker than the surrounding integument. Length, 5 mm.

The only tick found upon lizards was discovered by Mr. E. Stewart Panton, who, in submitting the specimen for examination, supplied the following information:—‘I was sitting under a mango tree yesterday, when suddenly a lizard—of the purple-tailed *Anolis* species—a mature male, dropped to the ground from the tree, when I noticed a tick adhering to the throat. On picking up the lizard I found that it was somewhat emaciated and quite weak. I may mention that it is the first time that I have ever seen a tick on a lizard. And situated as it was the lizard could not get at it; otherwise it would no doubt have been eaten by its host before it had even reached its present dimensions.’ [Thornbury, Highgate, S. Mary, 14th December, 1908.]

Quite a large number of lizards were examined during the course of the expedition, but none of them were found to harbour ticks in any stage. The species captured were *Anolis maculata* (many); *Meiva dorsalis* (48); *Gecko* sp. (5).

## ENEMIES OF TICKS

Gosse, in his delightful work on the Birds of Jamaica, was apparently the first authority to call attention to the fact that the two native ‘Blackbirds’ (*Crotophaga ani* and *Quiscalus crassirostris*) feed extensively upon cattle ticks; and although he did not find the remains of ticks in the *post-mortem* examinations which he evidently made, yet his evidence is amply conclusive.

Williams\* considers these birds as the greatest friends to the cattle owners, and that they afforded him much amusement, as there

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\* *Loc. cit.*, p. 215.

seemed to be 'an understanding between them and the cattle whereby they are assisted and encouraged to destroy the ticks.' He appeals also for their preservation. There is no need, however to appeal to the pen keepers or the planters for the protection of these birds, as everywhere the people are unanimously of the opinion that the services which these birds render in destroying ticks are incalculable. The observations which were made in regard to the tick-eating propensities of these two species of birds fully confirm the statements given by former writers and the pen keepers, though it would seem that the 'Tinkling Grackle' (*Q. crassirostris*) feeds much more extensively upon them than the 'Parrot-billed Blackbird' (*C. ani*); this assumption is based both upon observations in the field and upon *post-mortem* examinations, the results of which are given below.

#### SAVANAH BLACKBIRD OR 'TINKLING GRACKLE'

*Quiscalus crassirostris*

(Plate XIV, fig. 2.)

This common species was observed usually in small companies, and seems to be generally gregarious, though odd specimens were noticed in many places. It was seen in considerable numbers in the parishes of Manchester, St. Elizabeth, Hanover, Westmoreland and St. James. In all of these places its tick-feeding habits were observed; and in one instance nearly every individual member of a flock was seen picking off the ticks from cattle which were browsing together under the shade-trees in the pastures. These birds will also follow cattle when driven into the pens, and, if undisturbed, will remove the ticks and eat them with apparent avidity, this habit being particularly noticeable in the mornings and evenings. They are remarkably fearless of man, and if alarmed generally fly into the adjacent trees to return again when unmolested or when hunger presses them to do so.

Judging by the few *post-mortem* examinations which were made, their food consists chiefly of insects and ticks; though they feed to a certain extent upon seeds, and are said also to feed freely upon tangerine and sweet oranges (Montpellier and St. Thomas). The

crop of one example was found to contain the remains of such fruit. The details of the food found in seven examples are given below :—

*Locality.*—Knockalva, Hanover, December 12, 1908. Birds procured immediately after leaving cattle in pen, early in the morning.

NO. 1. CONTENTS : 25 Texas-fever ticks (*Margaropus annulatus australis*); 5 fully, the rest partly engorged females.

3 Silver ticks (*Amblyomma cajanense*); all fully engorged females.

13 Geometrid moth caterpillars.

1 Beetle larva (*Geodephaga*).

Remains of a large centipede.

Hairs from ox.

NO. 2. CONTENTS : 74 Texas-fever ticks (*M. annulatus australis*), 3 of which were fully engorged females; the rest, all adult females, slightly engorged.

12 skins of small geometrid moth caterpillars, all apparently of one species.

Posterior third of a centipede.

NO. 3. CONTENTS : 13 Texas-fever ticks (*M. annulatus australis*), all partly engorged.

10 skins of a small geometrid moth caterpillar.

A mass of the fibrous portion of the fruit of the orange.

*Locality.*—Great Valley, Manchester, December 23rd, 1908. Birds procured under similar conditions to the former, but in the late afternoon.

NO. 4. CONTENTS : 32 Texas-fever ticks (*M. annulatus australis*), all partly engorged females.

3 noctuid moth caterpillars ('cut worms'), all of the same species.

5 geometrid moth caterpillars, all of the same species.

NO. 5. CONTENTS : 3 Silver ticks (*A. cajanense*); 2 fully engorged females, 1 partly so.

- 2 Texas-fever ticks (*M. annulatus australis*);  
one fully engorged female, the other partly  
so.
  - 13 small geometrid moth caterpillars.  
1 spider, in fragments.  
1 chrysalis (pupa) of a noctuid moth.
  - 34 seeds of *Portulaca halimoides*, L., and  
minute fragments of small unrecognisable  
insects.
- NO. 6. CONTENTS: 7 Texas-fever ticks (*M. annulatus australis*),  
all partly engorged females.
- 64 large dipterous larvae resembling those of  
the genus *Tipula*.
  - 3 geometrid moth caterpillars and remains of  
numerous others.
  - 1 pupa of a large Hymenopterous insect, half  
an inch in length.
- NO. 7. CONTENTS: Chiefly fragments of moth larvae and other  
insects, with one small pebble.

