

## INTEGRATE CONTROL OF *BOOPHILUS MICROPLUS* IN CATTLE

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### INTRODUCTION

The well-publicized global human population growth will result in increased world food demands. World food production may have to increase considerably to keep pace with this population growth. One major demand will be for beef and milk, and this will put existing farming systems under great pressure to increase productivity. However, on one side the potential for increasing grazing lands is constrained by the lack of suitable land in many regions, and on the other side increased livestock production on the existing land will result in problems of overgrazing, soil erosion and other environmental degradation. Therefore, the increased need for production must come from better livestock productivity, i.e. better disease control, genetic selection of high producing animals and optimal feeding. Superimposed on this is the requirement to make livestock products cheaply available and free from residues. As parasitologists, we have a continuing commitment to try to improve parasite control; it is of great importance that we integrate parasite control within the general scope of disease control and the increased need for animal production.

Tick and tick-borne diseases are an important cause of losses to the livestock industry, in particular the production of cattle and small ruminants in tropical and subtropical areas. World-wide losses due to the diseases transmitted by ticks is principal due to the ability to transmit a wide spectrum of pathogenic microorganisms, such as protozoan diseases (babesiosis) and rickettsial diseases ( anaplasmosis) are the main health and management problems of domestic cattle.

One of the most important tick with significant in certain areas is *Boophilus microplus*. The genus *Boophilus spp* contains only five species of small ticks, all of which are one-host ticks and takes approximately three weeks to complete their blood meal, preferably on cattle. *B. microplus* is the most important species. Originating from South-East Asia, this species has spread to countries of East and Southern Africa, and South and Central and North America (only Mexico) *B. annulatus* has been introduced into Mexico on livestock, subsequently spreading into much the southern United States of America (USA), before being successfully eradicated, together with *B. microplus*.

In recent years, there have been excellent reviews, on the control of ticks in cattle, and their epidemiological background. Therefore, we have chosen to discuss this subject by trying to answer some questions which we think are relevant:

- 1.- Based on the distribution of cattle worldwide, what are the target parasites and which (integrated) control system has been implemented?
- 2.- Until now control, has been based mainly on the use of acaricides. Novel acaricide delivery systems and user-friendly methods of administration have become available. Is there a real need for a change?
- 3.- What are the non-chemicals prospects for control? A neglected subject or a waste of time?
4. Who will develop and implement integrated control systems? Who will evolve in the transfer information to the producers?
5. Has a parasite control been efficient and can/need it be changed?

6. - How can we integrated tick control in the general design of diseases control?

The overall observations of the present paper are particularly pertinent, though rarely stated: safe highly effective acaricide exist to treat cattle against ticks. Do we need to concentrate our research more on the proper use of these acaricides, or do we have to invest more in the development of non-chemical control?

**WORLDWIDE APPROACH ON THE CONTROL OF CATTLE TICKS**

The total cattle population has been estimated to be approximately 1.3 billion, of which almost 18% are dairy cattle. The farming systems in most regions area characterized mainly by being extensive with traditional small holding and nomadic pastoralism, the availability of poor pasture land and/or arid climates: few epidemiological studies on tick infections has been conducted in this regions and, consequently, the development of control programmes has been impeded. In some other regions of the world, cattle production and the approach to tick control rely on (1) type of production: dairy or beef cattle; (2) climate: temperate to tropical; (3) management involving housing and/or pastures: and (4) tick species involved. Overall review on tick control practices in particular countries and under particular conditions are very scarce (Jongejan and Uilenberg, 1994).

**CAN WE CONTINUE TO RELY ON ACARICIDE ALONE?**

The control of cattle ticks, which at the present relies on acaricide treatment, is effective if properly used and there is, for the moments in some places no apparent need for change. Eradication of ticks is generally no feasible, except on islands. Acaricide resistance is perhaps one of the main reasons for the failure to control *B. microplus* where intensive control is established. The control of ticks depend mainly on intensive tick control using acaricides and this chemicals are sometimes toxic, leaves residues in meat and milk, and cause environmental pollution. Moreover, acaricides are costly and require expenditure in foreign currency, thus constituting a major economic strain on the development of the livestock industry, particularly in developing countries. Finally, the resistance of ticks to acaricides poses and increasing threat to livestock production.

