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Assessing Accomplishments since the first Symposium in Grenada (2003)
and Coping with Current Threats to the Region**

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TROPICAL BONT TICK SURVEILLANCE AND CONTROL IN THE CARIBBEAN: HOW RESEARCH OUTPUTS CAN HELP DECISIONS

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INTRODUCTION

Tropical Bont Tick in the Caribbean: Spread and Eradication Efforts

The Tropical Bont Tick (TBT) *Amblyomma variegatum* represents a major constraint for the development of livestock in the Caribbean and in Africa. Indeed, this tick induces blood spooliation and provokes skin infection or abscesses on the site of attachment. It is also responsible for the transmission of *Ehrlichia ruminantium*, a bacteria responsible for heartwater which is a fatal disease of ruminants. In addition, TBT favors the development of the acute form of dermatophilosis, a skin disease caused by the bacteria *Dermatophilosis congolensis*. The tick was first introduced in the Caribbean in the nineteenth century, and now threatens North America. However, heartwater has been diagnosed only in Guadeloupe (including Marie Galante) and Antigua, and *E. ruminantium* has not been identified elsewhere in the Caribbean (Vachierey et al. 2008; Molia et al. 2008).

While the tick was restricted to three Caribbean islands until the 1960s (Guadeloupe, Antigua and Martinique), TBT infested 18 Caribbean islands by the end of the 1980s, from Barbados (southern limit) to Puerto Rico (northern limit) (Barré et al. 1987). This rapid spread coincided with the recent introduction and dissemination of cattle egrets (*Bulbucus ibis*) in the region. Indeed, these birds live in close contact with ruminants and are believed to be partly responsible for the TBT spread by transporting immature stages (Uilenberg 1990; Corn et al. 1993). In the mid-1990s, two eradication programs were launched: the Caribbean Amblyomma Programme (CAP) in the 10 islands of the English Lesser Antilles in 1994 (Pegram, De Castro, and Wilson 1998), and POSEIDOM in the two French islands in 1995 (Barré et al. 1996). There were heterogeneous results concerning TBT eradication. When the programmes stopped (2005–2006), TBT was eliminated from eight islands (St. Lucia, St. Kitts, Montserrat, Anguilla, Dominica,

Barbados, St. Vincent and the Grenadines, and US Virgin Islands), and the level of infestation was slightly to highly reduced in five islands (Guadeloupe, Martinique, Nevis, Antigua, and St. Maarten). Later, ticks were rediscovered in some free islands and eliminated (St. Croix, St. Vincent, and the Grenadines), and three islands considered TBT-free were re-infested (St. Lucia, Dominica, and St. Kitts). The origin of island reinfestation is unknown and we cannot tell whether the new TBT focus in these countries originates from a residual and undetected population or whether it was introduced from infested islands.

Since 2004, it has been recognized that TBT eradication cannot be achieved in the Caribbean because of funding, socio-political, and ecological reasons (Pegram et al. 2002; Pegram et al. 2004; Anonymous 2004). Therefore, new surveillance and control strategies need to be defined, along with the recommendation to move toward a strategy of TBT control in the islands (Anonymous 2004).

From CAP to the Caribbean Animal Health Network

The Caribbean Amblyomma Programme (CAP), as a regional CARICOM programme, mainly implemented by FAO, provided strong technical support to the countries. During CAP, trainings were organized (e.g., tick identification and biology, how to monitor the eradication progress), materials for public information and awareness campaigns as well as acaricides were delivered to the participant countries, and a common database (TickINFO) was developed. The programme also ensured the coordination of surveillance activities and provided technical and scientific advice on surveillance and control strategies. As a result, the veterinary services of the islands involved in the programme collaborated with technical experts and funding agencies as a region to combat animal diseases. This largely contributed to the Caribbean animal health network, CaribVET, which is recognized by the COTED (CARICOM). CaribVET is a collaborative network involving veterinary services and diagnostic laboratories of 32 Caribbean countries and territories, research institutes, and regional/international organizations (Gongora et al. 2008; Dufour and Hendrikx 2011). Given the economic impacts and the risk of TBT spreading throughout the region, the CaribVET Steering Committee recognized TBT and its associated diseases as a regional priority. There are six CaribVET working groups, one of which is dedicated to ticks and tick-borne diseases (T&TBDs). This group provides regional expertise on T&TBDs for harmonized regional diseases surveillance and diagnosis and for control protocols and strategies, and is responsible for the regional communication system/data management.

TBT Research and Expertise in the Caribbean

The biology and ecology of TBT and the research on heartwater in the Caribbean have been thoroughly studied by acarologists, biologists, and epidemiologists coming from Guadeloupe, Antigua, Africa, and the United States. In particular, CIRAD Guadeloupe has conducted research on TBT biology and heartwater for over 30 years in partnership with African laboratories, where both the vector and pathogen originate. The main model study of CIRAD Guadeloupe is the host-pathogen system *Amblyomma variegatum* / *Ehrlichia ruminantium*, with current research encompassing immunology, genetics, proteomics, and modeling studies.