The total number of ticks found in the six birds was 159. As these were all females, it will be seen, had they been left to mature, that they would have produced between them over 1,000,000 eggs or a corresponding number of young grass lice; so that the value of the Tinkling as a tick destroyer cannot be over estimated. We gather from these records also that it feeds very largely upon the caterpillars or larvae of moths. This being so, it is only fair to assume that it may feed upon some of the various species which are known to be destructive to various cultivated plants. Whether seeds form a part of its regular diet the writer is at present unable to say; in all probability this may be so; but the seeds may have been taken in lieu of pebbles or sand, as was apparently the case with certain other insectivorous birds\* of the Island.

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\* A female Radiolated Woodpecker (*Centurus radiolatus*, Wagl.) which had regaled itself with cockroaches, contained also five of the large black spherical seeds of the Bitterwood (*Picraena excelsa*, Lindl.), about the size of a buck-shot, which were so hard as to almost resist the blade of a knife. *Platypsaris niger* contained seeds of the West Indian Birch (*Bursera gummiifera*, L.), the Green Tody (*Todus viridis*), seeds of *Panicum glutinosum*, S., and other seeds which were not identified. A rather large seed was also taken from the stomach of the common Petchary (*Tyrannus caudifasciatus*, D'Orby).

## THE SAVANAH OR PARROT-BILLED BLACKBIRD

*Crotophaga ani*, Linn.

Plate XIV, fig. 1

Like the European Cuckoo (*Cuculus canorus*) this bird appears to exercise little or no choice in the selection of its food; nauseous plant-bugs being eaten apparently just as freely as those insects which belong to the edible group. Judging from observations in the field one gathers that this bird also feeds freely upon ticks, though not to such a marked extent, as has already been pointed out, as the Tinkling (*Q. crassirostris*). The writer had many opportunities of watching these birds at close range, as a brood of young birds was reared in close proximity to the bungalow in which the laboratory work in connection with the expedition was conducted. Seven old birds took part in rearing the young, and on several occasions they were seen to take ticks (probably *Amblyomma cajanense*) from the heads of the horses which were grazing hard by. Their method of procedure was to walk close up to the animal while grazing, so as to be able to reach the parasite without flying at the animal's head. On other occasions they were seen inspecting a small herd of cattle which were lying at rest beneath some shade-trees. Three examples only were dissected, and the contents of the stomachs are here appended.

*Locality*.—Stony Hill, St. Andrew, January 4, 1909.

- NO. 1. CONTENTS: Almost filled with portions of the nests (cells, larvae and pupae) of the common paper building wasp (*Polistes crinita*); there were also a few skins of moth larvae; and one spinose skin of the larva of a Nymphalid butterfly.
- 1 beautifully coloured beetle (*Homophoeta equinoctialis*, Linn.) of the Chrysomelid group, having a yellow thorax, with deep violet wing-cases bearing eight large white spots.
  - 1 weevil (*Rhyncophorus* Coleoptera).
  - 3 specimens of the pupal stage of the bright orange red 'Cotton stainer' (*Dysdercus* sp.).

- 1 small mollusc (non det.).
- 1 purple berry of the noxious Lantana.
- 3 hard brown seeds (non det.).
- 1 Texas-fever tick (*M. annulatus australis*),  
a partly engorged female.

*Locality.*—Stony Hill and Constant Spring, St. Andrew, January 14, 1909.

- NO. 2. CONTENTS : Large fragments of the common 'Green stink-bug' (*Loxa flavicollis*, Drury), in both immature and adult stages, the stomach being well filled with the remains of this insect.
- NO. 3. CONTENTS · 2 almost perfect examples of the 'Green stink-bug' (*L. flavicollis*) and many fragments of others, the stomach being about half filled with the remains of this insect.
- 1 beetle resembling a small *Harpalus*.
  - 2 small grey weevils and a number of fragments of another Rhyncophorous beetle of a dark brown colour.
  - 1 spider.
  - 1 Texas-fever tick (*M. annulatus australis*),  
a partly engorged female.

These records give us in a small degree the nature of the dietary of this interesting bird; and it is clearly evident that it is practically an omnivorous feeder. The finding of ticks is of economic value; while the discovery of the green 'stink-bug' (*Loxa flavicollis*) is of great bionomic interest. This bug, whose odour is horribly offensive, does not possess any warning coloration; but being of a uniformly green colour is highly protected and difficult to discover when resting among the leafy branches of a tree or shrub. It is common, but not apparently abundant; though it is not infrequently attracted at night by artificial light. The amount of odoriferous matter contained in the stomachs of the birds found to contain the remains of this bug was so offensive as to render the operation of dissection positively unbearable, and the foetid odour was with difficulty removed from



the hands of the operator. Another find of economic as well as of bionomic interest is that of the injurious 'cotton stainer' (*Dysdercus* sp.): a pest which simply swarms in the cotton plantation in the Parish of St. Andrew, where, if the birds were numerous enough, they might do yeoman service in checking the ravages of this insect.

Another record of interest in reference to the food of this bird was made one day in the month of January, while watching the habits of a small family party bringing food to a fully-fledged young one, which had perched itself in a very convenient place for observation, quite close to where the writer was seated. At first one of the old birds was seen to advance with a huge mouthful of something, appearing most like a bundle of dark coloured feathers, which it was seen to procure from the foot of a tree not far away. This object was offered to the young bird and accepted by it immediately; and while it was making a strenuous effort to swallow the dry-looking morsel, a couple of missiles thrown into the tree made it relinquish its hold of the object, which, when secured, proved to be the somewhat mangled remains of one of the huge black 'Witch Moths' (*Erebus argarista*), measuring originally nearly six inches in the wing expanse.

