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OPERATIONALIZING CRISIS AS A REGIONAL INVASIVE SPECIES SAFEGUARDING
MODEL: EXPLORING MULTIPLE PLATFORM INITIATIVES

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FRENCH OVERSEAS DEPARTMENTS PEST SURVEILLANCE AND DETECTION ACTIVITIES IN THE CARIBBEAN REGION

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ABSTRACT

The French Departments of Guadeloupe and Martinique are particularly sensitive to the problem of invasive species. This problem is the responsibility of the Services and other organizations in charge of animal and plant health. These agencies have established concerted information activities and regional co-operation aimed at preventing the introduction and the control of invasive species, which could have important economic impacts on agricultural production and the ecosystems of these Departments. We report the strategy of regional co-operation and progress pertaining to some potential invasive species or species undergoing mutation, and the prospects for controlling them in the event of their introduction.

KEY WORDS: region-wide implementation, early detection and warning, environmental and sanitary risks, CaribVet, EPIVET, CISSIP, avian influenza, sugarcane diseases, Black Sigatoka and mosaic streak virus of banana (BSV), coconut lethal yellowing, begomoviruses, *Ralstonia solanacearum*

RESUME

Les départements français de Guadeloupe et de Martinique sont particulièrement sensibles au problème des espèces envahissantes. Il concerne les services et les organismes chargés de la santé animale et de la santé des végétaux. Ceux ci ont mis en place de manière concertée des activités d'information et de coopération régionale visant à contrôler l'introduction et la lutte

contre les espèces envahissantes pouvant avoir un impact économique important sur les productions agricoles et les écosystèmes de ces départements. La stratégie et l'état d'avancement des activités de coopération régionale relatives à certaines de ces espèces envahissantes potentielles ou en cours de mutation sont développés, ainsi que les perspectives de lutte en cas d'introduction.

INTRODUCTION

Prevention and rapid response in advance of or at the very onset of the environmental and sanitary risks depend upon the operation of uninterrupted and powerful early warning systems. The nature of the environmental and sanitary risks faced by Caribbean countries requires total system development - which exceeds the limits of any one country. Contagious diseases, either from humans, animals or plants, diffuse easily beyond national frontiers; in the same way, natural risks are seldom limited to only one country. A regional dimension thus seems to be the relevant scale for developing early detection and warning systems for environmental and sanitary risks.

1. Reasons for Developing Early Detection and Warning Systems

In the sanitary field, the development of the principle of precaution and the public expectation of a high level of health protection, approaching “zero risk”, justify the need for maintaining powerful early detection and warning systems. The successive crises caused by bovine spongiform encephalopathy in Europe or the contamination of food by dioxins in several localities of the world, illustrate the arousal of concern and vigilance by consumers and their demand that early detection and warning systems be developed and implemented to essentially guarantee food safety.

This concept of safety of the people has been accompanied by increased media attention to events relating to people's health, and to the protection of the environment. Such media coverage has instigated increasingly important social requirements relative to the capability of early detection and warning systems adequate to prevent or better manage these events.

2. Sanitary Early Detection and Warning Systems in the Caribbean with Special Activities Developed in the French Caribbean Islands

2.1. Sanitary Early Detection and Warning Systems

2.1.1. French Overseas Department Pest Surveillance and Detection Activities: Animal Health Control through the Caribvet Network

The frame of reference for detection and warning relevant to animal health is the World Organisation for Animal Health (International Office of Epizootics or OIE). OIE Member States are committed to urgently notify the OIE of any significant epidemiologic event, and this information is then made available in a timely manner to all Member States.

This international device supposes the existence of powerful national detection and warning systems. In the Caribbean, a regional network of animal health (CaribVET) was set up reinforce these national early detection and warning systems and to imbue them with regional

coherence by the harmonization of their procedures and the exchange of technical and medical information.

The Caribbean Animal Health Network (CaribVET) (Molia et al., 2005) is a collaborative network among veterinary services, diagnostic laboratories, research institutes, universities, farmers' associations, and regional/international organisations to improve animal health and the safety of animal products in the Caribbean. Its specific objectives are to foster communication and exchange of information between people involved in animal production and health in the Caribbean, promote collaborations and a regional approach for diseases control and emergency preparedness, develop and harmonize regional veterinary diagnostic capacities, and strengthen national epidemiosurveillance networks through training and skills building (epidemiology, risk analysis, geographic information systems (GIS), etc).

Initially CaribVET was developed to support the Caribbean Amblyomma Programme (CAP), the first regional program aimed at an animal pest in the Caribbean, and the need to adopt a regional approach to tackle animal diseases such as classical swine fever (CSF), which was reintroduced in Hispaniola in 1996-1997.