**NON-CHEMICAL PROSPECTS FOR CONTROL: NEGLECTED SUBJECT OR WASTE OF TIME**

There are several prospects for non-chemical control tick control but this no intend an exhaustive review but rather as an outline of the present status and prospects:

*Exploiting breed resistance*

The development of cattle lines or breeds with enhanced, genetically based disease resistance is a specially attractive prospect (De Castro and Newson, 1993). Good examples of exploiting genetic resistance to livestock diseases in general, and parasites in particular, have been described for resistance of *B. indicus* to cattle ticks. Advances in molecular genetics should offer opportunities for identifying markers for parasite resistance which would hasten progress in selecting for resistance, however, research on this aspect is still in its infancy (Frisch, 1999).

## MANAGEMENT AND/OR PRODUCTION SYSTEM

A large number of recommendations on how to control levels of parasitism through management practices, mostly in combination with tick treatment has been made. Examples are pasture resting, mowing, reducing livestock density, stock rotation onto clean pastures and alternating grazing between animals. The main objective is to reduce or even eliminate acaricides (Suthers et al 1979). However, it is obvious that a great deal of work needs to be done to gauge the applicability of most of the proposed practices and to fully adapt them to different regions in each country. The main weakness of many grazing management proposals is the fact that livestock owners consider them as too complex, time and effort consuming and, maybe of greatest importance, they are often not adapted to local grass availability and climatic conditions, and they usually do not fit in with the farm management.

## BIOLOGICAL METHODS

In recent years, intense research activity has been focused on the potential of biological control of cattle ticks by destroying fungus *Metharizium anisoplae*, but this has been done in laboratory conditions. The future of biological products depends on the interest of the pharmaceutical industry and the price, which should be competitive with acaricides (Onofre et al., 2001). Also some legumenes such as *Stylosanthes* has been used as biological control of ticks (Fernandez et al., 1999).

## VACCINATION

Vaccination is still the most desirable means of combating infectious agents. The fact that vaccines are potentially safe, cheaper and more efficacious as prophylactic than acaricides is based mainly in our experience to date with anti-microbial vaccines.

The development of an anti-tick vaccine against *B. microplus* is a major new approach in the control of ticks. This type of vaccination makes use of tick gut antigens, rather than salivary antigens, as the target for immune response. This approach has already demonstrated to work in principle by Allen and Humphreys (1979), who succeeded in inducing immunity against *D. Andersoni* in guinea-pigs and cattle, using extract of the midgut and reproductive organs of the adult ticks. Agbede and Kemp (1986) were able to immunize cattle against *B. microplus* using extracts derived from the internal organs of the adult female ticks. They showed that this immunity was not mediated by a hypersensitivity reaction, that vaccination caused death of adults rather than larvae, and that many of these ticks had gut damage. It was concluded that these antigens normally located on the plasma membranes of the tick gut cells using in this type of vaccination, were concealed from the host immune response.

The immunity induced with these antigens appears to be based on specific action of host immunoglobulins resulting in damage of the tick gut during feeding. Recombinant DNA technology provided a breakthrough in the production of sufficient amount of the relevant protein (Bm86) (Willadsen et al., 1995). Confirmation of the success and economic viability of this vaccine would considerably raise the hopes of obtaining similar vaccines for use in future integrated programmes against other species of ticks and tick-borne diseases. Biological control of ticks using anti-tick vaccines should reduce the reliance on acaricides and allows more widespread exploitation of tick-susceptible cattle (Redondo et al 1999).

## CONCLUSIONS

On the question “Non-chemical control: a neglected subject or a waste of time?”, the answer is both!. It is a neglected subject where little progress has been made because interest by the scientific world has not always focused on the priorities. A non-chemical control systems can only “survive” if it is applicable in practice. In the search for a new or improved control systems, it is notable that the priorities dominated much more by the interest of certain research institutes than by priority in the field.

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