### THE DOMESTIC FOWL

It is common knowledge amongst the pen keepers of the Island that the domestic fowl feeds to a marked extent upon cattle ticks. The writer had several opportunities of confirming this, and of noting also that where domestic fowls were not kept that 'grass lice' occurred in countless numbers *inside the cattle pens*, collecting together in enormous masses on any convenient platform that would afford them a means of securing a host. The parents of these had evidently dropped from the cattle when the latter were brought into the pen; and in the absence of fowls had brought forth young, without apparently any check. Mr. Stafford Maxwell, one of the many contributors who furnished us with observations on ticks, evidently attaches great importance to this matter, and says that 'by keeping the pens swept and clean and allowing "Indian Game Fowls" to run in the pens they pick up any ticks which fall from the cattle, and the pens are thereby kept free from these pests.'

## LIZARDS

By the introduction of the mongoose some of our contributors have expressed the opinion that this animal has not only exterminated the quail\* and reduced the numbers of insectivorous birds, but that it has also diminished the number of lizards to such a marked extent that the ticks of the Island have increased proportionally as their enemies have been lessened. This is unfortunately true, so far at least as the birds are concerned; but we have no evidence to show that the innumerable lizards which still exist almost everywhere in the grazing districts play any part in the destruction of ticks. That they are of great value in destroying insects generally there can be no doubt, and these, together with the birds and other predaceous animals, may be considered the only forces with which nature has provided us, to work against the foes of man and his cultivated plants and animals. Some attention was given to the food of the ground lizard (*Meiva dorsalis*); but unfortunately the specimens which were procured for dissection came from the outskirts of Kingston, where there are no ticks, so that it was not possible from post-mortem examinations to glean any facts in support of the theory that these animals feed to some extent upon cattle ticks. But it may be of interest to note, however, that a number of captive ground lizards refused under any condition to eat cattle ticks, though no other food was supplied to them during the many days in which they were kept under observation. But although the results in so far as their tick-feeding propensities are negative, yet one gathers from the few post-mortem examinations which were made that, in a state of nature, they feed exclusively upon those insects which are commonly met with in their haunts, such as earwigs, two-winged flies, including the parent of the noxious 'screw worm' (*Chrysomya macellaria*, see also p. 462), noctuid moths, and numbers of the smaller scarabaeid beetles. These observations on the food of the lizard will not, it is hoped, prejudice the Islanders against the economic value of this animal or any of its allies. Further investigation may yet prove that the inference which has been drawn by the pen keepers and others as to the tick-destroying properties of this and other lizards is a valid one.

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\* *Ortyx virginianus*.

‘ BULL FROG ’ (*Bufo marinus*)

The faeces of a number of freshly captured examples of this common batrachian were carefully examined in the hopes of finding traces of cattle ticks in them, but none were discoverable. Seeing that the animal is subject to the attacks of ticks, it may be inferred that it does not eat them, or it would readily remove the parasites from its own body. Such a feat would, however, be an anatomical impossibility on the part of the host; and one may assume that it does not act the part of the Samaritan in removing ticks from its neighbour. Several tick-infested toads were kept together for a considerable period, and it was quite evident that no attempt was made by them to remove the parasites from each other. The remains found in the faeces consisted almost entirely of insects; some comminuted, others quite perfect; and by far the larger proportion were of the common brown Scarabaeid beetles known locally as ‘ Christmas bugs ’ (*Ligyryus fossor*, Latr., and *Cyclocephala tetrica*, Voct.), which sometimes swarm in the house and on the dining table at night when the lights are on.

ROTATION OF CROPS AS A METHOD OF ERADICATING  
TICK-INFESTED PASTURES

Various plans have been put forward in the United States of America for the eradication of the cattle tick by adopting a system of rotation of crops suited to the farms in certain parts of the country. Such a system, however, is quite impossible in Jamaica, where the pastures are laid down more or less permanently.

RESULTS OBTAINED BY BURNING PASTURES

This was a question which was also submitted to the pen-keepers. The answers to this were, in a very large percentage of cases, that no beneficial results had been obtained by adopting such drastic measures, and, moreover, they nearly all agreed that pastures so treated became more heavily infested, a few weeks afterwards, than before the grass was fired. But the contributors were certainly not unanimous in regard to this question. Two of them claimed that they had obtained ‘ very good ’ and ‘ very satisfactory results ’ respectively. Many consider the burning of pastures as a ruinous proceeding, as

weeds take the place of grass ; while others, again, adopt the system more or less regularly, though the results so far as the destruction of ticks are concerned are apparently nil.

One correspondent is opposed to the burning of pastures, because of an extremely interesting discovery which he once made in reference to the silver tick (*A. cajanense*). He says that 'in digging a pond, ticks, in crowds, turned up at a depth of 2 feet to 18 inches.' He argues, therefore that if ticks exist under similar conditions in pastures which may be full of cracks in dry weather that burning must be perfectly futile.

Natives, it would seem, are also opposed to the burning of pastures, because, in their opinion, fire causes ticks to breed more freely ; and so firmly is this idea rooted in their minds that it is very difficult to get them to burn even those ticks which are picked off cattle.

Burning, of course, destroys all those ticks which are upon the grass or herbage ; but it is quite evident that the majority of those which are protected in cracks or crevices in the ground or under logs of wood and under stones escape destruction ; otherwise it is impossible that re-infestation could be brought about so rapidly afterwards. The explanation of the failure of fire in the destruction of ticks in pastures is, in the writer's opinion, undoubtedly due to the fact that the ground had not been cleared of all stock for a sufficiently long period to enable the ticks to lay their eggs and for all the grass lice to hatch and disport themselves over the herbage, thereby exposing themselves to the flames and ensuring complete extermination. To obtain thoroughly satisfactory results in the burning of tick-infested pastures, fire should not be applied until the eighth week after the removal of the stock ; and it is scarcely necessary to add that this should be done in the dry season, and that none but clean cattle or 'horsekind' should be turned into the pasture afterwards. It was suggested by one correspondent that in his opinion 'the huge full-grown ticks which fasten on the "frogs,"\* which are found in great numbers at night in burnt pastures,' may be the cause of the re-infestation of grazing land. The tick in question (*Amblyomma dissimile*) is not of any economic importance to the pen-keeper, as it

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\* *Bufo marinus*. See also the tick *Amblyomma dissimile*.

does not attack his stock ; and, moreover, it does not, so far one could gather, occur in sufficiently large numbers to cause any appreciable annoyance to man or his domesticated animals. Further information regarding this tick is given in other parts of this Report (pp. 445, 446).

