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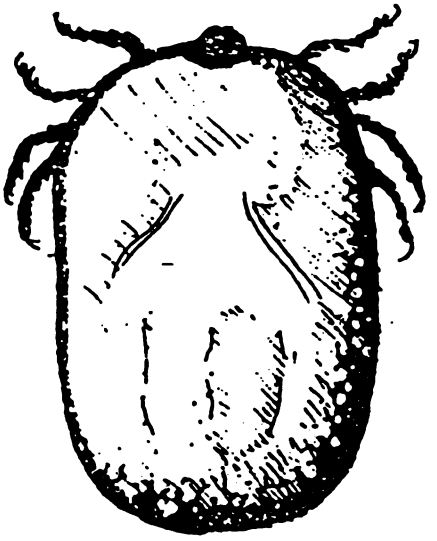
THE CATTLE TICK: BOOPHILUS MICROPLUS



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PREFACE TO THE ENGLISH EDITION

This document, originally published in French by CIRAD/EMVT[1] in French Guiana was entitled "La Tique du Betail: Boophilus microplus".

The English version of this publication was produced jointly CIRAD/EMVT in French Guiana and the IICA Office in Guyana, under the auspices of a collaborative project entitled "Hemoparasite Network for the Guyanas". The research and authorship belong entirely to CIRAD/EMVT in French Guiana. IICA provided translation, editing and publication of the English version, under its national project "Strengthening of the Veterinary Services in Guyana".

This is the second CIRAD/EMVT animal health publication to be translated, published and distributed by IICA. The first, published in 1993 and entitled "Horseflies of the Guyanas: Biology, Veterinary Significance & Control Methods", was distributed to veterinarians, livestock productionists and producers in Guyana and Suriname.

Animal pests and diseases do not recognise geographic, political and language boundaries. Animal health professionals in French Guiana, Suriname and Guyana share many common concerns, problems and goals. The exchange of veterinary information among these three countries can serve to assist these technicians and producers in their responsibility to improve animal health and livestock productivity.

I wish to thank Dr. Desquesnes of CIRAD/EMVT in Cayenne for sharing this document. I also wish to thank Mrs. Cicely John of the University of Guyana for translation services.

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[1] Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement/ Elevage et Medecine Veterinaire des pays Tropicaux.

THE CATTLE TICK
BOOPHILUS MICROPLUS

1. INTRODUCTION

The cattle tick is the principal vector of babesiosis. To a lesser degree it can participate in the transmission of anaplasmosis which is mostly transmitted by the horsefly. Each of these subjects will be treated separately, and we will deal only with the cattle tick in this publication.

In French Guiana there are numerous species of cattle ticks, of which the most common are:

- genus *Amblyomma: A. cayennense, A. dissimile...:*
- genus *Boophilus: B. microplus*

Also found are:

- genus *Rhipicephalus: R. sanguineus....(sheep)*
- genus *Argas: A persicus (goat)*
- genus *Dermacentor: D. nitens*

The most significant species in cattle rearing is *Boophilus microplus*. Zebus (*Bos indicus*) and Zebu crosses are relatively resistant to cattle ticks; European breed cattle are very susceptible.

A knowledge of the biology of the parasite allows one to develop control methods which target both ticks in the pasture and ticks attached to cattle.

We will present successively the biology of the parasite, the pathology which it produces, control methods in the free phase (pasture) and in the parasitic phase (on the cattle). We will then present recommendations for control and EMVT's proposals for intervention and research.

2. BIOLOGY OF BOOPHILUS MICROPLUS

Although capable of surviving on various domestic hosts: (cattle, horses, dogs) as well as on certain wild animals such as the agouti, *Boophilus microplus* feeds almost exclusively on cattle.

The parasitic phase (stays on animals) lasts about 21 days during which the tick takes three blood meals. It can change cattle during this phase when there is close contact between the animals. However, this rarely occurs.

2.1 Parasitic Phase

The three stages, larval, pupal, and adult, last approximately 7 days each. A blood meal is taken during each phase.

At the end of the cycle, the engorged female drops from the bovine in the early hours of the morning and enters the free phase.

The duration of the parasitic phase is almost constant and independent of climatic phenomena. The cycle is slightly extended if the animal has high resistance to ticks (e.g. zebu cattle).

2.2 Free Phase

The engorged female seeks a suitable location for egg laying: a humid microclimatic environment, generally at the base of a clump of grass or a shrub. Several stages can be described:

- Prelaying: 2 to 6 days.

- Laying: 2 to 10 days, one female produces 2000 to 4000 eggs; this occurs only at a temperature above 15 degrees celsius.

- Incubation: 14 to 100 days. A temperature lower than 10 degrees celsius inhibits embryonal development (this does not occur in the Guianas).

- Hatching: the period between the fall of the female to hatching lasts from 18 to 120 days.

- Search for a host: the larvae climb onto the blades of grass and form clusters, usually shaded from the sun. They remain dormant there, until a host passes, to which they attach themselves in clusters. Therefore, infestation is generally massive.