OBJECTIVES

Most of the time, research is perceived as a complicated science far remote from reality, operational issues, and farmers' concern. This paper illustrates how ticks and tick-borne diseases in the Caribbean are researched by CaribVET to improve surveillance and control strategies implemented in the Caribbean.

METHODS AND RESULTS

The link between research, surveillance and control is an essential component of CaribVET, especially as regards TBT in the Caribbean. Indeed, data from surveillance and control programs, along with good field knowledge, enable the persons in charge of the coordination of these activities to raise specific issues and questions. These gaps in the knowledge of TBT biology, disease epidemiology, or tick response to treatment are opportunities to design relevant applied research, while benefitting surveillance (i.e., implementation of risk-based surveillance) and control (adoption of the best cost-effective strategy).

Role of the CaribVET T&TBD Working Group: Connecting Surveillance and Control with Research Stakeholders

The members of the CaribVET T&TBD working group are Caribbean specialists who are recognized for their competence and/or experience in the theme targeted by the group (CaribVET Charter 2011). Members of the group are veterinary services of islands with TBT-infestation or at-risk of infestation, farmer association representatives, tick experts from the Caribbean, and scientists from research institutes with tick expertise (i.e., CIRAD Guadeloupe and CENSA Cuba).

The group meets annually to discuss the TBT situation in every island, review the latest advances in research and surveillance, share their experiences, and identify the main gaps and constraints that prevent the full operation and success of the field work. At the end of each meeting, the group formulates recommendations for control/surveillance according to each island's infestation level and for the proper applied research to improve TBT surveillance and control. The group leader (CIRAD Guadeloupe) is in charge of coordinating the research and follow-up processes, and reporting the activities of its group to the CaribVET Steering Committee (SC). The working group uses the recommendations as a guideline for implementing future activities. This framework circulates information among the stakeholders and is favorable for the integration of field observations in defining relevant applied research.

Key Role of Laboratories in Research Development and Scientific Communication

Besides being research institutions, CIRAD Guadeloupe and CENSA Cuba are also diagnostic laboratories for T&TBDs and are involved in the national surveillance networks. As such, they are familiar with field constraints and with the objectives of surveillance and control measures implemented by their partners. In particular, because of its TBT expertise, CIRAD Guadeloupe was involved in the Caribbean Amblyomma and POSEIDOM eradication programmes, and developed tight collaborations with the French veterinary services (Guadeloupe and Martinique)

and farmer associations in charge of TBT surveillance and control. This greatly facilitates the communication of laboratories with other national surveillance network stakeholders and members of the T&TBD working group.

Applied Research Needs and the Recommendations of the T&TBD Working Group

The challenges for veterinary services and animal health partners are to reduce infestation levels in the islands where TBT is still present, to quickly identify new foci in the islands where the tick is sporadic and take appropriate control measures, to prevent TBT and heartwater spread to other Caribbean islands, and to reduce the costs of surveillance and control for the islands.

A model of the TBT population dynamics was developed in CIRAD Guadeloupe, based on the bio-ecological and bionomics data collected from the field and from laboratories in Africa and the Caribbean (Porphyre et al. [in preparation]). The model finds direct application in the framework of the T&TBD working group with, for instance, potential TBT distribution range, predicted population dynamics in several islands, and comparison of treatment efficacy.

Other research questions also were raised during T&TBD working group meetings and recommendations were made for countries/territories according to their TBT infestation or at-risk level. Detailed summaries of the meetings of the working groups are available at the CaribVET website (<http://www.caribvet.net>).

CONCLUSIONS AND PERSPECTIVES

Members of the multidisciplinary CaribVET T&TBD working group collaborate to regularly assess the current TBT situation in the Caribbean, update research advances, and propose practical recommendations for countries according their level of TBT infestation. These recommendations are made by the countries themselves, based on information from researchers and tick experts. This greatly eases the design of cost-effective and sustainable programs to be adopted and adapted at the country level.

In addition, the group recently broadened its scope to include the Common Tick, *Rhipicephalus (Boophilus) microplus*, which is very common in the Caribbean and is responsible for anaplasmosis and babesiosis transmission. This tick may have developed flumethrin resistance where Bayticol® has been intensively used for more than ten years. The CaribVet T&TBD working group is addressing acaricide resistance in the Common Tick and the evolution of anaplasmosis and babesiosis in the Caribbean. CENSA conducts research on anaplasmosis and on alternative control methods of *Boophilus sp.* In addition, work on the identification of best cost-effective strategies to control TBT will aim at preventing resistance in both ticks species.

By promoting continuous links between research and surveillance, CaribVET aims to increase the efficiency of surveillance and control of national diseases and vectors and to improve animal health in the Caribbean.

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