#### APPARATUS

The terms 'sprays' and 'washes' are practically synonymous, as the agents used in both cases may be identical in composition. But tick-infested cattle must be treated according to the existing conditions or size of the herd. Small owners need go to no expense in the purchase of apparatus, as washes can be applied with a suitable brush, a piece of cloth, or a bundle of tow ; but for larger herds the pen-keeper will require either a spraying apparatus or a dipping tank. There are numerous forms of spraying machinery on the market, which for the most part are rather costly. For experimental purposes we used a Stot's Syringe fitted with one of their fine nozzles and a Cooper's 'Bucket Spray Pump,' kindly furnished by the inventors. The syringe proved by far the more convenient apparatus ; it was, moreover, extremely economical, there being practically no waste of material. By its use, also, the spraying was carried out expeditiously, and the movements of the animal could be much more easily followed than with a heavier piece of apparatus. The Stot's syringe or hand sprayer costs 10s. 6d. (f.o.b.), the Cooper's spray pump 28s. 6d. (f.o.b.). The best form of brush for liquid washes is the kind used for grooming horses, known technically as a 'body-brush.' A native-made brush, in general use in the Island, is prepared from the fruit stalk of the cocoanut palm ; it forms an excellent apparatus for applying thick tar and oil preparations, but is quite unsuitable for the more mobile washes.

*The use of dipping tanks.* This is undoubtedly the most efficacious means of treating tick-infested stock, as has been abundantly proved in other parts of the world. Unfortunately, dipping is out of the question in some localities owing to the scarcity of water at the time when stock most require dipping. But there are certain parts of the Island where public dipping tanks could be erected, and there are certain estates on which it would repay the owners to erect such a structure for their own use exclusively. This

is a question, however, which the pen-keepers can best settle among themselves, and one also which has been brought forward recently by the Government and the Agricultural Society, through the generous offer of Messrs. Cooper and Nephews to supply the apparatus free of cost to the Island.

#### CATTLE WASHES AND DIPS\*

Williams, in his official report,† recommended as the cheapest and most reliable dressing for cattle ticks: 'One pint of tar to three pints of boiled linseed oil, to be applied to all parts of the tick-infested skin,' and added that 'if one dressing be not sufficient a second should be applied in a few days.' This formula, with various complicated modifications, has been in more or less general use for the last thirteen years. That this mixture or a modification of it is effective *as a local application* cannot be denied, but it is much too drastic in its effect upon cattle to be of any real service in the treatment of tick-infested animals.

There are also numerous other forms of washes in use, many of them prepared from materials which the settler may have at hand, but these, for the most part, are altogether too complicated and, in many instances, also too costly to be applied on a large scale.

Several proprietary washes and dips are also used; and in many instances with satisfactory results. In the series of experiments which were conducted by us at the Government Laboratory some of the more popular of these were tested, by spraying a number of tick-infested cattle. The results obtained gave a percentage of dead ticks varying from 5 per cent. to 65 per cent.

After prolonged experiments a most effective spraying wash has been evolved, consisting of a mixture of Cooper's 'Dip powder' and Cousin's 'Paranaph.'‡ The former is a most effective preparation

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\* This portion of the Report is contributed *in part* by the Honourable H. H. Cousins, M.A., F.C.S., Director of Agriculture, Jamaica, and his assistant, Mr. E. J. Wortley, F.C.S.

† *Loc. cit.*

‡ The formula of this preparation is as follows:

1. Soft Soap (Chiswick Imperial)	55.6 %.
2. Water .. .. .	21.7 %.
3. Naphthaline .. .. .	5.2 %.
4. Paraffin .. .. .	17.5 %.

when used as a dip, but was not found sufficiently mobile to use as a spraying mixture, as it does not readily penetrate to the skin, especially in long-coated animals, and this was particularly noted in a young calf which was used for experimental purposes. Cousin's 'Paranaph' is also a proprietary article, consisting of soap-paraffin and naphthaline, devised originally for washing hops and fruit trees in Kent. The proportions of Cooper's dip used by us is the minimum strength recommended for use in dipping sheep and cattle; but in South Africa, where the 'Bont Tick' (*Amblyomma hebraeum*) is very difficult to kill, the powder is used with safety half as strong again. The 'Silver Tick' of Jamaica (*A. cajanense*), though closely allied to the 'Bont Tick,' does not appear to be so tenacious of life as its African relative. Realising the difficulty of obtaining the exact nature of the result of this compound upon 'grass lice,' which from their minute size are rendered almost invisible among the hair of the host, control experiments were made by placing masses of the young lice in muslin bags. These were completely immersed in the dip and afterwards suspended in the open air in a cool place and allowed to dry. Eighteen hours afterwards the 'lice' were found still living but on the third day every tick was dead; so that we may justly claim that this preparation is equally effective for all stages of cattle ticks. The exact formula of this wash is here given.

Paranaph 1 part, water 6 parts.

Cooper's dip 1 packet to 20 gallons of water.

One and a half quarts per head seems quite enough if applied properly. This preparation has proved not only effective in its immediate results, but a most persistent and adherent tick-destroying medium. The cattle which were sprayed by us, although left to graze in pasturage which was positively alive with 'grass lice' for a period of five weeks, had at the end of that time scarcely a live tick upon them. We are sanguine, therefore, that the tick problem in Jamaica can be controlled cheaply and effectively with appliances readily obtainable and usable by any owner of stock; but the following conditions should be rigorously adhered to in spraying or washing cattle:—

1. The application of this mixture, which contains POISON, must not under any condition be applied at a less interval than fourteen

days; and in our experience every five to eight weeks during the winter months is sufficient to keep the cattle practically free of ticks.