The infestation capability increases between hatching and the 25th day, then decreases slowly. The total duration of survival of the larvae in the pasture varies from 20 to 240 days according to prevailing climatic and microclimatic conditions. Survival is particularly favoured by shade and humidity.

Note: *In man, parasite implantation is very disagreeable since the larval infestation gives rise to irritation and itching, generally at the waist. This phenomenon is transient, for the Boophilus does not manage to implant in man, unlike Rhipicephalus and Amblyomma.*

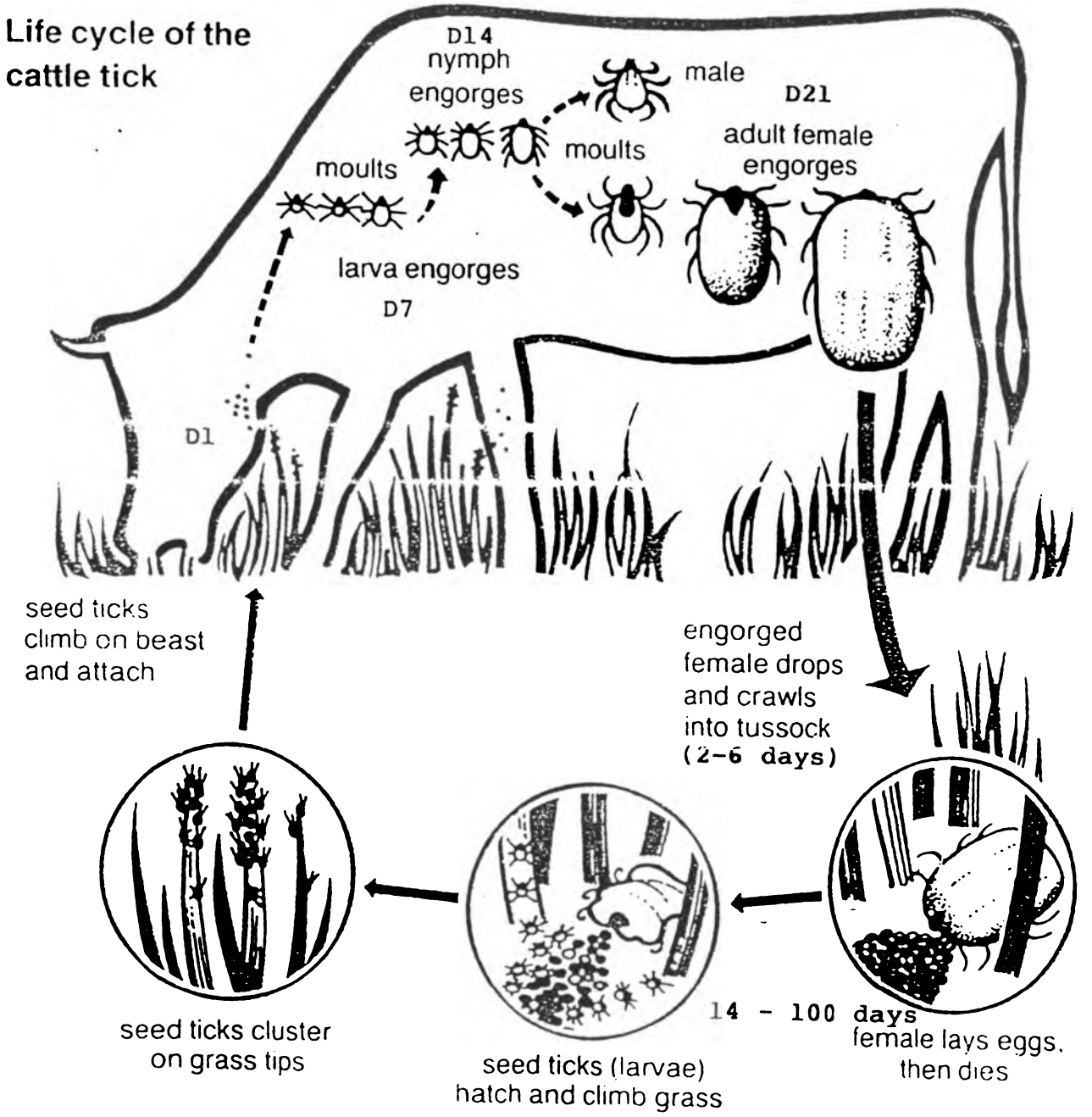
2.3 Complete Cycle

In total, a period of 20 to 300 days may elapse between dropping of the female and death of the larvae from lack of sustenance. The average duration is 50 to 70 days. A complete cycle may then unfold in 40 to 320 days, with an average of 50 to 70 days.

In French Guiana, temperature is never a factor limiting the proliferation of ticks. Only low humidity can play a role at the microclimatic level, inhibiting the free phase of the parasite. Larvae are relatively sensitive to desiccation.