Various projects and activities coordinated by CIRAD Guadeloupe have been implemented through CaribVET in the last six years: on classical swine fever (CSF) (CAFP-EU project for the control of CSF in Hispaniola and surveillance in Bahamas, Belize and Jamaica; inter-laboratory assay for CSF diagnosis in the Greater Antilles), ticks and tick-borne diseases (scientific and technical coordination between CAP and tick control programs in the French West Indies, development of the TickINFO database, integration of CAPweb on CaribVET, training), West Nile virus (creation of a network for surveillance, samples analysis, and diagnostic transfer), or salmonellosis (seminars, diagnostic transfer). Other activities of the network include annual regional meetings, training workshops (epidemiology, lab techniques, GIS, sustainability of surveillance systems), and dissemination of information on the CaribVET website: www.caribvet.net.

In order to continue the development of CaribVET, it was decided to equip it with common structures of decision-making, coordination and collaboration, in order to reinforce its coherence, its effectiveness and its sustainability. This was discussed with the Chief Veterinary Officers (CVOs) of the Caribbean Region during the Joint Meeting on Animal Disease Surveillance and Preparedness - Focus on Avian Influenza in the Caribbean, in Trinidad on April 3rd, 2006. A new organization for CaribVET was adopted, which includes a steering committee (composed of the CVOs of the Caribbean and representatives of the regional/international organizations), a coordination unit, and technical working groups on avian influenza, classical swine fever, ticks and tick-borne diseases, information management, epidemiosurveillance and laboratory diagnostics (Figure 1).

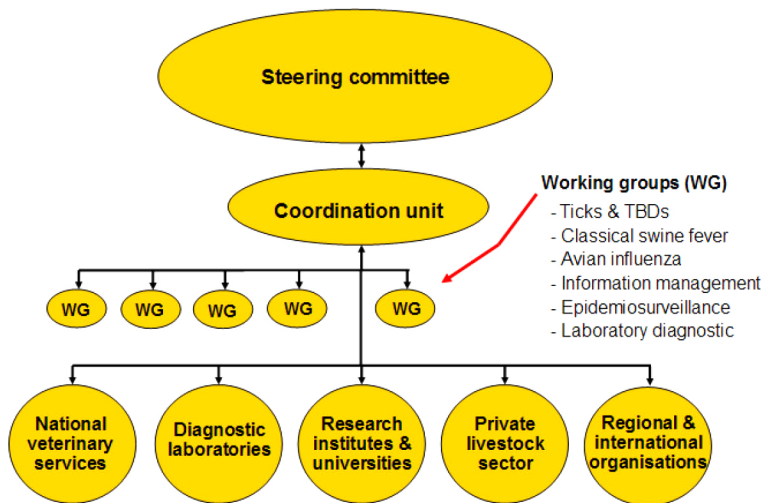


Figure 1: Organization of the CaribVET Network

Activities which will be developed through CaribVET for the period, April 2006- April 2007, include the evaluation of national epidemiological surveillance networks through a standardized questionnaire, the organisation of regional technical workshops (on basic veterinary diagnostics, epidemiosurveillance of avian influenza, avian influenza diagnostics, and databases and surveillance), an inter laboratory test on the diagnosis of CSF, a study on animal health economy in the Caribbean, development of recommendations and tools from the various working groups (avian influenza surveillance protocols, databases...), and development of the CaribVET website (on line participatory update; databases on surveillance, laboratories, and animal diseases; new pages on avian influenza, CSF, bibliography, etc.). Results of these activities will be discussed during the annual CaribVET meeting which will be organized next year jointly with the CARICOM CVOs annual meeting and a workshop on performance indicators of surveillance networks.

This network is currently supported by a project funded through the priority mutual aid fund (Project EPIVET “Regionalization and animal harmonization of the networks of épidémiosurveillance”) of the French Ministry of Foreign Affairs and by several projects funded through the regional co-operation funds (FCR) of Guadeloupe.

2.1.2. Agriculture

The equivalent of the animal health network, CaribVET, is being created for plant pests in the field of agriculture also with a regional system of monitoring of the invasive species (Caribbean Invasive Species Surveillance and Information System, CISSIP). In addition to each country of the area, many institutional partners and regional scientists are involved in this program: CABI, CARDI, CARICOM, IICA, FAO, CIRAD, etc. This regional project aims at assisting the countries of the Caribbean Region in the monitoring and protection against the invasive animal and plant species likely to cause environmental degradation and damage to agricultural production. These activities are based on the reinforcement of inspection networks of pests and invasive species as well as implementation of quarantines to avoid their introduction

and spread. The network will be based on tools of rapid communication (Web site) which make it possible to create links between laboratories and specialists in the diagnosis of alien invasive species and to distribute the results of risk analysis and messages of alarm (“pest alerts”) as well as guides of good practice. These means of action will be concretized and reinforced through training, diagnostic capacities of the laboratories of the area, the organization of regional workshops and through expertise.