2. All sprayings or washings should take place in the early morning; and the cattle should be allowed to dry in the shade before turning out to graze.

3. If cattle have to be driven for any distance they should be allowed to cool before spraying. Driving both before and after should be quiet.

4. Cattle of all ages and also cows in calf may be sprayed. Cows in milk should have the lower portions of their udders sponged before milking on the first day of the spraying.

5. The spray should be so finely distributed that practically none of the liquid drips off the animals treated. To avoid danger the operation should be conducted on a site devoid of grass.

6. All waste products and washings from the apparatus used should be thrown into the drains, or, safer still, into a hole in the ground and covered with a layer of soil.

7. All these instructions are applicable both for dipping as well as for spraying. *But in-calf animals should not be dipped a month or so before calving.*

We have every confidence in recommending this preparation, which, although containing *arsenic* is perfectly safe. The cattle treated by us did not suffer in the least; moreover, Cooper's dip and other arsenical preparations have been in use for several years in Africa, Australia and South America, and although thousands of cattle have been put to the test in all of these countries no loss has been occasioned when the regulations for its use have been strictly carried out

In the conditions obtaining in Jamaica we do not consider that 'dipping' is a practicable method; it is too costly, consumes too much wash, and is not without risk to stock. We advocate spraying with a wash, as above, possessed of such wetting power that a very fine spray will serve to wet and destroy all the ticks at one operation.



## CONCLUSIONS

1. That the tick responsible for the transmission of Texas-fever is the so-called Texas-fever tick (*Margaropus annulatus* var. *australis*), though experimental proof is needed to confirm this in the Island of Jamaica.

2. That ticks are most abundant during the dry season.

3. That ticks are dispersed from place to place chiefly by the host to which they are peculiar.

4. That rain or temporary flooding with water does not destroy ticks or their eggs.

5. That a relatively large number of young ticks will hatch and possibly survive for longer periods in dirty pastures than in pastures which are free from weeds and scrub.

6. That ticks cannot survive indefinitely and reproduce their species without access to a host.

7. That all natural enemies of ticks should be encouraged in every possible way, and that fowls should be kept in all cattle pens.

8. That in all cases where it is practicable the burning of pastures should not be carried out until the eighth week after the removal of all stock.

9. That tick-infested animals should be thoroughly sprayed or dipped regularly at intervals of five to eight weeks, or at less intervals if found necessary. Local applications being of little use in the destruction of cattle ticks, though useful in destroying those species which infest the natural cavities of the horse and mule.

10. That the effort to destroy the ticks must be a united one ; no half measures will serve ; all must participate in the work.

11. That the evidence of those pen-keepers who have constantly waged war against this pest is that ticks, on their respective estates, are not nearly as troublesome as formerly. The writer very willingly bears testimony in support of this statement.

12. That the Island Government remove the duty from all materials used in spraying and dipping cattle.

GLOSSARY OF COLLOQUIAL NAMES OF TICKS IN USE  
IN THE ISLAND

NAME.	STAGE IN DEVELOPMENTAL CYCLE.	SCIENTIFIC NAME.
Blood or cattle tick ... ..	Replete adult females ... ..	<i>Margaropus annulatus australis</i> and <i>Amblyomma cajanense</i>
Bull-frog tick ... ..	All stages attached to host ... ..	<i>Amblyomma dissimile</i>
Constab or red-back ... ..	Nymph ... ..	<i>Amblyomma cajanense</i>
Cow tick ... ..	Replete adult females ... ..	<i>M. annulatus australis</i> and <i>Amblyomma cajanense</i>
Dog tick ... ..	Adult females ... ..	<i>Rhipicephalus sanguineus</i> and <i>Dermacentor nitens</i>
Flatticus ... ..	Usually unengorged adult females	<i>M. annulatus australis</i>
Cow tick ... ..	Replete adult females ... ..	<i>M. annulatus australis</i>
Grass lice ... ..	Larval or first stage ... ..	<i>M. annulatus australis</i> and <i>Ambly-</i> <i>omma cajanense</i> ; also all other species in this stage
Jamaica tick ... ..	Replete adult females ... ..	<i>M. annulatus australis</i> and <i>Amblyomma cajanense</i>
Long red-brown oval tick ... ..	Engorged nymphs ... ..	<i>M. annulatus australis</i>
Pimento tick ... ..	Adults of both sexes ... ..	<i>Amblyomma maculatum</i>
Red backs ... ..	Unfed nymphs ... ..	<i>Amblyomma cajanense</i>
Red tick, small ... ..	Unfed nymphs ... ..	<i>Amblyomma cajanense</i>
Red tick, large ... ..	Engorged nymphs ... ..	<i>M. annulatus australis</i>
Red grass lice, large ... ..	Unfed nymph ... ..	<i>Amblyomma cajanense</i>
Silver tick ... ..	Male and female (unengorged)	<i>Amblyomma cajanense</i>
Silver backs ... ..		
Texas fever tick ... ..	Usually the partly and fully engorged female	<i>M. annulatus australis</i>

**MYIASIS IN MAN PRODUCED BY THE LARVAE OF  
CHRYSOMYIA (COMPSOMYIA) MACELLARIA**

Dr. J. A. Allwood of Kingston very kindly presented to the School three immature larvae of this horrid pest which he extracted from the ear of a Syrian, December 26th, 1909.

Though immature they are undoubtedly referable to this species, and there can be little doubt that the patient had become infested during his short stay in the Island. At Constant Spring and also in other parts of the parish of St. Andrews this insect is one of the commonest of the 'blow flies,' and the foetid carcase of a bird or mammal, placed in the sun, forms an attractive bait for this very handsome though much dreaded Muscid. They are extremely active in their habits; but though repeatedly disturbed by the sweep of the fly-net they would return again and again to the same tempting bait.