Life Cycle of Female Boophilus microplus[1]

<—Parasitic phase: 21 days—>



Waiting Phase
<—20 to 240 days—>

Development phase
<—18 to 120 days—>

<—Free Phase: 20 to 300 days—>

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[1]Source: Davidson, S.: Towards a vaccine for the cattle tick, *Rural Research*, 128

3. PATHOLOGY AND IMMUNITY

The pathology induced by ticks is due to bites (mechanical action), the injection of saliva, and the extraction of blood.

3.1 Bites

After 1 to 2 days on the host, the larva attaches itself and consumes its blood meal: the same occurs at each phase.

The results of skin perforation include:

* pain;
* itching;
* damage to hide;
* possible secondary infections: myasis, common or specific bacterial infections (dermatophilosis).

3.2 Injection of Saliva

During the meal, blood sucking and injection of the saliva regularly take place in succession. Without salivary injection, the blood would coagulate in the buccal structures of the parasite. Tick saliva also increases blood flow to the location of the break in the skin.

The injection of saliva causes:

* cutaneous irritation (hyperemic factors)
* cutaneous allergy to salivary antigens;
* inoculation of microorganisms, including *Anaplasma, Babesia*
* *Anaplasma*: transstadial transmission with multiplication of the rickettsia in the digestive tube and the excretory apparatus of the tick larva or nymph then reinoculation by saliva of the nymph or adult. Alternatively, the bite lesion may become contaminated by tick excreta during tick feeding. The tick thus plays a major role in the multiplication of the parasite and a minor role in its dissemination within a herd. Mechanical transmission is also possible by change of host during the cycle but this is very rare.
* *Babesia*: transovarian transmission, in which multiplication of the organism occurs in the salivary glands of the adult tick which transmits this infection to the eggs. Reinoculation of the organism is effected by the tick larvae during their first blood meal. In this case, multiplication and the dissemination of the organism are dependent on the tick. Mechanical transmission is also possible.

Mechanical transmission of hemoparasites is relatively rare with *Boophilus microplus* for it rarely changes host in the course of its cycle. The horsefly is mainly responsible for the passive transmission of the hemoparasites and dissemination within herds. Accidental transmission is also possible via needles, which has occurred during routine herd deworming.