2.1.2.1. Developing a Disease Network for Sugarcane Crop Protection in the Caribbean

Sugarcane is one of the main crops in Guadeloupe; the other being banana. Around 46% of cultivated area is planted to sugarcane. The main damaging pathogens are *Ustilago scitaminea* (c.a. of smut on sugarcane), *Leifsonia xyli* subsp. *xyli* (c.a. of ratoon stunting disease), *Xanthomonas albilineans* (c.a. of leaf scald) and Sugar Cane Yellow Leaf Virus (c.a. of the yellow leaf disease). To be able to develop knowledge on these sugarcane diseases, CIRAD has developed diagnosis processes, based on tissue immunoprinting for large scale and distance sampling. This technique is used for the diagnosis of *Leifsonia xyli* subsp. *xyli*, *Xanthomonas albilineans* and Sugar Cane Yellow Leaf Virus because infection of sugarcane by these three pathogens does not necessary result in observable symptoms. Tissue immunoprinting was used recently within the WISBEN cooperative work for ratoon stunting disease diagnosis. This work led to the first identification of *Leifsonia xyli* subsp. *xyli* in Jamaica where the diagnosis process was then transferred and to the evaluation of RSD disease status in the fields of the Belize sugar industry. This cooperative work could be extended to other Caribbean countries such as the Dominican Republic or Cuba to help sugarcane diagnosis with a construction of a disease network. A disease network will be also useful to share information on cultivars responses to main diseases.

2.1.2.2. Evaluation of the Effectiveness and Durability of Resistances of Yellow and Black Sigatoka of Hybrid Varieties of Banana Plants; Study of the Potential Risks of Diffusion of the Mosaic Streak Virus of Banana (BSV) Starting from these Hybrids.

In order to fight combat black streak disease of the banana, which is caused by the fungus, *Mycosphaerella fijiensis* Morelet, and against nematodes, important programs to develop resistant varieties were set up in order to obtain new hybrids to these parasites. Such hybrids are currently cultivated on large areas, in particular in the Caribbean countries, in Cuba and in the Dominican Republic. This project aims (I) at evaluating the impact of the use of these hybrids on the dynamics and evolution of the populations of *M. fijiensis* to evaluate the effectiveness and durability of resistances; (II) at evaluating the potential risk of diffusion of the mosaic streak virus of banana (BSV) starting from new hybrids, starting from endogenous sequences BSV present in the genome of *Musa balbisiana*. This will be accomplished by a one-year epidemiologic follow-up of the pathogenic populations of *M. fijiensis* in the field. The evolution of these populations will be studied using molecular markers and biological tests. In the same way, the levels of prevalence and diversity of BSV will be evaluated and compared in zones planted with hybrids and zone planted in varieties that are strictly *M. acuminata*, which lack endogenous sequences BSV. The anticipated results and the collaborations likely to be developed will make it possible to establish a durable strategy for diffusion and use of these hybrid varieties of banana resistant to these diseases at a regional scale. A five day workshop

will be organized in Guadeloupe in October 2006 to present this strategy to our Caribbean partners.

2.1.2.3. Control of the Coconut Lethal Yellowing in the Caribbean

The department of Perennial Crops of CIRAD clearly expressed its priorities by creating the Research Unit 29 (UR 29) on Coconut Lethal Yellowing (JMC, CLY) and Greening of citrus fruits. UR 29 developed a network of collaboration in the Caribbean anchored in Cuba (Instituto de Investigaciones en Fruticultura Tropical, IIFT) and Jamaica (Coconut Industry Board, CIB). Twice, in 2005 and 2006, UR 29 accommodated a Cuban expert of the Instituto de Investigaciones en Fruticultura Tropical (IIFT) for his PhD in Montpellier. A member of UR 29 is part of the PhD committee and the defense is scheduled at the University of Havana in 2007.

An entomology mission on the transmission of the CLY was carried out in Cuba and Jamaica in 2005 (Myrie et al., 2006b; Lebrun et al., 2006). It made it possible to give a progress report on the insects which are suspected to transmit CLY, in particular two planthopper species in the Cixidae present on the two islands. At the end of 2005, in collaboration with the CIB of Jamaica, UR 29 highlighted the existence of the JMC-CLY on Nevis Island by PCR, cloning and sequencing. The disease has been present since the beginning of the 21st century in the Jamaica-Cuba-Cayman Islands zone (Llauger et al., 2006). It appeared on Hispaniola in the 1960s. Thus for the first time in more than 40 years JMC-CLY has progressed towards the southern islands of the Caribbean in direction of Guadeloupe (Myrie et al., 2006a).