On one occasion over twenty individuals were counted while they were frequenting the carcass of a mongoose. They seemed equally common during December and January. Like the allied European *Lucilia serricata*, which it much resembles in habits, it evidently passes its larval stage usually in putrid carcasses, but, unlike the latter, it also infests man as well as his domesticated animals. Fortunately for Jamaica the John Crows (*Cathartes aura*) remove practically all traces of carrion from man's habitation, and in this way, no doubt, very materially check the increase of this pest.

The fly may be readily recognised by the following characteristics :

**FEMALE.** Face and jowls testaceous, the latter clothed with long golden hairs; cheeks golden yellow. Third segment of *antennae* smoky brown, basal segments paler. *Eyes* red-brown, widely separated. *Thorax* brilliant metallic grey-green with three broad, equidistant, black stripes having bluish reflections; scutellum bronzy-greenish blue. *Abdomen* bronzy green with bluish reflections. *Legs* black. Length, 6 to 9 mm; expanse of wing, 9 to 17 mm.

**MALE.** Similar but smaller, and the eyes almost meet in the median line.

### HORN FLY

*Lyperosia irritans*, Linn.

This is the small black fly which is known in the United States as the 'Horn-Fly,' so named because of its peculiar habit of clustering in masses about the bases of the horns of cattle. Howard,\* who has given a very interesting account of the habits and life-cycle of the insect, points out that there is no foundation for the belief that it damages the horn by eating into it or causing it to decay. Curiously, this extraordinary habit does not obtain in England, nor, so far as the writer's experience goes, does it in certain portions of the Continent of Europe; and the few examples which the writer saw in Jamaica certainly did not resort to the horns of cattle as a resting place. Howard discovered for the first time that the eggs are laid in freshly dropped dung and that the whole cycle occupies about a fortnight. Although the writer has had abundant opportunities for the study of the life-cycle in England, he

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\* Insect Life, Vol. II, p. 1.

has not so far been able to find the larval stages in cattle dung ; though the insect has been reared artificially in such materials. In Jamaica, as in Europe, the flies generally confine their attacks to the back and flanks of the cattle, and they show a marked preference for certain animals, such as roans and blacks, though for some unaccountable reason they have been seen to single out a red-coloured cow and leave the rest of the herd in comparative peace. It is a most vicious biter and will follow cattle into the shade in sheds as well as under trees, causing them great annoyance.

The first indication of its presence in Jamaica was made by Mr. Stephen Maxwell, of Elphinstowe, St. Elizabeth, who, in forwarding examples for identification, stated that 'these flies have been noticed here for the first time this year, and are very troublesome.' This locality is in the mountains of the Santa Cruz range. Subsequently the writer met with this insect in several places, never, however, in great numbers ; and it would seem at present as if it were more particularly confined to the parishes of St. Elizabeth and Manchester. Dr. Froggatt\* records the occurrence of this pest at Vera Cruz, and says that when leaving this place for Habana, Cuba, that on coming on board the vessel he found 'the cattle were smothered with the blood-sucking Horn-fly.' It is evident, therefore, that this insect is common in some of the other West Indian islands. *As a remedy*, or rather a preventative, against the attacks of the flies the wash recommended for ticks may also act as a deterrent against this insect. In the United States train oil, or train oil with a little sulphur or carbolic acid added, has been found to keep off the flies for a few days ; and a spade full of lime thrown upon cow dung will destroy the larvae which may be living in it. (Howard, *loc. cit.*).

#### THE 'STABLE FLY'

*Stomoxys calcitrans* (Linn.).

This is the commonest blood-sucking fly in the Island, and appears to be very generally distributed ; and although it usually occurred in small numbers, in one or two instances it was plentiful enough to cause the animals annoyance by its persistent attacks.

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\* Official Report on Fruit and other Pests in various countries, 1907-8, p. 26.

The writer has already traced out the life-cycle of this insect; \* but some observations which were made in Jamaica may not be without interest as bearing upon the economy of the species. Larvae were found at Stony Hill, St. Andrew, in the month of January. They were feeding, in small numbers, on fermenting stable refuse, but in such portions of it only as contained an *excess of green fodder*. The fully matured ones had crawled several feet away from the refuse and pupated in the soil an inch or so below the surface. Several had congregated together at the foot of a tree growing hard by; and many pupae were found in the bifurcations of the main roots close up to the trunk of the tree. Flies were bred from some of the pupae, so that there can be no doubt as to the identity of the species.

#### SMALL YELLOW HORSE FLY

*Chrysops costalis*, Fab. (= *C. amazonicus* Rond.)

Representatives of the Tabanid group of blood-sucking flies were not only very scarce but also extremely local in their distribution. This was markedly so, at any rate, during the months of December and January. This *Chrysops* was seen in small numbers in the Port Henderson swamps; and all the specimens which were taken by the writer were captured by him as they settled upon a native driver. They did not attack the mule which was being driven through this little fly belt; but they evidently attack horses, as two examples which were presented to the School by Dr. Turton were captured by him while in the act of sucking blood from his horse. It produces little or no noise when flying; and it settles so quietly as to be scarcely felt.

#### A NEW BLOOD-SUCKING TABANID

*Atylotus jamaicensis*, n. sp. (Newstead)

Thorax grey; abdomen pale brown; wings faintly speckled.

*Head.* Face white, pubescence white, *beard* white. *Palpi* creamy white, with mixed black and white hairs, the latter preponderating, the former forming a faint black tip. *Forehead* dull bronzy

\* Journ. Econ. Biol., Vol. I, 1906, pp. 157-166, pl. XII.