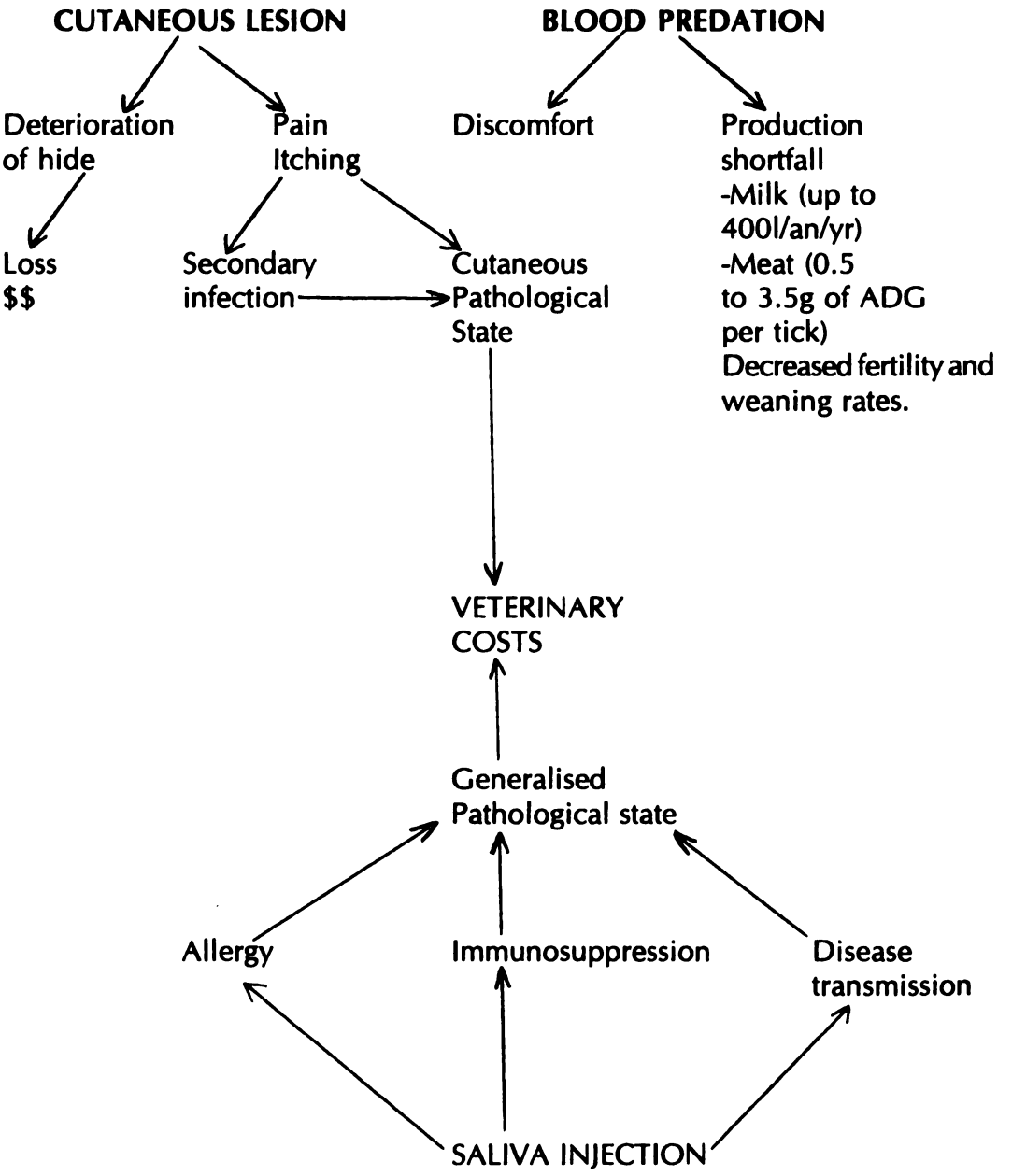
3.3 Blood Predation

During the ingestion of blood, there is:

* Direct predation: blood is concentrated and serum reexcreted with the saliva. The quantity extracted is three times greater than the volume of the engorged female. A bovine can become anemic from tick predation alone.

* Tick infection by the hemoparasites present in the bovine blood initiating its role of passive vector, (dissemination of the organism), or of active vector (multiplication +/- dissemination of the organism), at the end of which the tick becomes hyperinfective (*Anaplasmosis* and *Babesiosis*)

3.4 Summary: Pathology and Consequences



3.5 Immunity

3.5.1 Against Ticks

When the tick population is not excessive, a balance is achieved between cattle resistance to ticks and the tick population. The inoculation of tick salivary antigens induces partial immunization of cattle. The cutaneous allergic reaction inhibits the bite, and some ticks are unable to complete their cycle. This phenomenon is marked in zebus, less significant in Jerseys, and weak among the other European breeds. It is therefore advisable to raise resistant cattle breeds in infested areas. In existing herds, breeders can select the most resistant animals by eliminating heavily tick-laden bovines. Therefore, it is useful to note the number of ticks on each individual animal. This can be done before the removal of ticks, by assigning a grade of 1 to 3 according to the number of parasites observed.

3.5.2 Against Hemoparasites:

The low grade circulation of *Anaplasma* and *Babesia* ensures that these diseases are never totally absent from the herds. The animals constantly exposed to these organisms develop some immunity and thus acquire a certain resistance to these diseases. It has been demonstrated that a level of parasites of approximately 7-10 *Boophilus* females per bovine is necessary to maintain this immunity.

Thus, the dairy herds of French Guiana are rarely affected by Babesiosis because the tick burden remains significant.

On the other hand, the total absence of ticks over a long period produces a loss of immunity to these various organisms. When the disease resurfaces, the whole herd is then susceptible and the consequences are much more severe than in constantly infested environments. This phenomenon is the cause of acute Babesiosis cases found in zebu herds in French Guiana, Suriname and Guyana.

Tick control should be undertaken with caution. It is not only useless but dangerous to eliminate almost all ticks in a herd over several months because this will create a loss of the immunity against both hemoparasites and ticks.

Eradication methods can be undertaken only in the case of completely isolated herds, free of all hemoparasites that do not introduce new cattle. These conditions are very rare.

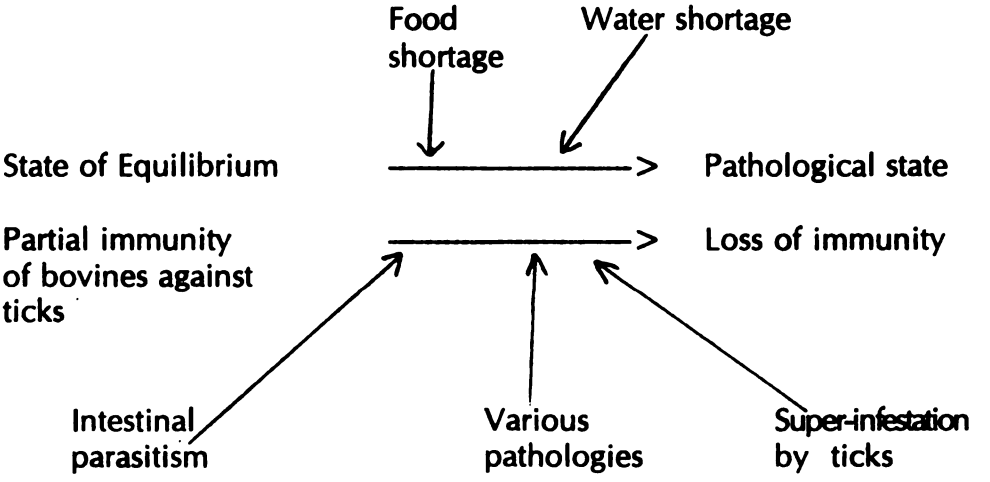
3.5.3 General Immunity

The tick also inoculates immunosuppressant factors which change the foregoing reaction. The host resistance may be weakened by:

* harsh climate;
* overburden of ticks;
* food insufficiency;
* other disease.