At the beginning of 2006 at the request of the Instituto Dominicano de Investigaciones Agropecuarias y Forestales (IDIAF), the executive manager of UR 29 carried out a mission in the Dominican Republic (DR) because of the appearance of mortality in coconuts on the southern coast of DR in a crowded seaside resort (Martinez et al., 2006a). Samples were brought back to the laboratory in Montpellier and the analyzes by PCR followed by cloning and sequencing made it possible to show that CLY was responsible for this new focus of the disease on the southern coast of the DR; although it had remained confined to the north of the island since the 1960s. A conference was given in Santo Domingo and recommendations were sent to the IDIAF.

A mission was carried out in Cuba to take stock with the IIFT on atypical syndromes causing many losses in 2005 on coconut in the state of Camaguey. The symptoms of bud rot (*Phytophthora*) were observed too. The IIFT wishes that UR 29 take part in the training of new staff at the beginning of 2006. In the state of Granma the damage caused by the hurricanes and tropical storms of 2005 are important. But this did not stop the spread of CLY. Moreover the suspect insect that we had highlighted in 2004 is always abundant there confirming our recommendation of this site for research on transmission.

A mission for the evaluation of dying coconuts was carried out in the States of the OECS - Barbuda, St Kitts and Nevis, Dominica and Saint-Lucia to evaluate the impact of CLY in the area. The conclusions indicate that it is indeed the presence of CLY which finally constitutes the key element for the future of coconut production in the Caribbean.

2.1.2.4. Emergent Citrus Diseases

No activity has been developed on this topic during this period due to the assignment of the expert from Guadeloupe to Montpellier.

2.1.2.5. Tomato: Begomoviruses and *Ralstonia solanacearum*

The European project “incidence and epidemiology of tomato begomovirus diseases in different countries of the Caribbean (Cuba, Dominican Republic, Trinidad, Guadeloupe and Martinique)” is in its final phase and a workshop will be organized at the end of this year. The introduction of the B biotype of *Bemisia tabaci* was concomitant with the introduction and spread of different begomovirus diseases on tomato in the Caribbean. These diseases caused severe yield losses, and sometimes, prevented the development of profitable tomato cultivation in countries of the Caribbean.

These studies tried to determine the respective incidences of different begomoviruses species on tomato (mainly TYLCV and PYMV), the key factors in epidemic development (at the production area scale, and at the plot scale), to model the progression of the disease in the plots in relation with environmental factors, and to build and evaluate IPM practices adapted to the different agronomic and socio-economic contexts. In 2005, IPM packages were tested in Martinique and Cuba. These packages included the use of insect proof nurseries, grafting, and use of more tolerant varieties. A final evaluation will be made in July 2006, during a seminar in Dominican Republic.

The new research program now deals mainly with *Ralstonia solanacearum*, causal agent of bacterial wilt on vegetables and Moko disease on *Musa* species. Using an innovative molecular diagnostic tool (Multiplex-PCRs), we found in Martinique a new emerging *R. solanacearum* population, whose host range is much larger than the historical strains known here. These emerging strains are much more aggressive on tomato (Wicker et al., 2005), a fact that may have several implications for the solanaceous vegetable breeders. Moreover, these strains may be present in other islands of the Caribbean, and need to be identified rapidly, with these relevant diagnosis tools. Collaboration between the CIRAD - Martinique Agricultural Research Centre, PRAM, UWI Trinidad and CARDI has to be built up to set up such a regional epidemiosurveillance network.

For the future, a regional project is in preparation with partners from Martinique (CIRAD-PRAM), Guadeloupe (INRA), Cuba (IIHLD and CENSA) and Trinidad (UWI). The first step of this project aims to upgrade the knowledge about the *R. solanacearum* (Rsol) populations prevalent within the partners' country, and to exchange diagnosis and detection techniques for the monitoring of Rsol strains in the environment. In the second step, tomato resistant material from different resistance sources will be evaluated in controlled and natural conditions for their resistance to begomoviruses, *Ralstonia solanacearum*, and nematodes (*Meloidogyne* spp.), in every partner island.

2.2. Promotion of the Environmental and Sanitary Early Detection and Warning Systems through the Regional Co-Operation

All Caribbean countries and territories are exposed to identical or similar risks. Moreover, the countries of the same region often share the same constraints, advantages and objectives; and

thus may find it beneficial to share methodologies of action, prevention, and control against environmental and sanitary risks. Therefore a thorough regional integration of these systems is necessary.

The existing mechanisms of regional co-operation appear to be well suited for the development and implementation of early detection and warning systems because there is real expertise in this field among the organizations and national institutions present in Guadeloupe, Martinique and French Guiana (Guyane), namely the Plant Protection Services, UAG, CIRAD, INRA, IRD, etc. These agencies share responsibility for regional co-operation and they are dedicated to continue the practical implementation of this knowledge and technology at the regional level. The Region-wide adoption of systems of early detection and warning will have reciprocal benefits because regional coverage will provide more complete and timely information and enhance the safety both of the French Departments and the other countries in the Region.

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