Reprinted Ann. Trop. Med. and Parasit., Vol. I, pp. 75-110, pl. V, 1907.

ochreous, hairs black; tuberculate spot, black, shining, especially on the lower half; with a very fine (almost obscure) black hair-line extending towards the vertex; the latter with a median blackish suffused spot. *Eyes*, in life, coppery brown with bronzy and golden reflections; and a faint narrow bronzy green band below the centre. *Antennae* reddish yellow, annulations on third segment intensely black; hairs on first segment mixed black and white, the former forming a black tuft dorsally; second segment fringed apically with black hairs; third with five to six scattered black hairs on dorsal surface of the swollen basal portion. *Thorax*, dark smoky grey, with two broad but almost obscure darker stripes. *Abdomen* pale smoky brown, gradually darkening apically; hairs mixed black and white; apical margins narrow and paler. *Legs* a little darker than the antennae; anterior femora, blackish dorsally for nearly their whole length; the tibiae, apically blackish all round; middle and hind pairs similar, but the black is less intense; tarsi, blackish apically, terminal segments entirely so.

Closely allied to *Atylotus completus*, but is distinguished by its smaller size, and the absence of any abdominal markings. It belongs to the same group which includes also *A. tritus*, Walk. Two females only of this small Tabanid were captured by the writer while in a boat off Port Royal, Kingston, Jamaica, December 1st, 1908. The first was taken shortly after leaving one of the little Cay Islands, the other when nearing the mainland of Jamaica. Both examples made repeated attacks on the naked feet and legs of the writer's companions, and one was eventually captured while in the act of sucking blood. When disturbed they disappeared mysteriously into the inaccessible portions of the boat, re-appearing after a lengthened absence. Though a careful watch was kept, no other examples were seen either on the Cay which was visited or on the main Island. It is remarkable, therefore, that the species should be met with at sea only.

#### SMALL DIPTEROUS FLIES INFESTING MAN

These flies resemble *Ceratopogon* in habits, i.e., flight and in their persistent habits of attacking man. All the specimens were captured by arranging half a dozen native boys in single file and then sweeping the net over their feet. They congregate chiefly round the toes; but

more especially those which have slight abrasions of the skin or small ulcers, dirt, etc. They are also easily attracted by fresh meat and recently killed birds and mammals.

Of these flies there were at least two if not three species; and the colour pattern as seen in life is herein appended.

*Large species.* Head, ochreous; eyes, bronzy with green reflections; large segments of antenna, ochreous; tip, smoky brown. Thorax, shining black with obscure greenish reflections (i.e., bronzy greenish-black). Abdomen, above, shining black to brownish-black; broad basal segment and venter, pale translucent ochreous. Legs ochreous; claws dark brown.

*Small species (A).* Similar to the above, but with the posterior tibia blackish, with pale basal and apical bands and darker tarsi.

*Small species (B).* Similar in size to (A), but all the tibiae blackish.

#### A HIPPOBOSCID PARASITIC ON BIRDS

*Ornithoctona erythrocephala*, Leach.

One example of this interesting though apparently common parasite was secured as it flew from the body of a freshly killed Green Parroquet (*Conurus nanus*), at Worthy Park on January 8th. Its flight was strong, and had it not persisted in its attacks on the writer it is doubtful if it would otherwise have been secured. Another specimen of this fly was also captured by Mr. W. Maxwell at Friendship in the Santa Cruz Valley, St. Elizabeth, from the body of a Peregrine (*Falco peregrinus nigriceps*), also in the month of January. This example was very kindly presented to the School. The colour pattern of this insect in life was noted at the time; here is a description of it:—

*Head*, red-brown; eyes, black; thorax, black. *Legs*, femora and hind coxa, above, dark vivid green; anterior and middle coxae pale translucent ochreous. *Abdomen*, with a faint tinge of vivid green, most strongly pronounced on the anal segment. Length, 8 mm. Expanse of wing, 21 mm.

## A HIPPOBOSCID FLY PARASITIC ON BATS

*Trichobius parasiticus*, Gerv.

In the hope of procuring ticks from the indigenous bats of Jamaica a visit was paid to the enormous cave on the estate of the Honourable J. V. Calder, Worthy Park, in the parish of St. Catherine. This was on January 8th, 1909. The most distant cavern was found swarming with bats, the whole roof of this enormous place being blotted out by a fluttering cloud 5 to 6 feet deep, their wings producing a sound like that of a strong wind passing through a forest of trees. Specimens of two distinct species of bats were secured, and as these proved to be 'rareties' in our national collections at British Museum, examples of both kinds have been presented to the authorities. *Chilonycteris parnelli* evidently preponderated, judging by the number of individuals captured; but the fruit-eating *Monophyllus redmani* also swarmed. The latter had evidently carried in enormous quantities of the large fruit of the 'Santa Maria' (*Calophyllum calaba*, Jacq.), and quantities also of the Ginep (*Malicocca bijuga*, Linn.), as both kinds were found germinating in the farthest recess of the cave, a great distance from the entrance. Here in this dark recess also were seen quite a number of flies flitting about the lamps as we moved from place to place. These were of two kinds, a tiny midge-like species and a larger kind resembling somewhat a house-fly in size and colour. Specimens of both were secured, but, unfortunately, those of the black-looking species were lost while returning from the cave. The smaller fly proved to be *Trichobius parasiticus*, one of the Hippoboscid group belonging to the family Streblidae. Besides those which were secured while on flight, fourteen others were taken from nine of the captured bats. They were extremely active, some of them taking flight when efforts were made to secure them; and they appeared by the artificial light somewhat like the small 'powder-winged' flies of the genus *Aleurodes*. Both kinds of bats harboured these parasites. In life the colour is of a uniformly pale yellowish brown; the wings being pale ochreous-white with delicate pale brownish veins. Length, 1.50 to 2 mm.