When a loss of the host/parasite equilibrium occurs, a proliferation of ticks results, causing simultaneous resurgence of all the parasitoses. Therefore, cattle should be regularly treated with anthelmintics at the rate of three treatments per year for zebus and four for European breeds of cattle, particularly dairy breeds

3.5.4 Summary



3.5.5 Conclusion:

- Choose a breed resistant to ticks and hemoparasites;
- Select the most resistant animals in the herd;
- Guarantee adequate supplies of food and water;
- Avoid mineral deficiency by use of appropriate supplements;
- Control concomitant hemoparasitic diseases, and intestinal parasitism;
- Maintain low-grade controlled infestation, to avoid outbreaks of ticks and tick borne diseases (*Anaplasma and Babesia*).

4. CONTROL DURING THE FREE PHASE

It is important to practice tick control during the free phase because acaricide treatments have limited effectiveness during long term heavy infestations. We will review the various parameters, controllable or not, which affect the infestation capability of the pastures.

4.1 Predators

Engorged ticks may be destroyed by predators, both wild and domestic.

- wild: ants, wild birds,
- domestic: usually chickens.

To promote this phenomenon, access of hens to an enclosure with a soft surface can be facilitated. This could be adapted as a management practice on the farm.

4.2 Destruction of Natural Habitats

Pasture development consists of clearing access to pools and streams and removing the underbrush from the animal rest areas. Most shady and wet areas in the pasture should be eliminated. One single shady refuge and access to a single watering point are necessary to provide shelter and water for the animals.

Shrubs in the pasture should be removed, either mechanically or manually. It is best to burn this refuse on the spot as fire is one of the methods of cleansing pastures.

In the case of more prolonged use of fire, precautions should be taken against loss of fertilizing soil elements by wind or heavy rains. The ideal is to build discrete fires limited to bushy areas after manual clearing (particularly for *Mimosa pudica*).

This method will have the advantages of controlling adventitious growth, fertilizing the soil and reducing sheltered areas for ticks. The results are better than those obtained by the use of herbicides.

Shaded areas should be eliminated as far as possible. Sun and dry conditions are excellent means of combatting ticks. It is desirable to take maximum advantage of the dry season, to cleanse the pastures as much as possible at least once per year.

A sufficiently dense pasture is desirable to maintain a short vegetal layer; low humidity is deadly to tick larvae and engorged females. This should not however be excessive, for food insufficiency would also have disastrous consequences to cattle. Mowing would serve this purpose very well.

4.3 Cultivation

Ploughing is the ideal method for cleansing a pasture. It eliminates all tick habitats for up to 4 to 6 months during which cleansing is almost complete.

4.4 Pasture Rotation

This alone would be sufficient if land shortage did not limit its use. Allowing the parasites to die on the spot would be a very simple control method.

Generally, a "rest period of" 3 to 5 months allows for cleansing 80% of a pasture. This control method should be used as much as possible. Unfortunately, land shortage generally constrains the use of rotations. Grazing interruptions should remain in effect for as long as possible.

Compromise solutions can be proposed such as:

* Control by pasture rotation during part of the year, and by acaricides during the other part;

* Making forage banks (haystacks) that are stored for 3 to 5 months before use;

* Silage making

4.5 Removal of Larvae

4.5.1 Artificial

This collection method may be implemented by dragging a "flag" behind a horse. It can be made of fabric or animal skin soaked with an acaricide. One can then cleanse a pasture before introducing cattle into it. This method would be useful in French Guiana where pasture rotation has little applicability to tick control.

4.5.2 Natural

One particular method can be used in the control of *Boophilus microplus* as this tick is ill-adapted to other livestock species. It involves having sheep graze or trample the pasture for a brief period. The larvae attach themselves temporarily to these animals who are then removed from the pasture and do not suffer to any extent from parasitic attacks of the *Boophilus microplus*. Goats may also be used; they have the double advantage of removing ticks and consuming the weed *Mimosa pudica*.

4.6 Other Methods

4.6.1 Pasture Dressing with Acaricides

This is costly and a source of pollution but can be used in cattle rest areas or confined areas with frequent circulation of animals such as corrals and paddocks. The same products can be utilized as for the treatment of bovines or for agricultural use. It is possible to use chemicals left over from insecticide dips or sprays on the pasture.

4.6.2 Fire

This will be used with very great care and in conjunction with pasture management. Fire should be considered as a last resort method of cleansing of pastures.

5. CHEMICAL CONTROL METHODS DURING THE PARASITE PHASE

Acaricide treatment is presently the most commonly used control method for livestock ticks. Various methods and acaricides are available; a strategy must be developed to optimise the effects and reduce the cost of treatment.

5.1 Choice of Method

This will be a function of the number of cattle, their mobility and the general level of infestation.

5.1.1 Acaricide Dip

This requires a considerable investment and is adapted only to relatively large herds; it is generally considered not economical below 500 head. If well maintained, it can be used more than 18 times per year for a herd of 500 to 800 head.