## CHIGGOE FLEA

*Dermatophilus (Sarcopsylla) penetrans*

Said to be common and generally distributed over the whole of the Island ; but this requires confirmation. It was certainly a serious pest in certain portions of St. Catherine, Manchester and St. Elizabeth. It is not only parasitic on man, but is commonly met with also on pigs, confining its attacks chiefly to the feet between and immediately above the hoofs of the animal (Pl. XV, fig. 2). Pigs are most subject to the attacks of the Chiggoe when they have free access to dry sheltered places in sheds or beneath the native huts, especially where the floor or ground is covered with a thick layer of dust and dirt. Pigs which have their feet more or less constantly in wet litter or mud do not apparently get infested.

The local remedy is to paint the infested parts with Jeyes' fluid, undiluted. Man sometimes also employs the same means for destroying the parasite. As a measure of prevention, pigs should certainly not be allowed to harbour beneath or near the native huts ; but it would be difficult to adopt even so small a precaution owing to the indolence of the natives, who, it would seem, would rather stay at home, when the occasion serves, paint their feet with Jeyes' and make a holiday of the event!

## ANTHRAX LUCIFER



This conspicuous and rather handsome fly with a streak of brownish-orange on its wings was frequently seen associated with butterflies, frequenting wet mud at the margins of wayside pools, in the beginning of December. It generally occurred singly, but was swift of wing, dashing away from its haunts with lightning rapidity, so that it was with difficulty that examples were captured. It may be of some economic importance, as are other members of the Bombiliidae, in that the larvae of certain species are known to devour the eggs of locusts. This is not a blood-sucking insect, and does not, therefore, come strictly within the pale of this Report. Its striking similarity to a Tabanid of the genus *Haematopota*, when on flight, was so marked as to completely deceive the writer on more than one occasion. For this reason alone has it been thought desirable to make this record.

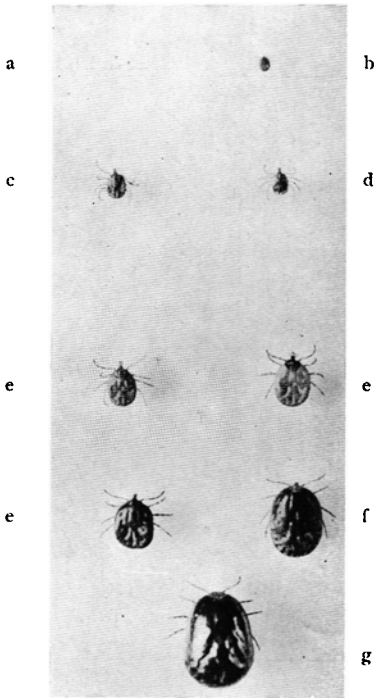


FIG. 1. Silver Tick (*Amblyomma cajanense*).  
Nat. size.

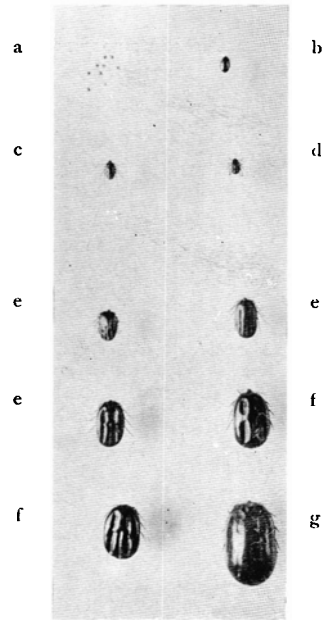


FIG. 2. Texas Tick (*Margaropus annulatus australis*).  
Nat. size.

a, Larvae or grass lice; b, Nymph; c, Unengorged female; d, Male; e, Females partly engorged; f, Female nearing repletion; g, Replete or fully engorged female.

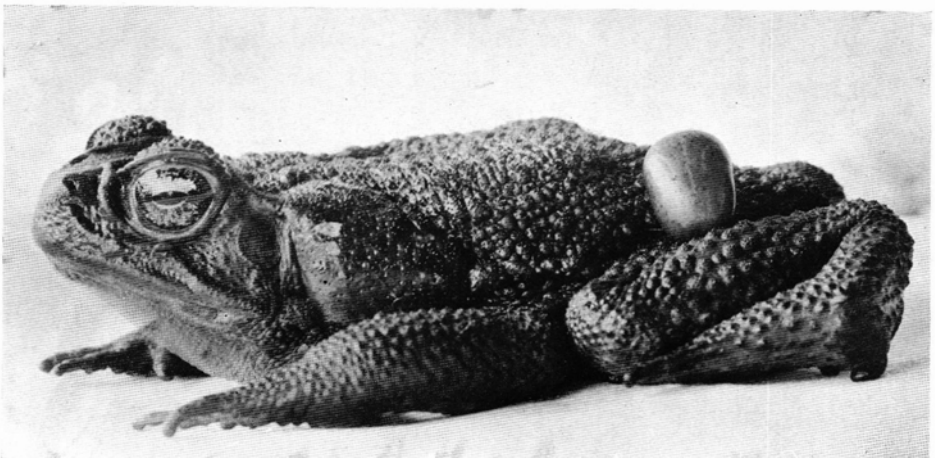


FIG. 3. 'Bull Frog' (*Bufo marinus*) with the Tick (*Amblyomma dissimile*).  
Nat. size.



FIG. 1. *Crotophaga ani*. Savanah or Parrot-billed Blackbird.



From specimens prepared by the Author.

FIG. 2. *Quiscalus crassirostris*. 'Tinkling Grackle,' or Savanah Blackbird.



FIG. 1. Cattle Ticks taken from the stomachs of two Tinklings (*Quiscalus crassirostris*)



FIG. 2. Feet of the pig infested with Chiggoes (*Dermatophilus penetrans*).