Since no precise dosage can be administered, the dip must be maintained and monitored to ensure that it does not become toxic or ineffective. This includes measuring dosage, refilling chemicals, preventing both mud contamination and dilution by rain.

We stress the importance of planning and maintenance of the dip tanks in order to optimize their efficacy. One must consider:

- approaches on hard ground
- acaricide foot bath
- roof
- dip tank size sufficient for total immersion
- regular assessment of mud levels to determine optimum discard time.

This control method can be applied to horseflies; the use of a dip would differ from the guidelines presented above, because the treatment frequency would be increased during peak season for Tabanids.

5.1.2 Acaricide Spray

This is useful for small and medium size herds. The dosage and cleanliness are optimised if the treatment liquids are not utilized more than once. Otherwise, it is advisable to control the quantity of mud which reduces the potency of the acaricide, dilutes it, and may block the pump. It should be noted that spraying is sometimes inadequate whether due to partial obstruction of the tubing, or to the rapid rate of passage of the animals.

If the treatment is administered using a manual sprayer, human fatigue or negligence may cause the method to fail.

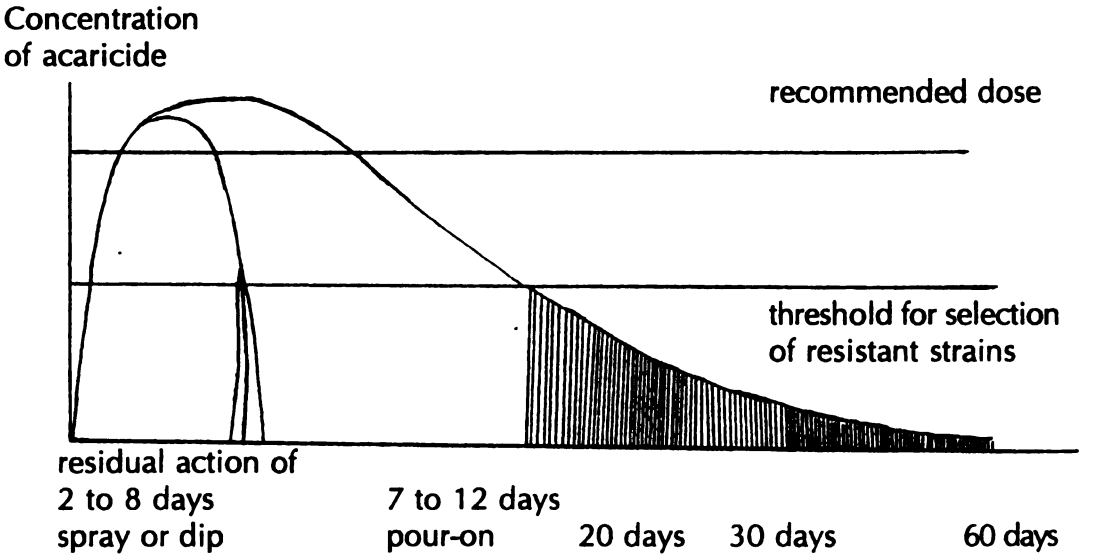
Spraying is still the best treatment method for herds of less than 500 head. This treatment is recommended for both ticks and horseflies.

5.1.3 Pour-on

This method is effective and easy to use, but expensive. However, the observed residual action is often less than that claimed by the manufacturer. The use of Butox pour-on has been disappointing in French Guiana (J. FAVRE, personal communication). Other preparations will be tested in French Guiana.

It is noteworthy that pour-ons must be applied regularly during the whole year. If not, they facilitate the development of resistant strains. In fact the slow withdrawal of acaricide creates a period during which the ticks encounter a reduced toxicity. The more resistant among them survive and produce even more resistant generations.

A pour-on effective for a period of 20 days would be followed by a period of under dosage of about 40 days as shown by the following graph:



periods of under dosage during which there is selection for resistant ticks.

5.1.4 Results

There are pitfalls, whatever the method used. An acaricide treatment usually reaches no more than 80 to 90% of the parasite population. There is often inadequate treatment application around the ears, the brisket, and medial surface of the thighs. Moreover, in the long term, the development of resistance is inevitable.

Acaricide treatment must not be considered the best nor the only method of tick control.

5.2. Choice of Acaricide

5.2.1 Resistance

F.A.O. test No. 7 allows the evaluation of tick resistance to various acaricides. Engorged females are collected from the herd (without any treatment so that they are not already intoxicated) and tested in the laboratory.

According to the results, a choice is made of the class of acaricide to use and the recommended dose.

The F.A.O. provides a diagnostic kit for tick resistance to acaricides. A less reliable test could also be performed by individuals using ticks from livestock farms and acaricide liquid treatments.

5.2.2 Rotation of Products

Several strategies may be used: either (a) exhaust the efficacy of the chemicals one after another, as in Australia or (b) change products regularly without knowing the exact state of resistance of the ticks. The latter is the case in French Guiana where the choice of acaricide is dictated by fluctuating supply. At the present time in French Guiana, products easily found include Butox (deltamethrine) and Asuntol (coumaphos) for use in dips or in sprays. Other products are being tested.

5.2.2.1 Organophosphates and Carbamates

Several sub-classes can be utilised, as their cross resistance is weak. The cost is low. The residual action is very poor therefore, the interval between treatments for *Boophilus* control is 21 days. One of the following products could be substituted for Asuntol depending on availability.

- Bromophos-ethyl and chlorfenvinphos: NEXAGAN'S Supona Shell
- Promacyl (carbamate): PROMICID

-	Carbaryl (wettable powder)	CARVIN, Ectigal, SEVIN
-	Chlorpyrifos:	DURSBAN
-	Diethion: (used in French Guiana)	RHODIACIDE, Rhodocede

The organophosphates and carbamates are extremely toxic for mammals, hence for man (the handler), companion animals (risk of ingestion), and cattle (intoxication by accidental ingestion or through skin wounds or lesions causing absorption of products.

Intoxication may cause convulsions and death.

5.2.2.2 Amidines

The products in question are cymiazole and amitraz, which are moderately expensive.

-	Amitraz:	TRIATOX
-	Cymiazole:	TIFATOL 300

5.2.2.3 Pyrethrinoids

Together they have only one type of resistance which is crossed with that of DDT. This contra-indicates the use of pyrethrins where strong resistance to DDT has been found. Residual effect of the preparations currently available on the market is around 7 days. The recommended treatment interval is 28 days. The cost of the pyrethrins is their principal drawback.

-	Deltamethrine	BUTOX
-	Flumethrine	BAYTICOL 6%

The efficacy of these products in dips or in sprays has been well proven.

The efficacy of "Pour-on" preparations is being studied in French Guiana.

The amidines and the pyrethrinoids are highly toxic for cold blooded animals. One should particularly remember fish when treatment liquids are being discarded.

5.2.2.4 Ivermectin

The acaricide activity of this product is very brief (a few hours) but there is no known specific resistance to it as seen for other classes of acaricides. Certain producers claim that the efficacy diminishes with repeated treatments. However, there is no evidence in the scientific literature.

Ivomec is not designed for use as an acaricide. Therefore, its cost is rather prohibitive. However, its use as a dewormer can however permit an acaricide treatment to be avoided.

NOTE: *In every case precautions will have to be taken when storing products to prevent deterioration and inactivation of the acaricide. (notably storage temperature).*

5.3 Applications

5.3.1 Introduction of New Cattle into a Herd

It is of paramount importance to treat newly-introduced animals because they can:

* introduce acaricide resistant strains of ticks, from the herd of origin.

* introduce contaminated ticks, carriers of Anaplasmae or Babesiae.

* contaminate cattle in direct contact, by shedding ticks.

Treatment should be carried out with a product with no known resistance. The ideal is to use Ivomec since the introduction of intestinal parasites will be prevented. To be on the safe side, we should also apply an individual spray treatment with a pyrethrin or organophosphate.

5.3.2 Interruption of a Significant Parasite Cycle

At certain times of the year, the parasite burden is so heavy that it is dangerous to await the end of the theoretical 21 days of the parasite cycle before treatment. It may become necessary to apply treatments at an interval of 15 or even 8 days under these conditions. In this case, we may refer to therapeutic treatment.

In a zebu herd this type of intervention is not necessary except in the case of management failure.

In European dairy herds, its use is essential.

5.3.3 Preventive Treatments

It is recommended to administer such treatments regularly every 21 days, from 2 months before to 2 months after the period of heavy tick infestation, if this occurs at regular intervals.

In the case where tick activity is unpredictable, as in French Guiana, treatment should be applied as soon as the infestation is deemed serious, i.e. above 40 engorged females per half-bovine, (see section 6-3), or when there is a change of pasture.

One must generally differentiate between tick control in a dairy herd with animals sensitive to ticks and control in a zebu herd. Dairy cattle must be treated on a regular basis with a product such as Butox dip or spray. In a zebu herd, treatments can be done sporadically with Asuntol dip or spray. Finally, in crossbred herds (Zebu X European) and creole animals, occasional treatments can be applied with Butox when the tick burden justifies it, (i.e. burden > 40 engorged females per half-animal), which is rare.

6. RECOMMENDED PLAN OF ACTION

6.1 Introduction of Animals into the Herd

It is advisable to isolate the animals from the time of their arrival and to treat them with Ivomec before putting them in contact with the herd. If they are tick carriers, one should proceed with an acaricide dip or spray treatment.

One should ensure that they are effectively free of ticks before pasturing.

6.2 Choice, Maintenance and Control of Acaricide Treatment

The choice of the treatment method, and construction of the spray race or dip tank must be based on the size of herd, usual frequency of treatments, general herd management, distance from the pastures etc.

With respect to selection and maintenance of the treatment material, the livestock producers should share their experiences. There should be monitoring of mud levels in the acaricide dip to permit better follow-up and to indicate the need for emptying the dip tank.

6.3 Evaluation of the Infestation Level of Cattle

A count is taken of the number of engorged *Boophilus* females present on a half-animal, (i.e. the side visible in the chute or pen). It is important to pay strict attention to the following areas: ears, dewlaps, axillae, inner surface of thighs, base of the tail.

If the total count exceeds 40 engorged females per half-animal, a therapeutic acaricide treatment is indicated. With a little practice one can quickly count the engorged females of more than 5mm in length.

6.4 Evaluation of the Infestation Level of a Pasture

The *Boophilus* larvae can be collected with a 'flag'. According to the number of larvae attached to it and the surface covered by the test, one can derive a good estimate of the infestation potential of the pasture.

This technique can be effectively utilised to determine the optimum 'rest period' for pastures in a rotational grazing system.

6.5 Treatment Recommendations for Cattle

Therapeutic:

- When the number of engorged females per half-animal exceeds 40.

Preventive for European Breeds of Cattle:

- Before pasturing,
- Between the fifteenth and the twentieth day after pasturing;
- In the case of very brief stays on small plots of ground, treatment should be given every 21 days during tick season without considering entry and exits from pastures.

6.6 Pasture Treatment

Fire can be utilised when it is integrated into pasture management.

Deinfestation of a pasture can be achieved by a brief grazing stay of sheep or goats on the plot.

Collection of larvae by dragging bovine skin impregnated with acaricide over the pasture may be done not only to sample, but also as a treatment.

7. VACCINATION OF CATTLE AGAINST TICKS

Since 1985, research into immunisation of livestock against the intestinal antigens of *Boophilus microplus* has been carried out, by CSIRO in Brisbane, Australia, and in other countries with other ticks.

The principle is to induce antibody production in cattle against tick intestinal epithelial cell antigens. These antibodies circulate in the blood, then are absorbed with the ticks' blood meal and can produce digestive disturbances in the parasite.

This model is very effective. The antibodies produced by certain cell surface antigens, in combination with complimentary factors, have a lytic action on tick intestinal cells. Ticks fed on immunised bovines acquire severe digestive disturbances with ruptures of the digestive tracts and extrusion into the abdominal cavity. The liberation of bovine white blood cells has a lytic effect on digestive, excretory and reproductive organs in the tick.

If vaccine production from tick intestines was successful under experimental conditions, commercial production will require genetic engineering of antigens. This has been achieved by CSIRO and the first commercial vaccines should soon be available.

A team of Cuban researchers has recently announced production of a similar vaccine and vaccine trials are underway.

CIRAD-EMVT would like to obtain tick vaccine from these researchers to conduct clinical trials on European breed cattle in French Guiana and possibly Guyana and Suriname.

A priori, this control method appears ideal for production of European breed cattle in tropical areas. Tropical animal husbandry could be greatly facilitated in the near future, depending on vaccine trial results, particularly the destruction rate of ticks and duration of activity of the vaccine.

7.1 Conclusions

In Zebu and Zebu cross herds, ticks do not pose a serious problem. Clinical signs due to ticks or hemoparasites are not usually observed, because all animals are carriers of ticks and hemoparasites. We observe a balance with gradual immunisation of animals from birth by colostrum and natural infection. The young animals are not susceptible to hemoparasites; these primary infections are asymptomatic.

Control methods for *Boophilus microplus* in the Guianas are most important to producers of European breeds of cattle. The significance lies in the direct effect of the ectoparasite as well as its role as a vector and reservoir for hemoparasites.

In areas where the cattle tick is established, it is impossible to raise *Bos taurus* without raising *Boophilus microplus*! Because it is impossible to raise European breed cattle without tropical disease problems, the producers must adapt their management practices to minimise the effects of these diseases, particularly the tick-borne hemoparasites.

For European breeds, we recommend a preventive program directed against both ticks and hemoparasites, to control the number of ticks on livestock but maintaining a regular, mild tick infestation (<40 per half bovine),to stimulate natural immunity of cattle against hemoparasites.

Control methods against ticks and hemoparasites should only be applied when the tick infestation is severe, by spraying cattle with acaricide and injecting imidocarb, (a drug treatment for Babesia and Anaplasma), at a dosage of 1.6 mg/100kg of Carbesia. The acaricide treatment can be repeated when the infestation becomes significant again. The imidocarb cannot be repeated before one month. It must be remembered that if tick control treatments are excessive, this will result in a breakdown of immunity against hemoparasites.

In suspected clinical cases of hemoparasites, blood samples should be taken in anticoagulant for microscopic examination of stained blood smears:

- For Anaplasmosis, if parasitemia is severe, treatment with tetracycline or imidocarb is indicated.

- For Babesiosis, if parasites are found on stained blood smears, even in small numbers, treatment with imidocarb is indicated (eg Carbesia 1.6 to 2.5 ml/kg).

Due to a high rate of false negatives, examination of blood smears is not sufficiently sensitive to discover the infection rate of a herd. If serological diagnosis of hemoparasites is available, the infection rate of European breed cattle can be regularly followed over time. A seroprevalence rate of greater than 70 or 80% in a herd of adult bovines indicates acceptable herd immunity. Otherwise, breakdowns of immunity should be expected, with concomitant risk of clinical cases.

8. REFERENCES

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